



## ***Darwin - Imperial Oil and Gas***

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***Darwin Convention Centre, Darwin***

***Speaker: Bruce McLeod***

Bruce McLeod: Good morning.

Hon. Justice Pepper: Good morning. If you could please state your name and who you're appearing on behalf of, thank you.

Bruce McLeod: Yes, my name is Bruce McLeod, Executive Chairman of Imperial Oil & Gas.

Hon. Justice Pepper: Thank you.

Bruce McLeod: Justice Pepper, traditional owners of the land, members of the scientific committee, ladies and gentlemen here this morning. This morning, based on my experience of a ten-year political fracking ban in New York State, I wish to take a high level view of the advantages of a well-regulated and properly managed fracking industry and the advantages it can bring and has brought to our shareholders. I'll just make sure I got this working.

The Northern Territory is one of the very few lucky regions worldwide where people have been bestowed with what is proving to be an exceptional energy resource. Importantly, this potential onshore gas resource is already supported by existing infrastructure, such things as LNG plants in the Northern Territory on the east coast of Australia. Some pipelines exist, new pipelines have been built. We believe that if this resource is responsibly developed, not only will many national energy and environmental issues be resolved, but it will generate many long-term jobs and provide long-term security to the people of the Northern Territory as well as assisting in transitioning this region and the world to a low carbon future.

Sorry, I just need to move to the next slide. We all know the importance of natural gas in our society. It's a component of many many items, from pharmaceuticals to fertilisers, to manufacturers of cars, glass, you name it, as an energy source and as a feedstock. Natural gas and other petroleum products are extensively used. In terms of, somehow I've missed a page here, ah, here we go. In terms of background, Imperial is a wholly-owned subsidiary of a company called Empire Energy. In addition to our Northern Territory assets, we produce oil and gas in the United States. The company holds over 400,000 acres of Marcellus Shale and Utica Shale in New York State, which is subject to a political ban on fracking. By political ban I mean, there was never a scientific inquiry into why fracking shouldn't be allowed.



It was basically driven by an agenda of people that live in New York State, people that live in upper New York State, i.e. where the shale and the ... Where the Marcellus and Utica Shales could be drilled and fracked, really didn't have a say. They represent a very small minority of the New York population. So Imperial welcomes a scientific inquiry into hydraulic fracking, which has shown that if shale was developed in a managed and responsible way, it can and will bring very significant benefits to all community stakeholders. In May 2017, Imperial presented to the committee a paper titled, "Presenting the Facts, Debunking the Myths of Shale Development." This focused on two major discussion points in relation to fracking.

The first being the benefits that fracking has brought to those lucky regions in the US that have been blessed with the right rocks. The second point is the misinformation of selective headline reporting by the media through either paid-for research which is so often retracted due to being incorrect but with no media attention on the retraction or litigation which in most cases with prolonged timeframes by the time litigation gets to a judgment point, the media has either lost attention to it or the outcome is not what the litigants wished in the first place.

Then in 2017, Imperial submitted the McArthur Basin Central Trough in Australia's Northern Territory. This was to provide a review of the geological importance of the McArthur Basin Central Trough as opposed to other basins which were more of a focus on the final draft report. We believe the potential of the McArthur Basin Central Trough, and I'll touch on this in a minute, has the potential of being one of the major shale gas targets in the Northern Territory. Back on the slide in terms of the importance of natural gas, over the last ten years, I've personally seen and experienced the huge benefits that have accrued to many people in the Appalachian Region of the USA. This has all been related to the development of the Marcellus Shale and the Utica Shale. As pipelines of construction are constructed, electricity prices and natural gas feedstocks have been become some of the cheapest in the world.

New billion-dollar power stations, gas-fired power stations are becoming common place. Electricity costs keep falling. But then the sad thing is there is a difference created by a simple manmade boundary, it's a state boundary between New York State, Ohio, Pennsylvania, West Virginia. Here, one sees some of the worst poverty in the USA, in upper New York State. Then directly across the border, we see a vastly improving social wellbeing of the states utilising the shale resources with which they have been blessed. The Rust Belt of the USA has become a lot less rusted.

Further, by using these shale resources, US CO<sub>2</sub> emissions are now at 1992 levels, in my knowledge, the only country achieving in surpassing CO<sub>2</sub> levels. The Northern Territory potentially has the resources to be at the forefront of this same revolution. In 2014, one of the world's most experiential groups identified the McArthur Basin as one of the most exciting global opportunities for the potential of shale gas and shale oil development. In 2015, Imperial entered into a farm out agreement with this group, American Energy Partners.



On a result-driven basis, American Energy Partners committed up to \$560 million US dollars for the Imperial Project with \$60 million US dollars to be spent in the first three years. However, due to the tragic passing of the founder of American Energy Partners, this farm out agreement was terminated in 2017. Discussions with new partners are ongoing, and I'll touch on some of those issues or some of those items a little bit further on. Just to clarify what the McArthur Basin Central Trough is, I've referred to it earlier, and work undertaken by American Energy Partners and Imperial has shown this is a highly unique and attractive target for shale gas development.

Key features of the McArthur Basin Central Trough are shown on the slide. I won't go through them. But one feature does stand out, and that the McArthur Basin Central Trough has a very unique hydrogeology compared to other basins in the Northern Territory. Based on our work to date, it appears that the McArthur Basin Central Trough aquifers are both very shallow or very deep. So unlike other basins, they do not communicate with other aquifers within the McArthur Basin itself. Further work is being done on this. What it does mean is that these aquifers can be isolated. If they're shallow, they can be easily contained. If they're very deep, obviously, fracking or drilling goes nowhere near them.

We believe those aquifers are around 100 to 150 metres, the shallow ones. The deeper ones are something like four to four and a half thousand metres deep. Obviously, fracking or drilling is going to be in the two and a half to three and a half thousand metre range. So this makes the McArthur Basin Central Trough unique compared to other basins or other sub-basins in the greater McArthur Basin. Again, this slide here demonstrates the characteristics of the rocks throughout the McArthur Basin. Some of you may have seen the slide on the left hand side. This was put together by American Energy Partners.

The rocks throughout the McArthur Basin, although a lot older, show a very strong relation to two of the massive USA shale systems, the Marcellus and Utica shales. Importantly, from Imperial's position, the dominant shale in the McArthur Basin Central Trough being the Barney Creek Shale is very closely incomparable to the Utica Shale, the best performing shale in the USA. The right hand graph demonstrates why it is the best performing shale. The red bars show the top 12 performing shale wells, Utica Shale wells drilled in the USA. The blue bars show the top 12 Marcellus wells drilled in the USA.

Now, although there may be some variations between each of these wells in terms of how they're fracked or how they're completed, it's clear that the Utica Shale wells demonstrate a much higher initial 30-day production rate. Each well drilled in the US is recorded for their 30-day production rate. So this information is readily available. If anyone wants a detail on these wells, we can supply it. This is important because the more production out of a well, the less wells you need to drill.



Wells in the US now are being drilled in the shale up to 3 1/2 miles, up to 19,000 feet laterals. So the more gas out of a well, the greater the lateral, the less surface disturbance. This is the way technology is trending. Wells can be drilled successfully over these distances, a well now 15 to 16,000 feet in the US is very common. This slide, again, I'll just summarise it, shows the major players in the McArthur Basin, the selection of wells drilled and more importantly, as we all now know, the first discovery well, well what could be defined as the first discovery well within the McArthur Basin, the Origin Amungee Well is critical in terms of development of the basin.

It is as it has shown, proof of concept for shale development. Many considered the shales in the McArthur Basin as being much too old. The shales in the USA are 3 or 400 million years old. The shales, especially the Barney Creek which is in Imperial's tenements, Imperial's tenements are highlighted in red is something like 1.4 to 1.6 billion years old. Most of the industry believes the wells, the shales are too old for the production of hydrocarbons. Origin have clearly shown now with the fracking of the Amungee Well that this is not the case. So development of these shales should show that the older the shale, as long as the shale basin itself or the shale hasn't been turned upside down or fractured will contain hydrocarbons which can be extracted.

So what are the benefits of developing the shale resource. This slide summarises the direct and indirect beneficiaries. We have all seen the same slide before. We know who the beneficiaries are and as such, I'd like to use an example to place the type of benefits can be extracted from the production of hydrocarbons. Ten years ago, a small company operating in Susquehanna County in PA started drilling the Marcellus Shale. Today, with just around 180,000 acres, it produces around 2.5% of total onshore gas produced in the USA.

Over the past ten years, this company has paid over a billion dollars US in royalties along with half a billion dollars in bonuses to local landowners. They have rebuilt roads, they have funded township sheriff and fire departments, community centres, hospitals, school buildings and so on. They fund local charities. They provide free milk to schools. They provide food and shelter for the needy. Funds flowing into the community have allowed farms to be resurrected and rebuilt. More importantly, from the people's perspective, local children now have local career opportunities.

They no longer have to leave the region looking for jobs. What this has done is allowed families to remain as families in a region where some of them have been for generations. This county is just over 2,100 square kilometres in size. That's the equivalent of about 500,000 acres and has a population of just 44,000 people. This clearly showcases the benefits that responsible development of the shale industry can bring to small regional populations. This next slide is important. A stranded gas has little value. With the building of the Northern Gas pipeline, Northern Territory Gas has several potential destinations.



Further, Imperial has had discussions with potential partners that once gas reserves are proven, gas processing alternatives can be built in a number of areas. This would include Darwin, Katherine or Nhulunbuy. I've highlighted the type of plants that can be built in these places, ammonia urea, i.e. fertiliser can be built where there's a row way line or a port, methanol where there's a port. There are two ports. Katherine obviously has a railway line.

Further, project funding for these plants is readily available if the gas reserves have improved up. To show what these type of plants are, this slide simply gives the flavour of two types of plants or processes that can be implemented at relatively cheap cost within the region or within the territory if the gas reserves are there. As can be seen, long-term direct and indirect employment opportunities for these plants alone are significant. These plants are built to produce for a minimum of 20 years.

If the gas supply is there, they'll produce obviously for much longer. Costs in job numbers on these type of plants have been modelled on very similar plants that these companies have built. The plants specifically there are based on plants ... I'm sorry. The models specifically there are based on plants that are being built in Jamaica where Jamaica has been processing conventional gas, optional gas for a number of years now. I wanted to include this slide to demonstrate the position of the Australian Energy Market. Although there are logistical issues in getting gas to the east coast where we all know there is energy chaos, chaos itself does provide opportunity.

Even though the Northern Territory itself could become a cheap energy region which will attract industry and jobs, ultimately, the long-term success for the Northern Territory, as with any other state in Australia, will be if the whole of Australia is functioning successfully, economically successfully. Getting gas or other forms of energy to the east coast will become a priority. The final slide today is useful. As I've set out several key features of why an exceptional source of natural gas can be so transformational. In this slide, I've picked out five different aspects of why the US now is achieving such successes while Australia sits here looking I guess to see what it should be doing to solve its employment issues, its energy issues and everything else.

I won't go through them. They're just set out there and obviously, they can be read. In summary, attractive energy pricing and competitive feedstock inputs will provide significant direct and indirect jobs over time. Gas will provide the ability to meet CO<sub>2</sub> reduction targets while still growing the economy. Usable natural gas reserves will ensure energy certainty along with a decrease in real energy costs and long-time or long-term security for Northern Territory economy.

In summary, Imperial's vision is very simple. It's here to develop its shale resources while preserving the region's rich, cultural heritage and environment. As such, Imperial, as an oil and gas operator, looks forward to working with all those stakeholder groups in the Northern Territory to



responsibly develop these extensive resources. Thank you. I'll now take any questions.

Hon. Justice Pepper: Thank you very much. I just wanted to quiz you a little bit about the benefits that you say will accrue from this industry. You've given us some examples from what's happened in the United States. Now, I appreciate that we don't have a developed shale gas industry here in Australia, but surely better comparisons would have been to have a look at and give us some of the figures about what's happened in Queensland or South Australia for example.

Bruce McLeod: Well, I think they are quite different.

Hon. Justice Pepper: How so?

Bruce McLeod: Queensland is coal seam gas, which is totally different.

Hon. Justice Pepper: Of course it is, but benefits are benefits are benefits. So ...?

Bruce McLeod: Well, no because in Queensland, you're dealing with a lot more wells to produce the same amount of gas. You're dealing with a lot of water. Quite different, the US in Appalachia where I've been operating since 2005, 2006 didn't have a shale industry at that point in time. So I've seen the development of the shale industry. I've seen acreage prices in Appalachia go from \$7 or \$8 an acre to 5 to \$13,000 an acre over that period of time. So I've seen from day one when Appalachia, the people of Appalachia, the counties of Appalachia had a very small, I guess it was shallow well gas industry.

That was 2006 and 2007. That's when a couple of companies, Range Resources, Chesapeake, Cabot Oil & Gas really understood or really worked out how to frack the Marcellus Shale. So I've seen the development of those regions over that period. Pennsylvania, Ohio, West Virginia have boomed. New York State really has gone backwards, people leave to go and get better paid jobs. Where do they leave? They just go across the border to Pennsylvania or Ohio.

To me, that is the real comparison. Queensland, coals and gas, is an industry, coals and gas industry in the US really shut down 10 or 15 years ago. Too many shallow wells, too many costs, too hard to control, no one really that I know of drills coals and gas wells anymore. They have coals and gas fields. They all just run those out. The potential of shale because you drill less wells, because they produce so much more gas, they're easier to drill. They don't produce water is the direct comparison to the Northern Territory shale.

Hon. Justice Pepper: But surely the land tenure regimes in the places you're talking about are very different, and the taxation regimes are very different.

Bruce McLeod: Land tenure is because the royalties go to the landowner.



Hon. Justice Pepper: Right.

Bruce McLeod: But the royalties here go to the traditional owners, get a portion of the royalties here. So that's exactly the same, though the magnitude is different. But that's just the way the system is set up here. The rest of the royalties go to the government. The government then can now reallocate those back to wherever they want to go. The royalties in the US are much higher than they are here. They're up to 20%. In some places, 25%. Royalties in Australia, in the Northern Territory are probably 13 or 14%. So sure, land tenure is different but you're just paying different people. That's the only difference.

Hon. Justice Pepper: If Imperial Oil & Gas is able to take advantage of shale gas development, if the government lifts the moratorium, what will you do as a company to ensure that benefits stay with local communities, that long-term jobs are created and indeed that aboriginal communities are benefited? What are some types of the programs? Give me some examples of the types of things that you would do because we've seen from Queensland that that hasn't necessarily been the case.

Bruce McLeod: Yeah. Well, that's a very good question. We've been working up here now since 2010. My colleague here, Geoff Hokin has ... Well, the company itself has probably had somewhere around 25 to 30 meetings with traditional owners, on country meetings with traditional owners. We have gone through all aspects of fracking, all aspects of oil and gas development. It's very difficult at this early stage to say, "Well, what would be available for jobs? What wouldn't be available for jobs?"

But we've put programs in place, training programs in place to employ as many Aboriginals as we can. More importantly, from Imperial's perspective, we're a small Australian oil and gas company. We know we don't have the expertise or the ability and by ability, I mean the financial capacity to develop this resource properly. We would be looking to bring in a partner as we did with American Energy Partners to help develop this resource.

From an American I guess operators' perspective. The most important thing is to have your staff, your operating staff local. You don't want them where they fly in or fly out. Now, obviously, that's going to be difficult in Northern Territory because the population is just not there. The service industries are just not there. But there are so many jobs that are available, that are created in this industry.

Hon. Justice Pepper: Just give me some examples of some of the local long-term employment opportunities that might be created.

Bruce McLeod: Well, just from our own example of operations in the US, we have people that from the start of a drilling of a new well, we have different companies that for example, make a roadway. A different company will make a drilling pad. We have different companies that will come in and set up the drilling pad. Then we have people that come in and drill. We have people that come in and cement. We have people that come in and complete the wells. We have people that come in and frack the wells. We have people that come in



and build ... We call it plumbing but connect the well to gas pipelines, oil tanks or whatever.

These are all separate service groups. There's not just one big body that does the lot. So you get a well producing. Then you have people that manage or monitor the wells. You have people that maintain the roads and tracks to the wells. You have people that maintain the pipelines. You have people that come in and take away the oil, if it's an oil well, if it's the combination of oil and gas. There are literally hundreds of different people involved in that process. They all play a different small part.

We have people that are responsible for fencing around the well or around a pad. We have people that are responsible for looking at animals. In the US, it's a little bit different because you're drilling on, many cases, you're drilling on farms where there's cows. So you have to maintain or make sure that the cows don't get into the way of pump jacks or tank patches or anything else. We have people that have to net or put nets over any water ponds or anything else so wild birds can't fly into them and so on.

Literally, hundreds of jobs. Then behind that, are all the indirect jobs. These people have to live somewhere. They have to eat somewhere. They have to stay somewhere. They have to drive trucks. They have to do this and do that. So the indirect jobs are just as large as the direct jobs. It's easy enough to sit down and make a list of all these jobs and all the indirect jobs behind it. But these are all available. These jobs are available. I know in the Northern Territory, there is funding available for the locals to buy equipment. Someone wanted to manage all the roads or manage the well platforms or whatever, the capital is available for them to buy the capital equipment to do it.

Hon. Justice Pepper: Certainly in due course, we'd very much appreciate it because no one yet has really furnished us with this information, a list of those indirect jobs so that we can look at what sort of real indirect employment opportunities there might be if this industry comes to the Northern Territory.

Bruce McLeod: I'd be very happy to provide a typical list of what we do. It's not what ...

Hon. Justice Pepper: Yeah, obviously, based on your experience.

Bruce McLeod: Someone else may do.

Hon. Justice Pepper: No, no, obviously. We'd be very receptive of that. Thank you.

Bruce McLeod: I think the important thing as well from Imperial's perspective, I touched on this, we have a group of very experienced people that have been in this industry for many years, drill thousands of wells, frack thousands of wells who we would work with in the Northern Territory and are very keen to work in the Northern Territory on these projects. So we would like to bring in people that have seen and don't get me wrong, just like in any industry whether it's oil and gas or mining, there's always mistakes made. The great thing about human beings I guess is that they do learn from their mistakes.



The more experienced the team is to develop this resource or this potential resource, we can't say it's a resource at this point in time, but this potential resource, the more experienced the people are, the more we're going to get this right.

Hon. Justice Pepper: Thank you. Yes, anything else? We got more, work our way. Yes, Professor Priestly? Thank you.

Prof. Brian Priestly: Yes, thank you, Mr. McLeod. In our report, you will have noted a couple of recommendations that relate to minimum setback distances from gas wells and treatment facilities and so on. These are designed to protect local communities from airborne contaminants and also to protect the local boars. From an industry perspective, do you see any practical problems with implement such setback distances? Would you care to comment on whether a failure to have such setback distances in the United States contributed to some of the health issues that were reported there?

Bruce McLeod: Look, I can't recall what the setback issues are. I totally agree, there's got to be setbacks. That's just logical. The distances, I would need to review the report or you could tell me. In the US, the setbacks are probably a little on the small side, and don't necessarily agree that they are on that small side. I can't recall. What was the setback here in Australia?

Prof. Brian Priestly: For airborne contaminants, we recommended 1,600 metres or one mile.

Bruce McLeod: That seems very extensive. I'm not sure what, I'd be interested to know what you're relying on in terms of airborne contaminants because one of the things I mentioned today, one of the big problems in the US, a lot of research has been done by universities, which is generally play-for-play type research. A lot of it is retracted. We never see the retractions. The media always plays the headline. The retractions that's peer reviewed by someone. In many cases, they're not well known peers. It's released, and then several months later, it can be retracted.

In a very interesting case, which was just retracted a few weeks ago, back in early 2017, I think it was the University of Maryland or something, put out a research report. We've outdone the survey over some wells in Southwestern Pennsylvania saying that the release of, airborne release of methane was around 3.4% of total production over the wells, plus a minus 0.4. Now, I'm just going on a memory here.

That was huge because methane as we know, appears to be a lot worse for the environment and global warming than carbon dioxide. When this result came out, the credibility of it was questioned by a number of people in the industry, but also by the Department of Energy in Pennsylvania. Cut a long story short, the Department of Energy in Pennsylvania itself did the same type of research. It was airborne. It was airborne research. The first thing they realised was that in the samples that the university utilised, there was no ethane or butane or anything else, which was very unusual because in a shale well, you get a combination methane, ethane, propane, butane, a few other thanes. It was just methane.



So they did this report. They did about five times as many samples as the university had done. So they now analysed that. They questioned the university and the peer review. The university came back and said, "Look, we got a couple of things wrong. We had the wind direction wrong." So we're going to reduce it by about close to double, close to half the contaminants, i.e. the methane in the atmosphere. So that dropped it down to about 1.8, 1.9% methane was being lost from frack wells, and connections, and pipelines and everything else.

Anyway, about three or four weeks ago, the Department of Energy came out with their own findings. Their own findings were very interesting. Where this university had undertaken their review of escaping methane into the atmosphere was over an area where there's a whole bunch of underground coal mines. In the US, underground coal mines by law must vent methane. What they were doing was they were collecting methane being extracted from underground coal mines.

The Department of Energy itself got back to the ... I guess the methane being released from frack wells in the connecting pipelines and so on was around 0.4 to 0.5%, not the 3.4 initially headlined by this peer play-to-play review. So these are the type of things that I know, I follow Pennsylvania, the Department of Health and Department of Energy in Pennsylvania very closely. A lot of reports are being put out where things like asthma attacks have increased, babies are born lighter, people are losing weight and everything else. But all this research is ultimately either retracted or found to be false. It's all available. But you just don't get it in the media. So you have to go to the source.

Hon. Justice Pepper: Yes, Professor Hart.

Prof. Barry Hart: I'd have a comment on that one. The University of Maryland may well have been incompetent rather than being paid for producing results in that particular way. I think you're making a bit of a long bow there.

Bruce McLeod: Well-

Prof. Barry Hart: I've got two.

Bruce McLeod: I understand, I understand, yeah.

Prof. Barry Hart: I've got two comments or questions rather. I didn't quite understand. You were talking about the aquifers.

Bruce McLeod: Yes.

Prof. Barry Hart: In McArthur Basin as being unique, I didn't get it because you said that there is a top one and a bottom one.

Bruce McLeod: Yeah, yeah.



- Prof. Barry Hart: The bottom one's way way down, fair enough. The top one though is 150 to 200 metres. So what's different to the Beetaloo? You're still going to put a well through.
- Bruce McLeod: Yes.
- Prof. Barry Hart: There's still the possibility of leaking wells contaminating. There's still the possibility of spills going through. I don't see where's anything different.
- Bruce McLeod: Well, if you've got an aquifer 150 metres and you know it's a freshwater aquifer as opposed to a saline aquifer whatever.
- Prof. Barry Hart: Yeah, yeah, got you.
- Bruce McLeod: And it's utilised, at 150 metres, you can put in three or four sets of steel casing and cement.
- Prof. Barry Hart: Sure, sure.
- Bruce McLeod: If it's at say 750 metres or thousand metres, you're not going to do that.
- Prof. Barry Hart: Sure.
- Bruce McLeod: So you have that extra safety at for shallow wells.
- Prof. Barry Hart: But that's no different. That's no different to what Amungee's done.
- Bruce McLeod: How do you mean it's no different?
- Prof. Barry Hart: Sorry?
- Bruce McLeod: No, if you have a shallow aquifer, you can put in, if you want to, three or four steel casings or cement it.
- Prof. Barry Hart: Absolutely. But that's what would happen in Beetaloo. I just don't see why you were making a distinction that this was some way unique.
- Bruce McLeod: Well, the distinction is that there's either shallow aquifers or deep aquifers. There's nothing in the middle.
- Prof. Barry Hart: Okay.
- Bruce McLeod: Look, I'm not a hydrologist or anything else. So this is work that we've been doing. If you would like a more in depth explanation, my colleague here.
- Prof. Barry Hart: No, no. I understand where you're coming from. That's fine. The second one I had was you put up the prospect of processing plants.
- Bruce McLeod: Yes.



Prof. Barry Hart: Methanol urea processing plants. Has that occurred in Australia? I mean, not that I know of. If it hasn't why not? I mean, why would you suddenly say this is a you-beaut industry that will suddenly flourish?

Bruce McLeod: Well, there is ammonia urea plants in Australia that use gas for their feedstock. They produce urea through natural gas feedstock. Why are these things going to magically appear? Well, they're magically appearing in the USA? Because feedstock is so cheap. There's methanol plants. I know at least three or four methanol plants have been built now. In fact, one company has gone around the world and purchased, closed down methanol plants, deconstructed them, shipped them to the US and rebuilding them.

There's one's being built in West Virginia. One's being built in, or two are being built in Louisiana. So that's on methanol. Ammonia urea, we have spoken to a number of people and potential partners that want to have a long-term source of fertiliser.

Prof. Barry Hart: Sure.

Bruce McLeod: These plants are not expensive if the gas is there. They are funded. You can fund them on a build-own-operate type basis, sort on BOOT basis.

Hon. Justice Pepper: Yes, Dr. Jones.

Dr. David Jones: Mr. McLeod, this is a supplementary follow up question to the one that Professor Hart just raised which is about the cost of gas. Certainly in the US, the cost of gas come right down.

Bruce McLeod: Yes.

Dr. David Jones: But is that because of oil production?

Bruce McLeod: No, the major influence in terms of gas has been the Marcellus and Utica Shale. That's I guess really as I said before, their production started about 2006, 2007 a major way. There is still a problem with Marcellus and Utica shale. That is it's still I guess stranded in many ways. They're still building pipelines to take it out of that region of the northeast US to get it either to the south or other regions where it can be utilised. So once these pipelines are built, it's certainly possible that gas prices in the US will fall even more.

Dr. David Jones: I guess my question more relates to the fact that we have heard from other sources that the economics of shale gas production in the US is largely being driven by competent oil production. So the question is with the NT for example, we are tasked with looking at shale gas production but to what extent is the industry considering oil production because that could change our risk assessments for example?

Bruce McLeod: Well, look, look, going back to the first part, shale gas in the US is economic. In the Northern Territory, I guess with the type of the rock and the age of the rock, and again, I'm not a geologist, but I guess people are looking for gas. People are hoping for gas more than oil because of the scarce shortages



here. The advantage about oil, obviously, economically, it's a lot easier to deal with. You can just cart it in a truck to the closest port and ship it off.

Gas, you've got the infrastructure costs. I think the thing here in Australia is it's gas-driven. There's markets to the north for LNG. There's markets to the north for urea. There's markets to the north for methanol. There's markets for all types of stuff. We're close to them. I don't know. Does that answer your question?

Dr. David Jones: It partially answers the question. What I was trying to get to is to what extent would the co-production of oil provide a greater industry, a greater economy at it?

Bruce McLeod: Yeah. A combination of oil or liquids, obviously, increases the economics significantly. There's absolutely no doubt about it. If you had a combination of gas like the ... I guess the great examples are in the north shale and the Permian Basin or the Anadarko Basin in the USA where they're producing very hot gas. So they're getting the liquids. They're getting oil. Those wells are extremely economic. If the same thing did occur and it may occur here in Australia, here in the Northern Territory, the rocks seem to be right for a combination of oil, gas and liquids, the economics would increase significantly.

Dr. David Jones: Thank you.

Hon. Justice Pepper: Yes, Dr. Vaughan.

Dr. Vaughan Beck: Thank you for your presentation. Just to make a couple of observations. In your last couple of slides, you're talking about Australia and US electricity prices, and just to note that in looking at electricity prices, the cost of generation is about a quarter or a third of the total cost of electricity generation and the cost of fuel then is even on a much lower proportion. So while I was pointing out some substantial differences between those costs, it's also appropriate to note that there are many other factors that go into constituting those costs, so the implications are that you just can't infer that it's all due to shale gas.

Bruce McLeod: No, I answer that. Yeah.

Dr. Vaughan Beck: In a similar vein, in terms of greenhouses, I note that you did give a reference to I think a Reuters article that was talking about how shale, sorry, how greenhouses are reducing. I'll certainly have a look at that. But it's also appropriate to note once again that in terms of any nations, greenhouses that energy generation is just one of a number of many factors that go into making up the total greenhouse profile of the nation. So the inference can't be always, and I'm not sure whether you're intending to make it, but it's all due to shale gas. But that's not.

Bruce McLeod: No, no, it's certainly not all due to shale gas because obviously, in the USA, there's still a lot of conventional gas produced, a lot of tight gas but tight gas is fracked as well produced. So no, I'm not trying to sort of say it's shale gas



entirely. But shale has had a big effect by coal-fired power stations especially swapping either from coal to gas or shutting down totally a new gas-fired power stations being built. That again in the northeast, I mentioned a billion-dollar gas-fired power stations have become a common place. They are. They're building them everywhere, half a billion dollars, billion dollar ones.

The gas, because there's so much gas, they can build a gas-fired power station that say services a county. They built it and probably the most important thing that you did mention is the great thing in the USA, the infrastructure's there. Even though they have to build new pipelines to get the gas out of some of the areas, there's still all the infrastructure's pretty much there, like power, electricity lines, smaller gas pipelines, roadways. So that makes a huge difference to implementing what is being implemented in the region and in the country.

Dr. Vaughan Beck: Because you acknowledge that is a very substantial difference in the infrastructure between US and Australia, so the implications are that you can't then draw direct analogue from the US to Australia because of those very substantial differences in infrastructure density.

Bruce McLeod: That's right. But if the resource is there, that infrastructure will be built. It will take time. But gas pipelines will be built roads will be built if the resource is there. Especially as going back to the point about if it's a mixture of gas, liquids and oil, which makes it much more valuable that infrastructure will be built a lot more quickly.

Dr. Vaughan Beck: Note, just note in passing that it's not just a matter of whether the resource is there. It's also totally or highly dependent upon the economics of it.

Bruce McLeod: Absolutely. Yeah. That's why the combination of oil, liquids and gas would make it much more attractive considering I guess a remoteness of this resource. The important thing is I think it has now been proven that the petroleum molecules are sitting out there in the rock as to whether they can be extracted and whether then they can be harvested I guess on an economic manner.

Hon. Justice Pepper: I do know the time limit. Just to ask you one last question this is really sort of by way of comment. I was curious to see on I think your, one of your slides, economic statement by using US as medians. Carbon dioxide reduction target's well ahead of time. I must very much appreciate a source for that because that's doesn't accord with my or at least I should say the panel's researches in that respect.

Bruce McLeod: Reuters released that on June the 6th, 2017.

Hon. Justice Pepper: Okay. That's based on the Reuters article?

Bruce McLeod: Yes, that was that the USA now in terms of their carbon dioxide emission levels were back to 1992 levels.



Hon. Justice Pepper: Will Stefan, renowned climate change scientist has made a submission to the inquiry. In that submission, he essentially says that if we've got any help of meeting our targets for the Paris Agreement, the gas should be left in the ground. What's your response of that?

Bruce McLeod: Well, sure. We can leave gas in the ground and shut down our coal-fired power stations. I'm sure we'd meet them. But our lifestyle and our society would be a little bit of a mess. I think the US has shown an interim step in terms of reducing CO<sub>2</sub> emissions is by the utilisation of natural gas. I think even back under the Obama Administration, they said exactly the same thing. There's got to be a series of interim steps to get to where we want to get to in terms of CO<sub>2</sub>. Sure. We all want to get there in the end but we don't want to see our society collapse trying to get there. In many ways, I think South Australia, and I don't want to get into politics or anything else because I'm just an oil and gas guy, so I don't want to thread on toes.

I think South Australia, in a way, is demonstrating that. I just read something last week about unemployment in South Australia, the cost of electricity. It's a good example of to me of how not do things. I've thing we've got to have interim steps and a whole series of those interim steps. I think the US is probably leading the way on that.

Hon. Justice Pepper: South Australia has been fracking for gas for many decades.

Bruce McLeod: Yes, but they have not shut down all their coal-fired power stations and they haven't built any gas-fired power stations to take up to the slack that relied on wind and solar. If they had built those gas-fired power stations, they wouldn't be in the issue they are now. But no, I totally agree with you.

Hon. Justice Pepper: Mr. McLeod, thank you very much for your time today.

Bruce McLeod: Thank you. Pleasure.