

AGL Energy Limited 2018

Webcast transcript for the introduction to Loy Yang

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Mr Rieniets:

Welcome to Loy Yang. My name is Steve Rieniets. I'm the General Manager of Coal Operations for AGL Loy Yang. So my role is just to acknowledge Welcome to Country and do a brief safety talk and then I'll hand over to Doug Jackson to kick the day off. So welcome to Loy Yang. So first I'd like to acknowledge the Gunaikurnai clan and the Brayakaulung people whose land we stand on today and acknowledge their elders past and present and acknowledge any elders who may be present with us today.

First of all, safety, emergency safety talk about this facility here. Technically we're not on site while we're in this building. Once we leave that front door of this building, we're technically on site, so we will need to kit up with hard hat, glasses, high-viz, if we go out the front door. Rest rooms and facilities are directly behind me in this corridor here, so go via this door or out the other door and back through there, so female and gents are there.

In the unlikely event we have an evacuation, you will hear a continuous siren. If that occurs, we will follow the evacuation procedure, so we will leave in an orderly manner through the front door, follow your AGL representative up the footpath and assemble at the entry site where we came in on the bus. In the event that that area is not available, we will go via another route, follow the AGL person and assemble in the car park directly behind us. So that's probably all we'll need to know regarding that; so follow the AGL people who will have a high-viz shirt on for the moment.

Later on we'll do the tours; we'll have to get kitted out with PPE and high viz. On the mine tour, we'll be on a bus, then we'll come back and we'll go into the power station where we'll need to assemble into three groups, so I'm sure we'll get that organised in the foyer of the power station. So three separate tours of the power station, but you'll all see the same things, it's just staggered so we can control each group more intimately.

Any questions before kick off on any of that? Sounds good. All right, so I'll now hand over to Doug Jackson to kick the day off, so welcome, Doug.

Mr Jackson:

Thanks Steve and some of you met Steve a little bit yesterday, but he'll be with us today, as well as a number of his team for the tours. It's going to be a fun day, exciting, a little more interactive than yesterday, got a bit more up and down, moving around, see some different things. I'll just talk about the agenda a little bit today. We're going to learn a little bit about Loy Yang, its history, so Steve will come back and talk to us about how the Latrobe Valley got going and how Loy Yang got built a little bit. We'll talk a little bit more from Melinda, who you all met yesterday, on the optimisation of

our assets and how we think about the markets, all of that. I'll come up and close a little bit with asset management and where we think we're going a little bit with Loy Yang longer term, beyond base load and just a bit of a story about that.

With that in mind, we're going to jump into it and have a good conversation. But before we get going to the technical stuff, going to have Brett come up and just talk to you a little bit about some media that came out today you may want to hear about. Brett.

Mr Redman:

Thanks Doug and it wouldn't be a day in power market without something going on, throwing out our plans a little bit. Look I just want to make a couple of quick comments on this morning's news. I wasn't going to take questions now, we've set up Q&A at the end; we're just trying to manage a little bit of the schedule. Just acknowledging, the Federal Government's put out commentary this morning around asking the AER to look into reference pricing and default rates. The two comments that I would make are firstly at AGL we've been listening to the concerns of customers and the community for quite some time about customers on standing offers effectively paying too high a price, simply because they're disengaged.

Over the last year or so, we've acted proactively to move loyal customers onto discounts, so all of our electricity residential customers, so all of our electricity residential customers who are with us more than two years are automatically moved to a discount. What that means is 96%, 96% of all AGL electricity customers are either on a market contract or on a loyalty discount, so only 4% of all electricity customers at AGL are on a standing offer with no discount. We've been acting for quite some time on this issue, we've been proactively moving customers to better deals, so 96% are already on a market offer or on a loyalty discount.

Second comment I'd make, a lot of you will have heard me talk about it before, is in the detail of what's being announced this morning are effectively two concepts and we're not quite sure which is ultimately going to be implemented or arguably both, but which is going to be implemented. One is this idea of a default rate which effectively is a regulated rate, a price cap. The other is the idea of a reference rate which we have to reference all of our offers against. AGL for some time has been very supportive of a reference rate approach. We do think it is confusing for customers to shop around. We have been actively trying to support the introduction of reference rates or comparator rates or comparator sites in the market. The devil is in the detail, it's kind of hard to do and we need a trusted body to do it. If we just publish it, unfortunately the state of the industry now is we're not necessarily the trusted body, we need someone independently to put it up. So we have been working with the AER already for some time, trying to put together a reference rate that people could refer to; we're very supportive of that.

We are very concerned about anything that brings back price regulation. So the idea that a default offer cap comes in, which represents the maximum that you could be charging the customers, is of concern. Even the lightest touch version of that, it might be brought in and you hear people talk about bringing it in now with lots of headroom and the ability to compete and all the rest. Our concern with it is once it's brought in, it represents the ability of future governments or future regulators to lower that price cap. That goes straight to the heart of your investment cases and straight to the heart of risk when we're thinking about investing in new plant and at a time when the market needs new investment in new generation more than ever, now is not the time to introduce new risk and more risk into the investment cases for new generation.

To recap, 96% of all AGL electricity customers are already on a market offer or on a loyalty discount. We very much support all forms or any form of reference or comparator pricing to allow our customers to shop around cleanly and by the way, can I say, really happy to compete in that environment, bring it on; let customers shop around, don't introduce price caps and re-regulation, that will hurt investment at a time when the market needs it.

With that couple of statements, I'll hand back to the regular agenda. We'll have a short Q&A at the end; I can pick up any questions on that at the end or anything else that I can answer for you today. Thanks very much. Over to you, Steve.

Mr Rieniets:

Okay, as I mentioned, Steve Rieniets, General Manager of Coal Operations for AGL. I'm just going to give you an overview, a bit of the history of what we see in this facility today, a bit of history about Loy Yang and its operation, then I'll hand over from there. Nearly a century of generation here in Victoria's Latrobe Valley, the first generation started in 1924 from Yallourn; you would have passed Yallourn on the way up here. The 1920s, '30s, '40s, '50s, '60s came and went with new construction of power station facilities. Loy Yang was the last of the power generation built by the former SECV and opened in the mid to late '80s but the coal mine obviously started before that; you need to develop the mine and access the coal. Early '80s, the coal mine started, power station commissioned mid to late '80s. Obviously corporatised, sold off, AGL full ownership in 2012. It has a life to 2048, that's our current planning, however the mine, due to the need to rehabilitate the mine, the mining licence runs to 2065, so some time after the closure of the power plant and that is to enable proper rehabilitation at the end of the mine's life.

Just some facts about Loy Yang and all of these brown coal plants, you will notice that the power station is built on essentially the lip of the coal mine. If you go to a black coal station, very different; power plant will be there with many months of coal sitting at the power plant. These designs are different, the coal mine is the essential buffer for the fuel source, with the power stations built right on the lip of the mine; it's a just-in-time operation. Mining licence we have is two billion tonnes, of which we've mined about a billion, so about half way through the resource, about a billion tonnes left.

We mine 28 million to 32 million tonnes per year, so 90,000 tonnes per day every day. We have a coal bunker and we'll see this on the tour. One of the key features of these plants is the buffer is quite small between the mine and the power station, so the coal bunker is here, holds 85,000 tonnes, so a little bit less than a day's supply. If there is an issue in the coal mine, we need to get on top of it fairly quickly to avert any issues in the power station.

Twenty-four-thousand tonnes at full generation for Loy Yang A. In addition, the mine supplies Loy Yang B station, so there's another 1200-odd tonnes per hour there to supply B station. Two-thousand-two-hundred megawatts is the capacity, three 560 megawatt Siemens units and one unit which is Unit 2, is slightly lower capacity at 530 megawatts. Average generation is about 15 terawatt hours per year.

Key features of the power plant, which we'll see more on the tour, now I believe everyone did David Bartolo's tour yesterday, so you're all experts on power supply. But generally the coal comes in, goes through a boiler that heats the tubes with the water inside the boiler, produces steam that runs the turbine generator and the power comes through and out. Obviously there are some waste products with gas going through the precipitator through the chimney and ash coming out. We dispose

of the ash, we treat the gas and we cool down the water through a condenser in the cooling tower. Think about you're lighting a fire, you're boiling a kettle, the steam comes out the top, obviously there's water in the kettle, steam comes out, that runs a fan that runs a magnet that produces electricity. It's in very layman's terms how it works. The boilers are 105 metres. You'll notice the boilers are quite large compared to a black coal station. That's due to the fuel differences. Auxiliary firing is brown coal or briquettes. You would have noticed as we drove in some black coal on the left hand side as we drove in, that's our auxiliary fuel for firing the units and ignition fuel is by natural gas.

The coal mine, where are most people from, Melbourne or Sydney? Melbourne, half and half, okay, I like this slide because it shows the size of what we're talking about. The mine started back in the early '80s in this site here. It's progressed in this direction in 30 years. To give you some idea of the size; it's 1200 hectares, it's 200 metres at the lowest point from top to bottom; width is 2.5 kilometres, 4.5 at the moment, ultimately it will be about 6.5 kilometres across. Very favourable mining conditions on a strip ratio of about six coal to one overburden. A lot of strip ratios are expressed the other way, so every piece of overburden we remove, we get six units of coal produced, so very favourable mining conditions. But if I was to overlay the City of Melbourne CBD on top of the mine, as it stands at the moment, AGL offices are about here, Docklands are here, MCG is here, Punt Road; Docklands over Punt Road, we end up over in Hawthorn when they're finished and if I go the other way, Southbank on this grid here, we're up in Carlton, Collingwood area. That's the size of the pit, you fit the Melbourne CBD inside the pit at the moment. It gives you some idea of the size of the operation.

Coal is dug on a continuous basis by bucket wheel excavators, or dredges, as they're called. There are four of these machines inside the mine and we'll see some of those as we go on our tour. One is predominantly used to strip the overburden; the overburden average thickness is about 20 metres on top of roughly 150 metres of coal. The overburden is stripped with a bucket wheel, we then use the other machines to strip the coal as it is exposed. Typically we would need two machines operating on coal to keep both A station and B station going, but we need contingency because there are maintenance manoeuvres, operational manoeuvres, hence we have four machines. Just to give you some idea of the size of the machine, if it was stretched from bucket wheel to tip, wouldn't quite fit goal square to goal square in the MCG. It's 190 metres; I think goal square to goal square at the MCG is about 180 metres; it wouldn't quite fit. It's the size of a medium-sized high rise building, 50 metres high, about six or seven stories, eight, 100-storey building and weighs 5000 tonnes. These machines can dig up to 36,000 tonnes per hour, but obviously there are manoeuvres, so you need to be able to cover when it's either travelling, out on maintenance and the like.

Safe and sustainable operations, we have a combined workforce of about 1000 people, internal and contractors working on this site. When we do an outage, which we are at the moment, so we have Unit 4 on a major outage and we have a large outage in our mine as well on dredger 14; it's probably about another 1000 people, so let's call it, as of today, there is probably 2000 working on the site at the moment. Our safety performance, the implemented target zero in FY16, we had the trend going up and you see some very good results in the last few years with the TIFR of 1.8 per million man hours worked. Our focus is on prevention and we're not happy until that is approaching zero.

Done a lot of work in the last few years on modernising the way we work. We went through a lengthy EBA process to come up with new ways of working that increase our flexibility and our productivity and increasing how we use technology in the business. We're getting on with that, we've had quite an extensive plan which we've been rolling out. We're starting to see the benefits and we're starting to see the cost savings come through on that and we're starting to see the more productive ways of working and the more modern ways of working here at Loy Yang. We're getting on with it and this plan, you'll see it as you walk through the plant and mine, it's really articulating quite simply our journey; it's going from good to great and all the things we're doing to get there. It's quite a simple way of explaining it to our workforce; it's clear and transparent and we're getting on with working through that.

Reliable performance, so this graph here shows in the last five years, the purple line is the average for the national electricity market average and the blue line is showing Loy Yang's performance, equivalent availability factor. High performance, high 80s, obviously it fluctuates depending on the major outages you have in a particular year. Quite good availability factor and output; you'll notice a kick-up in FY18, a little over 15 terawatt hours and we've seen that increase since the Hazelwood closure in March '17. We anticipate similar sorts of outputs in FY19.

That's very quickly a quick overview of the plant and its performance; you'll see a lot more during the site tours and hopefully it comes together.

Question: *[Inaudible]*

Mr Rieniets: Per tonne of coal?

Question: Yes.

Mr Rieniets: It would be all up \$4 a tonne in that order.

Question: *Okay and if you think about the strip ratio to the end of your mine life, would it be similar to the 6:1 right to the very end?*

Mr Rieniets: Yes, depending on the effective strip ratio once you take into account benches and batters and things, but it's very favourable all the way through.

Question: *Lastly, just coal quality, similar sort of coal quality?*

Mr Rieniets: Very similar, similar quality. We know where the poor quality coal is, we've got a mine plan to try and avoid that as far as we can.

Question: *Okay, thank you.*

Mr Rieniets: I'd now like to hand over to Melinda Buchanan, who is the General Manager of our physical markets to take you through how it all works in the market. Melinda.

Ms Buchanan: Thanks Steve. It's an excellent introduction to the way we see Loy Yang in the Latrobe Valley and here in Victoria, but the way we view it is as part of the NEM, so let's give some context for Loy Yang in the NEM. As Steve said, 2200-odd megawatts, that makes it the third-largest power station in the NEM after Eraring and Bayswater. But let's face it, size isn't everything and what's actually a more important statistic from my point of view when running the portfolio is the 9% of output, of NEM generation overall. The reason for that relatively high, punching-above-its-weight contribution is nicely shown in this chart, asking about short run marginal costs. This is a chart produced from AEMO's ISP and not to say that we

endorse all assumptions in the ISP, but it does give you an independent view of how AEMO benchmarks the coal assets with certain assumptions about their coal costs and then for each of the gas assets, for varying gas prices with an increasing tranche as we go through, what the equivalent gas price is on a short-run marginal cost basis. Right on the left, the stumpiest of bars in the chart, is where Loy Yang sits. That, I guess, enviable position in the merit order is part of why it's so valuable in the fleet and part of why it makes such a significant contribution to NEM overall output.

We might think of Loy Yang as an asset that doesn't really have much optimisation; run it hard, hedge its outputs, sell to customers and job done. But instead, we like to think of Loy Yang as part of the overall NEM fleet, rather than just an element of Victoria. To do that, this chart starts to show you how we see it differently. Clearly it adds to fuel diversity, as Steve said, with brown coal as distinct from the brown coal assets, renewables and gas generators, we have fuel diversity in the supply stack. But also, if we look on the demand side, these are the FY18 figures by megawatt hour, you can see that while Loy Yang is in Victoria, Victorian demand is not the only source to which we put the output of Loy Yang and equally, if we slice our customer base in different ways, we see that there's no single mapping of Loy Yang to any particular customer market, or particular state.

To see that another way, I mentioned very briefly yesterday, for those that attended, this idea of co-optimising between markets. Where we see Loy Yang located in Victoria, clearly through appropriate hedging strategies we can sell its output to customers in New South Wales and adjacent regions, customers in South Australia and thereby use the differential in prices between different regions and that enviable merit order position to sell to customers in other regions as well. Moreover, where we use that generation in other states, effectively we offset the consumption of fuel. If we're selling into South Australia from generation at Loy Yang, then we can use the gas that would otherwise have been burned at Torrens Island and sell that into the gas markets. Of course through the financial markets, we hedge our risk in the National Electricity Market, but equally through co-optimisation of gas and indeed offsetting coal purchases at AGL Macquarie, Loy Yang plays more than a role than purely Victorian output.

But at the end of the day, it is in Victoria, it does earn the Victorian pool price and as I like to say to my traders, to get the earnings across the year, that's the sum of the earnings in every single half hour and there's 17,528 of them. To picture a day from FY18, we've taken a half hour, one of those 17,528. On 17 January, temperatures got to 30 degrees in Victoria and the pool price was sitting around \$120 a megawatt hour. If we were to split our demand stack on that day, we have that same breakdown of categories and if we split our supply stack on the day, you can see the significant portion that's met by Loy Yang on what is a relatively typical summer's day. On top of that, there is some wind from our assets and some output from hydro, but the net position in Victoria on that half hour was a short one; we had pool purchases in that particular half hour. That is offset by generation in other regions. When we look at our overall NEM position, we're not necessarily concerned that purely in Victoria we had a short position; we're trying to optimise NEM wide.

Let's roll forward to the next day, on 18 January, same bat time, same bat place, we had 40 degrees and a pool price that was 100 times higher. In that instance, by keeping up out of dry, or rather our water in our dams, we were able to flex the renewable to portfolio, meet that flexing consumer market demand responding to

the higher temperature and have net pool sales into that 100 times higher prices. You will also see that Loy Yang flex its generation across those two days and where we see high temperatures coming, we work with the folk here at the power station and mine to make sure that the station is prepped and as ready as possible for full output on those days and, if needed, doing preparatory maintenance the day before. That shows you a bit of the flexing within Loy Yang, but also within the overall portfolio and that's really the aim of it in the fleet.

Last but not least, while we can see that position in the merit order today and we can see the output that it produces today, there is no necessary expectation that that will be the case forever and we would be foolish to be not looking at how to better optimise in the future. Of course we have increasing renewable penetration and we might be lowest in the merit order for thermal assets, of course with renewables you would still be undercut. To that end, with increasing renewable penetration, changes in demand profiles and so forth, we see a change in role of Loy Yang in the future, although for those who were here yesterday, it does of course provide some of those critical system functions, like frequency control, inertia, system strength and indeed system restart services, as David alluded to at the end of his presentation yesterday.

With its location in the transmission network, on the 500 kV spine through to Melbourne and its connection to Bass Link, through further more to the connection to the potential for Snowy Hydro, it's neatly located in the transmission network, adjacent to both potential batteries of the nation, whichever particular location is your favourite for the potential future pumped hydro. With those things in mind, we're looking forward to seeing how this asset changes in the future and to that end, I'm going to hand over to Doug to talk about his team optimises the asset to be ready for those things. We'll do Q&A at the end.

Mr Jackson:

Thanks, Melinda. You heard a little about flexing our portfolio, but we also have to have our assets ready to flex and so that takes different thinking about our money and where we spend it, how we spend it. You hear us talk about asset strategies and we think about our plants in phases of life: early phase, mid-life, late phase. Loy Yang is in mid-life, so we're investing; we're going through mid-life investment, mid-life refurbishment. The dredgers, we're putting new control systems in, new bucket wheel gearboxes, that kind of stuff. The turbines at Bayswater Loy Yang, you're seeing turbine uprates, generator replacement strategies, that kind of work. Big heavy maintenance spend in the mid-life; it's not unlike us, we get 40-ish, 50-ish, you have to do things a bit different, take different healthcare opportunities. We're doing that in our plants right now. Some of our older plants we're looking to retire: Torrens A, Liddell, you've heard lots about those, so they are in a late phase of life, so we are thinking about how do we manage the capital so we don't strand them, but keep them safe and reliable and meeting the market's needs in the short term.

Our early phase, we showed hydro in there because we've got some new hydro, but there is some older hydro as well and they run for a long, long time. Wind and solar, they have a different investment strategy. We think about all of our assets slightly differently; we customise our investment, if you will, to meet what our market requires from them and to optimise across the portfolio, not just as an asset level, which we think is a real advantage for AGL. All of those things set up our capital plans going forward, so this is where it starts from.

But we also think about the life cycle, the whole of life of a plant. This is a traditional bathtub curve from the early start of its life, commissioning, early operation, you

have some early failure rates which occur and happen, things that are new stuff, think about new technology, it doesn't always work exactly the way you want to; you fine tune it, you invest in it, you maintain it, you do different things. Then over time, it sort of comes along here and somewhere on a power plant, they're designed typically for 40 years, so that first curve. If Loy Yang had its normal 40-year life, 2028 we'd think about retiring it. We're right now in the mid-life investment phase down here in the middle and that's the kind of things, you're going to see a few pictures and you'll see some examples of what we're actually doing out in the business with; generators, turbines, dredgers, that kind of work as I mentioned.

We're going to make this investment so we can come off of this curve and our target today is making 50 years, which is 2038, so the late '30s. We want to be careful that we don't just say, let's go all the way to 2048 today. you always hear us talk about not later than 2048 is how long does Loy Yang run, thus this curve, it's a 60-year typical end of life, if you make this investment and you make another future investment choice in the late '30s. You have to do it ahead of the curve, otherwise if you go from here to here, there's a huge reset cost, so you have to do the work back here; the design, the thinking, the application of it to get it onto this curve. That's the work we're doing. We have a whole of life plan that gets us to there, but we've made commitments to this strategy so far, we'll make future commitments in about a decade or so to this strategy, depending on the market. We'll keep a close watch on that. That's how we think about it, that's how we apply that whole asset strategy.

It shows up this way in terms of numbers. You see about \$150 million-ish a year we spend in the mine and the station on capital. That's the investment, these mid-life refits. You see if you look back to '10, '12, '13 timeframes, it would have ramped up and so we're in a fairly heavy phase right now. I'll come off a little bit in '23, '21, '22 area, but a fairly heavy investment over the next five years. We time it, so you see the purple dots are showing when we do major outages, the lighter purple dots are when we do minor outages. Every four years, these get a major overhaul, every second year they get a minor overhaul, in between years, we do a little pit stop just for reliability for summer. They seem to work best at that strategy. We had a couple of dips, we think six years was the old strategy, a bit too far, so we've gone to a four-year strategy which we think optimises Loy Yang's forward market needs.

Here are pictures of what we're doing out there. I think it's important, what do we spend \$150 million a year on roughly? It's generators, refurbishing our generators. People who live in Melbourne will recall when we shut down the streets of Melbourne, the highway, to move this big generator through to the port and take it out. That was the generator going over to Germany to get repaired and refurbished. Low pressure turbines, we're doing some business case on replacing them right now, upgrading and replacing them, optimise the output. We're doing things with the high pressure turbines, high pressure replacement strategy, so we will only open this up about every 12 years going forward, but you have to do the work now to get it into that shape, so that is what we're doing. New condensers, so you hear a lot about condenser leaks. Here in Bayswater, we're replacing our condensers to make sure they can make the run to 40, 50 and in the future, 60 years. So that is physically what some of the stuff looks like.

That's kind of the physical assets, but the other thing we're doing is thinking about how do we optimise everything digitally? Everyone talks about the age of the digital era, the cloud, big data, well that all works here too. Dave Bartolo who was teaching

the electricity stuff also runs our asset intelligence group we talked about. He's thinking about how do we go from all the things in the fields, motors, control valves, controllers temperature sensors, those kinds of things, what kind of system do we need in the middle to organise it all, how do we display it so people can understand what's going on, but better yet, we'll go from, as I will show you later, from all of this, through the cloud, to a digital system that really doesn't take the operator much to do it, just like a plane can actually fly and land by itself today. We don't do that, we still trust the pilot, because we are not kind of - we worry a little bit about the computer; we're getting there in the electricity industry as well. Pretty soon we'll have far more data, far more cloud-based technology.

This ODC, or operations diagnostic centre I talked about that Dave looks after and his team, they have a thing called Predict It, is the brand, it's advanced pattern recognition software. This saved us over \$20 million in the last three years; it finds failures before they find us. Predicting failure is important, we can do something about it, we can time when to repair it, we can catch it ahead of a summer peak period, those kinds of things; it makes a big, big difference. We applied it on our wind farms, our thermal plants, our solar farm, batteries in people's homes in the future. Asset management, it's how we do asset management today, is with advanced pattern recognition.

Operation systems are meeting IT in a big way. How do we do that? Well, we think about using different kinds of technologies to capture it. Sigfox won't mean much to a lot of people, it's a brand, but we have areas in our plants, our big plants especially in our hydro operations where there is no electricity. Funny, we're an electricity supply plant, but there is no electricity in some of these little remote sites. How do you get signals from there? If you have a pond that can overflow or if you have a raceway in a hydro system that has no electricity but you need to know when water's flowing, how do you know that? Well, we can put sensors out there that will send their own Wi-Fi signal to us that we can capture and run data in real time.

New technologies like that, the bottom right box, it's a drone. We now have entered into agreement with a drone supplier here for Loy Yang, just getting up and going. I think Dave said the drone might be here. I don't think it's going to do a flyby for us, but it's the kind of thing, jumps out of its box, flies a route, comes back to its box, plugs in and charges up all by itself. They're advanced enough now they can go from an infra-red camera head to an optical camera head, they can make their own changes; they can charge themselves. You put these things in series, you can run down a 50-kilometre cord or with having the box every so far. We're playing with that now. We're running here at Loy Yang, we're going to do some stuff at Macquarie and we're thinking about our hydro operation as well, so getting on with these kinds of things.

Then everything in the middle, how do you take all that signal, working with the cloud, how do we organise and think about it? Big data with our IT teams, our operations teams and we're working with Richard's team in wholesale markets, we're working with our IT team on creating time for people, these digital specialists, just to take a day a week, sit down, their job is to figure out what we could do with all this data, how do we make tomorrow happen today; thinking differently, working differently every day.

It kind of looks like this, I used to call it data to results at the speed of light. I think it's actually now really possible. All this data in your plant, all this stuff, aggregating it together, putting it into the historian, that's all arguably yesterday, it's been doing

this for a decade or more on most plants. What's really coming on is these cloud-based services. OSI Pi is the one we picked on here, but it's one that we know works. There are a number of other ones and all these new edge devices, Beyond the Edge, the Sigfox I talked about, how do we take all of that to the cloud, hook it up and take advantage of it and that's what these people working together every day, one day a week, are going to think about. But this is where we are and where we're going. It's a pretty exciting time for us in a very old, utility mindset industry. I think we're leading the edge in this way. If you talk to our competitors, not many are doing this yet.

It's one thing that you have assets that you invest in differently, it's one thing to think about the cloud, but what do you do if these assets start to change and go from more baseload operation to the future? We're thinking and this isn't just about Loy Lang, but it's thinking about what we can do with places like Loy Lang, what can we do with our existing wind fleets, our other operations, how do we organise ourselves for the future? How do we think about where we spend our money and our time? On this side, things that are mature and obsolete technology, on the right hand side: conventional coal on the bottom right, obsolete; it's really out of vogue, you won't build conventional coal, you'll do super or ultra-super critical coal in this area, you hear a lot about the heli plants, that's what that area would look like. On this side, things like nuclear fusion, synthetic gas products and other kinds of nuclear technologies. The bolded items are where AGL is playing and will play in the future as we think about it today: pumped hydro, windfarms, base load yesterday, peaking turbines and engine plants, large solar, absolutely.

The green dots, storage; where do we want to play in the storage? Well today we're thinking about lithium-ion, maybe some flow type batteries, you might hear more about flywheel or synchronous condensing, so we'll do some things on storage as well. But really thinking in the future, hydrogen and where does hydrogen show up for us? Not today, but tomorrow. You hear a lot about CSIRO's road map for hydrogen for Australia. That is now getting a lot of mainstream time. Here at Loy Yang we've invested, along with an Australian consortium and Japanese consortium in understanding how to take brown coal and convert it to hydrogen, so that is the next story for us here.

Why hydrogen? Well hydrogen has a number of things. It can be used for electricity generation, it can be used for transportation, it can be used to heat your homes and replacement for natural gas, it can be liquefied and shipped offshore. You can make hydrogen by using renewable energy, so solar and wind, converting water into hydrogen, so there is zero carbon and you get this great product called hydrogen. When you burn hydrogen, it becomes water, so it's a virtual circle. It's also useful as a feedstock and a number of things that we use every day and don't think about, but industries, petrochemical industries, use hydrogen for everything. There is a great opportunity to expand into that. Japan is really, I think, leading right now in this area. They want to use it for electricity and transportation. They're a nation of, I don't know, 60 million people I think roughly, I'm not positive, but I think about 60 million, maybe more, small nation. They don't have abundant resources, so they need to bring fuel and energy in, so they're looking at hydrogen as one of their futures. They can't build renewable, not enough space, can't have enough solar or wind; how do they do it? They have to buy oil today, they buy gas today, they want to buy hydrogen in the future, so they're making a big bet. They've put over \$0.5 billion into it, along with the Federal Government in Australia. We think this is one to watch. Not in it today, other than working on the pilot here, but thinking about it as a future for us.

What do you do when you're done with a mine? Brown coal mine, the nice part is you have a really good strip ratio, the bad part about a brown coal mine is you're burning the dirt you're taking out of it. It's basically lignite or a peat, it's almost dirt, literally. We're trying to burn all of that dirt, we're in a black coal mine, you take all the dirt off and you burn the coal and you put the dirt back and you often have a hill left over because you can't squish it down as much as it was. Here you're going to see, we have a big hole and we'll never fill it up with dirt. You'd have to dig another hole somewhere else to fill it up and it just doesn't work, so you have a hole somewhere. We think you clay line it, you put grass and trees and shrubs as appropriate for it, but you then fill it up and it becomes a natural lake at the end of the day. In 30 to 50 years, I think we'll have a lake here called something or other, I don't know what we'll call it, but it will be a lake. It will be surrounded by greenery and you'll see examples of what we're doing with grasses and other plantings, including agricultural uses, as part of our progressive rehabilitation.

At Liddell, I'll just talk briefly about it. If you haven't heard about it, we have a thing called the Liddell innovation project, which we're really looking to what do we do at Liddell after Liddell retires? You can use it for other kinds of energy, as an energy hub, inertia hub, absolutely, but there are other places. We're working with manufacturers and other alliance partners to think about life after Liddell. We've got an expression of interest process going on right now where I think we have probably three or four times the amount of jobs could be created there than we'll be leaving there, when we close up plant Liddell. I think some exciting ways AGL are thinking about leading on rehabilitation, paying attention to the communities we work and live in and creating, we think, economic prosperity and diversity, not just another mining opportunity or not just another power plant opportunity, but creating bono fide new opportunities.

Here is the standard disclaimer. I won't read it but I assume you've seen it before. It's the same one you always see with us. It's in your pack, so please study it, it won't be on the test, but please study it. That's it, I think, other than some questions and answers. Brett, maybe you want to join us up here.

Mr Redman: Thanks Doug. So how long have we got? We've got about 15 minutes for Q&A, a little bit of a tight schedule, but we've got a few members of the exec team here as well as me. Just for the benefit of the webcast, make sure we use the mics.

Question: *Thanks. Good morning Brett. Thanks for your opening remarks about default offer and reference tariffs and things like that and to get this straight, the reference tariff is AGL's favoured option. Who is AGL's preferred reference rate setter and then what's to prevent somebody coming in and evolving a reference tariff into the thing that you don't want?*

Mr Redman: In terms of who our preferred reference rate setter is, we don't have a strong view beyond needs to be somebody trusted by the community. We had been working with the AER already, so I think they're a good organisation in terms of being trusted. The important thing is, it's something that people will respect in terms of it is a good benchmark that we all go off. Could a reference rate be turned into a regulated rate at a future point in time, potentially, but that takes a whole different level of legislation and debate between the Commonwealth and the states. I think we saw the states all get out of regulation over the last 10 years for good reasons that I won't rehash on the spot here in the interests of time, so there is no reason to think that the states will necessarily rush back into re-regulation either of their own accord, because you get back to, some states more than others, recognise the need for investment and

they get the thread of it, I think. The risk here is people hunt for a short-term solution that kind of feels good, but doesn't deal to the long term structural needs of the market, which is we need investment. We really don't want to see that hampered.

Question: Just a question on the generation app here, Melinda presented around 30 and 40 degree days, but can you talk about what the capacity of this plant would look like on a 40 degree day?

Mr Redman: I might pass to one of the experts. Steve, do you want to tackle that?

Mr Rieniets: A lot of work in the lead up to summer, summer readiness, so that is the time we get those days. Obviously our plan is to have everything available on those days, mine and power station. Only minimal maintenance is done on those days to ensure we have maximum output, all units running maximum during that time. It does with some of the condenser issues we have, but that's part of the upgrade on Unit 4; we're putting in a new condenser that will improve that D-rate factor. That's part of our investment.

Question: Just to follow on from that, on one of Melinda's slides - apologies, Rachel Fleming from IFM Investors - on one of Melinda's slides earlier, we saw a 30 degree day and a 40 degree day and there was a section on the 40 degree day stack chart where renewables had flexed, it said. I was just curious how you flex renewables.

Ms Buchanan: The particular assets that we would have dispatched on the second day, as compared to the first, would have been hydro assets, so Dartmouth, Eildon, McKay, West Kiewa, et cetera.

Question: Hi, (49:35) from Hesta. On the topic of hydro assets, I was wondering with the plan to basically make a lake out of the mine in the future, could that be used for pumped hydro? Could it actually be used as a power source in the future?

Mr Redman: I don't think this site, but I'll pass to Doug.

Mr Jackson: In the long future, yes. In the short future, no, because we still have to keep the act of mining through the - so you need the bottom. You can't build a berm in the middle and just mine; it would be a bit risky. But as we get out of mining, yeah, absolutely, the water comes - you could use the elevation to do that.

Question: I'll go again. I think, Steve, you mentioned you got about 2000 FTE on the mine and the plant. First question is could you give us a summary of the demographics of that workforce and how that is looking and how you're managing that? Secondly, if you were to start with a blank sheet with the same kit, how many people would you need?

Mr Rieniets: Okay, that's about four questions there, I'll unpack them. Two-thousand people, that's how many we have on site at the moment because we have two major outages on, but our BAU number, I'm going to call it about 1000, it's about 600 AGL employees and about 300 to 400 contract employees who perform the maintenance. That's the first question.

Demographics, average age is probably 50, thereabouts, late 40s, 50 and I didn't think that was very old once, but I do now. No. The average age, we have had quite an exit of the workforce, so we've been able to regenerate that with the closure of the Hazelwood station, taking some younger workers from there, bringing them across here, exiting some of our older workforce; be able to regenerate it with that.

Predominantly a male workforce; we are promoting females coming in, particularly in the operating roles. Our apprentice program on this site has 30%, 40% female intake, so that's how we're addressing that. Also in our operator and mine operators as well, we're promoting more women into those fields as well and also into our management ranks.

Your last question, clean slate, how many people? Good question. I guess the technology question, could we have driverless bucket wheels and dredges and all, of course, down the track, but we're not there yet. I would assume there would be a reduction. What it is, it's hard to say, but we have looked at all of those things in our new operating models we're introducing both mine and power station. We've seen some reductions in headcount in our control rooms in our mine that drives that productivity. What it ultimately is, I really don't know.

Question: I've done a little bit of maths, so bear with me for a sec. From Melinda's slide, say an SRMC of this plant of, call it \$20 to \$25, you'd be looking at a total operating cost of about \$350 million to \$400 million a year, roughly. If I took your mine rate and your cost of mining, I'm thinking about a third of that would be coming from your mining. I guess what I'm trying to come to is what's the fixed and variable cost component of this plant, the remaining two-thirds of the \$350 million to \$400 million, would that be roughly fixed costs to run this asset?

Mr Redman: This sounds like one for the CFO. We don't disclose, based on plants, but that \$350 million is much higher than this plant would ordinarily run at. For the thermal fleet, it's roughly about \$400 million, so thermal fleet being this and Macquarie. I'll start again. The thermal fleet is around about that number, but we don't break it down to that level. Maybe half of that would probably be roughly the number, would be somewhere in that vicinity.

Mr Rieniets: Thanks Damien.

Question: You talked a little bit before about the optimisation that's going on, on site and how the EBA has introduced flexibility for you. Can you maybe just talk about what the opportunity is in terms of dollars around that flexibility or is it more in terms of increased output?

Mr Rieniets: No, it's really about doing what we do with less input and that creates the productivity and hence lowers your cost. We're not at the end of that game yet, but we have seen several millions of dollars' worth of saving already and we're continuing on that journey.

Question: G'day just a question about the flexing. To your average generation in a day, what sort of flexing capacity can you increase on a percentage? Is it 20% more than your average day? What do you have in that generation?

Ms Buchanan: Just off the top of my head, I can't pull that one out. Of an average day, I mean certainly-----

Question: I think a different way to answer would be, you've got four units, so with a little bit of notice, you can decide how many units are on, so that's your first big level of flex. Individual units, how much can they flex?

Ms Buchanan: On a typical day we would run full output at Loy Yang unless we see opportunities in the frequency control market to back off or we see opportunities in the price

volume trade off where we have a windy day, lower prices and so forth. But across the fleet, there is definitely-----

Question: How much could a unit ramp down to?

Ms Buchanan: Steve, minimum load?

Mr Rieniets: Three-fifty.

Ms Buchanan: Maximum load, 560.

Question: So about 200 per unit is your nominal flex but base load runs best when it's on and steady.

Question: With the smart technology and all of the monitoring and sensors and all of that sort of stuff that you're using, how much redundancy do you have and how much reliance do you have on any one individual data point in the event of either power outages and failures of the cloud to operate and also in the event of potential hacking or interference in the information that's coming through to you?

Mr Jackson: Really good question because we've isolated those systems. Our operating systems are totally separate from all this data information system. Operations are contained within an asset so that they can be maintained and operated there from a cyber perspective, so very, very limited protocols of how we let people into that system, so it's really internally run. Our information management system, built up on everything comes through what we call a dirty server. All of the work gets done there and only the clean stuff comes out into our operation diagnostic centre. We've been pretty thoughtful; working with the IT team on the architecture from an operating network through to the information network to how do we control things. Our renewables suite, we do dispatch and operate out of Melbourne. We have backup operations for disaster recovery as well and we have at least two paths of connectivity to all of those sites as well, physically separate paths.

Mr Redman: All right, well I think that might be the end of time for our formal part of the day. Thanks very much to all of our presenters and thanks very much for your questions at the end. I'm looking for someone who will now direct us towards the logistics. I think that's a wrap on the webcast.

END OF RECORDING (58:53)