

Positive Futures Series 110823

What's the Fracking Fuss all About?

Panel Discussion

Karyn: The world's modern economies are incredibly dependent on cheap energy. Developing countries look at our lifestyle and they want the same prosperity that we have, China and India particularly are on a fast track to getting that. But 1.4 billion people in the world tonight don't have access to electricity. Another three billion people tonight will be relying on wood, charcoal, and dung for heat and lighting.

Electricity is the great economic enabler. To get it these people in developing countries need access to energy as cheaply as we've had it. Today that energy mostly comes from fossil fuels: conventional oils, gas, and coal, which are becoming increasingly expensive to find and develop, taking them even further out of the reach of developing nations. And the costs are not just economic.

From a purely selfish perspective as Australia's demand for energy continues to escalate, we also need to be looking for alternatives. We are self sufficient in electricity, largely through coal and gas, but not self sufficient in oil. When oil prices rise we feel the ripples everywhere, from the petrol pump to the cost of a loaf of bread.

We're also aware though that our reliance on burning coal particularly comes at a very heavy environmental price. Tonight we are going to make a nod right up front to the option of renewables but we're not going to spend a lot of time on it tonight. There are huge opportunities but also enormous challenges in replacing our domestic consumption of renewables, and that's why we're having a full forum just on renewables here in this room on the 18th of October.

Realistically we're a generation away from renewables being available in sufficient volumes to replace conventional fuels. The Beyond Zero Emissions Report indicates an investment of thirty-seven billion dollars a year every year for ten years to drive Australia into a renewable future.

So renewables are one answer, but for the time being at least they are not the only answer. What will we do in the meantime for both domestic and export demand? There's another really important aspect of this energy question which is about our behaviour as consumers, whether we're individual or business consumers.

Again, we'll be having a full forum about that on the 6th of December, so we'll touch on it tonight but probably not spend a lot of time on it.

There are environmental, economic, social, and ethical questions attached to the decisions that we make, not just for ourselves but for other countries that depend on us.

If we don't come up with new energy resources how will we live? How will we work? How will we transport ourselves and the things that we need? How will we feed ourselves and the forty million other people in the world that we

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feed? And how will we continue to operate industries such as tourism and manufacturing on which our economy is also reliant?

Taking a global view of the world and how its resources are distributed, what are our rights and our obligations in supplying developing countries with what they need and what we have in plenty? But how do we balance these development needs with our global environmental responsibility?

A wicked problem, politically certainly, but also personally a wicked problem. Now we're not naive enough to think that we're going to solve this problem in ninety minutes tonight but we do think that this community, our state community, our country is or ought to be smart enough to find ways to have the lifestyle that we want, including the prosperity and the jobs, and to protect and enhance the environment at the same time.

Enough of the preaching. Let me introduce to you briefly Mr. Wally Wight. Wally represents the Australian Association for the Study of Peak Oil. You can find his bio on tonight's program, as you can the bios of all of our panellists tonight. While we have varying estimates of when the world's consumption of oil is going to outstrip its production, and the International Energy Agency is now saying that that's already happened in 2006; Wally, can you tell us what does peak oil actually mean for us here in the room tonight?

Wally:

Well peak oil as a concept is the time when our production of oil maximises and from this point onwards we'll produce less and less oil. It is quite right that oil did peak by 2006 if we're talking about what we describe as conventional fractions of oil.

We are able to produce more oil than we did in November of 2005 by using unconventional sources, and by substitutes for oil. What oil means to us, or what the vulnerability to oil depletion means to us is that we're likely to face three kinds of events. One of the events is a sharp and sudden decrease. If for instance one of the suppliers like Saudi Arabia has an uprising and that's not totally out of the question, that could disrupt supplies and we could find ourselves with a diminution of availability of fuels. We could also have a great variability in the supply/demand balance and associated with fluctuations in the economy which means a wild variation in prices. That's what we've been experiencing over the last few years.

The other event is just the gradual diminution of supply that comes as the search for the renewables and the alternatives are unable to meet the growing demands of the emerging economies like China and India. So we're faced with those.

What it's going to mean to us is that we are going to be disadvantaged, particularly those of us who are highly dependent on oil for our transport. And in Australia seventy-two percent of our oil consumption is on transport and ninety percent of our transport is dependent on oil.

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So those of us that live in the fringe areas will find it more and more difficult to be able to afford to travel to work. We saw a parallel of that in the United States where in the global financial crisis people weren't able to drive their large pickup trucks to work, so they lost their jobs, so they couldn't pay their mortgages, and whole suburbs were abandoned.

I think that Australia will be in a better position than that but it is something that we will have to use land-use tactics and other means to make ourselves less dependent and to give ourselves the resilience to respond to the vulnerability.

Karyn: I think what you're saying is that there was some suggestion that in fact the global financial crisis was perhaps partially triggered at least by peak oil, and that was responsible partially for the mortgage crisis in the U.S. suburbs and cities.

Wally: Certainly partially, it wasn't the only factor but it certainly was one of the contributors.

Karyn: You've talked a bit about the fact that we need to make some changes in terms of our usage patterns. Where are the big opportunities that you see for us in Australia or particularly in Queensland, I guess, for where we might be able to substitute some alternatives, either in terms of unconventional resources, or in terms of industry changes?

Wally: I think the biggest gains that we're going to have are in the personal transport areas because it's the personal transport areas where we waste the most energy that we derive from oil. It's our private cars, so what we need to do is to change our planning arrangements so that we access more of our goods and services more locally, so that we don't have to travel so far to get our goods and services, or to work.

If we are obtaining our goods and services more locally, that will stimulate the enterprise locally that will then give us jobs locally. That's a different pattern. We'll have to put more of our investment into group transport, public transport, and active transport -- cycling and walking, which will go hand-in-hand with the clustering and the localisation of enterprise.

There's quite a number of things that we're trying to do for other reasons, and I treat oil vulnerability as one of our urban-design tools for better place making.

Karyn: I could see that that will work for some industries. I'm wondering about the role of manufacturing, for example as an industry. And we've already seen this week with Blue Scope Steel some quite major disruption in that industry. I'm wondering about what potential you see for those kinds of industries, where it's really not going to be, I think, the circumstance where you can localise production in that way.

Wally: I think in those instances that we will see a trend away from dependence on oil for a lot of those kinds of things. The steel industry for instance is highly

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dependent on coal for their major energy source. Part of the issues that we have is that the extraction of coal is highly dependent on oil. But I think we'll see automotive power in mining and so on, trending away from the use of oil, and that the mining equipment and so on will progressively be using either gas or electricity in those processes.

Karyn: Thank you. Can we move on then, move the conversation on. Wally, you talked about unconventional sources of oil. I want to move the conversation to Liam Tobin of QER, one of Queensland's resources companies. QER is investing in exploration and technology development for shale oil and a decade ago the Stewart Oil Shale Project in Gladstone was shelved for economic and environmental reasons. And we've not heard much about shale oil in Queensland since then. It would be great to understand what shale oil is up to. Liam, can I get you to tell us a bit about what is it, where is it, how are you getting to it?

Liam: Before we go there can I pick up a bit about peak oil?

Karyn: Please do.

Liam: I guess we'd make a distinction between transport fuels and stationary energy, so coal and gas and so forth could be seen on the stationary side and obviously gas could make that leap over into transport fuels as a liquid as well.

The point that Wally made about the seventy-two percent of our transport being road transport, and that's what puts food in our supermarkets and so forth. We are absolutely dependent on that so that's a huge factor for us in Australia, particularly with regards to the peak oil.

I know there's a wide spread of opinion. You go from the IEA in 2006 they said that peak oil -- you can stretch it out from there. Certainly we see there are new finds of oil but increasingly they are getting more difficult to get to or they take more processing to be able to use. They come with other issues as well.

The point I'd make though is in Australia we see it already. In 2000 we were self sufficient in oil use. In the last decade we've dropped to about half of our self sufficiency. That's a really big factor. That's a big issue for us from an economics point of view, with the balance of payments and so forth. And it's slated or predicted, and these are figures that come from federal bureaus and agencies and the consultants reporting into the federal government, that they're predicting that by 2030 we're looking at eighteen percent self sufficiency in all. That's a very big drop.

That whole fuel security issue starts to become quite significant. I'm not sure if people are aware but this year we saw China shut off the diesel exports out of China, to be able to protect its own resources. If we rely on eighty percent of our fuel coming from offshore, then we're very much into that realm where we rely on others and the whims or decisions of other governments, particularly national oil companies and so forth.

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They're real factors for us to be concerned about. The other point I'd make about oil, and I'll put my ex-refinery manager hat on here, and I'll invoke the previous title which was Oils Aint Oils and they aren't. There's a very wide range in terms of the quality and the types of oils so in Australia most of our refineries would refine what they call light, sweet crudes which are very low in sulphur, and low in terms of specific gravity, to very heavy, sour crudes which typically Middle East crudes would be, and most of the Australian refineries would not be able to refine those and create fuel products out of that.

It's not just that oil is being found. Is it the right sort of oil for those production facilities and to be able to put fuel into those markets? There's some distinctions there.

Karyn: Can I bring you back to shale oil?

Liam: Yes, sorry.

Karyn: Let's have a chat about what that is and where it is and what you're working with.

Liam: Thank you. Again this is probably a personal story; part of my move to Queensland Energy Resources from Caltex was very much driven about the future supply and my views of where that was going. I was trying to run a refinery where we were struggling to find oil to supply into the refinery. I'll just use one other stat and then I'll go onto shale. That is; Lytton, which is Caltex's refinery at the mouth of the river, over the next five years it would account to run, that one refinery, for about eighty to one hundred percent of the available crude in the Asia Pacific region, that one refinery. That's not sustainable. It's got to do other things to keep going.

That leads me to shale oil. Shale oil is algae that's been laid down in sediments in a sea or lake environment. It's a typical hydrocarbon in many respects. It just hasn't gone through some of the final processes of heat and pressure.

What we would do with it is we would mine it in a traditional fashion and put it through a vessel that was heated and we heat it to a temperate where it would send off the oil as a vapour, collect that, and then we can process it in a normal refinery way.

Queensland has about ninety-two percent of Australia's shale oil. Mostly located around the central Queensland region, so from Gladstone up to north of Mackay and inland through the places like Duaringa and so forth. Shale oil that we know about and we think is recoverable is about twenty-two billion barrels of oil. To put that into perspective, that's about four or five times the original inventory of Bass Strait. We've got that declining, but here's a very significant resource.

There is other stuff at depth and we know about but we're not sure how you would get to that. You probably wouldn't get all of that twenty-two billion barrels but it's a very, very significant resource.

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- Karyn: Liam, how close are you to tapping a resource? What's involved with that?
- Liam: We do a few things. I should point out we've been doing this since about 2004. You mentioned the Southern Pacific Petroleum; QER bought or took over their assets. In the meantime we tested their original facility which we decided that wasn't an appropriate technology. It couldn't meet what we thought were the requirements that our society would expect of it.
- We have a sister company in the U.S. where we took ten thousand ton of shale oil from Australia and put it through the same process in Colorado, and then we produced diesel and jet from that. We know the shale will go through this process and it works and works in a very sustainable way. It's economic and it will perform environmentally.
- The other thing that we've been doing is we've been building a demonstration facility near Gladstone, about fifteen kilometres north of Gladstone. It's about a hundred million dollar facility. It's about as small as we thought we could build to demonstrate effectively to the community and the government the technology works, and that it is also environmentally sound. But obviously that's very significant. It will never make any money. It will cost us a lot of money to run it, but its sole purpose is to prove to the community and to the government that this process is technically and environmentally capable and sound.
- That's what we've been up to. In the meantime we've been working with the community in the Gladstone region particularly but also in a wider field. Gladstone really would be the only community in Australia that has had any recent experience with oil shale, and we find the work that we've done, we've taken people from that community to see the Colorado facility. We've taken members of the Queensland government, from DERM; from the federal government, from geosciences, and DEWHA and so forth to the Colorado facility. The next bit for us is really to show people.
- We've built an odd sort of facility. It's very much a demonstration plant with a lot of visitor access and explanation as opposed to a traditional industrial facility but it's about showing people and getting them to understand how the process works.
- Karyn: Thank you. The original project I understand was shut down because it was economically unviable but also there were concerns about impact on the Great Barrier Reef, for example, and some other environmental issues. What kinds of concerns are you discussing with the Gladstone community at the moment and what sorts of things are you aware of that the communities might be concerned about?
- Liam: I should also point out that at the time that SPP was running that facility, I happened to be the Associate Dean of Engineering at Central Queensland University and I mediated -- it seems an interesting leap from there to here, but the mediator, the community with the company concerns so I do understand the original community concerns. They were very much based around odour, noise, and dust.

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The process we're talking about is completely different. I could put them at different ends of the spectrum. Ours is a sealed process that works with lump. The temperatures that we use are much lower. The environmental emissions control and things like that are a world apart from what was there previously, and that's what we hope to demonstrate. We understand where the community was and they were very concerned about that. Certainly there was visible smoke and so forth.

Having run this facility in the U.S. and we're confident about what our process will do, we know it's sealed. But if for example we stop the power to it, it will just sit there. One of the issues at the previous plant was its only option was to dump it to the ground, five hundred ton of very hot shale material with hydrocarbon coming off it. You can't leave that in a horizontal kiln and so forth. We don't have those sorts of issues. We have a very simple, reliable, robust technology.

Karyn: We might come back to that after we've moved on a bit further. Thanks Liam. Let's move onto CSG. You could be forgiven for thinking that CSG is a new industry in Queensland. Certainly over the last few months it's become a very hot topic of discussion in this state.

If you have natural gas connected to your home at the moment though, chances are you're already using CSG every day. It accounts for around ninety percent of Queensland's gas supply. The CSG industry says that after fifteen years of safe and efficient CSG extraction in Queensland we have no reason to fear the rapid expansion of the industry to supply export markets.

Around forty-five billion dollars worth of CSG projects are on the slate for Queensland, bringing some eighteen thousand jobs to regional areas in desperate need of employment opportunities and adding around a billion dollars each year in taxes to the state's coffers for infrastructure and essential services. Those are some compelling economic numbers.

On the environmental side of the ledger, Australian studies by CSIRO and Worley Parsons indicates that CSG fired power stations emit up to seventy percent less greenhouse gases than our existing coal fired power stations. But in both Australia and the U.S., where our next speaker is based, CSG has raised significant environmental and health concerns related to contamination of water and fugitive emissions, and the environmental and health impacts of those.

In Queensland it's also at the heart of a looming stoush over property rights. If I could welcome Professor Michael Economides. Leaving aside the property rights for the moment, could I just ask you; what's your understanding of the concerns being expressed in Queensland about the environmental impacts of CSG?

Michael: Fear is a motivating force everywhere. Let me just preface this because with this lighting over here and the previous speakers here, I'm getting into a catatonic state. Relax. If I were to tell you the end is near, is coming, you

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guys get impressed. If I tell you the middle is near, relax. You don't get impressed and I don't sell as many books. That's a problem.

Let's talk about some of these concerns. A hundred and forty thousand fracturing jobs in the United States last year, and not a single contamination of any drinking water. I would imagine case closed.

1.2 million frack jobs in the history of underground fracturing in the United States, the *New York Times*, after five exposes, very attacking exposes, has perhaps found one case in 1984 that might have been some contamination and that has been discredited, suggested it's coming from a defective casing.

So the issue of production from what we call coal-bed methane and you call coal seam gas, it's a proven technology. It is not to be afraid of and it has proven itself beyond doubt it can be done very nicely, thank you.

Now if people in this room are here to debate, and if you more than start to debate a future of hydrocarbons, I have some news for you. The world is going to be dominated by hydrocarbons for the entire twenty-first century. In other words, I have this vision that by the year 2100, a great grandson of mine is going to be in front of an audience suggesting that eighty-seven percent of the world energy demands still comes from oil, gas, and coal.

Sunshine is free. Solar energy is bloody expensive and it's not going to happen without government subsidies. Let me ask a rhetorical question. Does anybody in this room believe that there would be economically extractable hydrocarbons in this world that would not be produced because we pass legislation in Washington, D.C. or Canberra? I suggest to you it's not going to happen. It's just not going to happen.

It will be produced. I've been working in China for the last thirty years. I'm the senior advisor to two major Chinese companies. And I can tell you that the Chinese are not going to play along. Last year China spent two hundred billion dollars buying oil and gas properties all over the world while we're contemplating our navels and were discussing climate change.

There has never been a bigger transfer, a faster transfer of power because energy means power in the world, than what we see right now without any war. The Chinese thank us quite a bit because of our apathy towards energy sources.

Energy is not something to debate in a town meeting like this in such a nonchalant fashion. The entire lifestyle that we live -- now if any of you here thinks that we should abrogate the lifestyle that we live for some other cockamamie idea of going back to the nineteenth century romantic attributes where we actually cook our own food and we live in forests and dress in animal skins, that's a different issue. I don't have a debate with you.

Karyn: Professor, I don't think anybody actually is suggesting that. I want to move you on to --

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- Michael: Listen, I have to tell you something. I have done fifty of these presentations throughout the United States. And implicitly -- people want to come and discuss about the environmental issues of fracturing which they are nothing. They don't exist. It's a figment of peoples' imagination. Whereas the motive is in fact the fact that they paid for some fuels.
- I would like people to fess up in other words, before we start any debate, what are the motives of people that are bringing up environmental issues with hydraulic fracturing? They don't exist.
- Karyn: Okay, I'm going to come in and act as a bit of a devil's advocate, I think, because part of the issue that I'm picking up in the Queensland community, and there will be others here to talk about it, is a lack of awareness and a lack of knowledge which relates then into a --
- Michael: I strongly suggest that people that are really interested, I have written a dozen books on hydraulic fracturing. All of my books are used by everybody in the world. I have worked in seventy countries. Every university in the United States and the world is using my textbooks on hydraulic fracturing. I have several books at the level that are not advanced graduate diploma, so please read something before we debate.
- Karyn: Can I ask you a couple of questions?
- Michael: Please do.
- Karyn: Some people claim that fracking can contaminate ground water...
- Michael: This is nonsense, total nonsense. We cannot debate an issue that has never happened.
- Drew: It has in Australia.
- Michael: Where?
- Drew: There's actually a case being undertaken right now just outside Dalby.
- Michael: Wait a minute, it's through casing or because of fracturing?
- Drew: Through a frack that was done straight into an aquifer.
- Michael: Have you more than fracture height migration from fracturing to the drinking water? Have you done that?
- Drew: The frack went straight into the drinking aquifer that was providing the stock and domestic water.
- Michael: It is absolutely totally wrong. There is just no way that that could happen. That is a physical impossibility for something to happen. Do you know why? Because if it's shallow enough the fracture will be horizontal and not vertical. So there's no way that the fracture can actually penetrate a drinking water aquifer.

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- Drew: It is if you set the frack at the wrong height.
- Michael: How can you do that?
- Drew: That's the legal case that's being charged.
- Karyn: We're not going to resolve this so why don't we move it along because part of the issue's got to be technological.
- Michael: No, but this gentleman here whom I don't know... I have modelled fracture height migration. I have produced twenty PhDs on the subject and I'm telling you we have never had a case where that thing could actually communicate vertically because the stress field is such that the maximum stress at that case would no longer be the vertical. And the fracture would become horizontal. It's a diabolical coincidence that what you suggested simply cannot happen. There is no law of physics that would allow fracture to penetrate drinking water aquifer. It just can't. Try.
- Karyn: Professor, can you talk to me about fugitive emissions please and what you see some of the issues being around that?
- Michael: I don't know what that means?
- Karyn: Gas that's escaping from wells that have been drilled and therefore possibly contaminate either the air or the water.
- Michael: I have never heard of that.
- Karyn: Okay. Not something that you've ever come across in the States?
- Michael: No. I mean, if you're talking about faulty casing? Are you talking about problems with the well itself? Faulty casing, bad cement jobs.
- Karyn: Potentially.
- Michael: It can happen, yes, that can happen but that has nothing to do with fracturing, that we're discussing now.
- Karyn: Can you talk to us about what you've observed that the Queensland industry's doing to manage the risks? You've suggested that technologically there actually isn't a risk in terms of fracturing as a technique. Are there things that the Queensland industry's doing here that you've observed are different or better from what you're doing in the U.S.?
- Michael: You are way behind still in terms of technology here. It's done by the service companies. If you look at the numbers you take the activity that you have in Queensland, you would have an order of magnitude more fracturing treatments in a similar environment in Canada or the United States. I would say more than perhaps one hundred times, two orders of magnitude more.
- Look at Western Australia for example. You have one frack spread in Queensland and then you have four frack spreads all together in -- just south Texas you are looking at one hundred frack spreads. Frack spreads is a unit

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of the fracks. Think of it that your activity is one-twenty fifth of something you would find in south Texas. You are behind.

As far as the young guys that I have met here working for Santos and companies like this, they are new, they are inexperienced. They hire the few experts from outside. There is a couple of great guys here from other countries. So they are trying.

The service companies are the same. Of course they are not as well equipped as they would be on our side of the world. It's something that is done -- personally as I mentioned before, I have worked in something like seventy countries. Before I was a professor I've done two thousand frack jobs myself in my career, everywhere in the world.

I've never had some of the problems that the mythology that I often see in newspapers like contaminating drinking water aquifers, which is preposterous by the way, or something like that. It's just not going to happen.

Karyn: Can you talk to me about the regulatory environment in the U.S.? From what you've observed, do you think that the Queensland government and the industry here have got a handle on the regulation of the industry?

Michael: I think so from what I have heard. I did speak to some of the regulators the last time I was here because I'm an advisor to both the EPA in the United States and the Texas Railroad Commission which regulates all petroleum activities in Texas. The railroad commission is the regulator in Texas. And also the EPA, I testified in front of the U.S. Congress several times on this. I see some of the regulatory body issues that we have in the U.S. already coming here with a lot of non-governmental involvement, a lot more. You are -- you try to be environmentalists in this country, which I endorse. I'm an environmentalist myself, believe it or not. I own an environmental company, so I'm very interested in environmental stewardship for sure.

The railroad commission in Texas is the sterling, I think, standard on regulations. We are not going to allow for instance leaking casing. It's going to be a hell of a fine if we catch somebody doing that, like what you were addressing before. So all of these things we are discussing right now have already been done ad infinitum and ad nauseam for decades. We're not going to reinvent hydraulic fracturing in Queensland, Australia after sixty years of experience.

Karyn: Yet you still have, don't you, the same kinds of controversy and pushback going in the U.S., even after sixty years you've still got people that are not convinced.

Michael: Of course, and you've got people too -- the United States is a free country. Australia is a free country. You have people getting up and saying everything. People do documentaries like *Gasland* which is a despicable lie. The whole idea of this documentary called *Gasland*, I don't know if you've seen it. It's just physically impossible for something like this to happen. But it almost got an Oscar because people like this kind of controversy. You see what I mean?

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We like to -- we have it inside us to -- it's the hubris against God, and being of Greek background I understand the word hubris for sure. This is part of all this argument and I'm telling you; much of the debate in this eastern part of the United States under the Marcellus Shale is from people that have this fantasy that the United States, especially under the Obama administration -- by the way, I'm a democrat. You wouldn't believe that but I voted for this guy. But you see, under the Obama administration we're going to go full throttle towards alternatives.

Imagine in this country, in this environment suddenly you have shale gas that grows from zero to twenty-five percent of the natural gas supply in the United States in five years. There has never been a story like this in the history of the oil and gas business. This brought out of the woodwork every sixties' hippy who just put a necktie on right now, and pretends to be a legitimate political to go out and demonstrate against the energy industry.

Karyn: I'm going to move us on professor, and we'll probably -- I'm sure we'll come back to you.

Australian farmers feed around sixty million people each day, forty million of them overseas and Queensland is responsible for around twenty percent of that production. Queensland farmers are operating already in areas where gas is plentiful so they're worried about their livelihoods and their lifestyles being at risk.

It's one more concern weighing down an industry already challenged by climate change, soil degradation, labour shortages and declining productivity, and considering that agriculture accounts for fully half of Australia's water use, you can understand their concerns about potential new threats to diminishing water supplies.

Drew Wagner is the Policy Director for agripolitical lobby group AgForce and Drew I'd like to ask you what your farmers' principal concerns are in relation to mining?

Drew: With relation to mining or with relation to CSG?

Karyn: Let's start with mining and focus down on CSG if you want to.

Drew: Okay, the biggest issue that we have, ladies and gentlemen, is one of balance and sustainability. This is not about one industry removing the other from the landscape. This is about both being in place to do what they do.

The reality as Karyn has just said is that we -- our consumption domestically in Australia in our fresh food and produce is ninety-six percent of our fresh food and produce is grown domestically. We still export a hell of a lot of that, but ninety-six percent is consumed here.

We are constantly facing landscape competition issues. We've got the climate change issues. We've got droughts, floods, everything else, and trust me we've experienced all of that in the last twelve or fifteen months. But the

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reality of landscape competition means if we remove the agricultural or food and fibre production system from this landscape and replaced it with one hundred coal seam gas wells or replace it with an open-cut coal mine, or replace it with a bauxite extraction process, then the production system that was there and in situ and has been there sustainably for generations to date, sustainably producing, sustainably looking after the environment that's there, will not be there anymore.

There are some industries that will be able to come back from, but particularly mining, we will never have an agricultural production system again on that landscape. We currently manage as agricultural producers some eighty-six percent of the available landscape of Queensland. That's everything that's outside of the city, eighty-six percent. Eight-two percent of the state of Queensland is currently covered by one or more mining and resource tenures.

Karyn: So Drew, what's actually changed in terms of farmers' legal rights as a result of the rush now to export for CSG for example? What's actually changed?

Drew: The unfortunate reality Karyn was that we've got the situation in Queensland where the referee of this game is also one of the sole largest beneficiaries. You spoke earlier of the billion dollars of royalties that's going to be paid back to the state coffers, and yet they are the ones setting the rules.

The reality some twelve months ago of how myself as a primary producer, sitting on my family property, because we have one hundred fifty-five thousand farm businesses across Australia, and nearly all but about two or three percent of them are still family owned. So it's mum and dad sitting around their kitchen table in the morning, get a knock on the door, "Good day, I'm from such and such gas company. By the way, here's my tenure, my tenure over your free-hold land, but here's my tenure. Would you mind stepping out of the way please, sir, if you're lucky, because I have the drill rigs at the front gate." That was their reality.

Just moving on, some of those rules have changed. Some of the conduct that these companies must adhere to has changed since October last year, and some of the realities for the exploration processes have been changed to try and gain some more of that balance there. But the process at the end of the day does not provide for a landholder to say "I've invested ten million dollars into this property. It's been in my family for five generations now and I've got my son and my grandkids already here that I want to pass it onto." I can't say no. That company does have the legal right to come on.

Karyn: And they have done, from the beginning.

Drew: And they have done from the beginning. The only thing that's really changed is the ability for us to attempt to negotiate some more conduct arrangements. There has been some compensation provisions and this is literally just at the exploration phase. This isn't moving forward to production.

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But AgForce as a lobby group decided if we're going to influence that process we needed to start at the beginning. The beginning is obviously the exploration phase. The reality of exploration for coal or minerals, about one in twenty coal exploration will probably turn into some sort of extraction. The minerals areas we'll sell you because of the variations of minerals, probably about one-in-one hundred. For coal seam gas, once that exploration well has been put down, the only difference between that and a production well is the head works on that well.

The reality is that every single well that goes down can turn into, if the resource has been proven, a production well. We currently have three and a half thousand wells, between three and a half and four thousand wells in Queensland. Ladies and gentlemen, we're proposed to move to forty thousand in the next single digit number of years.

Karyn: I heard some disagreement from you earlier when you talked about the fact that you would never be able to have a compatible agricultural and mining sector sitting alongside each other. Do you want to talk about that a bit more?

Drew: I don't think we'll never be able to have, I think it's one about balance and sustainability. Just as strong as the energy debate is, the food security debate is just as simple and strong as well. If we do not have the landscape available to us to provide for those production systems, we do not have the landscape available to us to feed the world's population.

Karyn: So can you tell me the wells that you're talking about on properties, how they're disruptive to the operations? That's what you're suggesting, that it's actually incompatible to have CSG wells on an agricultural property? Is that what you're telling me?

Drew: There's a number of issues here Karyn. I'll go back to the beginning and work the way through the process. The first issue is that we have a Queensland government where you had a previous resource minister quoted to say that the "Queensland government is doing what someone in the automobile industry did for the very first time in taking the car out of the garage, to see what impact it had on society." The Queensland government is doing that with the coal seam gas industry.

That to me is code for we're playing Russian roulette. The reality of the impost that we have across our landscape is we have these wells, we have these pipelines, we have these compression stations. We are not operating under the same land management rules in the agricultural sector as what the coal seam gas or resource sectors are in some areas. We're seeing the impost of this infrastructure across our facilities, whether it be a laser-levelled intensive irrigated cotton paddock that I've invested millions of dollars into to get to that sense. And I suddenly have a coal seam gas well in the middle of it. Or even if it's just purely an extensive grazing industry where I suddenly find three dozen wells across a five thousand acre property.

We also then have the reality that this is a hit-and-run industry. The coal seam gas production from a well is only about ten to fifteen years in longevity.

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The agriculture production I've already mentioned has been there for generations now. And sustainably done so, will be there for generations to come, if not in perpetuity.

The reality of coal seam gas wells is the industry as a whole in Queensland, and you can ask any of the companies, they're actually proposing to be removed from the economy and from the industry perspective by about 2040. That's only because the graduated process of rollout of wells at this point in time. They're also saying the full impact of this industry and of these works will not be felt until 2065.

Karyn: What do you mean by that, Drew? What do you mean the full impact won't be felt?

Drew: The main impact of that longevity issue is more around the governance of water. And it's not just contamination. It's also draw down. If an agricultural landholder wants to extract water from whatever aquifer, we need to get an extractive license. That extractive license is done because it's a sustainable take, therefore that level is set at a sustainable level.

A coal seam gas well will extract millions of litres of water over its life. It does have a curve to it, for those of you who understand the production of these systems. The upfront generation of water is normally greater than the upfront generation of gas. Over time that does weld off.

The reality is that over time we are putting forty thousand pin pricks into these aquifers, and sucking gigalitre upon gigalitre of water out. The reality of the porosity of these aquifers and the coal seams that they're in is the movement of water is obviously not instantaneous. It will take some time for the aquifer to actually resettle. The reality also at this point in time of why an agricultural system has an allocated license, it's because of that sustainable yield.

In Queensland, the CSG wells do not have an allocatable license because it's not considered a sustainable take, therefore why would you put a sustainable license on it? That's the Queensland government's own explanation.

Karyn: I'm going to pick up the water issue with Chris Moran and then we'll probably come back to Professor --

Michael: We cannot let what he said without a response. Please, there is no statement of fact in what he's saying right now. They are totally unconnected. The drinking water aquifers that agriculture is going to use and the water that comes from a coal seam gas are totally unconnected, separated by hundreds of thousands of feet of impermeable rock. There's no connection.

Drew: Do you understand -- I don't mean any disrespect, but do you understand the geological formations in Australia?

Michael: Absolutely.

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- Drew: Why are the companies themselves coming back to us saying we will have these impacts? And the environmental authorities have gotten the licenses, they're saying we will have these impacts.
- Karyn: We're going to move on because we need to. We will pick up the issue. I'm not suggesting we won't come back to it. Drew I want to talk to you then, farmers are huge users of transport fuel and electricity to run their operations. If not CSG then what? We've actually got a crunch coming. If it's not CSG what are we going to do?
- Drew: Very much Karyn, and that's why we're saying it needs to be in balance and needs to be sustainable. We're not saying there's no room or no place for this industry. It's a very important industry, not just for Queensland but internationally as well, but we need to have that balance.
- It's not the reality of where would you have put it, but we do not know what the sustainability is of that forty thousand wells. It's purely a numbered target at this point in time to reach international obligations, to go through an LNG plan based at Gladstone.
- Karyn: What is your suggestion then?
- Drew: Our suggestion at this point in time and our policy on this is we've actually been calling for a moratorium of this for quite some time. If we've got three and a half to four thousand wells right now, that's statistically ten percent of that forty thousand proposed. Surely that's enough of this industry *in situ* right now, and yes the majority of it's servicing the domestic market, and we're looking now at the international market. But surely there's enough of that industry in there right now to actually identify what these impacts that the companies are telling us will happen, to identify what those impacts will be to ground truth the modeling that we're all praying is correct, to then look at whether or not forty thousand is sustainable.
- What happens if forty thousand isn't, and only ten is? What happens if a hundred thousand is sustainable? We've got different issues then but surely we've got enough now to find out what the realities are.
- Karyn: So the issue you're concerned about and the reason you're calling for a moratorium is because you're interested in the sustainability of the water use, not issues of contamination?
- Drew: Water is our primary concern, both quality and quantity. But the second reality there is also our landscape competition and our ability to still have the landscape to provide for our food and private production.
- Karyn: I'm still not clear from you where you think there is a solution but we're going to keep moving and we'll come back to it. Environmentalists have actually long promoted gas as a cleaner energy resource than coal and as a viable transitional fuel on the road to renewables. Just in the last week this message has changed federally. It appears that the push is on for an immediate move to one hundred percent renewable energy.

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I want to call on Adam Stone, the Queensland Greens candidate. Can you tell us, Adam, what if anything's changed in the thinking that means you're now going full steam for one hundred percent renewables?

Adam:

I don't think anything's changed in the thinking. As far as the Greens are concerned anyway, I can't speak for -- environmentalists are sort of a wide range and disparate group. As far as the Greens are concerned, our position is still not never coal seam gas and our position is not never natural gas anywhere, ever, from any source.

Our concerns with the coal seam gas industry overlap significantly with what Drew has just been talking about. It's to do with the sustainability of it, it's to do with impacts on ground water resources. It's to do with the impacts on our productive farm land.

We've also got questions about the overall lifecycle greenhouse intensity of the process. But that's not to say we're opposed to natural gas from anywhere. I'm aware of different -- everyone would be aware that the Greens' position is that as far as our energy consumption is concerned, we should be moving to the cleanest available energy mix in terms of greenhouse gas intensity that we can, within the shortest possible timeframe.

I've seen different roadmaps about how that might be achievable and exactly what the steps along the road would be, and what the ultimate mix of energy sources would be. You mentioned the beyond zero stationery energy plan. That's probably one of the more ambitious that I've seen in terms of saying one hundred percent renewables within ten years without any gas. There have been other roadmaps. I've seen one that was sponsored by Greenpeace somewhere in the 2000s that did see a heavy role for gas as a transition fuel. Mark Diesendorf from the University of New South Wales writes a lot about this. In some of his roadmaps you see gas; in others you don't.

I personally, as a non-energy expert, don't know whether it's possible to do it without gas or not. But in any case, that's not our position. I think we're looking at doing it in the cleanest available way but we don't think it's acceptable to say if gas is going to be somewhere in that mix, then it needs to be coal seam gas and it needs to be dug up from underneath Australian farmland, while there are unanswered questions about what the long-term impact of that would be.

It's not just the Greens and it's not just farmers saying there may be impacts on underground water resources. Some of the bodies that we turn to for expert advice in this area have also raised similar concerns, such as the National Water Commission, which in their position paper towards the end of last year raised these exact same concerns. They said, "We don't know what the interconnection is between all of these aquifers in every case. We don't know what the impact is going to be of depressurising some of these aquifers, even if it's only temporarily, and then we re-pressurise them. We don't know whether we might make interconnections between these aquifers through the fracking process."

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Also sometime last year, I think it was actually the coalition in the federal Parliament got a document released from the Federal Environment Department that was their own internal advice to the government from their water group within the environment department. They also said, "We are concerned that there are substantial risks here that we can't evaluate on the available information."

Our position is really while we can't evaluate those risks, and while we can't discount them, let's call the thing to a halt and have a look at it, and then decide what we do, once the research is in. I don't know if CSIRO just started their own research project into some of these questions. That's anticipated to go for about five years. I've had email contact with one of the people who's overseeing that project in CSIRO just because I was curious about exactly what risks they're going to be covering. It pretty much covers the full suite of our concerns, so five years didn't seem like a very long time.

Karyn: That's the duration of the moratorium you're suggesting, five years?

Adam: Our position is that we want to call the thing to a halt until we can answer those questions. If it turns out that CSIRO can do that within five years, then I guess we'd reevaluate then. It's impossible for me to say what would come out of that project.

Karyn: Okay. I think we're probably going to need to get an industry view on what the implications of waiting five years are because of course part of the economic push is going to be servicing markets that could be potentially serviced other ways. But I want to ask you whether or not, from your understanding of the relationships between government, industry, and the environmental sector, understanding that's a lot of different interests, do you think industry and government understands your concerns?

Adam: I would certainly hope so. We keep on voicing them.

Karyn: Where I'm going with this is; is there going to be some resolution of it? Do you see some light at the end of the day? What I see in terms of the way this issue is playing out in the media and in general community awareness is that you seem to have some quite hostile and conflicting kinds of views going on. I would be really comforted to know that actually there is some good discussion happening between the parties that are interested to take the issue forward. Is that what you're seeing happening?

Adam: Between government, industry and --

Karyn: The environmental sector because I'm hearing from you and also from Drew that you see there is still a role for mining and CSG in agricultural areas? That's what I'm interpreting that you're saying. I want to be sure you feel the discussions are moving us forward to find that balance and sustainability. Drew is shaking his head.

Adam: If those conversations are happening, I'm not involved in them. I'm a candidate in a state election campaign as opposed to an elected

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representative representing the Greens and being involved in these negotiations. I wouldn't be involved in them.

I know that some discussions have happened at the political level and certainly in the federal Parliament, because some of those have played out in the public domain over recent weeks. But I don't see any change of view from the other parties, and certainly there's been no change of view on our part because we haven't seen any data that would support a change of view.

No, I don't really feel very optimistic at this stage, but I guess this still has some way to go in terms of playing out. I don't really know what could happen that would lead to some sort of view, given that at least in the political space both of our major parties are happy enough for this industry to go on ahead unchecked. There's probably not much need to negotiate in the sense that there doesn't seem to be much standing in the way that can't be crashed through.

Karyn: Do you see the industry is going ahead unchecked? In Queensland at least, CSG projects -- I'm not sure about shale oil but CSG projects have around twelve hundred environmental regulations they need to meet. What's the unchecked nature that you're talking about?

Adam: I guess the unchecked nature is that the industry is still going ahead despite any resolution of these main concerns that I'm raising, and it's hard to imagine how conditions could adequately account for them, given that the problems aren't probably understood. The risks aren't probably understood.

Karyn: I want to continue along that line but I want to switch to Chris Moran if we could please. Chris is the Director of the Sustainable Minerals Institute at the University of Queensland. With enormous expertise in agricultural and soil science, as well as a more recent focus on the impacts of mining on water resources. Chris, of what you've heard tonight, which of the issues that we're talking about do you see as being most critical?

Chris: The issue is the issue we're here to talk about, which is informing the debate properly. We've actually had a microcosm of this debate, haven't we? We've got Armageddon, impossibility, and no impact. They're probably all correct or they're probably all incorrect. I'm going incorrect.

The real feature of the debate that we've got is the poor quality of the debate. I'd come back to something Professor Economides said at the beginning; how many people have read how much of this information? You know what, almost nobody can. The quantity of information that is being generated at the moment by coal seam gas companies on the problems that we don't know anything about is incredible.

Each of the environmental impact statements was twenty thousand pages. The supplements to the environmental impact statements were another ten thousand pages. Each of the companies that have been supported at the moment that have produced the first pass materials, the stage one plans, for

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response to the federal government only, the federal government conditions, each of those runs out to at least one and a half thousand pages each.

Put your hand up if you've read one percent of that information? Put your hand up if you can imagine reading .1 percent of that information? Professor, I agree with you that it's very important that in the technical discussions that people try to get on top of the technical issues. There is an impossibility of how we go about getting on top of all the information, and therefore, informing the debate of some ridiculous statements that have been made about what we don't know, and some ridiculous statements that have been made about things that can't possibly happen, that *can* happen.

What we have to do is acknowledge that the natural environment is complex. We will never have enough data about the natural environment to make certain decisions about the way we manage it. What we have always done, and what we will always do is adaptively manage. What we've done very poorly is adaptively manage in an organised way, in a way where we actually treat it as a scientific process rather than trial-and-error oops, trial-and-error oops.

For goodness sake, Australian agriculture, if you read, if you go back and read the history of Australian agriculture in the 1930s and '40s, people were screaming. They were screaming at the government because metres, metres of soil were disappearing overnight. This is not fiction or myth. This is documented and it's been re-documented in work that we did for the Murray Darling Basin Commission several years ago.

We have fundamentally changed the face of this continent in managing natural resources. We have fundamentally over-extracted the water resources of the system. First the surface water resources and then the ground water resources, they are connected; the systems are connected. We know they're connected because in many places our rivers don't run anymore. They haven't run for many years. They can run again if you understand the recharge processes occur in big pulses and the extraction occurs every year.

You have to also understand and look at the information that's out there historically on the way that we've analysed the continent. The federal government has put a lot of money through CSIRO but in particular also through state governments in understanding the natural resources of Australia. The National Land Water Resources audit was produced in the year 2000 to 2001. It showed that the majority of agricultural land in Australia shows a net return, a net negative return at full equity. Almost none of Australia's agricultural lands are in full equity. By far the majority of returns from Australian agriculture come from irrigation in an area where the soil is either reasonable or good, really very small areas where you have this coincidence of water and soil.

We have one of those that's heating this debate that's making these silly generalisations. We have the Liverpool Plains in New South Wales and the Darling Downs in Queensland, two fantastic places. They're fantastic

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because they have water and soil that coincide, not because of the soil inherently. We have soil like this in other places in Australia. We're not very interested in it because we don't have water for it, or it's salty because it's been there for so long.

The overlap area between this and mining and coal seam gas, the quotation numbers of what's actually happening needs to come to the table and that needs to be put against the actual change of production that's under threat. We invented the stump jump plough until we figured out how to get rid of all the trees, so we could get really big ploughs. Now we've got a problem that apparently we can't plough between five hundred metre spacings.

So let's get some of the nonsense and the heat from the political positioning, start to get at how we've managed natural resources, the way we're going to continue to manage natural resources. We're not going to have a moratorium. We're not going to have a moratorium.

We've got a coal seam gas industry. We've got a hell of a lot of information that can be analysed, that can be read, that can be digested, that gives you a reasonable sense of the risks. In 2008 we produced a document for the Queensland government. We laid out these risks. They're known. They're not impossible to occur. They will occur.

They will occur in some places. They will not occur everywhere. Stop the hysteria about these things occurring everywhere. They will not occur everywhere. Water will move extremely slowly in the majority of places. Some of that water may actually be formation coal water. It may be hundreds of millions of years old. That's the kind of rates. We haven't gone anywhere near that water.

The rates of movement around that are going to be incredibly slow. They aren't anywhere near the surface aquifers that we're using in most of the places. They interact with surface aquifers in areas that we're beginning to know, and some that we know quite well. And we should focus attention in those areas, we should get the monitoring into those areas, and we should risk manage those areas very carefully. We should stop taking fifty thousand square kilometres and treating it the same as two thousand square kilometres.

Sort the problem. Figure out where we really need to focus attention. Get some of the heat out of it, and get some technical advice. Get some research and get the information that we need. We've got to calm down. I'm not getting very calm, am I?

What we're doing is clouding the possibility of managing the issue with noise and we've got a community out there that's panicky and hysterical. We aren't focusing on where the real issues are, where we can really make a difference with research, and where we can really make a difference with the technical information we've got.

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The first thing that I would do is get the information that is available in the state from the agricultural community, from the coal seam gas companies, and get it to the scientific community.

Karyn: What's stopping that from happening?

Chris: If I buy something why should I give it to you?

Karyn: So simply sharing of --

Chris: It's my information. If I purchase that information at the cost of tens to hundreds of millions of dollars, we're not talking small amounts of money. That information is now making its way to the Queensland Water Commission. That's a good thing. It will never come out of the Queensland Water Commission. Only the results of modeling will come out of the Queensland Water Commission. That's a really big problem for scientists.

It doesn't matter whether it's the CSIRO, doesn't matter whether it's the University of Queensland. Doesn't matter if it's the Queensland Water Commission. If we don't know anything about the quality of the models with respect to the data that went in there, we can't know anything about that. It's very difficult for us to build our confidence.

Karyn: I'm moving on to another question. You talked earlier about panic and hysteria and part of the thing that drives this, I think, is the Great Artesian Basin for example, is as iconic in Australian's minds as the Great Barrier Reef is. When we hear that CSG particularly but mining generally on agricultural land for example is threatening the Great Artesian Basin, I think that's part of where the hysteria and panic comes from.

From your professional experience and knowledge, is it at risk? What are the risks around the Great Artesian Basin? Do we need to be worried, and if we do, you mentioned that sometimes some of the potential risks could happen; what if we do get it seriously wrong? What's the risk?

Chris: Armageddon has already been vested on the Great Artesian Basin. It's called extensive grazing. We depressurised vast areas of the Great Artesian Basin. We've had a program in the last few years to try to re-pressurise locally some of those areas. They are responding, so we've capped bores and we've used pipes. Instead of using in the desert open channels to move water, we've used pipes. What a brilliant idea.

We've capped some of the open bores so that we're not just having water running through the desert for no particular purpose and we're seeing re-pressurisation in some places. We have depressurised large parts of the Great Artesian Basin. We've done it in areas where there's good water.

If you're an agriculturalist, if you're a farmer, and you're looking for water, and someone drills a hole and you find salty water, what do you do? You fill in the hole and find another place where you don't get salty water. We've got a nice sample of fresh water. We know quite well where the fresh water is. We also

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know that these aquifers are not simple layers underground where everything is the same. They're incredibly complex. They fine as you move up. They have bands in them of clays. They have bands in them of fine materials. There's actually coals throughout the place.

For example the Walloon Coal Measures, the target that we're talking about for coal seam gas, only has about twenty percent of the layers in there that have and produce gas. This is the thing that's hundreds of metres thick. These are small bands that sit in there.

Think of the landscape that's out there now. Think of where the trees are, where the rivers are, where the beaches are, and squash all that down by a factor of ten. That's why you've got all this complexity out there in the landscape when you drill holes through it this way.

Sometimes you're going through rock. Occasionally you go through coal. That's what the Walloon Coal Measures look like. Above and below them are other systems, the so-called Great Artesian Basin aquifers that Walloon coal measure is a Great Artesian Basin aquifer. They've got all these layers of rocks and fine materials and then within these other aquifers themselves, you have great variability.

What can happen as you take a hole through there, you've got to case that hole very carefully so that you don't get exchange, it does direct exchange through the bore itself. What we then do itself is we depressurise and remove the water from these multiple layers within the Walloon Coal Measures. I'm just using them as an example. They're not the only ones.

What you've done now is reversed the usual direction of the head. The water, like heat, will move from hot to cold. Water will move to equalise pressure. If you create a low pressure then there's a natural desire, if you like, if water has a desire to move into that place. That's actually the water movement we're talking about.

The main water movement we're not talking about is radical vertical hydraulic fractures opening and renting the earth. The main water movement we're talking about is reversing the natural head and therefore we're into these very slow water movements. Fast water movement from the pumping, slow water movement towards the Walloon Coal Measures.

Our fear of the higher aquifers, our risk of the higher aquifers is that they're subsequently connected. But they could be a hundred or two hundred metres away. So in the majority of the landscape, we shouldn't have those fears. We shouldn't spread those fears.

Where we should look very closely in the landscape is where these coal measures come up toward the surface, where the Great Artesian Basin aquifers come up near the surface, where the modern aquifers are up near the surface around the rivers, around the highly productive agricultural areas, in this case where you will get interaction.

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Now the distances are not quite so far. When you've reversed the head, you can actually get water movement in those areas. They're the ones we should watch. They're the ones we should be looking at signatures on, and they're the ones we should risk manage very carefully, particularly if they're overlying irrigation areas that are highly productive.

Karyn: How long might it take us to know that there is negative impact happening there?

Chris: We should know very quickly. What we haven't done, what we've asked the Queensland government to do five years ago -- we didn't, I did, was to get geochemical signatures of the various aquifers. Why don't we know this? We should know this. We should have known this fifty years ago. For managing agriculture we should know our aquifers properly, properly, and we should have that information. We should have had it, and we should get it now. We should stop messing around, get the signatures on those aquifers so that when they do mix, when we do measure things, we know and we can say where is it coming from; what are we doing to do about it. That's adaptively managing the aquifer system.

Karyn: Thank you. I really want at this point to go to the audience and get some questions going of the panel. We're not going to get a whole lot of time just because it's been such a deep conversation already. We're not going to get a whole lot of time for interaction between the panel. I really want to make sure you in the audience have got time to ask questions, so we'll do that now.

The way I want to do that is we are recording this evening for a podcast. So if you have a question can you please put your hand up but then can you please wait for the microphone to get to you? One question at a time, and please respect the expertise of the panel that you have but also the audience members that are here as well. I don't want a lot of long statements. I want some succinct questions, please.

Out the back here, thanks. When you get the microphone, your name would be great. Thanks, so that we know who we're talking to.

Questions and Answer Portion

Angus: I just wanted to know, this fracking has been going on overseas as we've heard from Texas, so there's a lot of information gathered from many decades of it being used there. All of that information, can we transplant that information into the experience that we have in Australia, for example; the geology, is that useful? Is it transferrable?

Karyn: Thank you, great question. I might go to Professor Economides and then I might ask Professor Moran.

Michael: I had a revelation while Professor Moran was talking over here. Let me correct so people cannot -- it's relevant to this question, what I have said

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before. I was under the presumption that there has been a mapping fifty years ago, as you have suggested, of the coal seams and the water aquifers because my admonition earlier on was under that presumption that these already were mapped, and people wouldn't actually go and drill in places with geological irrigation. That would be pretty silly to do. Do you agree?

I was under the presumption in my comments earlier on. So going back to your statement to the question; of course, geology is geology and geology is complicated. I'm not a geologist by the way. I'm just a user of geology myself. But certainly the technology for hydraulic fracturing is particularly robust. There is nothing wrong with hydraulic fracturing in applications with of course the knowledge of the geology that we are fracking in. In other words, we have to make certain presumptions.

None of us in the oil business, the oil and gas business are really interested to go out there -- we are not black hat wearing Dick Cheneys. We are very much interested to do the job in the right way.

I myself am very worried about fracture height migration that I mentioned earlier on before. So the geology as well as what we are injecting and the kind of things we do, they come hand-in-hand. But we never inject blindly. In other words, part of the model itself is taking into account the geology we're going to frack.

Rule number one, if I was working in Australia, is to try to learn the place I'm going to work, obviously. Then we're going to discount all of the dangerous places *a priori*, whether some independent group is going to do -- like your group for example, or somebody else, that need to be done. Geological study has to be done. I was under the presumption that people are not drilling here where there is a communication for crying out loud. I presume they are not.

Karyn: Thanks. I'll move onto Professor Moran for a comment.

Chris:: I think there are two things there, one about the communication where there's obvious connection that you know those things. It's actually more subtle from the point of view of very old landscapes. The point I would make about fracturing, and Professor Economides can correct me if I'm incorrect but I don't think so, is we actually have some advantages here in that system that I talked about before, where you have lenses of coal actually sitting between shales and mudstones. You have a much stronger probability of that horizontal propagation because the coal is so much less strong than the rocks.

You can imagine you only need to apply the force. You don't want to spend money, time, and effort applying the force into that system to break something you don't want to break. That's quite handy.

The downside of that, if you like, is as you propagate this way, and they are horizontal. I don't think there's any doubt about that. The question is whether you potentially create connections between areas that have other communication. It's a secondary effect you would be interested in there and

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the modeling and micro seismics that we would do or need to have done around the fracturing in coals is incredibly important.

I think the other issue that needs to be thought through and it's another big issue so we probably don't have a lot of time for it tonight, but it's the whole question of reinjection and re-pressurisation. If we're going back into those same systems as a way of recreating pressure in the future, then the fracturing of the coal seams and the extraction of water and gas actually changes the coal itself. Whereas in shales you change the structure but the microstructure of the shales is essentially preserved in fracturing; whereas in coal that can change. But that's a valid area of fundamental research for us to be doing and there is work and has been work going on for some time at UQ on that, but more work needs to be done.

Karyn: Thank you. Question down the front, please.

Rolf: My name is Rolf. I understand one of the by-products of the coal seam gas is salt in quite large quantities. What is the solution or what is going to be done with all that salt down the track?

Chris:: The question here is really the question around water management. So that if you have a situation, and this is often the situation in the U.S. and life can be a lot simpler often with shale in the U.S. where you've got lower volumes of water, but you have much higher salt; you can reinject that water and dig straight back into another saline aquifer that has no purpose.

Part of the reason why we've got quite complicated in the discussion in Australia, there are two reasons; we don't want to surface store the water and wait until the coal seams are re-available, if you like to put the same water back into them, because we don't want to take up a lot of land and evaporate water.

But actually the main reason has been quite a strong push for beneficial use of water. If you're going to take the water, and I need to correct something I think is quite important, which is under a petroleum license you're right; you don't need a license to remove the water to the surface, but you can't do anything with it without getting a license. So you've either got to put it back or get a license. The licensing thing occurs when you move into the beneficial use.

For beneficial use there are a number of things you can do. You can use it directly on the surface. If it's too salty you can't use it directly for agriculture. You may be able to dilute it. There are quite a few farmers around who are interested in volumes of water being put into very large surface water storages, just straight dilution.

The other thing you can do is you can inject it into other areas. You can inject it into other aquifers that you used or over used. Now the problem is now you've got a salty water source, you don't want to inject that into a good aquifer so you need to clean the water. You effectively have to remove the salt from the water, and then you can reinject once you've got what you think

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is a reasonable water quality match with underground, and you're left over with the brine.

What they're doing with the brines at the moment, the way they're dealing with the brine issue at the moment, they're looking in two directions. One is disposal/storage of brines per se, that is repositories effectively of salt. The other is to take them right through to crystalline form and then actually separate the salts and start to produce products. This is being done in the Murray. You may have seen this Murray River Salt. That's actually produced by a set of bores that are holding salt water back out of the river Murray and long-term agricultural uses of the lands of the lower Murray.

That salt could also have metals and other things you can extract for value. My view is that won't happen in the short term. That will be something that has to happen in the longer term. We should be building, I think, salt repositories not salt disposal areas.

The calculations, back of the envelope calculations, I've had a look at would say that over a thirty-year period in kind of a big scale sort of worst-case scenario, from the point of view of how much water and how much salt you might have, you'd produce over thirty years about ten percent of one year global supply of salt, which will give you a ballpark figure. That's a horrible amount of salt to have in your backyard, so again we're going to have to be looking after our soil.

We do this in irrigation areas already. If you look in the River Murray irrigation areas, amongst the irrigation areas are salt disposal basins where effectively water that's too salty that's getting in the root zone for irrigation is taken out for evaporation and long-term storage of brine from evaporation. We have a good technical knowledge on how to manage them as disposal basins. I prefer we were looking at them as long-term repositories.

Karyn: Thanks. We had two questions here.

Jeffrey: My name is Jeffrey. I'm a physician. Professor Economides asked us to declare our position from the outset so I'd like to say that my position is that I believe that our beliefs and actions should be determined by the best peer reviewed scientific research. You made a few comments, saying that anybody who oppose fossil fuels are rabid fossil fuel haters. People are wasting their time talking about climate change. I'd like to ask you; do you believe that anthropogenic global warming is a problem?

Michael: Do I believe anthropogenic, this is a very good Greek word. Yes, of course, there is an element of anthropogenic global warming, yes for sure, why not? What's the question?

Jeffrey: Is it a problem or are we just wasting our time talking about it?

Michael: Yes it is problem for certain but there is no alternative to hydrocarbon energy sources. In other words, it is a problem we have to live with and I do not believe in some of the more dire predictions of what anthropogenic global

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warming will do, but whether it is a problem or not is something -- the scientific evidence is overwhelming that there is anthropogenic global climate change. Not just global warming but global climate change, so yes why not?

But what you're going to do about this, that's a very big question which nobody has the answer for that, especially in the current economic climate of the world. That's why my rhetorical question is; do you really believe even if the most dire of all predictions are true, do you really believe that anything can be done about this? Do you believe there will be economically extractable hydrocarbons in the world? That's the question that I posed. That would not be produced because of global climate change policy. I don't think so.

Jeffrey: Can I respond?

Michael: Yes please.

Jeffrey: As a physician I always have to talk about benefits and risks of everything we do. One of the big problems of modern industrial society is immense waste. Unfortunately we are poisoning ourselves and over consuming and producing excessive waste, incredibly fattened from our modern industrial society. So a physician might say you're due for big trouble because of that overconsumption, heart attack or whatever, and they would advise you to reduce the consumption and exercise more.

Same thing, a prescription for this problem is to reduce consumption and move to some more healthy diet of renewables rather than fossil fuels. But I see it all the time. My patients just ignore me.

Michael: Send me your invoice. I'll pay.

Karyn: I'd really like to move onto another question if I could, please.

Michael: Good point. (laughter) Have a free checkup here.

John: My name is John. I've worked in beneficial reuse of waste water since 1983, and worked on energy projects and other related issues for a long time. I'm trying to understand the impacts to the agricultural systems of Queensland, and I'd like to know from Drew and perhaps Chris what sort of losses in agricultural production do you foresee with the development of coal seam gas, should we go to forty thousand wells?

Karyn: Drew first?

Drew: We're already seeing the reduction of head heights or reduction of pressure in some of the aquifers that are currently being used for agricultural production. Farmers will tell you that. The coal seam gas companies will tell you that. The Queensland government will tell you that, to the point where they've even set trigger thresholds for remediation works to be done over that last twelve or eighteen months.

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If it gets to the point where these aquifers through whatever interaction occurs are either contaminated beyond the point of use or drawn down to a point of not being commercially extractable for the production system, it's not that production won't exist. But we're not just talking about the irrigated areas. We're not just talking about the intensive cropping regimes.

Intensive cropping only covers about four percent of the state. We're talking about stock and domestic water that we have an extraordinary large percentage of the population of Queensland that is reliant on that. If we talk about the Darling Downs that Chris mentioned earlier, in the Western Downs Regional Council there are twenty-one towns. Nineteen of those rely on these aquifers for one hundred percent of their water.

Karyn: I'm going to ask Chris to respond too though, because I thought that what Chris was saying was that we weren't going to have impacts on our agricultural aquifers.

Chris:: No, I don't think I said that. What I tried to do was to bring the problem down to those acute areas. I think town and water supplies, it's important to protect town and water supplies. From my perspective that's one of the areas of risk you look at very closely for aquifer connection. Sorry for reading, but I was actually looking for some numbers because we have looked through those numbers before and the rates of decline of aquifers in the region are very difficult to separate from historical rates from the time that CSG changed because of the significant changes that have occurred under agricultural over extraction.

That's not pointing the finger at a given agriculturalist. That's actually a failure of water governance. We have a failure of water governance around the country; you don't know that from an individual well but that you're the cause of a general regional issue.

But because we've had these declines in ground water availability and ground water pressures over a long period of time, we've kept up to them by pumping harder. We haven't seen a feedback on the production system because we've managed to keep up the supply.

The question really is around this whole timing of where we get major recharge events into those surficial aquifers and get enough recharge that we can keep running a bit faster. Some areas, the Liverpool Plains I think felt it much harder than the Darling Downs where allocations have been reduced and there has been an attempt with understanding those aquifers to bring them much closer to how much water really is available on an annual basis for what level of production. We've seen production decreases as a result of that.

The production decreases as a result of less water tend to have been picked up by agricultural research that's allowed an improved yield through better management of the land, better management of the soil, better care of the soil for example. You've got competing technologies in there to try to figure out what the productivity loss would be.

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I think it's right in -- if we come to the other mining area which we haven't focused much on, on open cut, I think it's not clear that once you take the surface soil away and open cut into these areas, that we've yet done sufficient research to be sure that we get the same level of productivity. We can grow things afterwards. We can graze and whatever. We know we can do that. Whether we can move that back into irrigated agriculture -- it's certainly possible. We know, we've laser levelled very large areas. We've cut through Gilgai country so we know we can deal with a lot of heterogeneity in the soil and still produce a lot.

I guess my short answer to you is there's a lot of this technological competition in there. It's not just about how much water you've got at a given amount of time as to how much production. Again, this is in those areas where you do have intensive production. I don't think we should have hysteria over rain-fed agriculture and dry extensive grazing areas that are rain fed.

Town water supplies, no doubt at all, we should be securing town water supplies for those areas, but as far as the extensive production around those areas that are dry land, I don't think that we should be thinking that there would be large impacts there, or any discernible impacts on production.

Karyn: The state government's recent announcement that they're putting in a two kilometre exclusion zone from the towns over a thousand people, is that -- Drew, you're smiling and shaking your head. Is that not sufficient, or it is sufficient for the concern about town water supplies?

Drew: Regardless of town water, the impost of a two kilometre buffer zone around towns over a thousand means there's a hell of a lot of small towns in Queensland that aren't protected that same affordability and there's a hell of a lot of rural and regional communities and families that are not protected the same. So to put a buffer zone around what is quite undeniably a quite naive process of saying but we put these buffer zones in to protect the greater good; there's a hell of a lot of Queensland you've not just protected. There's a hell of a lot of Queensland you just said you're obviously a second-class citizen compared to some of those other towns. That's a very different debate than what we're here for tonight.

Karyn: Thanks. I'll ask for another question. In the middle over here, thanks. Then we'll come back to you, thanks.

Drew: Could I just make one comment before we head into that question; one of the biggest issues that we have is often discussing this with landholders. We've been doing extensive work trying to assist landholders and understand all these processes. It's not pro-agriculture, not pro-CSG, it's just what their rights are and where they stand.

The reality of this entire industry is we're talking about a gas industry here. It's not a gas industry ladies and gentlemen; it's a water industry that has gas as a by-product. The majority of their production to start with is water. What we do with that water, how we manage that water, where the water goes,

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what contaminations does that water have, what pressurisation changes that has within the aquifers, they're the issues that we need to deal with.

Right now these companies that are representing the CSG industry can sell their gas. They've got their forward contracts in. That's fantastic. That's great for the economy. That's great for jobs. That's great for whatever other process you want to say. The reality of that water is still to us, unfortunately, as a Queensland community, the multi-billion dollar question.

Karyn: Thanks Drew.

Hannah: My name's Hannah. I'm just interested to hear probably from Chris; industries claiming -- gas industries and government's claiming that gas produced from coal seams will burn at up to seventy percent less emissions than coal-fired power stations. I'm just interested to hear whether you think enough or whether adequate study's been done to show that through the full production, through the full lifecycle of the gas being produced, whether this is actually the case? It's actually going to be less? I know that there's been a recent study done at Cornell University that has shown shale gas rather than coal seam, I know there's differences, may not actually produce less emissions than coal. This is because of the methane leaked during the process. In Australia where there's high fire risks, the methane when they're testing wells is often just leaked straight into the atmosphere instead of being flared off.

Chris:: I hear noise to my right so someone else has obviously read the same paper.

Michael: The Cornell stuff has been thoroughly discredited by Cornell University. You guys are six months behind times. I'm sorry. Please, go to Google it tonight. You see how discredited that study from Cornell University has been. It's ridiculous. Why I would come over here in Queensland and hear about the Cornell study tonight is very disheartening, frankly.

Karyn: Chris, please.

Chris:: It was interesting when it came out last week and there was a big political hoo-ha about it last week. When I first heard it was about emissions, I immediately thought "Ah, someone's finally realised how much energy's required to manage the water, and we're going to figure out the additional indirect energy associated with the water." But indeed it wasn't. It was this other paper.

I was approached by the Queensland government and ABS straightaway to say did we know about the paper, do we know about other information around this. The two key points that are in that paper that need data behind them are the so-called flow-back associated with fracturing, so how much gas actually is produced that you don't capture during the process of fracturing, and how much venting occurs.

Venting is an interesting concept. Venting is a creation of engineering when your downstream compressing system where you bring gas and whatnot together can't quite cope with the rates of flows coming out everywhere, so

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occasionally you get a little bit of extra gas back in the system. You can't stop so you vent that gas.

You have those two components in the Cornell study that came up with very high numbers for one of the shale formations so we don't know what those numbers may or may not look like. They're both engineering based.

One of the beauties of that is it brings in this whole carbon tax question; how much would you pay to save that gas? Would you pay twenty-three dollars a ton, CO² equivalent for that gas, and if you would then you would invest in the research that would create technology to trap the gas, at a minimum to flare it right. If it's there you flare it, you reduce the CO² footprint of it immediately by a large margin.

I think the short answer to your question is I think we actually have to work through more of the lifecycle. The water management energy component I think needs to be looked at so we really understand the footprint component. The beauty of the problem of the other fugitive emissions associated with engineering is you can imagine technology to deal with that relatively simply. Can you actually create that for twenty-three or eight Euros a ton? That's the key question on coming back to global climate change and response.

Karyn: A question at the back.

Samaya: Samaya (ph.), I just wanted to touch upon a few other environmental impacts that are associated with the activity. We have obviously discussed a range of environmental and social impacts tonight which has been great. There's also these projects are really the largest disturbance of land that we've seen in this state. It's going to carve up millions of hectares of vegetation and land and watercourse crossings, etcetera. I'm wondering if maybe Chris could answer this. Has anyone looked at the ecological costs associated with all of this, and the economic and social costs and put it all together over the long term? Have you worked out what that total cost is?

Chris:: No I haven't.

Samaya: So we can make a sensible decision?

Chris:: I think I have to take exception to the introduction to your comment that this is the largest disturbance of the landscape that we've seen. It's not by any means the largest disturbance of the landscape. We've been clearing Australia and Queensland particularly at faster rates than the Amazon until very recent times, and we've created very significant change.

Now we have precious systems left. We have precious systems left and with five hundred metre spacings we've a line into each one. Biodiversity fragmentation is a serious issue for those areas. There's good discussions, I think, going on between the government and the companies about offsetting of that. It's not a one-for-one offset. It's how much either other protection or other growth and perhaps Drew knows more about those conversations on how they're progressing. There's at least a positive conversation.

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The second part of your question I think is probably addressed best by looking at the new CSIRO program that's just been established with APLNG. It's called GISERA, it's run by a chap called Peter Stone from CSIRO.

When they launched that a few weeks ago the CEO of CSIRO was very strong that a large component of that would be to look at the whole systems issue, what would be the social, environmental -- and could you bring that together. No one's ever done it right, so no one's ever actually managed to make a kind of good indicator statement over a region of change or over even an existing region. It's a very difficult thing to do.

But you do need to do it, try to do it. CSIRO have had a couple of goes at this before. They have reasonable experience. They've done a pretty good job in the Goulburn Broken area in Victoria and New South Wales, in the irrigation there. They did a reasonable job of the Herbert River area quite some years ago as well, so there's good experience in that organisation, I think, for looking at those systems-wide issues. They're on the case and I encourage you to go and talk to Peter Stone and get a sense of how they're going to progress that.

Karyn: We've got time for two more questions. Thanks.

Kate: My name is Kate. My understanding is that the water commission in New York City has been able to have coal seam gas activities excluded from the Catskills watershed. Chris nominated before the need to protect town water supplies as being an important factor to consider for the industry. I'd just like to ask the panel what they consider the approach to exclude coal seam gas activities from drinking supply watersheds, as a compromised approach to a full moratorium.

Karyn: Can I ask Adam Stone to start with that? Adam would you have a view on that to start?

Adam: I did miss part of the question. Can you run that by me again?

Kate: The full question was my understanding is that the New York Water Commission has lobbied and been able to exclude coal seam gas activities from the Catskills watershed. My question to the panel is how would that approach in terms of excluding coal seam gas activities from drinking water supply catchments be as a compromise to a full moratorium on the activities?

Adam: Chris might have to correct me here but if I understood what Chris was saying earlier correctly, I guess I'm still left with the impression that we haven't aggregated all of the data and informed a comprehensive picture of exactly what the picture is going to be on underground water supplies across the full breadth of the terrain where this industry is being considered.

Based on my understanding, in the absence of that kind of data, then just excluding areas where it might impact upon town water supplies would not account for the full range of potential problems. If we're looking at potential water contamination or unavailability either now or in a hundred years when

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the water trickles from a highly pressurised place to a less pressurised place, and that's going to have an impact on agriculture or other beneficial uses of that water. Then I think that would also be a concern that needs to be discounted before we roll on ahead with the industry. But I maybe misunderstood Chris's explanation so you might want to add to that.

Chris:: I don't think I'll even go that direction. I think we can understand the local systems. I'm not sure that's a very helpful -- for the people who want to stop, everything is going too fast I'm frightened, I don't think that's a very satisfying emotional or intellectual response for those people, particularly, because I think they're coming from a different position. I think Professor Economides put that quite well in the beginning; I think people are working from very different emotions and fear points. I don't think that particularly helps.

The direction I'd look at is the quantities of water as well. If a multi-billion dollar company is faced with a make-good provision over a rural water supply, it's actually a relatively easy engineering problem. Making good on the water for a few thousand people is a relatively simple task. Mining companies do this all the time, where they integrate the mine water supply with the town water supply for the town that would be supported by it. They don't even necessarily look at local water supply as the solution to those towns' water needs.

I think the capability of engineering to move water, to clean and make water available for example from surrounding areas to those towns is probably a relatively easy engineering problem. But I don't think the moratorium issue is an engineering question.

Karyn: Can we have the last question for tonight please?

Francis: My name is Francis. My issue, I'll try to put it in small words, is probably about social justice. We understand that there's really four CSG companies that are investing and getting billions of dollars each year even though they've only been around for a few years in this territory. My concern is that the short term, medium term, and long term for the farmers, the landowners, the communities, the population that lives here, and the population that's served in the urban areas by these farmers, or the landowners is a real concern. What can the community or people do about this? We can wait five years for a CSIRO report. We can wait for debate for state, federal, and local governments to argue about certain things for many years. What can we the community, the people do?

Karyn: I'm actually going to take that question and feed it to each of the panel, as an opportunity to make some closing comments, please. But I'm going to start at this end because we've had a lot of focus down the other end at the moment. Wally Wight, what can the community do as a result of the discussion that we've heard tonight? Sum it all up for me. What can the community do to allay concern but to also be part of some of the decisions and discussions that are going on?

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Wally: I think part of the issue is to inform ourselves as community on not just the technologies but about the responses. I think one of the things that Jeffrey touched on is that one of the issues about energy exploitation is that we have this intent to use more and more energy. I think there are opportunities to have our community use less energy and put less pressure on the sources of energy. I don't think that we need to rely on accelerating our consumption in order to live a lifestyle that's worthwhile.

Karyn: Thank you. Liam.

Liam: I hardly feel qualified in this, but I was thinking the information line and how already people go into entrenched positions and how little they maybe understand or how simplistically they try to understand a problem. I guess for me it would be inform yourselves and be part of the debate and then be into the process, as best you can do. I realise the problem is a difficult one and I guess standing back from that I think one of the things I notice about this is we have had mining and farming going on in Australia but not necessarily in each other's pockets like it's occurring here. We're going through quite a significant change in that. We've been able to do these things without impacting on each other. There's a lot of working that out and working it through with each other before we could actually be able to move it forward.

Karyn: Michael.

Michael: That's the best question of the night, by the way. Thank you. This is really a dilemma and it's a choice. If you look at the Japanese expected incremental natural gas demand after the Fukushima disaster, 1.5 TCF of gas, trillion cub feet of gas per year.

If you take the Chinese expected increase in natural gas demand by the year 2020, based on what the NDC, the National Development Council has decreed, that's going to add around 9 TCF of gas. Those of you that are engineers in this room, that's 10.5 TCF of incremental natural gas demand in the Pacific. That's for a good measure, let me use a number so you can understand, that's eight times what Australia is exporting today.

You want to play that game? It's a hundred billion dollars per year that are estimated right now, counting the multiplier in the economy which is four times the multiplier, we are looking at an incremental economic activity that Australia could participate in of the order of five hundred billion dollars per year. That's about two-thirds of your current GDP.

In other words, if Australia were to take any market share of this, believe me, many countries are interested. Canada is interested, Russia is sitting over there at the end of pipelines. The Chinese are not interested to be Russified, so here you are probably there is no economic opportunity for Australia that comes even close to what I'm talking about right now. That would increase your GDP divided by twenty million people about twenty-five thousand dollars per year. That's the magnitude we are talking about.

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All these other things we are talking about pale by comparison to this issue. Social justice, how much of that do you want to get for example? That would be very good, by the way. That's the magnitude. Every time you debate this issue from now on, remember we're discussing a five hundred billion dollar incremental activity in the Pacific. That's the magnitude we're talking about, Japan and China.

Karyn: Thank you, Drew.

Drew: I don't think I can come at it so capitalistic as that. I think the food security debate may need to play a role in that. I think the comment's already been made; educating yourself in this process is very important. It's not just social justice. It's also social license. You hear a lot of the companies talk about their social license to operate.

There are only four companies and I believe that a lot of them are doing some good work towards that. Some of them have got a hell of a lot more to go on that journey than others do. There are some companies who already recognise what those obligations are, and it's more than just giving some new jerseys to the local footie team and five grand to the local show.

They're operating within communities across Queensland. They're operating in some very intensely settled areas which is a big difference we're seeing now, but they are across Queensland. They are part of our community and they need to remember that. Part of that community needs to also recognise the sustainability of that community, whether it be rural, whether it be regional, whether it be a local town, city, whatever.

To educate yourself on that process also then leads to then making some decisions as an individual. The only way we will influence this debate in any way is by working with those who make our legislation. Those who make our legislation are our politicians. If we believe strongly enough that we need to have an outcome then they are the people that you need to be working with, like the gentleman to my left. Because the reality of whatever we decide as an individual means that we should also have the purpose and drive to carry that through. If that means trying to affect change, well that's where change can be affected.

Karyn: Thank you. Adam.

Male: If there's anyone in the room that has anything in the library cloak room, it's just about to close. I'm sorry gentlemen, I did not expect that response. (laughs)

Karyn: Those of you who are able to stay for another couple of minutes, we're very nearly done. Over to you please, Adam.

Adam: The question was about how does an ordinary member of the community get involved in these issues, and sort of pushing for what they see as being the preferred outcome, is that right?

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Karyn: Not just ordinary.

Adam: Extraordinary, good.

Karyn: Give us a task, give us a challenge.

Adam: There's lots of ways to get involved. There are lots of groups getting involved in different ways, groups like Drew's. There are companies involved, governments getting involved at all levels, different community groups are popping up and weighing in when their community gets affected. Obviously you can also try to influence the process by lobbying your politicians or casting your vote according to whoever you think is speaking the most sense on this issue.

I've got a lot of sympathy for people trying to work out in which direction they should direct their efforts in getting involved because to me certainly and also to a lot of people I speak to I think a lot of these issues we talk about are very murky and the air is kind of thick with claim and counterclaim and purported statements of facts from various seemingly reputable bodies that don't properly align with one another can make it really difficult to work out which is the best way to direct your energy.

I can only give you my view on what outcomes we should be striving for. As I said I think there's a multitude of different ways that you can push for change, whether it's by trying to push for greater clarity of information or trying to empower others to get involved in the debate, or spread awareness and educate yourself as various other people have mentioned, or through the political process. I guess there's a variety of ways. You might want to make use of all of them, given your extraordinary abilities.

Karyn: Thanks Adam. Chris a final word?

Chris:: I divide the world in three levels, and I think we've just heard all three of them. There's in a sense a moral imperative to allow people to eat, and to sleep in some degree of warmth and comfort. There's over a billion people that are in that situation now, so there's a moral imperative. And comrade, I'm with you, the capitalist system seems to be looking after that big picture.

We seem to have a reasonable amount of muscle at the moment, at the national level, of pulling the resource back out of resources sector to build the twenty-five thousand dollar a year per person advantage. Where it is now is local and you might have heard this term "royalties for regions" and there's essentially two things that you can do. You can go to government and look for a better share of royalties and will clear share a royalties, and -- not all -- and you go to the companies who have sustainable development policies and practices that are designed to work with that community.

What I would suggest is that while you're sitting behind the locked gate, you very carefully plot and talk to one another about when the gate opens, what advantages you are going to seek from the government and from those companies when that conversation restarts.

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If it's only a defense battleline with guns at dawn, and then finally that's resolved, and let's say it's resolved in the direction of the big companies and the government for example, and you're left with no plan behind that, then I actually think you've let the community down.

It's what's plan B while the gate's locked with respect to royalties for regions and respect to the sustainable development policies of those companies.

Karyn:

Thank you. Ladies and gentlemen I'm terribly sorry for the disruption at the end. We weren't aware of that issue. We are out of time, very much so. If you would like to keep the conversation going, there is a discussion thread going up on the institute's Facebook page tomorrow. Please join in the discussion. Keep the conversation going. Please don't forget that we have our Renewables forum here on the 18th of October and I think similarly that's going to be a really interesting and challenging kind of discussion.

Those of you who are left, two of you might be lucky. We've actually got some *Griffith REVIEW* -- "Wicked Problems, Exquisite Dilemmas" copies taped under two seats in the room. If the people that have left, if there's not one under yours you might like to check either side. (laughs) They're little USBs. Could you please thank our panellists. They have been very generous with their time and their perspectives. We're very grateful to our Brisbane Institute partners and particularly the State Library of Queensland who's let us have this venue tonight. Very much grateful to you too, thanks very much for being committed enough to the issue to turn up and have some discussion and thought about it. Thank you very much, take care going home.