ECONOMICS AND INDUSTRY STANDING COMMITTEE

INQUIRY INTO MICROGRIDS AND ASSOCIATED TECHNOLOGIES IN WA

TRANSCRIPT OF EVIDENCE
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Members

Ms J.J. Shaw (Chair)
Mr S.K. L'Estrange (Deputy Chairman)
Mr Y. Mubarakai
Mr S.J. Price
Mr D.T. Redman

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Hearing commenced at 10.05 am

Mr BRIAN SPAK
US electricity sector expert, Commonwealth Scientific and Industrial Research Organisation, examined:

The CHAIR: On behalf of the committee, I would like to thank you for agreeing to participate today for a hearing for the committee's inquiry into microgrid and associated technologies. My name is Jessica Shaw and I am the Chair of the Economics and Industry Standing Committee. I would like to introduce the other members of the committee. To my right is Yaz Mubarakai, member for Jandakot; sitting across from me is the Deputy Chair, Sean L'Estrange, member for Churchlands; Terry Redman, member for Warren–Blackwood; and Stephen Price, member for Forrestfield. It is important that you understand that any deliberate misleading of this committee may be regarded as a contempt of Parliament. Your evidence is protected by parliamentary privilege. However, this privilege does not apply to anything you might say outside of today's proceedings. Before we begin with our questions, do you have any questions about your attendance here today?

Mr Spak: No.

The CHAIR: Would you like to kick us off, Brian, with an opening statement or do you want to walk us through the slide pack? How would you like to go through?

Mr Spak: Maybe I will spend a minute or two just introducing myself and how I got here, and then we can walk through the slide deck.

My name is Brian Spak. I lead a research program at CSIRO focused on electricity grids and renewable electricity integration. I have been here in Newcastle for about a year. I have spent about 15 years in the industry. Immediately prior to coming to CSIRO, I spent five years at a vertically integrated utility in the US on the west coast called Portland General Electric. For Portland General I ran the new energy program. I ran a division that looked after that, so we developed new vehicle programs, new demand-response programs, energy-storage programs and community solar. Prior to that, I spent 10 years in Washington DC. I worked primarily as a consultant at a small firm whose principal was President Clinton's chief climate adviser.

From that 10 years of experience in DC, I developed a broad understanding of US energy and climate policy, and then got really deep into specific aspects of it and the electricity utility industry over the past five years. Sometimes I explain my background in electricity. My first really deep-dive project on electricity was—I had a client that was an energy storage company, so I learnt about electricity from energy storage, which is unconventional. I have a policy background. I have a Masters in Global Environmental Policy, but I learnt about electricity from energy storage on the way out. Most people come and understand the conventional electricity system, and then learn about storage, which really throws the whole thing on its head. Sometimes I have a somewhat different take on conventional electricity issues, and a lot of it is borne out of that experience. That is it from me, I guess.

The CHAIR: That is fantastic, thank you. As you and I discussed, the committee is about to head off to the US. It is a very fleeting visit. We are going to Sacramento and San Francisco and then to New York, and then the committee's trip winds up. We are hoping to meet with many of the regulatory agencies and stakeholder groups and visit a few facilities. But we thought in advance of that it would great to get a bit of an overview of the energy context more broadly in the US, and then specifically a bit of a deeper dive into the Californian market and the development around distributed energy

there, and then again in New York. I understand that things are done quite differently but really quite innovatively in both jurisdictions. Thank you very much for offering to help walk us through that today. We really appreciate it.

Mr Spak: Again, I am happy to help. You will see as we walk through that I have focused this primarily on electricity. I will start with an overview of the US and then focus on California and New York and try to provide some general background about the way to think about small energy resources, which are sometimes called distributed energy resources. But please feel free to interrupt with questions at any time and if you have questions unrelated to what I am talking about but about the broader energy in the US, please feel free. Again, I spent 10 years doing this in DC for lots of different American and international investors, so I have a general awareness and I am happy to talk about what I know or defer the question and help you get an answer some other way.

The CHAIR: Great.

Mr Spak: I have already run through the agenda—now to slide 4. I will try to run through this first section quickly. From an electricity perspective, the US is made up of three separate grids—three physically independent systems. There is one in the west, which is a purple colour on this slide and called the Western Interconnection; there is one in the east called the Eastern Interconnection; and, because Texas has to be Texas, Texas gets its own grid called ERCOT. These systems do have linkages between them but they operate relatively independently of one another. The grid is functionally operated by 66 independent authorities known as balancing authorities.

I will move onto the next slide—slide 5. In the late 1990s and early 2000s, the US electricity industry deregulated. It went from having lots of vertically integrated utilities to having what we sometimes call organised markets, of which there are now seven in the US. Importantly for your visit, both New York and California have organised markets; that is, they have taken the generation of the wholesale market—the big power plants—and made them an independent market all unto themselves. They are not tied with the transmission and distribution companies or with retail. Oftentimes in these markets, and this is true in California but not in New York, selling retail electricity is tied to the company that owns the poles and wires.

If you live in San Francisco, you get electricity from Pacific Gas and Electric—PG&E, the biggest utility in the country—and that company owns the transmission and distribution wires and they sell you power and you have no choice about who you are buying from. But they are not allowed to own generation, generally, and they have to buy energy off the open market. When California deregulated, they did go through some pains to divest of the resources. The utilities there still own all the hydro plants and the nuclear plants, somewhat because nobody else really wanted them—it is a long story. Everything else besides hydro and nuclear is owned by someone who is separate from the retail and poles and wires companies. New York is more fully deregulated —

The CHAIR: Brian, just before you move on from that, was there a particular reason why they chose not to disaggregate the transmission from the retail part of the market? We have done that here in Australia in both the Western Australian and the national energy markets. Why was the decision made in California not to disaggregate those two?

Mr Spak: It is an interesting question. I can speculate, but I was not active in the space at the time to give you a definitive answer. I will say a couple of things. I think in general there is a big emphasis always, and there continues to be on low-income customers in the US. I think there was a worry that at the time it would unduly impact low-income customers. This is also true in New York. In New York, it is disaggregated but the poles and wires company is also known as the POLR—the provider of last resort. In other words, if you do not buy your electricity from some other retailer, you are default with the provider of last resort.

The CHAIR: And that is the poles and wires company that is the POLR?

Mr Spak: That is correct. I think at the time, also, the benefits of that were unclear. In most parts of the US actually, large customers do have freedom of choice. That is even true in Oregon just north of California where I lived. In a lot of the white areas here—because if you are a grocery store or bigger you can choose, but smaller customers were generally kept free from that competition. In New York in the last year, they have actually started to put in restrictions on the way that retailers can sell to residential customers, mainly because they have not seen any benefit from the 15-year experiment with deregulation there. Customers have not saved money from it. It would be an interesting question to ask that.

Mr D.T. REDMAN: Just one more question. I guess without going in too deep because I am sure that it is absolutely complex, can you give us a quick cast of what the regulatory arrangements are in the US. Given that there are three network systems, I assume that the Federal Government has some sort of regulatory responsibility. If you can imagine that similarly here in Australia, we have a national energy market on the east coast with some regulatory responsibility sitting at the federal level, but in Western Australia we largely stand alone. I assume that most of the network retail and generation groups are private companies and there is no government-owned enterprises.

Mr Spak: A little bit. I am going to get to that. Let me just run through the next couple of slides and we will get there.

Slide 6 is not that important. It just sort of shows all the balancing authorities, and it is a mess. People say things about how China has three balancing authorities and the US has 66—it is a mess.

Mr D.T. REDMAN: Why is the word "balancing" used?

Mr Spak: It is effectively someone like AEMO who balances the system, who keeps supply and demand exactly equal every nanosecond. They are the people who keep the grid balanced.

The CHAIR: It is not the way we use it in our market. Over here we use "balancing" as a financial term. The balancing function is about clearing through the short-term energy market here, so there are balancing prices. It is just important that we have that clear in our minds.

Mr Spak: Yes, "balancing" is a thing with the physical electrons.

Slide 7 outlines all the investor-owned utilities. These are privately owned companies that are making money in this business. They are some version of poles and wires only, which is what you would see in Texas; poles and wires plus retail, and that would be true in California; or poles and wires and retail and they own generation vertically integrated, so that would be everywhere that was white on that previous map and that is coloured on this map. Everywhere that is white on this map, that is a publicly owned utility. It is owned by the municipality, traditionally. There are some big cities in the US that still operate that way—Austin, Texas, Seattle. They tend to be progressive but largely all of Kansas—no, that is not Kansas.

Anyway, some of these states are quite conservative in their electricity regulation and that tends to be the status quo of public power. That is an arrangement that goes back to the 1930s and getting everybody electricity access. They are mostly co-ops and how they came up. Those co-ops are wholly independently regulated. Because they are publicly owned, they are owned by their consumers, they have unique regulatory status that is different from everybody else.

Mr S.K. L'ESTRANGE: Just looking at the map, Georgia Power down there is a combination of white and brown on the map. What does that mean?

Mr Spak: All the brown parts are investor owned. I am going to guess that Atlanta is included there, and every bit that is brown is served by the investor-owned utility. The rest of them are public

entities, so it is probably the region in which those white states run the retail grid. Because that is the south east, they get most of their power from TVA, so from a federal dam. That is also a complicating factor. There is a big federal dam down there that provides most of power. That is also true in the Pacific Northwest. Most of the white part in the Pacific Northwest is white because they get federal hydropower and they get preferential treatment, basically, for rural customers there.

Slide 8 here shows that California is a mix of public power and investor-owned utilities. PG&E, Southern California Edison and SDGE—San Diego Gas & Electric—are generally referred to as the three investor-owned utilities in California. You will notice that Pacific Power is also an investor-owned utility in California but that is in far north California where effectively no-one lives. Generally, they actually get excluded from a lot of the regulatory requirements that fall to the other three Californian utilities because it is a pain for them to participate.

If you look on the right of this graph, both Sacramento and LA are municipal utilities. In LA it is the Los Angeles Department of Water and Power, and Sacramento is a different shade of yellow on the right—SMUD or the Sacramento Municipal Utility District. I think they are both joint electricity and water utilities, although I could be wrong about SMUD. LADWP has a long history related to the Hoover Dam and getting electricity from the east, and really the blossoming of LA came from them building dams further to the east. So Cal Edison, which is a very big utility in the US, basically serves all of southern California but for LA county.

Just keeping on here. You will see that New York is actually all investor owned. I noted here that these are the network companies or POLRs—providers of last resort. Con Edison, which is the darker shade of blue or the medium shade of blue, has the most customers because they serve New York City. They are the ones to know and they are doing some of the more innovative things, although National Grid is as well. I think this slide is somewhat dated. Long Island is now actually LIPA—Long Island Power Authority. These companies are bought and sold on a relatively regular basis and merged, so it is relatively hard to stay up-to-date with who is who.

Now to get back to your question on slide 10: what does oversight look like generally? In the US Constitution, arguably the most important clause is known as the commerce clause, which gives Congress the unique ability to regulate interstate commerce—anything that goes interstate. Historically, going back into the 1920s and 1930s, I think there were a number of questions raised about whether or not the federal government had authority over any electricity sales.

So basically the legal system has worked out that they have rights over all interstate transmission, so that is between states, but that effectively makes it all transmission, because it is very different. Because that first line—that western interconnect, eastern interconnect and ERCOT—it has been presumed that basically all those systems are interconnected and allow for interstate commerce, so that there is federal oversight over all of that. The distribution system, though, tends to be state regulated in and of itself. That is relatively important to know.

There are a number of rules related to transmission and how transmission is set in the FERC. I will get to this in a couple of slides. I will go through everybody's names and who they all are. But FERC, which is the Federal Energy Regulatory Commission, sets interstate transmission rates. Basically, if you were a transmission provider, if you own transmission in the US, you have to get approval from FERC for how much you are going to charge for transmission.

The CHAIR: Do they also do access; so it is access and pricing?

Mr Spak: Yes, well, if questions come up about open access, then FERC adjudicates them. There is open access. The tariffs are the OATTs—open access transmission tariffs. They are what are filed with FERC. Then FERC approves or disapproves them.

Mr D.T. REDMAN: Do they need to seek permission for investment as well in terms of getting any return on investment in terms of that pricing?

Mr Spak: I do not believe so. I think FERC only wants to make sure that rates are just, fair and reasonable, and that they are openly applied to everyone, because in many places the transmission owner also owns a fair bit of generation and owns access to the end-use customers, so there is no self-dealing. If you are a private independent power producer, you are able to compete fairly against the incumbent company that owns the wires and the generation. When you work in a very vertically-integrated utility like I did, you have to take an annual sort of compliance test and there is a fair bit of regulatory work that goes on to make sure that those two parts of the business are not talking about trade-sensitive things.

Mr D.T. REDMAN: Do the US markets in general have any subsidisation involving different parts of that that sort of skews the commercial and market working openly?

Mr Spak: There is plenty of subsidisation in the US electricity sector, so it is hard to unpack a lot of it. If you focus on only electricity, the thing that probably comes first to mind for me is access to the power coming off the federal dams. These were effectively paid for by federal taxpayers and public power gets preferential treatment in accessing them. Congress over time has passed some laws to try to remedy some of those issues and to make—if you are a customer of an investor-owned utility that could be served by public power but it is not served by public power, you get sort of a benefit; you somehow get made whole. But a lot of people do not think that the way that they do that math works out fairly. Then there are a lot of basically production incentives—that would be the best way to talk to them. There are a number of incentives that mining companies get to get gas out of the ground basically to protect them from drilling and not having anything come back up. They are basically protected from that on that side.

Both solar and wind have fairly generous federal tax benefits. There is a 2.2c per kilowatt production tax credit for wind. So every time a wind turbine produces a kilowatt hour of electricity, it gets 2.2c of tax break. So that is a production tax credit; that is just based on production. Solar gets an investment tax credit—solar and lots of other things, geothermal and other alternative technologies—that effectively brings down the up-front investment by 30%. If your solar system was going to cost $1million, you get a tax credit for it for $300,000.

For a long time, there were ongoing issues about those tax credits; they were always in limbo. A couple of years ago, basically industry, regulators and Congress came together and set long-term trajectories for both. They both now slowly start to wind down over the course of the next five to seven years and then will end and be gone forever.

Mr D.T. REDMAN: The sheer number of private operators suggested here at every level in the supply chain suggests that the market is working reasonably well, or are there strong hands-on regulatory controls to keep that going?

The CHAIR: Or does it vary by market, because I think there are multiple markets in the US?

Mr Spak: The US market is heavily regulated and continues to be so. That slide you saw of investment-owned utilities somewhat distorts the reality there; over the last five to 10 years there has been a tremendous amount of mergers and acquisitions. Georgia Power, for instance, is listed as a severed company; it is, but both Georgia Power, Alabama Power and some of those other companies are owned by Southern Company and it is effectively all one business. It just operates as different subsidiaries in different states.

Depending on who you ask, regulatory oversight is stronger in certain places than in others, but there is a lot of oversight. As I mentioned at the beginning, my background was really in public

policy, so one reason I sometimes will joke that I have had success in this industry despite not being an engineer is that basically it is an industry that requires people with regulatory policy understanding. That is really of benefit because it is so heavily regulated.

The CHAIR: Brian, you have talked about the fact that FERC regulates the transmission system; are distribution level assets regulated at the state level or at the municipality level? How does that work?

Mr Spak: Primarily, if you are a private company—an investor-owned company. The important thing I forgot to mention, too, on that map of all the investor-owned utilities, those serve—I forget the exact number—about 70 or 75% of the population of the US. So most people are covered by an investor-owned utility. It might even be higher than that. Those rates are set by the distribution system. Often, in some of the transmission system, it gets confusing but the distribution system costs and the retail rates are set by state regulators known as public utility commissions or public service commissions. But if you are a public power entity, basically it is up to you to have an independently appointed board who sets all those things and that is accountable to the community.

The way that happens, there are a couple of different parts of that—maybe I will stop. Basically, the amount you pay per kilowatt hour and the way that you are charged is determined by the state in something called a rate case. But unlike here, at least on the east coast, where the utilities have to go in every five years to AER and apply for their next five-year plan, it is up to the utility company to go in whenever they want to. So there are companies—like my old company for a variety of reasons was going in almost every year for a new rate case, because we building a lot of new assets. Other companies like Pacific Power, who you saw on the map, has not been in for like 15 years for a rate case, because they are relatively happy with the way that their rates are set and feel like they are making money. In the absence of a rate case, it is relatively difficult for the state regulators to get a lot of insight into what is happening.

The CHAIR: So rate cases can only ever be initiated by the regulated company, or is there the opportunity if the regulator sees there is a problem for them to proactively initiate a rate case?

Mr Spak: I imagine there is an opportunity for that regulator or just some other intervener to start a rate case in theory but in practice it never happens.

So, on wholesale rate designs. This is PURPA. PURPA is the *Public Utility Regulatory Policies Act* of 1978. It has been updated several times after that. They basically set rates to make sure that independent power producers have open access and the rates that the buyers of that power are buying it at are equitable. FERC has oversight over that although the state PUCs set those limits. So there is a bit of federalism there.

The CHAIR: So the wholesale energy market prices are set under this PURPA, or reviewed?

Mr Spak: They are in certain instances. If we go back to that slide that had the organised markets, in organised markets PURPA enabled all independent power producers to compete against the incumbent vertically integrated utilities. In that way, it still applies because the transmission owners have right of open access. But otherwise, the California ISO, the New York ISO—those work just like AEMO. They have wide open markets, where everyone competes against everyone else.

Both California ISO, and less so New York, and PJM, which is Pennsylvania, New Jersey, Maryland—the mid-Atlantic states—those are the two most progressive ISOs, independent system operators, in the US. Whereas, in Australia there is basically an energy market and an FCAS market. In California ISO those are maybe, I do not know, 10 to 15 probably different products that are sold on something like a real time market or a-day-ahead market as least. The same thing on the east coast with PJM. Those markets are a fair bit more sophisticated.

Working down the slide here, resource adequacy means basically making sure that there is enough power on the system to supply even on hottest days. It tends to be a state-by-state thing, but the feds do have oversight within those. The other thing that I should have mentioned, but I have not, is basically in those organised markets, FERC has tremendous oversight. In essence, FERC is the regulator and plays the role of the state commission for those markets on everything except for what residential customers pay for retail prices. Those prices are set by the states.

One other thing on this line that I have mentioned is generation mix. This is: where is the power coming from? States and local authorities have the ability to do this. So, CCA there, which I am not going to mention again, but you will undoubtedly hear about it in California, stands for community choice aggregation. It is a relatively recent thing that has happened over the last five years in California, which gives communities the ability to say, "We want all of our power from this resource no matter who our utility company is." So Palo Alto, which is served by Pacific Gas and Electric, an investor-owned utility, where Stanford is, right in the heart of Silicon Valley, has said, "We are a community choice aggregator. We want 100% renewable power. We will pay the cost for that, but we get to elect for that committee that serves us."

That is something unique to California to give independent communities the ability to make that choice; for elected officials to have the ability to make that choice. Otherwise, generation mixes are set by something called RPSs in the US—that is a renewable portfolio standard. Roughly 30 states in the US now have some version of a renewable portfolio standard. Almost all the renewables on the system and climate mitigation that has happened in the US is a result of those renewable portfolio standards.

The CHAIR: Are they for both large and small–scale renewable sources, Brian?

Mr Spak: Yes. Every state has a slightly different version of a RPS and what qualifies as renewable varies between states. Whether or not existing hydro counts as renewable or not differs. How they deal with small generators differs. But, yes, in general, they apply to both small and large–scale generation sources. Both California and New York have RPSs and I will get to those in a couple of slides. Any other question on this? This is important—this is as important as anything I am going to talk about, I would say, to take you up to speed.

The CHAIR: How do they treat storage? Is that counted as part of the renewable portfolio standard or not?

Mr Spak: No. From a policy perspective, the only thing that is valuable there is that the IRS has determined that storage that is built as part of the same system as a renewable is eligible under section 48—that is solar plants and other things that get that 30% investment tax credit. If storage is part of that same system, it has been determined that it also qualifies for that 30% investment tax credit, which means that if you put in your home—in practice, it is people putting storage in their home that are getting that 30% tax credit. For a variety of reasons, people still have not really co-located large storage with large renewable power plants.

Mr D.T. REDMAN: Do the utilities have any regulatory constraint on bringing some innovation to the table in either storage batteries or whatever it might be, which seems to be emerging around the world, in terms of delivery of their services?

Mr Spak: Yes, they do. In similar ways to Australian utilities, they determine their revenues based on capital expenditures and operating expenditures. All the operating expenditures are pass throughs. The capital expenditures, they get to rate base and that is where they make their money. A guaranteed rate of return that is somewhere between nine and 10%. There are a variety of reason why storage and some of these other innovative technologies would not take off absent other policy

intervention. One is they have a relatively short asset length, which is not particularly good if you are a capex business. So storage right now is generally treated as 10-year depreciable asset. Sometimes you will get 15, but it is rare that you get anything beyond that. Compare that with a transformer or more poles and wires, which are going to 50 years or longer asset lives, which is a better thing on your books? For your shareholders' perspective it is a better resource. There is not a lot of benefit to doing something and messing up, right? If you invest in storage and you do not do it right, you are out of the money. There is not a lot of incentive to do it.

With that said, lots of people are doing interesting things, but it tends to be—to my utility, actually we built the first big battery in the western US in 2009, but that was a result of coming out of the great recession. There was a bunch of money put into electricity innovation and storage, and we got some of that money to build that first big battery. It is all mentioned here in a bit. There are storage mandates in California and New York and that is what is pushing those. Basically, they are told, "You must invest in storage", and by and large the utilities are behind that because they are told they have to spend money on a capital asset, so it is not the worst thing in the world. Did that answer your question?

Mr D.T. REDMAN: Yes, thank you.

Mr Spak: If we jump to slide 12, you will see just some general terms that are probably helpful for you guys to be aware of. California ISO, that is the equivalent of the NEM or AEMO in California. In New York that is called the New York ISO. The people who actually regulate electricity prices in California, that is the California PUC. In New York, it is the New York Public Service Commission, so Audrey Zibelman was the chair of the New York PSC before she went to AEMO. You will hear a lot about the California Energy Commission. They do not regulate electricity prices. They regulate buildings and energy-using devises and they have a role in how some of the utility money is spent, but they do not regulate the utility companies, the CPUC does. That is a bit confusing for people and people often get those two confused.

NYSERDA is a unique thing to New York where basically it is a third-party, non-profit organisation that does energy R&D and energy efficiency in New York. I am just listing here the two major sort of climate regulations in both places. In California it is AB 32, which is the Californian Global Warming Solutions Act. The best way to really understand climate policy in California is that AB 32 is an umbrella policy that basically ensures that emissions will be kept at a certain standard or else it is cap-and-trade. But effectively, it is not AB 32 that is leading to reductions. It is a whole host of other policy measures that California has that are actually driving the emission reductions.

So in the electricity sector, it is the RPS standard—the renewable portfolio standard—that accounts for most of the emission reductions. So the utility companies or the load-serving entities, that is the legal term—the people that serve load—have the RPS obligation. They pay a fair bit of money to meet it, and I could go through that if you really want to know, but they pay to meet it and by meeting it they more than meet their obligations under AB 32. They pay relatively little for the carbon credits because they are taking care of their emissions in a different way. RGGI in New York covers, I believe, 10 north eastern states and is basically cap-and-trade only on the electricity sector. It is a relatively modest cap-and-trade program but it is one of the oldest in the world. It has been around for a long time.

The revenue from that cap-and-trade program flows into NYSERDA. NYSERDA gets money in other ways too but it is not a particularly robust carbon market or anything. It has been a while since I looked at RGGI but the last time I looked, carbon credits were like $2, so it is not an expensive market but it exists. It is a real regulation.

On the federal side, there are two organisations worth knowing: FERC, which I mentioned before, and NERC, which is something that I have actually talked to Audrey about trying to institute in Australia, but there is no Australian equivalent. There was a big blackout in New York in 2003. It started basically because a squirrel got fried in a transformer in Ohio and it caused this multistate blackout on a very hot day. People did not understand really why that happened. Frankly, there was a lack of regulation on how resilient and reliable the power system or the poles and wires system had to be. So NERC was created through an act of Congress in reaction to that, but NERC then was set up basically as a—the investor-owned utilities effectively make up NERC. It is this unique sort of public–private partnership entity that sets reliability standards on utilities and load-serving entities or people with transmission distribution grids.

The CHAIR: Here the ERA sets those reliability criteria as part of its oversight of the—the Economic Regulation Authority in WA. It sets reliability criteria and network and utility performance standards for both generation and transmission but it is not AEMO or AMC or any of those other agencies. The ERA specifically undertakes that function for us here in WA.

Mr Spak: Is that only in WA?

The CHAIR: Yes.

Mr Spak: Any questions there?

The CHAIR: No.

Mr Spak: On the next slide I just tried to put a bunch of information in that you guys might find interesting. There are a couple of things to point out on this slide. I guess both California and New York by national standards have quite expensive electricity. They are probably the two most expensive markets in the US. You will note that New York can give much bigger breaks to commercial and industrial customers than they do in California. The generation numbers there are a bit misleading. I did not spend a tonne of time on this so I believe those are just for the month of May.

Those renewable numbers are affected by how much water was coming into the hydro systems and the Niagara Falls and everything in New York. If you looked out over a year, it would not necessarily play out that same way. On the distributed resources side, so small-scale solar, California leads the country in that. It is still nowhere near Australia in terms of per capita solar whereas I think in WA, 30% of households have solar or something along those lines. It is maybe eight per cent of households throughout California and, if you are lucky, 10%. But as an absolute number, it is pretty big, and that also includes kind of five-megawatt systems that are incentivised in a variety of ways in California.

Mr D.T. REDMAN: These numbers, Brian, on the cents per kilowatt, is that US or Australian?

Mr Spak: They are US numbers. California has relatively twice as many people as New York, relatively similar income levels, and all the dollars on here are American.

Mr D.T. REDMAN: What is the relative price performance across the different types of generation? We have had an historical position where renewables have been expensive but they need a subsidised driver. I am not familiar with what the pricing is in nuclear, but I see that coal is very, very low. I am assuming that is a resource-based decision as much as it is a greenhouse decision perhaps—I might be wrong there.

Mr Spak: Yes. It is entirely a market-based decision. So, a couple of things—what has killed coal in the US is a variety of different things. A lot of people like to blame regulations. They were not necessarily carbon regulations. They were a variety of what we call criteria pollutant regulations, so other pollution that coal plants were creating. Under new source review, it required a lot of those

plants to be looked at, but, frankly, it has been a little bit of that, but that has not really been what has killed coal. It has been the economics of gas. So, gas has just gotten so cheap in the US that because of the way—again, this is misleading because it is May, which is spring in the US, which also means it is a relatively high hydro month, so you know that you are getting a lot of really cheap power onto the market from the dams.

If you want to run coal and make money on it, you have got to keep that system on for at least 24 hours, if not longer, and in May, it is never going to happen. You are not going to need it. You will never need it for 24 hours or you will not make money if you leave it running that long. So, gas will always win there.

Mr D.T. REDMAN: I am not familiar with nuclear. It is a fairly high mix in New York. Is that something that is cheap relatively? It obviously has to run like a coal-fired power station, I am assuming.

Mr Spak: There is a similar conversation that is happening in the US right now around nuclear to what is happening in Australia around coal. It is a little bit more pronounced in the US, I would say, but a lot of the nuclear plants are actually getting sort of operated out of the market. The market is killing the nuclear plants, including in New York. That will be an interesting thing for you guys to talk to them about. Nuclear plants in New York are losing money and this basically happens because renewables are flooding the market and going very low or negative prices. The negative prices are exacerbated in the US by that wind production tax credit I mentioned. So, because it is a production tax credit, you can sell electricity for negative 2.1c per kilowatt hour and you are still making money, so in the middle of the night that is absolutely what is happening in California and in parts of New York.

So, that plus the hydro, and you want to keep your nuclear plant on; you have got to, but you have got to bid in negative dollars. So, those nuclear plants are getting killed in New York, also in the midwest. It is kind of an active source of discussion because that is carbon-free power too, just the market rules are not flexible enough to sort of prioritise that and absent any broader carbon policy, those nuclear plants are getting killed. Some of them are quite old as well, it is worth mentioning.

The CHAIR: Brian, so there is a revenue stream available to generators purely on a sort of kilowatt hours basis, but there is value in the other things that plant like nuclear can provide in terms of voltage support and frequency control. Are there revenue streams associated with the different types of services that different forms of generation can provide or is the value that more traditional thermal generation assets can provide recognised? Or the flip side of that—the fact that the intermittent generation types increase the requirement for those types of services, the cost of having those generation sources on the market, is that reflected? I can accept that there is a cents per kilowatt hour figure for the production of energy, but there are services provided by different forms of generation or value in the things that they do—are there revenue streams attached to that? Have I made sense? Sorry.

Mr Spak: I think I know what you are asking. Let me see whether I can restate that question, which is: are there market products available that require buyers and sellers to come to the table to acquire the variety of services needed to run the grid on the wholesale —

The CHAIR: Yes, thank you.

Mr Spak: In California, very much so. Some of it is still done bilaterally, so it is not an open day-ahead market, but much of it is done in some sort of real-time transparent market in a marketplace where multiple buyers and multiple sellers come or multiple buyers come and then the independent system operators are really the only buyer, but they buy it based on a Dutch auction and similar to the way that NEM works.

I am less familiar, frankly, with New York ISO and the way that operates. My sense is it is probably somewhere between Australia and California, where California is one of the most sophisticated markets in the world. It is really getting good at enabling—a lot of what they are working on right now is enabling really small resources, like demand response and distributed solar, and small-scale storage playing into those big markets, but they have got the market constructs available to them not just for frequency regulation, but for voltage support and other things and, importantly, for reliability.

The next slide—a couple of things I wanted to mention here. So, this is just what are the mandates in the States. So, one is this 50% renewable portfolio standard that is equal in both California and New York. I believe in New York, the number actually includes at least a fair bit of legacy hydro, so that number is somewhat misleading because it is mostly met by old dams. Both California and New York have these big storage targets. So this is mandating that by 2024 or 2025, more than a gigawatt of storage capacity is built in each market. On the previous slide, I had numbers in there on storage. Those numbers were quite low actually. They were old too. They were 2015 numbers. California by now has a lot more storage than that.

That New York mandate is pretty fresh; it is maybe six months old, if that. That was signed into law. California has had a storage mandate since 2010, I want to say—2010, 2011. It was 1.325 gigawatts and then they added another 500 megawatts to it. The way that they implemented that was relatively interesting. They said that a certain amount of it had to come from behind the meter or customer sites. A certain portion of it had to be installed on the distribution grid and then a certain portion could happen at the large scale, the transmission grid. One of the interesting things about that big Tesla battery in South Australia is that it is huge in terms of capacity relative to what you see in the US.

So, in the US, I think 30 megawatts is probably the biggest facility. New York is 30 megawatts but 120 megawatt hours, so that is almost the same size in megawatt hours and energy as that Hornsdale battery. That is 129 megawatt hours, but it has got a tonne of capacity—100 megawatts. In the US, there is a variety of reasons—they have to do with the peculiarities of siting storage and it is often a lot easier, cheaper and better to do it at 10-megawatt bites. So, even those 30-megawatt projects are often three 10-megawatt bits that are each built on a distribution transformer all sitting at the same substation.

The CHAIR: Is that because of network constraints or is that because people do not want big facilities located? Is it more a constraint on what can physically be input into the network at a particular location?

Mr Spak: It is two different things. I would say the primary driver there is the closer you get to load—the closer you get to the customer—the more value streams you can unlock from any distributed resource, including storage. By putting it on the distribution system, you add additional value to the system—you add back-up to that whole transformer. If you put it up in the transmission system, you are not going to get that benefit, so you would much rather put it on that side of the wire than the other side of the wire, because you are backing up that whole distribution system. In other words, if I have a substation that has three 20-megawatt lines coming off of it—three 20-megawatt feeders—and I have two transmission lines coming in there, if both of those transmission lines drop off, I am out of power normally.

But if I have storage there, I can get power out to the community on the back end of that for as long as I have that storage. There is more value to it there than on the other side. That is the primary reason. You always put it closer to the customer if you could, because that is where you provide the most reliability. But then you have to take in scale economies and all sorts of other things. It is also

the case that after 20 megawatts you run into different engineering requirements and it becomes a transmission asset, and that has a wholly separate engineering analysis that you have to go through. It can take 18 months and it is a big pain in the ass, frankly, so you would just as soon avoid that by building something smaller.

Something else I wanted to mention here is relatively pervasive in the US. I guess this happens in Australia, but I am less familiar with it. There is a public benefits charge that is set—it is basically a tax that you collect through electricity bills. It is used to pay for good things and the electricity system. There was a question before about where is the incentive for utilities to do innovative things. There is not much except for here. It is often how some of that innovation comes in. In California it is 15% of a cent of every kilowatt sold—you get that money. In California that creates big money for research development and deployment programs, which are these EPIC programs that now—I think we are not going to get through this presentation, but at the end they are doing something like a $50 million R&D program for microgrids in California. That money is all coming out of that 15 milli-cents per kilowatt hour charge.

Historically, those public benefits funds are also used to go in and fund energy efficiency programs. That has been a really important and valuable thing. In many states—this is true generally on the west coast—when utilities do their planning they say, "Here is how much energy we need to meet" and they say, "What is the most cost-effective efficiency we can get for that?" Efficiency is always assumed to be the first resource. Rather than doing anything else, you would do efficiency. These funds, like that EE line 54 milli-cents—that is collected and either a utility or third party administrator like NYSERDA is then obligated to go out and acquire a bunch of energy efficiency, basically, pay for cheap lightbulbs out of that money.

The CHAIR: Brian, we have about 10 minutes left and you still have quite a few slides in your pack. Keeping in mind that we will ask CSIRO to come back—we are off to the States and when we come back we will do the next phase of our inquiry, which is looking at barriers. We will ask CSIRO to appear in front of us and we can have a more fulsome discussion about what is going on in Australia. In preparation for our trip, what should we be focusing on or what you like to talk us through in the back end of your slide pack.

Mr Spak: I will leave it up to you. I can try to quickly summarise what I have put into the back end of this deck on California to New York. I think that would be just a preview of what you are going to hear when you are there. Or I can do a sort of interlude that helps contextualise the way to think about small resources and how they work on the system? I am happy to talk about either.

The CHAIR: We have had quite a bit of discussion and evidence presented to us that talks about the interface between distributed energy resources and the network. We have had quite a bit of evidence on that. We have been doing that for about the last six months. I think that maybe a bit of a walk-through about what has gone on in New York and California and anything in that system operations context that is relevant would be good, but warming us for the States would be great.

Mr Spak: Let me quickly try to run through these. You are welcome to look at the slides but I will not necessarily stay with the slides. This starts on slide 21. New York has this reforming energy vision. My frank sense of what has happened there is that there has been more ink spilled and less done. It was the Governor's initiative. The Governor said, "I want to do this." He created an energy plan that set out three goals—40% reduction in greenhouse gas emissions, 50% of electricity from renewable resources, all this efficiency. He did not necessarily create enabling legislation to force that to happen. It was just his plan.

There was a fair bit of effort put into getting the regulation right. It was top-down. It came from the Governor, then through the Public Service Commission, chaired by Audrey. She certainly was more

than capable of doing it but it got into a huge political quagmire and there was not a legislative authority to do it. It was really coming from the Governor. It was his vision. But the legislation did not say by law you must do this. There is money behind that program and that money is manifested in all these demonstrations, projects and initiatives. They are the same thing generally but the demo projects are just ones that involve utilities. The initiatives do not involve utilities. There are some interesting projects that have happened there.

Most of it has crapped out, if you want my honest opinion about it. It has been a bunch of money for people to play around with and do interesting things but in terms of real revolution, I do not think New York is where it is at. There is interesting projects happening there but there is interesting projects happening throughout Australia, throughout other parts of the US—not California. Basically they are a result of how much money people are wanting to spend on this stuff.

The CHAIR: If the problem in New York is that it has been policy without the legislative requirements to force things through and it has been top-down, how could they have done it better? The targets are ambitious and overarching, it sounds like a really great thing. How could they have done it better? What should we be looking out for? What sorts of questions should we be asking when we are there?

Mr Spak: I am biased. I am west coast, or whatever, so you should make up your own mind as to whether or not you think that my assessment is accurate. A way I will often talk about this is that some people think the big transition that is happening in the electricity sector is moving from thermal generators—coal or gas—to renewable generators. I disagree. I think the big transition is going from a traditional industrial production line where you have big generators and the only way you can get electricity to your house is through thousands of miles of wires to one where basically you can meet all your energy needs at your own house nearly cost effectively—not quite, but almost.

That is the big change that is happening and technically that world is almost here. In parts of Western Australia it is here. It is technically and economically viable to do that. The problem is we do not have to just get the technical bit of this right. There is a whole institutional policy based inertia to the sector. There is all of these regulations that were built upon a twentieth-century version of the technology that is a one-way production line. Those institutions do not work for a high small-scale grid.

To me, what is really the more interesting work is happening in that space, in getting the regulations right, rethinking the regulatory construct, so that you are effectively pricing and crediting these small-scale solar generators, battery storage, demand response—all these things that households can do, businesses can do to provide value to the whole system. They absolutely can do that. We have done a bunch of demonstration projects—they have done them in the US and Europe—that all show that these things add value to the system. But getting the regulations in place is the real hard work of this. That is the problem, I think. That is my "beginning of a problem" statement.

I do think California in a much more understated way has gone after this. California is uniquely enabled to do this because—I did not even put the California Air Resources Board on that slide of different things, but that is a different regulatory body. California is the fifth biggest economy in the world and has huge regulatory oversight. Because of that, they have thrown so many different laws and regulations at this problem. They do not have one plan that came from the Governor. They did not do that. On distributed energy resources, they have an action plan. It came from the California Public Utilities Commission—experts in this space—so they worked it. Those folks developed it on their own initiative based on the fact that the legislature kept giving them different targets and put a clear policy push towards those resources. They never said it that clearly because it happened over

the course of 20 years with 25 different pieces of legislation. The experts, of their own accord, said they need a plan on this. It is worth reading through. If you are not deep in this stuff, it might be a bit of a head turner but it is not long—it is, like, 10 pages—that is their action plan, the PUC's action plan. In general, I am more supportive of the California focus. I think that what they are doing—I have a slide here for it, slide 27—on the integrated distribution plan is what is particularly interesting. This gets far less press and ink than New York REV, but it is fundamentally much more meaningful, I would say.

For 100 years, distribution utilities have been making decisions about how to serve their load—what poles and wires to build. Those are hard decisions. You need engineering expertise to do it. Because of that, it has basically been a black box that no-one has been able to look inside and see what they are doing. In California, because the legislature there passed a law that said that you have to do what is now called integrated distribution planning. I can send you that law; it is a page long. It basically said you have to open up your distribution planning to a public process. Forever in the US, decisions on big power plants have happened in transparent processes—big state open process.

But what happens on the distribution grid has been a closed process. You are now at a point where often it is cheaper to do solar and batteries than to build transformers, especially for efficiency. It is basically that. In California, they forced the opening up. It is taking time. That law was passed in 2013 or 2015 and just now there are starting to be really robust distribution plans coming out of the utilities because it is hard. Opening up the distribution system and mapping the distribution system, and providing visibility to the distribution system is what needs to happen. CSIRO is trying to help the network companies here do that. If there is one thing that I think Australia ought to do, or people ought to do, is to force a more transparent distribution planning process.

Mr D.T. REDMAN: The challenge, I suspect, is not anyone's desire of what might be the landing point or the final set of regulatory goals. It is a political bumpy road to get to that outcome. We have seen some of this play out federally now with energy policy at a national level in Australia. Has that been the experience of California? Has there been a politically bumpy road to get to what you are now describing as a bit more robust?

Mr Spak: Yes and no, I would say. I am sure you will hear about here or there—I think there are active debates in California's legislature about setting a 100% renewable goal. The environmentalists have had a go at that for each of the last five years. It has gotten more likely but it still has not passed. That will continue to happen. I do not know if it is going to pass this time. This thing, on the integrated distribution plan, you have to be pretty far into the weeds to understand what the hell this is and why it matters. Most people outside of the utilities industry probably did not care a lot. Frankly, this was a Solar City, which is now Tesla, and some of these small companies pushing for it. They had sympathetic ears in the California legislature and pushed it through. The utility companies at the time, I am sure, objected to it and said this could be really hard. But ultimately it coalesced.

The Bill that they passed just was not a huge political football because it was basically—tell people how you are planning the poles and wires that are going up in my neighbourhood, the way you are doing that. This is not about how much renewables are going to be on the grid. It avoided a lot of that political football.

The CHAIR: We are going to have to draw a line under it, because somebody else has got the room shortly. Brian, thank you so much for today. We really do appreciate it. It has really helped me think about what it is we are about to head off and see. We really look forward to discussing the outcomes of our trip when we have the CSIRO back in a month or so. Thank you so much for making yourself available and sending the slide pack. We really do appreciate it.

Mr Spak: Thank you. It was my pleasure.

The CHAIR: I will proceed to close today's hearing. Thank you for your evidence before the committee. A transcript of this hearing will be emailed to you for correction of minor errors. Any such corrections must be made and the transcript returned within seven days of the date of the letter attached to the transcript. If the transcript is not returned within this period, it will be deemed to be correct. New material cannot be added by these corrections and the sense of your evidence cannot be altered. Should you wish to provide additional information or elaborate on particular points, please return a supplementary submission for the committee's consideration when you return your corrected transcript of evidence.

Thanks, Brian.

Mr Spak: Thank you.

Hearing concluded at 11.23 am

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