MELBOURNE ENERGY INSTITUTE

GRATTAN Institute

Energy Futures - The future of gas supply and demand in eastern Australia – 13 November 2014

The emergence of liquefied natural gas (LNG) export facilities in Queensland means that now for the first time eastern Australian gas is linked to the world market. This Energy Futures seminar explored the impacts this will have on Australians that use gas in their home or business. Will there be adequate supplies now and in the future, and at what wholesale and retail prices? What can and will gas users do to reduce their use of gas, or will they to switch to other energy sources?

Moderator: Tony Wood, Grattan Institute
Speakers: Mike Sandiford, Director Melbourne Energy Institute
Ursula Alquier, Lock the Gate
Peter Cleary, Santos
Craig Memery, ATA

TONY WOOD: My name is Tony Wood and I'm the Energy Program Director at Grattan Institute. We've got a very strong partnership with the Melbourne Energy Institute (MEI), and tonight is the last of our *Energy Futures* series for 2014. Firstly, I would like to acknowledge the traditional owners of the land on which this event is occurring and also the university campus, which is the land of the Willandra tribe, and pay respects to their Elders past and present.

Tonight we'll be doing some discussion that could go in all sorts of directions because there are so many different elements to the material we're going to discuss tonight. I guess the central part of the discussion really is about the extraordinary change that's occurring even as we speak in Queensland with the development of very large LNG export facilities. For the first time in the world large LNG cargoes will be based upon coal seam gas developments in the state of Queensland primarily, although other gas may fit into that. That will mean that most likely – although nothing's definite in terms of forecasting – within a few years Australia will be the largest LNG exporter in the world and that will be something like $60billion a year in terms of Australia's terms of trade. So it's significant economic change.

However, of course these things don't occur without consequences and so what we also want to do tonight is explore some of those consequences. Part of that was some stuff that we covered in a report recently which talked about the cost impacts. So as a result of connecting the eastern Australian gas market to the global market, price increases are likely to be significant and in Victoria those price increases are likely to be more significant for households than any other part of Australia, and tonight Craig Memery is going to cover that issue. We're also going to cover the second and probably equally disturbing issue for many people, but it's worthwhile thinking out in perspective as well, and that is the whole question of coal seam gas and fracking and what that means from a health, environmental and safety perspective, and try and put before you some of the arguments both in favour, the challenges that the industry is having, and the challenges for landowners. Tonight we'll have Ursula Alquier from the Lock the Gate movement to talk a bit about the perspective for the landowners.

First, Peter Cleary from Santos is going to describe to you the perspective of a large gas producer, not particularly large in this state at the moment, but certainly one of the companies that's very active in developing those very LNG facilities that I spoke about and a company that's also been centrally involved in the debate around coal seam gas development in some parts of New South Wales. Peter's got a very significant background in the LNG industry, both with Santos and, before that, with BP. So the intention tonight is that Peter will speak for about 15 minutes, followed by Ursula and followed by Craig. After each of those three speakers have completed their short presentations, Mike Sandiford from the Melbourne Energy Institute will join me and the others on stage and we'll get the conversation going with a few points we'll discuss amongst ourselves for you to think about the things you might want to put to the speakers, and then we'll open it up to the floor.

So without further ado, I'll ask Peter to begin the discussion, so please welcome Peter Cleary.

PETER CLEARY: Thanks very much for the opportunity to address you tonight. It's an important topic, the future of gas supply in eastern Australia. The topic, as Tony said, is broad and certainly not without controversy. The aim of my presentation is to touch on several elements in the expectation that not all that I say you will find agreement with, but hopefully in the panel discussion and through the audience participation we can cover some of these issues and have a decent conversation. I also know that I will not cover areas that perhaps you want to hear about. There's a multitude of topics here that we could cover, again, I'm happy to answer questions on those.

First a bit about the company I work for, Santos. It's an acronym for South Australian Northern Territory Oil Search. We're celebrating our 60th year. We're a proudly Australian company. Our genesis is in the Cooper Basin, which is the basin that straddles the Queensland and South Australian border, and we've been producing oil and gas out of there for 40 years. We supply about 15% of Australia's domestic gas requirements, both in the eastern Australian market and in the Western Australian market.

Tonight I'd like to cover a few topics. Firstly, the broader world and regional context: with the start of the LNG trains in Gladstone, Australia's east coast market is definitely connected to the world gas market and particularly to Asia. This presents both opportunities and challenges. Secondly, how Australia can supply both export and domestic through the further development of what we have, an abundant gas resource. Thirdly, the east coast market dynamics, how they're changing and why prices are moving up to between $6 and $9 per gigajoule – that's the unit in which we sell gas – on the east coast of Australia: what can we do to create a more efficient market? And finally, how gas has a role to play in lowering our carbon intensity.

Back to the global and Asian context. By 2030 the world's population is expected to reach 8.3billion people. Half of the world's population growth will be in Asia. Population growth translates to greater energy requirements. Also, 1.3billion people today do not have access to electricity. Energy demand grows the fastest in the Asian region when people move from rural existence into cities. When they urbanise, they migrate, they want the use of electricity; they want to be able to access the things that we access every day of the year, the iPhones, the washing machines and the televisions. This drives energy demand growth and to put it in context, China expects to move 15million people a year from the rural existence to city existence; in India, 9million people a year, more than Australia every year. But no more important country is there to look at when we talk about growth in Asia than China. China's power demand is expected to double between now and 2030. China is expected to account

for a third of the global gas growth by 2030. These are big numbers and, as you can see from this graph, energy is growing faster than the need for water and food, but each is going to grow significantly over this next 15 years.

It may not be something that people want to hear, but let's turn to the role of gas in the energy mix. Most forecasters agree that fossil fuels will continue to dominate the energy mix for decades to come. These 2030 forecasts show gas' share of primary energy mix at 29%. Gas, as I said, is the fastest-growing of fossil fuels, reflecting an increased attractiveness of gas as a cleaner-burning fuel. Today's technology is enabling the world to access gas resources that were perhaps uneconomic some years ago. This technology, together with the need to address the environmental impacts and the constant push by nations to diversify their supply, points towards natural gas remaining the fastest-growing fossil fuel for decades to come.

As I said earlier on, this presents great challenges and great opportunity for Australia. We have a relatively small gas market; we represent about 1% of gas consumed around the world. The IPCC's recent 5th Assessment Synthesis Report also gives us a stark reminder of the need to decarbonise our energy mix. It also highlighted the importance of natural gas as a transition fuel as we go down that path. Renewables, they must have a strong future but they can't do it all on their own and I will show to you shortly how we think gas and renewables complement each other and will help build the renewable future we seek.

If I come back home, this slide shows how embedded gas is in Australian use, it shows its importance in everyday lives, in industry and to the national economy. The oil and gas industry is a major contributor to Australia's current prosperity in numerous ways, including investment, currently contributing more than a third of Australia's business investment; direct and indirect job creation; regional development; export revenue; taxation; and energy security. Oil and gas production and exploration contributed $29.4billion to the national economy a couple of years ago and accounted for 2% of Australia's GDP. This is expected to rise to $65billion, as Tony alluded to, by 2020, representing 30% of our forecast GDP.

Here's where I might get into trouble with Mike, the geology expert. We have abundant resources. Resources doesn't mean the gas flows immediately into a pipe, more needs to happen before those resources get into production and go into the pipe. The resources and the nature of them are changing. If we focus on eastern Australia - and you've got to remember at the moment the east of Australia and the west of Australia are not connected physically as markets – then we can see that the conventional resources that we've relied on for many year, those from the Otway Basin, Cooper and, of course, Gippsland, are mostly produced or accounted for. At current domestic consumption we have about 11 to 12 years left of those resources.

Overwhelmingly our future on the east coast will need to come from coal seam gas or unconventional sources, such as shales or tight formation gas. Producing from these sources is more expensive and more intensive. For example, there's one well in near Darwin, which can produce the same amount of gas as 100 wells in the onshore environment. The cost of developing conventional resources is also rising as we stretch resources to the smaller, deeper and where there are higher impurities. The Federal Government's East Coast Gas Market Study recognised that the next wave of developments were going to need a higher price, otherwise the gas would stay in the ground.

Our domestic market, what's happening? As Tony said, next year three massive projects in Queensland will start up and they'll triple the demand for gas on the east coast. The grey bar and the green bar are the current domestic markets, and the orange, blue and red bars are the LNG projects. That's why, as Tony said, we've seen enormous shift in the terms of trade, an enormous overseas demand shift that has led to the development of these east coast coal seam gas to LNG resources. Demand from this, as I said, will triple. However, the domestic remains important to us.

As we look out to 2025 we see a few things happening. First, the domestic market in Australia is expected to remain relatively flat. I've already mentioned the cost of development will be increasing. The growth in gas markets is driven by exports. The fundamental economic point is that scaled development of these CSG resources would not have occurred if we had just to rely on domestic demand. Major CSG developments will only be brought into production when the market prices justify their development. The development of an export industry has had a beneficial impact on the domestic supply as well. For example, the extension of the 40 year operation we have in the Cooper Basin has led to Santos, Beach and Origin, three Australian companies that operate in that area, to spend $800million on the upgrade of the Moomba facilities. As we see prices rise we're able to supply more gas from that area into the market.

I acknowledge that the price of gas in eastern Australia is expected to rise and, as I said, our expectation is that the wholesale price will rise to between $6 and $9. This has not come as a surprise, as many would suggest; it's been signalled for many years with the export opportunity. But high prices do not mean that our marketing is failing and that there is a need for governments to intervene into this market. The market works because the gas is flowing to the area of greatest economic value. We also need to look in perspective where Australian gas prices sit. Australian prices are in the middle of the pack, and I'll give you a couple of examples. At the top end you've got the gas that we liquefy and sell into Japan that lands into Tokyo Bay at $15 to $16 per unit, and Seoul's the same. If you go to Jakarta, the price is now between $9 and $10 landed at the gate. If you go to the Shanghai city gate, it's already $10. The only place in the world where the price is going down is the United States, and we'll come to the reason why that's happening.

We also look at what the consumer pays. I do need to look to Tony's work which says the major component of your bill – and I use the New South Wales bill, as he did – is mainly made up of what they call network costs, the pipelines and the pipes to your home, and they cover 59% of your bill. The producer component today is about 11% and if the prices goes up it could rise to about 21%. But what can the gas industry do, because no-one likes to pay higher prices I understand all of that? I think our response to this is the response that is what we're able to do and capable of doing, and that is to invest in further development and to bring more gas to the market. Billions will be required, but we're prepared to do that.

Other things probably around the margin but important. Bring greater efficiency to the market. For too long the market has been a very bilateral few suppliers, few buyers; we now need to develop the trading hubs around Wallumbilla to give the flexibility that buyers need. Add liquidity to that, add efficiency to that and you get more opportunity for buyers to choose the contracts they want, to take the mixture, to take some of the volatility out of their price mix. Create pathways to more participants entering the market. We're going to open up our facilities to make sure that people can process their gas through our facilities. It's not a blocker; it's an enabler to further development. And we need to

work with governments, universities and other stakeholders to ensure that the regulatory regime is based on solid science and engineering and has, importantly, community acceptance.

The point about the United States is that we saw in the mid-2000s, when America thought it was going to run out of gas and they were going to start importing LNG in massive quantities, that people in this industry said, "Hang on, hang on, there are other solutions here". They started to look at their geology. They started to look at their production techniques. Yes, they did start to frack shale and they've done it in a major way and brought on a significant amount of not only gas, but oil. America is now leading itself towards self-sufficiency. It consumes 18million barrels a day and it's producing about 9million barrels, growing at about 1.2million barrels a year. It's a phenomenal story. And guess what happened when supply came to market? Prices came down. That's what our industry can do. We can put our technology to work, we can put it into reducing the cost in our industry, and we can put gas to the market.

I don't think anyone here's going to listen to an oil and gas man say, "I've got green credentials". I'm not going to try and pretend that, but natural gas can play an important role in reducing greenhouse emissions in Australia and LNG exports can reduce emissions elsewhere. Renewable energy sources, such as solar and wind, are intermittent; they cannot provide continuous power generation. Renewable energy must be combined with forms of base load power, such as gas-fired power, and peaking power to give us the supply continuity and surety that we wish for. I believe it's important when we examine tonight's topic that we look at some of the ways gas can encourage and support the development of renewable energy sources, and I've picked on South Australia where I live and picked on Victoria where I grew up as two examples.

In South Australia we don't have much coal, so our electricity supply has grown up differently than it has here in Victoria. We make most of our electricity from gas, wind and solar. The impact is that our CO_2 intensity levels are not as low as Germany - but remember Germany has 15% nuclear power in its mix - but we compare favourably with Victoria. The gas has for many years demonstrated that it can play an important transitional role to a lower carbon future and in South Australia this is already happening. We can also look at the role that Australian gas is playing internationally. When converted to LNG, natural gas can help reduce greenhouse emissions elsewhere in the Asia-Pacific region. For every ton of greenhouse gas generated by LNG production in Australia, 9million tons of emissions are avoided in the Asia-Pacific region if coal is not used and gas is used in its place. The IPC recognised these benefits in its latest report.

I'll touch on an important one. The final comments are pertinent to what's likely to happen here in Victoria when our industry decides, chooses or is able to develop onshore prospects. Our onshore experience is predominantly in South Australia, New South Wales and Queensland, but we have operations and have had operations here in Victoria since 2000 when we were drilling onshore in the Otway. As a result, Warrnambool was one of the first regional centres to be connected to natural gas. Over the years, Santos has dealt responsibly with farmers and created employment in regional areas. I would encourage those concerned about our activities to go and talk to the communities around Port Campbell.

What we've found is, if we're able to abide by the principles shown above and we're permitted to operate on farming land that we're accepted by regional communities and we've demonstrated that we do operate in a safe way and minimise our impact on the environment. Our analysis shows that in

communities where we have the most activity we have the strongest support and, again, if you get the chance, go to Dolby, Chinchilla and Roma to test me on that. As an industry, we've drilled over 5,000 in Queensland; we've signed over 4,000 agreements with landowners; and the industry has contributed to regional communities over $127million. I'm sure you'll ask me questions about water, but I'll leave that for the panel.

That's a disclaimer, but in my short time here tonight I hope I've covered a few issues. I haven't talked about fracking, ready to talk about that when we're up at the panel. I haven't talked about price impacts on Victorian industry or households, I'm going to let Craig introduce that subject and we'll talk about that at the panel. But I'm certainly happy to provide what information I can and I hope you can understand that what we're trying to do is give our perspective. We know we have to convince communities. We do not have a right to just barge our way into communities; we have to convince communities that we can operate safely, reliably and with the minimum impact to our environment. Thank you very much.

TONY WOOD: Our second speaker is Ursula Alquier. Ursula has been involved with the Lock the Gate movement now for a little while. She also however, given her perspective, is one of those landowners that might need to be convinced by Peter in the future. She's certainly been involved in this area for a while now. I'm sure you'll be aware, if only from the media, the issues around landowners in this whole coal seam gas issue have been quite significant, particularly probably more pointedly in some parts of New South Wales. So let me hand over to Ursula.

URSULA ALQUIER: I'm going to talk about a slightly different element of this debate. It's very complex for a lot of different aspects of it that we can talk about tonight, but I have 10 minutes so I'm going to talk about what's been happening here in Victoria and the massive community movement that has been growing over the past three years.

I first got involved two-and-a-half years ago when I found out that the town where my mother lives in South Gippsland, a little town called Poowong which is a dairy-producing town, was under a licence for exploration for brown coal and coal seam gas. And a small group of us became a little bit more informed about what that actually meant and started talking to other community members and it became apparent that, firstly, no-one in the community was aware that this licence had even been granted. We then heard about Lock the Gate and we decided to conduct a door-to-door survey in our community. We door-knocked over 550 residents and we asked them one question: do you want to declare this community coal and coal seam gas free, yes, no or unsure? And an incredible 95% said "Yes".

So Poowong became the first town in Victoria to declare ourselves gas field free and whilst it has no legal bearing, it's about a community educating themselves about something and removing the social licence for this industry to operate in their area and it is incredibly powerful. Since this has happened we've now had 44 communities in Victoria, in Western Victoria and Gippsland, declare themselves gas field free and the percentages have ranged between 87% which was our lowest, which was in the Latrobe Valley, right through to 99% with Briagolong in the Wellington shire. So an overwhelming majority of communities are educating themselves about this issue and the impacts and saying, "We do not want this here".

Wow, I'm just trying to think where to start! There are so many reasons why rural communities have very valid concerns about unconventional gas. The big one obviously is water. We're talking about not

just water contamination, but also lowering of the water table. A lot of irrigators rely on that water to run their business, to produce the food that we all eat. In Gippsland alone we produce 23% of Australia's milk. We are dealing with the two food bowls of our state, that is what we are risking here and it is an industry that doesn't have a very good record in terms of water contamination, salt contamination and methane contamination. Santos in February this year were fined by the EPA in New South Wales for contaminating an aquifer with arsenic, lead and nuclear waste. So that is something that has happened. Admittedly, the fine was only $1,500, but that is a big concern when you're talking about a food bowl.

The big thing that's happening in this movement that I've definitely never seen before is that it's a broad movement. This is not a group of environmentalists. This is very conservative people and progressive people and everybody in the middle. A lot of farmers who, for a very long time, felt that the government represented them, protected them, respected them as producers and as a vital part of our economy - and agriculture is a big part of our economy as is tourism, which is another sector that is greatly impacted by this industry - and this is not the case anymore. They feel let down. They feel that they've been ignored. There had been no community consultation until there was a massive outcry for it. We're now in the middle of a community consultation process and yes, we do have a current moratorium in place but that is also only because there has been a massive building up of a movement right across the state, particularly in rural areas. More in rural areas than Melbourne because that's where they have to deal with these licences.

The community in Seaspray is a really perfect example of this. This is a very small community. They have dairy farmers; they have a piggery; they have sheep farmers; and they have Covinos, Victoria's largest carrot producers. This is a productive farming region. They're also on the 90 Mile Beach, so during the summer months it is a thriving tourist hotspot and last time I checked most people don't want to holiday in a gas field. These community members, some of which are fifth generation farmers, have invested their entire lives in these areas. They love these areas, they're passionate about these areas, and they are absolutely not going to allow unconventional gas into their communities. And we don't just run workshops in terms of what it could mean for the area, but we are also running direct action workshops. These farmers for the first time in their lives are considering taking peaceful, non-violent direct action if they have to. They are prepared to do whatever it takes to stop this industry because they cannot prove that it is safe and the onus should not be on communities to prove that it isn't, but currently that is the case.

A couple of things I will also touch on that were mentioned. We talk about that gas prices are obviously rising because of our expansion into the export market. We're told that we need to keep drilling and drilling and drilling and get more and more and more gas. This gas is not even for domestic requirements. Peter Ryan from the Nationals has even come out and said there's at least 30 years of gas left in the Bass Strait. So when we're having this argument about "the need", who is the need for? The need is for these mining companies. The need is for them to export to pay their shareholders. The need is not for us here. What will these farmers get out of it? Their water could be contaminated, this will ruin them and the food-producing regions of this state are the most precious thing we have. Our food and water security, in my opinion and in most people's opinion when they start to educate themselves about what this industry presents us with, is that why would we risk it? Agriculture, manufacturing, education and tourism far out-employ mining. So we need to be protecting those industries that have been the backbone of our economy for the last hundred years and will see

us through many more hundred years to come, and drilling and drilling until there's nothing left is definitely not the answer.

Peter mentioned that you need to potentially go up and visit Dalby and Chinchilla. I have been up to Dalby, I have spoken to landowners up there and we actually had a group of farmers from Gippsland make a trip up there earlier this year. The thing that really dawned on me - apart from the fact that over 50% of the properties that you drive around have a for sale sign up on them and most of them seemed deserted – was that huge areas of State Parks have been bulldozed to allow for massive pipelines to carry water, to carry gas, and massive areas have been cleared for compression stations and evaporation ponds. And I'm talking about acres and acres that hold these ponds. These ponds are huge. This is waste water that they still don't know what to do with. But the thing that really dawned on me that was that in the area we were in these were huge properties. These were 5/10/20,000 acre properties and the impact it has had on these communities was very obvious. And when we look at Gippsland and we look at Western Victoria, firstly, we are much more densely populated in these areas than where the industry is currently operating in Queensland. Most dairy farms in Gippsland are between 100 and 300 acres, much smaller acreages, many more people. How's that going to impact our densely populated areas if it's having such a devastating impact already on areas that are less densely populated? That is a real concern.

I will just finish by saying that in terms of who should decide if this industry goes ahead, I think that communities should have a say about how they see their future and I am absolutely confident that the communities that I have the absolutely privilege in working with on a day-to-day basis will not allow a gas field industry to develop here in Victoria. That is because these people are well-informed, they understand the risks and they also understand the benefits of protecting these industries that we all need to protect, and they are also keen to look at other alternatives, such as renewable energy, and that is something that we need to see our government supporting these communities in because if we don't protect our food and water security then it won't matter how much gas is flowing, we will be in one almighty mess. Thank you.

TONY WOOD: We've obviously set up one level of tension, we'll try for a second and I'll ask Craig to join us. Craig represents the Alternative Technologies Association which may sound a strange beast to be speaking tonight, but certainly a few months ago the work that Craig and his group have been doing was brought to my attention. They've been doing a lot of amazingly detailed work in understanding the impact of electricity and gas prices on consumers and the report that Grattan put out recently on the impact of gas prices very much grew upon the sort of work that Craig and his team have been doing. And so not only have you heard about the environmental concerns relating to gas development but, as Peter said, there are also these issues to do with the price impact and Craig is going to cover these issues. So please welcome Craig.

CRAIG MEMERY: Thanks very much Tony, thanks Grattan and Melbourne Energy Institute for hosting the event and for inviting me along. So I'm with the Alternative Technology Association (ATA). We're a not-for-profit organisation and we've been around for about 34 years. We're a member-based organisation, our members are generally people who have an interest in sustainable living and we do a lot of stuff. My role with ATA is to advocate for affordable, sustainable energy for all Australian energy consumers.

So what's the problem that we're here to talk about? Well, while we were all focused on electricity prices going up so much in the last few years, gas prices actually went up by about a third as well without most of us noticing. The other problem of course is that rainbows made out of spaghetti invariably fall apart, as you can see by this slide. The future of gas prices are expected to go up. There are a lot of different forecasts with different views on where exactly they're going to go and they have one thing in common and that is the fact that they're forecasts and forecasts have been proven to generally be not very reliable in the Australian energy market in the last few years. However, one thing's for certain and that is prices are likely to go up and not down. At the same time though, a lot of things that run on electricity that do all the same things that we use gas for – space heating, water heating, cooking – are becoming more effective, cheaper and more efficient to own and to buy upfront. They include split system air conditioners that can do heating and cooling of space, as well as heat pump-based hot water systems and, of course, induction cooktops.

So with all of this happening we started to wonder what's going to be the most cost effective thing for consumers in a residential setting to use? A lot of large energy users don't have the luxury of being able to choose between fuel types because of the nature of their appliances, but small consumers do have that choice. We wanted to understand what were the current options based on future gas prices and we found that there wasn't really much out there, so we had to go away and do the analysis ourselves.

So we went to our good friends at the Consumer Advocacy Panel, who do support us, and asked them for some support to do some economic modelling research to work it out and basically what we wanted to find out was what's the impact of retail gas prices on consumers in the context of what efficient electricity and what efficient gas appliances are available now, and what alternatives are there where they might exist? Because we're a bit geeky, it is a pretty detailed study and I like to think it's quite robust as a result. And there are a lot of considerations that we took into account, firstly, like-for-like appliance substitution. You wouldn't go replacing your gas cooktop with an electric resistance stove because electric resistance stoves kind of suck, so we assumed that people would have preferences for a minimum level of amenity from their appliances.

We considered different household types in the analysis, ranging from small to large households as well as new homes, which had different energy use characteristics and different opportunities in terms of appliances. Because we're particularly concerned with affordability for vulnerable and disadvantaged consumers, we also considered public housing stock and the typical appliance mixes that they've got, as well as homes that use LPG instead of mains gas. We considered the climate impacts on appliances which are two-fold: electric-efficient appliances run better in warm climates and slightly worse in cold climates because of the way they work with heat pump technology, but also, of course, warmer climates have different gas prices and a higher heating need, so that was quite a significant impact on the results. We considered gas and electric price scenarios, and I'll come back to those shortly.

Now, we considered a range of different replacement or substitution options for homes. One was for new homes or homes that weren't connected for gas today: should they actually connect to gas or should they instead spend their money on electric appliances? We considered existing dual-fuel homes: should they be staying on gas or should they be, where they can, replacing their gas appliances when they fail with electric efficient ones? Importantly, we considered the 10 year and whole-of-system costs. So we weren't just looking at the upfront cost, we weren't just looking at the

maintenance costs; we were looking at the whole lot, which is important for robust economic analysis. We also considered the age and condition of existing appliances. If you've got an appliance that's broken or is about to be replaced then the economic case is different to if you've got an appliance that's working and in perfectly good condition. And look, there was a lot of other stuff that we considered as well. I'm sure if there are any questions we'll come to them. This slide indicates that it was pretty extensive. Gas prices vary a lot across Australia, as do the electricity prices in the areas where you can have gas and climate considerations. So we did a very, very extensive analysis that considered 26 different gas pricing zones across the national energy market on the east coast, which means that most consumers are actually covered.

What did we assume in terms of gas prices? As you saw from the spaghetti rainbow before, there are a lot of different forecasts for where they might go. Now, we considered what I think is a reasonably conservative medium range in terms of price increases - I won't go through the details of each one because it varies from state to state. We did some sensitivity analysis though looking at a high price trajectory and a low price trajectory as well. More recent forecasts have suggested an expectation that we might see a bit of a price bubble in the next few years which could burst spectacularly, or we might see a gradual increase in the next few years which might peter off over time. We, of course, might see sustained high prices, we might see sustained low prices; we really don't know. What our analysis found that was interesting though is that the economic case generally where it occurs for moving to or away from gas isn't altered a lot by the pricing in the shorter term and it is affected a bit more by the longer term assumptions.

Electricity pricing is even more interesting in this context. Electricity prices are generally expected to go down on a supply basis. This is a very complicated area that if I had another half-an-hour on top of this I'd go into the details of. A couple of points to consider, because of the downturn in demand of electricity pricing we're likely to see the unit price go up for what we pay networks for pricing of electricity and, at the same time, the wholesale price might start to come down if energy retailers start to pass through some of the savings that are occurring through cheaper wholesale prices. Or that might not happen because generators that are driving down wholesale prices at the moment might be retired from the energy market and also we might see and we're likely to see changes in how network pricing occurs that means there is more cost reflectivity. That has very complicated impacts on some of these economics. You can see there's quite a dip in prices here before prices come back up again, and that's because the fantastic favour that the government did for us of wiping the Carbon Tax so we'd all get cheaper bills and stuff, blah, blah, blah.

So, findings. Some of the findings we really didn't expect and some of them we did. Generally there weren't too many huge surprises. Using energy-efficient electric appliances we found generally uses a lot less energy. Now, it's not apples and apples to compare megajoules for gas and kilowatt hours for electricity; you've got to compare them both in megajoules or both in kilowatt hours. So here's an assumption of what an efficient gas home uses and a similarly efficient electricity home uses for those services. You might observe that there's actually a much greater reduction in electricity demand than is brought about by just the appliance efficiency alone and one of the reasons for that is when we looked in great detail at how to substitute gas space heating, particularly gas ducted heating that's popular in Victoria and the ACT, with multiple split system air conditioners we found that there's a natural zoning effect that occurs as well as the efficiency gains there.

In terms of the findings for new homes, quite significantly we found that in no place in Australia is it cost effective for a new home that's not currently connected to gas, be it a home that's just been built or an existing all-electric home, in no location is it cost effective for one of those homes to connect to gas when they have the option instead of installing electric-efficient appliances. There is a caveat to that: some homes aren't in a position to install electric-efficient appliances and they might include apartments where they can't have external compressors for air conditioners and so on. In a lot of the homes where you can't install electric-efficient appliances, gas is still a cheaper option for those homes to install.

Another case that's interesting, some gas network businesses are heavily subsidising the connection of gas, particularly in Victoria where the government's handing out a lot of taxpayer dollars for them to do so in new network areas. In some of those cases where there's a heavy subsidy provided the cost of new appliances might be cheap enough so that those homes will be better off economically connecting to gas. The case for homes that are currently connected to gas is far, far more complex and there's a long list of factors there which play into whether or not homes are better off moving away from gas or not and, of course, the findings are equally complicated as well. One thing that was common is that generally speaking across all climate zones it's very cost effective to replace gas heaters with multiple reverse cycle air conditioners and that's regardless of whether you've got ducted heating, a gas wall furnace or even those quaint little inefficient heaters that people use that look like they're heating and they're actually just a flame, the decorative ones.

We also found that switching multiple gas appliances to electric is cost effective in some warmer climates with higher gas costs. So this is not even waiting for appliances to fail, just saying, "Alright, I want to get rid of all my gas appliances and replace them with electric. Should I do that?" In some places it's more cost effective. Generally, actually, it's not. Heat pump hot water systems are generally cost effective where the relative price of gas to electricity is high and/or where the climate is warmer. Now, I didn't detail this in the findings. What we found is in Victoria generally the gas prices work out to about 20-25% of the electric prices. In other parts of Australia it ranges from 30-50%. Generally in Victoria gas remains cheaper for hot water if you've already got a gas hot water system. Switching from gas to induction cooktops – and this is quite an interesting one, in fact, this is true of most appliances – if it's the last appliance that you've got and switching from gas to electric means that you also avoid the $200 a year in fixed charges that you're paying on the gas bill because it allows you to disconnect from the gas network, in a lot of cases it makes it cost effective to do that even if your appliance isn't due for replacement.

Finally, we found that customers in new gas zones pay a lot more for gas, which is a bit ironic. So the Victorian Government is handing out $100million to gas distribution businesses to roll out new gas lines to homes that don't current have gas. It doesn't cover all of the costs though, so those gas distribution networks need to have higher charges for those consumers to recover those costs of the gas pipelines. We found invariably those customers are getting stooged in terms of prices, unfortunately. So that's my opinion not a fact. "Stooged" isn't a scientific word in that context.

So as a result of this research we made some recommendations. Firstly, because we're very concerned with the welfare impacts of this we thought that energy concessions should be improved to address the cost of living impacts on gas prices for vulnerable and disadvantaged consumers. Also, we should look at the potential to control gas prices for vulnerable and disadvantaged consumers. Now, when people hear "controlling gas prices" they usually think "gas reservation" and have a panic

attack. We're not talking about that. We're talking about the potential to take other measures such as social tariffs that could be used to mitigate that impact. Also, providing better information for consumers regarding the real cost of purchasing and operating gas and electric appliances. Financial counsellors still today advise people to use gas because the conventional wisdom persists that gas is a cheaper option, however that's not always good advice, as we've learnt. It's not just financial counsellors that do that, there are existing gas businesses that still market gas as cheaper, cleaner and all that stuff, when in actual fact we've found that very clearly it's not compared to the electric alternatives. We found one business that was making statements like, "Oh well, when gas costs 3c a megajoule it must be heaps cheaper than electricity, which costs 30c a kilowatt hour" but it's kind of like saying that 3' is longer than a metre because there's three of them instead of one. There's some really dodgy marketing out there.

We also suggest there should be an urgent review of policy and programs to subsidise and support the expansion of the gas networks. We're considering partnering with the Institute for Public Affairs to see if they'll join us in this one to stop handing out subsidies to, in this case, gas distribution businesses to roll out networks where it's not cost effective to do so. Importantly, we think that investments like that should be in the long term interest of consumers, which is in keeping with the national gas objective. We think therefore that those policies that are intended to provide affordable energy should actually be structured in a way that they do so, rather than just building an asset that's vulnerable to a future death spiral, which leads us to recommendation seven.

What we found is that no network businesses that are in gas network operations today are actually assessing their competitive position against electricity to see if consumers are going to move away from using gas to using electricity. Now, we all worry about the electricity network death spiral because everyone's using solar and in future they'll install batteries and give the finger to the electricity network. We think that the issue is much bigger and more pressing in the gas network space because gas is a discretionary fuel for a lot of Australian consumers. The networks though are going to have to pass through the costs of those networks to the consumers who can't afford to move away from it which exacerbates that affordability issue that we discussed before.

Finally, public housing. So Victoria's Department of Human Services still has a policy which is if gas runs past your house in the street we will connect it and we won't install electric AC split systems and we will only install gas for heating, unless the home needs cooling for medical needs. Obviously, that is a policy that is no longer in the best interests of those residents and we also suggest that there should be support to help those who can't afford to move away from gas appliances to more efficient electric or more efficient gas, if that is an option for those consumers and it is a better one, appliances. And I'll leave it there, thanks.

TONY WOOD: I should assure you that I have checked and Craig does not have an electricity appliance shop out front when you leave tonight, although you might be suspicious when you hear some of those numbers! Hopefully what we've done now is set up a few of the issues that are worth exploring. What I'm asking is each of the speakers and Mike Sandiford from the Melbourne Energy Institute join me on stage. I'll put a couple of questions to each of the people on the panel and that will give you a few minutes to think about some of the issues you'd like to raise and questions you'd like to put to the panel.

Some of you who may have attended our sessions before would be aware that MEI have done some of the most detailed work looking at the changes in the use of energy across the last four or five years, particularly electricity and solar and so forth. But I guess one of the questions I'd like to just start with Mike – and I'll get to the more interesting ones in a few minutes – is how do you see, from what you've heard and what you understand yourself, the role of gas in the Australian energy mix given that on the one hand we've got the high price and you've seen the impacts that Craig's been talking about, but equally the role that gas would play in complementing renewable energy, as Peter talked about? So I'd just be interested what your perspective would be from someone who doesn't obviously have a particularly vested interest, but more from a research perspective?

MIKE SANDIFORD: Well, good and complicated question with many dimensions to it. An interesting point I'd like to pick up here which was raised in several of the talks is the relatively small cost of supply of fuels in this game. We heard earlier that only 11% of wholesale prices for gas is in the retail margin. In electricity the spot price is similarly small, maybe 15-20%. You can get 20% discount just by asking your electricity retailer and telling him you'll pay on time, it's in the retail margin. The costs are in the distribution and here we are running grids, massive long term investments, to some extent some costs but they have to be augmented, that are chewing up a greater and greater proportion of the cost that we as consumers use, as was raised quite well by Craig. And it does seem to be at a very sensitive thing.

Really, what we're doing is running two massively expensive grids to supply essentially the same thing, heat, light, communications – although communications aren't being supplied by gas at this stage – but energy services are being supplied there and it does seem to be sensitively balanced. So there's a big issue for us of concern. How do we deliver the sort of amenity that we want into the future in affordable ways? Do we continue to do it by running two grids or do we sensibly opt out of one of them, or do we leave it to the market to decide? We'll probably leave it to the market to decide, but it is sensitively balanced and I think so sensitively balanced that as we start to tip it one way it can very quickly go. So the cost of developing electrical services will get less if people opt out of gas onto electricity because the unit costs of delivering the electricity is going to be reduced and in an efficient market that should come back. So the disparity grows through time. So it does seem to be quite sensitively balanced and there's an interesting question there about how do we regulate it to deliver the thing we really want, energy service? So that's an interesting question.

On the broader issue of our fuels, the development of these new technologies to allow us to access the crust in new ways has been quite astonishing. Had we been sitting here 10 years ago or a little over 10 years ago, we would have been concerned about gas security on the supply side in Australia. We're no longer really thinking about that in a macroscopic level. We're thinking about exporting vast quantities, but we're also concerned about how we use deeper groundwater resources; we're interested in how we get carbon back into the crust; I'm interested in how we might utilise the heat resource which exists in our crust through unconventional geothermal which just happens to require fracking, a clean source of energy. Our calls on these are growing and as they grow the interaction between the usage regimes who want our crust to supply it is growing. That's becoming a very pertinent issue and a lot of attention we've heard in this commentary is about how we reconcile those different uses.

TONY WOOD: I guess one of the challenges we'll have to think about is how do you think about geothermal energy particularly in the same context? But I'd like to come to one of the very sharp

points that was raised and, Peter, get you to respond to it. You made the comment about the way in which your company has been dealing with landowners and the challenge that Ursula was putting is has the industry demonstrated to the satisfaction you believe of landowners that coal seam gas is safe when you take into account the sort of issues that Ursula's been raising and some of those concerns about evaporation ponds and so forth? What would be your argument as to how the industry, and your company in particular, has demonstrated that?

PETER CLEARY: I don't think the industry got off to a great start in this area, especially in Queensland, and that probably did us quite a significant amount of damage. What we've done since is said simply to people and to farmers that we won't enter their land without permission. So we patiently and respectfully spend time talking to farmers and talking to the broader community – because it's not just about the farmer – about how we can access their property and what we're able to do on that property, and we reach agreement before we enter that property. So I think we've learnt a valuable lesson in being patient and respectful and that's why I think we've had success in places like Queensland, particularly around areas close to Narrabri we're now getting more acceptance, you may not believe that as you read it.

As I said before, where we tend to get the most reaction is in areas where we're not and I accept Ursula's point that we need to convince communities that what we do can be done without interfering with their activities. Our objective is to be in coexistence with agriculture. Not to the exclusion or to the detriment of agriculture, but to be in coexistence with agriculture.

TONY WOOD: Ursula, I haven't read it in detail but I've seen some of the recommendations from the O'Kane Report in New South Wales. For those of you who aren't aware, Mary O'Kane is the New South Wales' Chief Scientist and she was asked by the New South Wales government to do a review of the coal seam gas industry and fracking. My understanding is that her recommendations were that within a range of requirements in relation to regulatory outcomes, including I think the sort of things that Peter was just referring to, the industry could proceed. Now that's not a blanket yes but it's obviously with a whole range of conditions. I guess I'd be interested in, if you've looked at it, how do you view the recommendations of the O'Kane Report?

PETER CLEARY: Not surprising and completely acceptable.

TONY WOOD: Sorry Peter, I was just going to ask Ursula. I'm sure I understand what you're going to say.

PETER CLEARY: Apologies Ursula.

TONY WOOD: I meant to say "Ursula".

URSULA ALQUIER: Well firstly, just on the point that Peter was making regarding approaching landowners. In our experience in Victoria we've had many landowners feeling bullied into signing an access agreement and that has happened on many occasions. And I think if you have a community that do not want the industry and you have one or two landowners in that community that decide to sign an access agreement, that is not giving a social licence because this is an industry that even if it's on your neighbour's property or it's 20km down the road from your property, you can still be impacted by it. So I think that saying that if a landowner gives you permission you have therefore got

permission to be in the area is false because this decision has to be made as a whole community, not just by one or two landowners that may or may not think that they might make some money out of it.

And you really cannot eradicate the risks. All well casings eventually fail and one in six well casings fail in the first 12 months. That's industry figures from America. So when we've got a case of wells failing, whether it be straightaway or 20 of 50 years down the track when the industry's long gone, is it then the responsibility of communities to mop up that mess? And we have seen this already with abandoned wells in Victoria. Some of these wells are 10/20 years of age, some of them have been capped with concrete, others haven't even been capped, and they've just been left. So what happens when they start to cause problems or already are causing problems? Whose responsibility is it? And so when we talk about coexistence it all sounds very lovely, but when you're talking about a small dairy farm in South Gippsland, maybe a 200/300 acre dairy farm and they have to deal with massive pipelines put through their property. It's not just a well pad that we're talking about; we're talking about water pipelines, gas pipelines, compression stations, massive evaporation points; companies need access to your property 24/7; there is noise pollution; there is light pollution as they work through the night.

There is flaring off which is a massive fire risk. In New South Wales they're allowed to flare off on total fire ban days. We live in an arid country. Bush fires are going to become a bigger and bigger part of our lives. And so I think it's totally false to say that better regulations will eliminate the risks because it can't and farmers don't want this infrastructure and they don't want the disturbance on their properties. And then there are also land contamination issues because a lot of crops that are grown have very strict regulations around vehicles coming on and off their properties, potato growers in particular, or vehicles have to be hosed down and disinfected on and off. So there's a vast array of reasons why coexistence is a myth.

TONY WOOD: Peter, now I'll give you the chance to respond. I didn't set you up for that, by the way.

PETER CLEARY: That's alright. I dispute a lot of the so-called facts that come out of Lock the Gate. One in six wells do not fail. Technology we use in drilling and capping and isolating aquifers has been shown, and the New South Wales' Chief Scientist has shown in her report, that the extrapolation is that it will last for more than 1,000 years. So we have an industry that is highly regulated, relies on the science and has an ability to do this in a way that is safe and managed properly. I also just take a point before; I think Ursula mentioned we were fined for dumping nuclear waste. I've got to call that Ursula.

URSULA ALQUIER: Oh yes, I actually meant uranium.

PETER CLEARY: No you didn't, you said we dumped nuclear waste.

URSULA ALQUIER: No, I said you were fined by the EPA in February of this year for contaminating an aquifer with lead, arsenic and uranium. And I did say nuclear waste and I meant to say uranium, so I apologise for that.

PETER CLEARY: But we didn't contaminate the area, we were fined –

URSULA ALQUIER: You contaminated an aquifer in the Pilliga Forest and you were fined by the EPA.

PETER CLEARY: First of all, that was – and this is not an excuse - but it was a company that we took over and we took full responsibility for their previous actions. We reported it to the New South Wales Government. We did the scientific studies to find out what the cause of the leakage was. We found that, we've cleaned that pond out, we've taken all the water out of that, we've mediated that area, and what the EPA found was there was a migration of naturally occurring minerals in that area. Nowhere near –

URSULA ALQUIER: Why were you fined if it was naturally occurring?

PETER CLEARY: Because it hadn't been reported by the company that we took over at the time that it happened and that's why it was $1,500. They can throw a bigger fine than that as us.

TONY WOOD: Okay, so I guess that's probably enough to open up some issues I'm sure for the audience - and Craig, I won't let you get away too easily. So I guess I was interested that one of the conclusions from your presentation, and Mike almost referred to it in a sense, which is, is this the end of the gas industry for the households and possibly even businesses as we know it? And does that mean, in some ways implied in both what Peter and Mike were saying, we might see gas in Australia, if anything, being used for power generation and that's about it? Do you have a view on that?

CRAIG MEMERY: It's quite interesting, especially given that gas for power generation is also becoming uneconomical in a lot of cases where it was once, but now we don't have such restrictions on carbon emissions or a Carbon Tax so it's a much more favourable environment for coal, and with the Renewable Energy Target, wherever that's going. Anyway.

Large energy users don't have the flexibility to choose so much what they use. They do have fuel switching options, so it's a very different case to them. Large energy users are exposed at a much higher level to the wholesale price. For them, the network costs are much less than half of the overall cost; it's actually the cost of the wholesale impacts for them. So they're the ones who are really facing higher price rises and have less ability to respond. In terms of households, look, it's anyone's guess but the economics pretty obviously point to the fact that rational people won't connect gas where it's not already there if they are looking at the economics of it and existing homes will move away from it with different services.

We did another piece of research about a year ago though that looked at the competitive position of the electricity grid against standalone power systems at a community level and we found something that's interestingly complementary to this research, and that is that for homes that don't have high heating needs or have another resource other than electricity for their space heating, they'll be the ones that go off-grid. So we might actually see homes staying on gas but going off the electricity grid with batteries and solar. That's a possibility as well, but that gets into the realms of forecasting and anyone who forecasts in the current energy market is very brave.

TONY WOOD: Mike, do you want to comment?

MIKE SANDIFORD: Interesting point there is we reflect back on why gas was introduced, particularly in southern states like Victoria. It was introduced to add competition into a state-owned energy supply market which was electricity. Now the electricity market has now been deregulated and has its own internal competitions, so the primary reason we introduced gas into the domestic market has

somehow disappeared. It was manufactured in some important way and we should look at it in that context.

TONY WOOD: Okay, obviously we'll leave the issue of where the Renewable Energy Target might go for another day. We'll open up to questions from the floor.

AUDIENCE: There are a number of things that come from different perspectives from all of the speakers that just leave me feeling a bit puzzled. Firstly, we've had a fairly strong emphasis on what happens at the domestic consumer level. There's not been very much comment about industry use and, given that gas is an essential input to a number of key industries, I'd be grateful for some comment because in terms of Mike's comment about the sheer cost of running two networks well, the fact that gas is an absolutely essentially input, say, for fertilizer production and things like cyanide production as well as certain types of plastics, you're going to have to have a network to keep the supply side up for that use.

The second point, Ursula in particular, what's your solution if we have an essential need for gas for industry, apart from your comment about 30 years' supply being still in the Bass Strait, that'll be at an increasing price, so if you don't want gas produced on competing agricultural use land in eastern Australia, where do you believe gas should be produced if we are, as a society, going to continue using it?

TONY WOOD: Okay, on the first question I might cover slightly because the main element of one of the reports we put out recently in addition to looking at the impact on domestic household consumption – but Craig's covered that – was the issue of industry. And I found it more than interesting myself to go to country towns like Echuca and talk to tomato processing and tomato growers and those sort of people for whom their gas input is a fundamental part of the cost structure of their business and they are seriously concerned about gas price increases. They're not the companies that were big enough to have seen coming the sort of price increase that Peter was talking about.

I mean, the big companies, the fertilizer manufacturers, the explosive manufacturers and so on, have seen it coming. They're not very happy about it and they've been clamouring for government to do something about this for a while, but I think for these smaller businesses for whom gas is an equally important input it is a big deal and they're looking at gas price increases of the sort that Peter referred to for them. One particular company we spoke to, their gas price would go from 5% of their costs to 11% of their costs and that would almost send them out of business, and they don't know what to do about it because the choices are not even as easy as the one Craig mentioned in terms of can you switch to electric appliances? They might have to go back to coal or oil or something.

So there are some significant challenges on that side of things. But Peter, do you want to add to that, otherwise I can pass to Ursula on the second question?

PETER CLEARY: Just quickly on that, it is an important issue. This is a bit of a fluke, but we signed a supply deal with Cronos in Sydney today to supply the methane from Moomba. It's important to continue to supply to the domestic market. I accept that there are challenges for the domestic market, but those same products are being produced in other nations where the gas price is a lot higher. I think one of the troubles we have in Australia is the scale of our industry, it doesn't allow us that efficiency in manufacturing. Oil refineries in Australia aren't going out of business because of the price

of oil, but the scale isn't to that. So it's more than just the price of the input that is causing some of these.

The other side of that is that we see these companies actually investing in the upstream. They don't believe that our price is good enough; they think that they can get out there and find it. We encourage that. I think that provides competition. The final point is, as I said, the economic fundamentals, if we can bring supply on we can reduce costs and hopefully reduce prices.

TONY WOOD: Ursula, do you want to respond to that?

URSULA ALQUIER: Yes, well, I suppose I'd make the comment that rising gas prices are due to Australia linking ourselves to the global market. Exporting gas is driving the price of domestic gas up, not lack of domestic gas in terms of how much gas we have for domestic use. So that would be the first part of your question.

Secondly, we are in a world that is running out of fossil fuels and we do need to look to alternatives and I don't think that food and water security should be the things that are thrown away in exchange for taking longer to transition to 100% renewable energy, which we know can be done. And I know that there needs to be a transition phase, but we do have enough offshore domestic gas to allow us to transition to renewables and I don't think that when we really sit down and understand what our most precious commodity is here in Australia, which is water surely, and the extraordinary opportunity we have to continue to produce food in this country. If those industries are eradicated because we choose not to transition to renewables as quickly as possible then we're going to be in a lot of strife.

So, I think we are told that we can't do that or that we shouldn't do that, but we need to be looking elsewhere. And I don't profess to have all the answers, but I think that we need to challenge ourselves to do that and we see many other countries leading the way in renewables and we're most definitely not leading the way in renewables in this country.

AUDIENCE: My question follows up from the previous question about reservation of gas or something for the manufacturing market here, because it is an essential input. Gas is not just an energy source; it is also what we use to make our clothing, our yarn, our carpets, all sorts of things like that. We refine it and we make it into valuable product which has a long life. We lock up the carbon and we use it and we can re-use it many times. When we burn gas it only has one use and then it's gone, it's in the atmosphere.

So I'd like to hear something from the panel around how they manage that overseas, because there are countries in the world, including the United Arab Emirates, where they have a very large gas and manufacturing industry based around their gas extraction. They appreciate that it can be more valuable as a product, rather than something that is used for fuel. We haven't achieved that here in Australia although, having said that, Western Australia has a 10% reserve for their gas there. I'm interested to explore how it is that it works overseas so we can consider it here. Thank you.

TONY WOOD: I think the issue is, is gas too good to burn is the question. Peter, do you want to respond to that?

PETER CLEARY: Yes, there are a couple of elements in that. I can talk to the UAE; I lived there for three years. It's a small country population-wise with vast resources and it does have a diversified

policy towards its gas use. One of those is LNG which it ships off to Japan and it has fertilizers and other uses as well. Qatar's the same: big gas reserve, small population. Australia has a similar opportunity. We have a domestic market; we have an export market as well. As I said before, scale is important in manufacturing. Your fibre that you talk about, your manufactured products, again, compete internationally. Their prices are set internationally, they're not set domestically. So whilst gas is an important component to that, it's not the only component and I use the example in polyethylene. There are a couple of industries here in Melbourne and over in Sydney that are very small compared to the masses you have in Asia, America and other places. They make it cheaper.

Reservation I don't think has worked in Western Australia. It's an incomplete policy. What it does is actually the opposite of what it tries to achieve. It actually sterilises resources; it doesn't create the opportunity to develop those resources. We took a billion dollar investment in New South Wales to develop gas around Narrabri, expressly told the New South Wales people and government that we wanted to supply that to our customers. Not 10% of it, but 100% of that in New South Wales. It was still struggling to get community and government support to develop those resources. Reservation doesn't work.

AUDIENCE: One of the questions is how do we supply the full realm of the market, that's both internationally and domestically? And while we have a lot of understanding in conventional gas about production and lifetimes and things like that, there is some concern as we move into the unconventional realm just how our expectation of those fields will evolve over their lifetime. So, a question that I would have to the developers of the unconventional gas is how confident are they that they can supply to their expectations over the lifetime of these fields and is there risk for us as a community that need a range of services supplied by that gas?

TONY WOOD: Any comments on that Peter?

PETER CLEARY: Yes. Arguments about geology with a Professor of Geology? Not a good space. All I can say is that, as you recognised earlier Mike, the industry does continually grow in its understanding, both subsurface and surface, it develops the techniques and it responds. What was possible some years ago, what was uneconomic some years ago; they're very different questions answered today. So as I said, the resource base in Australia is large. How much of that resource will end up economically capable of being produced is an unknown question at this stage, but that's why we invest the money we do in both the research and our activities to make that happen.

AUDIENCE: I live on the edge of the Pilliga Forest and I've lived there for 40 years, which is near the Narrabri area that Peter claims supports coal seam gas. My water supply is a spring, I drink that, and Santos is drilling into the rock, the Pilliga sandstone that my water supply comes from. It's proposing to drill 850 wells through the Great Artesian Basin in the Pilliga Forest, which is called a Conservation Zone, a state-owned area, and Santos has completely failed to convince our community and, as Ursula said, we've actually asked everyone what they think and Santos does not have support. We've surrounded you by nearly 3million hectares of up to 98% of people who say we don't want you there. There is no social licence, but you're on state government land. But you've failed to convince us as a community that it is safe to drill through the Artesian Basin and to drill into the aquifers that our water supplies.

So, this is a question for Peter. Can you answer that?

PETER CLEARY: Sure can, thank you very much. So let's start from the base that I think we agree on, that is our intention is to develop first in the Pilliga State Forest in an area that has been zoned for logging and mining purposes for many years, not in national farm or national reservation areas for nature reserves etc. So it's already been reserved for what I would call primary activity. We don't drill into your aquifer and stop; we drill through and we case and seal as we go down, and that's the way we do things. Water from other sources into our wells is a problem for us. It's not a help, it's not something we want. We want to drill to the coal seams and get into only the coal seams for the area we produce. Any other area above that, which is where most of the water you're talking about is including the water you drink, is much closer to the surface. It will have probably a triple layer of cement and steel that completely isolates that zone from the zone from which we're producing.

Now, I'll also accept that we've still got work to do to prove that to you, but the Chief Scientist of New South Wales has looked at this on behalf of the Greater New South Wales community, as have the Namoi Water Catchment Area Studies, and shown that we can conduct our activities if done properly – I accept that, if done properly – in a way that will not disturb the aquifers that the farmers and townspeople use.

AUDIENCE: There are a few points I'd like to make. You talk a lot about price, but in fact the cost is climate change. The fossil fuel industry is virtually entirely responsible for the creation of climate change which will kill us all, so I don't think we should be talking about price per gigajoule; we should be talking about the destruction of humanity which is actually quite likely. And I've got two little granddaughters and I'm not happy about this. The thing about regulations is that all through the western world we've got pretty weak governments. We've just seen the election in America totally bought by the fossil fuel industry, so there's now a whole Congress that will not do one single useful thing for the future.

TONY WOOD: Sorry to interrupt, could I just ask, is there a particular point that you'd like to put to any member of the panel?

AUDIENCE: Yes, I'd like to say the point is that everyone should be moving as fast as possible to renewables because the fossil fuel industry has been useful in creating a larger economy, but that economy is now growing at such a rate that it's actually destroying the environment and our future. So I'd like to ask everybody about the opportunities for development of renewables, because it's our only hope.

TONY WOOD: I think one simple answer to that – and I think even Peter referred to this – is that the sooner we put a cost and a price on the environmental damage that this is causing and cause the sort of transition that we're talking about, the better. And I don't think anyone that I know of in the industry, certainly the gas industry –

AUDIENCE: But governments won't do it because the governments are accepting subsidies from the fossil fuel industries at a very large rate.

TONY WOOD: Okay, that might be a good topic for another Grattan forum I suspect.

AUDIENCE: I've got a very interesting question because there's another event happening on Monday around the carbon asset bubble. So my question is, it's great that we've got a liquid gas boom but

why should we care and how long is it going to go for, especially if there is an asset bubble of companies that invested in carbon-based fuels?

TONY WOOD: Peter or Mike, do you want to comment?

MIKE SANDIFORD: That's an investment risk you take. Where is your super? That's the market at play. I mean, we have a lot of issues in this market. The question is there's still demand for carbon-based fuels. I'm a geologist. My profession is often tarred with promoting that. Actually, I'm very concerned about the management of CO_2. Why am I interested in gas? Well, one of the things that we have to do is get CO_2 out of the atmosphere. That's a lot easier job if we're using gas primarily to make electricity to capture carbon. That might be doable in ways that it's not doable with coal.

Now, the issue for me is not renewables, even though I work on 100% renewable plans. The issue is managing carbon, that's the issue. It's no different from managing waste from nuclear; it's no different from managing the production of rare earths that go into our turbines which are done with fluorination processes which have incredibly toxic effects to the environment. We need to manage this in whole-of-life scenarios and deal with the problem. It's not clear to me how fossil fuels will play out in that space unless we can learn how to manage it. Gas has some attractive propositions, it has some unattractive propositions; fugitive emissions for example being one of the unattractive sides of it. It's a complex area. It's not solved at this stage.

TONY WOOD: I guess that was also a free advertisement for the *Carbon Bubble* seminar on Monday night.

AUDIENCE: The Monterey Shale Formation in California was to be two-thirds of America's unconventional energy resource and in May this year, after research by the Post Carbon Institute, the energy administration had to downgrade that resource by 96%. This was two-thirds of America's energy renaissance gone overnight. It didn't get much press here in Australia, but in the US it was obviously a very big news story. People were asking how could this disappear overnight? Well, it disappeared because the company who produced the report used data from the energy companies.

So my question is, given that these resource estimates are crucial in the formation of policy especially the deployment of renewables, and given that there are such profits to be made by the gas and oil companies and the oil field services companies, like Halliburton and Baker Hughes etc. who are making a fortune at the moment, who can we trust? Where do the figures come from for the resource estimates in Australia and can we trust them, given their importance?

TONY WOOD: Peter and Mike, would you like to answer that?

PETER CLEARY: I can't speak directly to the Monterey, but my suspicion is that if it's a Tri Gas field it's probably because the price of the gas is lower than the cost of extracting it, which is the economic test that you always look for. So you can have the same amount of gas in place, but how much of that is economic to produce is determined by the price at which you can sell that product.

AUDIENCE: Why was the estimate so far out?

PETER CLEARY: Again, I can only give you one potential explanation. I'd have to look into it, I don't know the answer for Monterey, but in Australia we use Geoscience Australia, the Bureau For

Resource Economics, and other people that work with the industry and on their own to determine the resource potential of Australia. When we go from a resource to a reserve that says we have the ability to produce that economically, it's audited externally, it's reviewed each year and, as a company on the Australian Stock Exchange, if we're caught telling porky-pies we're in a lot of trouble.

MIKE SANDIFORD: There are a lot of technical details about what it requires to get conventional resources from the source rock and they depend not just on the nature of the rock and the gas in it and how it's held, but they also depend critically on the stress field and how you can manipulate the fractures. That's the fracking technology. Following the success in the US, in the east coast particularly where gas has demonstrably been produced maybe financially because it has a lot of liquids in it - and it depends whether it's wet or dry gas in particular whether it's currently economically viable - but it has demonstrably been able to be extracted. There's been a lot of interest in Australian shale gas plays and Chinese shale gas plays, but the Chinese, where it's been more developed, they're proving very recalcitrant rocks not because they don't have the source rock but because of the stress field. It's hugely under compression and the fractures tend to be horizontal and they won't bleed the gas off, and large parts of Australia may be the same.

So there are a lot of factors that we need to learn about to understand whether that can be bought at economic cost with current technology to the surface and that plays out. I think the thing that we've learnt, and it's possibly a concern for the climate side, a decade ago we would have been concerned about the amount of accessible carbon in the crust. We're no longer concerned about the amount of accessible carbon in the crust; we're demonstrating that there's more than enough carbon in the crust to burn us literally, the climate. So we have to manage that in a different way and that's the imperative.

As a geologist what do I say about that? Well, we need to learn how to use that crust not only to provide our energy service as we have in the past, but to manage carbon and if we can't do that we can't access that other surface. It's an ongoing problem and learning how to better assess the resources, use it, value the pore space for what it delivers for groundwater, what it delivers for storage potential for carbon in the future; these are key issues which will be really important to how we as a society address this issue, providing energy services in an environmentally sustainable, affordable, secure way.

TONY WOOD: Hopefully what some of this conversation tonight is about and some of the points you've made yourselves is demonstrating that, if anything, this whole issue is becoming more complex, rather than less. The questions we have before us either as individual consumers, the sort of numbers that Craig was talking about, the list of issues that we all have to consider as we think about even the choice between gas and electricity, are far more complex than they used to be. Getting access to reliable information, whether it be about the availability of gas or electricity for our appliances or whether it be about an understanding of the resources, is going to be more complex. The interaction with communities, partly because of the sort of movements that Ursula's involved in, the social media aspects are becoming more and more complex. This isn't going to go away. Hopefully it will also provide more meat for further discussions next year.

I'd finally like to, firstly, thank and recognise the Melbourne Energy Institute, our partners in producing this series of events. I thank you for attending tonight, hopefully we'll produce some more next year and one of our challenges is to try and spend as much time as we can having this sort of interaction

and not talking at you, but to try and have the opportunity to help better explore some of the complex issues that are ahead of us. Also finally could I please ask you in joining me in thanking our panel? Thank you.

END OF RECORDING