NATIONAL BULLETIN

Bulletin 3 | 2022

Integrating DER into the NEM

By Jeff Allen, National President of the Electric Energy Society of Australia | 17 March 2022

Australia is installing renewables on a per capita basis at about ten times the world average. The pipeline of projects for largescale renewables is twice the current capacity in the NEM. In addition, there is 23GW of battery storage planned. As of November 2021, approximately 3 million rooftop solar PV systems had been installed in Australia, totalling a quarter of our generation capacity (14 GW) with another 9 GW forecast to be installed in the next 4 years. Note that the NEM peak demand for 2021 was approximately 14GW.

In 2018, renewables supplied 38% of the peak. In 2021, the contribution increased to over 60% of the peak. AEMO base-case forecasts show that there will be times when renewable energy is able to supply 100% of Australia's electricity needs by 2025. These occasions will become more frequent from 2025. I note that in South Australia there are already occasions when renewable generation exceeds demand.

As we have seen from recent announcements, the growth in renewable energy is contributing to financial stress on fossil fuel generators, resulting in earlier than scheduled plant exits from the market. It appears that the following coal fired power stations will be closing in the next 10 years with Liddell (2,000MW) closing in 2023, Eraring (2,880MW) in 2025, Callide B (700MW) in 2028, Yallourn (1,720MW) in 2028, Vales Point (1,320 MW) in 2029, and Bayswater (2,640MW) in 2033. A number of these are closing earlier than originally planned. Many businesses are moving to "green energy" electricity contracts, and this is also putting pressure on the economic viability of coal fired power stations.

AEMO indicate that around 9GW of gas-fired generation and an extra 620GW hours of storage (provided by batteries or pumped hydro) will be required to provide backup generation capacity when solar and wind are unavailable.

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

Thus, the National Electricity Market is undergoing a profound transformation from a centralised system of large fossil fuel generation towards an array of smaller scale, widely dispersed wind and solar generators, grid scale batteries, rooftop solar, and demand response. This transition will require adaptation by all participants, from generators,

EESA
Electric Energy Society of Australia

NATIONAL BULLETIN

Bulletin 2 | 2022

transmission, and distribution businesses through to customers, and is driving a significant package of reforms that need to be put in place to ensure that "the market framework" remains fit for purpose.

Thus, DER is playing a central role in transforming the grid and the market. Key technologies, such as smart inverters and batteries, smart monitoring and control systems are enabling a fundamental shift in what is possible. DER is changing consumers' behaviour from passive participation in the grid to active involvement. Consumers have shown that they will take up new technologies if they can see the benefit.
At the domestic customer level, DER is currently synonymous with rooftop solar panels but increasingly DER will also include battery storage and vehicle-to-grid electric vehicle supply.

The typical domestic DER owner will gain benefit from the ability to sell surplus power at a profit. It will mean, however, that electricity networks will have to change their cost and operating models to make their pricing structures more reflective of their costs.

The recent move by SA Power Networks is a good example of change. Back in 2008, SAPN was required by the government to offer those who installed solar panels a 20-year guaranteed 44c/kWh feed-in rate (to incentivise early uptake of solar). Now, with one of the highest penetrations of residential solar in the world, SAPN reports that the need to support excess rooftop PV exports will be the number one reason for upgrading the network.

Whilst peak demand is still a consideration in building the network to respond to customer needs, it is no longer a key driver for how to manage a network and the associated costs. The primary consideration in network response over current and future Regulatory Control Periods will be the need to upgrade the LV and MV networks to manage the uptake of solar generation and the resulting two way flows and significant voltage variation.

As an example, SAPN is offering an 85% discount for electricity used from the grid from 10am-3pm, while also moving a rule change through the Australian Energy Markets Commission, which will allow networks to charge customers for exporting solar during congested times — and reward them for exporting during periods of high demand.

NATIONAL BULLETIN

Bulletin 2 | 2022

Another factor at play is that energy consumption for most consumers will move from three fuels (electricity, natural gas, and petroleum) to all-electric over say the next 10 to 20 years. This means a massive expansion of electricity consumption.

Another issue facing the electric energy industry is the lack of people with necessary skills, particularly engineering skills, to ensure these significant changes can be successfully implemented. Infrastructure Australia is forecasting an unprecedented wave of public infrastructure projects over the next five years, for which we do not have the skilled workers, especially engineers. We need to understand the capability of the current energy workforce and implement a "people plan" that enables the energy transition.

DER integration is a complex exercise, with many stakeholders. There are technical, economic, customer, and community aspects to be addressed to satisfactorily manage this challenge.

CONTENTS

LOCAL NEWS

ELECTRIC VEHICLE NEWS

RETROSPECT

HUMOUR BREAK

CONTENTS CONT.

INTERNATIONAL NEWS

CIRED INTERNATIONAL NEWS

CIRED PAPER

CIGRE INTERNATIONAL NEWS

LOCAL NEWS

NSW FLOOD DISASTER CHALLENGES NETWORK OPERATORS

By Terry Miller | 18 March 2022 | Source: Essential Energy Media and 7 News

The following photos need no accompanying words to portray the extent of the recent floods in NSW and the destruction wrought on the electricity supply network. Our thoughts go out to all the residents and businesses affected, and the mighty contribution of all those involved in the recovery efforts.

LOCAL NEWS

DAINTREE RENEWABLE MICROGRID TO GO AHEAD

By Terry Miller | 18 March 2022 | Source: Australian Government media release

Readers may recall a previous Bulletin article about the challenges of providing electricity grid supply to the Daintree region in Far North Queensland. A combination of terrain, geography and the environmental sensitivity of the Daintree forest present many obstacles.

After many years of analysis and studies of alternatives, the Morrison Government is supporting the creation of a "world-leading" renewable microgrid for the Daintree community.

The government has awarded Volt Advisory Group $18.75 million over three years to develop a highly innovative renewable energy microgrid for the Daintree region, supporting more than 200 jobs in Far North Queensland.

The grant is being delivered under the Daintree Microgrid Program, following a feasibility study completed under the $50 million Regional and Remote Communities Reliability Fund.

The renewable energy microgrid will incorporate an 8 MW solar farm, 20 MWh of battery storage and a 1 MW clean hydrogen plant.

In recognition that the Daintree rainforest is in the World Heritage-listed Wet Tropics of Queensland, the project aims to avoid disturbance in the area by deploying the microgrid along roadways and on previously cleared land.

Minister for Industry, Energy and Emissions Reduction Angus Taylor said the Daintree Microgrid will ensure the Daintree community has a more affordable, more reliable and a more resilient electricity supply.

"This is a major win for communities in the Daintree Rainforest, which will see reduced pollution and noise from diesel generators, and will be a valuable demonstration of solar to hydrogen technology" Minister Taylor said.

"The renewable and hydrogen microgrid will use cutting edge technology to reduce emissions and drive down costs by ending the community's reliance on costly diesel generation."

Assistant Minister to the Minister for Industry, Energy and Emissions Reduction Tim Wilson said the microgrid would generate direct benefits for the Daintree community.

"Building this world-leading renewable microgrid is a giant leap forward in building Australia's carbon neutral future. This renewable microgrid will deliver cheaper, reliable power and is an essential investment in the Daintree community," Assistant Minister Wilson said.

"Once completed, the microgrid will displace more than 4 million litres of diesel fuel consumed in the Daintree each year. This highly innovative project demonstrates the public-private leadership required to get Australia to carbon neutrality by 2050.

LOCAL NEWS

"It also presents a significant opportunity to develop key learnings that can be applied as we pursue further microgrid options across Australia."

Federal Leichhardt MP Warren Entsch said he was proud to have delivered this important project for the Daintree community.

"This project is a game-changer for the Daintree community and delivers on my firm commitment to residents to deliver a solution to their power needs," Mr Entsch said.

"This project, which also includes the laying of new fibre-optic cables, will significantly improve communications in the region and will be welcome news for residents and business owners.

"Microgrid technology is becoming increasingly cost-effective, creating the opportunity for reliable, low-cost, off-grid power in communities like the Daintree.

"But more importantly, from an environmental aspect, it will remove the need to burn dirty and inefficient diesel in the Daintree, allowing residents to have access to a cleaner, more affordable, more reliable source of energy."

Funding to develop the microgrid will continue the momentum generated to date and ensure that the Daintree community can access the benefits of renewable energy as quickly as possible.

The project will commence this year and the microgrid is due to begin operations by 2024.

Commonwealth support for the Daintree microgrid builds on more than $100 million in funding the Government has already committed to support the investigation and deployment of microgrid technologies across regional and remote Australia.

REGULATORY INCENTIVES DELIVER SUBSTANTIAL SAVINGS FOR ENERGY CONSUMERS

By Energy Networks Australia | 11 March 2022 | Source: ENA media release

An independent report into Australia's incentive-based regulation for energy networks has demonstrated a $1,466 benefit to customers from the schemes' operation over the period 2006-2020.

Produced by HoustonKemp for Energy Networks Australia (ENA) the analysis shows how the Australian Energy Regulator's (AER) incentive schemes have improved services for customers while helping reduce their power bills through lower network prices.

The report comes as the AER conducts its own review into incentive schemes.

LOCAL NEWS

ENA Chief Executive Officer Andrew Dillon said incentive schemes had encouraged networks to become more productive and deliver more for network customers.

"This analysis shows households with a gas and electricity connection are $1,466 better off," he said. "This includes benefits that are already 'locked-in' under the current schemes and will continue to be delivered to consumers.

"Incentive-based regulation encourages networks to innovate and deliver value-for-money service, savings that are passed onto customers.

"Energy networks provide an essential service to almost every home and business in Australia. It is imperative that while networks exist in a regulated market without competition, they still deliver the best service to customers and the lowest cost."

HoustonKemp's analysis shows that the AER's incentive schemes have delivered $18.6 billion (present value $2020) in benefits between 2006 and 2020 and customers have received most of these benefits ($13.4 billion).

To view the full report, click here.

TRANSGRID PREFERS ABOVE GROUND TRANSMISSION LINK FOR SNOWY 2.0, OPPONENTS WANT UNDERGROUND LINK TO PRESERVE NATIONAL PARK

By Michael Mazengab | 16 March 2022 | Source: Renew Economy

Network utility Transgrid will press ahead with plans to construct an above-ground transmission link through the Kosciuszko National Park, linking the Snowy 2.0 project to the rest of the grid, despite strong opposition to the development.

Transgrid has been tasked with designing and constructing new network infrastructure that will allow the Snowy 2.0 project – currently under construction – to be properly connected to Australia's main grid.

The project is set to see new above-ground high voltage power lines erected through the Kosciuszko National Park and it has attracted the ire of environmental groups who have argued that the project will have an unacceptable impact on the iconic national park.

The environmental impact statement for the network upgrades are being assessed by NSW Government planning authorities and it has attracted dozens of submissions from individuals and community groups, with around 65 per cent of the submissions expressing opposition and calling for the use of underground power lines.

LOCAL NEWS

Snowy Hydro's Tumut 3 power station.

"The apparent reluctance to acknowledge cost as the primary driver has resulted in an EIS that attempts to make a frankly Orwellian argument that underground cables have a greater environmental impact than would overhead towers in a permanently cleared easement," the submission from the National Parks Association of NSW says.

"The proposition is simply absurd, the lower environmental impacts of undergrounding are precisely why overhead transmission is no longer regarded as acceptable practice on the international stage."

None of the submissions expressed active support for the project, while around a dozen submissions – mostly from government entities – provided general comments and advice on the project.

The overwhelming concerns were the proposal to construct overhead powerlines through the Kosciuszko National Park, and the potential for impacts on the park's biodiversity.

Environment groups have called on Transgrid to use underground network infrastructure to minimise the project's long-term impact on the Kosciuszko National Park.

Transgrid pushed back on the request, arguing that there would still be permanent impacts on the park even with underground network infrastructure. Its latest assessment suggests going underground would also significantly increase the project's costs while making it more challenging to maintain and repair the network link.

LOCAL NEWS

Transgrid said that design options that use overhead transmission lines would allow the project to be built at a cost of around $290 to $450 million while using underground power lines could increase the construction cost to between $1 billion to $1.4 billion.

"The merits of the project including the benefits of connecting Snowy 2.0 to the NEM are considered to outweigh any identified adverse impacts of this project," Transgrid's response to the submissions says.

"While some environmental impacts cannot be avoided, they have and would be minimised to the extent practicable through the implementation of mitigation measures and where residual impacts remain, they will be offset."

While the expansion of the Snowy Hydro scheme will add much-needed energy storage infrastructure and 2,000MW to the scheme's generation capacity.

But the project has attracted its own criticism, with environmental groups and a significant number of energy market experts saying the Snowy 2.0 expansion was likely to significantly exceed stated cost estimates.

The groups also argued that the Snowy 2.0 project would also have an unacceptable impact on the Kosciuszko National Park, described as the "worst possible project in worst possible location".

The transmission link for the project is set to be one of a number of new transmission projects that are facing some level of community pushback due to the potential visual and ecological impacts, but will be needed to support the construction of new renewable energy and energy storage projects.

This week, Transgrid said that it had progressed early works at its EnergyConnect project, its share of a new interconnector linking South Australia and New South Wales.

Transgrid said that it had commenced the establishment of new workers camps and kicked-off new studies for the project as it prepares to start construction of its $1.5 billion share of the $2.3 billion interconnector. The link is expected to allow up to 800MW of electricity to be shared between the two states.

Transgrid will be responsible for the New South Wales side of the link – a 700-kilometre transmission line between Wagga Wagga and the South Australian border, while project partner ElectraNet will construct the remaining 200 kilometres of network link on the South Australian side of the interconnector.

"Not only will the new interconnector enable the sharing of electricity between New South Wales, South Australia and Victoria; it will also save NSW energy customers $180 million a year and generate up to 1400 new jobs," Transgrid's executive general manager of delivery, Craig Stallan, said.

LOCAL NEWS

SOUTH AUSTRALIAN GRID MAY OPERATE WITHOUT SYNCHRONOUS GENERATION

By Giles Parkinson | 14 March 2022 | Source: Renew Economy

South Australia – already leading the world in the uptake of wind and solar and operating its grid at high levels of renewables – could be the first gigawatt scale grid in the world to operate without synchronous generation.

The possibility has been flagged by the Australian Energy Market Operator in one of a series of stakeholder briefings that canvass the changes to technology and operating procedures that were once unimaginable, and for some energy people still are.

South Australia is unique in the world because it is the first gigawatt scale grid to operate at such high levels of wind and solar, which in the past year have accounted for 64 per cent of local generation, according to AEMO.

LOCAL NEWS

It's also unique because – apart from closing the last of its two coal generators six years ago – it also runs this high level of renewables without hydro, or geothermal. And the big challenge now is how to remove the need for the remaining fossil fuel generators, which are primarily gas with some diesel.

It will take some time to do away with all gas and diesel because until enough wind and solar and storage is built – be it from batteries, pumped hydro or even hydrogen – those fossil fuels will be needed to supply power in the case of wind and solar droughts.

But AEMO is also looking to run the grid at times with no synchronous generators, meaning no fossil fuels. Up until recently, at least four gas units were required to be online even if there was enough wind and solar to meet local demand.

The installation of four synchronous condensers – spinning machines that do not burn fuel – means that that requirement has been reduced to just two gas generating units, operating at very low combined capacity of 80MW. Sometimes that's a mere fraction, less than five per cent, of the amount of generation.

The next step is to reduce the need for those two gas generators to be needed at such times. The answer will come with either more syncons, or more preferably, inverter technologies capable of providing "grid-forming" services, meaning that they can provide the system strength and inertia needed to maintain grid security.

"Initial desktop studies for grid formation and grid reference show (the) SA system could be theoretically capable of 'holding together' without synchronous generators," AEMO writes in an newly published presentation made to stakeholders earlier this month.

"Further desktop studies and real time tests (are) required as this is (a) world-first operation," it adds.

Indeed, it would be. Some of the South Australia batteries – such as Dalrymple North and the expansion of the Hornsdale Power Reserve – can offer "grid forming" inverter technologies.

But AEMO, and the state governments, will want to see this tested at scale, hence the recent launch of a new $100 million funding round by the Australian Energy Market Operator to assist at least three new big batteries that provide "grid forming" capabilities as a core part of their offering.

That funding is provided because there is not yet any market that recognises these offerings, one of the many tasks on the "to-do" list of Australian energy market reforms.

AEMO's presentation notes that it is considering options such as contracts and market services to meet some of those power system requirements.

"Further studies to be done to determine if other system requirements can be met through alternative arrangements," it says.

AEMO has had to rely on direct contracts, or substantial grant funding from the likes of ARENA, for many of the landmark battery projects, such as Dalrymple, Hornsdale, and the Victoria Big Battery, currently the biggest battery installation in Australia that has been allowing the main link between Victoria and NSW to operate at or near full capacity.

LOCAL NEWS

It notes that if it does move to a system with no synchronous generators, then the so called "operating envelope" will have to change.

This includes the amount of electricity that can be exchanged through the major transmission links at any one time. It warns that the prevalence of rooftop solar and other distributed resources – rooftop solar can, on occasions, meet nearly all of state demand – makes the transition even more complex.

AEMO expects to be able to provide updates on the findings of its desk top analysis and plans for the next steps by the middle of the year.

What is discovered in South Australia will be crucial for the rest of the Australian grid, which is expected to follow quickly down the path of closing coal, and lifting the share of renewables to a very high level.

Other states, however, will likely benefit from having existing hydro facilities and multiple links with other states that will also provide a cushion for energy security.

COAL SHUTDOWNS: WHAT'S IN STORE FOR BATTERIES?

By Australian Energy Council | 24 February 2022 | Source: ECA media release

There has been plenty commentary about the implications of coal plant closures following Origin Energy's Eraring announcement last week, along with earlier announcements from AGL Energy and EnergyAustralia, as well as the "audacious" bid by Brookfield and Mike Cannon-Brookes for AGL with reported plans to accelerate coal plant closures if successful**[i]**.

The announcement of potential early coal plant closures is significant, but it is also not unexpected by the market. It reflects the reality of the changing energy dynamics in Australia. Our energy market is in the midst of a renewables revolution.

Coal plant is retiring faster than the market operator had previously anticipated and current announcements will see more than 5GW of the current 23GW of coal plant capacity leave the market by 2030**[ii]**. The Australian Energy Market Operator's (AEMO) step change scenario in its draft Integrated System Plan forecast coal closures could increase to 14GW by 2030 (although this has been contested), while the level of capacity withdrawal under its slow change scenario would be 10GW based on expectations of lower operational demand.

Energy companies, which invest heavily in renewables as well, know the switch to renewable generation has made life harder for coal-fired power stations. This is because they are a more inflexible generation source – they are designed to turn on and run constantly, which makes them a lot less nimble than gas peakers or other forms of generation. This in turn makes it harder for coal plant to operate in a market which is increasingly dominated by generation from lower cost renewables, but which are also variable depending on weather conditions.

LOCAL NEWS

Increasing periods of negative pricing and low operational demand driven by renewables complicates the economics of coal plant that are more limited in their ability to ramp up and down with rapid changes in demand. The Australian Energy Regulator (AER) has asked AEMO **to reconsider its assumptions around coal plant operations** and the ability to operate flexibly on an intra-day basis, given they are known to adopt different daily load profiles. While this may impact the forecasting of the timing of coal exits, it will not change the overall market dynamics at play.

Currently, the National Electricity Market (NEM) relies on 23GW of firm capacity from coal, and another 20GW of dispatchable firming capacity from storage and gas generation. As coal plants exit the grid they will be replaced by renewables supported by with batteries, pumped hydro and gas generation.

Battery storage and pumped hydro will play an increasingly important role. **Large-scale batteries are being proposed** to replace capacity as coal plants retire.

There are multiple types of storage as shown in table 1 below.

Table 1: Types and depths of storage

Different types and depths of storage

- **Distributed storage** – includes non-aggregated behind-the-meter battery installations designed to support the customer's own load
- **Coordinated DER storage** – includes behind-the-meter battery installations that are enabled and coordinated via VPP arrangements. This category also includes EVs with V2G capabilities.
- **Shallow storage** – includes grid-connected energy storage with durations less than four hours. The value of this category of storage is more for capacity, fast ramping and frequency control ancillary services (FCAS, not included in AEMO's modelling) than for its energy value.
- **Medium storage** – includes energy storage with durations between four and 12 hours (inclusive). The value of this category of storage is in its intra-day energy shifting capabilities, driven by the daily shape of energy consumption by consumers, and the diurnal solar generation pattern.
- **Deep storage** – includes energy storage with durations greater than 12 hours. The value of this category of storage is in covering VRE "droughts" (long periods of lower-than-expected VRE availability) and seasonal smoothing of energy over weeks or months.

Source: AEMO Draft ISP 2022

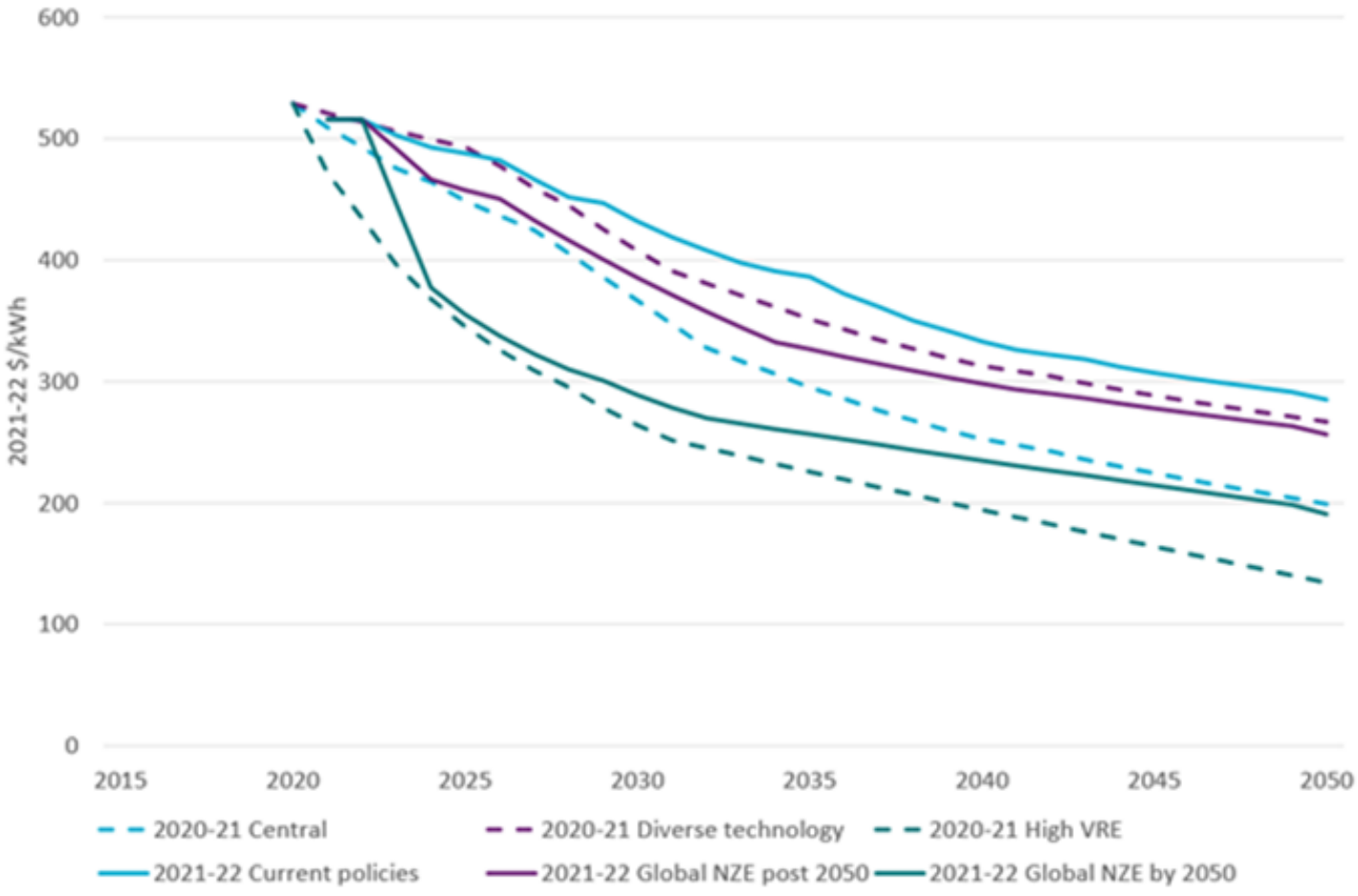
LOCAL NEWS

Lithium-ion batteries are effective at providing shallow storage and battery storage systems can be used for a range of network services including load shifting, ancillary services and Frequency Control Ancillary Services (FCAS)**[iii]**.

Aside from small-scale batteries as part of distributed energy resources, there are around 14 large-scale BESS currently in operation or under construction**[iv]**, including the 150MW/194MWh Hornsdale Power Reserve system in South Australia and the Victorian Big Battery (300MW/450MWh) and we are increasingly seeing renewable generation proponents looking at integrating and co-locating them with BESS. Aurecon notes that most new large-scale BESS developments require the support of funding or support mechanisms, but this is expected to reduce as costs fall and energy market price profiles change**[v]**.

The cost of batteries has come down significantly, and in its latest assessment Aurecon revised the capital cost of large-scale 2-hour duration batteries and projected the future cost trend for these batteries (figure 1) based on various scenarios.

Figure 1: Projected capital costs for 2-hour duration battery by scenario



Source: GenCost 2021-22

LOCAL NEWS

Batteries have sustained cost reductions and historical cost reductions came from deployment in areas like electric vehicles and consumer electronics, according to the CSIRO's 2021-22 GenCost report. It found that battery current costs saw a 5-6 per cent decline in costs over the previous year, while pumped hydro current cost estimates did not change significantly.

Around a third of homes in the NEM have rooftop PV with around 15GW of capacity. In another decade (by 2032), this is expected to increase to more than half of the homes in the NEM and increase to 65 per cent (69 GW capacity) by 2050, and increasingly as the costs improve rooftop systems are expected to be complemented by battery storage. Home batteries are predominantly used to take greater advantage of solar output, but as they increase in numbers there will be potential for aggregation of energy storage. In its work Aurecon estimated home battery costs to be $13,000 for a 5kW/10kWh system or $1300/kWh, including installation – more than twice the cost of large-scale batteries[vi].

The most pressing utility-scale need in the next decade, according to AEMO, will be for 4-12 hour storage to manage variation in output from renewable generation and meet demand as coal leaves the market.

Pumped hydro is the most mature technology for storage and Snowy 2.0 is expected to provide much of the necessary additional storage depth to 2030 (2000 MW/175 hours), but additional deep storage will be required in subsequent decades to support renewables.

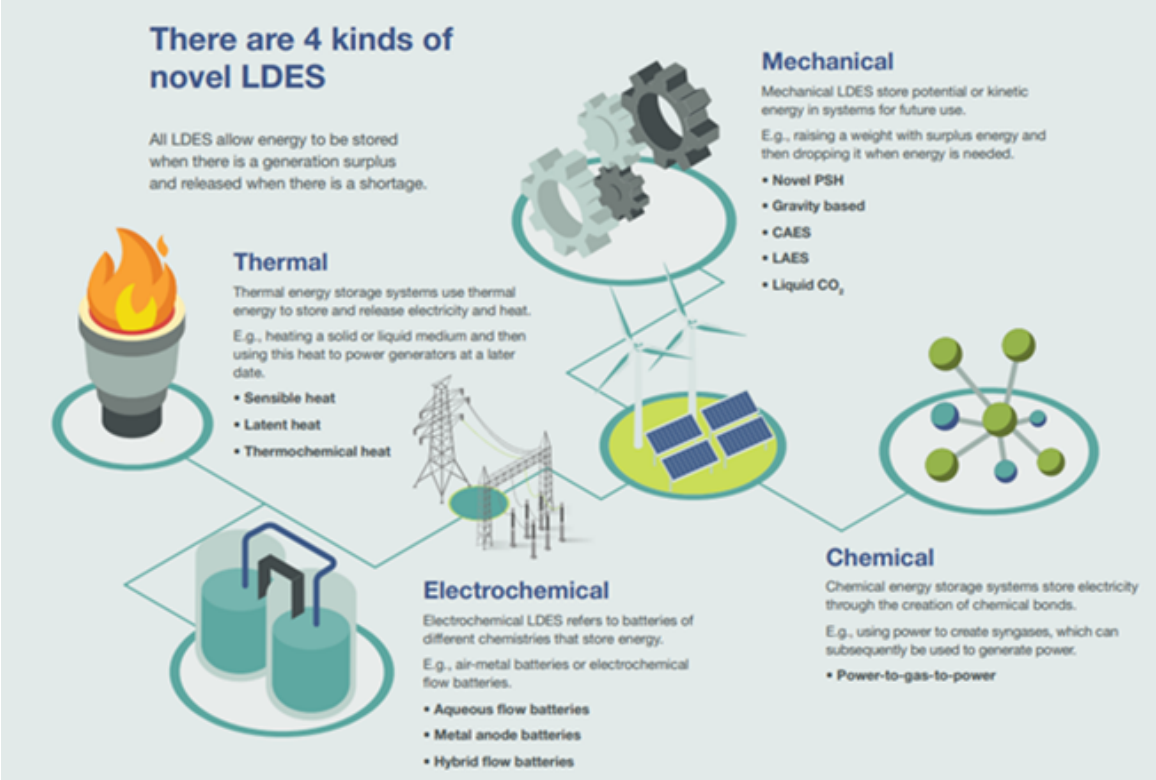
Large-scale vanadium redox batteries are considered to have the potential to complement lithium-ion and other storage technologies for medium storage applications. They offer potential longer duration storage (at least 4 hours). The Yadlamalka project in South Australia, supported by the Australian Renewable Energy Agency (ARENA) is expected to be the first grid-scale battery in Australia using the technology, but will still be only 2MW/8MWh. The largest operational battery of this type is a 15MW/60MWh system in Hokkaido Japan. Large-scale flow batteries have a higher capital cost than lithium-ion but have a longer lifespan. Aurecon has estimated the EPC cost of a 5MW vanadium-redox flow storage system to be $21.7 million (grid connected - 4 hour storage) and $21.4 million when col-located with a renewable plant. For an 8-hour system the cost is estimated at $29.1 million and $28.8 million respectively. The relative energy cost was estimated to be $372/kWh for both durations and whether grid connected or co-located.

Long-duration energy storage is being flagged as a possible storage solution – there are more than 5GW/65GWh of LDES capacity announced or operational, according to McKinsey Sustainability, which has recently released a report into the potential of the technology. LDES types are shown in figure 2.

Source: GenCost 2021-22

LOCAL NEWS

Figure 2: LDES types



Source: McKinsey

In its most recent GenCost report, the CSIRO provided an update on the cost of storage based on the most common types currently in use and this is shown in the table below.

Figure 3: Storage current cost by source, total cost basis

	$/kWh					$/kW				
	Aurecon 2019-20	Aurecon 2020-21	Aurecon 2021-22	GenCost 2019-20	AEMO ISP July 2021	Aurecon 2019-20	Aurecon 2020-21	Aurecon 2021-22	GenCost 2019-20	AEMO ISP July 2021
Battery (1hr)	1029	820	775	-	-	1029	820	775	-	-
Battery (2hrs)	648	549	516	-	-	1295	1099	1032	-	-
Battery (4hrs)	511	437	407	-	-	2045	1747	1629	-	-
Battery (8hrs)	464	385	357	-	-	3711	3082	2859	-	-
PHES (8hrs)	-	-	-	259	316	-	-	-	1994	2525
PHES (12hrs)	-	-	-	184	226	-	-	-	2118	2711
PHES (24hrs)	-	-	-	136	148	-	-	-	3139	3543
PHES (48hrs)	-	-	-	76	111	-	-	-	3517	5323
PHES (48hrs) Tasmania	-	-	-	-	52	-	-	-	-	2472

Notes: Batteries are large scale. Small scale batteries for home use with 2-hour duration are estimated at $1300/kWh (Aurecon, 2021b).

Source: GenCost 2021-22

LOCAL NEWS

The total cost basis means the costs are calculated from the total project costs divided by the capacity in kW or kWh. The $/kWh costs fall with increasing storage duration, while the cost in $/kW increase as the duration increases because the additional duration adds costs without adding any power rating to the system – additional duration is most costly in batteries, so batteries are best placed to manage shorter changes in demand, while pumped hydro storage becomes more competitive with longer duration.

[i] $20bn to reinvent coal-free AGL, The Australian 22 February 2022
[ii] Draft Integrated System Plan, AEMO, December 2021
[iii] Aurecon, 2021 Costs and Technical Parameters Review, Revision 1, October 2021
[iv] Aurecon, 2021 Costs and Technical Parameters Review, Revision 1, October 2021
[v] Aurecon, 2021 Costs and Technical Parameters Review, Revision 1, October 2021
[vi] GenCost 2021-22

AEMC PROGRESSES TECHNICAL STANDARDS FOR DISTRIBUTED ENERGY RESOURCES

By Australian Energy Market Commission | 17 March 2022 | Source: AEMC media release

Customers have led the way in our transition to net zero through investment in their own assets.

Whether it's to manage their electricity costs, make a contribution to tackling climate change, or both, Australia has the fastest uptake of solar panel investment in the world and that is set to continue.

Today, the Australian Energy Market Commission (AEMC) released its forward plan for its next phase of work on technical standards for distributed energy resources (DER) as part of its final rule determination on the governance of DER technical standards.

To ensure the regulatory framework continues to keep pace with the development of DER technical standards now and into the future, the Commission is committed to reviewing the need for new DER technical standards in the national electricity market (NEM), as well as assessing current requirements are already in place.

AEMC Chair, Anna Collyer, said a key aspect of this review will be considering the ability of DER devices to deliver benefits to consumers as well as the NEM.

"With the continued growth of DER, including rooftop solar systems and small-scale batteries installations, the grid is increasingly supporting two-way power flows back and forth from consumers," Ms Collyer said.

"We believe the future energy system is one where customers' energy resources will feature highly.

LOCAL NEWS

"We want to ensure the system works for all customers, and customers will have choices about how they get the most value out of their investments. In all our work in this area it's critical we start with the customer perspective, so the performance of their assets and the system will meet their needs."

This means the NEM requires technical standards for DER, which are critical to maintaining its security and reliability and minimising negative impacts for the benefit of all electricity consumers. For example, some technical standards ensure rooftop solar systems and batteries which can withstand sharp changes in voltage and don't automatically switch off.

The final rule determination is to make no rule on the basis that no new rules were required to enable the AEMC to act as sought by stakeholders.

Ms Collyer said today's final rule determination allows for a review process that leverages our powers to be flexible in order to respond to the changing needs of customers as they evolve.

This review is complementary to the ESB's current work on interoperability standards and fits within the broader DER Implementation Roadmap.

This determination was made in response to a rule change request made by Energy Security Board Chair Dr Kerry Schott AO in her former capacity as Chair of the Energy Security Board.

INTERNATIONAL CASE STUDIES TO GUIDE DESIGN OF CAPACITY MARKET FOR AUSTRALIAN NEM

By Energy Security Board | 18 March 2022 | Source: ESB website

The Energy Security Board has published the following summary of the findings of NERA's review of five international case capacity markets to understand how they work and draw possible insights for the Australian National Electricity Market.

Click here to read the summary

ELECTRIC VEHICLE NEWS

ISRAELI COMPANY ON TRACK TO DELIVER FIVE MINUTE EV CHARGING BY 2024

By Joshua S. Hill | 4 March 2022 | The Driven

Israeli battery developer StoreDot says it is on track to deliver mass production of batteries capable of charging 160-kilometres of range in 5 minutes by 2024, on the way to reaching a 2-minute charge time by 2032.

StoreDot, which was founded in 2012, has been prominent in battery development thanks to its promised 5-minute charge battery technology, "extreme fast charging (XFC) batteries that overcome the critical barrier to mainstream EV adoption – range and charging anxiety."

At the beginning of 2021 the company unveiled engineering samples of its first-generation 5-minute charge battery which the company claimed proved the commercial viability of its extreme fast-charging battery technology.

The company subsequently unveiled in September a fast-charging cylindrical battery cell in the style of Tesla's 4680 battery cell that it claims can be fully charged in 10 minutes.

StoreDot has also pioneered a new self-repairing battery cell technology that is able to regenerate underperforming battery cells while they are in use.

But it is the company's 5-minute charge batteries which will have the most impact if they are able to bring them to the market soon.

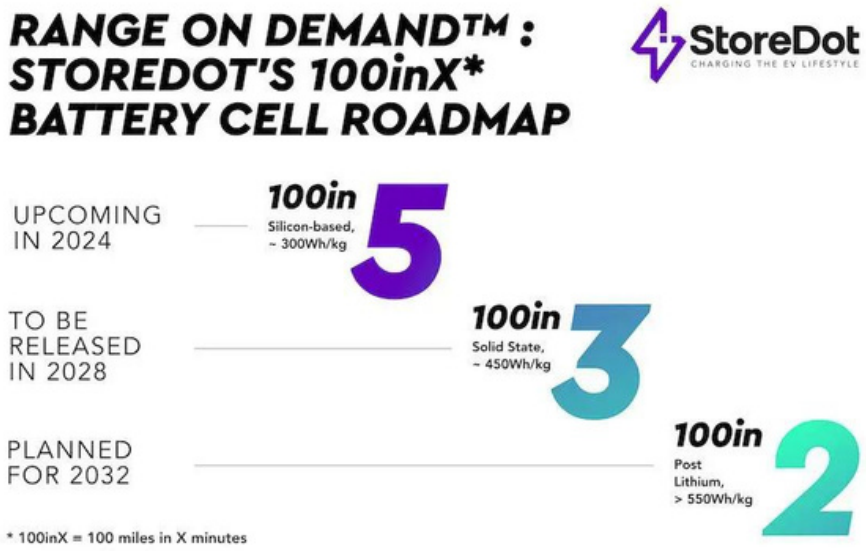
The company's strategic technology roadmap unveiled this week promises that the company is "firmly on track" to reach its first milestone, the production of its silicon-dominant anode XFC lithium-ion cells at scale by 2024 that will be capable of delivering 160-kilometres of range in 5 minutes of charge.

"It's absolutely crucial that we give global automotive manufacturers a clear, realistic, and hype-free roadmap for the introduction of our fast-charging battery technologies," said Dr. Doron Myersdorf, StoreDot's CEO.

"After intensive development of our silicon-dominant chemistries we will be mass-production ready by 2024, delivering a transformative product that will overcome the major barrier to the widespread adoption of electric vehicles – charging times and range anxiety."

StoreDot expects to deliver these batteries in both pouch and 4680 family form factors.

ELECTRIC VEHICLE NEWS



In addition, while running in parallel to bringing its 5-minute battery to mass production, StoreDot claims that it is already at the "advanced stages of developing ground-breaking semi-solid-state technologies" which it believes will further improve its batteries by 40% over the next four years.

StoreDot believes it will be able to deliver batteries that produce 160-kilometres of charge in just 3 minutes in mass production by 2028.

The third generation of StoreDot's battery technology – described as 100in5, 100in3, and 100in2 of miles per minute of charging – will deliver batteries capable of 160-kilometres (100 miles) of charge in 2 minutes by 2032.

"Our ultimate goal though, and one that is now absolutely in our grasp, is to produce cells that will revolutionize charging times, achieving 100 miles of range in only 2 minutes," Myersdorf said. "This breakthrough performance that was once considered impossible – is achievable with StoreDot's technology in just 10 years from now."

ELECTRIC TRUCKS ALREADY FINANCIALLY VIABLE ACCORDING TO QLD GOVT REPORT

By Sophie Vorrath | 22 February 2022 | Source: The Driven

The Energy Security Board has published the following summary of the findings of NERA's review of five international case capacity markets to understand how they work and draw possible insights for the Australian National Electricity Market.

ELECTRIC VEHICLE NEWS

Battery electric freight trucks could be financially viable on Australian roads "even today," a new report has found, if they were deployed in the right applications and backed by the right leadership, collaboration, and investment.

The report from the Queensland Transport and Logistics Council (QTLC), in partnership with specialist consultancy Mov3ment, warns that "significant deployment" of zero emission trucks will be required to meet state and federal government net-zero targets.

That's because in Queensland, alone, transport is the third largest contributor to the state's greenhouse gas emissions, at 13%, and heavy vehicles are the second contributor to that amount.

On the flip-side, QTLC CEO Lauren Hewitt says Queensland's freight sector is in a good position to provide early deployment opportunities for zero emissions trucks – as long as governments and industry get on board and the right "sweet spot" of technology and deployment is found.

According to the report, the right technology for the rapid decarbonisation of freight transport are battery electric vehicles – hydrogen fuel cell trucks are unlikely to be commercially viable by 2025 or even 2030, the analysis concludes.

Battery electric trucks, meanwhile, could be financially viable right now in the right application, the report finds, namely for first-mile and last-mile delivery in urban areas, and high engine hours/low kilometre travel like some waste operations.

6.1. BEV trucks

Figure 10 shows applications that are expected to be technically and economically viable for a BEV truck between now and 2025. Applications in **bold** indicate higher confidence in suitability across a range of users.

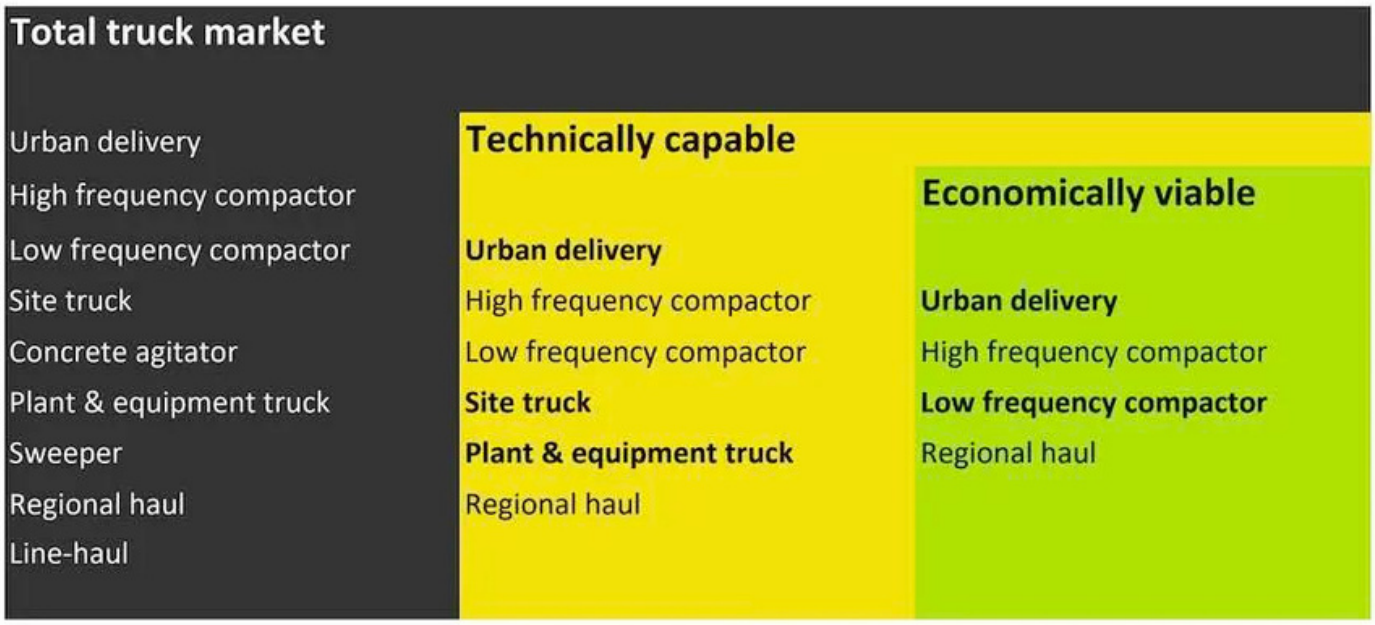


Figure 10 – Battery electric truck sweet spots

ELECTRIC VEHICLE NEWS

"There is a lot of focus on hydrogen for heavy vehicles. While it is technically suitable, we don't see that being commercially viable by 2025 or even 2030 without significant government subsidies," said Mov3ment director Mark Gjerek.

"But the report shows battery electric trucks can be financially viable even today in the right application – including urban delivery, low frequency waste compactors and regional haul."

That said, QTLC's consultation with fleets and transport precincts highlighted a market that is underdeveloped due to a range of market maturity and cultural barriers – some of which would require significant leadership, collaboration, and investment to surmount.

"Of the many barriers identified in the project, model availability and compatibility, economic suitability, and confidence-building reliable information remain the main stumbling blocks," the report says.

In particular, says Gjerek, "we need to get beyond limited trials of one or two vehicles to achieve mainstream adoption." As things stand, zero emission trucks, and alternative fuels more broadly, represent a fraction of the new truck market in Australia, sitting at well below 0.5% market share even at their peak over the last decade, the report shows.

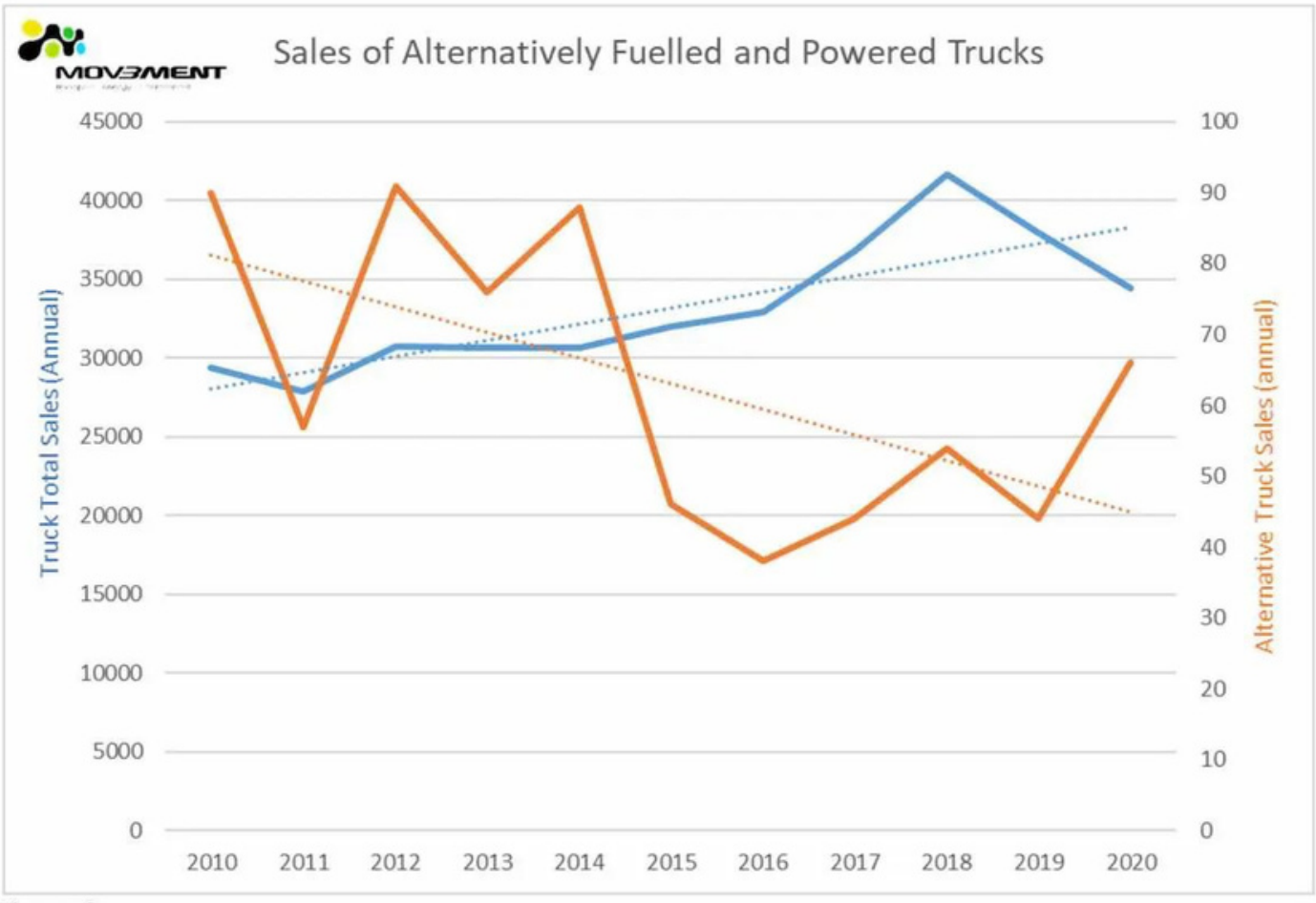


Figure 6.

ELECTRIC VEHICLE NEWS

"While there was a slight uptick in sales in 2020, the Australian market is yet to exceed more than 100 sales per year for all alternative fuelled and powered trucks including hybrid, CNG, LNG, EV and hydrogen."

For governments, the report points to a number of policy levers available to all levels of governments to support the electrification of the transport and logistics sector, starting with firm emissions targets and extending through to funding, incentives and leading by example with government freight contracts.

For the industry, the report recommends developing zero emissions zones and precincts as catalysts for change. "Freight movements are often concentrated in precincts and industrial zones, which can be used to support early adoption collaborations to build industry confidence," the report says.

Traditional freight hubs such as ports, industrial parks, rail heads, and intermodal terminals – that can support higher numbers of ZE trucks – could aggregate demand for fuel/energy and offer opportunities for collaboration, it theorises.

To that end, QTLC has committed to support investment in into the establishment of zero emission transport hubs and precincts, by rolling out a program for these high traffic areas over the next couple of months and then share the learnings with all fleets, industry and government.

"We look forward to collaborating with our members, fleet precincts and their customers to provide something that delivers both lower emissions and reduced costs for the sectors," said Hewitt.

In the meantime, the key message of the report is that there are already technical and economic sweet spots for battery electric trucks, and that's a fine place to start.

RESEARCHERS CLAIM MAJOR BREAKTHROUGH IN LITHIUM SULPHUR BATTERIES

By Joshua S Hill | 22 February 2022 | Source: Renew Economy

Researchers from Philadelphia's Drexel University say they have developed a commercially viable method of creating lithium-sulphur batteries that avoids previous dangerous pitfalls, and would result in batteries with three times the capacity of lithium-ion batteries and able to last more than 4,000 cycles.

Despite its proliferation through consumer electronics and electric vehicles, traditional lithium-ion batteries are not particularly ground-breaking, especially when compared to other potential battery chemistries.

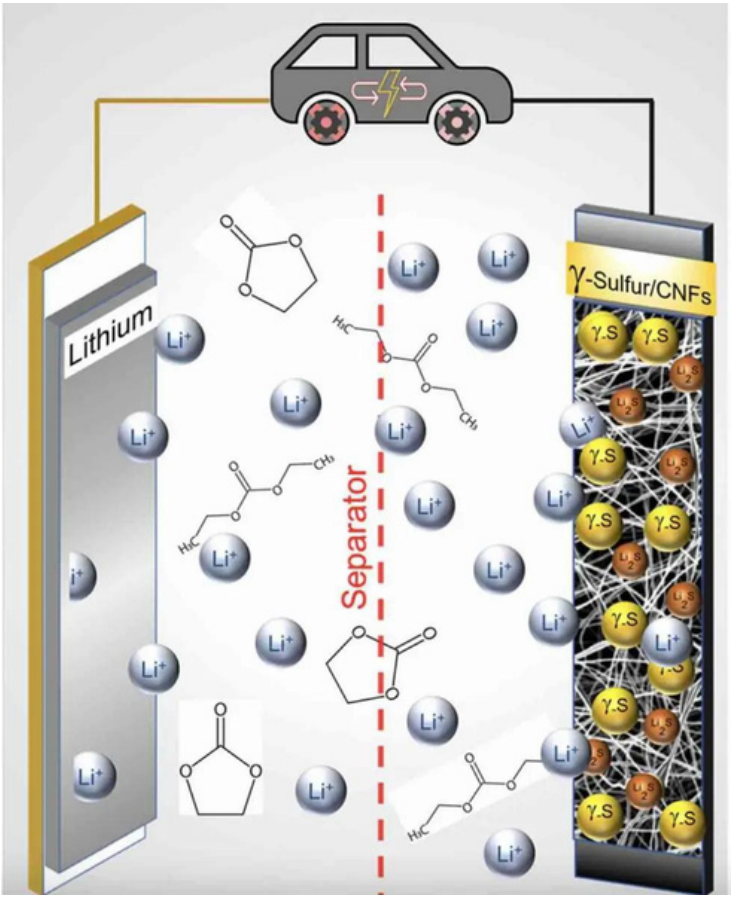
Moreover, some of the materials needed for lithium-ion batteries are scarce and/or expensive, and retrieving more of them can be detrimental to the environment.

This has sparked a search for new chemistries such as lithium-sulphur batteries, which offer greater performance and storage, and rely on more abundant materials.

ELECTRIC VEHICLE NEWS

However, introducing sulphur into a lithium battery along with the commercially friendly and preferred carbonate electrolyte has been difficult, due to what the researchers describe as "an irreversible chemical reaction between intermediate sulfur products, called polysulfides and the carbonate electrolyte".

In previous attempts to use a sulphur cathode in a battery with a carbonate electrolyte solution, this has resulted "in nearly immediate shut down and a complete failure of the battery after just one cycle."



Drexel's sulfur cathode breakthrough could pave the way for better-performing and sustainably sourced batteries for EVs, computers and mobile devices.

However, new research from Drexel University's College of Engineering – published in the journal *Communications Chemistry* – offers a commercially viable method of sidestepping these issues.

"Sulphur has been highly desirable for use in batteries for a number of years because it is earth-abundant and can be collected in a way that is safe and environmentally friendly, and as we have now demonstrated," said Vibha Kalra, PhD, George B. Francis Chair professor in Drexel College's department of chemical and biological engineering, who led the research.

"it also has the potential to improve the performance of batteries in electric vehicles and mobile devices in a commercially viable way."

The researchers attempted to confine sulphur in the carbon nanofiber cathode substrate using a "vapor deposition technique." While this process did not succeed in embedding the sulphur within the nanofiber mesh, it did something extraordinary, which revealed itself when the team began to test the cathode.

"As we began the test, it started running beautifully – something we did not expect. In fact, we tested it over and over again – more than 100 times — to ensure we were really seeing what we thought we were seeing," Kalra said.

"The sulphur cathode, which we suspected would cause the reaction to grind to a halt, actually performed amazingly well and it did so again and again without causing shuttling."

The unlooked-for solution was the fact that, during the process of depositing the sulphur on the carbon nanofiber surface during which it transforms from a gas to a solid, the sulphur crystallised in an unexpected way to form a slight variation of the element, called monoclinic gamma-phase sulphur.

This chemical phase of sulphur had previously only been created at high temperatures in labs and, therefore, had only

ELECTRIC VEHICLE NEWS

been observed in nature in the extreme environment of oil wells.

"At first, it was hard to believe that this is what we were detecting, because in all previous research monoclinic sulfur has been unstable under 95 degrees Celsius," said Rahul Pai, a doctoral student in the Department of Chemical and Biological Engineering and coauthor of the research.

"In the last century there have only been a handful of studies that produced monoclinic gamma sulphur and it has only been stable for 20-30 minutes at most.

"But we had created it in a cathode that was undergoing thousands of charge-discharge cycles without diminished performance — and a year later, our examination of it shows that the chemical phase has remained the same."

The Drexel researchers continued testing for more than a year and found that the sulphur cathode remained stable, with no degradation over 4,000 charge-discharge cycles – equivalent to around 10 years of regular use.

Similarly, and as predicted, the sulphur cathode battery boasts a capacity more than three-fold that of a lithium-ion battery.

"While we are still working to understand the exact mechanism behind the creation of this stable monoclinic sulphur at room temperature, this remains an exciting discovery and one that could open a number of doors for developing more sustainable and affordable battery technology," Kalra said.

The unexpected breakthrough could revolutionise battery development.

"Having a cathode that works with the carbonate electrolyte that they're already using is the path of least resistance for commercial manufacturers," the researchers note.

There have been efforts in the past to make sulphur work as a battery material, such as experimental research that used an ether electrolyte rather than a carbonate.

But while lithium-sulphur batteries have demonstrated exceptional performance in these conditions, they are not commercially viable, considering that the ether electrolyte is highly volatile and has components with a boiling point as low as 42 degrees Celsius – a problematic issue to say the least.

"Having a cathode that works with the carbonate electrolyte that they're already using is the path of least resistance for commercial manufacturers," Kalra said. "So rather than pushing for the industry adoption of a new electrolyte, our goal was to make a cathode that could work in the pre-existing Li-ion electrolyte system."

Maybe most importantly, however, is the fact that a lithium-sulphur battery such as that demonstrated in Drexel's recent research will alleviate the need for sourcing the large quantities of cobalt, nickel, and manganese which are currently required in existing chemistries.

"Getting away from a dependence on lithium and other materials that are expensive and difficult to extract from the earth is a vital step for the development of batteries and expanding our ability to use renewable energy sources," Kalra said. "Developing a viable Li-S battery opens a number of pathways to replacing these materials."

ELECTRIC VEHICLE NEWS

AUSTRALIA'S EV BOOM: WHAT IS DRIVING ITS SUCCESS?

By Stephane Marouani, Country Manager ANZ at MathWorks | 17 December 2021 | Electrical Comms Data

Over recent years Australia has fallen behind on the adoption of electrification compared to other countries.

Both from a political and general public perspective, the thinking has been that EVs are not adopted in Australia because of range limitation and the long distances people are often required to traverse.

However, the opposite is true — Australia is well suited to EVs, not only because its renewable energy capacity (mainly solar) is growing at a fast pace (with the ability to provide a cheap and easily deployable recharging network) but also because, in many situations, EVs make a lot of sense in major Australian industries.

For example, EVs such as utes or trucks for the mining industry are not only safer, especially in underground conditions, but also much cheaper to maintain — with significantly fewer mechanical parts subject to wearing in harsh conditions. Many mines in Australia are remote and already have plans for microgrids and operating their own renewable energy plant and storage batteries for their needs. In this particular scenario, using EVs makes absolute sense, and forestry or farming equipment fall in the same category. So, it is no surprise that electrification start-up companies are growing, with the need for specialised vehicles in mining (SafeScape), farming, construction and forestry (DC Equipment) and even aviation (MagniX).

So, what is it about Australia that has led to this boom?

- **Engineering experience:** After some of the large original equipment manufacturers (OEMs) such as Toyota and GM either left Australia or reduced their local workforce in recent years, there is now a pool of very experienced automotive engineers who have decided to innovate and create their own startups, rather than relocating internationally.
- **History of renewable energy research:** Australia has been hosting the world's largest solar EV race, which has led to significant innovation in this market. For example, the first solar-powered luxury sedan from a company called Lightyear had its infancy in the Darwin to Adelaide Bridgestone World Solar Challenge.
- **Industry and university research collaboration:** Universities such as UTS and UNSW have been collaborating with businesses to drive electrification research and innovation, which means local innovations in electric vehicles came years ahead of those from mainstream EV manufacturers. The first battery-powered electric Holden Commodore, developed by Melbourne-based startup EV Engineering, was around as far back as 2012.
- **Overlap with motorsports:** Automotive suppliers such as MOTEC are increasingly transitioning their motorsport racing experience across to the electric vehicle industry.
- **Funding and investment:** The importance of funding to support the industry should not be underestimated. ARENA (the Australian Renewable Energy Agency) has been supporting electric vehicle innovation with the investment of a $200 million+ fund targeting charging technologies and infrastructure.

One example of an Australian business making waves in the EV industry is Lumen Freedom.

ELECTRIC VEHICLE NEWS

Wirelessly charging McLaren's fastest road car

The McLaren Speedtail Hyper-GT is the British auto manufacturer's fastest road car ever. Near the end of testing, a prototype of the sleek gas-electric hybrid sports car hit 403 kilometres per hour at the Johnny Bohmer Proving Grounds, NASA's runway in Florida. Specs for the 2020 production model say that it can go from zero to 300 kilometres per hour in 13 seconds.

To charge the lightweight battery whenever the aerodynamic three-seat vehicle isn't in use, McLaren partnered with Lumen Freedom to use its wireless electric vehicle charging (WEVC) system. The Speedtail is the first vehicle in the world to incorporate it.

Although inductive, or wireless, charging is becoming more common for phones, smartwatches and other small devices, Lumen Freedom's wireless system for the Speedtail represents a unique solution for electric vehicles, according to Lumen Freedom general manager Rod Wilson and software team lead Radek Pesina.

For Lumen Freedom, the Speedtail project is just the start. Its production-ready system has the potential to transform automotive design, transportation and even the power grid as it currently operates.

The Lumen Freedom team envisions the adoption of WEVC systems by OEMs and infrastructure providers, leading to sweeping changes. One benefit will be the eventual reduction in the size of electric vehicle batteries.

"As wireless charging and accessibility to wireless charging becomes more commonplace, the forward projections are that battery sizes will be reduced because you won't need to carry as much energy onboard," Wilson said.

Wireless charging might also move Australia closer to vehicle-to-home and vehicle-to-grid scenarios. Wilson predicts that EVs will help power a house or become conduits to sell electricity back to the grid. Users just set battery storage to the desired retention level and hit a button from the car or house to engage energy transfer. The fully charged vehicle runs the lights, the TV and small appliances. For high-power home appliances, the system would revert to power from the grid.

Wireless EV charging is emerging just as autonomous vehicle testing ramps up. In August 2020, the US state of Michigan announced plans to explore building a 64-kilometre roadway between Ann Arbor and Detroit just for autonomous vehicles. Several major automakers agreed to provide input. The idea is to start with shared vehicles and then expand to personal and freight vehicles.

Wilson expects cities worldwide will designate areas like this for autonomous electric vehicles that can charge as they go.

"It's coming with a rush. We're looking forward to a big, bright, wireless future," he said.

What does the future hold for the Australian EV industry?

Moving forward, there is likely to be an 'OEM-isation' of the EV industry. The industry will start to move from large

ELECTRIC VEHICLE NEWS

players, such as Tesla, doing everything themselves (because as one of the pioneers of the industry, they had to invest in their own R&D — especially in battery development) to a more traditional model pushed by the traditional large manufacturers who assemble components from specialised suppliers.

There will be continued growth in Australian startups, innovating in areas such as battery technology, battery management, motors, controllers, wireless charging plates, solar charging roofs and so on. In addition, with volume increasing and technology improving, the EV industry will diversify from high-volume passenger cars to either specialised industry-focused vehicles or even restomod electrification. For example, more and more small suppliers, including in Australia, provide crate electrification conversion to either classic cars or industry-specialised vehicles.

Australia has a unique combination of engineers and researchers who can combine experience and expertise in electrification, automotive and industry. It does not seem likely that there will be a major car manufacturer coming back to Australia anytime soon, but certainly it could become home to a thriving EV supplier and specialised EV industries, thanks to the country's engineering excellence, unique needs and potential.

RETROSPECT

THE DAYS BEFORE ELECTRIC LIGHT

By Terry Miller | 19 March 2022 | Source: Frank Lloyd Wright Trust

It is hard to believe that 100 years ago electric lighting was in its infancy and only just starting to appear in the domestic setting, often affordable only by the wealthy.

Candles, oil lamps, gas light and of course daylight (when available!) were the go to sources of illumination.

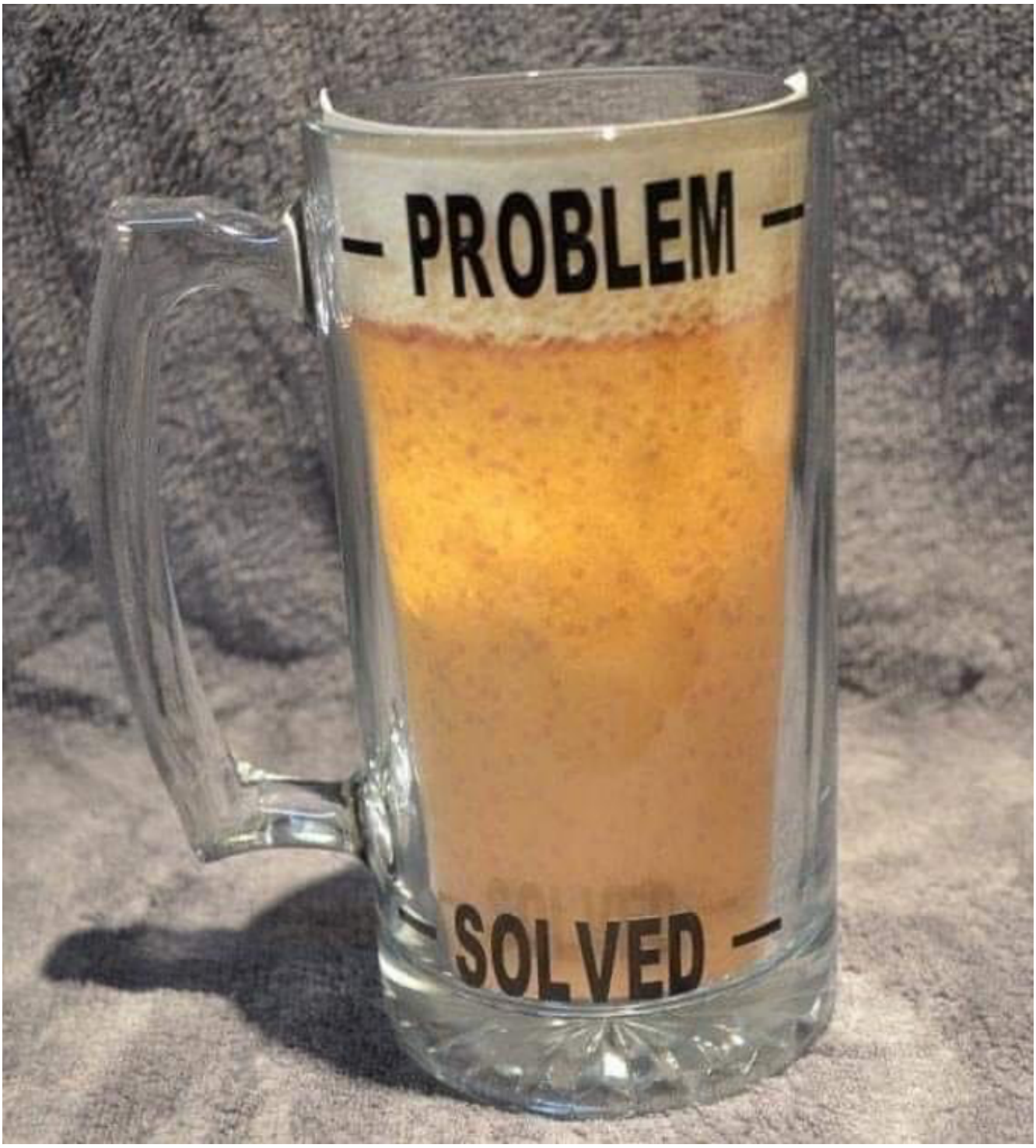
One example of ingenious ways of lighting the interior of otherwise gloomy buildings was the Luxfer prism, designedby famous American architect Frank Lloyd Wright.

Wright eventually patented 45 variants of the Luxfer Prism for the American Luxfer Prism Company.

Typically installed in the upper registers of windows in both industrial and commercial spaces, these ribbed, 100mm square sheets of glass used refraction to illuminate large, deep spaces with natural light. Wright's many designs for Luxfer Prisms are distinguished by their geometric patterning. They feature abstract compositions made up of beading, squares, circles, and ovals that are reminiscent of Friedrich Froebel's Gifts that Wright engaged with as a child. Wright's patents for the Luxfer Prisms resulted in royalties with which he was able to construct a new studio at his home in Oak Park.

HUMOUR BREAK

**WELL TESTED AND PROVEN STRUCTURED PROCESS FOR SOLVING COMPLEX ISSUES.
ALSO WORKS WELL IN SMALL GROUPS.**



INTERNATIONAL NEWS

With Ukraine war and Covid-19 surge in China, chip shortage worsens

By Dan McCarthy | March 2022 | Morning Brew - Emerging Tech

Wait times hit a record-high 26.2 weeks in February, and have likely gotten longer since then.

At the start of this year, the prognosis for semiconductor production was...not great.

We had shortages of semiconductors, made worse by shortages of the machines necessary to make semiconductors, all exacerbated to an almost comical degree by a shortage of semiconductor-making talent. Lead times for chip orders hit a new record-high of just under 26 weeks. Surely, things must have improved since then.

Right? Very wrong. In February, lead times ticked up even further to just over26 weeks, per Susquehanna Research Group data cited by Bloomberg. And that data mostly reflects a period of time before Russia invaded Ukraine—and it entirely misses recent Covid-driven disruptions in China.

- Ukraine is the world's main producer of neon, which is used by the laser-etching machines that turn slabs of silicon into chips. Following Russia's invasion of the country in late February, its two neon giants—which together account for around half of the world's semiconductor-grade neon—halted production. There aren't reliable estimates for how much neon the semiconductor industry has stocked up, but TSMC says it has "safety stocks" that will get it through the near term. Smaller chipmakers may not fare so well.
- China makes a lot of things, including semiconductors. And one of the major places in China that makes things is Shenzhen—a manufacturing hub with more than 17 million residents that was shut down in recent days due to surging Covid-19 cases. The Wall Street Journal reportedthat 40+ Taiwan-based semiconductor and electronics producers temporarily closed facilities in Shenzhen and a nearby city Dongguan on Monday.

Looking ahead...A few weeks ago, President Joe Biden urged Congress to pass a reconciled version of the semiconductor subsidy acts that have passed the House and Senate in different forms. The bill in its current form, called the America COMPETES Act, could authorize $52 billion in subsidies for US chipmaking plants. That would be a transformational sum, but building semiconductor plants takes time—and even then, the semiconductor supply chain will remain exposed to events like pandemics and war.

INTERNATIONAL NEWS

DOE labs talk innovation, future of nuclear

By Kevin Clark | 8 March 2022 | Power Engineering

The leaders of three national laboratories under the U.S. Department of Energy speak at CERAWeek Tuesday, March 8 (Photo/Kevin Clark).

Editor's Note: Clarion Energy's Kevin Clark is on the ground in Houston for CERAWeek and is reporting the latest from the conference.

The U.S. Department of Energy's 17 national laboratories tackle the most pressing scientific challenges of our time. This includes researching, developing and innovating cutting-edge technologies. It also means working with commercial partners to scale those technologies in helping the country meet its net-zero goals.

The leaders of three of those labs spoke at a CERAWeek conference panel March 8. Doug Arent, executive director of the National Renewable Energy Laboratory (NREL); Brian Anderson, director of the National Energy Technology Laboratory (NETL); and Paul Kearns, director of the Argonne National Laboratory, answered questions about how to accelerate the energy transition in the face of a mounting climate threat.

Arent cited two steps that he said are important: staying on the cutting edge of integrating renewables and moving toward net-zero energy systems; and creating and cultivating partnerships.

He noted NREL currently has about 900 partnerships, including small and large businesses, nonprofits, educational institutions, and local, state, and federal government.

"We are actually trying to get the innovations that are created and validated in the laboratory, into the hands of commercial partners who can scale them and take them to commercially viable, sustainable solutions," said Arent.

NREL's research campus in Golden, Colorado (Source: National Renewable Energy Laboratory).

NuScale Power Reactor building (Source: NuScale Power).

INTERNATIONAL NEWS

Anderson discussed the federal government's efforts to fund job creation projects to help regions transition away from coal and coal-fired power. He leads the White House Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization, which was created last year and seeded with nearly $110 million in funding.

"We're working not only on the technologies that need to get implemented to tackle the climate crisis, but how we can do it in a way that does not leave the communities behind who have served our economy for the last 100 years," said Anderson.

Argonne National Laboratory, led by Kearns, focuses on basic science research, energy storage and renewables, environmental sustainability, and supercomputing. It was originally founded as a lab dedicated to finding peaceful uses of nuclear power.

DOE's Office of Nuclear Energy recently selected three Argonne scientists to help usher in the next generation of nuclear reactors. Argonne is partnering with TerraPower and X-energy, under the DOE Advanced Reactor Demonstration Program, to build two advanced nuclear reactors that can be operational within seven years.

In 2020, the department awarded each company $80 million in initial funding for the public-private partnership. The projects would become fully commercialized with help from $1 trillion infrastructure bill signed into law last year.

Despite some retirements and delayed or abandoned nuclear projects, there is a renewed interest in nuclear tech.

When asked about this nuclear renaissance at CERAWeek, Kearns said the "stage has been set" but that it would depend on whether projects moved quickly through the licensing process in the next two or three years.

"If there's an upset in the regulatory process or we have an early fail, I think that'll be more challenging scenario for the industry," he said.

Arent was more optimistic, pointing out there are small modular reactor companies with the backing of private equity. DOE has partnered with both NuScale Power and Utah Associated Municipal Power Systems (UAMPS) to demonstrate this decade SMR technology at the Idaho National Laboratory.

Anderson chimed in: "With modularity comes the ability not just to do pure baseload, but to be able to do some load following. If we added [load following] then we have added an attribute to next-generation nuclear that will have a place in the market."

Nuclear power currently provides 52% of the nation's clean electricity. A recent Associated Press survey of the energy policies in all 50 states and the District of Columbia found that about two-thirds cited nuclear, in one fashion or another, as positioned to help take the place of fossil fuels. Roughly one-third of the states had no plans to incorporate nuclear power in their green energy goals, leaning instead on renewables to try to stave off the worst effects of a warming planet.

INTERNATIONAL NEWS

DOE Releases First-Ever Comprehensive Strategy to Secure America's Clean Energy Supply Chain

March 2022 | T&D World

DOE report includes over 60 actions to enhance supply chain resiliency, spur domestic manufacturing capacity, and create millions of good paying jobs for American workers.

The U.S. Department of Energy (DOE) released America's first comprehensive plan to ensure security and increase our energy independence. The report, "America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition," lays out dozens of critical strategies to build a secure, resilient, and diverse domestic energy sector industrial base that will establish America's role as a global leader in clean energy manufacturing and innovation.

In addition to spurring job creation and economic growth, these strategies to invest in and strengthen America's supply chains will help combat inflation and reduce costs for American families and businesses by protecting against global supply chain disruptions and backlogs that drive up prices. The report was produced in response to President Biden's Executive Order 14017, America's Supply Chains, and is supported by 13 deep-dive supply chain assessments across the energy sector — ranging from solar energy to semiconductors to cybersecurity.

As the federal government begins to implement the Bipartisan Infrastructure Law, which provides US$62 billion in energy sector funding, DOE's report summarizes how the U.S. can capture the economic opportunity inherent in the energy sector transition and build a world-class American energy manufacturing base and workforce.

"Taking bold action to invest in our supply chains means America will reap the tremendous opportunities that tackling climate change presents to kickstart domestic manufacturing and help secure our national, economic, and energy security," said Jennifer M. Granholm, U.S. Secretary of Energy. "The strength of a nation relies on resilient and reliable critical supply chains across sectors, and DOE's report provides the key strategies and recommendations for Congress and the Federal government to act now to help deliver more jobs and a stronger, cleaner future."

Demand for clean energy technologies such as wind turbines and batteries for electric vehicles has increased significantly as technology costs have plummeted over the last decade. The global clean energy market is expected to grow exponentially — reaching US$23 trillion at a minimum by 2030.

Without new domestic raw materials production and manufacturing capacity, the U.S. will continue to rely on clean energy imports, exposing the nation to supply chain vulnerabilities while simultaneously losing out on the enormous job opportunities associated with the energy transition. Yet, in many cases, the United States has untapped potential to support greater domestic production.

Recent shortages of foreign-manufactured automotive semiconductor chips due to the COVID-19 pandemic have forced slowdowns at U.S. car manufacturing plants, highlighting how shortages can hurt American workers. The strategies and actions included in this report will ensure the United States has the capacity to respond quickly in the face of challenges such as global production shortages, trade disruptions, and natural disasters –and to bolster a domestic clean energy supply chain that leads the global economy.

INTERNATIONAL NEWS

"America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition" provides seven key areas for boosting supply chain resiliency and rebuilding American manufacturing:

- Increase availability of critical materials — Critical minerals, such as cobalt for batteries and rare earth elements like neodymium for offshore wind, are key components to the clean energy technology we need to achieve our national climate and economic goals.
- Expand domestic manufacturing capabilities — There is opportunity to boost America's manufacturing capabilities Through efforts such as increased funding for workforce development, investments in manufacturing programs to support the clean energy transition, and coordinating with manufacturers and state, local, and tribal governments to support the establishment of regional clean energy industrial clusters.
- Invest and support the formation of diverse, reliable, and socially responsible foreign supply chains — This will complement domestic opportunities to diversify clean energy supply chains, such as promoting the adoption and implementation of traceability standards to improve global supply chain mapping capabilities. These actions will instill integrity of product custody, and support carbon footprinting of energy supply chains, as well as build on current efforts to support investments in America's supply chain security — such as investing in a graphite mine in Mozambique — a mineral key to lithium-ion battery manufacturing.
- Increase the adoption and deployment of clean energy — By leveraging federal purchasing power, we can provide a sustained demand signal for both domestic clean energy products and the capability to manufacture them in the United States, advancing activities to grow and sustain the demand signal for sustainable transportation fuels and associated supply chain industries.
- Improve end of life energy-related waste management — This includes advancing technologies to recycle and recover valuable materials like batteries, aluminum, and steel that can continue to feed domestic clean energy supply chains safely and effectively.
- Attract and support a skilled workforce for the clean energy transition — By working across government to embed strong labor standards and support for organized labor in federal funding for the energy sector industrial base, and engaging key stakeholders, we can set strategic nationwide plans to encourage the creation of good, family-sustaining, union jobs with competitive wages and benefits.
- Enhance supply chain knowledge and decision making — Developing supporting studies that assess and quantify the economic, environmental, social, and human rights impacts of different aspects of the energy supply chain for all clean technologies, and the creation and maintenance of a manufacturing and energy supply chain office as well as database and analytical modeling capabilities, will help ensure supply chain policy and investment decisions are grounded in an understanding of critical factors such as risks, dependencies, material availability, and supply chain and market dynamics.

DOE has already made great progress addressing supply chain vulnerabilities and is taking significant steps to further secure our energy supply chains. Ongoing efforts include:

- Mining Innovations for Negative Emissions Resources (MINER) Program: DOE released a US$44 million funding opportunity for the MINER program which will provide commercial-ready technologies that give the United States a net-zero or net negative emissions pathway toward increased domestic supplies of copper, nickel, lithium, cobalt, rare earth elements, and other critical elements required for a clean energy transition.

INTERNATIONAL NEWS

- New Manufacturing and Energy Supply Chains Office: DOE is creating a new Manufacturing and Energy Supply Chains Office that will focus on strengthening and securing energy supply chains needed to modernize the nation's energy infrastructure and support the clean energy transition. This office will engage with private-sector companies, other Federal agencies, and key stakeholders to collect, analyze, respond to, and share data about energy supply chains to inform future decision making and investment.
- Rare Earth Element Facility: DOE has released a Request for Information for the $140 million allocated from the Bipartisan Infrastructure Law for the design, construction, and build-out of a facility to demonstrate the commercial feasibility of a full-scale integrated rare earth element facility for extraction, separation, and refining. This first-of-a-kind of facility will accelerate U.S.-made rare earth elements processing technologies that will boost domestic manufacturing of rare earth metals crucial for clean energy and national defense industries.
- Clean Hydrogen Hubs: DOE has released a Request for Information for the $8 billion allocated from the Bipartisan Infrastructure Law to establish at least four Regional Clean Hydrogen Hubs to serve as a network of clean hydrogen producers, potential clean hydrogen consumers, and connective infrastructure.
- High-Capacity Batteries: Building on the 100-day supply chain report on high-capacity batteries issued by DOE last spring, Congress included in the Bipartisan Infrastructure Law more than US$6 billion to fund domestic battery materials processing, manufacturing, and recycling that will help improve grid resilience and scale up the electrification of cars, trucks, and buses. These grants, starting with two Notices of Intent just released for funding worth nearly $3 billion, will allow companies to expand and build new American factories with quality job opportunities in regions throughout the country.

Critical Minerals and the National Defense Stockpile: The Departments of Energy, Defense, and State executed a memorandum of agreement (MOA) that sets the foundation for a critical minerals stockpile to support the U.S. transition to clean energy and national security needs. The MOA formalizes an interagency partnership to acquire and recycle selected materials for technologies that range from grid-scale batteries to wind turbines.

"America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition" represents not only dozens of specific actions that DOE is taking or commits to taking, but it details a whole-of-government approach to the nation's energy supply chain challenges and opportunities. The strategies described in the report lay out inter-agency collaboration on efforts such as small business loans, foreign investment in U.S. manufacturing, community engagement on mining for critical minerals, and port infrastructure to handle energy product shipping.

The report also includes more than 20 recommendations for congressional action related to the energy supply chain, such as:

- Enact legislation to provide tax incentives to support domestic clean energy manufacturing and deployment, including incentives for building new facilities and for the ongoing operation of those facilities.
- Appropriate funding to DOE to utilize Title III of the Defense Production Act in partnership with the President.
- Appropriate funds to establish regional and state-level sector partnerships and Registered Apprenticeships to recruit, train, and place workers into careers needed for domestic supply chains.

To learn more about "America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition," view the Fact Sheet or click here.

INTERNATIONAL NEWS

Renewables, nuclear and energy efficiency in IEA plan to break EU reliance on Russian gas

March 2022 | Smart Energy International

Ten-point plan in line with Green Deal but IEA does not rule out ramping up coal plants to cut gas dependence.

The International Energy Agency today unveiled a 10-point plan which it believes could wean the European Union off Russian gas imports by more than a third by this time next year.

The plan includes measures such as bringing in gas from other countries and boosting national reserves, as well as accelerating the roll out of renewables and increasing energy efficiency in buildings, industry and among consumers.

It also incorporates maximising power from nuclear plants, with a suggestion that countries which are currently planning to retire nuclear plants may want to "revisit those decisions".

The move comes in response to Russia's invasion of Ukraine and subsequent fears over Europe's energy security because of its dependence on Russian gas.

Gas as 'economic and political weapon'

"For decades the European gas supply has been dominated by Russia and now nobody is under any illusions – Russia is using this as an economic and political weapon," said IEA executive director Fatih Birol in a press conference.

Last year, the EU imported 155 billion cubic metres of natural gas from Russia, accounting for around 45% of EU gas imports and close to 40% of its total gas consumption.

Birol said the IEA's 10-point plan "provides practical steps to cut Europe's reliance on Russian gas imports by over a third within a year while supporting the shift to clean energy in a secure and affordable way.

"Europe needs to rapidly reduce the dominant role of Russia in its energy markets and ramp up the alternatives as quickly as possible."

Birol: Russia is using gas "as economic and political weapon".

INTERNATIONAL NEWS

The 10-point plan

Here's a breakdown of the 10 points:
1. No new gas supply contracts to be signed with Russia.
2. Replace Russian supplies with gas from alternative sources, such as Qatar, Algeria and Azerbaijan.
3. Introduce minimum gas storage obligations for European countries to boost system resilience for next winter.
4. Accelerate the deployment of new wind and solar projects, which Birol said could reduce gas use by 6 billion cubic metres within a year. He said Europe is "already a world leader" in renewables and added it could go further by speeding-up the permitting process. "We don't need to cut corners: we just need to cut red tape."
5. Maximise power generation from bioenergy and nuclear, which the IEA estimates could cut gas use by 13 billion cubic metres in a year. Birol said: "For those countries looking at retiring nuclear plants, there may be some merit to revisit those decisions."
6. Enact short-term tax measures on windfall profits to shelter vulnerable electricity consumers from high prices, which the IEA hopes would reduce energy bills even when gas prices remain high.
7. Speed up the replacement of gas boilers with heat pumps.
8. Accelerate energy efficiency improvements in buildings and industry.
9. Encourage a temporary thermostat reduction of 1°C by consumers, which Birol said would alone reduces gas use by some 10 billion cubic metres in 12 months.
10. Step up efforts to diversify and decarbonise sources of power system flexibility to loosen the strong links between gas supply and Europe's electricity security.

'No miracle remedy'

Joining Birol for the press conference was Barbara Pompili, France's Ecological Transition Minister, and Kadri Simson, the European Commissioner for Energy.

Pompili said that "there is no miracle remedy" to reduce Europe's reliance on Russian gas, yet she stressed that the 10-point plan would "strengthen the robustness of the energy system".

Pompili: "We must enhance the energy transition."

"More than ever, getting rid of Russian fossil fuels and of fossil fuels in general, is essential. What is at stake is both the need to accelerate our fight against climate change, and, as we can see now, the short-term energy security and independence of the European continent."

"We must enhance the energy transition that we have started. Each additional wind turbine or solar panel is a step forward in the fight for the climate and for our energy independence."

She added that she hoped that within 15 days the Ukraine grid would be fully connected to the European network.

Simson opened her remarks by stating that "Russia's attack on Ukraine is a watershed moment". She said that next week the EC "will propose a pathway for Europe to become independent from Russian gas as soon as possible" and added

INTERNATIONAL NEWS

that the IEA's plan offered "concrete steps we can take towards that goal".

Climate change

She also stressed that all 10 proposed measures were in line with the EU's Green Deal. "The Green Deal agenda is one for our energy security as well as climate change."

Many of the actions in the plan such as those around energy efficiencyand renewables are also key elements of the IEA's Roadmap to Net Zero by 2050.

However, the IEA has also highlighted other measures which are in line with neither its own Net Zero report nor the Green Deal, but "are available to the EU if it wishes, or needs to, reduce reliance on Russian gas even more quickly – but with significant trade-offs".

Chief among these is an increased use of coal power stations or using oil in existing gas-fired power plants.
The IEA says that these options "may also be costly from an economic point of view", however it concedes that "they could displace large volumes of gas relatively quickly".

"If the fuel-switching option were to be fully exercised in addition to the complete implementation of the 10-Point Plan described above, it would result in a total annual reduction in EU imports of gas from Russia of more than 80 billion cubic metres, or over half, while still resulting in a modest decline in overall emissions."

This morning, European Commissioner for Climate Action, Frans Timmermans, told the BBC that the coal option was certainly on the table. Indeed, he suggested that Poland could still make its switch to renewables within its existing timeframe by cutting out gas and switching to coal until renewables were on line.

Kadri Simson wears the colours of Ukraine for press conference.

INTERNATIONAL NEWS

Technical Studies to Design Transmission Expansion for a Clean Electricity Future

March 2022 | Source: ESIG Energy Systems Integration Group

Reston, Va. – A massive expansion of the bulk transmission system is needed to support very high levels of clean electricity, a massive effort that requires rethinking our current approach to expanding the grid. A new report by the Energy Systems Integration Group, Design Study Requirements for a U.S. Macrogrid: A Path to Achieving the Nation's Energy System Transformation Goals, articulates a set of recommendations for the next stage of proactive transmission planning of a macrogrid.

"A future energy system that is affordable, reliable, and clean will require a tremendous expansion of our transmission system, and planning for transmission at a national level will deliver large efficiencies in siting, permitting, and cost," said Debra Lew, associate director of the Energy Systems Integration Group. "This report discusses a national-scale HVDC macrogrid that could be built over and interconnected into the existing AC grid—infrastructure that would enable massive interconnection of clean energy resources, provide economic benefits by facilitating the use of the most economically attractive resources, and confer resilience to extreme events."

To date, the many facets of design, construction, and operation of a macrogrid have received only cursory or qualitative attention. This report describes a cadre of studies be launched to develop the next level of quantitative detail about how a properly designed macrogrid could transform the operation of the electrical infrastructure in the United States. Initial design studies will examine technology selection, macrogrid topology, circuit capacities, and performance evaluation. Work would then proceed to a reliability assessment (including stability analysis), a resilience analysis, an assessment of economics and feasibility, and an operations analysis.

"A dramatic re-thinking of bulk transmission expansion is needed," said Bob Zavadil of EnerNex and a lead author on the report. "A properly designed macrogrid employing advanced HVDC concepts and technologies could completely transform how bulk electric energy is produced and transported across the U.S. and have positive impacts on system reliability and resilience for generations to come."

The Energy Systems Integration Group is a nonprofit organization that marshals the expertise of the electricity industry's technical community to support grid transformation and energy systems integration and operation.

Click here to download the full report.

INTERNATIONAL NEWS

Can Artificial Intelligence Help Close the Gap between Day-Ahead, Hour- Ahead, and Real-Time Energy Forecasting?

2 February 2022 | Source: T&D World

Current electricity grid infrastructure is ill-equipped to rapidly integrate distributed energy resources (DERs) like solar panels, wind turbines, electric vehicles (EVs), and battery systems.

Mitigating the worst effects of climate change requires large-scale adoption of renewable energy and storage technologies across every sector of society. However, current electricity grid infrastructure is ill-equipped to rapidly integrate distributed energy resources (DERs) like solar panels, wind turbines, electric vehicles (EVs), and battery systems.

Just to highlight one green technology, the International Energy Agency (IEA) notes that global solar PV capacity grew 23% from 2019 to 2020 – despite lockdown restrictions. And in just the US alone, the Solar Energy Industries Association (SEIA) reports that the nation's PV industry has enjoyed an average annual growth rate of 42% over the last decade. When you add in falling PV panel prices, new green incentives, and rising utility rates, it's clear solar adoption will only accelerate. And this is just one renewable energy technology of several.

Although this is the right direction for society as a whole, our transition to a truly sustainable future remains in jeopardy unless grid operators can find a way to onboard, manage, and distribute an exponential influx of green energy and storage potential.

Why Are Renewables So Difficult to Manage?
Grid operators are responsible for managing the electricity network, forecasting future demand, and generating enough supply to cover real-time energy needs. Even before the rise of DERs, managing all this data was a constant balancing act that required continuously predicting demand and producing energy at the lowest possible cost (or highest potential profit).

In theory, adding more distributed energy resources should make the entire grid greener since renewable technologies can offset the fossil fuel many energy providers use. Integrating DERs should also make the grid more reliable since power generation, storage, and transmission all become less centralized.

However, transitioning to renewables at scale poses several problems. Already discussed is the sheer number of new solar installations coming online. But batteries, EVs, charging stations, wind turbines, and microgrids are all on similar growth trajectories. And this results in more data than any grid operator can potentially manage.

The great irony, of course, is that a lot of data is missing from the equation. That's because many distributed energy resources like rooftop solar or electric vehicles are privately owned, making them behind-the-meter and outside the direct control of utility operators.

INTERNATIONAL NEWS

There is one additional layer of complexity.
Renewables like solar and wind are intermittent, which makes accurate forecasting incredibly difficult. Seasonal variations and changing weather conditions both have an obvious impact on power generation. But even a passing cloud can dramatically decrease real-time output for a mega solar PV farm.

With so many variables to manage, conventional methods for forecasting and capacity planning are insufficient against this deluge of information. Grid operators are increasingly forced to update their day-ahead, hour-ahead, and real-time operating procedures. This often involves migrating to a distributed energy resource management system (DERMS) technology that can better manage this information. But that still relies on human decision-makers who must collect, analyze, and act on many terabytes of streaming real-time data.

Leveraging the Power of Machines and Automation
There is now a growing push to use artificial intelligence (AI) to overcome many of the grid management challenges outlined above. When coupled with adaptive machine learning, AI is capable of:

- Analyzing historical load data, weather information, and other network parameters
- Generating highly accurate energy demand, generation, and price forecasts using continuous learning leading to improved accuracy over time
- Incorporating new data to further refine its predictions and become increasingly more accurate
- Optimizing grid conditions by collecting real-time data and sending real-time instructions to distributed energy resources, microgrids, and utility operators

Note that this isn't just theoretical. Artificial intelligence is already being used in the field alongside (and sometimes instead of) traditional utility operators.

For example, Veritone's AI-powered Forecaster uses historic and real-time weather, power demand, and DER device data to generate incredibly accurate predictions about the future supply, demand, and price of electricity. It recently chose California as a test market given that:

- It's the most populous state, with nearly 40 million residents[1] dependent on the larger power grid
- California is the undisputed leader in solar PV, EVs[2], and battery storage[3] (and an impressive 6th in installed wind capacity4).
- The California Independent System Operator (CAISO) is responsible for managing 80% of all the energy in the state

When put to the test in November 2021, Veritone's day-ahead market (DAM) energy Forecaster outperformed CAISO's forecast by a staggering 31%.

In addition to millions in direct savings to utility customers, this level of forecasting accuracy also helps to make the grid more resilient since energy is generated, sent, stored, or sold – all in real-time and under optimal conditions. Equally important, accurate forecasting also has a tremendous impact on operational planning, with grid operators often struggling to close the gap between the forecasted vs. actual supply, demand, and price of energy.

A 31% improvement not only offers measurable benefits in the form of economic savings and improved efficiency, but it also delivers environmental dividends as well. By becoming more resilient, the grid can more easily integrate distributed renewable energy and storage technologies. This is particularly true when using AI to both predict and manage this integration.

INTERNATIONAL NEWS

Better still, these predictive capabilities will only become more accurate over time as Veritone's AI-driven Forecaster continues to collect new data and adjust its forecasts.

Conclusion
The current challenges energy providers face are not going away anytime soon. In fact, they will only become more pronounced as falling technology prices and rising utility rates move the world away from fossil fuels. With more moving parts and data, managing the grid will become even more difficult – resulting in transmission losses, congestion, surges, shortages, equipment degradation, and even blackouts. And of course, consumers also pay a price in the form of less reliable delivery and worsening air quality.

And therein lies the paradox. Rapidly greening the grid has the opposite effect of making energy delivery more expensive and less green.

However, AI and machine learning have the potential to help resolve this paradox – allowing us to rapidly decarbonize while ensuring affordable and reliable power whenever and wherever it is needed at that moment in time.

References:

1. https://www.census.gov/quickfacts/CA
2. https://afdc.energy.gov/data/10962
3. https://www.energy.ca.gov/sites/default/files/2019-12/energy_storage_ada.pdf
4. https://neo.ne.gov/programs/stats/inf/205.htm

Current Revenue Recovery Schemes In Need Of Overhaul

March 2022 | Source: EEnergy Informer

Designed for a different era, they are no longer sustainable for an increasingly distributed future homeowners in sunny parts of the world facing steep retail electricity tariff have found that theycan generate their own. It is cheaper than buying kWhs from the network – with all its fixed andvariable charges, taxes, levies and other add-ons. And if the homeowner can afford a battery &/or an electric vehicle (EV), then the excess generation during sunny hours can be stored for later times.

A variety of other devices, for example an electric water heater with a large tank, can serve as a virtual battery. The house can be pre-heated or pre-cooled, another way to store the excess energy during the sunny hours. A typical homeowner can generally recover its investment by making it smart and shortening the payback period.

It is renewable energy, it is locally generated and consumed reducing line losses while offering protection against frequent power outages. If properly managed, it could reduce congestion on the distribution network and help the network operator to better manage peak demand. On many levels it seems like a no brainer. Why would any sensible regulator be against distributed solar generation at customers' premises?

As it turns out, it is not that simple.

INTERNATIONAL NEWS

First, many utilities are against it because as more consumers become prosumers, they buy fewer kWhs from the network, which means that they don't contribute as much to the upkeep of the network as do non-solar customers. In places where distributed solar has taken off, the impact on utility revenues has become noticeable. For example, the investor-owned utilities in California, which has over 1.3 solar roofs, claim that they are already losing some $3 billion per annum in lost sales. This lost revenue, which they currently collect from everyone else – i.e., the non-solar customers – raises average retail rates, which in turn encourages more customers to go solar – leading to a death spiral.

The problem becomes emotionally charged because in many parts of the world, the solar customers tend to be more affluent than the average population –hence the cost shift amounts to a reverse Robin Hood scheme – not politically justified.

Second, it is generally agreed that utility-scale solar can produce power at a fraction of the cost – generally at a third of the cost or less – even after accounting for all the other benefits of distributed solar. If the aim is to decarbonize electricity generation, would it not make better sense to encourage utility-scale solar rather than the more expensive distributed variety –the critics ask?

Fundamentally, both issues have to do with how the industry collects revenues from the customers – in many places primarily or exclusively through volumetric tariffs. The tariffs in many places are totally out of line with the cost of generation, transmission and distribution – which is the reason consumers have an incentive to become prosumers. In California, typical residential consumers facing retail tariffs in the 25-30 cents/kWh are personally better off generating their own – and can recover their investment in 7-10 years or less, on average under the current regulations.

This personal gain, the critics argue, is made possible by subsidies from the non-solar customers, which makes the tariffs even more absurdly high. Solar customers argue that this is the only way they can avoid paying what they consider to be exorbitant prices. Utility-scale solar is great, and may cost next to nothing, but it does not reduce their monthly bills. Rooftop solar does.

And if the excess generation fed into the network – the net energy metering (NEM) scheme – is the problem, prosumers will invest in storage and stop exporting altogether. If the regulator imposes unreasonable fixed connection charges, some prosumers may totally defect by cutting the wire. That would only make the revenue collection problem even worse, wouldn't it?

As extensively reported in the Jan and Feb issues of this newsletter, the debate about how much to pay for distributed solar has reached a point where regulators and the industry in sunny places with high retail tariffs can no longer ignore it. But what is the way out? If the existing NEM schemes are no longer sustainable, what is the alternative? More broadly, how should the distribution companies collect sufficient revenues from their customers to be able to maintain the network?

To answer this question, one must start by asking what are the services provided or enabled by the delivery network – not just for solar but all customers– and how should different types of customers be charged for their fair share of those costs.

INTERNATIONAL NEWS

Viewed from this perspective, it becomes eminently obvious that not all the woes of the distribution companies can be blamed on the solar customers. EV owners, for example,who charge during peak demand hours – 4-9 pm in California – impose far more costs on the network than do solar customers. There are currently over 1 million EV owners in California with as many as 7.5 million expected by 2030.

Similarly, customers with large, poorly insulated houses and big air conditioners running at full blast during the same peak hours are far more expensive to serve than solar customers. If the regulators are primarily concerned about equity issues and cost shift, these customers impose significant cost shift to those who live in small, well-insulated houses and/or get by with a fan rather than cranking up their ACs.

At its core, the issue is a better, more efficient and more equitable way to recover sufficient revenues from different classes of customers based on their

- Load profiles;
- Service needs; and
- Level of dependence and the costs imposed on the network.

Solar customers, big homes with big ACs, with EVs and those living in super-efficient smaller homes with efficient appliances, frugal customers, those living in smaller apartments and those living in urban or rural areas impose vastly different costs on the network and must be charged accordingly. If the time has arrived for solar customers to pay a monthly network connection fee, shouldn't a similar fee apply to EV owners or those with large ACs? Should urban apartment dwellers pay the same for service as hard to serve rural customers? Should frugal customers with easy to serve load profiles pay the same as those with peaky profiles? The answer, as most experts would agree, is no.

What comes after rooftop solar and batteries? Grid defection

As the service needs of customers diverges, the existing tariffs are not sustainable. The time has arrived to come up with a better, more efficient and equitable way to allocate costs and collect revenues to maintain the electricity network. The basic principle should be that those who impose more costs on the network – and presumably gain value from it accordingly – should pay more. The debate on NEM schemes is misdirected, a red herring. **The regulators and the industry must look at the changing fundamentals, and get it right.**

We're going to need a lot more grid storage. New iron batteries could help.

By Dawn Stover | 23 February 2022 | Source: MIT Technology Review

Flow batteries made from iron, salt, and water promise a nontoxic way to store enough clean energy to use when the sun isn't shining.

One of the first things you see when you visit the headquarters of ESS in Wilsonville, Oregon, is an experimental battery module about the size of a toaster. The company's founders built it in their lab a decade ago to meet a challenge they knew grid operators around the world would soon face—storing electricity at massive scale.

INTERNATIONAL NEWS

Unlike today's lithium-ion batteries, ESS's design largely relies on materials that are cheap, abundant, and nontoxic: iron, salt, and water. Another difference: while makers of lithium-ion batteries aim to make them small enough to fit inside ever shrinking phones and laptops, each version of the iron battery is bigger than the last.

In fact, what ESS is building today hardly resembles a battery at all. At a loading dock on the back side of the ESS facility, employees are assembling devices that fill entire shipping containers. Each one has enough energy storage capacity to power about 34 US houses for 12 hours.

The company, which last year became the first long-duration energy storage company to go public and has ambitions to open factories around the world, will soon begin work on a battery that will dwarf even these truck-size versions. In partnership with the utility company Portland General Electric, ESS plans to construct one that will fill a half-acre building on land adjacent to its factory. It's expected to have almost 150 times the capacity of the biggest batteries the company ships today.

ESS's key innovation, though, is not the battery's size—it's the chemistry and engineering that allow utilities to bank a lot more energy than is economically feasible with grid-connected lithium-ion batteries, which are currently limited to about four hours of storage.

The iron "flow batteries" ESS is building are just one of several energy storage technologies that are suddenly in demand, thanks to the push to decarbonize the electricity sector and stabilize the climate. As the electric grid starts depending more on intermittent solar and wind power rather than fossil fuels, utilities that just a couple of years ago were looking for

INTERNATIONAL NEWS

batteries to store two to four hours of electricity are now asking for systems that can deliver eight hours or more. Longer-lasting batteries will be required so that electricity is available when people need it, rather than when it's generated—just as ESS's founders anticipated.

Good chemistry

Craig Evans and Julia Song, the founders of ESS, began working on an iron flow battery in their garage in 2011. A married couple, they met while working for a company developing fuel cells. Song (now the chief technology officer of ESS) is a chemist, and Evans (ESS's president) is an engineer and designer.

They saw the price of renewable energy systems dropping dramatically and predicted that this would drive demand for energy storage. An electric grid that is 80% powered by solar and wind, for example, would require an affordable way to store energy for at least 12 hours.

Currently, about 95% of the long-duration energy storage in the United States consists of pumped-storage hydropower: water is pumped from one reservoir to another at higher elevation, and when it's released later, it runs through turbines to generate electricity on its way back down. This simple method works well but is limited by geography.

Batteries don't have that limitation. However, most grid-scale batteries operating today are lithium-ion batteries. Relatively expensive, they also deteriorate within a few years and are made from difficult-to-recycle materials that can burst into flames or explode. Worse, if you want to double the storage capacity of your battery array, you have to buy twice as many batteries. That makes it too expensive to store energy for longer than a few hours, says Scott Litzelman, who manages a program that focuses on long-term energy storage at ARPA-E, the US agency that funds research and development of advanced energy technologies.

Flow batteries, like the one ESS developed, store energy in tanks of liquid electrolytes—chemically active solutions that are pumped through the battery's electrochemical cell to extract electrons. To increase a flow battery's storage capacity, you simply increase the size of its storage tank. When the battery grows to the size of a building, those tanks become silos.

Inside the flow battery's electrochemical cells, two electrolytes are separated by a membrane. One electrolyte flows past a positive electrode as it's pumped through the cell, and the other electrolyte flows past a negative electrode. In ESS's battery, these two electrolytes are identical: iron salts dissolved in water.

As the electrolytes flow through the cell, chemical reactions take place on both sides of the membrane. When an electric current is charging the battery, the electrolyte at the battery's negative electrode gains electrons, and dissolved iron salts are deposited onto the electrode's surface as solid iron.

When the battery discharges, the process is reversed: the electrolyte loses electrons at its negative electrode, the plated iron returns to its dissolved form, and the chemical energy in the electrolyte is converted back to electricity. At the positive electrode, the opposite process occurs: the electrolyte loses electrons and "rusts" to a brownish fluid while the battery is charging, and this process reverses during discharge.

In a conventional lithium-ion battery like the one in a mobile phone or electric car, the cell and electrolyte are contained inside a single package. "What you have at the start is what you get," says Evans.

INTERNATIONAL NEWS

But with a flow battery, keeping the electrolyte in an external tank means that the energy-storing part is separate from the power-producing part. This decoupling of energy and power enables a utility to add more energy storage without also adding more electrochemical battery cells.

The trade-off is that iron batteries have much lower energy density, which means they can't store as much energy as a lithium-ion battery of the same weight. And flow batteries require more up-front investment and maintenance than lithium-ion batteries.

However, when it comes to safely storing large amounts of energy for long periods, they're hard to beat. And that's exactly what grid operators will need to do a lot more of in the coming years.

Long-lasting

The batteries that utilities use today typically store power for four hours or less. That's fine for tasks such as smoothing out short-lived frequency fluctuations and supply drops, but as the electricity sector moves toward 100% clean energy, "you absolutely can't do it with four-hour batteries," says Hugh McDermott, senior vice president for sales and business development at ESS.

To accommodate the ups and downs of solar and wind generation, most grid operators use natural-gas "peaker plants," which can start up rapidly when electricity is in high demand. A battery that can provide 16 hours of storage would be cheaper to install than any peaking system, McDermott says.

Flow batteries are a small but growing part of the grid-storage market. By the end of 2019, they were used in only 1% of large-scale battery installations in the United States, according to an August 2021 update by the US Energy Information Administration on trends in the battery storage market. A few utilities began installing large-scale flow batteries in 2016 and 2017, but those batteries use a vanadium-based electrolyte rather than iron. Vanadium works well, but it's expensive.

Evans and Song initially set out to design a vanadium flow battery but changed course when they stumbled across some iron-based chemistry done at Case Western Reserve University in 1981. Iron struck them as a low-cost alternative to vanadium, "but it had challenges," says Evans.

One challenge was how to prevent roughly 1% of the electrons on the negative side of the battery from bonding with stray hydrogen ions in the water-based electrolyte instead of plating iron. Over time, this side reaction generates a buildup of hydrogen gas and causes the two sides of the battery to depart from a chemical balance in which both electrolytes return to their original, identical state when fully discharged.

"All batteries have side reactions," says Evans. But because it's easy to access the chemicals that circulate through a flow battery (unlike the chemicals closed inside a conventional battery), designers can include a mechanism to recover from these side reactions.

Evans and Song dealt with the problem by adding a "proton pump" to their battery. It's a fuel-cell-like unit that converts hydrogen gas back to protons, which reduces the pH of the electrolyte and brings the two sides of the battery back to the same state of charge. With the pump, the battery is expected to be able to cycle an unlimited number of times, for at least 20 years.

INTERNATIONAL NEWS

At Case Western, researchers have tried another approach: plating dissolved iron onto the particles in an iron slurry rather than onto a fixed electrode, so that the plated metal is stored in the battery's external tank. It worked well in smaller cells, but in bigger cells the slurry caused clogs.

Both Case Western and ESS have received ARPA-E funding to build and demonstrate iron flow batteries. The $2.8 million, five-year grant ESS received in 2012 enabled the company to develop the proton pump and move to commercial production.

Breakthrough Energy Ventures, a fund established by Bill Gates and other investors concerned about climate change, has also backed ESS. The company sold its first product in 2015: a battery that enabled a California vineyard to store solar energy during the day and power an irrigation system in the evening.

Today ESS has a backlog of orders for its shipping-container-size battery, which has a capacity of up to 500 kilowatt-hours. The company has begun delivering some to SB Energy, a clean-energy subsidiary of SoftBank, which agreed to buy a record two gigawatt-hours of battery storage systems from ESS over the next four years. The deal is valued at more than $300 million.

Buying time

ESS batteries can currently hold four to 12 hours of charge depending on how they're configured, but eventually some energy-storage systems may need to work for days or even weeks to accommodate seasonal fluctuations in wind power. Massachusetts-based Form Energy is developing an iron-air battery technology, which uses oxygen from ambient air in a reversible reaction that converts iron to rust. The company claims its battery could store power for up to 100 hours. Its first installation will be a one-megawatt pilot plant in Minnesota, scheduled to be completed in 2023.

Utilities aren't just thinking about how to store energy as they move toward renewables; they're also thinking about how to make the grid more resilient to extreme weather and other effects of climate change. Long-duration batteries have a role to play there, too.

In a project with San Diego Gas & Electric, ESS's iron flow batteries will be paired with a solar array in the wildfire-prone town of Cameron Corners, California. If the utility needs to shut down transmission lines to prevent or respond to a fire, the solar-battery microgrid can keep the town's critical services functioning. The project is slated to come online later this year.

ESS's Wilsonville facility has room to ramp up production, but the number of orders it gets will depend to a large extent on the fate of clean-energy tax credits that are part of the Build Back Better bill currently stalled in Congress. Proponents of energy storage argue that long-duration storage deserves the same incentives as renewable energy.

If lawmakers agree, those credits could help make energy storage technologies like the iron flow battery cheap enough for utilities to begin using them widely. Both the ARPA-E program and the US Energy Department's Long Duration Storage Shot aim to have cost-competitive systems that can store 10-plus hours of energy on the market within a decade.

For ARPA-E, that means getting the levelized cost of energy storage—which takes into account all costs incurred and energy produced over a lifetime—down to less than five cents per kilowatt-hour, Litzelman says, which would be a 90% reduction from 2020. The initial cost of a battery is just part of that equation.

INTERNATIONAL NEWS

Flow batteries aren't the only promising technology being developed for long-duration energy storage. Other companies and researchers are experimenting with different types of batteries, as well as with hydrogen storage and mechanical systems such as compressed air or "mobile masses" that are hoisted and lowered to convert electrical energy to kinetic energy. One experimental system funded by ARPA-E stores energy by pumping water into rocks, and extracts energy when the water gets squeezed back out.

All these systems have a shared goal, says Litzelman: "24/7 clean energy." Getting there will very likely require multiple new storage technologies, and many more companies will have to reach the point where ESS is today. Unless, of course, a different kind of technology breaks through.

CIRED INTERNATIONAL NEWS

CIRED Porto Workshop 2022 E-mobility and power distribution systems

2 & 3 June 2022

CIRED workshops on specific topics are organized in Europe every two years between CIRED main conferences. In 2022, the workshop will address "**E-mobility and power distribution systems**". It will be held on 2-3 June 2022 in Porto, Portugal. **Registrations** for the 2022 CIRED Workshop in Porto are now open! Find all relevant information on the Registration page.

Head to the registration website to join us! Early rates apply until **13 April**.
Full paper submission for CIRED Porto Workshop 2022 is now **closed**. Selected authors will be notified by **25 March 2022**.

Four renowned keynote speakers have already confirmed their participation in our Porto Workshop:
Filipe ARAUJO, Porto City Hall (Portugal)
Jan HAUGEN IHLE, Ionity (Norway)
Lili LI, Tsinghua University (China)
Luca LO SCHIAVO, ARERA (Italy)

See you in Porto!

Our hybrid workshop will take place in Porto on **2-3 June**.

Attend the workshop in person for all our live **oral presenta0ons** and **poster sessions**!

Unable to join us in Porto? We offer you the possibility to participate through our **online platform** and access all our live streaming, recordings, presentations, Q&A, chat and posters.

Important dates
25 March 2022: Full papers notification of acceptance
13 April 2022: Early rates registration deadline
2 - 3 June 2022: CIRED 2022 Porto Workshop

EESA

CIRED PAPER

IMPLEMENTATION OF ISO 55.000 AT MITNETZ AND LEAN MANAGEMENT PROCESSES

Paper 2312 | Madrid | June 2019

The energy transmission, the pressure of regulation on grid fees and the expectations of customers and shareholders set difficult targets for the grid operator. A process to deal with these targets is described in ISO 55001; more specifically ISO 55001:2014 which comprises the requirements of asset management as management systems.

MITNETZ STROM and MITNETZ GAS are among the first companies worldwide to implement this international standard and combine it with elements of the famous "Toyota Way", now mostly known as lean management. This paper presents the approach of Mitnetz facing the necessary challenges of ISO 55000 in accordance with the implementation of an industrial managing process. ISO 55000:2014 is the superordinate norm giving an overview and describing the principles.

DOWNLOAD PAPER

CIGRE INTERNATIONAL NEWS

FROM GLOBAL CONNECTIONS
Transforming our Grid

2022

The electric utility industry is facing unprecedented change. As efforts to deploy distributed energy resources accelerate, the interconnection and integration of these resources becomes ever more central to grid operation and investment. At the same time, we see new loads coming online to electrify transit, buildings, and industry, adding new dimensions to an already complicated metamorphosis.

by Terence Donnelly
President and COO of ComEd

Motivations: Climate Realities and Decarbonization
The changing configuration of the energy system poses operational challenges for utilities, but the effort to overcome those challenges is justified by benefits accruing to customers. Last year, ComEd's service territory was hit by a derecho storm generating more than a dozen tornadoes, which resulted in almost 800,000 customer interruptions. As our crews successfully respond to increasingly severe and frequent storms, we see the urgency of grid investments that will help to mitigate climate change and to respond to the storms to come.

In northern Illinois and Chicago, ComEd is facing these challenges head on. Over the past decade, we've transformed the distribution grid to improve reliability and system performance. Reliability improvements are paying dividends in community benefits, fostering resilience and sustainability across our territory.

State and federal policymakers have recognized the role of a clean energy system in resilience, decarbonization, and job creation. The infrastructure bill that the US Senate has passed includes support for investments to promote grid resiliency and flexibility. The legislation promises to be a significant driver of grid investments. In many parts of the country, state legislation is providing additional support for clean energy resources and a roadmap for advanced grid capabilities. Here in Illinois, the Governor signed into law a landmark clean energy bill that establishes new ambitious beneficial electrification programs and expansion and retention of clean energy generation in the state. Clean air, a stable climate, and social welfare are central objectives of this legislation.

Decarbonization is the key to avoiding the most pernicious impacts of climate change, and the grid is the prime enabler of mass-scale decarbonization. The grid must be prepared to serve all the essential loads that are currently reliant upon fossil fuels. This work will define electrical distribution for decades to come.

Grid Challenges

Integration of clean energy resources including electric vehicles poses a series of challenges to traditional utility infrastructure. When we talk about "integration", we imagine a grid that goes beyond interconnection of advanced energy resources. Fully integrated technologies function in concert with other grid equipment, sustaining grid operations, responding to grid conditions, and communicating fast enough to protect our customers, crews and equipment.

CIGRE INTERNATIONAL NEWS

The realization of full integration will take time. Electric utilities have been integrating technologies for over a century and it is a core competency. Right now, we need to focus on integrating the necessary technologies onto the grid with a planning and operational approach. The increasing penetration of distributed energy resources (DER) may challenge relay protection coordination, exceed transformer capacity and cause phase imbalance. Intermittent renewables and stochastic EV charging further complicates the daily work of distribution system operators and belies standard load forecasting approaches. As DER penetration increases, transmission operations can also be impacted, posing new coordination challenges to transmission-distribution operation teams and industrial simulation software.

Solutions: Strategic opportunities for grid design and adaptation

Grid challenges can only be overcome by successfully integrating complex and dynamic system components. ComEd is working to develop and demonstrate a portfolio of technologies that have the cumulative capabilities necessary to guarantee visibility into system performance, efficient utilization of available capacity, increased resiliency, power quality, grid modularity and speed. The best hope for success comes from partnerships across the industry with the U.S. Department of Energy, the Department of Homeland Security, National Science Foundation (NSF), IEEE Power and Energy Society, key vendors, universities, national labs and industry researchers. ComEd's portfolio of 18 federally funded projects is an example of what allows us to leverage DOE, DHS, and NSF resources to learn as a team.

When it comes to system visibility, sensors will play a critical role in risk mitigation as new equipment and configurations are brought onto the system. We look to advanced sensors like phasor measurement units (PMUs), line sensors, and our new ComEd-developed, DOE-sponsored intelligent sensor platform, or SIMPLETM to demonstrate the further enhancement of this capability. These sensors are able to leverage the advanced communications infrastructure that ComEd is deploying to establish secure, low-latency connections for capabilities such as distribution automation schemes. Sensors also inform software systems that can automate interactions with grid assets. ComEd is demonstrating distributed energy resource management system (DERMS) projects that provide new options for customers. In one deployment, we use software to maximize the utilization of available DER hosting capacity. Without this software, substantial grid upgrades would have been required at considerable cost, to bring three solar farms onto a distribution network with several wind farms already interconnected. The first installation of this DERMS went live on April 1st, 2021 and the next month it successfully managed DER output to support system safety while adhering to equipment capacity constraints. Additional DERMS deployments are planned to manage power quality from PV output and to coordinate a battery system that participates in the frequency market. We anticipate an Advanced Distribution Management System (ADMS) that will track system conditions and respond in automated ways. DERMS demonstrations are building capabilities that we will unify within a software layer extensible to many different use cases.

While grid investments necessarily involve long-term planning, we must also anticipate events for which there is little time to plan. Emergency response is a core function of every utility, and the rising tide of extreme weather events makes these activities much more significant. ComEd has engaged a wide range of stakeholders for major storm preparedness. This initiative involves careful planning to prepare for worst-case scenarios and extensive use of analytics. Our data analytics team has deployed advanced weather sensors to improve storm prediction and outage recognition. We have used advanced analytics to identify system vulnerabilities so that they can be hardened in advance of a storm and for conducting N-1 contingency analysis and other scenario planning. ComEd recently ran a simulation with key stakeholders to anticipate microgrid emergency response capabilities and to make best use of advanced resilience capabilities.
In September, the U.S. Department of Homeland Security (DHS) and the U.S. Department of Energy joined us for the unveiling of a technology that will enhance resilience for ComEd customers and reduce the impact of cyber and physical

CIGRE INTERNATIONAL NEWS

threats. Developed by the American Superconductor Company and funded in part by the DHS Science and Technology Directorate, the Resilient Electric Grid system (REG) uses a high-temperature superconductor wire that can carry 200 times the power of standard copper wire and provide self-healing capability. ComEd is the first utility in the nation to permanently install AMSC's REG system into the grid.

Our initiatives continue to line up with our core responsibilities such as maintenance, new construction and engineering but the character and form of the work is changing rapidly. Customers and policy makers are demanding new standards of performance across multiple dimensions of clean, resilient, safe, secure and affordable. New systems require our engineers and crews to develop new skills and competencies and to revise established practices. Many new systems require testing. That's why we recently built a state-of-the-art lab to conduct extensive testing of advanced technologies to ensure their safety and effectiveness before being tested by the harsh realities of large power grids serving millions of customers.

Our microgrid demonstration project, in concert with the DOE and over a dozen partners, incorporates multiple components that were first tested in our lab. For instance, the microgrid integrated solar storage technology was lab tested along with the microgrid master controller prior to field deployment. The benefits of these technologies are clear. The Bronzeville Community microgrid directly serves more than 1,000 residences, businesses, and public institutions from the ComEd grid, including 11 customers that provide critical public services. The utility-operated microgrid cluster was designed and deployed to maximize community benefit; it also informs how we can deploy technologies to integrate DER and provide higher levels of resilience across our service territory. Through these projects, we are learning as part of a community of partners.

Conclusion

The electrical grid of the future cannot be provided by the technologies of today. As an industry, we must continue to draw on our history of integrating new technologies and making things work in the real world that powers our lives 24X7. The global deployment of the electric grid produced incalculable benefits, improved the lives of billions, and increased access to economic, medical, educational and cultural opportunities that were once only accessible to the very few. Now, the bar has been raised in a big way, driven by climate change and other threats such as cybersecurity. As we transform to meet these challenges, our industry is poised to deliver on a new era of power, achieving new standards of safety, reliability, resilience and sustainability. This new era of power will energize a future we all want, a future accessible to all.

UPCOMING EVENTS

Substation Design

6 - 7 APRIL 2022 | NSW ACT | VIEW EVENT

Overview:
Substations are a critical component of the electricity supply network whether it be to connect generators to transmission systems or deliver electricity to end users. This course provides an overview of the substation design process and includes description of the key components of substation design. The course is suitable for all individuals working in the electrical power engineering industry. Read more.

Time: Two day event

Location: Online

Cost: $1,770

Resilient Energy Systems to a Changing Climate

THURSDAY 7 April 2022 | QLD | VIEW EVENT

Overview:
Extreme weather events are increasing in magnitude and frequency in Australia, physical climate risk and adaptation is top of mind for the energy industry. This presentation will focus on climate risks for assets and operations for the power generation, transmission and distribution sectors. A consideration of transition risk/opportunity as it interfaces with generating resilience.... Read more.

Time: 3.30 PM - 4.30 PM AEST

Online webinar

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

Synchronism-Check Application Over a Wide-Area Network

WEDNESDAY, 20 APRIL 2022 | WA | VIEW EVENT

Overview:
Recent technological developments have enabled solutions to power system protection and control issues that have previously been either too difficult or too expensive to implement. Synchronising generators to the power system requires analogue and digital information from both the generator and the network. Transmitting information via copper cabling requires the... Read more.

Time: 6.30 PM - 7.30 PM AEST

Online webinar

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

UPCOMING EVENTS

Integrating EVs @ Scale with the Electric Grid

WEDNESDAY, 27 APRIL 2022 | NSW ACT | VIEW EVENT

Overview:
What happens when two critical sectors of the society we have created come together? Whether we realize it yet or not, we are going to witness this phenomenon over the next ten years as the electricity and transportation sectors come together in a new way. It is up to us— professionals in the electric grid and automotive sectors — to develop the technology to ensure that the merging of these two sectors... Read more.

Time: 11 AM - 12 PM AEST

Online webinar

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

Using Energy-Economic Models for Climate-Related Financial Impact Analysis

THURSDAY 28 APRIL 2022 | NSW ACT | VIEW EVENT

Overview:
In this webinar, Dr. Sergey Paltsev from MIT discusses how climate change poses financial risks that arise from shifts in the political, technological, social, and economic landscape that are likely to occur during the transition to a low-carbon economy... Read more.

Time: 12 PM AEST

Online webinar

Cost: FREE

Synchronous services markets: maximising the capacity of existing transmission networks

WEDNESDAY 11 MAY 2022 | TAS | VIEW EVENT

Overview:
Old synchronous generators are quickly being replaced by cleaner, cheaper providers but ones that can't provide synchronous services that used to come for free. If only there was a way to keep receiving these services, without the pollution.

There is,.. Read more.

Time: 5.30 PM - 6.30 PM AEST

Location: In-person at Hydro Tasmania, 4 Elizabeth Street, Hobart.
OR online webinar

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

UPCOMING EVENTS

EECON 2022 - Our Energy Future – Unlocking Net Zero

11 - 12 OCTOBER 2022 | NSW ACT | VIEW EVENT

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

Time: 2-day event

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

ABSTRACTS NOW OPEN!

EECON 2021 RECORDINGS AVAILABLE

SESSION RECORDINGS FROM EECON 2021 ARE NOW AVAILABLE TO STREAM.

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

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

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

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

EESA

THANKS TO OUR CORPORATE MEMBERS

PLATINUM

TYREE TRANSFORMERS

MISSION

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

GOLD

Endeavour Energy
essential energy
HORIZON POWER
NOJA Power
S&C
western power
Cargill Helping the world thrive
Transgrid
MathWorks

SILVER

SEL Schweitzer Engineering Laboratories
Ausgrid
alliance automation
APD Engineering
AMPCONTROL
Energy Queensland
GPA
TasNetworks Delivering your power
WILSON TRANSFORMER
EATON

BRONZE

amsc
CitiPower
Powercor Australia
Clarence Consultants
EcoOrigin
ElectraNet
Power Line Systems
safearth Specialist Electrical Engineers
Schneider Electric
united energy
energysafe Victoria
middleton Group
GRAPH MOSDORFER Knill Gruppe
MV Technology Solutions
Powerlink Queensland
SA Power Networks
ZEROSEQUENCE
ea technology