

ECONOMICS AND INDUSTRY STANDING COMMITTEE

INQUIRY INTO MICROGRIDS AND ASSOCIATED TECHNOLOGIES IN WA



**TRANSCRIPT OF EVIDENCE
TAKEN AT PERTH
MONDAY, 18 JUNE 2018**

SESSION TWO

Members

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

Hearing commenced at 10.29 am**Dr TANIA URMEE****Senior Lecturer, Murdoch University, examined:****Dr FARHAD SHAHNIA****Senior Lecturer, School of Electrical Engineering, Murdoch University, examined:****Dr GM SHAFIULLAH****Lecturer, School of Electrical Engineering, Murdoch University, examined:**

The CHAIR: On behalf of the committee, I would like to thank you for agreeing to appear today for a hearing for the committee's inquiry into microgrids and associated technologies in Western Australia. My name is Jessica Shaw. I am 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; to my left, Deputy Chair, Sean L'Estrange, member for Churchlands; Stephen Price, member for Forrestfield; and Terry Redman, member for Warren-Blackwood. 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 before the committee today?

The WITNESSES: No.

The CHAIR: Would you like to make opening statements?

Dr SHAHNIA: First of all, I would like to thank you very much for inviting us. As an academic and researcher working in the field of microgrids, most specifically from the electrical side, it is really interesting for me just to see how interesting this topic is, not only around the world but also in Australia and Western Australia, especially by the government side. Hopefully, this type of initiative will help our local utilities and industries, and researchers can combine and join their fields together to move solidly into a very hard to research field.

The CHAIR: Great. Thanks. Did you want to make a comment?

Dr URMEE: I can just add something. There is a need for developing this interface, especially for the microgrid control, because there are so many advanced technologies out there. Tag-and-pay-type microgrids and modular-type microgrids is something that is needed for remote communities. That is what our research is based on at Murdoch University. We are also focused on developing and training people in local areas because that is very important in terms of the sustainability of this sort of system. The technological side is okay, but this is one side in which people are still struggling how to maintain and how to operate, especially if local people are not trained that way. I think that is one of the focuses that we are putting.

The CHAIR: Thank you. I was very interested in your submission. Thank you very much for providing it to us. I was interested to see the reference to the IEEE Power and Energy Society. Two weeks ago I was in Singapore at its conference on microgrids. I was asked to deliver a presentation there on policymakers' concerns around microgrids. One of the things that came across to me was about this

communication between the engineering community, governments and research institutions. Obviously you refer in your inquiry to a number of CRCs that you are involved in. I just wondered whether you could maybe give us a bit of insight into how you think we might be able to more effectively communicate between the engineers, governments and policymakers and where academia has a role in that.

Dr SHAHNIA: That is actually a very interesting point because as you clearly said, different people from different aspects are more focused on their own fields, like from a research perspective you are more focused on probably a more technical side and some policy sides of the things. But that does not necessarily mean that manufacturers, either globally or in Australia, are exactly collaborating with us, in saying that if these people are proposing these techniques, then shall we use them or not? They are also trying to build up.

Based on their own research and development programs, they are trying to chase and improve their own products and find out afterwards. In a very similar way, when it comes to government and its policies, of course there are some very significant or key type benefits in terms of different technologies, especially about microgrids, which might be very interesting for the government but that does not necessarily communicate very well with the universities in which direction their research must be more focused on. Currently, the research focused mostly at universities is more on the technical aspects, less into, generally, the management side issues, policies, regulations, how things should work or how existing business models of utilities should change in order to facilitate that type of new emerging technologies in the systems.

I would personally say that one of the very interesting things that can happen is that because we have two utilities here, both of which have already started some trial projects in the last one or two years. They are very interested mainly for financial benefits for their own things, but they also have some limitations in terms of how to put these new things to work, because they were traditionally a pole and wire company that conveyed energy that was generated in power stations to customers. But now they are going to take responsibility for some other initiatives, like energy storage, renewable systems and renewable systems that are owned by the customers and not only by the utility.

So, how these things are going to be managed and orchestrated such that all the loads in the system are supplied and there will be no problem from a reliability perspective. A framework that can join all these efforts together, saying what we need and what we really need from the technical side and how our local manufacturing companies can come up with some sort of products that fit there, and for that, what type of technology improvements they need that universities and academics can provide. I feel that this general framework that is bringing different people from different aspects together and facilitating them to develop orchestrated systems from every level, from technical side to customer side together, is one of the best things that can happen and can significantly boost the uptake of this technology, undoubtedly.

The CHAIR: I think that that is a really interesting perspective. It is one of the things notable about the scientific community—its ability to collaborate and across multiple disciplines come together around shared goals. Everybody brings something to the table, and you are able to work. It is just such a hallmark of the scientific community and one that probably we could learn a little from, from the policy community, but then also in the corporate world. Are you involved in the formulation of the CRC that is being proposed around these new energy technologies? Is Murdoch participating in that?

Dr URMEE: Yes, we are involved in one of the CRCs, the material one—my job is involved in that, but not the new energy initiative; we are not involved. The one we are involved with is mainly the

energy storage things—batteries and then materials that are used in the batteries, mainly chemistry and that side.

The CHAIR: We have submissions from two universities; I am trying not to confuse the two of you in my mind. The lithium research, I think must have come from the Curtin submission. In your research on microgrids, under sub-point (a) in your submission, you talk about some study you are doing around techno-economic analysis, developing a road map for renewable energy application and developing the investment, implementation and operation policies and frameworks. Could you expand a little on the research you are undertaking in those fields?

Dr URMEE: Yes, research that we are currently doing is in the area of looking at how PV and storage can be incorporated into a remote community and could use less diesel. That was one of the ideas. We used the structure on PV forecasting from that. There are lots of tools available around the world, the commercial tools that can calculate all these things, but all those tools are mainly one hour of data. Currently, we are developing one of the Excel-based tools that can calculate this minute-by-minute information so that we know how much diesel you need to operate and how much reserve you need to put there, and based on that we can develop some cost–benefit analysis to see and ensure that they can plan that.

We also did one of the surveys sent to experts around the world to see which criteria is important. We did use the consultant, academics and industry experts and from there we had different criteria and sub-criteria. The main criteria we looked at was economic, environment, social and technical. From this different group we have different types of ratings for all of these. The consultants put more emphasis on environment and social than the technical ones because they thought that the technical is already solved and can be solved by the industry. But industry also put more emphasis on the economic and the technical side, but have less emphasis on the social.

We also talked with the academic world and all of us work more on the technical side, as Farhad mentioned, but less focus on the social and environment side. Also the economic focus for the academic is not as high as the consultant or the industry. From that research we try to develop criteria that we then implement into three different types of systems to see which one is most efficient for a rural community. We take a community here in Western Australia, one of the networks, and use all these on that to see which one comes best. That is the sort of technical framework we are doing.

The CHAIR: The social factors that you talk about, what were you specifically looking at? What were the social issues that you identified or what were the outcomes that you were looking towards?

Dr URMEE: There are a few things. One of them is the job creation in the local areas and the technology acceptance for the people, because some still think the PV will not work, those sorts of things. We also look at how they feel about this whole microgrid concept if they are totally isolated from the grid and have their own storage. And also the cost and what they think about it: is it too expensive or the community is willing to invest, say, a percentage of the cost? We ask those sorts of things.

The CHAIR: You were interviewing people in the communities?

Dr URMEE: We sent a questionnaire to them. Yes, we had gone through the ethics and all those things and now send the questionnaire to all the experts around the world. We got 68% back from there. We use microactivity analysis to analyse all that data. We submitted that paper, which is not yet accepted, but I am happy to send you the draft.

The CHAIR: I would really appreciate that, because the social impacts of these types of technologies is very important and it is something we have not had masses of evidence on. But I guess both the

acceptance within communities of these technologies, but then the benefits from a social perspective in terms of—obviously, if you can offer least cost energy to households, there is a significant social benefit there. And understanding and qualifying the degree to which that is understood and accepted within communities is very important.

Dr URMEE: One of the things I want to add is that when you think about the social benefit, you cannot generalise even around Australia, because different communities have different social needs and their needs are different and their acceptance is different. We need to have research to see in each communities, which we could not do because of our lack of resources, to talk with the communities around rural areas to see—more advanced and detailed research is needed on that perspective.

The CHAIR: Have you done it specifically in WA in any towns here?

Dr URMEE: We have not, because we did not get resources to do it, but that is one of the things I really wanted to do, because that will give us a platform to see. Even if I can do one or two communities, I can have a baseline to tell what is needed.

Mr D.T. REDMAN: What sort of communities would you be considering?

Dr URMEE: Mainly the remote areas, remote communities. But as we know, there are different sorts of communities. Currently, we are working on one small proposal that we are thinking of—there is a mining community.

There is an Aboriginal community, but I am not sure if we can do that, and then there is the rural community which link forces, and all those things. There are different groups that we could cater to using a microgrid, and it could be different, like some could be the rooftop PV, some could be the small microgrid and then all of those can talk to each other using this software and technology at a level, and can make a whole system.

Mr S.Y. MUBARAKAI: At this point of time, have you identified any projects? Is there something in the pipeline within Western Australia?

Dr URMEE: We do have a few ideas, and we are writing an energy proposal for Pilbara council, and we do not know—the problem is the funding is there, and not there, and we have to struggle with that, but, yes, we identified a few communities, and we are talking with the Department of Housing to see if we can do something. But as I said, you need to go there and talk with people. It is not that I am sitting at Murdoch University and saying, “Okay this is what happens”, and sending the questionnaire. No, that is not the way, so that is what we are actually struggling with.

The CHAIR: It is not hard data based, when you are looking at social factors. There is quite a bit of soft data there, and you need to be able to have those conversations, right?

Dr URMEE: That is right, yes.

Mr D.T. REDMAN: I am interested in where you have come from, and looking at your little nametags there, you are all engineers. My experience is you talk to engineers about what the most important thing is, and they will come up with the engineering outcome, and you talk to social people, and then there are different skews that sit in the marketplace. I guess my question is: how important is government leadership, whatever colour, because there are a lot of elements to this in terms of the take-up and landing the right outcome for the communities that we represent? How important is government leadership, and how big a barrier is the lack of leadership? Again, this is not targeted at any particular group of politicians, but in the sense that there are the social elements, there are the technical aspects of it, and there are the regulatory aspects of it, and any favouritism in those areas can almost deliver a different outcome that might not necessarily be the best outcome for the

state. If you have a view about that, is there a particular mechanism through government that you think could be used to facilitate getting the whole scope of feedback on getting a good outcome?

Dr URMEE: There is always this dilemma that policymakers are the other side of the table. They are all listening. The researchers and academics work on their own. We never talk with each other. We do not know what to do. We do our research on what we think is important, and that is why, because we are engineers, we put more focus on the technical side and less focus on the other side. I did my PhD on the holistic approach of renewable energy and that was mainly policy areas like—I tried to put more on the social and policy areas of work.

To answer your question, I do not have any mechanism, but regulation and government policy is very important, so if there is regulation, then people tend to address that. This is something that we need to do. If we have regulation, for any new community—I can give an example, like in California they did this legislation that all new houses should have some percentage of solar. Even in the small developing countries like in Bangladesh, in the city, any new building will not get electricity supply unless they have 10% of their electricity coming from renewables, so the rooftop. That makes some changes that create business, that create jobs and all these things. Definitely, regulation will help, but, as I said, I do not have any access to say, “This is the mechanism that the government should do.” What is important is stakeholder consultation, and government is one of the stakeholders, so we need to come and talk together before we develop something—a project or a plan or policy.

The CHAIR: Is there any sector that does it well? Many years ago, I worked for the British High Commission, and they participated in what they called the Forum for European and Australian Science and Technology Collaboration—it is called FEAST—and they used to bring all the heads of mission together and all the innovators. There were some in nanotech; there were some in genetic engineering. They would bring the leading scientists from Europe and Australia together in the specific fields to try and get those dialogues opened up. Is there a field that you are aware of where there really is this type of collaboration that goes on between government and industry and academia? Is it in nanotech or biotech, or is there some part of the research community or some field of science where this is done, that we could usefully look to for guidance or for a bit of a model of where it is done well?

Dr SHAHNIA: In Australia or —

The CHAIR: In Australia, or that you are aware of—where is it done well, this collaboration between industry, government and academia?

Dr SHAHNIA: Outside of Australia I am aware of, for example, currently there is a very good collaboration, especially in the field of microgrids, between Denmark and China. What is happening is that China’s government is supporting financially the universities in terms of research funding that is used either for purchasing research equipment, for scholarships for students or hiring money for the postdocs and researchers. They are collaborating currently with a university in Denmark—the Aalborg University, which is one of the highest universities, and most active universities in the field of microgrids. Through that one, if we currently look back into the number of publications that have been published in the field of microgrids probably in the last five years, now China’s universities are among the top around the world, followed by some other countries, but the number and the difference of the number is very significant so it is not possible for any country to overcome that gap in a short period of time.

I feel that both parties are gaining benefits, not only financially but in the outcomes of that research. What I feel is that the Chinese government is probably looking into commercialising those outcomes of that research into products which are going to be sold everywhere around the world. From an investment point of view that is a very, very good example.

The CHAIR: How do we compare? We have received quite a bit of evidence to suggest that WA is actually a very innovative place in regard to microgrid technologies and there is some really fantastic value, IP, that is being generated here that could be commercialised. We have heard that from both industry participants in the private sector and government trading enterprises that seem to be doing some fantastic work. What is your sense of how WA stacks up?

Dr SHAHNIA: Probably mainly because of the geographical distribution of the state, and the fact that the key feature of the microgrids is that it is a system that can operate in either grid-connected mode or islanded mode. It is very suitable for WA, and WA's context, not only even in Western Australia, but also the Northern Territory and parts of Queensland, especially the north of Queensland. These are the very good avenues for having microgrids. If you are looking to the other countries—as I said, for example, China—they have a very well developed large interconnected system. Probably they are not looking from the perspective that we are looking from here. We are more looking here from the perspective of helping the utilities to reduce the levelised cost of energy production for that.

For example, in one of the studies which we had done before, and it was for Laverton, a town in WA, our study showed that if the utility moves from a purely fossil fuel-based system into a combined fossil fuel and renewable and energy storage, the levelised cost of energy for them almost becomes half. Comparing that number versus the number which currently—I know that the government is providing a lot of subsidy for Horizon Power, because they are slightly losing money on supplying electricity to customers. The amount of energy consumption cost is more than what they are receiving back as bills from the customers, so that is a very, very good economic motivation for the utilities, and not only the utilities but also for the Government, because, back to Terry's question, in which he asked about initiatives the government or legislators can take, currently the Government is providing a lot of subsidy to utilities, but considering the other side of the story, by reducing the amount of fossil fuels they are consuming and going into having some sort of renewable energy, which of course, on the other hand we should guarantee its reliability and security of supplies as well by having enough backup systems *et cetera*, which are technically available, then, of course, over the life of a project, which may be 25 to 30 years or 20 years, we can definitely reduce a lot of the cost of operating our systems.

The CHAIR: When you did the Laverton trial, how did that come about? Was it you proactively saying, "Look, we see an opportunity; there's a piece of research we'd like to do here about looking at your levelised cost of energy", or were you invited in by the energy provider there to say, "Look, we think this can be done better. How about you guys come on board and help us with a study?" How did that work?

Dr SHAHNIA: It was the first option, so we were looking into finding an avenue in which microgrids can help us, and we can prove that financially it is going to benefit the utility. One of my students was leading this project. He got into contact with Horizon Power and got the actual demand data from them over a period of time, about the facilities, the number of sources they have *et cetera*, and we did that type of analysis with as much realistic data as we had. So, it was the first option.

The CHAIR: In terms of the datasets, then, that you had made available to you—this is something that I have actually heard quite a bit—Horizon Power has smart metering available, and it is at the premises level, so you can have very high visibility, but that is not necessarily something that is available in the SWIS. I just wondered, how important do you think it is to have access to premises level or sub-distribution, at the very least, level datasets in order for these technologies to deliver the best outcomes for the system?

Dr URMEE: I think that is mandatory. We need those sorts of data so that we can calculate very precisely what is going to happen. As I mentioned, it would be nice if we could get the minimum of data which sometimes the generating companies can give us, but it is very few, and one of the other problems that we are always facing is they do not want us to publish anything so, in the academic perspective, if I cannot publish, and that is the currency for me, so there is a problem in those sorts of things and most of the time we cannot publish those and so translates into electing to work on this —

Mr D.T. REDMAN: Which is going into a space where there is a pretty competitive process out there now even with the government trading enterprises, Horizon and Western Power, as to what their operating turf is, and they are both trying to project out what things are going to look like with the distributed energy resource, and the impact of that and what it is going to happen on their network, where there is clearly some vested interests that play through, and I guess the point you are saying there is you have got availability or potential availability of data, which is so critical to making decisions and indeed recommendations from a parliamentary committee like this, which is being protected, presumably for the commercial benefit of that government organisation, albeit a government organisation. That is a bit scary.

Dr SHAFIULLAH: Precise data and information is really needed if we want to develop an optimised and controlled system, because renewable energy is intermittent and subject to cloud and other things. We do not know the exact maximum generation from solar or wind. If utilities want to develop dispersed energy systems or operating systems for dispersal, we need information for our research as well to identify that control —

The CHAIR: It is a perennial problem, is it not? In some jurisdictions, and I think New York is one of them, the network operator receives all the data and it is all very transparent, and they are basically just then managing—they become like an information exchange platform and there is far less sensitivity. I remember in the WA gas market, when we put the gas bulletin board together, the real concern was about the visibility of data and production and consumption, but once you have made the decision that there is a real benefit in making that data available there seems to be a whole series of then system-wide optimisation opportunities.

Dr URMEE: I think that if you are actually thinking seriously about that, if you can, that would be really helpful for even the industry and for us too and the economy. I went to one of the microgrids in Indonesia to look at the performance and I asked them, “Is it possible to give me the data?” and they said, “Yes, no problem” and they gave me two years’ data at that point. With a USB, I did not have to write anything, just sign a form.

The CHAIR: It must have been a bit like Christmas for you.

Dr URMEE: Yes, it was. I am not saying we should have a process, just if we can get all these things.

The CHAIR: What about the actual visibility? There is a problem, as I perceive, potentially around the rollout of these smart meters across the south west interconnected system, and then not necessarily support from regulatory agencies for the communications infrastructure that sits behind that that allows access to the data and both visibility and dispatchability of any assets that might be attached to those metering points. How important is it to have that communications platform sitting there and the actual operability in order to make the best of these microgrid opportunities?

Dr SHAHNIA: Very important. Without that communication, eventually smart meters are going to be just a monitoring device without providing that information that they monitor into either a human being or a machine or an algorithm program that tries to analyse that and use that information. Of course, one of the larger technologies that we have—either we talk about it like

large interconnected systems or microgrids—is this demand management, or we call it demand dispatch or demand-side management. They are different phrases, but they simply refer to controlling the loads. Mainly, we talk about the loads at residential levels. We have more flexibility in controlling them and they are not very crucial loads that you cannot disconnect them or interrupt them. That smart meter information is one of the things that can very significantly help us in coming up with developing that demand-side management scheme.

Once we want to interrupt some loads or you want to connect the loads or do any control over the system, as detailed information as we have from the system, what loads or how significant the demand of a house is, that is going to help us to make that decision-making about demand-side management. Without that, of course we can do it at a more aggregated level, but the results are not going to be as effective and as efficient as having much more detailed information. Simply, that rolling out of smart grids is providing us with much more flexibility and control over the system. Every bit of information becomes much more visible for us in terms of if you want to control something, what is available and how much, if you change them, it is going to benefit us.

The CHAIR: Do you have a sense of how urgent it is that we get this right? Could we wait five years or would there have been a great opportunity missed if we did not act soon?

Dr SHAHNIA: It is very enabling technology. As time goes on, in electrical systems we are trying to add and integrate more and more digital computation and communication devices. Those digital computation devices provide us with the monitoring and controllability. For that we need that detailed information and, of course, the communication infrastructure, which is the backbone of that system. In a very simple example, without that it is like we install a photovoltaic system but we do not control it; it just operates as it is. If we do have that extra controllability, it can help us to optimise the performance of the system, minimise the overall cost of the system and minimise the electricity generation costs not only for the person who has installed it, but also to benefit the utility and benefit the customer from an energy bill perspective. It provides lots of other benefits because it is simply an enabling technology.

Dr URMEE: Just to add to that, if you know the load pattern of households or industry, and we know during the daytime how the load fluctuates, it is very easy to design the PV to match that load, so you do not oversize things unnecessarily—like 50% oversizing—and your costs go up. That definitely would be very helpful. If we want to use renewable energy, I think we should start. We are already late, so there is no time to delay anymore to take any decisions whether we should do or should not. We are so fortunate here in WA that we have lots of sunshine all year round. For example, in my house, I have a small solar panel on my roof and I do not pay anything during the summer time, so it is an almost zero electricity bill for myself. I was one of the pioneers; I got the feed-in tariff. My consumption is around five to six kilowatt hours per day. That definitely will help if we know those patterns. Rolling out smart meters as soon as possible will be much more helpful for the utility and for all of us to see how they can push more PV into the system.

The CHAIR: And batteries as well.

Dr URMEE: Batteries as well, definitely.

The CHAIR: This comms capability that we are talking about could enable dispatch behind the meter and would enable potentially a distribution network operator or a transmission network operator to peer behind the meter and start telling your air conditioner when to turn on and turn off again and when you can press it to start or when it is okay for the washing machine to run or not. From a social research perspective, have you done any analysis or any research to indicate how acceptable that is to people, whether they would be tolerant of someone coming in and running their equipment behind the meter?

Dr URMEE: Not here in Australia. I marked a PhD thesis last year from New Zealand—the University of Canterbury—and the research was on the Maldives, where they have a problem with the diesel coming and the only system they have is a generator there. Sometimes due to the delay, they have to load-shift sometimes for two days—total blackout. The student did a system so that people will know in advance on their mobile phone and then the utility will send a message to the mobile phone to say you can turn off unnecessary devices—like the washing machine or water pump that you do not need—and please do not turn on until we give you a message. Then when they get the message, they will again turn it on. Otherwise, there is a blackout. From that survey and that exercise, they got everyone to say yes, and they are happy to do it because nobody wants to be in dark conditions for two days rather than not operate any particular thing. Not washing your clothes for two days is fine rather than not having electricity.

I did the same research back in Bangladesh in one of the small communities. When you talk with the community and you explain the things with the stakeholders and show them things—that was not for the microgrid; that was for a solar home system. They use batteries. Most of the time we found that they abused the batteries all the time. They switch on the TV and there is no power for the batteries. I went there and talked with the people and showed them a glass of water and said, “If you drink this much, you have to fill up that much. Your battery can only fill up this much, so please do not do it.” That was a very simple thing, but people understand that because they can then see what is happening. That sort of communication is needed for the community to understand. I think it works.

The CHAIR: Do you think around this microgrids issue in particular, because it is not broadly understood—there are some trials that are going on, particularly in the peri-urban fringe—having that communications piece to explain to people the benefits of these types of technologies would be a worthwhile exercise?

Dr SHAHNIA: Definitely.

Dr URMEE: I think so. Most definitely, we think a comprehensive discussion with the community when we do something is always good to involve everyone, so that everyone has a stake and they have ownership of the development of renewable technology. This is one of the things that is very important. If we can develop the ownership, everyone will think, “This is not a government thing; this is our thing.” If it works, it is good.

Mr D.T. REDMAN: Just to expand on that, I can appreciate your Bangladesh example; when someone is looking down the barrel of having power out for two days, they can therefore put up with the washing machine not happening at a particular time for the sake of that. That is a pretty clear choice. In our society, there is the expectation that that power will be on; you flick the switch and you will get it. That suggests that alternative mechanisms such as tariff structures and so on will be something that will drive behaviour probably more. Is that an area of assessment, so that rather than discussing with a hall of people, “How are you going to buy into this?”, you use the tool of tariffs?

Dr URMEE: I do not agree with you. I am also doing research with community housing and one of my PhD students is working on that. This is on energy efficiency, not microgrids. They are trying to see how those people actually use energy, because they are so different. They have low incomes, different types of social backgrounds and all other things. So behavioural things were very important for that community housing group. We monitored those houses for one year. We did an energy audit and talked with them, and from there we also analysed two years of their electricity bills and then showed them how they were using and gave them a guideline. Again, we monitored for one more year to see if there were any changes, and there were changes. They actually understand the

concept of not overusing things—do not run the washing machine. Although they are not on the time-of-use tariff, they actually listened, because we can see when they switch on the machine.

Mr D.T. REDMAN: Do you think that there was a motivation for them to contribute to a greater good argument?

Dr URMEE: There was a motivation. We need to convey the message why it is important and what is happening. In Australia, one of the good things is we all actually want the environment to be good and the climate to be good. Everyone is happy to do it. I do not think it is that much of a problem.

Mr D.T. REDMAN: So an educational program is a pretty important piece to any progressive approach?

Dr URMEE: I think so, yes.

Mr Y. MUBARAKAI: Dr Tania, can I just go back to your research with your PhD student? Is that current research?

Dr URMEE: The community housing?

Mr Y. MUBARAKAI: Yes.

Dr URMEE: Yes.

Mr Y. MUBARAKAI: You mentioned two things about monitoring the data for two years and the project for the one year that you have monitored the household in educating them about the usage with two years' worth of monitoring. Could you go into a bit more whether any of those houses have PV installations and ones without, and could you give us a bit more about that research that you have got? I would be keen to hear a bit more about it.

Dr URMEE: These houses were all built between 2009 and 2010 and this is mainly in the north of Perth. I work with Foundation Housing. They are very helpful in giving me access to those people they rent to.

Mr Y. MUBARAKAI: The number of houses?

Dr URMEE: We started with 35 and then in the end we have only 10 houses and we have very detailed information about designing. We used AccuRate to see the current rating and we changed all the behaviour patterns. Based on the audit data, we then input it in AccuRate to see what was the initial design rating for the building. The building was rated five to six stars, but now we have found it is four to five stars because of their behavioural pattern. Some of these people are really vulnerable, but they do understand the concept. We asked them to open the window during the evening to get the cool breeze coming in and not to open the north side and west side curtains during the summer and all those things. They do this and we measure the temperature inside the house in five places, and from there we can see what they did.

Mr Y. MUBARAKAI: What was the difference? There are a lot of Western Australian families out there currently struggling to pay the power bills. It is one of the utilities that really takes on a big burden with the financial status and that is a big concern as well to the way we are moving forward. Could you just share whether that engagement provided any gaugeable benefits? Can you share that data with us?

Dr URMEE: Not all the data because —

Mr Y. MUBARAKAI: Some—just an example.

Dr URMEE: Yes. For example, all these households have insulation according to the plan. The roof insulation was there and people—I think it is around 2R to 2.5R roof insulation. We found that if we increased the roof insulation by one more—3R or more than that—you can save some energy;

especially in the summertime, people do not need to switch on. During the wintertime, we tell them to wear more clothes, rather than switch on the heater, and some did. Even though there is one old couple, they actually were very good and they said, “This is something we should do because we can save energy.” We have not done one thing, and that is talk with Foundation Housing and how they should renovate these things. These buildings are from 2010, which is pretty new.

Mr Y. MUBARAKAI: Dr Urmee, can you give me an indication of the monitoring before and after consulting and addressing and helping and consulting, really? What was the disparity?

Dr URMEE: The range?

Mr Y. MUBARAKAI: Yes.

Dr URMEE: Because this is a household, although their energy use is not high, but there is one of the houses whose energy was 35 units a day, whereas an average WA household is 15 units per day. That household reduced their consumption by around 15, so we brought that down. They switch on the aircon, and then there are doors open in the back—same as for the heating. They feel suffocation, so they did switch on the aircon and heater, but there are doors and windows that are open. Then we tried to explain to them why it is not good, and all these things. But, as I mentioned, these households are like social housing people who are struggling with economics.

The CHAIR: On the social housing aspect, the state government is the largest individual developer of housing stock in the state. We have just announced a \$384 million package to roll out a whole range of affordable housing and social housing right across the metropolitan area. Have you engaged with the state government at all on the specifications for those buildings if, as you say, increasing insulation or including a panel battery system as part of a new build of a house, without even touching welfare payments, can lead to a marked increase in an occupant’s standard of living purely by reducing their energy cost? Have you engaged with the state government on that in any way?

Dr URMEE: Not yet. I am talking with the Department of Housing and a few people there. I am planning to have a workshop with some of the stakeholders and with the Department of Housing at the end of July to talk about this and especially because there is some housing—for example, St Vincent de Paul came to us and asked us whether we could help them see whether having PV on their rooftop can save their electricity bill because this is too much for them now. So, some of our students are doing an energy audit with those buildings and they send us those quotations they got from different suppliers; we are cataloguing. Based on that, we then say, “Let us talk with the other housing industries and community housing providers and see what their needs are.”

So, we have done a bit of research before, but it is not very extensive. Also, the Australian building code has very detailed information on what to do and for which climate zone. One of the things I am now raising in my next research paper is the software under the NatHERS that we have, the AccuRate, BERS Pro and other one. The assumptions they have are 20 years old. They have assumptions for each appliance and all those appliances—it is 20-year-old data. For example, we now have smart entertainment devices and they are not there. That is something they need to update because that is the engine they use for all three—AccuRate, BERS Pro and FirstRate5. They use the same engine and if the assumptions are not correct, they will not get the correct information on the rating system. Now when you use AccuRate and say, “This building is six-star”, it might be three-star. We do not know. That is something we need to do.

Mr D.T. REDMAN: There is a really interesting point sitting in here in the social housing space and those that are, as Yaz said, most impacted by power prices who can ill afford to pay those bills. In the case of government-owned social housing, they are not motivated in any way to put solar panels

on the roof. They do not own the asset. I do not know whether they can or cannot do that. I guess if they ask permission, they might be able to do it but they probably cannot afford to do it. It is also behind the meter, so government is not necessarily looking at that. It is a massive government-owned asset, some over 30,000 State-owned houses, where you could have an investment that fundamentally changes what happens on the network because of how big that asset is, yet, it does not necessarily flow through to government to have the outcome, but there is a big outcome for the user. How do you navigate those competing interests of those outcomes for socially disadvantaged, the broader challenge of balancing a network and the microgrid tech that sits there?

Dr URMEE: Sometimes these people also do not have to pay their electricity bill because if they cannot pay, government is paying it for them.

Mr D.T. REDMAN: Fixing that up is a benefit to government.

Dr URMEE: Foundation Housing and all these other housing groups wanted to put solar PVs on the roof because they can see that would benefit because most of those people living in those households are staying home all the time so their daytime use is perfectly matched with the PV on their roof. For us, no-one is home and at night-time I do not have PV, so unless I have a store, it is not really benefiting me. They are actually looking. As I said, a few housing estates come to us and ask us what would be the benefit. I want to talk with all of them. I want to talk with the CHIA WA and Shenton Housing, who is now the leader for WA, and all the other housing to see what they are thinking and what the points they are struggling with now and how we can help.

Dr SHAHNIA: If I can continue, the same concept is also valid for rental households. In the majority of the houses used for renting, usually the house owner does not bother to install the photovoltaic system on that because he does not live there; he will not get any financial benefit. He does not invest in that and the person renting does not have permission to do those things. It is not simply an ad hoc thing that they do and once they are leaving, they take it out. They do not have that flexibility. A while ago I was doing research with one of my students in which we tried to come up with some data that tried to see what percentage of households that at that period of three months were available on the real estate website did have some sort solar system on that. Interestingly, it was just below one per cent. We were trying to come up with some kind of mechanism for how we can promote those type of house owners or the renters —

The CHAIR: Incentivising landlords.

Dr SHAHNIA: Exactly—to come up and install those things. It seems like this outright buying the equipment and installing this is probably is not going to be an option. It has started probably the last few years in the US that there was a scheme for roof rental. What happens is that the company who is active in the field of renewable energy and photovoltaic system go and rent a roof of a house and they install their own photovoltaic system on that and then the power that it is producing is either first sold to the tenant there with a price that is cheaper than the tariff from the utility but more expensive than the feed-in tariff. The excess of that electricity is going back to the grid with the feed-in tariff.

The CHAIR: Where is that happening in the US? Would you like to take that on notice and send us some information on that? That would be great.

Dr SHAHNIA: Yes.

Mr S.K. L'ESTRANGE: In your submission, you make note that there are over 100 published journal articles in this area and you conclude by saying that the solution can still be achieved through research. Are you looking to map your research effort with a view to trying to solve this problem?

Dr SHAHNIA: Usually in our field it is very hard to exactly chase the uptake of our research outcomes because once the outcome of a research is published and they are publicly available, any company or any manufacturer can come and either use one of the proposed techniques or merge multiple methods proposed by different people to come up with their own products. On the industry side and the manufacturers' side, they do not usually go with a single person or single research proposal and outcome. They usually look into the overall proposals on the same topic and then try to merge them together. Probably some of them at some point may be redundant. Some of them might be some sort of backup or auxiliary to the other one. That is usually how they try to come up with their final product. It is usually a bit hard to map that uptake of the—that was the exact question, right?

Mr S.K. L'ESTRANGE: Probably more from a view of the university itself. How are you mapping where you want this research to go with a view to how you want the electricity supply situation in Western Australia to look like at the end?

Dr SHAHNIA: From the electricity engineers' perspective, not me, they look into the future electrical systems in the form of smart microgrid-based systems. It simply means that the future system is going to be based on our existing infrastructure, but we are going to add as much as we can—more digital computational and communication infrastructures—on to that to have more information about what is happening at the load side, what is happening about the power flows in the system and what happens at the generation site. We can control it much more easily. Of course, we want to integrate as many renewable energies as we can. That improves the sustainability of the system.

On the other hand, we have to improve the reliability of the system by adding extra auxiliary devices such as energy storages. One thing that is thought again as the future of that system is going to be more in the form of currently there is a monopoly in the system. There are some generators that generate electricity and the customers that consume the majority of the electricity, and there is no trade between two households that are next to each other. So, the future plan is that if a household has some sort of solar photovoltaic that is generating some power that is more than what he needs right now, he can also export and sell that power to a neighbour that needs that power—again, with a price that will be better for the customer—instead of selling it directly to the network with feed-in tariff. Also, the buyer will benefit because he is going to buy that electricity cheaper than the tariff from the distribution network.

This peer-to-peer trade and management are also going to be on top of all these things. So, they are looking into a smart network that can be isolated as small microgrids. They can operate standalone, so that increases the reliability of the system. These microgrids can also exchange power with each other in case, for example, a cloud is passing over one suburb and the power generation in the rooftop cells of that suburb is declining, but another suburb is not affected, so this one now has excess generation that can supply that. It is going to happen through the existing network infrastructure, so there is no extra thing there. The only thing that is happening is more from the software space behind that—how the smart meter information is coming to a controller and saying, "I am selling at this price; this customer is buying at this price", and automatically it will be eventually calculated on the monthly bills of these people. This peer-to-peer power trade has been something that has been very recently, in the last two years, started around the world and different pilot projects are appearing as well.

Dr URMEE: Just to add to that, as we discussed, not enough research has been done on the social and environmental policy area, so that is one of the areas we wanted to pursue. Definitely there is a lack of information there.

The CHAIR: We unfortunately are going to have to call it a day, but certainly this peer-to-peer and this platform, we have had submissions on that from one of the major innovators in that space, and

we are aware of the platform and information exchanges and the work that has been done in other jurisdictions. It is going to be a really interesting part of our work.

Thank you very much for coming in. I will proceed to close today's hearing. Thank you for your evidence before the committee today. A transcript of this hearing will be emailed to you for the 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 via these corrections and the sense of your evidence cannot be altered. Should you wish to provide additional information or elaborate on particular points, please include a supplementary submission for the committee's consideration when you return your corrected transcript of evidence. Thank you so much for coming in, that was great.

Hearing concluded at 11.30 am
