2025 State of Energy Research Conference

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The Hon Matt Kean – Chair, Climate Change Authority

Check against delivery

Can I begin by acknowledging as others have done the traditional owners, the Bidjigal and Gadigal people of the Eora nation, on whose land we meet. I'd like to pay my respects to their Elders, past, present and emerging.

I'd also like to thank the organisers of the State of Energy Research Conference for the invitation to speak. I'm honoured to be here.

Energy is fundamental to how we live - so it's particularly fitting to host this week's event at the University of New South Wales.

It is not hyperbole to say the work done here, and at UNSW's partner institutes, has helped transform the global economics of energy – delivering us the cheapest source of energy in history.

Cheap solar has also given the world a fighting chance to decarbonise our economies in time to avoid the more catastrophic end of the climate change tail.

Many at UNSW deserve our praise and thanks: Martin Green, Renate Egan, Shi Zhengrong, among many others.

Today, I'll explore how the energy sector is entering a dynamic new phase that will assist Australia to electrify almost everything on the way to net zero emissions.

In summary: power to the people has never been so within our grasp.

My views are informed by two recent reports by the Climate Change Authority: One, a sector-by-sector study of how to cut emissions, and the other, a close examination of the electricity industry.

May I commend both reports to your reading lists.

Now, you've probably heard "game-changer" a lot when it comes to energy.

However, it can be a challenge to pinpoint just when the game changed given how pundits have repeatedly been surprised at the pace prices have plunged for solar – and now batteries.

And, as for the rules of the game, do they remain fit for purpose?

Success will be determined by whether we seize the emerging opportunities – or fumble them.

As those in this room know better than most, an awesome solar and battery revolution is upon us.

Hardly a day passes without new data prompting surprise.

For instance, last month saw solar energy eclipse nuclear in the European Union for the first time.

Solar supplied more than 22% of electricity in June to become the largest source. Coal's share sank to a record low 6.1%.
Global solar power output has been doubling about every three years, so records will continue to melt.

It took 68 years for the world to install its first terawatt of solar capacity – based in no small part on the intellectual property created right here at UNSW. The second was installed in just *two years*.

And China alone *added* almost 200 *gigawatts* of solar in the first half of 2025. The full-year tally could reach 380 gigawatts.

How do these developments stack up with nuclear, another low-emissions technology that's lately been debated in Australia?

The US recently completed its latest nuclear power plant, Vogtle, that took more than a decade to build just over 2 gigawatts of capacity.

The cost of two reactors was $35 billion US dollars, or about $A53 billion, drawing criticism that Americans would be supplied with the most expensive energy in the world.

By contrast, the US last year added almost 50 gigawatts of solar – a record (though one China is matching roughly every seven weeks).

If the US had paid Australian prices for their solar – which they don't because of high and rising tariffs – they could have installed more than 35 gigawatts of PV for what they spent for that nuclear plant.

Now, speed is a priority when it comes to cutting greenhouse gas emissions. But so is price.

On both scores, it's increasingly a case of "shine, baby, shine", and "store, baby, store".

In 2016, electricity for our solar farms was costing about $160 per megawatt-hour, according to Professor Egan, executive director of the Australian Centre for Advanced Photovoltaics, based at UNSW.

By last year, those farms were producing at $40 per megawatt-hour. ARENA – Australia's Renewable Energy Agency – is aiming to halve that to $20.

The "Ultra Low-Cost Solar" program, here at Renate's centre, is targeting 2035 for that goal to be clinched.

The proportion of the solar energy converted to electrons is now about 22-24%. So-called "peak silicon", with module efficiency of about 27% could be reached by about 2030.

We'll need new materials, such as perovskites which can – deployed in tandem with silicon – to deliver efficiencies above 30%.

Much research is underway here and at other labs around the world, and artificial intelligence will increasingly joining the fray. We should prepare for positive surprises.

Now let's look at how batteries brighten this outlook even more.

Global batteries prices sank by a third in 2024.

Battery demand this year will be about 1.5 terawatt-hours, with electric vehicles dominating. That tally will be about 5.5 terawatt-hours, or not far shy of a four-fold increase by 2035, Bloomberg New Energy Finance estimated just yesterday.

Prices are falling even as demand soars. Bids this month in China for big battery capacity came in at the equivalent of about $A80 per kWh.

That was about 15 percent below previous records and almost a third below 2024 prices.

By comparison, CSIRO's draft GenCost report for 2024-25 estimated storage costs this year would be about $268 per kWh – or more than triple what was just offered in China.

Regulators in Australia should be adjusting their forecasts of the take-up of batteries big and small – assuming that at least some of the price plunge extends our way.

Will we need to build as much transmission, for instance, if developers add more – and larger – batteries to the grid? Will more solar and wind farms get the financial tick from investors if more of their generation charges batteries rather than gets curtailed?

The immediate action, though, may unfold on the home front, as households stampede into the Albanese government's battery program.

Green Energy Markets and SunWiz the 30% battery subsidy is already revealing two changes: households are using the bonus to buy *bigger* batteries and, if they don't already have solar, they are stumping up for *larger* systems.

Good quality batteries are going into homes for $600 per kWh, or less. That's about half the battery price the *Australian* Energy Market Operator had anticipated for this year.

Green Energy Market had expected it would be 2028 before consumers bought 10 kWh batteries. Instead, they're seeing average battery sizes more like 16 kWhs after the government program kicked off on 1 July.

In the Sunshine state, purchases of 20 kWh storage are common.

(Sorry, Queensland, we're all sunshine states now.)

The average solar system was about 6.6 kW capacity last year with larger systems in the 8-10 kWh range, SunWiz says.

Now we're seeing 10-15 kW systems becoming more common.

These technological shifts will be tectonic, particularly when more people buy electric vehicles capable of discharging to the grid.

That flurry of household activity will deliver important capacity and flexibility at a time when large-scale generation projects are in a bit of a lull before the government's Capacity Investment Scheme revives growth.

Mind you, storage developers haven't been in the doldrums.

In the March quarter alone, investors signed off on six large batteries with 1.5 gigawatts of capacity – with the pace likely to accelerate as costs drop.

Just as an aside, it's worth recalling how some in the media and elsewhere sought to exploit Spain's blackout in April to cast doubt on Australia's renewables rollout.

To be clear, authorities are yet to settle on the precise causes.

A cursory survey would suggest our nation's grid are not so alike – and that rather than us learning from Spain, the reverse should probably be true.

For about a decade, our regulators have been seeking to take lessons from the 2016 state-wide outages in South Australia to avoid a repeat.

Spain, when its outage struck, had just 1 gigawatts of battery capacity on a grid with 64 gigawatts of solar.

Australia's solar capacity is about half that total, but we had 2.3 gigawatts of large-scale batteries at the end of 2024.

That storage tally could soar 8-fold to 18GW by 2035, Bloomberg said in March – before those ultra-low Chinese battery tenders.

Spain also doesn't have a single synchronous condenser, the kit that helps provide grid inertia and other services previously provided by fossil-fuel power plants.

Australia, though, already has four of these "synch-cons" in operation. AEMO has identified the need for the equivalent of 22 of them across the National Electricity Market, as our own recent electricity report found.

Batteries with grid-forming invertors may offer similar services, and Australia had seven of these at the end of last year, and 34 more in the connections pipeline.

And thanks to our system of crediting solar, grid operators here have a finely-honed understanding of how the panels are distributed – something Spain apparently did not possess.

Our recent report also zeroed-in on one part of the economy where Australia has a lot of untapped solar and storage potential. That's our factories, warehouses and shopping centres.

Such commercial rooftops supported about 4.4 gigawatts of solar capacity at the end of last year, versus 21.2 gigawatts for households.

Even six years ago, suitable commercial and industrial sites were estimated to be about 28 gigawatts – a figure that is now likely to be conservative.

All these trends tell us the economic scales are tilting in favour of owners of rooftop solar and batteries.

But are market governance and consumer information keeping up?

Attendees at this conference yesterday saw Tim Nelson present detailed thoughts on his independent panel's upcoming wholesale market report.

It's encouraging to see the panel's recommendations will reflect and promote many of the industry developments I've discussed in this speech.

Harnessing more of the distributed generation and storage for the good of the grid and consumers is high on my list of suggestions too.

It's clear we do need to focus more on the demand side of the ledger. Supply-side matters have long dominated debate, even as technology shifts indicate that we take a more even-handed approach.

In a sense, this adjustment is about changing the game itself.

After all, we should soon expect many more households with a lot of self-generated and self-stored energy.

They have a great opportunity to save money by adjusting power usage while helping the grid when it is squeezed.

We'll all benefit if we make more efficient use of networks and other assets – avoiding costly investments in the process.

Independent energy Gabrielle Kuiper *[pron: Kai-per]* estimates that integrating distributed energy resources could create $19 billion in energy system net benefits by 2040.

Thank you, Gabrielle, for your tireless efforts in this field.

Homes and businesses have already invested $25 billion in such DER assets – a figure likely to rise rapidly.

If consumers are increasingly likely to be prosumers – those producing and using energy – can we make the market more pro-prosumer, so to speak?

Take the information available to the public, such as the Australian Energy Regulator's legally required Energy Made Easy website. This popular site helpfully assists households to compare electricity plans.

But search on the website for "virtual power plant", or VPP, and you'll get a "we've found 0 results" answer.

If the government's forecasts are accurate, the battery subsidy will support an extra million small-scale batteries. VPP offerings are likely to expand at pace.

So, let's start helping consumers snare the best plans on the market.

As things stand, comparisons can be tricky – are we signing up, say, for a limited number of times per year that the network remotely extracts power from our battery? And what compensation do we get?

If I opt to discharge my car battery or a home battery into the grid during peak demand days in winter or summer, wouldn't it also be great to know how the benefits of my voluntary action are distributed?

It might sound overly demanding to require a minimum of the spoils – say 50% - be shared with the battery owner. But why not make the proportion transparent?

Nudging networks to share that data could give them a competitive edge and help them attract more VPP participants.

Meanwhile, it's been good to see the wholesale demand response mechanism in the National Electricity Market has lately doubled to 146 megawatts, according to The Energy.

(That publication, by the way, is an fine addition to the industry's debates.)

The big gentailers aren't so keen but there's clearly a value in "nega-watts" of avoided energy use on peaky demand days.

The potential could be much bigger, a gigawatt's worth or more, according to Enel X, an aggregator, Renew Economy reported last week.

The need for a more flexible market is only going to grow as power demand rises. We're going to need to electrify almost everything, and then the extra load coming from data centres.

Our coal-fired power plants are aging, and it's not uncommon that a 400-megawatt unit fails without notice. Having more of those "nega-watts" on standby could be critical for maintaining grid stability.
As a recovering politician from the Liberal side of politics, I naturally veer in favour of markets providing the solutions.

But I also know market failures are "a thing", and sometimes we can't leave everything to the market's Invisible Hand.

Once upon a time, under a Liberal Premier, Rupert Hamer, the Gas & Fuel Corporation in Victoria ran four model home displays to show households how to live comfortably using less energy.

Industry, too, could even borrow new energy efficient equipment to try before they bought.

The Corporation was also the biggest seller of home insulation.

That was the 1970s but the issues remain similar. We waste a lot of energy, and reducing those losses should be a top priority of the Productivity Commission or any other body looking to improve our economy's competitiveness.

Supporting the take-up of solar panels by four million homes over the last couple of decades was a seminal achievement. Having 1 million-plus batteries under those same roofs will be another.

But if those homes use poorly performing electric - or gas - appliances and are poor insulated, energy wastage will erode potential savings and comfort for their inhabitants.

We need better building codes – as another Climate Change Authority report recently argued for. And we should insist on world-best standards for the appliances being sold to us.

If a nation like Chile can align its standards with the EU, why should we put up with inferior products?

Let's help consumers make smarter choices.

Take efforts to get household off gas.

If people replace a gas hotwater system with a resistant electric one, they might think they are reducing gas usage.

However, if the new unit uses electricity sourced from a gas-fired power plant – as might be the case during calm winter spells in Victoria – it can actually boost gas demand.

Steering consumers towards heat pumps – and several states offer attractive subsidies – resolves that problem. Lower electricity and gas demand is the outcome.

Government support for energy performance programs has tended to be tiny – certainly compared to the billions spent to offset electricity bills.

More bang for a lot fewer bucks is definitely an option that we should take as budgets everywhere get strained.

There are, of course, many people who don't want to think about their energy bills.

More of us, though, are becoming quite comfortable dealing with phone apps to handle our various finances. Fluctuating energy prices offer many opportunities to save and even make money.

Are consumers going to be up for it?

Turn off a power-hungry appliance and earn a few dollars. Supply a couple of kilowatt hours of power and earn more. Or turn off unneeded usage to avoid high wholesale prices. These habits could all become second-nature.

I'm among those watching the watts – and the prices that go with them.

People do respond to price signals and particularly profitable ones, in what some might see as "gamifying" the electricity sector.

It's something the gambling industry has long understood, and a trend that other companies – such as in the media – have sought to tap into to bolster revenues.

So there you have it – game changes and a changing game.

Let the games begin!

Thanks for listening…and I look forward to joining the panel after Mary and Monique's speeches.