Darwin – Tim Forcey

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Speaker: Tim Forcey

Hon. Justice Rachel Pepper: Welcome to day two of the second round of the consultations, the public hearings in Darwin. I omitted to do this yesterday, for which I apologise, but I wish to acknowledge the traditional owners of the land upon which we meet today, the Larrakia people. I pay my respects to their owner's past, present and future.

Tim Forcey: Good morning.

Hon. Justice Rachel Pepper: Thank you very much.

If you could please ... and again I do thank you for your patience, as I said we will just power through you will not be in any way short-changed time.

If you could please state your name and if you're appearing on behalf of an organisation, who that organisation is, if not, that's fine.

Tim Forcey: Good morning. My name's Tim Forcey. And I'm here to talk thought the information contained in a couple of reports that I was co-author at the University of Melbourne. So that's what I'll be talking about today. Firstly ...

Hon. Justice Rachel Pepper: And for those of us that don't know, what's your background?

Tim Forcey: Yes, I'll hit the background here.

I trained as a chemical engineer and worked for 30 years in the petro-chemical, oil and gas industries for companies such as ExxonMobil, BHP and Jemena. As those companies I performed such roles as leading engineering teams to design LNG plants, overseeing multi-billion dollar facilities of the Bass Strait oil and gas operations down Victoria, and I've acted as Commercial Manager of the Queensland gas pipeline.

Also from 2010 to 2012 I worked at the Australian Energy Market Operator known as AEMO, where I was the gas principle responsible for delivering the annual Gas Statement of Opportunities.

From 2013 up to, and including, this year I have acted casually as an energy researcher with the University of Melbourne. I have authored or co-authored seven major research reports that have covered aspects of gas, electricity, renewable energy, fuel-switching, energy efficiency and energy storage.

Today I will present information contained in the two most recent reports.

The second report shown on the right-hand side of this slide covering methane emissions is already been submitted to the inquiry. So I'll come to back to methane emissions later.

But first I would like to cover the first report shown. Which was published just recently on the 18th May.

In that we investigate gas supply and demand in the Eastern Australian gas market. The report is entitled 'A Short-Lived Gas Shortfall: A review of AEMO's warning of gas supply shortfalls.' My co-author there is Dylan McConnell of University of Melbourne.

Back on the 9th March this year, AEMO published its most recent statement of opportunities. In that report AEMO cautioned that within 18 months shortfalls could occur in the Eastern Australia, either in the supply of gas or in the supply of electricity generated by burning gas. AEMO suggested solutions to these potential energy shortfalls, these included construction of new pipelines such as from the Northern Territory, or the development of new coal seam gas fields such as Narrabri, New South Wales.

This warning of gas shortfalls was heard right up to the Prime Minister who, very quickly, in April announced plans to implement the Australian Domestic Gas Security Mechanism. This was to allow the government to impose LNG gas export controls when there is a gas supply shortfall in the domestic market.

The Prime Minister also recognised that Eastern Australian wholesale gas prices are at historically high levels, as they are now linked to international prices.

Our report investigated AEMO's claims. We found that, though in Eastern Australia there is a shortage of cheap gas, a gas supply shortfall is unlikely to occur.

Why is gas in Eastern Australia now expensive?

We found that the former gas buyer's market that prevailed in Eastern Australia has shifted to become a seller's market where before the wholesale gas price had been nearly the cheapest in the developed world, at about three or four dollars per a gigajoule. Today it is nearly the most expensive in the developed world, and offers to gas buyers prices up to 20 dollars a gigajoule.

These high gas prices are a result of the Eastern Australian gas market being linked to overseas benchmarks, overbuilding of gas export capacity with contractual export over commitments. And opaque gas market and opaque gas producer behaviour, and the high costs of producing unconventional gas, now estimated to cost around seven dollars per gigajoule to develop. This excludes pipeline transportation costs.

Given these factors a return to cheap gas in Eastern Australia is unlikely.

But what about AEMO's announcement of impending gas supply shortfalls?

We found that the size of AEMO's forecast shortfall was very small, amounting to no more than around 0.2% of annual supply of either gas or electricity. The scale of that is represented in this pie chart, with the potential of gas supply shortfall represented by the small black slither.

We found that even this small gas supply shortfall is unlikely to occur. For a number of reasons. First, the rapid rise in the price of both gas and electricity in Eastern Australia is reducing industrial activity. Industrial decline will reduce energy demand by an amount far larger than AEMO's forecast gas supply gap.

Indeed, only 11 days after announcing its supply gap concerns, AEMO essentially closed the gap when it published on its website updated lower electricity demand forecast.

In addition to this destruction of industrial energy demand, other reasons that gas supply shortfalls are unlikely to include, include the reasons that gas supply shortfalls are unlikely to occur include a rapid increase in the amount of electricity generated by renewable sources, wind and solar, which is now available at lower cost than the electricity that can be produced by burning gas.

Another reason. A new focus on market-driven electricity demand response mechanisms whereby electricity demand can be reduced during critical times with customers compensated for reducing their demand.

And another reason. Gas customers are choosing to economically fuel-switch away from gas, to using more economic energy sources such as heat pumps.

Given the significance of our findings, it was necessary that we challenge AEMO's urgent warning of shortfalls, and that we challenge AEMO's suggested solutions; new pipelines and new gas fields. Solutions that focus only on the gas supply side of Australia's energy equation.

We found that AEMO's sent the wrong message when focusing attention on a very small, very unlikely and ultimately short-lived gas supply shortfall concern.

Furthermore, AEMO-suggested new pipelines and new expensive gas fields are false solutions. These massive fossil energy infrastructure investments are not needed to address a supply shortfall that is not likely to occur.

Furthermore, such investments in gas infrastructure will not reduce the wholesale price of domestic gas. New gas sources including unconventional gas sources here in the Norther Territory are expensive to produce, and in any case in the seller's market that now prevails, domestic wholesale gas prices remain linked to international benchmarks.

AEMO may have heard our message, because less than a month after we published our report AEMO, now under their management of new CEO, declared that revised modelling did not indicate a gas supply shortfall, and gas supply production would be sufficient to meet gas demand, and there was no threat of gas supply shortfalls causing electricity blackouts.

So let me summarise the domestic gas demand situation in Eastern Australia. And here I'm talking about ... not talking about the gas exported overseas as LNG, I'm just talking about the gas used right in Eastern Australia.

The demand for gas in Eastern Australia peaked in 2012, and by 2016 it had fallen by 16%. AEMO now forecast gas demand will fall by another 9% by 2020, to reach a level just 74% of that 2012 peak.

The demand for gas is declining in every sector. Less gas is used in buildings for heating, hot water and cooking. Less gas is used in industry, and less gas is being used each year to generate electricity.

One very significant finding of our research is that, if you're looking for electricity, it is now cheap to go out and build a brand new wind or solar PV facility and to collect the electricity from that. That is cheaper than feeding high price gas into existing gas-fired power stations in Eastern Australia.

So you might ask why is gas still being fed into gas-fired power stations in Eastern Australia. Well, clearly as yet not enough wind and solar has been built. But across Eastern Australia we do see a massive construction wave of renewables, now, thanks to the various renewable energy targets at the territory, state and federal level. But if these high gas prices hold, as I expect

they will, we will continue to see beyond that more and more renewable energy development deployed until very little gas is burned to generate electricity.

So that is the national electricity market, what about on the home front? Where for example where I just came from in Melvin, many people who's used gas for decades to heat their water and living spaces and for cooking.

Well here's another remarkable finding from the University of Melbourne, we found that instead of using gas, it can be far cheaper for many Australians to heat their homes using their air conditioners. At home, where I live with my wife in Sandringham, Victoria, we now use our reverse cycle air conditioner to heat our house at a cost just 1/3 of what it use to cost us to heat with gas. 1/3.

Our study found that an average home in Melbourne could save over $600 a year by heating with their air conditioners. We found that where Victorians collectively to heat with air conditioners that they already own but do not use in the winter time. Collectively these Victorians could save a quarter of a billion of dollars a year on their energy costs. This might be the biggest consumer win ever. But Australians remain unaware that reverse cycle air conditioners, which are more properly known as heat pumps in other parts of the world, can be cheap to operate. Because heat pumps harvest free renewable ambient heat from the air outside your home.

This slide shows that if you own this particular heat pump, when you buy one unit of electricity to drive the compressor, the fans and the electrical controls in the device, you get six units of heat coming out of it. Those five extra units of heat are drawn from the thin air outside your house by the magic of the refringent cycle contained within the heat pump. Now I've made dozens of public presentations on this concept so I know it can be hard for folks to get their head around the idea that you can get heat out of what is basically a refrigerator running in reverse but the idea is catching on.

Certainly, even in Melbourne there are many new homes being built that instead of having two separate heating and cooling systems, the gas heaters and then the evaporative cooling, the developers are finding it makes more sense to just install air conditioners. Since this is a scientific panel, this next diagram might provide a bit more technical insight to these comparative economics. This diagram shows that, over on the left side there, to produce 10 megajoules of useful heat for your home with a docked gas system you might have to buy 33 megajoules of gas and plus some electricity also to run the blower. Where as using the heat pump to produce the exact same amount of heat you may only need to buy two and a half megajoules of energy in the form of electricity. So two and a half megajoules versus thirty-three.

This is a factor of 13 times less energy you have to buy and since gas is not 1/13 a cost of electricity on a per mega joule basis, hopefully this drawing helps describe why in our home the heating bill is now 1/3 of what it use to be. And let's not forget that these days in many homes people are generating their own electricity with rooftop solar PV panels. And these people are asking, "What can I do with all this electricity?" I don't want to have to put it back onto the grid." So a heat pump is a perfect fit. You can generate your own electricity and heat your home. Not only by day, but even by night as home batteries such as Tesla power wall shown here, become more common place.

Heat pumps are also a good fit for heating water and over at the Mercure hotel by the airport, that's how the water was heated there in some of the units with a heat pump. This shows a heat pump and Australians, some circumstances if you install a hot water heat pump as we did at our home earlier this year. You can earn renewable energy certificates just the same as you would as if you were installing a set of rooftop solar panels. In the media we often hear about home owners thinking about leaving the electricity grid because people hate their electricity companies but what is actually happening as you could see at this Facebook group, "My efficient electric home," is that people are leaving the gas grid. Disconnecting from gas and having their gas metres taken away.

A study about the Alternative Technology Association found there is no longer any economic need for any new home or any new suburb anywhere in Australia to be connected to the gas grid. No economic need. Taking that advice it was reported that Riverview, a suburb starveling the ACT New South Wales border, that whole suburb will not be connected to the gas grid. The prevalence now of the efficient heat pumps mean that at homes across Australia, gas is being very uneconomically and very unproductively used. You could even say wasted. When this highly valued gas could be productively used elsewhere. Governments and other stake holders are interested in making gas more available say for industrial use. They could inform people of these home economics so that less gas is wasted in homes and other buildings.

At the University of Melbourne our research found that if less gas were wasted in Australian buildings, over time, enough gas could be freed up to nearly supply all of our future industrial demand for gas. Around the world in places like China, Europe, New York, Japan, governments are subsidising building managers and home owners to heat with heat pumps and move away from heating with gas, oil or coal. In Australia there are no such governments end up for space heating with heat pumps. And in fact, there have been rules in place to favour the use of gas over heat pumps. Perverse incentives.

Like homes, some industries can also economically switch away from gas to renewable alternatives. It was recently announced the vegetable grower

Nectar Farms was looking into energy options for it's new Glasshouse facilities in Victoria. Nectar Farms opted not only for wind and solar PV to meet their electricity needs but also industrial scale heat pumps to provide heat. A report by IT Power for the Australian renewable energy agency shown here describes how gas used in industry could be replaced by heat pumps and other sources of renewable energy.

Now I'd like to switch from talking about gas to man and talk about gas reserves in eastern Australia because another reason that a gas supply short falls unlikely is that there's plenty of gas in the ground across eastern Australia. It's not cheap to develop but there's plenty of it. This chart graphically compares the eastern Australian gas reserves and resources. First, on the left hand side it shows the volume of gas that will be produced in eastern Australia over the next 20 years for domestic and export LNG purposes. This is about 40,000 petajoules of gas, 20 years worth.

That's a lot of gas but beyond that first 40,000 petajoules, there's a large yellow block shown on this chart depicting a further 220,000 petajoules of reserves and resources that have been identified in east Australia and reported by the Australian Energy Market Operator. Five and a half times as much as it will be produced over the next 20 years. So all this gas could take us out to 130 years from now at currents rates of LNG gas export and domestic gas use. This is the gas identified just in eastern Australia, defined as Queensland, New South Wales, Victoria, Tasmania, south Australia. There's no northern territory gas included in this chart.

Now there are different ways to categorise gas reserves. Gas reserves can be classed into prude reserves probable reserves, continued resources, perspective resources. With each grade indicating greater uncertainty about the existence and producibility of the gas. With the next chart, I'll drop off a large chunk of gas. I'll drop off the most uncertain of these categories, the volume of gas class as perspective resources. This leaves me with this chart, which is a more detailed gas cost supply curve. This is dated from my email but as far as I know we are the first to plot it in this way so you may not have seen it before.

This chart quantifies and ranks on a production cost basis. All the reserves and contentious resources for all the eastern Australian gas fields. As you go across and you see the different thicknesses of the bars, that represents the different volumes of gas that's been identified for all those different resources. At the lower end of the cross scale on this chart for example, you can see best straight gas at a production cost of just $2.70 per gigajoule but after that as we move across 20 years worth of gas, that 40,000 petajoules, we move up to gas that costs around $5.40 per gigajoule to produce. And beyond that on this chart there's still another 35 years worth of gas with production cost rising up to $9 per gigajoule.

This chart shows eastern Australian gas only, no northern territory gas, however, AEMO and their consultants did peg northern territory gas at a production cost of around $6.50 per gigajoule but if you wanted to send northern territory gas to the eastern Australian gas market, of course you would have to add on the cost of transportation by pipeline. This would increase the cost of northern territory gas delivered to the eastern Australian market by another few dollars per gigajoule.

The point of this chart is that eastern Australia already has stacks of gas. Far more than will be produced in the next 20 years or even the next 40 year. Yes, the production cost of some of that gas is said to be high in the same league as the production cost of northern territory gas but it does raise the question, with all this gas already identified in eastern Australia, how can anyone possibly be talking about a supply short fall? Where's all the gas hiding? A place to look on this chart is that the gas identified as being under the control of Shell Arrow. We know of the six energy export trains operating today at Gladstone, Queensland. Shell bought two of those when they bought the company QGC but we might forget that before this Shell Arrow had identified enough gas reserves, they had plans in place, they had regulatory approval to construct another four LNG trans in Gladston, to bring the total to ten. The shale air gas makes up a large part of this missing gas. We don't hear too much from shale air about this gas. Although back in March and April when the subject of gas supplies was a hot topic right up the prime minister, Shale did come out and announce they would make some relatively small additional volumes of coal seam gas available from the Tipton Dan Dean and Ruby fields. So why is Shell just sitting on this gas? Shell is a global player in the gas industry and they would have a view as to when and where they can and can't make money by developing more gas fields even for domestic or export markets. Shell are aware of the current softness in the global gas market, and are content for most of this gas to remain in the ground for now. Developing it would only compromise their positions elsewhere in the global LNG market. But this Shell controlled coalseam gas is a fairly obvious competitor, versus northern territory gas, should such a contest ever arise.

I've been going on for a while here about the eastern Australian gas and electricity markets. But one thing I noticed in this panel's intern report, is that the report seems to be silent on the topic of northern territory gas supplying the east coast market. I don't know why the intern report is silent. I don't think you should be silent on this topic because it sure is being talked about out there. For example, from the Australian financial review a few days ago, regarding Origin and Beetaloo Basin. I quote, "Origin energy could be sitting on a multi billion dollar gas resource in the northern territory several times the size of the northwest shelf, and with the potential to keep the energy short, eastern states markets well supplied for years." And just yesterday there was a headline in the Alice Springs News online saying " NT gas could bring down eastern Australian energy prices." So following what you've heard me say today and what you've heard others say, I think the

topic of NT gas supplying the eastern states should be discussed in your final report.

At the University of Melbourne we found there will not be gas short falls in eastern Australia. The Australia energy market operator, now under the management of a new CEO, has backed away from the earlier position. But nearly every day, I still see headlines about the looming east cost energy shortages. This story is just too good to kill. So I think the word shortage and short fall will continue to be popular in the media, despite our best efforts at shedding some light on the topic.

That concludes my prepared remarks about the eastern Australian gas and electricity markets, of course I'm happy to take questions on that later. But now I'll move on to my second University of Melbourne research topic for today, "Monitoring and Quantifying Methane Emissions from Oil and Gas production." As I mentioned at the start, back in October, we published this report entitled "A Review of Current and Future Methane Admissions from Australian Unconventional Oil and Gas Production." A few months ago I submitted this report to the inquiry and I can see in your intern report that some of the points we made have been taken on board, so I thank you for that. Although climate action in the United States has recently hit a rough spot, the importance of getting emissions of the powerful greenhouse gas Methane under control, was emphasised only just a year ago ... Around a year ago in March, 2016 by U.S. president, Obama and Canadian prime minister, Justin Trudeau. The year before that, the Obama administration had announced a new goal to cut Methane emissions from the oil and gas sector by 40 to 45 percent.

I won't go through all the findings of our University of Melbourne review because I think the panels have crossed those. But one key point is that here in Australia, Methane emissions from unconventional gas production are not being properly counted. An example is from the coal seam gas fields in Queensland. In their environmental affects statements, the proponents said the CSG LNG projects claim, "They would hardly emit any Methane at all." Perhaps as little as just 0.1 percent of production. However, there were never any regulations put in place to hold the CSG LNG industry to those claims as we shall see.

Briefly let me classify Methane emissions form oil and gas production into three types. First, there's the continuous emissions from gas industry infrastructure. Infrastructure such as well as pipelines and processing planes. Second, there are intermittent emissions from infrastructure. And lastly, there's the Methane that comes bubbling up out of the ground at some distance away from any infrastructure. So, I'll go through all three of these.

Continuous admissions from infrastructure occur where the infrastructure has been intentionally designed to vent Methane continuously. An example

are vent lines on coal seam gas water pipelines in Queensland. In February, I hired from Singapore, a sophisticated infrared camera valued at around 137,000 dollars. And I travelled to the coal seam gas fields along with an ABC journalist to get some images of these continuous vents. Of course, the difficulty with Methane is it is a colourless and odourless chemical that is lighter than air. So, you can have volumes of Methane pouring from these vents and you would pass by and not even know. However, with this sophisticated, military grade camera, you can produce a visible image of this invisible gas. And so that's what you see on this slide. Over to the left is the visual image of event stacked. And over to the right is the infrared image with the Methane coming out of that vent.

In their environmental impact statements, the CSG producers committed to zero venting of Methane. But that is not what we see. There are thousands of these vents already in Queensland and there will be thousands more. The quantity of Methane emanating from these vents has never been declared by anybody. We do know that a basis for a fisher reporting of Methane emissions from the coal seam gas industry, is to use factors and assumptions from the U.S. conventional gas industry, which are known to be not relevant. These CSG water pipelines events, can I say, are quite unconventional. And so we conclude that these vent emissions, as one example, are not accounted for. But you could say, that's coal seam gas. Here in the northern territory we're talking about shale gas, so it'll be different. So perhaps the most important learning here is not so much about Methane, but rather more about what is said by project proponents in environmental impact statements and then what actually happens in the field. And the community trust that is built or lost when commitments made during the project approval phase, later are not fulfilled.

Another category of emissions are intermittent emissions from infrastructure. You can see it a little bit better on that one. Again we have a visual image, and then an infrared image showing the Methane release. Intermittent emissions from infrastructure. An example here would be where the gas company must for any number of reasons, operational or maintenance reasons, depressurize a pipeline. Since these emissions are intermittent, it can be challenging for a regulating agency to know that emissions of this invisible gas are occurring. Or to quantify how much gas was emitted. Locals in the Queensland CSG fields, farmers, they do report very loud, high pitch noises or roaring sounds coming from gas field infrastructure. Sometimes these noises occur at night. And let me remind that the CSG LNG proponents said there would zero venting of Methane.

The images you see here are from North Dakota, where the community has more ready access to these special infrared cameras. Here in Australia, you can imagine that if a farmer from Queensland rang me up about a screaming pipeline blow down event, it might take me a while to rustle up the camera from Singapore, get it clear of customs, and on a plane, by which time the event would be concluded. So this can make identification and

quantification of these intermittent releases challenging for any independent observer in Australia.

A third type of Methane emissions ... You see here is where the Methane starts to bubble up out of the ground kilometres away from any gas industry infrastructure. These can be referred to as migratory emissions because the Methane gas migrates from some disturbance underground until it finds its way to the surface and up into our atmosphere. Since Methane is a colourless and odourless chemical, a passerby is most likely to spot these emissions coming out of a body of water. Such as the Condamine River you see here. Methane coming up out of dry land, you would probably hardly ever notice. Recently, the CSIRO, working as part of the gas industry funded Jazeera lines, published a fact sheet that stated amongst most other things that quote, "CSG industry activity in production fields five to six kilometres away has reduced pressure in the coal seams, leading to possible up-dip flow of gas into the network of fractures and thereby into the Condamine River." In another report written by my co-author and ex Shell geologist, Dimitri Lafleur, he notes that the aquitards, the clay layers that might seal off gas flow in the region of the Condamine River are thin or absent. So clearly this region should have been a geological no-go zone for the CSG industry. But instead, you will find thousands of gas wells there today.

In the past in Australia and also overseas, there has been much focus on the Methane emissions associated with improperly installed or failed well bores. In the USA, this interest has been because of the potential impact on wells drilled by land holders for their drinking water becoming contaminated with methane, and these concerns also exist in Australia.

This focus on wells also in Queensland around the start of the enormous CSG industry that we now see. The first infrastructure out in the field was the wells. So the wells, and the well completions, and well petek equipment, that's had a fair bit of scrutiny, but when you look at the actual Australian government reported methane emissions inventory, as my co-author Hugh Saddler did, it seems as if emissions from wells and well petek equipment is all that is reported. What about all of the other infrastructure and potential emission points as illustrated by this diagram?

Pipelines, water gathering lines, compressor stations, processing plants, all of that are potential sources of methane emissions either continuously or intermittently. If this panel has been through our Melbourne Uni report on methane emissions, I won't go through it again, but I encourage equal focus be put on all the gas industry infrastructure, not just the wells, the well pads, because all of it can be a source of methane emissions. All of it can be a source of the so-called super-emitters, which I'll talk about next.

So I have described some of the challenges for anyone trying to get on top of and anyone trying to stay on top of methane emissions from unconventional and gas production. Our University of Melbourne report

describes the various ways that researchers in North America are trying to develop methods. One you see in this slide, it illustrates how satellite data was used to identify a methane emission hot spot over the so-called four corners region of the United States. So basically, this methane hot spot could be seen from space. The four corners region of the United States is a location with coal mines, conventional oil and gas, shale oil and gas, and it is also the largest coal seam gas producing region in the world. A very interesting paper that was published after the cutoff date for our research, and so we didn't reference it in our paper, took a closer look at this four corners methane anomaly.

This paper, which I recommend to the panel, by Frankenburg et al, is entitled Airborne Methane Remote Measurements Reveal Heavy Tail Flux Distribution in the Four Corners Region. The researchers describe how they were able to instrument aircraft, fly over this region of interest, and with the sensing equipment on board, they were able not only to identify 250 individual methane plumes, but quite amazingly in my view, they were also able to quantify how much methane was being emitted in each of these locations. This was over an 80 by 40 kilometre area of land that they flew over and found the 250 individual methane plumes. Emissions that they were able to detect and quantify ranged from right down to just two kilogrammes per hour up to eight tonnes per hour. The researchers then went down onto the ground and they were able to confirm emission sources such as equipment at a well pad, a coal mine venting shaft, a well completion site, a gas processing plant, and so on through the list of 250.

One finding from this research, as was reflected in the title of the paper, is that the top down aerial surveys find a heavy tail distribution of emission sources. In other words, a small number of emission sources can emit a large amount of methane, and these have been dubbed the super-emitters. Some researchers have tried bottom up approaches where you try to measure how much methane is emitted from individual pipe fittings or gas fuelled instruments. This is useful date, but it is time consuming and a costly exercise, and the end result is that the auditor will never know if they have failed to detect large sources of emissions that might relate to just one particular, but rare, equipment failure such as a corroded pipeline, or one operational or maintenance activity that can cause a greater volume of methane to be emitted in a few hours that might emanate from some other pieces of infrastructure over its entire lifetime.

I know this panel's trying to work out what to report regarding methane emission measurement, regulations and monitoring, but I would expect future best practises will include some sort of routine and recurring airborne monitoring along the lines of what you see depicted here. Making the invisible visible is possible as methane detection and leak quantification technologies advance, but only if these technologies are actually brought to bear.

That's the end of my prepared remarks.

Hon. Justice Rachel Pepper: Thank you very much. Is it mister, doctor, professor Forcey?

Tim Forcey: Mr. Forcey.

Hon. Justice Rachel Pepper: Okay, thank you Mr. Forcey. Just a couple of comments.

Tim Forcey: I'm only a doctor on the radio when they ring up.

Hon. Justice Rachel Pepper: In relation to why the interim report's silent on the northern territory supplying the east coast gas market, strictly speaking, that's not within our terms of reference. However, it is one of the matters that ACIL Allen will be looking at as part of the consulting work that the panel has under-gauged them to take so that is why it is not currently in the interim report. That's apparent when you look at the scope of services for the economic impact modelling on appendix nine, page 147 of the report. That was the first comment. Second comment was I quite properly was corrected yesterday for selectively quoting from the CSIRO fact sheet in relation to methane seeps in the Condamine River and I think, with great respect, you have perhaps done the same thing. Indeed, you've taken one aspect of one dot point of the key points listed on the first page of that fact sheet and it does bear reading in its entirety.

Tim Forcey: Can I respond to those or?

Hon. Justice Rachel Pepper: Yes, please. No, go ahead.

Tim Forcey: Yeah, on the first one on the east coast market, yeah sitting down in Melbourne and having an eye on the energy situation down there we just hear and hear and hear how this northern territory gas is going to make everybody warmer in their houses and their bills will go down so, I think that when you look at social licence or economic justification for activities, I don't think you can be silent on it.

Hon. Justice Rachel Pepper: As I said, we are guided by our terms of reference.

Tim Forcey: And, yes, on the ... certainly I chopped out a paragraph from the CSIRO fact sheet and the key word there is possible, so they're saying that the-

Hon. Justice Rachel Pepper: May is the word they've used.

Tim Forcey: -and possible is in there as well.

Hon. Justice

Rachel Pepper: "Variation of problem on the Condamine River may be caused by," they then list three reasons. The last dot point says, CSIRO "Our research has found no evidence that these seeps have any adverse environmental impact on the planet or animal life at the river and its surroundings. To date there is no public health or safety risk caused by the methane concentrations measured in the area of these or any other seeps in the Surat basin that CSIRO has measured." Thank you.

Yes, Dr. Beck?

Dr Vaughan Beck AM: Thank you very much for your detailed presentation here today, most of which I have great sympathy and would agree with. I'd just like to make some observations. Firstly, just so I clarify, on the first slide you noted that you were an energy advisor, I'm just wondering are you here representing the MEI or Melbourne Energy Institute, or are you in your own capacity as an individual?

Tim Forcey: It's just in my own capacity because the University of Melbourne, you know, it was casual research so there'd be funding or an interest in some activity I could help out with so I would get involved with that and at the moment I'm not currently on a contract with Melbourne Uni. Don't know what might happen tomorrow but yeah, I am under instruction to not claim that I'm representing the University but they are happy for me to talk about papers that my name is on, otherwise how would I get that information out there?

Dr Vaughan Beck AM: I appreciate that clarification, thank you. Also, just for your information too, the section in the interim report on greenhouse gases was prepared by panel members, myself, and we also engaged Professor Sandra Kentish from the University of Melbourne and a former director of ... associate director I think she was, of the Melbourne Energy Institute. So there's that, just as the background. If I go in reverse order and talk firstly about methane emissions and then perhaps come back and talk a little bit some questions in relation to the gas markets. In the interim report, firstly I think you noted that there are many intermittent sources as well as more regular sources in the report, we have a report on our life cycle greenhouse gases so it does include both intermittent and regular sources. So it takes a life cycle and includes all of those particular sources. It also takes into account you mentioned the four corners regions, that particular emissions is also referenced in the report as well too, as well as referencing the MEI report that you mentioned.

So the report does cover those sources that you identified and some of the issues and the other one that's particularly important is that you mentioned intermittent sources and the super emitters and that's also covered off in the report because we referenced the report by Littlefield 2017 from the National Energy Technology Laboratory in the United States where they have actually characterised unassigned emissions, which they characterise as, in part, super emitters but a whole range of other potential sources. So those particular references used and it quotes emissions from gas fields in

the United States to be 1.7% of methane emissions and about 0.3% of that is associated with unassigned emissions.

So just to relate some of your commentary back to the interim report -

Tim Forcey: Can I respond to that or?

Dr Vaughan Beck AM: Pardon?

Hon. Justice Rachel Pepper: Yes please, please comment, yes.

Tim Forcey: One of the reasons for highlighting the intermittent and the continuous forms of the emissions is to, I'm thinking about the regulatory challenge that lies ahead for regulating methane emissions and also, I guess these sorts of things are being wrestled in North America where they do have some regulations in place.

Dr Vaughan Beck AM: Yes.

Tim Forcey: So it's just to make sure that whatever regulations are there in the future that they're, where there's two different types of emissions that there will be some that you're looking for that could be going continuously and others that may be more intermittent. So how do you capture both of those?

I noticed in the report you mentioned some work from the US in 2012 where they specifically talked about methane emissions you could have from completions, compressors and pneumatic controller storage tanks. So it's great that the US are getting across those four things but there is lots of different ways that methane can be emitted from oil and gas infrastructure. Those vents you saw on the water lines, did anybody else out of the coal and gas industry even know what they are about?

So to have, so that the challenge in the future will be for regulations that will cover everything regardless of whatever technology or new technologies that the oil and gas industry will come up with.

If you go down the prescriptive route and just look at completions, compressors, pneumatic, whatever, you'll probably miss something else that gets developed in terms of technology, so that was my reason for just emphasising those types of emissions.

And then, in terms of emissions calculations and you mentioned Sandra Kentish who I know, table 9.1, I'd like to request, is it possible to get more information about those numbers there? The basis for them? I've had a look at table 9.1 and some of the other figures and assumptions in the text around there, but I'm not able to reproduce those figures so I'm just wondering if, at some point in the future, if I could have access to some of

the underlying calculations there so I can try and check those or peer review them or reverse engineer them or whatever, I'm unable to do so.

Dr Vaughan Beck AM: Yeah, we're happy to do that. The basis of the calculations are detailed there so if you're having some issues, I'll only be too pleased to take you through them.

Tim Forcey: Yeah that would be good because there will be other assumptions what heating value did you use there or what composition did you use there or perhaps some of the figures, the calculational inputs were taken from some reference from somewhere so it would be useful to have that reference because that reference probably does go into more detail, so, yeah that would be great to be able to get that information.

Hon. Justice Rachel Pepper: I think they were derived from an article by Stone amongst others in 2016 and that's referenced in that footnote, 265 and it's also included I think in appendix, I'm not sure if it's appendix one, no it's not. So you'll find the reference to that article in the back of our report.

Tim Forcey: Yeah, I've been through that and I'm unable to get close to the numbers in that table, so -

Hon. Justice Rachel Pepper: We'll take that on board, thank you.

Tim Forcey: I would appreciate that. The calculations you can do on methane emissions that might potentially come from this activity in the Northern Territory, of course it's very easy to come up with some very big numbers because the gas reserve is potentially so large so what assumptions you make about how much of that gas is produced and then what your emissions rates are and then looking at the global warming potential of methane over a 20 year basis, you can come up with some very large numbers such as are in that table, but it's possible to come up with numbers that are even a lot larger where just the production from the Beetaloo Basin could be an extremely large fraction of Australia's total green house gas emissions.

And also, you could make comparisons between what might happen with the Beetaloo Basin and Northern Territory Gas versus the Adani Carmichael Coal Mine, which has a lot of public interest at the moment. People talk about the green house gas emissions when all that coal gets mined and burned. You could come up with much larger figures for the Northern Territory from these gas resources, so, that's something I would like to make sure that I understand the basis you've got there.

Dr Vaughan Beck AM: Also, just to clarify, in terms of regulations, there is a reference in the interim report to the use of the New Source Performance standards in the United States as an example of potential, best practise and where now, they have a request out for a response in terms of use of both base line

monitoring, which is noted in the report and also ongoing field monitoring to monitor actual performance, so that covers off some points that you were perhaps making in terms of best practise.

If I could now just turn attention back to the issue of the supply of gas and the price of gas. One issue just to clarify because I think it was one on the use of the gas supply cost curve, which you put up and I have seen that diagram before. I think that it references the AEMO report for the Gas Supply and an Opportunities Report 2017 if I recall and in that report, so that particular chart which you put up, referenced data and you compiled data from the AEMO.

Tim Forcey: Yeah, that's where the data comes from, sure.

Dr Vaughan Beck AM: Now, in the AEMO report of 2017, there is also a figure, which shows gas supply out to about 2034, 2040 and it's where, over that time period in that report, they predict an aggregate shortfall of I think 150 peta joules in the first segment of that time frame from about 2019 to about 2024. But that chart shows declining supply from various fields and out into the future there is other declines from other fields so it's an interesting point that I would like to raise with you that, on one hand you are extracting data from the AEMO report, it's giving that cost curve, which leads you to say there is plentiful supplies potentially, depending upon the cost. Yet, the original AEMO report, shows declining outcomes from various fields and does plot those potential shortfalls. And I appreciate what you said about the new incoming director of AEMO, she just arrived after the publication of that particular AEMO report. But, there is an interesting dichotomy there. So would you care to comment?

Tim Forcey: Yes I'm not sure that there is a dichotomy. One thing I should point out is that in June, AEMO published another document, which basically supersedes the gas statement that you're talking about, they call it the ESO, the Energy Supply Outlook I think it is, so that's in June, so I would recommend that to the panel to have a look at that. And that's where they basically retracted some of the positions from earlier.

What we said in our report, is that one of the dramas or problems or things that could be improved, is the basis on which AEMO does it's modelling, and I used to work there, I used to be the gas principal and for a long time, gas was not of a huge interest in AEMO, electricity was the thing, everybody was interested in electricity, gas not so much because gas was cheap and there was plenty of it and nobody was complaining so it kind of was on the back burner. Yes, AEMO had some statutory obligations to produce things like the gas statement on an annual basis. And so as good engineers do, you try to come up with some sort of a model to feed into this thing and come up with some statements you can make. Which, historically, were pretty bland because, you know, nobody saw any dramas. But the basis for the modelling that AEMO does, they go out to the gas industry and they ask the gas

industry, "Can you please provide this information, that information." So that would be were the gas, to a certain extent, that's where some of the gas reserves information comes from. They also go to consultants, like Core Energy, who will either be paying attention to what the gas companies are saying publicly or there may be other ways to come up with some figures. And so that's the basis of the reserves' information.

Yeah, one of the problems is we don't have any better. Like the Victorian Government, for example, doesn't really know how much gas is in the Bass Strait. I think you've got a important resource for the whole state, for the whole country, and you don't really know. I used to work with BHP. In the old days, BHP used to publish reserve information. But there becomes a point when companies get so big that any one little asset is no longer what they call, "Material to their overall position globally," and so they're no longer under any requirements to report information to, like The Securities and Exchange Commission in the United States, or whatever. So that information's not available.

Now I suppose that it's within the power of governments to try to find out more information about how, for example, how much gas is in the Bass Strait. So there is a lot of uncertainty around gas reserves. We quoted some folks in our paper, some industry analysts, who were saying that, "If you want better transparency on this sort of reserve information, you'll get it from Thailand, you'll get it from Malaysia, you'll get it from other countries. Whereas Australia, not so much." And again, part of the reason, you know, I'm not saying that anybody's evil here or anything. It's just part of the reason nobody cared in the past. But now I think there's real strong reason to care.

And there are powers that could be brought to bear, to get better information, so that AEMO can go do a proper job. Not only on reserves. Our reserves is one point, but then another one is the production rates. So again they'll go out to companies and say, "What do you think that gas plan will be producing ten years from now?" A number comes back. They stick that into their models, push a button, you get an answer. And then you might get a headline after that. But really I think there needs to be more scrutiny, better information coming into AEMO, better capability within AEMO to actually be able to process that, and then carefully to consider the messages you're going to put out to the public.

Dr Vaughan Beck AM: I would agree. And also, just note that it's also an issue of price as well, too. In terms of the potential availability. If I could just make one further point-

Hon. Justice Rachel Pepper: And final.

Dr Vaughan Beck AM: Yeah. In the dynamics between the gas and electricity market you've alluded to and that you've outlined some potential other sources where you might

be able to use electricity. But just in terms of the current situation, the Finkel Report does look at the dynamics between gas generation and for electricity and other forms of electricity, including renewables and coal. And over the period from now out to 2034, the supply of gas into the electricity market is projected to fall from about 6% down to about 3%. So there is a projected fall and that is looking at the dynamics between the various forms of energy. So gas is still seen to have a role in the marketplace for electricity generation. And a changing role, because its then seen in the report to be providing more of a peaking role rather than necessarily a base load. So its role is changing, it's diminishing, but there's still a significant role for potentially gas in the marketplace. Not assuming any market disruptions which can occur from new technologies.

Tim Forcey: Right. And so that's the last point. The disruptions possibly already happened. So my co-author, Dylan McConnell, is more the expert on this, but he's used the latest cost information with respect to renewables and energy storage for that matter. And so what were saying in our paper is we don't (...) We see the decline and the use of gas for electricity to fall even harder and faster than what is in the Finkel Report, because our report is based on more recent cost information.

If you're gonna use a lot of gas for electricity generation, that's gonna be more in your combined cycle or base load plants, and when they would run a large period of the time where their electricity on the market is expensive or cheap. We definitely see that falling away, because gas is just too expensive now to just keep burning in a power station. Well you know, when electricity prices go up and down you would not use it. So the volume of gas that's used for electricity generation, because it will come out of those areas first, gets really small. And now you are just down to peaking loads and in that situation, at the gas prices we have, you're even competing with diesel. So why bother to have a gas contract? And I think that's what their doing in South Australia. The equipment that's to be supplied by GE is initially a diesel generator. It can be converted to gas. Maybe it never will. It comes down to how often you think you're gonna use it. How much diesel you're gonna burn. And you might just say, "The heck with it. I won't bother with a gas contract. I'll just use diesel from time to time." Until you get to the point where the batteries become cheaper and cheaper and even the pumped hydro energy storage that's being talked about. And so the role for gas and the electricity generation pretty much disappears.

Dr Vaughan Beck AM: Yeah, well as-

Hon. Justice Rachel Pepper: Thank you.

Dr Vaughan Beck AM: As a difference of opinion-

Tim Forcey: There's new cost information, obviously, all the time on renewable energy and so people need to keep up with that.

Hon. Justice Rachel Pepper: Yeah, thank you. Thank you very much Mr.Forcey for presenting your detailed submission. I take it that we have your presentation? That's right?

Tim Forcey: Mm-hmm (affirmative)

Hon. Justice Rachel Pepper: We have your presentation?

Tim Forcey: Yeah, yeah sure-

Hon. Justice Rachel Pepper: Okay thank you-

Tim Forcey: Yes you do.

Hon. Justice Rachel Pepper: Thank you very much. There will be a short five minute, five minute only, break and we'll resume at ten past eleven. Thank you.