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EDITED TRANSCRIPT

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PRESENTATION

James Kilty

(foreign language) Good morning, and welcome, welcome to all of you here. And to all of you joining us online on the webcast. That was a very short Maori welcome, a short mihi and a short piphi by me to take you through what I just said. I welcomed you to Te Mihi [Uwi Na Ako Kohaku,] which is full name of the Te Mihi power station named after the eponymous and sister of [Ngati Tanangita Kyoto Oruanui] on whose tribal lands we are operating. They are a hapu the broader [Te Whakatohea] tribe, whose names I've also acknowledged in the quick opening.

Then, I'll introduce myself, my name is James Kilty and I am the Chief Generation and Development Officer at Contact Energy.

In Maori terms, I have delivered a piphi so I told you about my [awa,] my river and where I'm from, which is down in Hawke's Bay, about an hour and a half south of where we are at the moment. That is my [taone kainga,] my hometown. So it's a great pleasure to welcome you here. I'll start with a little bit of an introduction to me and to the other speakers. So I've been with Contact for a long time, I started with Contact in 2002. I joined from a law firm. I am a lawyer by training, I'm a recovering lawyer. It's been 10 years since I last practiced. I joined the legal team and was involved in a great deal of transactional work at the time. The industry was in its very early days. There was a lot of M&A work happening and a lot of development at the time and some scrambling around buying retail businesses and trying to learn how to be retailers, if you cast your minds all the way back then. And I've worked in a variety of roles across the business, and in fact. across the full spectrum of the business. And in my current guise, I'm responsible for the wholesale part of the company. So the production and wholesaling of electricity and fuels, including more broadly our sustainability program and a lot of our stakeholder management in that context.

The speakers today will be: Dr. Mike Dunstall, who is down here, who will take after me. Here's General Manager of Geothermal Resources and Development. And Mike has been with us for about 10 years now, maybe coming up 11 years, I'd say. Yes, coming up 11 years and brings world-leading knowledge on the management and development of geothermal resources and you'll see some of that on display, later in the presentation. And of course in the Q&A session at the end, you will hear the unmistakable tones of [main curion,] CEO, Dennis Barnes, who has sworn not to utter a word for the first section.

Exactly, can't respond in a rare moment. Just the normal disclaimer for a session like this. We do want to talk about the future. We do want to discuss with you some views that we have about conditions now and in the future and I need it to be taken in that context obviously. They are our currently views about this industry, it is always changing and the environment is always changing and so they must be taken as current views of the future.

And that's our program for this presentation.

I'm going to open up with some discussion around the wholesale market and our wholesale business. That will be followed by a discussion from Mike on our geothermal advantage here at Contact Energy, and then I will return to talk a little bit about our geothermal options and then will close out with a Q&A session facilitated and led by Dennis.

And before we crack on with our presentation, one request please, and that is to hold your questions for the end. I know that will be challenging for some of you. I know some of you are well enough to know that want to ask a question on every point that we discuss. If you could hold those off until the end, that would be very helpful. That way, we'll enable and we'll capture them with a mic and the people on the webcast will be out here as well. If we try to do that through the discussion, it could get quite logistically challenging, checking the mic with phones around and making sure everyone can hear. So if you could hold off, be patient and take notes. You've all got books and pens and ready to go. And we will address your questions at the end.

So to start with, I'm going to address these topics. A little bit around the environment in which are operating, and how we think about that, and how our strategy is born from that and sits with it and indeed enables us to thrive within that environment. I'll also talk to you a little bit about how we've reorganized ourselves to be to enable delivery of the strategy recently. And finally, some wholesale market outlook comments. Really just raising some puzzles that many of you are probably familiar with, that's some things that we're puzzling over as we look to the future of our market and our business in that context.

So Contact. This is a little bit about the company. I'm sure most of you know this. We have a national footprint. We have over 570,000 customers, 11 power stations scattered around the nation, actually centered in 3 large regional centers in fact. So our thermal assets generally centered in the Stratford area over in Taranaki, our Hydro assets down in Balclutha in the central Otago, lower South Island. And here at Wairakei, our geothermal assets.

So we have a very strong regional presence. Our retail businesses obviously has a footprint that is nationwide as well. We are a major contributor and investor and supporter of communities all around the country, particularly in the communities in which we operate. And our assets, particularly the renewable assets, are long-term, they are very long-term assets. We are here at Wairakei, which this year will celebrate it's 60th anniversary. And we see another 60 years of sustainable generation from this field ahead of us. With that sense of longevity of connection to the community and to the physical resources that we utilize and are stewards of, sustainability is part of who we are. Sustainability has become quite the buzzword, everyone is trying to carve out their path on sustainability. For us is its BAU. Our assets are long-lived assets. Our presence in the community is subject to the whims and views of the community, so we have to be a good neighbor and operator of assets. We have to be aligned with the views of the society in which we work, and that connects us through to our customers as well. So every year, we get a stakeholder counsel together, reflecting a wide range of our stakeholders and we work with them on what we call our material aspects. What are the things that they are seeing in our environment that we need to be thinking about as part of our business and as part of our strategy.

We work with those stakeholders to understand what's important to the -- an example of that, a recent example of that is some of the work we've been doing with Ngati Tahu, and that has seen us -- Ngati Tahu is the iwi at the Ohaaki geothermal resource, down the road from here and we have been working with them on a range of products including working with them in Kenya at the request of the U.S. energy agency to help Kenjin understand how a business works with community in order to develop resource and maintain resource. And we received an award from the U.S. energy agency for our work in that regard. So we work with our stakeholders in a range of projects to ensure that as we drive our business forward, we are balancing how it will impact on people, how it will impact on culture, how it will impact on resource, on the environment and how of course, how it will be economic for all parties going forward. An activity is not sustainable unless everyone on the chain is making a turn. We are very, very clear on that. Some of the more visible signs of our leadership in the sustainability space, you can see there, we have been integrated reporting since about 2015. We were issuing sustainability reports for many years before then. We comply with the Task Force on Climate-Related Financial Disclosures. We are the issuers of New Zealand's first green borrowing program, and we are adopting science-based targets: targets around our own emissions, around our emissions' intensity, and around transition of customers and industry to lower carbon fuels.

And we see that theme around the environment and climate change all around us. There are many, many reviews at the moment and many new targets announced by the government. And the government is reflecting, in our view, societal view. As we talk to our customers, as we talk to our stakeholder counsel, climate change is on their mind. It is a very material issue for our stakeholders. And so we see that as a macro trend. We do believe that New Zealand will move to a lower carbon economy. We do believe that, that will happen globally. And of course we've been on this

path for some time at Contact. We've halved our emissions over the past 5 or 6 years and are, in fact, a finalist in another global award of Standard & Poor's Platts Energy Awards that are held in New York annually. We have been nominated for the energy transition award for our work in sustainability and in reducing our own emissions. We have, however, resisted the urge to jump on the bandwagon on many things you can sign up to and be part of in the space. We've actually taken quite a number of months to work out our own views. We've worked with our stakeholders, we've worked with our staff and we've worked with our Board to settle on our own opinion on climate change and what it means for Contact and our business, the risks and opportunities it presents to us.

And in summary, our view is that climate change is real and humans are in fact impacting on our environment. We do believe the world will continue to pursue a lower carbon future and we believe New Zealand is very much on that path, and these reviews that you can see on the slide very much reflect that. We also acknowledge that we are uniquely placed in New Zealand with our high level of renewable electricity generation to benefit from the abundant of renewable resources available to us. But we understand there is some caveats to it. We understand that our unique hydrological conditions make it quite challenging for the electricity market, for electricity supply to transition quickly to allow a carbon future. We equally understand that our trade exposed industries have challenges in transitioning their fuel mix to a lower carbon fuel mix. Our commitment is to work with customers and to work with suppliers to try and find answers to those problems. We do not think it is easy, but we think there's a path if everyone can work together, and probably in quite different ways until in the past. And those challenges really come back to those 4 circles that are on the price slide, and in particular, the one around economic returns. It isn't sustainable unless it's economic. Capital needs to flow to these -- to the investments. They need to be made, to drive a lower carbon economy, and it won't flow unless there's a genuine return to investors.

So in that context, our strategy is clear. For now, optimizing our customer and wholesale business to deliver strong cash flows. We increasingly see the two businesses, customer and wholesale, as having quite different characteristics and strategies going forward and they are articulated on this slide.

On customers' side, the customer business' future has to become a value in service focused retailer, connecting customers through solutions. That is a one to many business, a mass business. On the right-hand side on the wholesale business, we will continue to drive innovation, make sure we are safe, efficient and reliable and work with customers to find lower carbon solutions. All of which must be underpinned by ongoing transparency for you and for all of our stakeholders and ongoing capital discipline. So for now the focus remains on cash. On ensuring we are managing our cash well, or your cash well. Even though the medium-term demand picture appears increasingly positive, now is the time actually for cash and capital discipline. We do see a balanced demand and supply position in the country at the moment. Short-term conditions are just that, short-term. And we see after 10 years of no demand growth, we see signs that demand growth could return, but it hasn't yet. We do not see material demand growth returning. We do have the fourth [port] line at the Tiwai Point aluminum smelter down at the bottom of the South Island coming in, so there's some demand growth there, but they are still at risk of efficiency gains and/or demand destruction elsewhere. So now is the time for discipline. If they see it in the medium-term, decarbonization could, I repeat could, drive an increase in demand for our product. We could see large-scale electric vehicle transport uptake, we could see industry switching to our fuel, our electricity in order lower its own carbon footprint. We do think through the market lead thermal transition could happen. And we'll talk a little bit about that later on. On the customer side of the business, regulatory sessions are continuing to drive an intensification of competition. So retail competition continues to intensify for our customers' business. See how there are 10 new entrants in the last 2 years. I think the total number of retail competitors is somewhere around 40 these days, 39, 40 and a small-market like ours, that results in a very, very intense level of competition in that market and we're certainly seeing that in our business. Likewise, as smaller retailers have entered the mass market end of the initial business, we are seeing some of the larger businesses move into the commercial and industrial space. So we have an intensification of competition and a reduction in margin in the commercial and industrial sales business as well, all arising from an increase of market leader increase in competition.

So this is what we've been doing the last few months to accelerate execution of our strategy. In the customer business, we have moved our ICT team into the customer business to integrate into what Vena and his team are doing to move to a lean operating model, continue to drive cost out through simplified processes, through automated processes, and to transform the technology in their business to continue at a lower cost.

Likewise, you recently will have seen we have repositioned our brand to better reflect a low-cost digital retailer of the future. And we're getting good feedback from customers, I think Dennis made that observation last night. We are getting good feedback from customers, and the brand is sitting more comfortably with the way we deal and talk to our customers.

On the Wholesale side, we're striving for sustainable cost reductions balanced against risk. And we have good form there, and I'll talk to you about that a little more shortly. We're continuing to invest in lowering the cost of geothermal and strengthening our geothermal capability, and Mike will share some observation on those two strategic strengths for you a bit later on this morning. And we're starting to work with customers in a more meaningful way on potential decarbonization opportunities, helping customers think about and address some of those decarbonization challenges that they face.

And our continuous improvement program, we have delivered really strong results. Remember our aim here to is produce sustainable cost reductions balanced against risk. And I will direct your attention to our cash costs, these are the direct operating and capital costs of operating the wholesale business. And you can see between [years] '16 and '18, a 25% reduction or thereabouts in cash costs and targeting and on track so far year-to-date to deliver another $20 million reduction, so overall a 33% percent across 4 years out of the generation and development business, the wholesale business. At the same time, you can see stable safety results and stable plant reliability and availability. So we are delivering cost reductions without impacting on our performance. In the decarbonization space, there is a lot of rhetoric, a lot soundbites. For our part, we are endeavoring to engage in fact-based discussion with regulators and with the customers and with market. And we see electricity as the solution, not the problem. A lower carbon economy in New Zealand will be enabled by electricity. Many of you probably know these steps but New Zealand has a rather unique emissions profile with over half -- around half of our emissions arising from on farm emissions, agricultural emissions. Energy emissions are about 40% of our annual emissions, but electricity is only 5%. And that is a highly unusual position internationally and therein lies the opportunity for decarbonization. And in fact, we would say market has driven an improvement in those electricity emissions over the last decade. As we saw fuel costs rising, thermal fuel costs rising, the middle of last decade, other fuels came in, in particular wind and geothermal, and substituted their thermal fuel, leading to a reduction in overall emissions from the electricity market.

And I'm going to talk a little bit later about some thinking we've been doing around -- through the thermal transition in the market.

Our contact with our large-scale commercial industrial customer base, the existing relationships we have and the capability we have, we think we are well-placed to work with customers and help them puzzle over some of the challenges they have in looking at their own future fuel needs. None of this is particularly easy, the economics for trade exposed industry around the country to transition to lower carbon fuels are quite challenging.

Any decisions by customers are likely to be aligned when they have made major capital reinvestment decisions on existing field equipment and with the rising carbon costs.

One of the things we think will be quite key here is the development of new energy management capability, and we have been investing for the last 12 to 18 months in developing our virtual power plant, what we call our demand flexibility platform. We have trialed it with residential and residences in small to medium enterprise, and we have now trialed it on our on large scale devices, major pumps and things down in Clyde. And it has passed all trials and we are now are marketing that technology. What that does is we place what we call a virtual pipeline hub in the customers facility. It is connected through to certain assets and can via the customer's control system, control those assets. It is connected to a virtual power plant platform, which is in the cloud -- situated in the cloud as is everything these days, and that is connected through to energy markets. So its connected through to demand response in New Zealand's markets and it's all automated. So if something happens in the market, it sends a signal to our platform. Our platform sends the signal to customer hubs, we can do that, and operates the equipment, i.e. turns it off. And we think the combination of demand flexibility, of energy efficiency at customer sites, helping customers just use their energy more efficiently generally, some new technology there might be some viable cases for battery rollout and solar rollout on site and a rising carbon cost, all of those things will accelerate the point at which genuine switching to electricity can occur on an economic basis.

So we are exploring opportunities with customers. We are finding a lot of enthusiasm. Customers are genuinely worried about the future of -- about climate change and about the future risk to the business of using carbon-intensive fuels. Again, you go back to that overall sustainability approach there, it has to balance or integrate all four elements of that: people, culture, environmental impact and economics. And at the moment, the economics are challenging. Nevertheless, we have seen signs of customers willing to take a leadership role and switch. So while we've been gearing up and organizing ourselves to deliver on decarbonization solutions for customers, we've continued to strive for efficiencies energy in our geothermal business. In fact, Michael will talk to you little more later on about some of the work we have be doing, some of the R&D we've been doing to drive these costs down in a sustainable fashion. I'll note that Mike leads, as part of his group, possibly one of, if not the only drilling team in the world whose sole focus is not drilling. They have developed extraordinary techniques that have seen us extend the life of existing wells, existing assets

by many years and that has taken a lot of cost out of our business in the last few years and out of our forward CapEx plans. And Mike will -- some of that IP is proprietary, Michael will hint at it later on.

Interestingly, because I know that Mike's a humble man, we are getting shoulder-tapped internationally for access to this intellectual property. So people are seeing what's happening here, Wairakei is the home of geothermal internationally, celebrating its 60th year and its still the leader in geothermal internationally. And you can see there are costs coming out across this slide here. Like all renewables, once you have heavily invested up front. You put most of your capital on the ground up front, you want to the then focus on absolutely optimizing the resource and doing that at the lowest possible cost. And that's what this work, that Mike and the team have been doing, is doing up here, Wairakei and Te Mihi.

I mentioned earlier that we have reorganized ourselves a little to accelerate the delivery of our strategy. I mentioned the ICT team has gone into the customer team. The customer business will become a digital business over time and so there is a national connection of that capability.

For us in wholesale, the commercial and industrial sales team has moved back into wholesale, for the first time in many years. These things are cyclical. But for now in order to help us connect more directly at the wholesale level with the C&I customers, and the C&I team into the moved back into the wholesale business unit.

And that sees us look at the wholesale segment like this, wholesale revenues like this. So we have effectively, through an internal transfer mechanism, a fixed price variable volume contract through to the customer business, through to the mass market business. And whilst we as individuals love our customers, we have a -- there is an emotional connection in my team to our customers, they love talking with their neighbors and friends about what Contact is doing and love hearing about what's happening in our customer base. From a financial perspective, that's what it looks like. It's a large fixed price variable volume hedge, through the mass market business run by Vena, our Chief Customer Officer.

We now directly sell, the commercial industrial sales team back in the wholesale business, we directly sell to C&I customers and manage the scale and shape of their book directly as over the last couple of months. And that likewise, that is a fixed price. There are a series of fixed price variable volume contracts with customers, with price based off the A06 obviously, including margin and credit risk and sewers et cetera. And we sell a number of safeties, some direct to competitors, Tier 2 retailers and some via other competitors to support some large customers, large scale customers around the country. And you all know about our support for NZAS New Zealand aluminum smelter down in the bottom of the South Island. And the price in there reflects volume, shape and credit risk.

And finally, we sell steam. We currently sell it over in Tauhara to timber mill and to some small producers here in geothermal, and of course out of our Te Rapa cogeneration site, we sell to -- steam too from [here.] We see scope for growth in direct heat, direct steam consumption, if industry can move to the resource. One of the challenges for renewable resources of course is you can't shift them, the business has to be on site. And so geothermal direct heat is in fact very cost competitive, in fact, it can be developed significantly -- at a significantly lower cost to a thermal supply for customers, however, facilities have to move to the resource, so there's that capital cost that needs to be thought through. And we're working with New Zealand Trade and Enterprise and Enterprise of Great Lake Taupo to work with potential international investors on moving facilities to New Zealand to utilize green fuel, and there's some interest in that.

A little extra on the bottom there, I must pick up. We do occasionally run a long position and that slide does exclude our merchant revenue so from time to time, when the market is in the right condition and our fuel is in right condition, we will get length to the market and receive merchant revenue, of course. And you see that little bit on the right-hand side in the net exposed revenue and that's last year's number, FY '18. You can see we managed to get some -- we had a couple of very dry periods that made it it quite difficult to get length first and we were net purchaser in some conditions: Last year was a consequence of those deep, deep dries but where possible we get length to too high prices.

On the cost side, you can see the components of our generation costs, you see the direct cost there, in the light gray color. You can see our indirect operating costs, carbon cost, and so son. Looking forward thinking about these costs, likely to be stable. We still have our continuous improvement program running, we run an online ideas hopper and we've really harnessed the knowledge of our people. Most of the cost savings that we have delivered, coming back to the earlier slide, most of those cost savings have come from ideas from the call face from our people who are working in ways and with systems that they wonder why we have to do it this way. And what we've had to do is given them the permission to point that out and a facility to lodge an idea. So we're finding with that online hopper, we call it ideas hopper, people are putting improvement ideas in there

all the time. There are several hundred in there at any given time. Other staff have been commenting on it and developing up the solution, and then at the sites they are empowered in a decentralized model to just make the change, and we've seen major efficiency driven out of that work. So we're still running the program, there are still ideas and we're still pursuing them aggressively to make sure that we're making sustainable cost reductions balanced against risk. The larger scale ideas come to a central pool where Jacqui Nelson, sitting down in the back there, our General Manager of Operations, works with the team on prioritizing those and deciding which ones get funded.

Now looking forward on our transmission cost, we do see upside in the post 2020 -- we see it and most of you will likely know this, we're likely to see a cost reduction for Contact in the region of $8 million to $10 million per annum, from our electricity transmission cost. Gas and carbon, I will come to in a separate conversation shortly but gas will be purchased and quantity is required to meet demand. Pricing will reflect market conditions of course, and carbon pricing will reflect market conditions as well and regulatory conditions in particular. So looking forward, that's the wholesale business of today, that we have just been looking at. One of the issues, one of the puzzles to think about going forward. This light sits out a range of demand outlooks that are published. Many of you will have seen these, lines on a page and other presentations. We are very cautious about demand growth. We have, and our competitors say I have, a terrible track record at predicting demand growth. The whole industry is not good at it. And so we're quite focused at the moment on maintaining our capital discipline. The industry does have a history of a little bit of boom and bust. Prices move, this thought -- thermal prices move, this thought of demand growth coming and everyone has seen curves like these on the page and then everyone piles into large-scale renewable build and the demand does not eventuate, resulting in poor returns on capital too and vistas. For our part, we are very focused on maintaining our capital discipline. Current market conditions, if you think about it with the various gas fields in the countries struggling with hydro lakes low, adjust their short-term conditions in all likelihood. They don't necessarily signal on any sort of investment in the electricity market at this time. We do, however, think that if they are genuine signs of demand growth, or if customers underwrite investment through direct contracting, there may be potential for development. And then we'll talk about that a bit later. To the extent there is development, it will come from renewable resources in this country, in our view. That raises certain challenges, challenges you'll be very familiar with. Most of the lower carbon forms of generation are intermittent, and in our own hydrological conditions here in New Zealand, that raises some big challenges for us. So our view is in fact that thermal generation will be needed for some time, in fact for a long time. This is not a short to medium term statement, it is a long-term statement. Thermal generation plays an absolutely mission critical role in this market at this time, and we see that continuing. The challenge there is energy storage, that's the ability to, at a low cost and on a reliable basis store energy for long periods of time and then release it when it's needed and not otherwise. Thermal generation is uniquely placed to do that at this time. Maybe in the very long-term hydrogen or something like that or large scale batteries, [MET] technology will advance to the point where it can start to play some of the role that thermal generation currently plays in the market, but there are -- that feels like a very, very long way off to us at this time. So our viewers, thermal generation has a long life ahead of it and it plays a critical roles. And in that context, we're thinking that now is the time, now is the time for New Zealand's gas market to be proving its worth and showing that it's reliable and flexible, however, recent conditions show that reliability has diminished somewhat. It's not clear to us whether that is a systemic shift, whether it's aging plant and we're going to see a continuation of outages or whether it's nothing more than one or two things that need to be addressed and we're back to the reliability of supply that we've enjoyed for decades here in New Zealand. And we are working with the gas suppliers to try and understand the reliability of gas going forward. And the short-term of course, we're seeing that lack of reliability result in the low hydro lakes result in an increase in coal imports. And it does make us wonder, it does make our wonder whether coal's role, not withstanding targets on earlier slides, whether coal's role will last a little longer yet in this country, simply because of its ability to be stored and applied only when needed, on a reliable basis. Again, capital discipline here is needed. The gas market, looking at that forward supply curve, will be deciding whether or not to invest in further drilling and they will be deciding that in an environment with a great deal of regulatory uncertainty for the -- equally renewable operators may seek to build into the white space on this chart. In theory at least, the capital should flow to the lowest risk investment there, it should flow to the lowest cost whether it's oil and gas drilling or our renewable build. We would encourage the gas market and gas suppliers to offer more regular and more transparent updates of reserves, and to tell us more about what they are doing to move reserves from 2P to 1P. That would be very, very helpful in terms of long-term as you're planning a long term market planning. In carbon, we are continuing to see costs rise and of course, hit and are tracking around the current fixed price of $25. Looking forward, we think the ETS will ultimately be connected to international markets. It will need to, to enable competitive committed response from our own industries. We think ultimately that cap will be lifted. It us unclear to us as yet in the current review when that will happen but the cap will be lifted and so carbon prices are likely to increase over time. To give you a sense of what means in terms of technologies and you'll be able to even toggle around these numbers. At a $25 carbon price, a combined -- our combined cycle plant over there in Taranaki is paying about $10 dollars a megawatt an hour for carbon. Used to be about $5 dollars, it was not that long ago, it was only $2 or $3 dollars, $10 per megawatt hour for carbon. Here at geothermal, Wairakei and over at Tauhara, you're paying under $1 a megawatt hour. In fact, you're probably paying about $0.40 to $0.50 a megawatt hour, it's a quite significant advantage of the resource here. And you may not have noted, but haven't been talking a

lot about renewables. I have been talking about low carbon generation, because not all geothermal is created equal. At our Ohaaki resource, for example, 24 minutes down the road, that equivalent cost of carbon is about $9 dollars a megawatt hour. It's a carbon rich resource, and in fact, I believe up in [Ngawha], it's carbon intensity exceeds of that of a combined cycle plant. So it's a renewable resource but with a high carbon footprint. So looking forward, we do believe the review will result in a lifting of the cap. We're not sure when that will be applicable from. We do believe the review will recommend connection to an international market of some sort to enable more liquidity, and we therefore believe that carbon costs will continue to rise. For our own positioning and covering our own risk in this regard, we don't take a long forward book on carbon, that is largely because we remain unclear about how much thermal generation we will have in our mix going forward and the bulk of our emissions come from our thermal generation fleet. So we don't want to be long carbon units facing much reduced thermal operations. The one area we do have certainty is in geothermal. Certainly of output and therefore emissions and certainty of tenure, here at Wairakei and Ohaaki. So if we look at opportunities to hedge going forward and potentially even look at reforestation as a form of risk management on our carbon footprint, we would size that to fit with our geothermal operations, where we have real certainty about the long-term operation. So with a forward gas forecast that's got a lot of white space on it would suggest upward pressure on fuel pricing. With carbon costs rising, what does that mean for the future of our Taranaki combined cycle plant? I'll just walk you through the economics of the TCC here, these are all done in dollars per megawatt hour. So last year we reinvested in the life of the plant and what is effectively about 9000-megawatt hours of potential generation that the unit has about five years of generation for the CCGT. And that came in at a cost of around $50 million cost, capital cost. At a gas cost, prevailing gas cost of $6 dollars or carbon cost of $15, that delivers you a short-run cost of $52 and to recover your OpEx and your assigned CapEx you need another $10 on top of that. So you're looking at about $60 to get a return on that investment. Looking forward to the next round of investment in that plant, on expiry of those hours the costs are higher. The CapEx costs are higher because the scope of the next outage has to be larger. It will potentially be in the $70 million to $80 million range in 2022. So that means to recover that, it could actually be another $3.50 a megawatt hour, so it pushes the cost of the unit up further, and every plus or minus a dollar a gigajoule on gas price is plus or minus the heat rate, 7,500. So $7.50 a megawatt hour, up or down depending on the then prevailing gas conditions. Likewise on carbon, some every $5 move on carbon adds or subtracts $2 a megawatt hour. So our view on TCC is that it's very unclear as to whether a further extension of its life will be viable, whether the market will support that at that time. And the time that we have to make the decision is probably 2020, late 2020. Because you have to order all the parts and all the prep work well in advance to enable an extension of life on a unit like that, it's a massive amount of work for our team over in Taranaki. So those are the things that are coming out for us, 2020 in this business is not very long away. And we're thinking very hard about what that might mean for us. And if you go back and think of that forward gas curve and the falling [to payer] reserves, you think that there's real potential for the market not to support the extension of life of TCC next time around, however, we will have more information. Time is a wonderful thing, time is a wonderful healer. More information emerges, we get more clarity and certainty from the myriad of government reviews that are happening at the moment. We understand what if any change emerges from OMV purchasing Shell's assets here in New Zealand, we understand what the Interim Commission on Climate Change says and what the full commission will be thinking about. We will understand the electricity pricing review. And we'll understand the ETS review, all of these things are really key inputs into giving us more or less certainty over the future of that asset. And so we're basically in a watching brief. It feels like a -- I'm sure to our operations staff, it feels like an almost constant state around our thermal assets, and watching brief on the future of those assets. Now if it is challenging to extend of TCC, if the market won't support that level of investment and get a reliable return, and if there is demand growth into our customers willing to underwrite investment, then we have a wide range of options here at geothermal, brownfield development options. We can toggle output here down or up to meet requirements, and we're going to talk to you a little bit more about that later in the presentation. You'll note, hopefully there is absolutely no timeline across the bottom of this page and that is because of -- I want to give you our assurance that we are very, very focused on capital discipline. We will only do this in the conditions we've articulated. Okay, so what I might do now is just open up for one or two questions before the full Q&A at the end, just a couple and then we might have a short break before Mike gets started. Mike is on his way, a microphone is on its way? Both are coming.

QUESTIONS AND ANSWERS

Unidentified Analyst

Okay, thank you for that. So I've got a question on your comment on boom and bust and the traditional cycles with long life assets. So to me what you're saying sounds very with other [gen ten] is saying which is we're going to wait for sustainable signs of demand growth and that's pretty much how every mining operation works, every long life asset operator works, which is exactly how you do create boom and bust in my book. So we don't have any investments, everybody sits and waits, everybody's waiting for the same signal. When that signal comes, everybody calls and then

they have 3 years to build and then they have another bunch of third-year assets. And then we have the boom and then the bust. So what is stopping you from investing now? And how do you sort of counter that risk?

James Kilty

We think, I'll take you back to this slide. There's a lot going on in our industry, and if you move back to one of those earlier slides, lots of red and purple dots all our it and all our reviews and other things going on, we will know a lot more over the next couple of years. We will know more about the genuine life of our own thermal fleet, about whether the market will support that. We will know more what our competitors are thinking about their own thermal fleet, and whether there is an opportunity for a market led -- more market-led thermal transition. And I think we'll know about the role of thermal plant going forward. So we think genuinely, there's an opportunity for value creation from thermal transition, but we have to see how all of these reviews play out and understand more about fuel supplies. So we will know more in 12 to 24 months. Now, our own work on thermal transition and on switching the electricity market from this current 80% to 85% renewable through to say, 90% tells us that market-led transition should be able to get us there to 90%, about 90% at a price that is very competitive through to customers. As you go beyond 90% and climb and certainly once you hit 93%, 94%, that would tell us that the hockey stick is straight up, and you have to apply a great deal of capital to replace the firming and energy storage ability that thermal plant currently gives us. So basically, we're saying, patience. Let us observe what's going on for a bit longer and then we'll make decisions on any further investment.

Unidentified Analyst

I might have a very short related follow-up.

Dennis Barnes - *Contact Energy Limited - CEO*

One follow-on, yes.

Unidentified Analyst

That is just on the last bit you said about the market will support TCC, and you talked a lot about their sort of market prices, which is less under your control, but when I look at your slide of the costs and what we already know about carbon cost and a couple of other moving factors, the CapEx for instance, it is difficult to see that there is not a supply replacement factor that's sort of unrelated to the market prices, i.e. there are other competing technologies, wind, your own geothermal, et cetera which it sounds to me significantly cheaper than running TCC, regardless of the market supporting or not.

James Kilty

I think I would agree with that, that long term prices and the falling costs of renewable generation will put a cap on long-term prices. We can bring geothermal to market at a very competitive cost. Wind can come to market at a competitive cost. So the ability for thermal generation, baseload mid-merit thermal generation, to pass through those costs, it's increased cost, is very, very constrained, we think, going forward.

Peaking plant and that energy storage role, mission critical and should be able to recover as costs going forward. But any sort of mid-merit plant starts to look quite challenging because you will see competitors build in underneath those costs. And that's effectively what happened 10 years or so ago. Couple of more? Grant?

Grant Swanepoel - *Craigs Investment Partners Limited, Research Division - Director & Head of Research*

Is there -- in your discussion or chats to clients on their carbon concerns and potential in the feature where you might do a back-to-back with them, is there a carbon price that you guys see as a trigger that could get them into action?

Edward James Kilty - *Contact Energy Limited - Chief Generation & Development Officer*

Well it's different, obviously, for every industry, but the carbon price has to be a multiple of what its today, that's the realistic position. So $75 and more, you start to get some interest. One more perhaps before we take a break.

Unidentified Participant

Sort of following on from Aaron's questions really, you talk about not seeing demand growth right now and I guess the question I've got is around what is -- what are the actual tangible signs of demand growth that you need to see before you want to push go? And the following on from that, once you've see that demand growth, it will take sort of 2, 3, 4 years to build, do we have a period there of undersupply and how do you balance that risk of security supply, which is in reality from an electricity perspective, worst-case scenario?

Edward James Kilty - *Contact Energy Limited - Chief Generation & Development Officer*

Okay, so a couple of questions in there. The signs of demand growth, new industries starting at scale. Mass demand, retail demand, we'll see ongoing efficiency gains in the home and population growth and the likes of electric vehicles may offset those efficiency gains and potentially more than offset those, in the case of electric vehicle growth. But it's -- at scale, it's new industry and expansions of existing plant and existing plant not closing. So the fourth part line, down on the bottom of the South Island is genuine demand growth that's observable, stable, and we look forward to its commissioning and stable operation. In fact, I think it's coming up right now, has been increasing.

In terms of security of supply, I think there's a very important role again for thermal plant through that processes. If there's a period where demand is growing and then there's a -- someone commits to a build, thermal plant will have to operate in the interim. So there's a strange kind of switch point here where we say, we want to drive decarbonisation for New Zealand and a lower-carbon economy, in that transition period, it is quite possible that electricity carbon emissions go up for a period, to manage that transition risk and ensure a reliable supply. If the rest of the economy is using electricity to decarbonise and that's driving the growth, that will be a net benefit for New Zealand in terms of our overall emissions. So we're not saying that the electricity markets emissions will necessarily fall materially at first instance as demand grows, the first capacity that will be filled will be thermal, because it's already there.

And that demand growth will then give a signal for lower cost renewables to come in underneath that thermal.

Okay. We might just take a 5-minute break, so everyone can freshen up. And will be back in 5 minutes. Thank you, Matt, for that feed. We will be back in 5 minutes, where you'll be hearing from Mike Dunstall on our geothermal advantage.

(Break)

Mike Dunstall

(foreign language)

As James said, my name is Mike Dunstall, I'm the General Manager of Geothermal Resources and Development, proud to say that I'm based here at Wairakei and have been so for the last 11 years. Little bit of history about myself, I'm a mechanical engineer by training and I studied for a PhD in geothermal reservoir engineering quite some years ago. I have also worked in electricity trading and then the development of hydro and wind. But I'm very happy to be home to geothermal. My wife is [Tuforitoa] so that makes my children and me, by extension, Tuforitoa as well. So this is

the place we really feel we belong. And it gives me a tremendous amount of pleasure to be able to talk to you about geothermal today, something that I feel very passionate about. What I'm going to do today, I hope, is to give you a brief introduction to geothermal. I know some of you have been to Contact's geothermal operations before and have some familiarity, some don't. So my first step is to take you through a very brief couple of slides of 101 to give you a sense of how geothermal works, what the nature of resource is like and what we're working with. I'll then talk a little bit more specifically about the resources that Contact is operating. And then on to the business side of how we go about running our geothermal business. Some of the areas of focus, where we feel we have been very successful in recent times as James said, on driving down the cost of operating a geothermal business and making sure that it's sustainable in the long term. So I'll talk about those things the towards the end of my presentation.

So first up, why do we have geothermal resources in New Zealand, and why do we have them where we have them? Most of the geothermal resources in New Zealand are located in the central part of the North Island in an area that's called the Taupo volcanic zone. And the Taupo volcanic zone runs from the volcanic center in the middle of the North Island out towards the north and the east, out towards the coast and right out to White Island. And you'll recognize that there are a number of large and active volcanoes along this zone in New Zealand. And that's not the only place that we have geothermal in New Zealand but that is where most of the high-temperature geothermal resources are located. And that's because the tectonic seating in New Zealand where we have the Pacific tectonic plate here sliding down underneath the Indo-Austrian plate and there's a lot of friction and melting when these plates rub together and you end up with liquid magma generated here which comes up and forms a surface expression in these volcanoes. And it's that heat that is ascending from this subduction zone and these plates that's really the heat engine that's driving all of the geothermal activity throughout this zone, and that's what we are making use of here. Now we don't get anywhere near the point of this molten material, that's down here.

What we're using is hot water that's been heated and sits in an economically accessible zone, much nearer to the surface.

So what do these systems look like? They're basically -- many of them geothermal systems are -- well, they don't look like this, this is a cartoon, but I'll hope that I can use this to explain what's going on. They're actually essentially failed volcanoes or the left over remnants of volcanoes. And what we have down in the very much greater depths than we can access with our drilling technology is some form of molten rock magma, a cooling body of rock that is truly enormous on the scale at which we are operating. And they might exist in 10-, 20-kilometers depth. So we don't need to drill to that depth to find that, what we are doing with geothermal is we are trying to make use of water, which has naturally descended through fractures in the rock, and come into the zones where it becomes heated and then becomes naturally buoyant. So just as warm air rises, warm water under the ground also rises and that warm water, that very warm, 300, 400 degrees C, rises up and fills in some of these shallower, economically accessible ranges of depth that we can actually drill into and if you have the right conditions, creates a geothermal reservoir that we can utilize.

So what one of the really important characteristics is that all of this heat that's represented in these fluids doesn't just sort leak away to the surface at the same rate it's being circulated through the system. And it's quite an essential feature of a geothermal future to have a layer of material over the top of the system here, right on the surface, which essentially seals it and provides a bit of a lid on the top. And for us here in Taupo that's a lot of lake sediments that are relatively impermeable to water and the hot water remains trapped underneath. And then you can end up with an economic concentration of these fluids that is able to be utilized. So we'll drill down into these zones looking for permeability and temperature and enough of these fluids that we can get economically producing wells, that might be anywhere between 1,000 meters and 3,000 meters deep.

The temperatures are very high. About 250 to 300 degrees C is pretty typical and you can very high pressure and temperature steam from those systems. Now one of the things that's really important to understand about geothermal is that you're not just managing this piece that's around the individual production wells. What you're doing when you're trying to manage the resource is you're trying to establish the right sort of balance between these natural flows of cooler water which are coming down, fluids that you may be returning to the system through reinjection wells and the production. And it's a battle -- a balance throughout the system that gives you longevity, and it's a balance throughout that system that allows you to sweep heat out of the rock over a really long time to give you much more than just what water and the steam is providing. Because most of the heat that you are taking, that you're using to generate your power is in this rock rather than in the water and steam. Some more than 80% of the heat that's in the system is in the rock. So you need to balance the movement of the water through that rock in order to bring that heat out and be able to use it in your power system or for industrial heat supply or whatever.

So this is a slightly more accurate sort of a cartoon, showing how the system works. You've got these layers of rock here which are, in our Taupo volcanic zone, filled with a lot of jumbled up material that's come from volcanic eruptions. There's plenty of space between all the jumbled up

material for water and steam to move and that's a very important characteristic to provide us with the permeability for that fluid to be able to move through the rock easily. We've got layers on top which prevent all of that stuff from just leaking out everywhere and we'll drill down through those to -- production zones, bring the fluids to the surface and this fluid that's produced is a mixture of steam and hot water, we separate off the steam from the hot water, take the steam through the power plant and then run the hot water either through another power plant or direct it back into the ground through reinjection. On the surface, the power station facilities that you see are just supplied normally with steam and that steam is taken through the turbine to generate electricity and then is condensed at the back end in a closed system which operates on cooling towers here at Te Mihi, on Waikato River at Wairakei in a once-through cooling system.

So here we see that concentration of our geothermal assets in the central North Island, there are number for the geothermal operations also through this zone here, but the 5 power stations, Te Mihi, Ohaaki, Te Huka, Wairakei and Poihipi. In the last financial year we generated over 3,300-gigawatt hours of generation from geothermal from about 430-megawatts of station capacity. And that was 8% of New Zealand's electricity. So that's a lot of energy. We've got about 122 wells in service here on Wairakei and Ohaaki and Tauhara fields, 90 of which are production and about 30 or 32 injection. So it's very typical to be of -- that sort of ratio is a fairly typical sort of ratio. We are able to have a larger number of production wells serviced by one reinjection, generally speaking. So Wairakei is a really important geothermal operation in the world context of geothermal. It was the first of its kind to be developed in the world, the very earliest geothermal operations ran on dry steam. And they were in the fortunate position that when you drilled a well, and this was in Italy, and West Coast of the United States, you drill a well into the ground, and the well would basically produce dry steam with essentially no water in it. And that was the first technology that was used to drive geothermal turbines. When Wairakei was developed, Wairakei was the first field in the world that had a mixture of steam and hot water that was produced together. And so some new technology was needed in order to be able to process that fluid to separate off the steam and hot water and to obtain something that was suitable for use in power station. And this turned out to be really, really important development because these wetter resources turned out to be the most common types of geothermal resources that were found in the world. So the dry steam one which was used initially turned out to be quite rare and the technology that was pioneered at Wairakei went on to provide a basis of technology that was used in most geothermal plants throughout the world. So that was 60 years ago, as of next week. Way back in 1958. And as you can imagine, anytime you have been operating for 60 years on one resource, there's a lot that's changed. Some of that earliest technology is still being used in a very similar way as it was when it was first introduced. And then other parts of it have changed dramatically over time. And the Wairakei story is really a story of evolution and development and evolving thinking in how you make good use of geothermal resource and how you manage that resource.

So here you see a few important points on the timeline for the Wairakei field. Back in 2000, for Contact, a very important step in the operation and in the flexible operation of the Wairakei resource was the purchase of the Poihipi Road power station and I'll show a slide in a few moments, which illustrates how that was the start of the flexibility that is so critical to our operation today. In 2005, a binary power plant was commissioned at Wairakei and that power plant makes use of the water which has been separated off from the geothermal steam. Now this technology did not exist in 1958. But it allows about 10% additional power to be generated from the same fluids. So there's quite an uplift in output from Wairakei, when binary plant was introduced and improved the efficiency of use in terms of gigawatt hours per million tonnes of fluid taken. We've continued to work to improve that efficiency and I'll explain a little bit more about that later too.

2007, an important milestone, where Wairakei's resource consents were renewed. So when the resource management act was introduced in 2000 -- in 1991, the major existing operations had 10 years to apply for consent and for Wairakei, that was done in 2001. That actually took a long time to get that first consent through. The consenting authorities had an awful lot to think about in terms of how to manage these older assets and some of the legacy issues that came with them. And the contents were granted in 2007 and a really important part of Contact's thinking was about how to meet the new environmental standards that were required under the new consents versus what was required or what was thought appropriate back in 1958.

And Contact had to think at that time about the potential for a complete replacement of Wairakei and that was 1 possibility with Te Mihi. At the same time, you could have gone in and extensively re-engineered the Wairakei plant to meet the new requirements. That was another possibility. The optimum solution turned out to be a blend of those things. So it was to build Te Mihi and to make some important changes to Wairakei basically while it was in operation to allow it to continue and to meet those standards. And the really big one down at Wairakei that was key to the ongoing operation was the introduction of a bioreactor, which removes hydrogen sulfide from the cooling water before it re-enters into the Waikato river. And hydrogen sulfide is a naturally occurring gas that comes in geothermal fluids, you know it has that characteristic rotten egg smell that to get in the geothermal environment. And some of that gas ends up dissolved in the water. So the hydrogen sulfide is removed by the bioreactor is a

really important piece of technology and quite innovative. I will talk a bit more about that later too. And then Te Mihi, of course, came in 2014, a really important part of the dynamic system that we have.

So Wairakei is New Zealand's largest geothermal field, it's the most -- it makes the greatest contribution to Contact's total generation and it is our lowest cost field to operate. You'll see here the cost on the Wairakei field, are our lowest of all of our fields and because it is the largest contributor that has the greatest effect on our average. That is consented until 2026, we'll re-consent it at that time and we have several options to consider at that time, including building a third unit Te Mihi, we have space out here you will be able to see that today when we go out for a walk around, as well as further options for how we could deal with Wairakei. The really important thing about the whole Wairakei operation is that it's not 1 power station and 1 steam field, it's a resource with 4 interconnected power stations on it and being able to operate those all together as 1 system, it's a significant source of value for us. And Wairakei is a low carbon emission field as James said, really much, much lower than Ohaaki, as you will see soon. We've got 90 wells in service here and 2,800-gigawatt hours of generation. That last statistic, I think, is a pretty impressive number, 70-terawatt hours of generation since 1958, that's a huge amount and a reflection on just how reliable Wairakei has been and what a great resource it is. And the best part of that story is that there's plenty more where that came from.

So some of the stats on our Wairakei operations is about half our generation or so is coming from Te Mihi, or did last year. We've got very, very high availability on our plant at Poihipi, there's some very impressive numbers there. At Wairakei, we have reduced the capacity effect over time. That 70 terawatt hours would not have been obtainable if this was a Wairakei number since 1958. We have scaled it back and that's because most of the time, at Wairakei, we are constrained by our permitted resource consent take. So our Wairakei plant being the oldest plant, it's not quite as efficient at turning stream into electricity as our new plant. So we preferentially supply our new plant with steam and we use Wairakei to provide the flex in the system. So our consents allow us to take 245,000 tonnes per day of fluid on average, you'll see that the number there is actually slightly greater than that, and that's because there's not a perfect alignment between our financial year and our consenting year. So we have the ability to flex that slightly between seasons if we want to. You'll see on those purple-colored spots on the bottom of the slide that we're been improving steadily the amount of electricity that we're able to generate from the fluid that we've taken from the ground. So we have, over the last few years, stepped up with just part of our constant drive for improvement and as James referred to some of the ideas that have led to these number here in the most recent times have come from our staff saying, hey how about we do it this way, how about we do that, let's look into that, can we squeeze a little bit more out of this tonne of fluid. There's been some really great ideas there and a lot of work going into getting the most out of the fluid that we are able to get from the resource. The interconnectedness of the power stations is a really key part of it.

Out at Ohaaki, our costs are considerably higher. The field is more difficult and more expensive to manage than Wairakei, it is consented for us to run again until -- to run until 2048. So that was re-consented in 2013 for 35 years. It has much higher carbon emission than Wairakei or Tauhara and main constraint that Ohaaki in recent times has been around reinjection rather than production. We do have the ability to get a bit more production, and we're actually drilling -- mobilizing to Ohaaki this week to drill 2 small reinjection wells to help with this constraint. And that's the first time we've actually drilled any wells since 2013. One of the interesting things that has been developed at Ohaaki is a silica extraction process. So while some of the aspects of Ohaaki make it more challenging and expensive to operate, it also creates opportunity. So there's more silica in the fluid at Ohaaki than there is in other fields, and we have been working with a company called Geo40 and with Ngati Tahu to -- on a commercial venture to extract silica from the geothermal fluids and to make use of that as a source. We are basically providing the feed stream to the process and Geo40 have the technology and the plant. Ngati Tahu are providing the land lease and so on. So it's an interesting diversification in the way that we think about using geothermal resources and that's been getting quite a lot of interest.

At Tauhara, we've had a presence basically since the start of Contact. Contact acquired the rights to operate at Tauhara and to build at Tauhara from ECNZ and purchased some wells that had been drilled earlier by the Crown at Tauhara. At that time, Tauhara was thought of as being relatively modest sort of a resource and the wells that had been drilled really only had explored a small part of that resource. Contact had some consents for building a small power plant there and the Te Huka power station was eventually built in 2010 from some consents that had been granted in 2001. But in the interim, we had also set up our first big, really big, direct heat supply with the Tenon wood mill and they used geothermal steam to dry lumber and kilns clear lumber for export primarily to the United States. They love geothermal, it's very, very fast, to heat their kilns, they were previously using natural gas, it's much cheaper and performs better for them. So they're -- they have been a very important step in that direction for Contact. And then in 2010, we did some more exploration of Tauhara, demonstrated that it was actually a much bigger resource than had previously been thought and showed that it was possible to develop at least another 250-megawatts from Tauhara and we secured resource consent in 2010 to do that.

Since that time, we've had some really good operational experience. And our experience at Tauhara has come through our operation of Tenon wood supply, the direct heat supply to that mill, and through the operation of Te Huka binary plant, which had been running up close, and sometimes over, 30-megawatt in the last few months. The great thing about this is this, is we've had 10 years of experience operating the system so we have been able to see how the wells respond, we've learned a lot about how to manage scale in those wells and, importantly, we have exercised the consents for Tauhara so we don't face a lapse period on those. Tauhara is another one of these fields with quite low gas, it's a field that is connected at great depth to the Wairakei resource and has some similar characteristics, it's a little bit higher in temperature then Wairakei and it does cover a much larger area. The Tauhara side of the field is about 50 square kilometers and the developed part of the Wairakei field is about 25 square kilometers. So together, that system is an absolute world scale geothermal resource, very, very, very large. So Tauhara's characteristics being more similar to Wairakei are resulting in costs that are not so dissimilar from Wairakei either. Some similar sorts of numbers there.

So how did we get there and why did we choose to focus on the things we did. I think this slide -- there's quite a lot of information on this slide, but it conveys the things that we believe are the really important points that you have to have right if you want to do geothermal development and if you want to do -if you want to run geothermal operations successfully. And quite some time ago, over 10 years ago now, we sat down and worked out where we thought Contact's geothermal business should go and the areas that we should focus on if we wanted to be successful. Because some of the elements that you need to operate and to build geothermal, you can buy in. And then there are some other elements that are actually much harder to find and you need to nurture some of those elements, you need to provide opportunity for people who are working in that space to work on good projects and we've been really blessed at Contact that we have had the opportunity to do that and to build up a great team of experts to support our operations. So when it comes to some of the specifics, you've got to start by finding the resources and identifying the resources in this first column, it's one of the areas that we have built up a level of expertise. We can't always manage the volume of work, but by having enough of our own in-house experts, when we bring others in, they're adding to the capacity that we need, but we are not entirely reliant on their views. We can be an expert customer to those services. So we have a number of those aspects. When it comes to the execution, we've got a really capable drilling team and a team that was -- had some of the greatest geothermal experience in the world when we were exploring at Tauhara, when we were building Te Mihi, when we were going through a really intensive period of development. Build up a lot of experience and then we had to make that really important shift that James was talking about, we had to convince the drilling team that the answer to the future for them was to try and not drill any more wells. And that was a pretty -- that was initially a bit of a tough sell. But they took to it and they really responded to the challenge. And what we've done there is we've gone away from using drilling rigs, is basically what we've done. Because drilling rigs are so expensive to mobilize and they are so intrusive that you often have to take a lot of other stuff out of service in order to get them in onto your operations. So we've gone away from that, using a number of other methods and much smaller equipment like coil tubing units and so on to shift the emphasis. When it comes to reservoir engineering, that's another area of great strength in Contact, really important for understanding the development side and that balance that you need to have in that cartoon that I showed you, the multicolored cartoon, how do you balance up reinjection, natural inflows, getting the right amount of pressure draw so that you can stimulate flow to come up from underneath from that great depth where everything is really hot, not to flood the whole thing with cold water and so on, really critical part of it. Plant design, we've not covered absolutely every aspect of plant design at Contact, we have tried to pick and choose the bits that help us the most. So how we developed stream field, how we manage the steam gathering system and reinjection systems, and so on, we think that's an area of really unique expertise. We are not so focused on building power stations, we can hire people in who can help us to build power stations, but getting the steam field right is something that we have focused a heck of a lot on. And then on the operations and maintenance side of things, we are pretty lucky again that our operations and maintenance staff, they get to work on some of the newest geothermal assets in the world and some of the oldest. So that spread of skill and breadth of experience that you need to be able to manage that variety of assets is a great strength of -- we've see many of the issues that come with owning decades-old plant that help us to anticipate how to manage the likes of Te Mihi into the future and so on, when this plant is not even 10 years old yet.

But we know what it's like to have decades-old plant. So those are some really important aspects.

And our project -- on the project-management side, you know we -- obviously, we had a very intense period that, we're building power stations, but there have been significant capital works that are recorded on an ongoing basis.

I guess overall in summary, we've been able to keep really talented people engaged because this resource, the geothermal business is very, very stimulating work and there's a lot of good stimulating work for a relatively small number of highly skilled people.

So as we shifted away from a focus on new development, new build, our teams really focused on trying to drive costs down in the operating part of the business. We've looked for innovative ways to do that. And you can see that there's been some quite significant shifts in the approach that we've taken to managing our fuel supply.

So from FY '10 to FY '14, you can see we were in the phase of drilling, we drilled a number of wells to fuel our plants, we were doing a lot of work-overs, a lot of maintenance on wells with drilling rigs and a relatively small amount of work, we had just started really with using coil tubing units and a small amount of experience with chemical interventions. Our first real step into trying to drive the cost down and to remove the need to bring in drilling rigs was a technique called broaching, which we started with in this period and we did quite a bit with broaching and that's a very low cost method of scraping scale out of wells that you can do on a wire line. So rather than having to bring a drilling rig in and all of that equipment to clear out scale, you could run these tools down on a -- basically it's just a wire that runs down on a winch and you can scrape material out of the wells that way.

That works, it doesn't work in every scenario and it does have some risk associated with it. We did get stuck a few times, had to recover that equipment and in some wells, we just couldn't effectively clean them that way. But it did show us that there was a path to some different ways of thinking about how to approach these problems. As we look for different technology, we put a lot of emphasis on the use of coil tubing. A coiled tubing unit is much, much more compact and much cheaper to operate than a drilling rig. Coiled tubing also has a characteristic where you can enter the wells with the wells hot. And this is a very important feature of coil tubing because a coiled tubing unit has a drum of pipe, as its name suggests, just coiled up in a big reel, it looks like a big cable drum, but it might have 1,500 meters of steel pipe, all wound on to a big drum and you can run that piece of steel pipe into the well in 1 trip. There's no need to join the pipe together as you do on a drilling rig. On a drilling rig, every 18 meters, you've got to screw the pipes together and carry on. You don't need to do that with coiled tubing you can go in and out in 1 hit. And you can do that with the well hot, it's quite safe to strip in and out with the well hot. And we work with the contractors to develop some methods that could be run on coil that allow us to enter the wells hot to clean the wells out while their flowing and that allows us to take any of the material that we were trying to remove and flow it back out to the surface so it doesn't fall down and block up our reservoir. It also means that in some instances, we can even keep the wells supplying the power station while we are clearing things out. That's been a great step forward, it's a lot cheaper and our turnaround times have gone from 3 weeks down to like 2 or 3 days.

So been a really massive step change there. The other big area of change is in the use of chemical anti-scaling systems to prevent scale buildup in the first place, and you will see some of those this afternoon on the field visit. And on some chemical interventions, which again where we've worked with suppliers, we've developed shared intellectual property around these types of chemical interventions and they allow us to manage scale both in the wells and in the reservoir, which is impossible to reach with any physical intervention, you can't reach out into the reservoir rocks with physical intervention using a drilling rig or coiled tubing unit, but you can, if you push chemicals out into the reservoir and we've done a lot of work on that. And together, those things have dramatically lowered the cost of us providing fuel to our operations.

Some other things that we have changed are around the way that we operate the power stations and this 1 is for the Wairakei field as I mentioned, that this is actually 4 power stations that are operated in combination and our main constraint on output from this field is around the amount of fluid that we are permitted to take. So we are allowed to take on average 245,000 tonnes per day of fluid and we used to have to average that over quarter. We've applied to the regional Council for a change of our consent conditions to allow that average that over an annual -- to have an annual average rather than a quarterly average and that gave us a lot of flexibility. So you can see that the lighter lilac colored here represents the kind of prefer that we might operate to on an annual retainer the darker purple line shows the sort of profile that he might operate to when we have a quarterly average. SO what we found we had when we had a quarterly average is that we would have to position our outages so that they crossed quarters for example. So that by placing the outages across the start and end of the quarter, we had a greater amount of time available to us to catch up that volume. So we could then use both of the quarters to -- essentially to catch up for any volume that might be displaced during the outage. When we moved to annual we got a bit of flexibility for that, so here's an example, where we can take an outage that might have been scheduled for the middle of the year when we'd actually prefer to have the generation available, to have that capacity available, and we can move it into a period of time in the year where we might have cover from 1 of the other plants in our portfolio, for example. So that's 1 important instance in which we can make use of that annual averaging.

The other one -- another one is that it reduces the amount of fuel that you actually have to have to be able to catch up. So running for longer periods of time at slightly lower output, means we don't have to have as many wells to be able to do that. So we don't have that peaking requirement

in terms of our steam field infrastructure because we don't have to run as hard over such short periods of time in order to catch up. So that's an important plus.

And then the other plus that comes from it is that our plant operates at its most efficient in certain settings so we can overload the plant and get the higher output if we need to. But if the prices are right and the circumstances are right, we'll try and run the plant over a longer period at maximum efficiency, so that we can get the most gigawatt hours per tonne of fluid taken. So those things have really, really helped in the flexible operation of Wairakei.

And here's an example of how we've configured our steam field to be able to do that. The original operations were based around Wairakei, and they were supplied by these Western borefield wells and some wells from Te Mihi. The Poihipi Road power station was a stand-alone operation before Contact acquired it, and it had its own wells. But they were never able to provide enough steam to really load that plant properly. So it was natural in the end for Contact to acquire that plant and to connect that up to some of the Wairakei systems through here to, to me. And that was the start of the flexible operations. We had Poihipi, at one end of the system, Wairakei at the other end of the system. And then when we come to build Te Mihi, we built Te Mihi so that it could be fueled by a number of wells up here at -- in the Te Mihi area, and some of those wells are dedicated to these Te Mihi units, 1 and 2. And then another group of wells are what we call our swing wells or our wells that can flex between supply to Te Mihi and Poihipi or Wairakei.

So if we take out Te Mihi unit 2 for maintenance, we can swing our wells away from Te Mihi, push them down to Wairakei, where we have some capacity, and we can continue to take it at the full take that is permitted for the field. And that has given us a lot of extra gigawatt hours.

Here's another cartoon depiction of what's happening in our system. And this is shown as an example of how the solutions that we've implemented at Wairakei have often been a blend of things. As I said, when we renewed our resource consents at Wairakei, it wasn't important -- there was an important change in the way that H2S had to be handled to meet the new requirements, and that was really to ensure that the river was not being subjected to a large hydrogen sulfide load. And part of that solution -- a really important part of that solution was to implement this bioreactor at Wairakei, which is really just a -- it's a bunch of tubes. They're 100 millimeters in diameter. They're polyethylene tubes that are about 100 meters long. And all of the water that comes from the Wairakei power station, all the cooling water, which has got some hydrogen sulfide in it, takes about 5 minutes to flow through these tubes before it enters back into the Waikato River. And those tubes just provide essentially a habitat for some naturally occurring bacteria that live in the river system. And those naturally occurring bacteria absolutely love hydrogen sulfide. And they just chew that stuff up, and in 5 minutes, it's almost all gone. And the water isn't able to enter back into the river system.

We don't have to stock the bioreactor with any of these bacteria. They're naturally occurring. So anyway you find geothermal fluids in the natural environment, you'll find these bacteria. So they're very happy. We just built them a really cozy home that they love to be in. And this has proved to be a really elegant solution for the emission issues at Wairakei. It's brought the Wairakei a long way forward in terms of its environmental performance, and it's been a very reliable system. And these guys don't -- they don't send us a bill for any kind of chemicals. They don't ask for wages. They just like to be fed. The thing that has been interesting is that the operators have had to learn -- they've had to learn how to manage a population. Because if you don't feed these guys enough, they'd die, and then it takes a little bit of time for them to get reestablished. So the operators have had to learn how to keep them warm, keep them fed, keep enough of them there so when they want to ramp up the output, there'll be plenty of that, that eat the H2S and so on. But as you know, with bacteria, if you give them the right kind of conditions, it doesn't take them very long at all to really get the population up. So that's been an important aspect and I think reflective of the approach that Contact takes to problem solving. This is the only geothermal bioreactor in the world. It's not the sort of technology that we'll be able to sell to hundreds of others because there are around hundreds of others with a geothermal power station operating on a river. But it is an example of how we've gone about solving some of the issues and bringing Wairakei forward into modern context.

I think this slide here really sort of sums up where we've been in the development of our resource here at Wairakei, and there is a very substantial uplift in the output that you can see over time. And it's come about through a number of things. There's the addition of the Poihipi plant. There's the Wairakei binary plant addition, which as I explained, added about 10% more power from the same amount of fluid. And then over here, you can see what we've done with the Te Mihi power station as we've introduced that. We've decreased our reliance on Wairakei and substituted that with Te Mihi. But compared to the business case that we had for Te Mihi, we're exceeding that now by a considerable margin. And the number of gigawatt hours that we've been able to get per million tonnes of fluid taken is greatly exceeding what our original predictions were. And that's a

combination of a few things: One, the reservoir is performing very, very well, certainly on the upper side of the range of possibilities that we considered when we built Te Mihi; and also the continuous improvement that's being made in the utilization of the fluid. There were many, many of those projects that we just not participated at that time that have contributed to that.

So that's it from me. I hope that's given you a bit of a sense of how we go about our geothermal operations and how we think about geothermal development, some of the things that have contributed to us being in a really good position that we are in today. Thank you.

James Kilty

All right. What we might do, rather than put questions to Mike now, is we wait until the end, then we can do a Q&A across Mike's section and this final section in which I'm going to talk to you a bit about our geothermal options. I showed you that wonderfully undated chart earlier. [Have us all] better paint some color onto the large gray area in the middle there over the next 10 or 15 minutes or so before we hear from Dennis and get into some Q&A.

So I'm going to touch on 2 topics: Wairakei 2026 and Tauhara development options. I guess the key point here is that any form of renewable development is much more than a simple consenting exercise. It requires long-term thinking. It requires genuine relationship building with stakeholders. It requires some clever solutions to difficult problems as well as the normal engineering considerations that you would expect us to be taking into account, the state of the reservoir, the costs of the safest facilities and the various safest facility options. There's an enormous amount of work done with stakeholders to build long-term relationships.

The Geo40 example that Mike gave earlier around our Ohaaki field is quite a good example of that. For us, for the silica-rich resource, removing silica from wells is very costly. If you can get a business in that takes the silica out of the fluid before you stick it back in the ground, it's a massive cost avoidance. For our stakeholders at Ngati Tahu, our partners there, they get some land rental, and they get cleaner fluid flowing through into their town or their [napa] and their troubled baths. So everybody is winning in that example. Our costs are lower. The new business gets access to a silica resource they can sell. [Gets them] to paint and other bits and bobs around the world. And the local iwi gets jobs, rental and an improvement in their traditional resources.

Those are the sorts of quite creative sustainable solutions that we seek to find. And when we've gone out and talked about Wairakei with people, and we have started this very early, it doesn't need to be reconsidered until 2026. But with that long-term thinking in play and to understand our forward options, we have started now. We have run, what's called a design thinking workshop process with over 70 stakeholders. Gone out and asked them what they think of the plant, what's on their mind, what they think of us and our operations, and what are the things that they believe we should be taking into account as we look at the options for Wairakei going forward. And these 5 areas that we're being guided towards by people who will have a major influence over the future of the Wairakei operation in 2026. So our stakeholders are telling us, make sure you are good stewards of the water you are using. And the bioreactor is a fabulous example of a creative way of reducing our impact on the Waikato River. They are looking for more cascade uses. What can they do with our waste to make money? And that's terrific for us. There are opportunities for people to utilize what's effectively our waste for the benefit of them, their families and their communities. Likewise, more community involvement is desired, so we need to be looking at perhaps opening ourselves up a little more to our communities. Letting them see what we do and understand us a little better. And then of course, as I said earlier, the core engineering disciplines. What will a reservoir sustain? And what's the optimal mix of plant on top of it to maximize its utility?

And this is what we're seeing. Based on the reservoir work that Mike and the team have been doing, by 2026, there will still be a substantial resource available for operation here at Wairakei. Over and above, the big red block there, which would be Te Mihi and Poihipi and the Wairakei binary plant still operating. The gray area would be the Wairakei station coming off or not. So the resource is stronger than we anticipated, and in particular, some of the older parts of the field, and perhaps on the steam field too, you'll hear a bit from the guys about that, that some of the older parts of the field down near the Wairakei station are producing more strongly than we anticipated. And that's where a lot of that value Mike talked about earlier that we're getting in the Te Mihi, against the Te Mihi business case. That's where that value is coming from. So there's fluid there. There's resource there. It's up to us to think about what are the best ways to utilize that going forward and then to build that into a sustainable solution that is consentible going forward.

So we're looking at 4 options, I guess, 4 thematic options because inside each of these, there's a myriad of variations on a theme. The one most of you will likely have in your thinking and has been our base case as well, hence it's in your thinking, is the one on the bottom there. Te Mihi unit 3. So that's just extending the plant we're sitting in today. Mike mentioned earlier, you'll be able to see where that would go, at the back of the facility you're in right now. That comes with a particular capital cost and operating cost profile and associated complexity and outage, et cetera, across that page. Possibly doesn't deliver the flexibility of some other options, and then comes at a higher capital cost. So as we explore other options, moving up the screen away from that base case, there is potential for placing a smaller, newer power station nearer this resource that is continuing to deliver. That is an alternative option we are looking at. That comes also at a higher capital cost, cheaper potentially than the base case, but nevertheless higher capital cost. That will require some outage, delivers a little more flexibility, not quite the efficiency of a Te Mihi unit 3.

Moving up that screen to the next step, we could repower Wairakei A and B. The facilities are all there. We could utilize the balance of plant, but essentially conduct a bit of open-heart surgery on that, repair at the heart of it and put in some newer kit, yes? That's probably lower cost again, and CapEx from the greenfield Wairakei idea, but it does come with a higher future cash cost, operating cost and would come with a long outage. You'd have to take Wairakei off for a long time to pull it to bits, pull the old bits out and put new bits in. That's a technical term -- and you get a less efficient outcome than the newer plant down below it. You would, however, probably get a more flexible outcome utilizing the plant because the steam field kit is all set up as Mike's demonstrated to enable swing of fuel down to Wairakei when the more efficient plant up here isn't available. Or alternatively and finally, simply maintaining Wairakei A and B and spending some money on upgrading it to more modern engineering standards and safety standards, that comes at a much lower capital cost but would have -- against the other options, are higher ongoing operating costs to us. Still comes with an outage and lower plant efficiency but a very, very flexible system that's already in place, so enables us to continue the sorts of operation that Mike's taken you through.

So right now, we're working on those. We're trying to understand rather than in scaled symbols what the actual numbers are so that we can start to make the trade-offs and think about what kind of solution could be available. That is an improvement on the current base case of unit 3 out here at Te Mihi. Looking to Tauhara, over the other side of the river, we have a large scale resource that we've learned a lot about in the last 10 years since we investigated and consented that resource. And at the moment, we talk about it as at least a 250-megawatt single stage development. However, that's not necessarily how we think it should be developed. You learn a lot in 10 years. You learn a lot about the resource and a lot about the plant options that can be -- that can come to market. And so we're seeing the opportunity for a stage development, a potential for a modular build out of that resource. And in fact if you think about boom and bust risk, managing boom and bust risk, modular investment is possibly the best way to manage both your resource risk long term, your capital cost risk and market impact risk. Just a staged rollout of new plant on a large-scale resource.

So we are doing some work right now to understand again what those costs are. We need to be able to make decisions for what we might do at Wairakei in 2026. We need to understand what alternative options are and what they might cost. And so we're investigating those right now to understand what options will emerge for us at Tauhara. If we did Tauhara, we're getting very good long-run marginal cost estimates coming into us. If we did Tauhara, it comes with a new transmission connection. And at the moment, at Te Huka, which is also on the Tauhara field, a small binary plant, we already operate there. We are slightly transmission constrained, not resource constrained and not plant constrained to a degree. So there's a low-cost expansion of Te Huka that becomes available before we develop the Tauhara field. And this is at a very, very competitive long-run cost to Contact. And so we look at all these options and go back to those earlier comments around the state of the nation's fuel supplies and risk of boom and bust of under build or overbuild, and think that these low costs, modular or stage development options are quite critical to Contact and quite an opportunity for New Zealand to manage a transition through a reduced thermal operating regime. Which is where we end up with our great big gray area, which tells you that we can raise or reduce our operations here as is required to be meet market demand. If there is large-scale demand destruction, there is no need to reconsent the Wairakei plant in 2026. If, however,, that doesn't happen, and it's stable operation, then we will adopt the best case option for Wairakei 2026 and keep operating at similar levels of production. If there is demand growth and/or thermal removal, there is the opportunity to bring in, in an optimal way, perhaps a modular way, an expansion, brownfield expansion at Tauhara and at Te Huka at a very good cost point. So all of those options sit in on our that portfolio with no specific time line underneath them. And we are doing the work now to understand ties cost associated with them. So I have deliberately rattled through that somewhat, so that there is time for the Chief to actually get out of his chair and contribute and for some Q&A. And of course, in Q&A, I encourage you to ask any questions from both my initial discussion, from Mike's conversation, from this brief review of our geothermal options, and of course, what the chief will now say. So I'll hand you over to Dennis.

Dennis Barnes - *Contact Energy Limited - CEO*

Thank you, James. So the only thing I can guarantee is that I've get out of the chair. I don't know about contribution. So really, this is just a wrap up of what you've heard from the guys this morning. Means somewhat tongue in cheek. Sustainability is the way we do things around here. Some of our competitor companies are trotting out their chairpersons to do roadshows on what sustainability means. We've had an integrated report for 4 years now. We have early-adopted TCFD, first Green Bond, so it really is the way we do things around here. Perhaps our favor has been PR, who's not been a strong point on this topic.

We really are preparing for a low carbon future. You can see through the many options we have available to us, from either new build, extension of continued renewables and the options we have around thermal generation. And part of what we've been doing this year is preparing for that. So the gas storage facility being sold and expanded is part of that story. I think it goes without doubt when you look at those numbers, both in absolute terms and in trend, that the operations of geothermal here are world-class. Some of you will remember, we had a look at some international assets a few years ago, and nothing compares to the resources we have locally. Now some of that is just, say, great resource. And we are blessed with that great resource. But it's also down to the hard work of the people and the focus we have on continually improving the operations. Those operations also give us a bit of choice, so there's a great virtuous circle here. While we're reducing the cost of operations, we're making the fluid use more efficient. It actually reduces the long-run marginal cost of what we might do in the future, whether that's the continued operations at Wairakei or it's brownfield development of Tauhara. And I keep stressing brownfield because we've been on that resource for 10 years. We've been on Wairakei for 60 years. These are pretty low-risk development options for us. The question that was asked this morning and the challenge we will have over the next few years is what does the market think about that? What is the opportunity for substitution or to actually build into demand growth? And you've heard it relentlessly this morning, albeit hard to pin down what the measures are, that we will only develop and spend money on the back of true, observable demand growth contracts or substitution. And having said that, I think the guys have given you enough insight that what we're talking about deploying here is pretty low numbers. The first stage Te Huka expansion would be less than $100 million. And if you actually look at how the market is developing anyway, you are seeing a trend towards more modular, lower-risk build. We like to talk about the upside from the 50 megawatts Tiwai Aluminium Smelter demand, but actually in the last year, you've probably seen about 50 megawatts come onto the system from small geothermal operators or improvements in existing facilities. I think that challenge changes over the 3 to 5 years. I think the numbers become bigger, and I think that's why we have to be ready, and hopefully this afternoon, you'll see that we're getting ready in a very ordered an efficient and commercially focused way.

So with that, all the presentations from this morning, and just because you're all here, we did also release our operational statistics this morning. And therefore, with the material from this morning and the op stats because I know some of you will have pored over them already, we're happy to take questions. And we will have to move to and from the microphone. Okay.

Unidentified Participant

Okay. So I've got 6 questions, but I'm going to stick with the first 2 for Dr. Mike. And this is just from my understanding, which is clearly not very high, in that I'm just trying to understand the nature of the consent for Tauhara. Is there any sort of use-or-lose type clause in those consents? Or can you sit on them forever to 2045 and do nothing if you want to? And second and related, and this is -- I assume the answer is no, but just for my understanding, can sort of anyone else bid for one of your consents, if I put it that way? Can somebody come in and say, you guys try to reconsent Wairakei and then somebody else says, hey, we got an even more environmentally friendly solution, we will now actually build or use this consent instead of you. Are there such clauses in these consents?

Mike Dunstall

Yes. So in terms of a use it or lose it kind of a thing, we're already using our consent at Tauhara. So our consent has been exercised in order to provide heat to our Te Huka binary plant and to the Tenon operations. So while we haven't used the full extent of it, it has been exercised, so it will not expire until the consent has run its course. So it's already in play, so that's the first part. In terms of, can somebody else apply for the consent or just take some part of the volume that's not being utilized at the moment? Yes, in theory, anybody can apply for a consent to utilize geothermal fluid or the Wairakei or Tauhara field for example. However having consent from an environmental perspective is only part of what you need. You

also need access to the land, to get access to the resource. And contact is a very, very strong land position around Tauhara, so we are a major land owner or have rights over very extensive areas of the Tauhara resource. So yes, you need environmental consent, but you also need an agreement with the land owner, and we have both of those things.

Dennis Barnes - *Contact Energy Limited - CEO*

Andrew? I've got one here with Andrew.

Andrew Rupert Pelham Harvey-Green - *Forsyth Barr Group Ltd., Research Division - Director and Senior Analyst of Equities*

Early on in the day, you talked about the potential, I guess, for using direct steam for industrial purposes and maybe bringing in some others into that space. Does it actually use the steam that is therefore would be unavailable for geothermal purposes? And I guess following on from that, presumably direct use is more valuable from your perspective rather than actually producing electricity.

Dennis Barnes - *Contact Energy Limited - CEO*

Yes, I mean, one of the guys will correct me if I'm wrong, but the use of direct actually uses quite a small part of the resource. So Mike referred to 122 wells on Wairakei. The Tenon heat is 1 well and 1 backup. So it's actually quite a small proportion of the resource. So it doesn't really limit your electricity ambitions. It's very attractive because it's so competitive relative to -- over fuel sources, that the returns we get on the investment are huge. But for a replica of Tenon, one well with one backup, we might be putting in $15 million, $20 million. So you're getting huge percentage returns, but absolute returns are relatively small. What we have done when we've looked to attract those businesses into the region is to look at electricity supply, heat supply and land use agreements. So you end up with quite a good package. It's very good for us, but it doesn't limit our electricity ambitions.

Andrew Rupert Pelham Harvey-Green - *Forsyth Barr Group Ltd., Research Division - Director and Senior Analyst of Equities*

And my second question, I guess, was just around Wairakei. And given you've got 2026 as your deadline, when do you need to have decisions made about what you're actually going to do at that deal? What's your drop dead date?

Dennis Barnes - *Contact Energy Limited - CEO*

It's a bit of chicken and egg. If we didn't have a thermal transition happening in the next 4 years, then -- again, correct me if I'm wrong guys, probably 2024 we'd make the application, and particularly if we're going for one of the low CapEx options, we wouldn't get around to it till 2023, 2024. But because we've got this thermal transition coming up and whoever Wairakei, Tauhara form part of the decisions around Huntly or TCC retirement, then we might go early. But there's nothing to stop us doing all the work on Wairakei and then just putting it on hold for a few years. I don't feel we're going to get a locally contentious process. It's actually more about taking that chart with the arrows and the pictures and turning them into some numbers to our satisfaction. Remember, Wairakei has been reconsented 7 times, is it? Several times, yes. It's probably 4, if I've not exaggerated it, but you get the point.

Unidentified Participant

Dennis, can I just start with Te Mihi 3? If you do go ahead with that, and it's at the worst case scenario, how many gigawatt hours is that? And what is the cost we should be penciling in for it?

Dennis Barnes - *Contact Energy Limited - CEO*

I mean, so Te Mihi 3 would give you something like 700 gigawatt hours so -- versus the Wairakei station production of 900 and north gigawatt hours. And based on the contract we did for the first 2 units at Te Mihi, you're probably looking at just shy of 300 million.

Unidentified Participant

And my second question is more short term. You mentioned that you're not very contracted into 2H for calendar year '19 on gas. And looking at your gas costs conversion into short-run marginal costs, if the $20 that's currently prevailing in the market holds in the second half, would we be looking at a $155 type costs to you guys to cover some of your load?

Dennis Barnes - *Contact Energy Limited - CEO*

Yes. I mean, the $20 is on -- it might fill a small milk bottle of gas volume. I mean, the traded volumes are tiny. That's not really the market that we're operating in. The market we're operating in is bilateral contracts, and the bilateral contracts have taken a step, but they've taken like $1, $1.50. They've not taken a step to $20.

Unidentified Participant

So you're not facing much 2H risk from gas pricing.

Dennis Barnes - *Contact Energy Limited - CEO*

I don't think gas pricing is a material issue. And if you think about what it means for our renewable business, one could argue that it's almost good for us. The question will be availability. I think the days where we could wait till February and then pick up 10 to 15 petajoules are probably gone. So we're working a bit harder on that front. I don't think we've got it wrong. I think '19 will be fine, but I think there's just a better posturing at the moment we have to work for.

Unidentified Participant

And then in terms of cash costs down to $143 million in FY '19, you were in the past talking about retail had a bit more to go. Is it still...

Dennis Barnes - *Contact Energy Limited - CEO*

$143 million. What's the $143 million?

Unidentified Participant

$143 million. Is...

Dennis Barnes - *Contact Energy Limited - CEO*

Oh, wholesale. Yes, yes, yes. Okay. Yes.

Unidentified Participant

Is there much more to go on that front into 2020 and beyond?

Dennis Barnes - *Contact Energy Limited - CEO*

Well, we've given you the number for 2020 of $190 million OpEx and $60 million to $65 million CapEx. And then I think there's another couple of years of turn but it will be retail. It will then be retail. It won't be wholesale.

Unidentified Participant

And the last one is just on contracted sales of around about 1,300 gigawatt hours in your slide earlier on. Half of that is the 80 megawatts with MEL for the -- what is the rest of that contract?

Dennis Barnes - *Contact Energy Limited - CEO*

I mean, there's -- so we've -- the smelter is probably now with the [fourth part line] 800 gigawatt hours. There's about 300 gigawatt hours, which goes to second-tier retailers. I think it was 305 gigawatt hours last year. So actively supporting the second-tier market to be healthy. And then the balance will just be short-term trade and buy a bit, sell a bit. We've got plenty of water this week, I'm sure we've sold CFDs. Steve?

Stephen Hudson - *Macquarie Research - Head of Research*

Dennis and team, you put up a number there of, I think, 6 terawatt hours or so of prospect for your geothermal output over time. I know there's obviously a lot of options, but can you give us a range of LRMCs within those, within that block of, I guess, an additional 2 -- 2.7 terawatt hours. Second question, are there any end-of-life remediation costs at Wairakei? And then third question, what do you think happens to EITE allowances for next year?

Dennis Barnes - *Contact Energy Limited - CEO*

So the first 2 are a bit easier than the third one. So the ranges, if it's brown, brownfield, like a Te Huka expansion, within the low 60s. And if it's brownfield, within the higher 60s. And if you wanted to do a -- what's return of capital, and what's running costs, cash running costs because we think about medium-term CapEx, we think about it in the LRMC, so 2/3, 1/3. We're pretty confident that, that range is pretty good. That's using a return rate we won't tell you, of course. But you cut on wholesale prices, you're looking at 9% to 10%, post-tax returns at those numbers. In terms of end-of-life, there will be no end-of-life at Wairakei. But let's say there is, which will be way after our time. I refer to the Te Mihi project and the work of the last few years as the midlife refurbishment. So I think we are talking about an end-of-life which is a long way away. I mean, I think it's still reasonable to assume that the scrap value of the kit pays for the site remediation, the rule of thumb for many power station operators. And also bear in mind that there's a pretty big Transpower facility on site, so they will continue to use the Wairakei site forever to keep the grid running. So a lot of the facilities will still be there in terms of rolled in and gates and access. So we don't -- it's pretty minimal. And then your last question. The only insight I have into that is actually a Macquarie report, Stephen, so you might tell us what you put in that report, which is that the large consumers who have been gifted units. I think just an aside on that, a few of them are waking their mind up -- waking up to the value of them. A lot of them have not been active in the market with those units. But I think the review of the ETS will see those be phased out over time. I can't remember what you put in your report but this is good a guess as anybody's. There's a sort of gradual phase in over 5 or 10 years, I think. What I would say is that there's probably a lot of those units banked based on some of the pretty rough methodology from 10 years ago, which is probably got a bit of a windfall for the holders of those units. Nevill?

Nevill Gluyas - *First NZ Capital Limited, Research Division - Director of Equity Research*

So kind of first question, the -- you talked about unit costs, long-run marginal cost. What would you be expecting to sell those stations at? I mean, I'm looking at sort of the more commercial end of the C&I contracts, sort of around $66 a megawatt hour, and you're talking about LRMCs in mid-60s, what would you be expecting to be able to sell your output from these stations at?

Dennis Barnes - *Contact Energy Limited - CEO*

Yes, I mean, if you look -- you've got to take the ASX really. If you think about the range of channels we have to market, I still think that even with the recent prices we've seen in Australia for wind and solar, with a requirement to firm the supply particularly with the deep storage needs in New Zealand, I still think the wholesale price in the 70s is a reasonable assumption going forward. I don't think it materially lifts, and I don't think it materially falls.

Nevill Gluyas - *First NZ Capital Limited, Research Division - Director of Equity Research*

Great. And a question just on my understanding around the Te Huka expansion kind of opportunity. Is that dependent first on more development at Tauhara or for the capabilities for transmission, to piggy back off capacity there?

Dennis Barnes - *Contact Energy Limited - CEO*

Yes, I mean, I can't -- is it 30 or 60 for first at Te Huka? Yes, there's an over -- yes. There's an over $30, which is just transmission. You can see the wells and the fluid are behind it. So that becomes pretty compelling at some point.

Nevill Gluyas - *First NZ Capital Limited, Research Division - Director of Equity Research*

That's not stand-alone compelling without the transmission expansion? The expansion itself wouldn't just pay for itself?

Dennis Barnes - *Contact Energy Limited - CEO*

Yes.

Nevill Gluyas - *First NZ Capital Limited, Research Division - Director of Equity Research*

So long-run price for gas. You talked about $1, $1.50.

Dennis Barnes - *Contact Energy Limited - CEO*

Dunk it. Do you want to answer that one?

Nevill Gluyas - *First NZ Capital Limited, Research Division - Director of Equity Research*

So $7, $7.50, does that feel like a number where it might settle to you or...

Dennis Barnes - *Contact Energy Limited - CEO*

Well, there's a bit of noise at the moment. There's the large proportion of New Zealand's gas assets going under a completion process from a sale. So -- and that's creating a bit of noise. You've got an outage, which is creating a bit of noise, and then, of course, there's the whole political story, which I'm not sure is entirely related. I think you look through all of that noise and you go, methanol still sets the price. So oil's gone up, kiwi's gone down, the net back to methanol is now higher than it was, and that will set the gas price. So a year after, we're moving $1, $1.50. [Paul]?

Unidentified Participant

Your comment on decommissioning, that would apply to TCC in terms of covering its own costs of winding it down.

Dennis Barnes - *Contact Energy Limited - CEO*

Yes, I mean TCC is a bit different because the peakers are next door, so you could actually just turn it off and close the gate and not do anything. But there's a shitload of copper in TCC, which is generally the most valuable thing you can strip out. Yes, okay. So yes, I mean, so it's not -- the storage costs are not that high. The site will still be there. Yes, so I would apply it to TCC. It's not going to be like Otahuhu, where the value was commercial land in Auckland, although we did get $11 million, which we shared with the new owner of the site for the scrap Otahuhu. So you do get a return on it. You might be able to sell the whole plant. There's a lot of GT26s in the world. And there's a lot of them looking for spare parts, so you can actually sell parts of the plant to operators of GT26s. But yes, same supply. Nevill again. [Paul] wants to get out and play golf, come on.

Nevill Gluyas - *First NZ Capital Limited, Research Division - Director of Equity Research*

I'd just throw one more in. Just in terms of the Wairakei decisions, and in the slide there, you talked about the options, the money slide.

Dennis Barnes - *Contact Energy Limited - CEO*

That's too far ahead. There we go.

Nevill Gluyas - *First NZ Capital Limited, Research Division - Director of Equity Research*

I'm just wondering how much is -- this makes it very much look like a commercial decision. How much are these choices dictated by the resource sort of consent conditions. In other words, how the discharge consents, for example, whether or not that simply becomes a roadblock that eliminates, say, your top 2 options.

Dennis Barnes - *Contact Energy Limited - CEO*

Yes, I mean, the -- we don't think this is going to occur, but if there was a roadblock which says no discharges into the river, then you do end up with a bit more limited here and here. But even with these 2 -- with this 1, you can -- sorry for the recording, for the repowering option, you could spend money on reinjection. So you don't necessarily have to discharge to the river at Wairakei and in fact, some of the Wairakei fluid is reinjected already. So other than maintain Wairakei A and B in it's current configuration, we have a roadblock of no more discharges to the river. These are free options that are available to us. Now this will take time to confirm, but increasingly, we see that the load-in that is now on the river relative to the last 3 consents, which is 10 years ago, the load-in is so much lighter now that it's more like the background conditions that the river would have observed before DFM or production was on the site. So -- but yes, if that roadblock was there, then the first one becomes much less likely. But we don't see that roadblock.

Nevill Gluyas - *First NZ Capital Limited, Research Division - Director of Equity Research*

And while we're on the subject, this sort of look like a linear declining trend in sort of total available production out of the fluid from the field, that was on the previous slide. Should we assume that decline continues out into the deep future?

Dennis Barnes - *Contact Energy Limited - CEO*

No, you just have to drill. Yes. We know the field. We know the fluids. So you just have to drill to maintain it. So it's really just a CapEx-facing question. What that slide is trying to say is that you've got 3% of New Zealand's electricity supply, which is low emissions, and it's proven, and we can see the fluid. So you'd have to be nuts to not let it continue operating. So that sort of tells the story that at the highest level, there's a compelling case to extract that fluid and keep it going at that pace for a long time. Aaron.

Aaron Ibbotson - *UBS Investment Bank, Research Division - Director & Research Analyst*

I was just curious if you're willing to share because I think you, James, mentioned sort of at least 250-megawatt for Tauhara. I just wondered if there was a range that you're willing to share if the consenting authorities would be willing to be cooperative?

Dennis Barnes - *Contact Energy Limited - CEO*

Well, I mean, I'm happy to, I mean, you tell me if I'm wrong. I mean, the 250 megawatts is a function of the fluid. So the consent is actually for the fluid extraction. And as we have worked with the consenting authorities on Wairakei, we've been able to expand and get more flexibility in our consents. So the equivalent story of Wairakei is 10 years ago, our consent was 170 kilotons a day. We increased that to 245 kilotons a day, which allowed us to build Te Mihi, and then we got flexibility around that 245 such that we can peak at 280 kilotons a day. Now the current pull on Tauhara would be -- how many tons a day would we have at the moment? So Tauhara is currently pulling 20,000 to 25,000 tons a day, consented for 213. If we are hitting our 213 kilotons a day in, I don't know, pick a time frame, 10 years' time, and we get enough scientific data to tell us that you can do more, the history with the consenting authorities has been as long as you can prove that you can manage the resource sensibly and sustainably, then you'll get it extended. That's just the current consents.

Aaron Ibbotson - *UBS Investment Bank, Research Division - Director & Research Analyst*

And second question, just on Te Mihi third unit. So James spoke quite highly about the modular approach in Tauhara. Is there a modular potential in Te Mihi third unit? Or is that sort of on and off your fourth alternative there? So basically, is there a scenario where you shut down or something Wairakei, focus on Tauhara instead, and then have Te Mihi as a modular approach as well?

James Kilty

Yes. Probably the best guidance I'd give you on that is that takes you into the greenfield Wairakei option. So you're not doing a Te Mihi unit 3, and that's the way we think about it. And then the base case and the numbers Dennis just gave you for that unit, you're actually placing possibly 1, 2 other modules in the steam field near the resource that is lasting a lot longer than we expected. So you're just placing plant nearer to the resource probably in that scenario, creating that modularity in the same way.

Dennis Barnes - *Contact Energy Limited - CEO*

Perhaps one of the ways to think about it as well, Aaron, is if we -- I think this is a crazy scenario but one we could have, which is to let Wairakei -- don't continue operations at Wairakei and 1 day in the future build the third unit. If demand is there, then we'd be spending on the next phases of Tauhara, at 4 million a megawatt. That's less than 3 million a megawatt probably. So you'd probably still do Te Mihi third unit before you do the outer reaches of Tauhara in that world. I think the likely to happen, that's why the band is quite wide, is that we do one of the lower-cost options

on Wairakei and Tauhara in due course. The scenario you've painted, I think, is obviously available to us, but I think if you NPV that, it wouldn't work. It's the dilemma with this charge. Te Mihi, you'll see it as beautiful, with sufficient -- the conversion rates are amazing. And then if you choose to go on Wairakei this afternoon, it's a different story. It's a great plant, but you can see the age difference. Andrew. Yes, last question then. We're all around all afternoon, of course.

Andrew Rupert Pelham Harvey-Green - *Forsyth Barr Group Ltd., Research Division - Director and Senior Analyst of Equities*

Just on the slide. I'm assuming the options A, B and C, (inaudible) 80 megawatts are just the same as Te Mihi unit 3, just due to the field constraints.

Dennis Barnes - *Contact Energy Limited - CEO*

A and B would actually still be that 120 -- well, we got 120 installed. Wairakei 130. And the reason we would keep that capacity in, because this repowering option is repowering on the current skids. It's not taking it all out and sticking it in a 90 megawatts. So it's refurbishing really. Because then you [stack rates], like Mike showed you how we can move production around to maximize the fluid take. Those 2 options would give us that continued potential. So you probably refurbish, repower at the same megawatts.

Andrew Rupert Pelham Harvey-Green - *Forsyth Barr Group Ltd., Research Division - Director and Senior Analyst of Equities*

And C?

Dennis Barnes - *Contact Energy Limited - CEO*

C, don't know. I mean, that's -- anything's open to us really on that one. I like A, of course, which is the trade we're trying to show here. We showed you the Wairakei ongoing cash cost of $14. But that's Wairakei plant and Te Mihi plant and Poihipi plant. And there's an order that Te Mihi would be by far the cheapest on an ongoing cash cost basis to run. Okay. So last question. Do we need to give instructions now, or is it? We're having lunch. Okay. So thank you all. Like I say, we're all around this afternoon. So you'd see us on various tours. If questions come to mind, happy to answer. Thanks for the team. I thought that was, I'm sure you agree, it was a fascinating unveil of geothermal world and the options available to us. So enjoy your lunch, and enjoy the tour.

Thank you all.
