# T R A N S C R I P T

# LEGISLATIVE COUNCIL ENVIRONMENT AND PLANNING COMMITTEE

## Inquiry into Renewable Energy in Victoria

Melbourne—Thursday, 17 March 2022

**MEMBERS**

Ms Sonja Terpstra—Chair
Mr Clifford Hayes—Deputy Chair
Dr Matthew Bach
Ms Melina Bath
Dr Catherine Cumming
Mr Stuart Grimley
Mr Andy Meddick
Mr Cesar Melhem
Dr Samantha Ratnam
Ms Nina Taylor

**PARTICIPATING MEMBERS**

Ms Cathrine Burnett-Wake
Ms Georgie Crozier
Mr David Davis
Dr Tien Kieu
Mrs Beverley McArthur
Mr Tim Quilty
Mr Gordon Rich-Phillips

**WITNESSES** *(via videoconference)*

Professor Andrew Blakers, Institute for Climate, Energy and Disaster Solutions, Australian National University; and

Dr Saul Griffith, Founder, Rewiring Australia.

**The ACTING CHAIR (Mr Hayes)**: I declare open the Legislative Council Environment and Planning Committee's public hearing for the Inquiry into Renewable Energy in Victoria. Please ensure that mobile phones have been switched to silent and that background noise is minimised. I would like to remind you to please try and mute when you are not speaking.

I begin this hearing by respectfully acknowledging the Aboriginal people, the traditional custodians of the various lands we are gathered on today, and pay my respects to their ancestors, elders and families. I particularly welcome any elders or community members who are here today to impart their knowledge of the issues to the committee or who are watching the broadcast of these proceedings. I welcome any members of the public.

I would like to introduce the committee to the witnesses. We have got Dr Samantha Ratnam, Mr Stuart Grimley, Dr Matthew Bach, and Mrs Beverley McArthur. That looks about it at the moment; we might have other committee members join us as we proceed.

Let us get started. I am allocating 10 minutes each to you, Saul and Andrew, to do your presentation. We might start off with Professor Blakers, if you would like to start your presentation to the committee. Thank you.

**Visual presentation.**

**Prof. BLAKERS**: The first point to make is that solar PV and wind won the energy race hands down. This is a graph of a bunch of energy generation technologies—all of them actually—and the size of the bar is the global capacity additions in 2016, 17, 18, 19 and 20. You can see on the left-hand end that solar PV and wind are now three-quarters of global net new generation capacity, and in Australia they are 99 per cent. All the others—gas, coal, hydro, nuclear, bio, solar thermal, geothermal—are also-rans. Solar and wind just keep growing and growing, and the others keep static or shrinking. So it is solar and wind from now for at least the next few decades. There is nothing in sight that will be able to challenge solar and wind.

The next point is that Australia is the global pathfinder for a rapid energy transition to solar and wind. This is a bunch of countries, and the size of the bar represents the amount of new hydro, wind and solar PV installed in 2020. So Australia came in at number two spot behind the Netherlands surprisingly, but because our wind is better and our solar is much better in fact the Australian solar and wind—the red and the green bits of those bars—represent a lot more input, only Australia is physically isolated. We cannot share with our neighbours, unlike Netherlands, Sweden, Norway, Belgium et cetera, so we have to go it alone. The take-home message is: it is turning out to be extremely straightforward and cheap to balance very high levels of solar and wind. In fact the more solar and wind, the cheaper the electricity.

This is a graph showing the fall and fall of gas and coal and the rise and rise of solar and wind. Renewables is the green bar going up and up, from July 2019 and projected up to July 2023 on current growth rates. It is a six-month moving average, so it wiggles a bit from summer to winter. Black is the falling, falling coal, and gas is the falling, falling grey line. So gas has halved in the last four years, and it is going to halve again in the next four years. So gas is not a transition fuel—the notion of a gas-led recovery is just laughable. Take-home message: renewables have won the race and are demonstrating that by rapidly displacing coal and gas in the Australian electricity system. We are tracking to 50 per cent solar and wind in 2025. In South Australia solar and wind are already 70 per cent and they are tracking to 100 per cent in 2025. So if South Australia can be doing 70 per cent now, 100 per cent in 2025, then there is no reason Victoria cannot be just a couple of years behind.

So, a pie chart of where the Australian emissions come from—about 500 megatons. Long story short: there is 80 per cent of really straightforward cuts in emissions by converting electricity production from coal and gas into solar and wind, and that is well on track; getting rid of oil from motor transport by using electric vehicles;

and getting rid of gas in water and space heating by turning to heat pumps. This is all completely off-the-shelf technology with low and falling prices. It is really straightforward to get 80 per cent cuts, and that buys us time if we get on to that now to deal with the harder 20 per cent cuts in agriculture, waste management and industrial processes. So we need to electrify everything basically, and that electricity will come from solar and wind.

Victoria has got pretty good solar by Australian standards and fantastic solar by world standards, and the worst place in Victoria is better than all of northern Europe. Obviously up in the north-west is even better than the south-east. If you live up in the north-west, you are really sitting pretty for a lot of influx—of population and people and businesses—to build solar farms.

The wind farm atlas—again in the west of Victoria there is really great wind, but it is also scattered up into the centre. The west of Victoria is where there is great wind and great sun and a lot of money to be made by installing solar and wind farms.

Stabilising 100 per cent renewable electricity—solar and wind together are better than either alone. Spread it out over a large area to reduce local weather effects. Obviously shifting those from night to day is good. And mass storage—pumped hydro is the overwhelming choice of storage around the world. It is about 97 per cent of all global storage.

This is the Tumut 3 pumped hydro system in the Snowy Mountains. Water can go both up and down. On a sunny and windy day the water is pumped up. It comes back down through the turbines at night to recover that energy.

Most sites are actually off river. This is an example from Italy: no river in sight. You just have two reservoirs separated by a 500-metre height difference and connected by a tunnel. The same water goes backwards and forwards—up, down, up, down, up, down—for 100 years. So you do not need to dam any rivers to get unlimited pumped hydro storage.

This is a global atlas of all of the 600 000 pumped hydro sites we found in our survey of the world. Australia has got 4000 of them. Victoria has got large numbers. Each of those dots represents a really good pumped hydro site—most of them obviously in the alps, a few down near the Otways. If you zoom in on the atlas, those dots start to resolve into upper and lower reservoirs. This shows a couple of potential reservoir sites near Bullioh. Together, that pair of pairs has enough storage to support 100 per cent renewable electricity for the whole of Australia, and there are 4000 other good sites. So we have unlimited solar, unlimited wind, unlimited off-river pumped hydro; we have got everything we need to get to very high levels of renewables. The one thing that we do not have is adequate transmission, so we badly need to strengthen transmission to get the new solar and wind into the cities—wind from the west, solar and wind from the north-west, pumped hydro from the north-east, offshore wind from the south and then connecting in Tasmania, and then strong interconnection into South Australia and New South Wales so when the weather is good in Victoria we can export solar and wind, and when the weather in Victoria is bad we can import solar and wind. So a strong interconnection interstate is also quite important.

What can Victoria do to move rapidly to more solar and wind? Transmission is the number one requirement. We badly, badly need to invest in more transmission to bring the new solar and wind into the cities. Victoria needs one or two pumped hydro systems to match Snowy 2.0 and Kidston and the others that are being built or already exist. Pumped hydro and batteries just take care of storage. We need to ban new sales of gas hot-water systems and air heaters in favour of heat pumps, and you save money by doing that because heat pumps over the life cycle are cheaper than gas burners. We strongly encourage electric vehicles, to push oil out—really strongly encourage it. Oil is imported to Australia, and the faster we get rid of imported oil the more energy independence we will have. And of course we need to electrify everything, which will double the electricity production once we have electrified transport, heating and industry.

What does Victoria get by going down that path? Thousands of long-term jobs in regional Victoria. In particular in the west and the north-west we are talking about thousands of jobs to support solar farms, wind farms, pumped hydro and transmission—good jobs, long-term jobs. This transition will take 20 or 30 years, and when the solar and wind farms are all built, in 20 or 30 years you have got to rebuild them because that is their lifetime, so these are long, long, long-term jobs in regional Victoria. You end up with a more reliable grid, not a

less reliable grid, because you do not have just one or two power stations, you have thousands of them, so any one or two breaking down does not matter very much.

The facts are in now. The more solar and wind you put into your grid, the cheaper your energy prices. So South Australia, with 70 per cent solar and wind, is right at the low end of Australian states for electricity prices. You eliminate smokestacks, coalmine fires, ash dumps, car exhausts, oil and gas imports, oil spills and gas leaks, and you get rid of 80 per cent of greenhouse emissions, so really it is a win, win, win, win, win for going down this route of rapid transition to solar and wind, and the faster we do it, the faster we get the benefits.

**The ACTING CHAIR**: Thank you very much, Professor Blakers. Dr Griffith, would you like to make your presentation now?

**Visual presentation.**

**Dr GRIFFITH**: Terrific. Here we go. I think Professor Blakers has done an extraordinary job in introducing the very good macroscale news for Victoria. I am hopefully going to be complementary and talk about the micro view, so what this means for households and communities. This is very much about households and what we need to do to get to zero emissions. Professor Blakers has already introduced that: electrify the vehicles, electrify the kitchens, electrify the water through heat pumps, electrify the space heat through heat pumps, and where possible use the cheapest energy source of all delivered to the end consumer, which is rooftop solar, and then augment that with all of the glorious grid-scale renewables we have just heard about.

Almost all the electricity in Victoria comes from coal. That is the current picture, but we have just heard how that can transition in the next few decades. Here is an important point: if you remap the energy system around the economic units, like a household, 42 per cent of our domestic emissions are decisions made around the kitchen table in that household—what fuels the car, what fuels the heating systems. Another 26 per cent of our domestic emissions are those same decisions made by small businesses: what they cook with, what heats and cools the office, what vehicles are associated with those small businesses. To get to zero we have to electrify the demand-side machines, so this is really a plea for the demand side as well as for decarbonising the supply, which is what we just heard about. That means electrifying all of the end uses in the households and providing the appropriate household infrastructure to do that. This means cleaning the electricity that comes into those households, either from grid-scale renewables and long-distance transmission that you see on the left or through to rooftop solar and batteries on the right. This will transform our energy system. These electrical machines are so much more efficient that we will need less than 50 per cent of the current primary energy to run our whole economy, without shrinking our homes, without shrinking our cars. We will need a lot more electricity because we are electrifying our transportation, and we will need yet more electricity because of our heat. So in fact we are going to need 250 to 300 per cent of the current amount of electricity delivered to the household, and a huge amount of this transmission will happen underneath the local electricity substation—that means on our distribution grids. There needs to be a lot of focus around that, and because it is going to happen in those communities it is going to transform household and community economics.

So simple heuristics of the efficacy of this electrification can be used to model the future electrical load. What do I mean by that? Driving an electric truck or an electric car will use less than a third of the primary energy of running it on petrol or diesel. Similarly, running heat pumps to heat our spaces is going to use about a third of the energy of using natural gas for the same effect, for a water heater about a third also compared to natural gas, and even our energy costs of cooking will go down by about 50 per cent if we move to electric induction from gas. The biggest saving of all, of course, is that roughly 75 per cent of the energy that goes into making electricity in Victoria today is lost as waste heat, and all of that is eliminated when we are generating it with wind and with solar.

All of those efficiencies really add up. For the average Australian household they are using 97 kilowatt hours a day of all types of fuel, and that will go down to 35 kilowatt hours of electricity per day. So in Victoria it is this picture: today it is 120 kilowatt hours per day per household, and that goes to 42 once we have done all of this demand-side electrification and we are providing that electricity with renewables. So that is a huge win. That adds up to an incredible economic windfall for the Victorian and Australian households and for our economy. This is the average yearly spend of an average household in Australia today. It is about $73 000 total household spending. Nearly $5500 of that is on energy—and obviously going up because of global issues beyond our

control right now; more than $3000 per year per house on petrol and diesel; nearly $1800 a year on electricity; and $600 on gas. In Victoria it is even higher, the gas component.

But when we electrify, here is what is going to happen for the average Victorian and the average Australian. Driving your average petrol car today at $1.42 a litre, which might be a mythical price now, is about 12 cents a kilometre. Running an EV off the current Victorian grid is about 7 cents a kilometre, and if you are running it off your rooftop solar it is about 2 cents a kilometre. The same for having an 8-minute luxurious shower: in Victoria it is about 50 cents run off gas, it will be 41 cents run off a heat pump off the grid today and if you are running the heat pump off your rooftop solar that will be about 8 cents for that shower. So these savings add up every day. The same for space heating: it is about $2.50 a day for houses heated with gas today; with heat pumps off the current grid about $1.90, but remember that grid is getting cheaper, as we just heard from Professor Blakers; and then if you can actually run this off your home rooftop solar, it is $1.22—yet more savings. You can even—I have missed one—express it in boiling a cup of tea: if you are using a mix of the grid and rooftop solar, your cup of tea is cheaper; it is about equivalent if you are running it off the current grid; and it is far cheaper if you are running it off solar. So all of those savings are going to add up enormously.

It is now down to what is the capital cost, so what I am showing you here are the cost curves of the technologies that we need to win this revolution. The 100 per cent is relative to today's price, this purple line, so you pay about 170 per cent of the price for an electric vehicle that you do for a petrol vehicle today. But we know by about 2025–26 they will be the same price in the showroom as petrol vehicles, and they will get cheaper and cheaper. We use the International Energy Agency model of lowering the cost of heat pumps in red. They are getting cheaper. That is the yellow. The cost is the cost of rooftop solar in Australia. It is getting slightly more expensive as we phase out the solar rebate, but technology is catching up. I actually think this is conservative—it too will get cheaper. But the biggest news story of all is that batteries are falling precipitously. These cost curves undermine an economic model that you can build for the household. So if you went out and paid retail today at the household for the 1.9 vehicles in the driveway and made them electric, electrified all the heating systems and electrified everything else, you would actually, after the cost of financing, increase the annual energy costs by about $5000. But you can see the miracle that is unfolding here because of the falling costs of the input electricity, because of the falling cost of the hardware.

In about 2024, 2025 we hit a break-even point where every Australian home is saving hundreds of dollars a year, and then you can see by 2030 the savings will be as much as $5000 a year per household for their costs of all of the energy that supplies their house and for the vehicles that they are transporting themselves in. So that is a pretty compelling picture of saving money while we reduce our energy demand enormously, completely eliminating our reliance on foreign oil and zeroing out 65 per cent of our emissions that are our residential, household and small business emissions in Australia.

And then realistically what we need to do if we are aiming for better than 2 degrees is we need to pick a target around 2040 and we need to, in some way, use this as the community targets and dashboards for getting higher penetration of rooftop solar, very high penetration of electric vehicles et cetera, et cetera. The good news here, and so I think this is the best way to understand this, is cars last 20 years, stoves last 20 years and hot-water heaters about 15. Basically we can nevermore allow new fossil fuel appliances or vehicles to enter into our economy, starting this year or as soon as possible. Every time somebody's car retires, it needs to be replaced with an electric vehicle. Every time somebody's water heater retires, it needs to be replaced with an electric heat pump. That is the schedule required to hit our climate targets. That is the schedule that will enable these community savings.

So we save households thousands of dollars a year. I think this is really interesting in terms of community economics. Take a thousand households—that is your average suburb—they will be spending about $3.8 million a year on petrol, another million dollars a year on gas and close to $2 million on electricity. If they are generating half of that electricity in that community, which is more than reasonable on the rooftops and community solar and storage, that is going to lower the money that is leaving the community by $3 million, meaning a single suburb will be saving $3 million a year by virtue of not buying all of that petrol and spending that money on energy. That is going to create a huge number of in-community jobs by two mechanisms. First is the tradie jobs of installing and maintaining all of this demand-side electrical machinery—that is, putting the vehicle chargers in, putting the solar on the roofs, deploying all the heat pumps. That will be probably a dozen jobs per 1000 households that are forever jobs. And then that $3 million that is being saved in that community every year is going to be a huge number of induced jobs that are spent broadly in the economy at the local cafe

and the local bicycle store. We are sort of going to run out of new classrooms and football fields that communities are going to be able to buy at the rate of $3 million a year. So that is the community renewal story that goes along with this incredible energy transformation that is happening by electrifying everything.

On the policy side, the NEM and AEMO rules are critical. We could lose that windfall for the communities if we do not get the rules written correctly, particularly around the distribution grid rules. We should be thinking there are a lot of people who would like a slice of that money—some of the banks that were going to finance it, some of the utilities that would like to charge a transaction fee for all of the electricity that is moving in two directions. I think we need to make sure that those distribution grid rules in particular are written to favour the household and the community, and that is up for grabs right now. Finance ultimately is going to be the equity issue. You do not get to zero emissions if only the top end of town can afford it, so this is going to be a credit rating, credit score—how do you make sure we bring along low-income households on this journey? They are the ones that will benefit the most from saving this money, but they are the ones that will struggle with the up-front capital costs of this transition. That means we are going to need subsidies in the early days while we are forming these markets and training the workforce and getting ready.

I think that might be my time.

**The ACTING CHAIR**: Thank you very much, Dr Griffith. It is good to hear about all those savings I am going to be making in the future. It is very encouraging. Yes. So we will go to questions now.

There is something I forgot to read in, but I will just mention it now. So, to witnesses: all evidence taken is protected by parliamentary privilege as provided by the *Constitution Act 1975* and further subject to the provisions of the Legislative Council standing orders. Therefore any information you provide during the hearing is protected by law. You are protected against any action for what you say during this hearing, but if you go elsewhere and repeat the same things, those comments may not be protected by privilege. Any deliberately false evidence or misleading of the committee may be considered a contempt of Parliament.

So with those serious words I will kick off to our first member's questions. And I would just say: could we confine it to two questions each, and then if we have some more time I will come round to people who want to ask another question. Mr Grimley, would you like to start?

**Mr GRIMLEY**: Thanks, Acting Chair. Thank you, Professor Blakers and Dr Griffith. My first question is to Professor Blakers. You mentioned the benefits of western Victoria in particular having some amazing opportunities out there in terms of wind and solar, which is fantastic. So my question is in relation to the transmission infrastructure, which you mentioned is one of the critical components. So in your view what kind of transmission infrastructure will be needed in a system with 100 per cent renewable energy? How are we going to get that energy from the regions into the city?

**Prof. BLAKERS**: Yes. So at the moment a solar farm company, a wind farm company, a pump hydro company, just needs to negotiate with a couple of landholders to get enough land. A transmission company has to negotiate with 200 farmers or something like that to get from western Victoria into Melbourne. There is a huge failure; that is that if you agree to allow a wind turbine tower on your land, you might get $10 000, $20 000 per year—per year—for the life of that turbine, 20 to 25 years. If a transmission company puts a transmission tower on your land, you get that once, up-front maybe. There is no reason why the payment made to landholders for transmission towers should not be benchmarked to wind turbine payments, but that is not allowed under current rules for constructing transmission. That needs to change, and just like with wind farms, if you do change it, suddenly community opposition to transmission melts away. If there is one recommendation to come out of this committee, I would recommend that Victoria goes it alone, tells the federal government where to go and makes sure that the compensation to landowners per transmission tower is pegged to the compensation paid per wind turbine.

**Mr GRIMLEY**: Thanks, Professor. That is a very interesting recommendation—and as you probably know we are getting a lot of community pushback at the moment through the Western Victoria Transmission Network Project that is currently happening, particularly with overhead powerlines. So that may be a bit of incentive for them. However, they are calling for the undergrounding of powerlines in most instances. Do you have a particular view on the undergrounding or the overhead powerlines at all?

**Prof. BLAKERS**: Undergrounding costs 10 times more, so going 500 kilometres underground is really quite prohibitive. Of course undergrounding through a ridge, for example—so it is not an eyesore running over a high ridge—is one thing, but I really think that if the transmission is compensated in the same way as wind towers, which is not just the owners of land but also the people next to the owners of land, just like wind turbines are compensated, a lot of the opposition will evaporate and we might even have competition: 'I want those towers on my land, because I'm going to droughtproof my farm'. It is just amazing how much difference it makes. These farmers are seeing their neighbours with the wind turbines getting lots of money and they are stuck with the transmission and getting a lot of less money—why?

**Mr GRIMLEY**: Okay. Thank you, Professor. I have a question for Dr Griffith, but I will wait until later on. Thanks, Acting Chair.

**The ACTING CHAIR**: Thanks, Stuart, I will keep you in mind. Ms Taylor, would you like to ask a question?

**Ms TAYLOR**: Yes. Apologies, I will go back and look at the slides; I missed the start because I was having trouble getting in. Thank you for what I have seen of the presentation; I really appreciate that. I was trying to think, because there are so many different angles that you have taken there. I do not want to work away from solar and wind, because you obviously know that in Victoria that is a very high priority for our government, and we are leading the way with investment in renewables and even things like looking after the vulnerable through gas heater upgrades for the people least able to afford the transition and so forth. I was just wondering, and this flows on from yesterday: because we have got the existing gas pipelines, I think there are discussions about whether there will come a point where hydrogen will be safe enough to run through them, because the infrastructure is already there—or are you not in favour of that? I am just putting that question because I do not know.

**Dr GRIFFITH**: My original degree was as a physical metallurgist, and the reason that the *Titanic* sank was hydrogen embrittlement. The problem with pipelines and steel is the hydrogen diffuses into it and makes it brittle, and then it cracks. The maximum safe amount that the most ambitious people believe you could blend hydrogen into gas is at about a ratio of 20 per cent, but that is not a lot of emissions reduction. And the other reality is for every one unit of clean electricity that Andrew and his friends generate, if you make it into hydrogen and then try to make it into heat, only about a half, or less, of that electricity makes it as heat. If you use Andrew's electricity to run a heat pump, 300 or 400 per cent of that electricity becomes heat. Hydrogen is never going to compete competitively with electrified heat pumps at the end use. And this is why we can no longer think of the infrastructure side of this as the generators and the lines. You have to think the infrastructure now goes all the way through to a Victorian citizen's living room. And we need to start thinking about how we are going to finance, especially for those low-income households, those heat pumps and end uses in similar ways that we finance infrastructure. That is the only way we are going to get to where we need to in the time frame required.

**Prof. BLAKERS**: I will just add one point: Victoria is not leading the way in any way, shape or form. South Australia, which is right next door—

**Ms TAYLOR**: Let us agree to disagree.

**Prof. BLAKERS**: No, South Australia, right next door, has 70 per cent solar and wind. Now, that is globally leading. Victoria is nowhere near South Australia, and there is no reason it should not be.

**Ms TAYLOR**: Well, thanks for the criticism, but anyway! I think you might want to have a bit of discussion with Lily D'Ambrosio about that and how you are comparing across the board. But anyway, when it comes to the heat pumps—and I am genuinely interested because I know we have got an investigation into that; I mean, I am not the minister, so I will not speak to that—what are the pros and cons? I just want to understand the challenges and how you overcome them with heat pumps—with different weather and extenuating circumstances.

**Dr GRIFFITH**: Despite what Victorians think, you have quite a mild climate globally. The coefficient of performance, or how well a heat pump works, is a function of temperature. Your climate is mild, so even in Victoria with a modern Korean or Japanese heat pump you will get COPs of three or four throughout the year. That means one unit of electricity goes in, and three or four units of heat come out. So you do not have a

climate barrier. They are a marginally higher cost up-front. We have not a sufficiently large workforce, so where we are stuck is in the workforce development. There are not enough tradies who want to do this and take the responsibilities. When you can find a tradie who will do it and you install that heat pump, you start immediately seeing energy savings month to month if you consider your electricity to your natural gas. But honestly the barriers are cultural and the barriers are workforce development; they are not economic and they not technical.

**Ms TAYLOR**: Interesting. I only had two questions, so I will leave it there for now.

**The ACTING CHAIR**: Thanks, Nina. Mrs McArthur, would you like to ask a couple of questions?

**Mrs McARTHUR**: Thank you, Chair. Thank you, gentlemen. I have got to take exception with a couple of your comments, which are that farmers would rapidly take up your option of extra money if they did have a transmission line over their property. I do not know how many farmers you have spoken to on the western Victorian transmission line project and anywhere else that might be proposed, but I can assure you it is not money that is driving farmers and their opposition—or the community's or the environmentalists'—it is the aesthetics and the imposition of overhead transmission lines. And I do not know how experts could possibly suggest that we can have green power without green transmission.

**The ACTING CHAIR**: Bev, sorry, I will have to bring you to a question, please.

**Mrs McARTHUR**: So I reject your notion that the costs are so much greater, because the triple bottom line costing has never been done on underground transmission over a 100-year period. So would you like to comment on your experience of dealing with farmers or anybody else in the communities that do not want overhead transmission lines?

**Prof. BLAKERS**: Well, my suggestion would be that we do an experiment—for example, that we do offer a bunch of farmers wind tower turbine prices for each hosted transmission tower and then also offer them the possibility of no compensation, but we will bury it, and then just see what they choose. So there is no need to speculate. We can just do the experiment and find out.

**Dr GRIFFITH**: I think if we are looking for ways we can succeed, rather than barriers, we can also recycle existing corridors of transmission that come from existing fossil generation. There is other fossil infrastructure, including coal rail lines for feeding those coal stations, including natural gas pipelines and the land that they take up, and we could utilise a lot of these corridors in clever ways. So I also remember that very, very likely half of the load growth in electrification will be serviced by rooftop solar, which requires no transmission infrastructure at all.

**The ACTING CHAIR**: Thank you very much. Bev, a follow-up question?

**Mrs McARTHUR**: Thank you, Chair. I notice your emphasis has been on switching households to renewables, but as we heard yesterday, there are many industries that cannot immediately switch to electricity to produce the products that they need very intense heat for. So how do you propose that industry switches to renewables?

**Dr GRIFFITH**: Like Andrew, I think the emphasis on electrifying the things that we can this decade and providing it with renewables, meaning our small businesses and our households, is for the pragmatic reason that the technologies that are substitutes for those heavy industrial processes, namely steel and cement—remember that aluminium is already all electrified as a process, for the large part—will buy us a little bit of time. One of my professors at MIT in fact started a company called Boston Metal that is a 100 per cent electric pathway to steel. It is an electrochemical pathway. It uses 25 per cent less energy than the existing pathways. Half of the cost of steel is energy, so this is going to be a cheaper pathway to cheaper steel, driven by Australia's profligate, cheap solar and wind.

I think we have solutions like that that are coming—five to 10 years out—for these industries, and I think the climate anxiety about making emission reductions now is to do the things we can do now and buy us enough time so that we can invest in those technologies to decarbonise industry next decade.

**Mrs McARTHUR**: I think we are only allowed two questions, Chair.

**The ACTING CHAIR**: Come back to it if you want a further question, Mrs McArthur, later on. Dr Ratnam, would you like to ask a couple of questions?

**Dr RATNAM**: Thank you very much, Chair. Thank you, Dr Griffith and Professor Blakers, for your evidence, both here and in written form, and all your work in this area. It is very inspiring and hopeful. I just want to take up one of the points that was raised before about transmission infrastructure, so following up on the conversation, Dr Blakers, about potentially a compensation scheme helping with some of the opposition that we have seen. In your submission you also talk about government's role in accelerating or amplifying the transmission capacity that we have, that being one of the barriers to a faster uptake of renewables or distribution of renewables. Could you expand on that a little bit in terms of what you think the Victorian government's role could be? What could it be doing more of to accelerate that investment in transmission infrastructure?

**Prof. BLAKERS**: In a nutshell, dump the RIT-T, which is the federally mandated test for the economics of a transmission system. Victoria just needs to tell the federal government to go away and to do it itself. Victoria can get the approvals five times faster if it just says, 'We're going to just do this'. It is somewhat equivalent to the NBN. After a while the government just said, 'Let's stop using bits of copper wire here and there; let's just put in a national broadband network'. What we need is a national transmission network. You know, basically it is the same as building freeways, building inland rail, building NTN or building NBN. Just do it.

**Dr RATNAM**: Can I ask on that point—you said dump that test; what is that test doing at the moment?

**Prof. BLAKERS**: It is slowing things down basically. It is a backward-looking test, which is totally inappropriate for fast-moving solar and wind transmission. It is appropriate for a coal system where almost nothing changes from decade to decade. It is way past being fit for purpose. Victoria just needs to go it alone.

**Dr RATNAM**: Thank you for that suggestion. Can I also ask about the way the generation, transmission and distribution networks operate? Because we have got quite a privatised system, which has kind of been a legacy now for decades in Victoria and right across Australia and the world, which is proving challenging for the faster acceleration of renewables. Have you done any work on any improvements in the regulatory environment that you think could help with that, or do we just work with this kind of privatised system? What is the solution there?

**Dr GRIFFITH**: I will let Andrew chime in after my comments on the transmission. Remember the highest cost component of the electricity part of our energy system is the distribution grid now, so the poles and wires to get to the homes are close to half of the cost of electricity. This is why rooftop solar is cheaper in every market in Australia, because it does not have to have that cost. Now, that sunk cost was once owned by the Australian people. You could say that we are now going to regret the late 1990s, early 2000s privatisation of those distribution grids. We gold plated them, increasing their price, and we have now motivated the incumbent players who own that infrastructure to charge for every electron going backwards and forwards. As I told you, in this romance novel of Victorian decarbonisation you are going to need 250 to 300 per cent more electricity moving over those distribution wires. If we are charging the same distribution cost for all of those that we are for the existing grid, that is going to ruin the economics. There is enough capacity on the local distribution grid to run all of those electrons and more, with appropriate digital management. So we are not constrained—it can handle it; it will handle it—but we could ruin the economics unless we change the rules of the distribution grid: we make it bidirectional and we make sure that households have something like equal rights to generators on the grid. Without this the savings will not be accrued by communities and households; they will go to the existing players who have been granted a monopoly.

**Prof. BLAKERS**: For the high-voltage transmission from western Victoria or the pumped hydro in north-east Victoria, for example, you can have a public monopoly like the NBN or you can have a regulated private monopoly like we have now. Either can work with proper oversight. But the last thing we need is to think about it and think about it and then do nothing. Let's just get on with it.

**Dr RATNAM**: Thank you very much. Can I ask one quick question? Is that okay, Clifford?

**The ACTING CHAIR**: I might come back to you. I did say two questions.

**Dr RATNAM**: Sure. No problem.

**The ACTING CHAIR**: Mr Grimley asked for one more question. I am sure we will be able to fit it in.

**Mr GRIMLEY**: Thanks, Acting Chair. My question was actually dealt with previously, so I am happy to divert. Thank you.

**The ACTING CHAIR**: Okay. Well, then, I will go to you, Sam, because you are the only one that has asked for a question.

**Dr RATNAM**: Thank you very much.

**The ACTING CHAIR**: Unless Bev wants another one, but I will come back to her.

**Dr RATNAM**: We have heard over the last day of our hearings a lot from the fossil fuel industry, actually yesterday, who were often referring to the net zero emissions targets as in some way—and I am paraphrasing here—creating a space for fossil fuels to still have a future in a renewable economy, saying that the net zero emissions plan does not mean that they do not have a role. I noted in your submission, Professor Blakers, you talk about the net zero plan being a distraction from the main game and how we should be thinking about deproduction. Can you talk to us a little bit about what those kinds of targets are doing for our acceleration of renewable energy and what we should be focusing on if we are actually keeping our eye on trying to keep our global temperature rise from hitting more than 1.5 degrees?

**Prof. BLAKERS**: Okay. Talking on and on about 2050 is irrelevant. You need to talk on and on about 2030 and 2025. You need hard targets, and in my view the number one problem is transmission. Number two is also transmission and number three is also transmission. Everything else is second order—helping distribution systems adapt, putting more solar on the rooftop, getting electric vehicles. But for the next five years it is transmission, transmission, transmission, and then below that comes push electric vehicles, ban gas heaters and a few other things to get us on track to a 50 per cent reduction in 2030. I mean, there is no reason at all that Victoria, which is going so slowly, cannot do what South Australia has done. South Australia often runs at 100 per cent solar and wind for a day—no hydro even, just solar and wind. Victoria is half that at best, so Victoria needs to go and look at what is happening in South Australia and repeat.

**Dr GRIFFITH**: I would like to add a little bit of history on the origin of the net zero conversation. Starting in the early 2000s there was the idea that we could create negative emissions by using, for example, bioenergy and sequestering the carbon. Because of failures elsewhere in the IPCC process, all of the countries, including Australia, that had strong fossil interests overlobbied for that to be included. That is why we have net zero targets, but there are multiple people who would like the net zero. The IPCC would like it for actual carbon drawdown, because they need 10 gigatons of negative emissions per year after the mid-century to hit any target like 1.5 to 2 degrees. Ten gigatons of negative emissions is an industry as big as all of the fossil fuel industries in the world today, which pull out of the ground 10 gigatons of fossil fuels—but putting it back in. That is not going to happen. The fossil fuel industry now believes that those negative emissions are also theirs to continue their game. So there are two people arguing for this, and it does not add up to any of the climate targets.

In reality you need to be close to zero—just plain old zero—emissions by 2035; 2040 if you wish to go close to 1.5 and zero emissions by 2050 if you want to go close to 2. That is how we got to the place where it is in the conversation, but it is being used very deceitfully by the fossil fuel industry, so you have got to do it. I do not think we can do anything with priority over anything else. So I agree with Professor Blakers that you need transmission, transmission, transmission, but if we wait one decade to start decarbonising the demand-side machines, then we are also going to miss our window. So we need to be doing the transmission, transmission, transmission at the same time as doing the electrification, electrification, electrification. Partly that is just the classic story of supply must equal demand, so at the time we are growing all of this supply on that transmission we need to be changing the demand to electricity to make it happen. So yes, and—we need to do both of these things with the highest possible priority. And the real time lines are exactly that—2025, 2030. At least 50 per cent reductions by 2030; do better by 2035.

But if I can do one quick plea for Australia's role in this: we have the easiest path of any nation in the world, absolutely. We have the best wind, we have the best solar, we have had the rooftop solar revolution, we have a trained workforce and we are a relatively wealthy country. We could increase the ambition of all of the world on climate by being the country that goes fast and proves the positive economics at household, at community and at state level to the rest of the world. I see us as having responsibility, partly because we have been such a

net exporter of fossil fuels historically, to go first, go harder and go faster. It will save us more money sooner, but it will also increase ambition globally for these critical climate targets.

**The ACTING CHAIR**: Thanks very much, Dr Griffith. We are running out of time now, so unless Bev has got an urgent one, I would like to ask one question myself. I just wanted to ask about transmission. You are saying that this is essential, and we have got a privatised system that we were talking about and several problems that have been identified. Would it be better if there was like an NBN or a public authority that took over the planning of transmission in the short term and really got started on that rather than leaving it to try to balance all these competing interests at the moment?

**Prof. BLAKERS**: The best system is the one for which a decision can be made this year. So just decide: we are going to continue to regulate a monopoly or we are going to do a Victorian version of NBN, so to speak—as long as we make the decision and then just go and do it.

**The ACTING CHAIR**: All right. Thank you. Bev, do you want to ask anything?

**Mrs McARTHUR**: Yes, thank you. I notice Professor Blakers has trees in his background. I wonder if he knows how many millions of trees are going to be wiped out in the western Victorian transmission project. One whole 35-kilometre biolink will be wiped out for a start, for which 45 farmers contributed their land.

**The ACTING CHAIR**: Let us quickly put that to a question.

**Mrs McARTHUR**: Would Professor Blakers and Dr Griffith come on a tour with Mr Grimley and I along the route—

**The ACTING CHAIR**: No, thanks. Sorry, Beverley, no—

**Prof. BLAKERS**: I accept your offer. I just toured regional Victoria and I loved it, and I would love to come back to it.

**The ACTING CHAIR**: That is something you can work out privately. Thank you very much. I want to thank the witnesses very much for their contributions today. And thank you also to the committee.

**Witnesses withdrew.**