

Sustainable Cities - Perth 4 May 2016

Australians are amongst the most urbanised people on Earth. Transforming the way we use and pay for energy to power and access our cities lies at the centre of a sustainable future. In this public forum, presenters from the Grattan Institute and Curtin University's Sustainability Policy Institute discussed recent work on climate policy, electricity tariffs, solar storage and rail funding, all of which can and will play vital roles in this transformation. The forum provided key insights with plenty of time for discussion and questions.

Moderator: Josh Byrne, Research Fellow, Curtin University's Sustainable Policy Institute

Panellists: Tony Wood, Energy Program Director, Grattan Institute
Jemma Green, Curtin University
Peter Newman, Professor of Sustainability, Curtin University
Evan Jones, Responsive Environments
David Martin, Director, Future Effect

JOSH BYRNE: Good evening. My name's Josh Byrne, I'm a Research Fellow at Curtin University, and it's my pleasure to be your MC and moderator for this evening. I'd like to start by acknowledging the traditional owners and custodians of this land and their descendants who maintain their traditions and deep spiritual connections to country.

To say these are dynamic times would be an absolute understatement, with continued urbanisation, new technology and information re-shaping the way we live globally. Australians of course are amongst the most urbanised people on Earth and our cities continue to grow. We have a choice: do we plan, design, innovate and prosper fairly, or do we groan under the weight of congestion and pollution; do we lead the world with creativity and bold policy, or do we keep doing what we did yesterday. This evening we'll hear from leading thinkers on how transforming the way we use and pay for energy to power and access our cities lies at the very centre of a sustainable future and how approaches to climate policy, electricity tariffs, solar storage and rail funding will all play vital roles in the transition to a more sustainable future.

Shortly, I will introduce our three speakers who will each give a short presentation. Following this, I'll introduce two additional panellists who will join our speakers on stage to respond to what's been presented so far, and then we'll open up the floor to you for questions. So let's get underway. Our first speaker is Tony Wood. Tony has been Energy Program Director at the Grattan Institute since 2011 after 14 years working at Origin Energy in senior executive roles. From 2009 to 2014 he was also Program Director of Clean Energy Projects at the Clinton Foundation advising governments in the Asia-Pacific region on effective deployment of largescale low-emission energy technologies. In 2008 he was seconded to provide an industry perspective to the first Garnaut Climate Change Review. Please join me in welcoming Tony Wood.

TONY WOOD: Thanks Josh and good evening. Please forgive my Melbourne accent, I used to come to Perth, but I've been Victorianised far too much because I've lived there for a few years. Let me first recognise the relationship that we're developing with Curtin. In other parts of the country we also have very good partnerships with universities. While we are not academics and absolutely steadfastly try

and make sure that we don't become academics, we also have very good strong relationships with people who are doing some interesting stuff and I think amongst the institutions in the country that are doing some interesting certainly Curtin is one of those, and you'll hear why a little bit later. What I'm going to do in the next few minutes is try and thread together a story that we've been developing around some of the things that are happening which are necessary if we're going to transform the energy system we have today to the one we want in 10, 20, 30 or 40 years' time. If you don't already, by the end of this evening you'll understand this is a non-trivial challenge.

There are three things I want to thread together and the pictures on that chart illustrate three reports that we've generated from Grattan in the last year or so. One is that the way we currently pay for power is both unfair and too expensive. We do need to reform the way we pay for electricity if we are seriously going to make our electricity pricing fairer and less expensive in the future. Secondly, one of the interesting things about Australia compared to the rest of the world is we have got more PV systems on household roofs than just about anybody in the world per head of population, well over 1.5 million and still rising. There are both good and, I think, poor reasons for that, but that's the reality of the world, people have adopted solar for a range of reasons. All consumers in most parts of the country have paid for that and we would argue some of them have paid far too much. The problem is that our policy and regulatory structures have to catch up with consumer choices and technology. Thirdly, climate change and energy policy are integrated areas of government policy and these have not been recognised until fairly recently, even by the Council of Australian Government's Energy Council to actually recognise that there is a connection between energy and climate change. Because energy, including transport, is responsible for something like three-quarters of Australia's greenhouse gas emissions, so if we're going to reduce our greenhouse gas emissions and don't so something about energy we've got a small problem, and yet up until about the middle of last year we were pretending that in some way they were actually disconnected. The current government has basically avoided doing things to put up electricity prices or do something called tax and the current opposition has recently announced a policy in which they've done everything except call what they're introducing a tax.

Finally, we would argue that we need a realistic policy that starts from where we are because pretending we've got to get to somewhere into the future quite different and not recognising that will be a big challenge. So what's wrong with networks? The first thing is we have got more networks than we want or need in this country. That doesn't mean that every piece of the network is no longer valuable. What it means is, as a result of a poor regulatory framework that basically gave the businesses incentives to keep building more stuff because they get an investment on more stuff meant, they built more stuff, not surprisingly. Secondly, history is that our capacity, we, the industry, governments' and regulators' capacity to forecast what was going to happen with electricity consumption has been appallingly bad and always in the wrong direction, at least for the last eight or nine years. The result is that we kept building the networks as though consumption was rising and consumption wasn't rising, it was flattening out and, in most cases, actually falling. Thirdly, in some states, interestingly not Western Australia but particularly Queensland and New South Wales, the governments, because they'd ripped into their network businesses to strip them of a lot of costs, found that reliability standards went down. They had blackouts, guess what governments do when that happens? They go the other way and spend an enormous amount of money on achieving reliability standards that were almost unnecessary. Again, too much cost.

We also pay for our networks in a way that does not reflect the cost of supply. We currently pay for the networks on the assumption that the demand we put on the network is directly proportional to the

consumption that we take from the network. That used to be largely the case. It's no longer the case because we don't all use electricity the same way anymore. We used to more or less do so. Now, because many of us have adopted things like air conditioning and also PV for very good reasons, the way we use electricity has changed and the regulatory system doesn't keep up with that. So we need to do some things about this. Firstly, we need to remove the subsidies in which some people are basically paying somebody else to use the system. Now that doesn't mean we can have the perfect cost-reflective system because that would be so complicated that no-one would even understand the way it works, but I think we can get a long way from where we are today in terms of having a system which is more fair. Secondly, if we were able to change people's behaviour through pricing such that they didn't continue without any price impact to simply contribute to peak demand, then what we would see was the networks wouldn't have to be as big as they have been in the past or might otherwise be in the future and we'd all be better off. Thirdly, if we had more cost-effective tariffs they would provide a much greater incentive for technologies like PV and battery storage.

In Western Australia our calculations in a report we published last year suggest that if we did this then a significant number, more than half of the consumers in the southwest, would save money and some would save quite a bit of money, and when you look at the way in which electricity is subsidised in Western Australia you would find that more than 75% of vulnerable customers would be better off. So Western Australia is in a very strong position to do something about it, but it's politically very difficult because, as in other states, when you take away subsidies you create losers and losers always value losses more than winners value gains, so the world never changes. The second issue is related to the first one, and that is what's happened with distributor generation. Now in Australia, as I mentioned, we've got a very high penetration of solar PV. This chart shows the percentage of owner-occupied dwellings in capital cities and what you find is in South Australia and Queensland it's just about 50% and that's getting close to the maximum penetration that's realistic, because many people have got houses that you probably couldn't put PV on anyway because of the configuration of the buildings.

So this has been an extraordinary change in only a small number of years and the costs have come down dramatically in other parts of the world. This is being driven by very favourable tariffs that get paid to people who put PV on their roofs, both by the state governments, in addition to that, the Federal Certificate Scheme and, finally, the way in which, as I mentioned, the network tariffs are structured which means that people who put PV on their roofs, as with other technologies, don't always pay the full cost of the impact they make on the system. Now it's not to be saying that we shouldn't be going down the route of PV, but it's saying if we're going to do that we need to get the pricing a whole lot better, because in our calculations the benefits of what we've done so far in Australia in putting PV on 1.5 million houses have underweighted against the cost by about \$10 billion. But the economics of PV are changing significantly and rapidly and new tariffs, if we get it right, will actually make solar more attractive in terms of being able to really contribute not only to reducing emissions, but also having an impact on that peak demand.

Finally, I'd also make the point that for many people who think they're going off the grid with PV and storage they might want to think again because that's a really interesting challenge for most of us who live in cities. So the things we have to do with distributor generation is we need to get the network tariff right; we need to deal with what might be redundant assets, because if we've got more assets than we need and want then who's going to pay for that? Is it the network businesses, the shareholders? Is it government? Or is it, as it currently is, the consumers? I suggest that continuing to pay for it is going to be difficult and at some point the piper is going to call and someone's going to have to play the tune. We're going to have to fix up network regulation and remove barriers to off-grid

solutions, and that means things like if we subsidise prices so that people in off-grid situations in regional and rural Australia are paying for electricity at prices which are well under the cost of supply it doesn't actually give them the incentive to adopt things like PV because it doesn't show them the real benefits they'd achieve.

The third thing I want to cover briefly is what I would call Australia's non-trivial emission reduction challenge. This chart is a little complicated, some of you may have seen some parts of it before, and I'll take you briefly through it. So the blue line shows Australia's total greenhouse gas emissions since then 1990s and you'll notice that it was going up, it went down a fair bit with a lot of changes and revegetation, it went up here, peaked at around 2005/6 and has been heading down. Interestingly enough, in March 2015 the Federal Department said, "This is where we think emissions are going until 2030". This is what they said in December of the same year. So anyone who thinks you can forecast anything in an industry you might want to think again, because that has been a non-trivial change in terms of greenhouse gas emissions. Right now we have a target to achieve a 5% reduction below 2000 levels by 2020. You would think that that means by 2020 our emissions should be 5% below where they were in 2000. Well it doesn't, because the international accounting rules allow Australia to carry over an overshoot against our 2008 target under the Kyoto Protocol of about 130 million tons.

You'll hear this if you listen to the debate in the Federal Election coming up where people will say, "How can we possibly be achieving an emissions reduction target while our emissions are going up?" Well, what you want to do is get out your accounting rules because that's the way the accounting works for international permits, and if anyone's interested I can certainly bore you to death with the way that works. But what's happening now is that the Federal Government in the lead-up to the Paris Agreement in December last year agreed that we should be aiming to reduce our emissions to 26% below 2005 levels by 2030. The reason we changed to 2005 levels from 2000 is because guess what? 2005 was much higher than 2000, so if you want to make challenge look really, really hard and beat your chest about how wonderful Australia's commitment is then you obviously choose the baseline that's the highest one possible to make your numbers look as good as they can. Equally, the Climate Change Authority and last week the Labor Party announced that no, we should have a target which is 45% below the 2005 levels by 2030. So that difference there is what part of the election will be about. Should we be aiming for 26% or should we be aiming for 45%? To some extent that's a silly argument because none of those targets are what we're going to do in 2030 anyway.

The really interesting question is what do we do now about how we start climbing this mountain? Forget about arguing how high the mountain is, wouldn't it be actually useful if we started because we've been putting it off for so long it's now going to cost us more and take us longer and be much more difficulty and politically very hard. So a lot of the debate has been therefore around the policies we adopt now and these are the sort of things you will hear, but I would suggest that maybe we should concentrate on the areas of climate policy where we have agreement, rather than those where we have disagreement, because since 2009 we've had probably one of the most toxic political debates on anything in climate change. It's certainly killed the careers of a couple of Prime Ministers and a couple of leaders of political parties federally and, who knows, it may not be finished yet. Therefore, I think it would be actually very valuable if it wasn't a major issue in the election that's about to take place because maybe the less people who argue about it the more likely it is they could find some common ground, rather than arguing about their differences. Because they do have things in common and these are the things at the top of this chart here. Firstly, both sides of politics have agreed to meet the commitment under the Paris Agreement. Secondly, that means they've committed

to working with the rest of the world to achieve an absolute temperature increase of no more than 2°. Thirdly, they've both got the same 2020 target and, fourthly, they both have the same renewable energy target. There are some differences. As I said, both parties have got different targets.

The current government has a thing called the Emissions Reduction Fund in which they're paying for emissions through an on-budget allocation currently of about \$2.5 billion. Remember, in last night's Budget, if anyone was listening, this wasn't mentioned in terms of any future funding from that Budget. In fact, I don't think the words "climate" or "energy" were mentioned at all in last night's Budget and given that this wasn't a Budget, this was a plan, you have to question what sort of plan it is when within only a couple of decades, if the world actually moves on climate change, then the world will stop buying our coal and within three decades will stop buying most of our gas. You'd think we'd have a plan to think about those sorts of things but, again, the Labor Party doesn't have a better plan on that than the current government. The safeguard mechanism is one of the mechanisms that the current government has and you'll hear more about that I suspect during the election. The Labor Party has announced a similar structure. Although they've called it an Emissions Trading Scheme, it's actually a very similar structure to the current government. Both parties support emission standards on vehicles, both parties support major improvements on energy productivity, and both parties have said they're going to review their processes in a couple of years' time, which means they're putting off the more difficult choices until later. That's called kicking the can down the road. I would suggest therefore that rather than emphasise these differences, there might be the opportunity to think about the things they do have in common because I think there are more things in common than there are differences.

So as we think about the way Australians are going to be using electricity, most of us in our cities, then the way in which we transform the system is going to be very important. There are a number of interconnected issues and hopefully what I've done in the last 15 minutes is illustrate to you what some of those issues might be and hopefully we can continue this discussion in question time a little bit later. Thank you very much.

JOSH BYRNE: Thank you Tony. Our next presented is Jemma Green who works in the field of disruptive innovation at Curtin University. She is responsible for industry research relating to energy, carbon, sustainability and climate-related business risk. She is also a doctoral candidate where her research is focused on battery storage and modular construction. Please welcome Jemma Green.

JEMMA GREEN: Good evening. I won't repeat some of the things that Tony said, but we've seen obviously the price of solar come down dramatically in the past decade and, alongside that rapid deployment.

What we've seen in Australia with more than 1.5 million houses isn't a situation unique to Australia, it's happening all over the world in developed and developing countries and this graph illustrates that as solar price declined the installation of solar has boomed. At the same time, the amount of investment in renewables is now double that of fossil fuels and this is a situation that's been kicking along for a little while. You can see the green line at the top shows renewables excluding hydropower and fossil fuel investment is the grey line below that, so it's actually a very significant part of the new energy deployed, granted that a lot of the existing infrastructure around energy is fossil fuel-based. So the overall mix is still stacked towards fossil fuels, but it is changing and changing very rapidly. In developing countries they're actually phasing out coal and the World Bank now won't fund any more coal-fired power stations. In the developing countries it's flattening or slowing down, and this is China in the middle here. You can see that their coal consumption has flattened and in non-OECD countries

excluding China the rate of growth is slowing quite considerably. Tony mentioned that we've got very high electricity prices and you can see here when you benchmark the cost of electricity against the consumer price index that it's grown very, very dramatically in less than a decade, since 2007. There are a whole variety of reasons for that, but this is a situation which is unique to Australia. If you look at the price of electricity in other high-income OECD countries you haven't seen this kind of electricity price inflation.

This is showing the deployment of solar in Australia and it's more than 1.5 million houses. In Western Australia we've got 550MW, it's now the largest power station here on the southwest interconnected system, it's growing double digits year on year, and our own Finance Minister and Energy Minister is predicting that by 2020 50% of our daytime electricity supply will come from solar and by 2025 70%. So it's not just the bone in the nose greens who are predicting this kind of shift; it's mainstream politics and to the right of politics as well. Battery storage is becoming a hot topic. You're not seeing many batteries installed in people's houses, there's actually only one installed in the southwest interconnected system right now and that's Josh Byrne's house, our wonderful presenter here tonight, and I'm going to talk to you about that in a moment. But battery prices are coming down and on the 30th of April last year Tesla announced its Powerwall battery and set the price at about US\$350 per MWh and it's fallen further since then. The prices of batteries are coming down in a similar fashion to that which rooftop solar PV have come down in price, so you can see that they're tracking very similarly. As a result of that, the financial analysts are predicting mass uptake of batteries in Australia and Morgan Stanley put this piece of research estimating the size of the battery market to be around 2.4 million houses. To put that into context, on the NEM (national electricity market) at the moment there are about 1.1 million houses with rooftop solar. So they're predicting 2.4 million houses will have batteries and they're doing that by saying that 2.4 million houses will have rooftop solar, so that's more than doubling those that have solar plus all of them pretty much having battery storage as well within about a decade. So it's very, very significant.

You might want to know who are these companies that are manufacturing the batteries and who are the companies manufacturing the solar? The battery manufacturers, by order of magnitude, are on the left, so Panasonic is the largest and some other brands you might recognise, like Samsung. BYD, which has 6% of the market, are a company that we're working with to do some battery trials here in Perth in a research partnership with Solar Balance. The PV manufacturers are on the left, so names you might recognise like Sharp, but there are plenty of companies that you may not be so familiar with. This is actually a graph showing the point at which solar and batteries will compete with grid-based pricing in the United States. Now I mentioned we've got very high electricity prices here in Australia and that's a situation unique to Australia. In America the prices are much lower so they're going to reach parity with batteries far into the future, 2025, 2031. It's a long time. Even so, people were really excited by the announcement of the Tesla Powerwall and they had \$800 million worth of pre-orders in the first week. So it's not just because people want to save on their electricity bill that they're buying these things. There's a bit of a retaliative response where they perhaps feel that their utility is ripping them off or they want to have backup systems in their garages instead of diesel generator backup systems. So there are other demand-drivers which are pushing people to purchase this kind of product. In Australia we have very high electricity prices and, although the Carbon Tax was blamed for our high electricity prices, this graph shows the Queensland market and it's actually a very small percentage of electricity prices. The orange shows the price growth in electricity, that is the network costs and they've become very, very substantial over time. They didn't used to be so greedy, but they are now. Because of that, solar PV and batteries at the point of consumption, i.e. side-stepping the network, make sense sooner in Australia than it will do in America.

This is analysis that I've done with Peter Newman as part of my doctoral research. What it shows is that for the A1 tariff, within about 18 months solar and batteries will be competing with grid-based electricity pricing. I mentioned Josh's house, this is the first house in Perth that has batteries. Josh has built an amazing ten star home and it's basically got every bell and whistle you could imagine. It performs so well it doesn't need air conditioning and they use very little electricity by comparison with a normal Perth house, around 8KWh per day. Josh put a 3KW solar system on but in spite of that he still got a bill, so we put a battery in and we simulated what would happen and it takes him about 95% off-grid. You think why wouldn't we go that extra 5% and take him entirely off-grid? Well the answer is that there are a few days in winter when the sun's not shining that you'd need to put more than 66% greater battery size and solar size to take him off-grid and the payback period on that is just not attractive. Plus, Josh produces 75% more electricity than he consumes and so if he wasn't grid-connected he couldn't sell that to the market. This is a graph showing before with just the solar panels, so he was still 55% reliant on the grid, and now with the solar panels and the batteries there's only a small amount of grid consumption left.

The other part of my doctoral research is looking at solar and storage on strata. Strata makes up 28% of the housing market in Australia, but hardly any has solar because the roof space is owned by the body corporate and often they're tenanted and investor-owned and investors don't want to provide solar panels for tenants who then reap the benefit. So we've developed a micro-grid system, it's a national research project with LandCorp, Arena, a property developer, Solar Balance, and Western Power, importantly, and we're looking at how micro-grids can share the infrastructure. Shared solar and shared batteries within apartment buildings can be used so tenants pay their electricity bill to the strata company instead of to Synergy. This is a project which has just commenced and goes on for the next three years and the project is in White Gum Valley, the suburb, and the name of the precinct is WGV. The first project will come online in October this year, it's called the Gen Y Demonstration House and it's very exciting. This framework uses strata law which is West Australian strata law, but as part of the research we're developing a national framework using strata law and community titling law in all the states and territories in Australia. So the big opportunity here is for property developers to avoid upgrading substations and transformers and save money on that to spend on solar and batteries in strata developments. There's also a revenue stream for investors, so it's not just rental income that they'll get, they'll also get electricity income, and they can also sell their surplus electricity to other consumers across the road and back to the network if they choose.

Now, all of this means that the utilities are in a world of hurt and they can adopt one of three responses to a new innovation, they can fight, flight or innovate, or they can do a combination of the three. So fighting is where they try and oppose deployment of renewable energy, they lobby for weaker support, they try and stop you being able to connect more renewables to the grid, and we're seeing all that kind of thing happening right now. Flight is where they exit the market or they do nothing and pretend that nothing's happening. Finally, they can innovate and we're starting to see utilities offering solar and batteries to consumers, offering supporting platforms so that people can trade electricity with each other, and they can also participate in the projects and own the solar and lease it to consumers. So they may be fighting and innovating at the same time whilst they grapple with this new world but, just like other disruptive innovations, the change is really not optional. To a large extent they really need to get on board with this otherwise the suffering is really inevitable.

On that note I'll hand you over to Peter Newman, thank you

JOSH BYRNE: Thank you Jemma. Our next speaker is Professor Peter Newman who, of course, is the Professor of Sustainability at Curtin University. Peter has written 17 books and numerous academic papers, but is perhaps best known, in Perth anyway, as a media commentator and, of course, one of the key people who helped save the Fremantle Railway. In 2014 Peter was awarded an Order of Australia for his contributions to urban design and sustainable transport. Peter has worked in local government as an elected councillor, in state government as an adviser to three Premiers, in the Australian Government on the board of Infrastructure Australia, and in the UN on IPCC as Lead Author for Transport. I also noted in the media just last week that Prime Minister Turnbull is now referring to you as his “tutor on matters of urban rail”. Not a bad title to have and I was going to ask, does he need a tutor in gardening because I would love to do a Gardening Australia story at the Lodge? On that note, over to you.

PETER NEWMAN: That’s a good idea. It’s very exciting the times that we’re in. Jemma didn’t mention it, but Western Australia is the biggest exporter of lithium in the world and a number of mines are about to start. We should be actually thinking about creating Lithium Valley here, which is something that we could do. The reality is we are ahead of the game on that whole delivery of solar, but I want to do a little bit about oil because it’s not just getting rid of coal. I want to show you this graph which is quite historic.

For the first time in the history of the world greenhouse gas emissions are going down. That is amazing, don’t you think? I mean, how many times have we been looking at these graphs where greenhouse gas looks as though it’s going totally out of control? But this year the International Energy Agency showed us for the first time it’s going down. It plateaued there for a while, but the blue line is very significant because it shows that we actually didn’t do it by getting poorer. It wasn’t because the economy was collapsing; we actually began back in the ‘90s to decouple the growth in wealth from the growth in greenhouse gases. Tony Abbott and others said, “That’s impossible, you need coal for humanity, you cannot have economic growth without fossil fuels”. Well we can and we have shown it. If you look at this, the red line is coal and oil is the purple one down there, oil has been steadying off, coal had a bit of a blip up there in the early 2000s and is now steadying out and beginning its descent. If you look at where it is actually happening in the world, this is Denmark, a typical European country and nearly every European country shows this, you can see that in the ‘90s the oil began to go down and coal followed it. They’re both on the way out and you can see why investors and financing bodies would not be terribly interested in those two as an investment over the future, not in Europe anyway. If you look at the US, both coal and oil are going down. The coal started to decrease back in the GFC time, but it keeps going down and, of course, the decoupling has set in.

What about Australia? The coal went up in the ‘90s, it’s now going down. We are using less coal every year now. Oil has plateaued, it’s got a little bit of a dip down, but clearly we don’t need it for the economy, we don’t need either of them. In China it’s actually decoupled also. It’s not that they desperately need it, China has had a dramatic increase in wealth, but not so much a dramatic increase in coal and oil and, for the first time, coal is going down. They are not building a coal-fired power station every week, that’s a bit of a myth that’s been around for quite a while. In India they are still going up and in most emerging countries that’s the case, but they are decoupling still and they can make that transition quite quickly. So it’s quite a hopeful story if you really look at that overall story that we can be wealthier, in other words we can address issues of poverty across the world without fossil fuels. Now, Josh’s house, he’s decoupling well from liveability from fossil fuels. It’s a beautiful house, it’s definitely an improvement in the standard of living and the quality of life, but he’s not using fossil fuels. You don’t need it. White Gum Valley is going to demonstrate that a whole

suburb can do this as well. We can create a future quite quickly and you can see from Jemma's graphs how quickly it can happen, that exponential growth working with us instead of against us can dramatically change our world. Are we ready for it is the big question?

Now what about oil? I've shown you a few graphs there where oil is starting to go down. Is it just because of more efficient vehicles? The only thing that Tony showed on the agenda was vehicle efficiency standards. There is actually more happening and it's about our cities. Essentially, transport and density are very closely linked. As density increases, transport fuel use, car use goes down, and there are different kinds of cities: cities built around the automobile, cities built around trams and trains, and cities built around walking; every city actually has a combination of the three of them. But what has happened in recent times is quite dramatic. American cities first began to show that they were driving less, per capita car use started going down. Now this was not predicted, we saw that it was starting to peak and flatten, but we never thought it would actually go down and then we began to see every developed city in the world following the same patterns. In all Australian cities, the top city there is Canberra, the bottom one is Sydney, Perth is the purplish one there, you can see quite dramatic declines in car use per capita. You think, "Well jeez, it doesn't feel like it out there" because it is complicated by the fact that peak hour driving, to city centres especially, has gone up, but the overall car use is going down, car use per capita, and if you don't have a big population growth, like we've had, then you will find that it is setting in and there is no obvious turning around in that trend.

Why is this happening? It's an economic factor as much as any. It's not just people say, "Oh, I've got to get out of the car. I've got to get some exercise". It is actually the nature of our cities is changing. So our book that's come out *The End of Automobile Dependence* shows cities are coming back in everywhere and particularly the young and the wealthy are moving back in so that they can have access to jobs and services much easier in city centres or sub-centres. So the top six most walkable cities in the US have over 38% higher GDP. This is how we're beginning to see a decoupling of wealth and car use. 70% of the knowledge economy workers in Boston live in walkable areas, they need to meet, they need to get together; they need these dense urban areas. That's now where knowledge economy competitiveness is being created. So cities are competing on how best they can become walkable. Our city centre has had a good transition recently in getting a more walkable environment, it's less Dullsville now, it's much more interesting. That's the way cities are competing and the density of labour actually has a very big effect on productivity, that's Melbourne data there. So we are finding this decoupling, wealth going up, car use going down, and if you look at cities like Washington DC and Portland, they are showing it more than other cities, the reason being they've got more urban rail. And urban rail is not just about transport, it's also about creating these dense centres where all the work is gravitating to.

So this is now the new urban agenda and you can see why if you've got that economic driver, just as we now have with solar, we do have an economic driver, it's going to be cheaper soon to have solar and batteries so the economic driver is there. We are now seeing it also in our cities. To have dense centres fed by electric urban rail, which can be zero carbon as well, that will be more competitive. So you can see the new light rail drawings for Sydney. Sydney's getting three new electric rail systems, northwest rail, southwest rail and light rail. This light rail has no catenary, no overhead wires. Why? Because it's got lithium ion batteries that can be recharged when you stop at stations, so these station areas need to be dense, need to be filled with PV cells recharging and creating zero carbon transport. So not only are you walking more and using public transport more, you're actually shifting to this new economy. Now these are the trends that are setting in, the opportunities are there. We either grab them or we don't. So every city that I see now wants to be polycentric, they want lots of centres linked

together, they don't want to keep sprawling. That's our plan, it's Sydney's plan, it's Melbourne's plan, it's New York's plan, it's Copenhagen's plan. So how do you fund urban rail and urban centres at the same time? That's the big question and that's what we've been looking at and what the Prime Minister really likes. It's very nice to have a Prime Minister ring you up and say, "I like this idea" but we've been banging on about this for some time, as you may have noticed in the media, but we are at a point now where we can say we've got something special.

The model that Evan Jones and I, Jemma and Sebastian Davey Slater who's doing his PhD on this, produced is called *The Entrepreneur Rail Model* and it is about how you go from that kind of environment to this which is not just about that light rail, it's about the developments around it which enable that to happen. So let me explain very quickly. If you want to build a transit system like we tried to do with MAX. MAX was a failure. The Federal Government gave the state \$20 million to plan an urban rail system. What they did was look in a detailed way at what was the best way for that to go in transport terms, how best to go from A to B, following the bus lines basically. Then when you've done that you go to government and say, "It's going to cost us \$2 billion, give us that" and then if you get it you're lucky and you might build it with a bit of land development around it. Probably not, because that's not your job. That's a failure as far as I'm concerned, that's not what we need to do with our urban rail. So we've suggested that you need to start by finding out where the urban land development really needs to happen, where is the redevelopment potential, and you say to the people who are going to do that, "Well this will only get unlocked, it will only become possible for you to really do this if you've got urban rail through it, so you should build it". So you get the finance and funding from that urban development and then you work out the transit numbers from there. So you can see why transport planners don't particularly like this because they are not running the whole process. This is a process designed to change our cities with both land development and transport together, and it's got a particular approach that requires finance to come from the private sector to make it happen.

Now that is fortunately the situation, it's a bit like how well planned our electricity system is to have the highest electricity prices in the world so that we can transfer to solar. It wasn't planned, of course it wasn't. Well, we have an opportunity now because governments don't have any money, so if you're going to get urban rail then you're going to have to get the private sector to do it and this is an opportunity therefore to integrate, to bring cities back in, to create these centres. We all want to see these centres, Stirling centre, Canning city centre, there are a dozen or so desperately wanting to get built. How can you do it? You get the urban rail in and you get it to be built by the developers. So how do you do it? You don't define the route, you just get a corridor. You do not specify exactly A to B, that's where we want the new MAX light rail to go or something. You call for expressions of interest from consortia that can build, own, operate and finance the rail project through land development. We do it in other areas of government. Government should manage the procurement process to enable the transit system integration, to enable land assembly, do all of those things that are necessary but that don't need money. That's how they do it in Japan. Japan has the best public transport system in the world: it's private and it's funded out of land development. The same in Hong Kong. The best ones are doing this model anyway. The result is it unlocks the lazy land that can't quite get developed, you zone it and you say, "Why doesn't it get developed?" Well it's got to have amenity created if you want to develop it. So it creates the dense centres, it then integrates land use and transit, because they depend on finance, it changes the politics of redevelopment because communities are getting a rail system out of it, and it's focusing the development. Instead of getting all that backyard infill which everyone hates, you get it focused in these centres. Finally, it enables the private sector expertise to be involved in this process. You've got to watch the white shoe brigade always, but in fact the private

sector builds cities and it drives this city form and transit. Now that's actually how trams and trains first started. They were all private, they were land development projects. We're now in a situation where there is a market again for urban public transport. We need it, we want it and we shouldn't be seeing it as a welfare system anymore. It is something that requires unlocking that market.

So coal and oil, they're going to go. How quickly can they go? If you take the trends we've seen, GDP can keep going up, renewables is going through the roof, coal and oil and gas will phase out, gas the last one, nuclear doesn't go anywhere, and you can get to 80% by 2050. We can also stuff it up, but the opportunities are now there. Thanks very much.

JOSH BYRNE: Thank you very much Peter, please take a seat to start our panel off. I'd also like to ask up Tony and Jemma back to the stage and then invite our next two panellists.

I'll start with Evan Jones. Evan is a town planner and urban designer who runs his own consultancy practice, Responsive Environments. He has prepared metropolitan plans for Sydney and Brisbane and worked in regional planning in Victoria. Here in WA, Evan was an Executive Director in the Department of Planning where he developed the Liveable Neighbourhoods Code, which I'm sure many of us know well, and he also led both Armadale and Midland redevelopment projects. Evan is a Fellow of the Planning Institute of Australia and contributes to public policy as the Chair for the Centre for Built Environment & Health at the University of Western Australia and is Director of the Australian Council for New Urbanism. Please come and join us Evan.

Our fifth panellist is David Martin. David has 17 years' experience in the Western Australian electricity industry, including five years as the Senior Executive of Horizon Power. David has experience in the areas of electricity utility management, regulatory engagement, energy sector marketing and branding, contentious issues and crisis management - that's a broad portfolio of background there. He is currently bringing this experience to navigating the challenges of electricity network planning and operation in a changing consumer and technology environment. David is also the Director of energy consulting firm Future Effect. Please join me in welcoming David.

Now to kick this panel off I'm first going to invite Evan Jones to make a few comments and remarks about what he's seen this evening. Just for your background as you may have heard, Evan has worked very closely with Peter on the private funding of urban rail around Australia, so we look forward to his comments, and then we'll hear from David. Once we've heard their comments and positioning statements we'll throw it open to you, the audience, for questions. Evan, the microphone's yours.

EVAN JONES: Thanks very much Josh. I feel like I've brought a knife to a gunfight with my limited expertise in these areas, so I want to generalise a few things from a range of experience. I think the first thing that we've discovered this evening is doing the same thing the same way is very unlikely to lead to a different result, and yet it seems that we continually in this country try to do just that.

The second problem is that we forget that the 21st century is not the same as the 20th century. In the 20th century we had rational scientific approaches, it was top-down, it bred large systems, it led to gross generalisations about how we live and work, and therefore how we delivered things. So in almost a prosaic urban design example, 20 years ago in Australia we largely weren't allowed to eat our meals on a street because, firstly, it was a public health issue - you know, the food could go off in the two seconds it takes to get to you - and, secondly, the council owned the pavement and you can't actually use their infrastructure for that purpose. So what we've managed to do in all sorts of ways,

and I particularly mention Generations X and Y, is throw the rulebook out in urban planning. They've gone and recolonised places and they're doing really interesting things, as Jemma said, with a lot of disruptive and third-way innovations. My hope is that what we're trying to do, and we're certainly trying to do it with the entrepreneur rail model, is break this paternalistic centralised system that says that only the government provides rail and we'll only provide it when we can find the money and we'll only do it that way, then the land use planners follow along and patch up things after the rail goes in a route that may not work together.

So I think that in all of this there are big political change programs but there's also a finer grain to it; that the 21st century is also about empowering local communities and local decision making. So the two exciting things for me in this are this local decision making and the ability of these change technologies to allow people to make much more decisions about how they're going to live their life and how they can contribute to the larger problems, rather than voting and hoping that at some stage someone's going to do something about it. Because that 20th century system that we've still got, it seems to me it's going to take a long time to do and change.

JOSH BYRNE: Thank you. David.

DAVID MARTIN: Thanks Josh. As I was listening to the three speakers I was intending to write down a lot of notes, but I only wrote three words: "tariff reform" and "topology". I'll start with tariff reform.

I think Tony's absolutely right, the electricity industry, and I'm mostly talking about Western Australia here, has been really, really good at being crept up on by changes in consumer behaviour. We'd make the world's worst ninjas. In the late '80s we suddenly realise that there was a plague of rooftop solar hot water systems and we realised that that was doing strange things to the power demand during the day and it was really starting that process we're seeing now about pushing energy tariffs away from cost-reflectivity, so we thought we needed to do something about. Three Emeritus Professors at UWA got together and drafted a report and the report said we need to reform the electricity tariff or we'll all be ruined, and that just didn't happen. Then in the late 1990s and 2000 we had pretty much the same sort of thing, we realised that all of a sudden there were cheap Chinese air conditioners all over the place, the spike in electricity demand was enormous, we were building power stations everywhere, building network capacity, customers weren't paying for that capacity necessarily and we realised that it was broken, we needed to do something about the electricity tariff, yet we didn't do it again. Now here we are in the mid-2000-teens and we're blaming PV for much the same sort of situation, which takes me really to topology. Topology is nothing more than really just a helicopter view of the system, the end-to-end value of the electricity supply chain.

So for the last 50-odd years the topology has been pretty consistent, we had large power stations down one end and they were connected to large transmission systems, and then they were connected to large distribution systems and they were connected to power-hungry customers, and we've pushed electricity out to consumers. The tariff model and the regulatory model took its cue from the physical system. The tariff articulated the cost of generation capacity, network capacity and the cost of energy, and the consumers had to pay that in a way that reflected their demand. But the topology has changed. As Jemma was saying - this is her presentation on citizen utilities - we now have generation out where the consumers are, believe it or not. It's on their roofs, it's in community windfarms, it's connected to distribution networks, and the reliance on the old push model power system and the aligned tariff model is completely broken. So we cycle back to the tariff reform and we need to do it, but we've been rubbish at it to date. If we get the chance we'll probably only get one chance, so we have to do it properly. So rather than looking at tariff reform to solve the problems

we're seeing now with the incremental impacts that are being caused by rooftop PV, we need to look at tariff reform in the longer term context of the changing network, the changing system topology, the emergency of citizen utilities, and the evolution of consumer demand.

JOSH BYRNE: Well said. It's now that time where we are going to throw it open to the audience.

AUDIENCE: I'm thinking of Jemma and Tony when I ask this question, but I invite anyone to contribute. When you're developing these integrated programs and international policies, what role does the government play in looking after the energy poor? I've read the Grattan Institute report and I agree with it in general, but your view on subsidies obviously does, in my opinion, cause issues for certain people and, again, for the batteries, people that can't access those markets. To what extent do you see the government needing to intervene in that area?

JEMMA GREEN: I believe that part of the disruption is there's a lot more supply in the market and that is ultimately putting downward pressure on electricity prices. Once we allow consumers to trade electricity with each other, as opposed to just selling it to Synergy at a fixed price, then we're going to be seeing more downward pressure on electricity prices. I agree, not everybody can afford a battery and that's why staying grid-connected is so important and if we don't have the electricity market reform in a sensible fashion people will go off-grid as a retaliative response. So I think that having an adult conversation about reform is important. We're also looking at low-cost and low-carbon housing, working with, for example, the Department of Housing, to see how solar and batteries can be incorporated into their housing supply and tenants will be paying electricity at a lower tariff than what they are currently. So I think that it's very important that we bring lower income earners and those that can't afford to buy this infrastructure, in spite of a very attractive payback period, with us.

TONY WOOD: I think one of the changes that have been talked about this evening uncovers something which has been very fundamental to our thinking about electricity in the world, let alone Australia, and this is this thing called "essential service". These days there aren't that many things we would call essential services, and by essential services I mean something that we think everybody in our community has a right to have access to at an affordable price. It used to be that in many parts of Australia we thought that way about eggs and bread and just about everything you can think of was regulated, prices were regulated and there were government boards of all sorts covering all these things in most parts of Australia. Most of them don't happen anymore. If you can't afford milk there's nobody who actually has an obligation to supply you with milk, but there are people in Australia who have an obligation to supply you with electricity.

The question is, is that the right model as we move forward? Because I think most people when you bring people together do actually recognise that if you want to have a reasonable standard of living in our community in the 21st century there are certain things that are part of that, and one of them I think is access to affordable energy and particularly electricity and of course, as you know, many parts of the world don't have that. So how do you bring these people on? No-one should suggest, I argue, that there's a right to have every sort of bell and whistle you can think of. I don't think there needs to be a right to have a battery, for example, but I do think we need to make sure that we don't lose people. My daughter thinks an essential service is a certain number of KWh to basically support her lifestyle and I would suggest that about half of that at least is not what I would call an essential service. So when you think about the nature of electricity and the nature of the way it's provided and who in our community is responsible for that, that's one issue. The second issue I'd make comment on is the issue of subsidies, because in our world in Australia we are very much used to the idea that the rich subsidise the poor, the big subsidise the small, the cities subsidise the country, and in many cases

we're very happy with that. We might not think about it, but when we really challenge and get to the issue most of us actually support it.

So the question then is how do we think about the way in which those subsidies work? Because the way that they were delivered in the past no longer works through the regulated monopolies that we have or the utilities we have. We have to deliver that in a different way, but we have to make sure it's still there because otherwise we will create a new class of poor. Remember, people aren't electricity poor. If people are in difficult financial situations they're in difficult financial situations. So how we address that is changing because the way we used to deliver the essential service and pay for it is also changing the same way as technology is changing, and that's going to be one of the big issues as we enter into this transformation.

AUDIENCE: Jemma, you mentioned that in Josh's case to get that last 5% of his energy needs would require a massive payback period and I think something like a 66% increase in his own personal battery capacity. I assume that 5% would be the same for every other user of PV, that their demand would come on-stream at around the same time. So have we done any work about what that means in terms of managing that peak demand and whether we need peak implants or can we do it through demand management? Because I assume it's three or four days a year where everyone with solar panels are suddenly going to want to access the system, so what's the cost structure? I realise that that also feeds back into the whole debate about your tariff reform, but how do we manage that?

JEMMA GREEN: The reality for a solar and battery-based energy system is that it's in winter-time where you have a few consecutive days with no sun that you're going to be very reliant on the grid, and if we move to a system that's largely delivering that then you're going to have a couple of gas-fired power stations which are effectively peaking for those peak periods and the peaks that we know at the moment, which are in the morning and the afternoon, won't be quite the same. David was telling me the other day, if we moved daylight savings actually we would move the peak demand alongside when the energy would be generated by the solar panels, so there's a very interesting reason to look at it again.

In terms of cost tariffs, I think that the utilities are going to want to increase the fixed charge so that we pay a higher amount of money regardless of whether we consume electricity or not. But that's actually going to drive more people to install solar and batteries in micro-grids in housing estates, in commercial buildings and in strata, because then you only pay one fixed charge for the master meter and all the other fixed charges for the dwellings you don't have to pay and it becomes part of the commercial proposition for putting in the embedded network. Now, I don't actually have answer to your question in terms of how do we get to a fair system because we don't really know what the demand profile will look like across there. I do think it needs to be fairer and a user-pays system, but ultimately with regard to the network, the poles and wires, if we do have a largely distributed system then the way we've got our poles and wires built at the moment, which is large transmission lines, is not needed and therefore the value of those will need to be written down. So a government is going to need to digest that reality at some point.

DAVID MARTIN: Can I add to that? You talked about how we're going to meet peak demand and if you look at peak demand in the southwest interconnected system over the last four years, we didn't have a peak demand event until February this year. We're going into that phase where network companies and power companies aren't at all certain that there is going to be a peak demand ever again, so there are companies in Australia, network companies in Queensland that have already taken a view that they're not going to build any extra capacity, they're going to work with their

consumers to actually deal with peak demand at the other end. The same thing's happening in Western Australia. When we looking at demand, in the very few areas where you could say there is actually a peak demand or an increased requirement for augmentation of a network, we're looking at that demand as if it may eventuate at some stage, but it might also disappear soon after that as well. So do your networks, do your generation companies invest in large chunks of peak demand that may or may not even be there five years after you've made the investment?

AUDIENCE: The point I was asking though was, as I understood from what Jemma was saying, the peak demand at the moment we understand to be on those hot summer days. In fact, the peak demand in this situation will be for potentially three consecutive days in the middle of winter, which will be a very different peak demand profile to the peak demand that we currently have. That was the point that I'm trying to get to. That power on those three days I assume would be extremely expensive because the assets potentially could sit idle for the rest of the year, accepting that there could be some demand management thrown in as well.

DAVID MARTIN: Probably not because those units are actually being used during summer when demand's higher anyway. So it's actually not a matter of peak demand, it's actually a matter of improving utilisation. So that's the point, the demand profile is going to change right across the year and batteries are going to make that even more fungible. It's going to change so it's becoming one of those environments where it's almost post-peak, we almost have to start thinking now about what we do on those days when there's not a lot of demand. What do we do, as Minister Nahan said, when we get 75% of households with PV on the roof and if they're all only using 45% of that generation and the rest of it's being tipped into the network what do we do with it, where does it go? Do we turn off the coal-fired power stations for that two hours of the day and never get a chance to turn them back on again? There's some real re-thinking that needs to happen about the whole system and the way the system works, the way the system interacts with all the individual pieces, and that's the point about the regulatory framework needing to be cognisant of the fact that the physical system has changed. The regulatory system needs to change and the tariff systems need to change in sequence.

JOSH BYRNE: Can I also say, just to clarify the question, that when you start to look at high-performance housing, whether it be single residential topology like my house or in high-performance multi-residential buildings, the whole demand profile totally changes. We don't have a peak period in the morning or evening at our house and we have high-performance home that doesn't require air conditioning, so we have a steady load all through the day. Once we've charged our battery by midday, the peak is actually the peak in exporting back into the grid. So that period that Jemma alluded to and the audience member was querying was those days in winter where you have multiple days of cloudy weather where the batteries don't get a chance to recharge. So then you're pulling back from the grid, and that is the expensive part to size up to cover and it doesn't make sense to do that financially. How do we manage it when everyone else is also asking for power at that same time? That is a key question about rapid generation of additional power locally. Exciting times and the point I guess to consider is that we don't just look at meeting that power demand in isolation or look at generation in isolation, it's about managing loads and about looking at the importance of building performance as well.

AUDIENCE: My question is with regard to transport. Somebody recently said that they had a plan for everybody who was working to be able to get from home to work in 30 minutes. How realistic is this, how can it happen, and when might that be?

PETER NEWMAN: Yes, that someone was the Prime Minister, but it is also something we've been saying for 30 or 40 years. Cesare Marchetti was a physicist who first worked out that there was a travel time budget in every city and there has been throughout history, and the travel time budget is about an hour. That is the average. So some people can't stand taking an hour, half-an-hour in, half-an-hour back, and they've got to have 15 minutes or something and others will go for two hours, but the bell-shaped curve is very clear in every city, the 30 minute city has existed for all time. So in the walking cities of the world you could walk across from one side to the other in one hour and you can go to these old cities and walk it yourself, so the average was a 30 minute walk. They didn't go beyond that, because if they did they became dysfunctional and people got very angry. The reality is we don't want to waste time, we get into road rage and so on, and if you don't like it you move to the point where you do have the 30 minute city.

Now what's happened in recent times in Australian cities is that the 30 minute city, which did exist in Perth until recently, we went through that in the last ten years and it's now about 33 minutes on average. In Sydney it's 37 minutes, that's on average. There are quite a few people doing the two hour commute, an hour in, an hour out, but they're a small group and they're angry and they get political kudos because they say, "We want a fast train so I don't have to do this" and if it doesn't happen they shift. So that's part of the reason for this coming back in of cities, to reinstate the 30 minute city, and why people want the polycentric city is that you want centres throughout the suburbs where you can be grouped around and most work, services, schools, shops can be located. So rebuilding the 30 minute city is something we are all committed to doing and most of the town plans say what they want. What we've tried to provide is a model for how to fund that.

AUDIENCE: My question is to Peter, when you talked about your financing model I think from a political perspective the most difficult element of that is not getting private developers to the table, it's actually getting those land banks to provide the financial basis for redevelopment and then it doesn't matter whether it's private sector or public sector. The most successful example of this is the MTI in Hong Kong which is an estate agency and they own all the real estate -

PETER NEWMAN: It's an estate agency that has to work as if it was a private consortium.

AUDIENCE: Yes, they're very agile.

PETER NEWMAN: And it does make a profit.

AUDIENCE: But from a political perspective, how do we drive the creation of land banks in brownfield areas and desirable areas that people want to live in to leverage into our transport-oriented development models?

PETER NEWMAN: That is exactly what this model is about. The reality is that the planners get very frustrated when transit planners go out there and say, "We want to go from here to here" and it's going to be along Fitzgerald Street and there's no redevelopment potential along there because they're all big wealthy houses that don't want to change and they're going to put a stop in next to a tennis court because you're going to get parking there. That's what was coming out of it, there was no transit-oriented development opportunities in what they proposed so it failed.

The option that we've been presenting is find the best redevelopment sites. Well, for a start, have a look at the government land that exists, have a look at the places, like Curtin University, like Stirling city centre, like Cannington city centre. There are a range of them that really want to have

redevelopment and they're trying to attract the money to do it, and if governments can assist that process certainly government land is a big step forward, but a consortium can buy up land because you don't need a lot around it, this is the thing, you need to focus it, and they can get private sector owners to become part of their consortium and say, "Okay, you can join into this and you can make some money and join us" so you can get the whole land assembly then put together. But certainly the Metropolitan Redevelopment Authority, each state has their own, would be needed to help with the land assembly and make that work. But that's all; they don't have to get the money. That's a huge difference.

JOSH BYRNE: This is beginning to feel like a bit of a poor man's Q&A, which I think is terrific, and just to give it that extra little push along –

PETER NEWMAN: What's poor about it?

JOSH BYRNE: Well we haven't got the live tweets I was going to say, but what we do have is emails that were sent in earlier and this is true, we had questions sent in earlier for those who may not have thought they would get a chance to ask. So I thought this is the perfect time to slip one of those in if that's okay Peter and actually direct this to Evan, it's a bit of a follow-up from a related question to the previous one. This is to Evan, how do we get the right mix between medium density infill and loss of amenity in the suburbs? And we're often talking about brownfields and TODs (transit-oriented developments), but how about the concept of greyfields developments where we look at trying to renew and regenerate ageing middle area suburbs? What's the potential there and how do we get it right, rather than just battle-axing the whole lot?

EVAN JONES: I commented the other day at the local government planners' forum because that the battle-axes and the units with the driveway down the middle are places where we bury the living because it's the worst form of development I've seen. We do it writ large because we have a blind code that was written in the 20th century to deal with separation of houses, it's called the Residential Planning Code and it's all about keeping things separate. So to bring things together you need to have a fine grain understanding of how things work and the relationships of buildings and people and so on, but I'll step back a step. So we need different coding because the currently codes are giving us just the worst possible development outcomes across Australia. The first thing is that we need to take low-hanging fruit, so we do need to work very hard on our transport corridors, they're underutilised.

Most of you wouldn't realise, but the Metropolitan Region Scheme has probably got widenings still from the 1960s along most of our major highways. When we did Beaufort Street as an urban renewal the Department of Planning told us no, we're not going to change and we want a \$300,000 transport study to show us you don't need those road widenings, notwithstanding the fact the government and council had just spent tens of millions of dollars putting in busways and the road's set in its capacity now for the next 50 years. So we've got these things that impede us, but the corridors, the sites that are available, the government land linked up with public transport but using the government and private land first where we can to link transport. The hardest thing anywhere on the planet to do is then go into the sprawled suburbs and say, "Hi, we're from here and we'd like to densify you". Density there means more traffic; it's almost akin to ask them to take poison. The problem with them is that the community centres, the little shopping centres, are all failing because they're all in the wrong spots, the roads are still too wide and, until they go down comparatively in value to other places, we find that it's very difficult to convince them to even link one or two cul-de-sac heads which would stop them walking down pedestrian access ways, otherwise known as rape and pillage opportunities because they're at the back of everything. So it's a difficult thing to get into those existing suburbs and

that's why it's very seductive to do the Tuart Hills and the Yokines and those sort of areas with these, as you say, battle-axe lots and just split them up. So we've got a longer conversation with the community about those.

The final point is the wrong way to do is to announce densities, everyone locks it into their superannuation funds and then they find they've got the wrong model. So we need a longer community conversation about the forms of development because imposing it top-down, and you've seen the huge controversies on development assessment panels of late, you cannot sit centrally and dictate to communities where buildings are going in the wrong place. It's their community and we need to work with them to get the permissions and understandings that density done with the right things, with public transport, better shopping, better mixed use, better employment is a good thing, not a bad thing.

JOSH BYRNE: So we're talking about community-led development models?

EVAN JONES: Correct. It has to be in the 21st century.

AUDIENCE: This goes back to Evan again but obviously anyone else can contribute. I look at this and I can see the five and ten year horizons of these wonderful schemes of value capture and development and that sort of thing, but we've got so many obvious things that could be done. For instance, with a place like Spearwood or Wembley Downs or wherever it might be, instead of running a gigantic 80-seat bus out there every hour, why don't we run eight-seat buses out there every five minutes?

PETER NEWMAN: Because it's got the same driver.

EVAN JONES: Yes, the drivers actually, believe it or not, are the very expensive part of utility in keeping that up. But Josh and I were just having an offline conversation about the transformative technology that's called self-driving vehicles. So I think that what we're stuck with now may not be the same in the future.

AUDIENCE: I'm going to speak for a forgotten mode of transport which unfortunately has very little funding thrown at it and that is cycling. We're talking a lot about cars and, as Peter says, there are fewer cars on the road and a lot of that is to do with how many people are now cycling. We've got double-digit growth in cycling every year and there's just not enough infrastructure for us, there's very little in terms of regulation to force building owners to put in end-of-trip facilities and the like, and I think cycling facilities will contribute to making cities sustainable and also living. So how do we do more of it? And that is something that has to be government funded in my opinion, because private people are not going to put in bike lanes.

JOSH BYRNE: Peter, would you like to comment?

PETER NEWMAN: Yes. We do need more cycling infrastructure. There's a lot more now than there was 30 years ago and they are used, believe me I can show you the numbers. When I started out trying to get cycleways in this city there were none, now there are some. It's nothing like Denmark, it's nothing like the Netherlands, but yes, the need is there and whenever it's provided it's used and the numbers are going up on cycling. You do have to keep in mind that the 30 minute city will still exist and you will not be riding from Joondalup to Perth, or very few will. There are limits just based on the speeds. Speed does matter, time does matter; it's not just a health exercise. So cycling is best done

around centres and into centres and linking them, and certainly providing that last mile/first mile from stations is extremely important and it's still not yet fitted into the system do to that. It's being seen essentially as a recreational activity and that's where most of the money's gone.

AUDIENCE: I'm interested that we've discussed a lot about solar power tonight but we don't seem to have talked about any of the other sources of renewable energy, and thinking of it in terms of those two or three days in winter-time when it's not possible to have enough solar power, quite often they coincide with a cold front which brings lots of wind. Has anybody done any modelling looking at the various weather events to see if we can actually use these synergistically together, and that could be wave power as well as wind power?

TONY WOOD: Yes, there's been quite a lot of that done. People used to say that these energy sources were not predictable. Well, they are mostly both in the long term. I mean, the amount of energy you get from solar and wind doesn't change all that much from year to year and in the short term they're actually reasonably predictable. Most likely you go outside and the sun isn't shining, right? So there is that predictability and you can actually build that into the scheduling of these generators so the energy market operator now does take into account the capacity to predict how this is going to work. There are short term fluctuations, clouds go across and so on, so certainly wind and solar yes. There is a lot of expectation around geothermal energy because the argument was that's inherently non-intermittent.

One of the great advantages of some of the water technologies, wave and tidal, is that they are both far more predictable and also broadly speaking don't have that same problem of intermittency as wind and solar do. The problem is that a lot of the technologies are still in the very, very early stages of development. What we should recognise of course is that all of our energy actually comes from nuclear energy, the sun, the nuclear power station, just happens to be a long way away and the radioactive waste doesn't get to us in a way that hurts us too much, so maybe we need to think about that a bit more as well. But I think the whole nature of the energy mix has to be thought about in combination because I think it's pretty well self-evident now that you can't do it easily. But I think, as we get to understand the way these technologies integrate, that the extent to which we can overcome some of what appear to be technical issues associated with that intermittency or other issues to do with those technologies will be far more manageable and we will be able to get much greater penetration of those technologies with that manageability. But it's still relatively early days in that context. I mean, as costs come down it will force people to get more serious.

DAVID MARTIN: The only thing I'd add to that is that energy storage is going to change that game completely and as energy storage comes down you don't need the sun shining during the middle of the night, you've got it stuck in the battery. So those things have to be considered as well.

AUDIENCE: This is not my area normally but it seemed to me for your winter gap, Josh, and so on that there would be scope for micro-wind. I know a lot of councils just don't allow it, but there are many types of wind generators coming out now that don't make noise and disturb people and all the rest of it. This is related to the previous question I guess, but I just wonder whether we can get around the local council's objections to micro-wind and what sorts of opportunities are there there for balancing out what PV can't provide?

JOSH BYRNE: Certainly from a technical perspective that's one thing that we did look at. One of the both benefits and challenges of our particular house site is that we are in a very sheltered and protected spot at the bottom of one of the valleys in Hilton, and we chose that on purpose so we had

some protection from the storms going over the top and we don't have our garden smashed every time there's a big storm coming through. We have plenty of solar gain, again, chosen carefully, but even the micro-wind turbines do of course suffer from protection from trees and what have you. A lot of the turbulence issues have been overcome with some of the vertical turbines.

But I think it's also important that we don't naturally all gravitate to want to be stand-alone just on a lot by lot basis. As Jemma mentioned, we very intentionally decided not to be off-grid, we feel it's very important to be grid-connected. Our philosophy is to be grid-optimised and that is to look at sizing the infrastructure in such a way where it's as cost effective and resource-intensive as possible. We don't want to be putting in more panels than we need, we don't want to be putting in more batteries than we need because it all comes with significant embodied energy and some form of environment source impact. It's about optimising and being able to put power back into the grid when we're not using it. So the idea of moving beyond just lot scale and going to cluster and, ideally, precinct scale and then even on a regional scale is obviously where the big conversations need to be had.

AUDIENCE: A question probably for Peter. Many sustainable cities, like Portland, have a limit to urban sprawl. How should Perth proceed and how do you see it proceeding, given the developer-directed planning that's been rampant for the last few years?

PETER NEWMAN: Back in the time when the plans for the future of Perth were done, *Dialogue with the City* and *Network City*, the public were asked what were the key attributes that they wanted to see from the city, and stopping the sprawl or having a growth boundary was number one, it was just so powerful in what they said. The planners all said, "Oh, but we already have a growth boundary, we've got that power, that's where the urban sprawl stops" and then two days later someone says, "We want to shift it" so they shift it. The reality is we don't actually have a firmly fixed growth boundary and so the city's gone out an extraordinary length now. It is way beyond the dysfunctional Marchetti limit for the 30 minute city. You can't even get to Joondalup from some of those outer suburbs in 30 minutes.

So we do need that growth boundary, it needs to be probably put in through National Park boundaries or Regional Park boundaries that cannot be opened up, because as soon as you have a boundary that's semi-rural or urban-deferred or something they just wait and find the right appropriate political opportunity and rezone the land, make a huge killing in profits, and then out come the developers who roll out the project homes and nothing else. That's what we've been doing and it's got to stop. Evan's tried to stop it in Sydney, what did you do Evan?

EVAN JONES: Sydney was fortunate in that the price of land on the greenfields was just so astronomical that it beggared belief that you could actually develop it. So we actually set about saying that if we're going to do this we need to do it properly, we need to value-capture, and I'm personally responsible for the biggest levy on developers that was then followed by Victoria in order to pay for the infrastructure and get the design and other things right. Our challenge here is two things. We're still producing, notwithstanding all those apartments you see, more than 70% on the fringe. So we have to find new ways of getting more housing at appropriate locations with appropriate employment and transport in the existing areas because otherwise that will continue, it's politically so hard to stop. So once we do that we can then just make sure that the people with the existing permits do it as well as they possibly can with the right design and the right infrastructure, so we're building good increments of city, we're not building poor sprawling increments that are going to add to the problems of the future. So we've got two simultaneous challenges which they've attempted and I think *Direction 2031* tries very hard to almost put a growth boundary in, but we've still got those two challenges.

AUDIENCE: I've got a question for a few of the panel members and they all relate to the solar battery and so on. My first question is to Peter and it's related to the lithium. With nuclear Australia's position to supply the world with uranium as opposed to Australia's position now to supply the world with lithium, if you could speak of the impact, the life of the lithium battery and what actually happens afterwards, is it going to end up in Ghana somewhere? The other question that I have is to Tony and that is as far as subsidies go, if we had to look at, for example, the budget right now with negative gearing, would that money be better subsidised to investors to install these solar batteries and panels?

PETER NEWMAN: Lithium is quite easily recycled and it is not like uranium a toxic element, it's a crustal element. So when you make lithium carbonate you can hold it in your hand, there are no issues that way. There's a lot of lithium in the world, so there is not going to be an OPEC formed around a cartel of people to stop it - that was a myth created by the oil companies - and it is certainly something that we ought to welcome. We certainly need to recycle even more of the lithium ion batteries that are in our mobile phones and computers, we're not doing much about that, but there will be increasing pressure to do it when it becomes part of household batteries and electric vehicle batteries, which there are going to be more and more of. So I welcome it.

The exact opposite is true with uranium because we still haven't solved the waste disposal problems and it is a major issue if any of it gets into the wrong hands. If ISIS gets hold of lithium maybe they might play some music or something, but it's not going to hurt anyone. The big problem with nuclear power is you've certainly got those toxicity, waste disposal and proliferation problems, but the main thing is it's the wrong scale. At the moment what's happening with the solar and battery revolution is that you can use the electricity right where you make it, you don't need massive great long distribution systems, so all those appalling huge powerlines that we see coming up from Collie and so, we hopefully in the future can get rid of all that. We don't need to have big long wasteful centralised systems that nuclear power is built for. It isn't feasible to make a tiny little power system out of uranium for each household, but we've got it now. It's happened and it is cheap.

JOSH BYRNE: Fascinating fact, does anybody know that Peter did his PhD in biochemistry? How's that, so well-placed to answer that one.

TONY WOOD: I think the trick with this stuff is that people have all sorts of views about what should work and what doesn't and one of the either good things or bad things about what I do is I get lots of phone calls from someone who's got the solution and all they need is some money from government and they convince government that this person's solution is the one that should be funded, and that includes subsidies for solar. I think we need to think about what the role of government is to use public funding for what purpose, and that's a tricky question because governments misuse public funding for all sorts of interesting purposes, many of which of course, as one of my colleagues, and I'm sure some of you may have read the report, talked about is the way in which we choose to build roads in many parts of Australia and some of the poor choices we make.

So I would not use money for subsidising people just to put on more solar. I would use public funding to try and drive down the costs of solar in certain circumstances and I think some of the things ARENA (Australian Renewable Energy Agency) have done which is fundamentally not to simply get more solar out there, because I think that's been an extraordinary waste of money in this country, but I would suggest what they are doing is to find ways of driving down the cost of solar so it becomes competitive and leave it alone. Some people have indicated already that once that happens then the market takes care of it. So even though I'm one of, I suspect, few people in this room who have

actually taken advantage of negative gearing in a small way, I think it's a bloody stupid idea and I would vote for anyone who'd get rid of it, but I wouldn't use any benefits created to subsidise people putting in more solar. I think there are better ways to encourage the technologies. The really important issue is not what the answer is, but to get policy and regulation out of the way of the answer being developed so that people can get on and do it. That's where one of the problems is I think, too much policy and regulation stops people getting on and developing the sort of solutions that we need.

AUDIENCE: My question touches a little bit on the last one, but I felt that perhaps not enough attention has been paid to the big opportunity for PV to be put on rental properties. I don't know what the percentage of Australian dwellings is that are rental dwellings, but it's significant and it's not going anywhere and there's a real lack of incentive. It was touched on, but land owners have been putting solar panels on their houses a lot, I'm seeing them pop up everywhere, but the fact that no-one has come up with a big mass solution for landlords to do this as well, it's like so much time has passed and it still hasn't happened yet. Why is that?

JOSH BYRNE: Perhaps we could pass this over to Jemma, given her research in the strata area, but could I also flag that it's not just landlords of rental properties not putting in PVs because they're not benefitting, they're also not necessarily building houses that benefit the occupants and the future. So it's not just PV, it's the energy efficiency of the homes, it's the water efficiency of the homes, it's the liveability of the homes. So it's a bigger issue, let's not forget that.

JEMMA GREEN: There are 2.4 million rental properties in Australia at the moment and there's also the question of strata as well, some of which are owner-occupied and some of which are tenanted, and in neither of those situations you can actually access the roof space because it's owned by the body corporate.

So the embedded network project we're doing is all around tenanted properties getting access to renewable energy and for freehold houses that are rented out there are companies now which allow you to put solar panels on your roof and the tenant pays their electricity bill to the owner while the solar panels are generating electricity, then for the rest of the day they pay their electricity bill to the utility, so the tenant will effectively get two electricity bills. So it's actually possible to do it right now. There are a few companies that have the technological smarts to be able to deploy this and if you want to contact me I can send you details about it. But essentially for the strata research we're doing it's really to solve that problem because there's a mismatch between who benefits from the solar panels and who pays for them, so the embedded network means that their tenant pays their electricity bill to the strata companies which provides the capital to pay back the investment in the renewable energy infrastructure.

TONY WOOD: One of the other solutions that's been used both for solar and for energy efficiency for design of buildings is called PACE (property assessed clean energy) financing and I'll describe it in a simple way. Basically the owner of the property is able to capitalise the value of whatever they've done in the rates and effectively what that means is the tenant moves into the house and the rates are slightly higher but the electricity prices are lower. It can work. It sounds very simple, but it requires some legislative changes. Victoria has implemented that for some commercial buildings and there are some signs that that's beginning to cause some change in the area mostly for commercial tenants, but there's no reason why it shouldn't work for others as well.

JOSH BYRNE: Thank you. That's going to draw the questions from the audience to a close. I will just leave you with one, more to ponder on than anything, and it was a question that was emailed into us.

Tonight's discussion has obviously focused on both energy and transport, given the focus of the event, but here's a good one just to take home and think about. Given the interdependency of water with food, tree canopy, biodiversity, health, local food production and, indeed, the energy intensity of water in Perth in particular, should we be designing our water future first? That's one to take home. Please thank me once again in thanking Tony Wood, Jemma Green, Peter Newman, Evan Jones and, of course, David Martin. Thank you very much.

END OF RECORDING