CLEAN ENERGY SOLUTIONS CENTER
ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY

Australian Capital Territory's Reverse Auctions and Its 100%-by-2020 Renewable Electricity Target

—Transcript of a webinar offered by the Clean Energy Solutions Center on 8 October 2018—
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Webinar Presenter

Greg Buckman	Australian Capital Territory
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Erik Ness

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Finally, one more important note to mention before we begin our presentations is that the Clean Energy Solutions Center does not endorse or recommend specific products or services. Information provided in this webinar is featured in the Solutions Center's resource library as one of our many best practice resources reviewed and selected by technical experts.

Today's webinar agenda is centered around the presentation from our guest speaker, Greg Buckman, who has joined us to discuss the policy context of the ACT's reverse auctions, their design, their evaluation processes, and their outcomes, as well as local investment benefits which have flowed from them. Before we jump into the presentation, I will provide you with a quick overview of the Clean Energy Solutions Center. Then, following the presentation we will have a question and answer session where Greg will address questions submitted by the audience. At the end of the webinar you will be automatically prompted to fill out a brief survey as well, so thank you in advance for taking a moment to respond to that.

The Solutions Center was launched in 2011 under the Clean Energy Ministerial. The Clean Energy Ministerial is a high-level global forum to promote policies and programs that advance clean energy technology, to share lessons learned and best practices, and to encourage the transition to a global clean energy economy. Twenty-four countries and the European Commission are members, contributing 90 percent of clean energy investment and responsible for roughly 75 percent of global greenhouse gas emissions.

This webinar is provided by the Clean Energy Solutions Center, which focuses on helping government policymakers design and adopt policies and programs that support the deployment of clean energy technologies. This is accomplished through support in crafting and implementing polices relating to energy access, no-cost expert policy assistance, and peer-to-peer learning and training tools such as this webinar. The Clean Energy Solutions Center is co-sponsored by the governments of Australia, Sweden, and the United States, with in-kind support from the government of Chile.

The Solutions Center provides several clean energy policy programs and service, including a team of over 60 global experts who can provide remote and in-person technical assistance to governments and government-supported institutions, no-cost virtual webinar trainings on a variety of clean energy topics, partnership building with development agencies and regional and global organizations to deliver support, and we also have an online library containing over 5500 clean energy policy-related publications, software tools, videos, and other resources. Our primary audience is made up of energy policy makers and analysts from government and technical organizations in all countries, but we also strive to engage with the private sector, NGOs, and civil society.

The Solutions Center is an international initiative that works with more than 35 international partners across a suite of different programs. Several of the partners are listed on this slide and include research organizations like IRENA and the IEA, programs like SEforALL, and regionally focused entities such as the ECOWAS Center for Renewable Energy and Energy Efficiency.

A marquee feature that the Solutions Center provides is the no-cost policy expert assistance known as Ask an Expert. The Ask an Expert service matches policymakers with one of the more than 60 global experts selected as

authoritative leaders on specific clean energy finance and policy topics. For example, in the area of reverse auctions that we're addressing today we're very pleased to have Toby Couture, who is the founder and director of E3 Analytics serving as one of our experts. If you have a need for policy assistance in reverse auctions or any other clean energy sector, we would encourage you to use this valuable service. Again, the assistance is provided free of charge. If you have a question for our experts, please submit it through our simple online form at cleanenergysolutionscenter.org/expert. That link is just below the map on the current slide. We also invite you to spread the word about this service to those in your networks and organizations.

Today's speaker is Dr. Greg Buckman, who is Senior Policy Officer in the Environmental Planning and Sustainable Development Directorate of the Australian Capital Territory government. Greg has worked on the nation-leading large-scale reverse auction program undertaken by the Australian Capital Territory—ACT—government since 2011 when the program began. And now I'd like to welcome Dr. Buckman to the webinar.

Greg Buckman Thank you, Erik. Just… thank you, Erik. As Erik said, my name's Greg Buckman. I'm from the ACT government. ACT stands for Australian Capital Territory. As the name suggests, I'm from the Australian equivalent of Washington State. It's a small territory in southeastern Australia, where the capital of Australia, Canberra, is located.

Between 2012 and 2016 we ran five different reverse auctions for solar and wind power, and we were the first, and those auctions were held to award large-scale feed-in tariffs to wind and solar farms. We were the first jurisdiction in Australia to use reverse auctions, and since the pioneering work we did between 2012 and 2016 reverse auctions have taken off around Australia with the Queensland, Victorian, National, and New South Wales governments all adopting them.

Today's webinar will... let me see… Today's webinar will, as the screen shows, will touch on an overview of the policy that underpinned the auction. I'll go through the auction rules and the legislation that supported the auction. I'll go through the process through which the auctions evaluated all the different bids and arrived at winners. Then I'll talk about the outcomes from the five different auctions. And then I'll talk about some of the side benefits from the auctions, particularly benefits that we used for local investment and local renewable electricity innovation.

Now, firstly, on policy overview, the ACT—the Australian Capital Territory, rather—has the most ambitious renewable electricity and greenhouse gas reduction targets in Australia. The Australian Capital territory is a fairly aggressive and liberal city with about 400,000 people in it. And there's a fair degree of affluence amongst Australian Capital Territory residence, so it's a fairly progressive electorate here. And in 2010 we set a target of reducing our 1990 level greenhouse gas emissions by 40 percent by 2020. And in 2016 we set a renewable electricity target of having complete 100 percent renewable electricity supply also by 2020. And our renewable electricity target will supply nearly all of the emission reduction needed to reach that 40 percent

target. By 2045 the Australian Capital Territory aims to be completely carbon neutral, to have net zero emissions by 2045.

Here's a map of—a stylized map of Australia with the different renewable energy and emission targets of the eight different jurisdictions that make up Australia. You can see that in the southeast corner, in the lower right corner, the ACT and Tasmania both have 100 percent renewable energy targets. That's higher than any other state or territory target. Ours, however, is more ambitious than Tasmania. I used to live in Tasmania and there's a lot of hydro development in Tasmania, and as you can see from this map, they were already at 92 percent renewable electricity supply, as you'd expect in a jurisdiction that has a lot of hydro. However, last year we were only sitting on 22 percent, so in incremental terms our renewable energy target is more ambitious than any other in the other seven states and territories that make up Australia.

From an emission reduction point of view, renewable energy matters a lot in Australia. We are the 14th largest, by country, greenhouse gas emitter in the world, as you can see in the top left-hand graph here. And in per capita terms we're the seventh highest per capita greenhouse gas emitter in the world. Our per capita emissions are about four times the global average and about twice the OECD average. The main driver of our high emissions is our coal deposits. Australia has a lot of coal. We're the largest coal exporter in the world. And that's brought a lot of wealth to Australia, but it's also brought a lot of emissions over time. Our electricity sector is very dependent on coal still for most of its generation, and the big challenge for Australia is to wean itself off coal if it is to reach a decent level of—and a responsible level of greenhouse gas emissions.

In here, in the Australian Capital Territory, electricity has traditionally made up the bulk of our emissions, as you can see in the bar chart on the left-hand side. When we first legislated our 40 percent by 2020 greenhouse gas reduction target in 2010, electricity made up about 60 percent of the emissions in the Australian Capital Territory. So, unsurprisingly, originally energy supply, particularly electricity supply was targeted to drive most of the emission reduction needed to reach our 40 percent by 2020 target. As you can see in the pie chart on the right there, we had originally hoped that residential and non-residential energy use would also make—and transport—would make significant contributions to the 40 percent emission reduction target. In the end they didn't, and the decarbonization of our electricity supply ended up—or, rather, will end up supplying most of the emission reduction, nearly all of the emission reduction needed to reach that 40 percent by 2020 greenhouse gas reduction target.

Now, traditionally, feed-in tariffs have been set by government, and the Danes and the Germans in particular in the '80s pioneered the use of feed-in tariffs. And what happened traditionally was that governments would set feed-in tariffs, or the rate of feed-in tariffs, and the market would respond with the amount of output that it wanted to produce with that government feed-in tariff incentive. However, over the last ten years reverse auctions have

taken off in a big way. There were only 6 countries that were using them in 2005; now there's over 70 that are using them. And the map on the left-hand side shows that countries that have—were using them by early 2015. That excludes Australia, but obviously should include Australia. And the bar chart in the lower right-hand side of this slide shows the growing population of feed-in—of reverse auctions.

Reverse auctions basically go to market and ask the market how much they need for a given level of output and capacity. So, instead of governments setting feed-in tariff rates, markets set feed-in tariff rates. There's a big difference between the old government style of feed-in tariff determination and the new reverse auction style. Reverse auctions are taking off in a big way, even in countries like Germany that have traditionally been champions of government-determined feed-in tariffs, and they've basically become the standard for the award of feed-in tariffs rather than the old government-determined system.

Reverse auctions aren't foolproof and certainly aren't perfect. Some of the criticisms—[coughs] excuse me—that are sometimes levied against reverse auctions include the fact that they can lead to uncertain delivery, particularly if a bidder underbids and puts in a price that's just too low to enable them to deliver on their wind, solar, or other renewable electricity farm. Another criticism is sometimes they can involve high administration and transaction costs. Sometimes it's argued that because, you know, to be a fairly large wind or solar farm it costs a fair bit of money to put in the bid, and therefore reverse auctions can discourage small-to-medium-sized wind, solar, et cetera farms from bidding. And another criticism of reverse auctions are that because they're very focused on price they tend to kind of implicitly discriminate in favor of areas that have good quality renewable electricity resources.

All of those weaknesses of reverse auctions can be guarded against. You can have bid thresholds to make sure that small wind and solar farms can bid. You can have a fairly streamlined bidding system to make sure that it's not too expensive for a wind or solar farm to take part. You can require a bond or a deposit to be made by a wind or solar farm to make sure they do follow through on their bid. And you can have an assessment process to make sure that bids don't concentrate too much in particular areas. So, they're not irreversible, and all these weaknesses can be overcome through clever and well-thought-through auction design.

In the ACT's case we used a sealed bid system, where basically people put in confidential bids that weren't known to other bidders. We had a contract for different feed-in tariff payments, and I'll explain exactly what that is in a minute. But our feed-in tariffs are ran—or, run, rather for 20 years. Our feed-in tariff payments weren't indexed for exchange rates or inflation rates, so they declined in real terms over the 20-year period. We were just open to wind or solar farms in our five different auctions. In our last auction in 2016 we did say that other types of renewable electricity generators like, say,

biomass generators could apply to bid but no one did. So, the five auctions that we've run have just embraced wind and solar technology.

We had maximum and minimum capacities. The minimum capacity was 2 or 20 megawatts and the largest capacity was between—was up to 109 megawatts. In our first—we did have a few prequalification requirements, particularly that development approval should have been started for a wind or solar farm. And as I'll explain in a minute, we had an assessment process based on several different non-price criteria, and we lined performance against those non-price criteria up against the price that different wind and solar farms bid.

You can learn more about the ACT reverse auctions in two different journal articles that we've published. One that was published—on the left-hand side—in 2014 through the journal Energy Policy, and that was focused on the two solar auctions that we ran in 2012 and 2013. More recently this year we've had a second journal article published through the Renewable Energy journal, the front of which is shown on the right-hand side of this slide, and that journal article covers all five auctions that we ran between 2012 and 2016.

As mentioned, we've had five different auctions. We had a 20-megawatt solar auction in 2012. And by 20 megawatts, I mean that we ran an auction that awarded up to 20 megawatts of feed-in tariff-supported capacity. So, our auctions were based around capacity, not output. And in 2013 we ran another 20-megawatt solar auction. In 2014 we ran a 200-megawatt wind auction. And then, again, in 2015 we ran a second wind auction for 200 megawatts of large feed-in tariff-supported capacity. And then, two years ago, in 2016, we ran a so-called next generation renewables auction that was open to wind and solar farms and that again awarded 200 megawatts—[coughs] excuse me—of feed-in tariff-supported capacity. And all together, the output from the ten different wind and solar farms that got feed-in tariff entitlements through those five auctions will deliver about three quarters of the 100 percent renewable energy target that we've set for 2020, and which we're well on the way to achieving.

The successful bidders in the five auctions that we ran are show in this slide. They're all in southeastern Australia. The Sapphire wind farm is in northern New South Wales. The Crookwell wind farm is just near the Australian Capital Territory here. We've got three different solar farms in the Australian Capital Territory. We've got two wind farms in Victoria, being the Ararat and Coonooer Bridge wind farm. And we've got a wind farm in South Australia, shown north of Adelaide on the left-hand side of the slide, for which we're supporting three different stages of that wind farm. So, that's the distribution of the different wind and solar farms that our reverse auctions awarded feed-in tariff entitlements to.

And this slide shows the winners—rather, the metrics and the bids that we received in the five different auctions. The first numeric column shows the capacities that we were going to award in each of the different auctions. The second lighter column under "Eligible technologies" shows which

technologies were eligible in the different auctions. The third column, "Number of submitted proposals," as the column—as the descriptor suggests, shows the number of bids that we received in each auction. The fourth column, "Total capacity of all submitted proposals," shows that generally we received about five times the amount of capacity that we could award. So, each auction, happily for us, was quite competitive. And the last column, "Average proposal capacity," shows the average of each bid. As I say, we got between five and six the amount of capacity bid in each of our auctions, so we could afford to be fairly picky about who would be successful in each of the auctions.

Now, the "contract for difference" scheme—basically, if, say, a solar farm gets, say, a $190.00 feed-in tariff entitlement awarded to it, under the contract for difference structure of our feed-in tariffs, we will pay the difference between that and the wholesale price of electricity that that solar farm will experience from time to time. So, if the wholesale price is, say, $70.00, we will pay—in a 30-minute trading interval—then we'll pay them $120.00, being the difference between $70.00 and $190.00. And you can see that in red there. In this example the wholesale price varies between about $20.00 and $40.00 per megawatt-hour and the feed-in tariff price is $80.00. But conversely, if the wholesale price goes above the feed-in tariff amount—whoops. What's happened here? Here we are. If the feed-in tariff price goes above the wholesale price, then the generator pays us. So, basically, what our feed-in tariff entitlements are are a guarantee of a certain income amount per megawatt-hour. And if the generator earns less than that from the wholesale market, we pay them; if they earn more than that from the wholesale market, they pay us. So, it basically gives a wind or a solar farm a guaranteed income stream at a known and predictable price over a 20-year period, and that makes the successful wind and solar farms a lot more bankable.

Reverse auctions haven't always worked really well. In the 1990s the United Kingdom government ran a thing called the "Non-fossil fuel obligation," under which fossil fuel generators were exposed to a levy. That levy was collected by the UK government and was used to finance a number of reverse auctions in the UK. But as this graph shows, the completion rate of the successful bids under the five auctions that it ran weren't high and generally declined over time. And the reason why it—the whole non-fossil fuel obligation reverse auction system was fairly unsuccessful was that generally the bids were too low and people found that once they had their feed-in tariff entitlement they couldn't actually build their renewable electricity generator because the bids were just too low and basically unrealistic. In broad terms, the market wasn't developed enough, wasn't mature enough, and people were too eager to get a feed-in tariff bid, which ultimately proved to not be particularly workable and to be too low. But happily for us, since the 1990s the renewable electricity market has moved on. It's a lot deeper. It's a lot more mature. It's a lot more sophisticated. And we've found and other reverse auctions have found that people these days are inclined to build reliable prices, sensible prices, and deliverable prices, rather than the unrealistic prices that the non-fossil fuel obligation in the UK experienced in the 1990s.

The objectives for the ACT reverse auction scheme were largely twofold. One was to reduce our greenhouse gas emissions, as I previously explained. A second objective was to basically position Canberra and the Australian Capital Territory as a national renewable energy innovation hub. And as I'll explain later, we used the auctions to basically get a lot of local investment benefit out of the wind and solar farms that were supported through them, and we used those benefits to support various initiatives in Canberra that cemented our reputation as a renewable energy leader across Australia.

Now, to the mechanics of our auctions. We passed the legislation that supported our reverse auctions in 2011. The statue—the legislation is shown on the left-hand side of this slide. The legislation was amended several times. It was amended nearly every year since it was passed by our Parliament. Basically, successful projects can be located anywhere in what's known as the national electricity market in Australia, which covers all the eight states and territories in Australia apart from the Northern Territory and Western Australia in the north and the west of the country.

The feed-in tariff payments are made by a local electricity distributor and they pass that cost on to retailers, who include the cost in their charges to their customers. So, basically, the cost of the feed-in tariffs that we pay out to our wind and solar farms are recovered from local electricity consumers.

We had a rules document, a so-called "request for proposals" document, that we sent out with each auction. This, what we called the RFP document, covered the process that each auction would go through. It came with different forms that each bidder had to fill out. And we had a public addenda process where any changes and any questions and answers that potential bidders might put to us were published and sent around to all people that registered as a potential bidder. So, it was a fairly dynamic process, but all the rules were ultimately encapsulated in our request for proposals document.

Some of this I've captured already, but our feed-in tariff payments were not indexed. They were fixed and they were flat over 20 years. As I mentioned before, they were paid by an electricity distributor. They—the feed-in tariff, the output that the feed-in tariff was for had to net off any distribution or transmission losses. As I mentioned before, it was paid on a contract for difference basis. And the successful bidder was free to sell on a wholesale basis to any market participant that they wanted. We didn't bind successful bidders in terms of how they went about earning their wholesale market income.

As well as price we had a number of non-price evaluation criteria, which are shown in this slide. We had one evaluation criteria that I counted as 50 percent of the non-price assessment that related to the timely completion of a process. Basically, that criterion looked at how feasible the timeline for a project was, how realistic their finance was, how doable their technology was, and sort of basic metrics like that that determined the deliverability of a bid. We also awarded 20 percent to local engagement. We were particularly keen to only support wind and solar farms that had good local support. The ACT government didn't want to support wind and solar farms that had a hostile

local community, so 20 percent of the non-price assessment for each bid was awarded according to how successful the proponents had been with their local community and how much demonstrated local support they had.

Another 20 percent was based on what sort of local investment benefit, what sort of ACT economic developments each could promise—and I'll go into more detail about that a bit later. And a fourth criterion, which awarded ten percent of the non-price assessment was based on basically what use a wind or solar farm wanted to make of a thing called a treasury financial guarantee, which is a slightly wordy descriptor for a guarantee that said that if local legislation was changed in a way that in any way reduced the value of a feed-in tariff entitlement, then the relevant wind or solar farm would be compensated. It was basically a mechanism that guaranteed that legislation couldn't be changed in a way that financially disadvantaged a successful wind or solar farm under our auction system.

So, going to the first evaluation criterion, the risk to timely project completion, as I mentioned before, this just looked at basically how experienced and how capable a proponent was, what their access to funds was like, whether they had lined up bank finance or balance sheet finance, what their technology was like, how advanced they were their development approval, and how realistic their time frame was. So, basically, the nuts and bolts of rolling out a proposed wind or solar farm.

The second criterion, local community engagement, as I mentioned before was basically based on how much support the local community was giving to the proposed wind or solar farm. Proponents had to lodge a community engagement plan that showed how they'd complied with local planning processes, how they'd engaged with local communities, how they were going to mitigate any local engagement risks, particularly any backlash from local community, and basically how far ahead of the pack they were prepared to be in terms of engaging with their local community. We found some bidders just want to do the basics: They just want to do a few community meetings, maybe send out a few leaflets, and just do the minimum. But others were prepared to be innovative with their local community engagement. We had two wind farms that invited a local community investment in their wind farms and kind of went the second mile, as it were, in trying to engage and include the local community in their proposed development. And that's the sort of thing we were most looking for under this criterion.

Now, the third criterion, as I mentioned before, looked at basically what promises wind or solar farms could make in terms of local investment here in the ACT, and there were four different areas that we looked at. One was the degree to which they were prepared to engage local contractors and the labor force. The second was whether they were interested in engaging with local tertiary education groups to develop research partnerships or teaching partnerships or skill partnerships. A third area was any kind of research type things separate to their—that were part of their tertiary engagement that would build research capacity here in the ACT around renewable electricity. And a fourth area was whether they were prepared to move some or all of

their corporate headquarters here to the ACT. And we had three wind farms that moved their operational headquarters here to the ACT, that meant we now host four different national wind companies here in the ACT.

And our fourth criterion, as I was mentioning before, was based on potential use of financial compensation. That varied according to wind or solar technology. If a solar farm wanted to make use of the financial compensation mechanism, then they could get a maximum of $1.75 million per megawatt of capacity. But if a wind farm wanted to make use of this mechanism, the most they could get it $1.23 million per megawatt of capacity, just reflecting the lower per-megawatt cost of wind compared to solar. But the scoring on this criterion was done a kind of straight-line basis, where if a proponent wanted to make maximum use of the compensation, they got zero, and if they wanted to make no use of this compensation mechanism, they got the maximum score of ten out of ten. So, we tried to incentivize as little use of the financial compensation mechanism as we could, but in our first auction in 2012 it was made quite clear to us that unless we offered some guarantee that wind and solar farms wouldn't be discriminated against in terms of future legislation, then the whole auction scheme wouldn't be bankable, basically. So, the financial compensation mechanism was integral to the financial security of our auction system.

Now, here are the winners from the five different auctions that we ran. There were three solar farms, shown in the rows listed "solar auction fast-track stream" and "solar auction regular stream." They were relatively small solar farms—20 megawatts, 7 megawatts, and 13 megawatts—all located here in the Australian Capital Territory. After that, in the first and second wind auction and the next generation renewable auction we awarded feed-in tariff entitlements to generally, but not always, fairly large wind farms. Most of the wind farms were between 80.5 and 109 megawatts, although there was one small wind farm at 19.4 megawatts, the Coonooer Bridge wind farm. The feed-in tariff prices that we awarded were done on a per-megawatt hour basis, and they varied, as you can see in the proposal FIT price column between $73.00 per megawatt-hour and $92.00 per megawatt-hour in the case of wind, and between $178.00 and $186.00 per megawatt-hour in the case of solar. And for reference's sake I should mention at this stage that at the moment the Australian dollar is worth about $0.70 US. So, you've got to add about—you've got to multiply that by 0.7 to get an equivalent US—no, you've got to divide by 0.7 to get an equivalent US amount. You've got to—yeah, if you divide by 0.7, you'll get an equivalent US amount.

The wind prices were very competitive at the time we ran the different wind options, particularly the $77.00 amount for the Hornsdale wind farm stage 2 and the $73.00 per megawatt-hour for the Hornsdale stage 3, as well as the $81.50 for the Coonooer Bridge wind farm. They were the lowest wind support prices in Australia at the time. There's since been even lower wind support prices in Australia, but in 2013, 2014, 2015 our wind prices were the lowest that had ever been reported in Australia.

One of the—this slide shows the downward movement in the range and the median feed-in tariff prices that were submitted to the three wind auctions. You can see there was a reduction from a bid over $100.00 per megawatt-hour on average in—sorry, in median terms for the first wind auction in 2014, down to a bid over $80.00 per megawatt-hour in the next gen renewables auction held in 2016.

This slide shows the downward movement in solar median feed-in tariff prices in the three solar auctions, or in the three auctions that were open to solar that we ran in 20112, 2013, and 2016. There was a steeper decline there from a bid under $230.00 per megawatt-hour to a bid over $80.00 per megawatt-hour mainly because the capacity factor improvements and the capital cost price declines for solar over the period of our auctions was a lot more radical and significant than it does for wind. Basically, there were greater learning curve improvements happening for solar than there were for wind, so the price reduction for solar was a lot more radical over the period of our auctions than it was for wind.

We had a number of different wind bidders that bid into both our first and last auction—so, that were open to wind farms. This slide shows the movement of prices that those five different proposals had in both the first wind auction and the next gen renewables auction, the first wind auction being held in 2014 and the next gen renewables auction being held in 2016. And those five bids were for the same wind farms, so there was no change in what the proponents were proposing in terms of size or location of wind farm. The bids simply became a lot more competitive between those two options, which we thought was testament to the competitive pressure and the competitive culture that our different wind auctions were engendering amongst different proponents.

One of the big drivers of price reduction in our different wind auctions was internal rates of return. Because our auctions were highly competitive and there was a lot of interest in the auctions, as each new auction came along, we found that wind proponents were prepared to be more competitive and were prepared to submit bids that basically gave them lower rates of return with each new auction, and that was a big driver of the different and lower and more competitive feed-in tariff prices that we got in later wind options.

Another driver of lower wind feed-in tariff prices over time through our auctions was lower cost of finance. During the period of our auctions world interest rates were coming down in the wake of the global financial crisis, so that helped deliver lower wind feed-in tariff prices. And as mentioned before, a big incentive for us was leveraging the successful bidders into our wind and solar auctions in terms of encouraging them to invest in the ACT, and we did that relatively successfully. As I mentioned before, we've now got four wind companies now headquartered here in the ACT. We've got a renewable energy center of—renewable energy skills center of excellence here in the ACT at a local tertiary institution that does training for wind developers and basic kind of safety rules and stuff. We've got a wind development course at a local university, which has been a byproduct of one of the bids that got up in one of our auctions. We used our last auction in 2016 to finance a $25 million

pool of money which is helping to roll out household and small business battery units across the ACT. We're using that $25 million to subsidize those batteries and to hasten the rollout of small-scale distributed batteries across the ACT. And we also used our last auction in 2016 to support a number of electrolyzers that will convert renewable electricity to hydrogen. One of them is a research electrolyzer that a local university is using to research hydrogen, and we've also got a number of hydrogen-powered cars that are part of that trial that we're going to use throughout the ACT.

This slide just details the battery rollout program that we've got. As I mentioned before, we've got $25 million in energy storage grants that we're using to subsidize small scale batteries across the ACT. We hope to roll out up to 5000 different small-scale batteries across the territory. We based the subsidy for those batteries on a thing called sustained peak output from the batteries. We've got a new data platform that we're rolling out at the moment that will capture output and storage data from the batteries and we'll pass that on to researchers and people at the—in the industry. And we're also trialing a VPP, or virtual power plant, under which an electricity retailer basically coordinates with different battery owners to dispatch output from their batteries at preordained times so that they can collectively act basically as one big power station or one big electricity supplier. So, that's been quite exciting.

We've—separate to the battery rollout we've also got an $8 million research program through our local Australian National University that's looking at integrated battery systems and how they can best work with solar panels, with electricity distribution systems, with things like the virtual power plant system that I described before. So, that's quite an exciting research innovation that we've got happening here in the ACT.

We've also used money from our last auction to finance an innovation hub, which is basically a low-cost office space in which renewable energy-based companies can hire desk space and base themselves there. We also have some seminars and events there. And that's been quite successful. It's fully subscribed now and it's proved quite popular.

And that brings me to the end of the presentation. So, any questions?

Erik Ness

All right. Great. Thank you, Dr. Buckman. That was a very interesting presentation. As we shift into the Q&A session, I'd like to remind our attendees to submit questions using the question pane at any time. We will also keep some links up on the screen throughout for quick reference that point to where to find information about other upcoming and previously held webinars. We received some great questions from the audience that we'll use the remaining time to answer and discuss.

The first question relates to lessons learned during the process of doing these reverse auctions. And so, the question is "What changes, if any, would you make now? Perhaps comment on the Victorian government's auction process, if appropriate."

Greg Buckman I don't know a lot of detail about the Victorian scheme. But I think that we would most change is the way we manage local investment commitments. I don't want to be overly critical but we had a number of bidders that promised a lot, but once they got their feed-in tariff entitlement they were kind of less keen on delivery than they might have appeared when they submitted their bid. So, that's not to say that a lot of commitments weren't delivered. They were delivered. But in some cases, delivery was a bit loose and a bit less enthusiastic than we might have hoped, and I think that's an area that we definitely need to tighten up on in future.

I think we're keen on having fewer local investment commitments, possibly making them cash-based rather than non-cash-based, and definitely making them more discrete and more manageable than the local investment commitments that we had in the auctions were.

I think more and more people that hold reverse auctions do want local benefit to flow from it. It's not unreasonable for local electricity consumers to want a return on the extra costs that they have to bear to support feed-in tariff entitlements. But the management of those local investment commitments has a way to go, I think. You can easily have a regime that's basically too loose and allows bidders to promise the world but to live as something much less when and if they get their feed-in tariff entitlement. So, that area does need a lot of tightening up and a lot of kind of probity in the future, I think.

Erik Ness Great. Thank you. Next question is "How scalable is the ACT's reverse auction process?"

Greg Buckman I think it's very scalable. And this does connect with recent reverse auctions held in Victoria. Our different auctions awarded 640 megawatts of feed-in tariff support capacity across five auctions, but the Victoria reverse auction has awarded slightly more than that all in one auction. So, they've gone over 600 megawatts just in one single auction.

So, I think it's very scalable. I can't really see any barriers to running a one-gigawatt auction if you wanted to. Yeah, I think it's very scalable.

Erik Ness Thank you. And then, the next question is "You mentioned that the local economic benefits include investing in solar batteries and that ANU has a battery storage integration program. Would ACT consider doing reverse auctions in the future not just for wind or solar separately but for a renewable energy project and storage combined?"

Greg Buckman Yes. We might consider doing that. Storage obviously has a higher penetration of renewable electricity, and anything that's basically not hydro and not biomass needs storage if it's going to be instantly dispatchable. So, the more penetration you have of renewable electricity, the more important storage becomes. And yes, I think we probably would look at including storage in a future auction. But yeah, storage and dispatchability becomes more and more critical the higher the penetration of renewable electricity, and I think it will be important for reverse auctions to increasingly focus on storage.

Erik Ness Great. Thank you. The next question is "How has the cost of the ACT large feed-in tariff scheme performed since the auctions were completed? Specifically, are they in line with forecasts and expectations?"

Greg Buckman Broadly. It's a tough thing to forecast wholesale prices. Here in Australia extreme weather events, particularly very hot days, can push up wholesale prices quite dramatically. I know last year we had a very hot February and we had really, really high wholesale prices for a few weeks in February. But that worked to the benefit of the cost-borne buyer scheme because, as I explained under the contract for difference slides, if wholesale prices go above the feed-in tariff price, then the generators pay us rather than us paying the generator. So, extreme weather events can be helpful for the cost of our scheme.

What's also very unpredictable is here in Australia there's a lot of discussion around whether we should introduce some form of carbon pricing into the electricity sector. We briefly had a form of carbon pricing between 2012 and 2014, and there's discussion about whether we should reintroduce a scheme like that. And depending on whether it's introduced and how it's introduced, that can also affect wholesale prices.

And then, on top of that, a third factor that affects wholesale prices in Australia is the—we've got quite an old coal-fired electricity cohort of generators that were mainly built in the '70s and '80s, but a number of them are coming to the end of their useful lives, and as they retire feed-in tariff prices tend to—rather, wholesale prices tend to go up. Although, conversely, greater and greater penetration of renewables tends to push wholesale prices down.

So, there's quite a different—quite a number of different swings and roundabouts that affect wholesale prices in Australia and it's quite a tough ask to predict where they're all going to go over time and therefore predict exactly what the cost of our feed-in tariffs will be over time. But broadly, the cost of the scheme has performed much as we expected it to when we rolled out the different auctions.

Erik Ness Thank you. Now, with the cost of wind and solar generation decreasing, particularly with solar power, do you think the feed-in tariffs and reverse auctions will be needed in the future? Or is this sort of a medium-term bridge?

Greg Buckman No, I think there will be a place still for reverse auctions in the future. The thing that a reverse auction gives is price certainty—not so much the auctions but the feed-in tariff entitlements that the auctions award. They guarantee to renewable electricity a known and specific amount of income per megawatt-hour over quite long periods. In the Victoria reverse auction, they awarded feed-in tariff entitlements for 15 years. As I mentioned, our reverse auctions awarded entitlements for 20 years. So, they provide an income certainty to renewable electricity developers. And just relying on the wholesale market, what we call "going merchant" here in Australia, can't provide that kind of certainty.

So, I think there is a place for feed-in tariff entitlements, but I think as different renewable electricity technologies, particularly wind and solar, become more competitive, then the amount, the price that will have to be allocated to them should come down over time. But as I mentioned before, there's still a need to provide income certainty for them if they're to be bankable. So, I think from that point of view there will still be a place for feed-in tariff entitlements and the use of reverse auctions to award them.

Erik Ness Thank you. Noticing how the bid prices came down during the auction process, is ACT nervous that it could be locking in prices that it's committing to that will be substantially higher than it could have received if it had simply waited longer?

Greg Buckman That is a risk definitely. But we needed a lot of renewable electricity capacity rolled out in fairly quick time to make sure we hit our 2020 renewable electricity target. If the target was further into the future, then yes, we probably could have sat back a bit and waited for prices to come down more than they did between our auctions, before we went to auction. But if we'd waited, then there would have been increased emissions in the meantime and we'd be playing a smaller part, a more modest part in the global greenhouse gas reduction effort if we'd done that. So, there's a bit of a tradeoff, basically, between responsibility and cost.

But yes, I think it's an indisputable fact that if we'd waited, we could have got lower wind and solar prices. But if we'd waited, we would have had more emissions in the meantime.

Erik Ness Thank you. How has the community engagement and local commitments made by the successful wind and solar bidders performed? Specifically, has the reality of the delivery matched what was promised?

Greg Buckman The community engagements worked quite well. None of the local communities around any of the wind farms have been hostile at all. And as I mentioned before, two of the wind farms offered community engagement in their wind farms, which we thought was quite innovative and quite ahead of the pack, and that helped increase community support for those wind farms.

For one or two of the solar farms there was a little bit of local community grumpiness, I guess I'd say, mainly about people that were concerned about their view fields being besmirched a bit by a local solar farm. They were all built in semirural parts of the Australian Capital Territory and there were a few kind of local kind of hobby farm owners that were used to seeing nice, verdant kind of pastures near their houses and they were a bit concerned that suddenly those pastures were going to have lots of solar panels in them.

But the grumpiness wasn't particularly vocal. It certainly never threatened the rollout of the solar farms, and we don't hear from the locals anymore. So, in the broad we're pretty happy with the community engagement.

Erik Ness Thank you. Do you think there's still a risk of successful bidders underbidding and not delivering on their successful reverse auction bids?

Greg Buckman I think that's always a risk in any auction. But none of the three solar farms or seven wind farms that we supported ever looked as though they weren't going to roll out. So, unlike the UK experience in the '90s we never seriously doubted that a successful bidder was going to go forward with their proposal. I guess—like, bidders in our auctions spent between about $300,000.00 and $600,000.00 AUD on their bids, so if they didn't go ahead with a proposal, then they're going to bid a fair bit of dough, basically. And we like to think that our auction process basically ascertained whether a bidder was serious or not when we assessed their submissions, and we only really considered bids that looked particularly serious. But the risk that a bidder might get a feed-in tariff entitlement through a reverse auction process and not proceed with it is ever-present in a reverse auction process. But I think that, as I mentioned a few times, as the market becomes more mature and sophisticated the risk of that happening must decrease over time, particularly if you've got a good assessment process behind a reverse auction.

Erik Ness Great. Thank you. And then, another question, "What's the process for dispute resolution, for example regarding nonperformance?"

Greg Buckman Basically, we sign deeds or contracts, basically, with our wind and solar feed-in tariff entitlement holders. And if they don't honor all the terms of those contracts, we've got a dispute process where basically we identify a nonperformance area, they have to submit a plan through which they agree to basically perform to the undertaking in the deed that we feel like they're not honoring, and if they don't do that within a certain time period, then we can withdraw the feed-in tariff support from them. So, we do have a kind of fallback mechanism that allows us to raise disputes with feed-in tariff entitlement holders and take them to an arbitration process.

Erik Ness All right. Thank you. That was the last question. So, thanks again for your presentation, Dr. Buckman, and for the informative Q&A session.

Greg Buckman No problem.

Erik Ness Now I'd like to give you an opportunity to provide any additional or closing remarks you'd like to make before we end the webinar.

Greg Buckman Yeah. I can say in the broad side that reverse auctions are here to stay. I think renewable electricity is here to stay. They're still a bit of a work in progress but I think they've proven that they're viable, that they're doable, that they deliver renewable electricity at least cost to electricity consumers. And it's really a question of refining them, I think, going forward rather than asking whether they're the way to go or not at all. I think they are the way to go when it comes to awarding large scale feed-in tariff entitlements, but there's always improvements and always refinements that can be made, particularly with local investment commitments, as I was saying before. But I think they are proven, both here in Australia and around the world, and I think they're here to stay. So, really, it's a question of refining them rather than deciding whether they're the right vehicle or not.

Erik Ness

Great. Well, thank you again. On behalf of the Clean Energy Solutions Center, I'd like to extend a thank you to our expert speaker and to our attendees for participating in today's webinar. We very much appreciate your time and hope that there were some valuable insights that you can take back to your ministries, departments, or organizations. We also invite you to inform your colleagues and those in your networks about Solutions Center resources and services, including the no-cost policy support available through our Ask an Expert service. I invite you to check the Solutions Center website if you would like to view the slides and listen to a recording of today's presentation as well as previously held webinars. In addition, you will find information on upcoming webinars and other training events there. We also post webinar recordings to the Clean Energy Solutions Center YouTube channel. Please allow a week for today's webinar recording to be posted.

Finally, I would like to kindly ask you to take a moment to complete the short survey that will appear when we conclude the webinar. Please enjoy the rest of your day and we hope to see you again at future Clean Energy Solutions Center events. This concludes our webinar.