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PRESENTATION BY PACIFIC ECONOMICS GROUP

[8.05 am]

CHAIR: Good morning everyone. I'd like to welcome you to the fourth and final day of the Commission's conference on the Gas Pipelines Inquiry Draft report. We must have worked far too hard yesterday because Wanganui Gas -- oh no, there they are, they have been faithful throughout the whole thing, so I'm glad to see you're back this morning. I would like, though, to thank everyone once again for assisting us yesterday to get through the material.

This morning we are starting with a session with Pacific Economics Group and I believe we have Dr Kaufmann on the video screen. PEG is presenting on behalf of NGC and Vector I believe. So with that brief comment we'll ask for introductions for the sake of the record and also say welcome to you, Dr Kaufmann, a familiar face, even if it is on the video screen rather than in the room, so please proceed when you're ready.

MR SHEPHERD: Good morning Commissioners, I'm just here really to introduce Larry given that he's on video. As you mentioned his work, a benchmarking study and comments on the Meyrick report were sponsored by Vector and NGC and I'll hand over to Larry to take the session forward.

CHAIR: Just before we start I notice there are as many slides as there are pages in the original report and we've got a fair amount of time, but I want to ensure that a significant amount of time is left at the end for questions, Dr Kaufmann, so I'm going to ask you to move through the slides as quickly as you can, covering the

points that need to be covered. So I think we have until 10.15 and I think we should ensure we have at least 45 minutes for questions, thanks. Please begin when you're ready.

DR KAUFMANN: Okay, thank you. I will move quickly, can everyone hear me okay?

CHAIR: Yes, we can, thank you.

DR KAUFMANN: Okay, great. Well thanks for giving me the opportunity to present. I had hoped that my presentation on PowerPoint would be beamed across, it would also be available, but I guess the technology isn't going to allow that, but you can follow along in the handout. Today I'm going to talk about two things, one is my analysis of the reports that were done by Meyrick & Associates, as you know there were two reports, the Meyrick report was the comparative benchmarking report, and secondly I'm going to talk about some benchmarking evidence that I developed on behalf of Vector and NGC.

My overall conclusion really is that ultimately the Meyrick & Associates benchmarking results were really limited by the lack of available data. Dr Lawrence said that he made the best use of available data, I believe he said that in the report and I don't necessarily disagree with that, but there really was a very limited data set available and used for the benchmarking studies that have been use d in the inquiry, only a cross-section of 14 companies for one year and it's very difficult to make reliable inferences on efficiency using such a small sample.

I think one of the implications of having such a small data set was that Dr Lawrence was essentially required to

use less powerful benchmarking techniques and because of that the benchmarking techniques that were used didn't really control adequately for a number of factors that are particularly important in New Zealand, and I'll be talking about some of those factors very shortly.

For this study I was approached by the gas distributors to do an alternative study relying on our database and Pacific Economics Group has been developing a gas distribution database for US gas distributors for over 10 years now and we think it's the best that's available to do really rigorous benchmarking for gas distribution. And we use this database and applied what I believe are much more rich and powerful benchmarking techniques to that data and our conclusion was that NGC and Vector are really pretty good cost performers. The data suggests that they're significantly superior, relative to what's expected, given the 40 companies in our database, and that differs quite a bit from the Meyrick results. Vector and NGC were generally well below the benchmarks constructed for the other companies in the sample and in some models were in fact 13th and 14th of the 14 companies.

So I'm going to talk about that, and before I do I'm just going to say a few words about the Meyrick results, beginning with the productivity growth study. I'm on slide 4 right now. That was a fairly short report and that study was limited by the fact that Meyrick was only able to obtain enough team series data to estimate total factor productivity growth for one of the New Zealand distributors and that was NGC.

NGC's customer base really only represents about a quarter of the customers served in the country, in the

entire industry and in my opinion that's just not comprehensive enough to be a very reliable estimate of the underlying productivity growth of the entire industry. Three quarters of the industry isn't accounted for and it's really difficult to project from one company's TFP growth to entire industry under the best of circumstances because companies' TFP can be very variable from year to year, for example it can depend on the timing of investment and a number of things, that's less true on an industry level.

So I think my message there is simply that I don't have any necessary concerns about the study itself in the estimate that was obtained, but it's difficult to use that number for that company alone as a proxy for the entire industry.

Turning then to the benchmarking study that was done, there Meyrick benchmarked the four New Zealand distributors relative to ten Australian gas distributors and the benchmarking technique that was used was a multilateral total factor productivity index level. So it's similar to the TFP study that was done for TFP growth but here the same sort of information is being used to construct levels of productivity relative to a baseline productivity level.

Now let me say that the multilateral TFP index is certainly a legitimate technique, I'm not questioning that technique per se, but I think most benchmarking practitioners would agree that it's one of the least powerful techniques, it's certainly not as powerful as econometrics done well. It's more of a blunt tool I think as opposed to a more finely tuned sort of instrument, and

when Pacific Economics Group uses multilateral TFP indexes, we very rarely do that as a sole source of benchmarking evidence, we'll do that as a supplementary or complementary source of evidence, but we usually try to rely on what we believe are more reliable sort of techniques to make more valid inferences on efficiency.

Some of the concerns I have with the Meyrick approach, there are really three. One is that it doesn't control adequately for differences in the scale of output and the economies of scale that might be realised, it doesn't control well for customer density, differences in customer density and the impact that that can have on cost performance and only a single year's worth of data was used. That's less of a concern than the other two.

So first on economies of scale and I'm on slide 6 now. One of the main problems with multilateral TFP indexes is that they don't control as well as econometric methods for economies of scale and this is a very important issue in New Zealand because the gas distributors in the country are so small by international standards and if you don't have a benchmarking technique that controls for the cost disadvantage of being small relative to the minimum efficient scale gas distributors can obtain by expanding output then companies are really going to be unfairly disadvantaged. It's very important to have a technique that gives companies appropriate credit for the scale economies they may or may not have attained.

It's fairly straightforward to demonstrate this. I have the map, a very simple demonstration on slide 6 and 7. If economies of scale exist and by definition, if you're comparing two companies at a point in time then the

changes in cost are going to be different than -- they're not going to be as great as differences in output between two companies.

You probably remember the sort of classic U-shaped average cost curve from economic principle classes; and what that is is average cost is cost divided by output and on the vertical axis you've got cost and on the horizontal cost you have output. The shape of the curve is that it starts high so that unit costs are much higher at very low levels of output, they tend to decline as companies expand and then they start to flatten out.

That area of the decline, that's the realisation of economies of scale. You can just dry down your unit costs by expanding output, then there's typically a long flat version where the potential to realise additional scale economies is relatively small and then at some point the cost curve can actually turn up meaning companies have exceeded the minimum efficient scale, they're actually too large and there are diseconomies associated with that.

So if you're looking at two companies at a point in time, if one company is relatively small then it's going to be way to the left on that curve and it's going to be up at the point where, because its output is small, its unit costs are relatively high. So you can compare two companies at a point in time and that's what I've done here in this math.

If scale economies exist then the unit cost for the company that's smaller, and in my example I've got companies A and B, A is the larger company and they both face the same input prices and if there are scale economies then if you just take the total cost of company

A divided by the output of company A, if A is bigger than B then that ratio is going to be smaller than the same unit cost ratio for company B. You can just invert that, then what you have is output divided by cost for A is greater than output divided by cost for B.

Turning to slide 7, cost just has two components, it's equal to the product of input price and input quantity, so I substitute that for the cost on the denominator of each of those expressions and then divide through by input prices which are the same for the two companies, and what we're left with is that output quantity over input quantity for A is greater than the output quantity over input quantity for B. But this is exactly what the multilateral TFP index is. The multilateral TFP index is a ratio of an number of outputs aggregated together divided by a number of inputs that are also aggregated together.

So what this shows is that if you have economies of scale for two companies, one company is larger than another and it's enjoying economies of scale because of that, that's going to be directly reflected in a multilateral TFP index. Other things can be in there as well, there can be real efficiency gains between company A and company B, that can also be reflected in the index, but economies of scale are certainly going to be in there and you need a more powerful sort of technique to untangle the impact of scale economies from other things and to try to isolate what you're really interested in, which is the underlying efficiency of the two enterprises. So I think that's a really important point and it's really one of the real deficiencies of this technique.

Turning then to customer density on slide 8, this is a very difficult issue to control for and I know the Meyrick study takes a number of cracks at it, there are three different models and they all -- the two alternate models were primarily designed to control for differences in density among the companies. The model one, which I kind of think of as the base model, has two outputs, and those are number of customers and volumes, and two inputs which are kilometres of distribution main and O&M costs, and in a multilateral TFP index the outputs form the numerator of the index and the inputs form the denominator of the index. You need a way to weight those things together to come up with a comprehensive input and comprehensive output.

In the Meyrick study the customer numbers receive an 86 percent weight and volumes receive a 14 percent weight in output and those weights actually come from a study that we'd done earlier in Victoria. The Meyrick study doesn't say what the weights are for kilometres and O&M costs, but because gas distributors are capital intensive I think it's likely that more than half of the weight is related to kilometres. I did some back of the envelope calculations with the data that were available in the report and I came up with a weight of approximately 62 percent. That's just an estimate.

So you have kilometres of line receiving most of the weight on the denominator of that index and customers receiving most of the weight on the numerator of the index, and the ratio of numbers of customers to kilometres of line is in fact a measure of customer density, so what that shows is that you have this business condition that

you're trying to control for, customer density; you don't want that to be distorting the efficiency measure that you're computing and in this case there's a direct correlation, a very strong correlation simply between customer density and the multilateral TFP index because of the fact that the components of the customer density measure are so highly correlated with the same sort of components in the numerator and denominator of the multilateral TFP index.

Turning to slide 9, model 2 is an attempt to control to some extent for differences in customer density and it's an alternate model where the inputs now are the ODV values of the capital stock and the O&M, so ODV has been substituted for kilometres of line and in the report it said this was justified in part by the fact that if you're just using kilometres of line you're not picking up all the costs associated with networks and that you would expect there to be more costs associated with more dense networks because there are more off-takes, more services, more meters that sort of thing. All those things are going to be -- if you have more customers along a gas distribution main then you're going to have all those extra costs and those would be reflected in the ODV value but they're not reflected in the kilometres of line.

So the thinking was evidently to have those costs reflected in the measure and if the costs are reflected then the measure is improved and I do agree that the measure is improved, but in my opinion the issue is actually different than that. The real issue is not just to get the costs associated with more dense networks, but it's really to look at the relationship between cost and

customer density and how that relationship varies.

So, for example, let's say you have a 10 kilometre gas distribution main from an off-take point single customer at the end of that main, obviously the real issue there is -- that's going to be very expensive to serve that customer because now you have 10 kilometres of gas distribution main taking it from the city gate to that customer's location. But if you have 100 different houses, say, along that line you can spread the cost of that gas distribution main over the bigger customer base and having more customers along that line is a reflection of higher customer density and what that does, yes, there are more costs associated with each of those off-takes and meters and things like that, so there are going to be more costs associated with each of those customers but the unit costs are going to be lower.

Customer density is something that -- higher levels of customer density are a favourable condition for distributors and it tends to improve cost performance not diminish it. The model 2 multilateral TFP index isn't subtle enough to really capture that relationship. All it's really doing is taking more costs associated with density, putting them in the denominator and by doing that it tends to collapse the score, the multilateral TFP scores, but it's not really addressing the fundamental issue which is how costs relate to customer density. In fact the report seems to almost say that the customer having more dense networks raises costs when in fact the opposite is true. It does raise costs but it reduces unit costs. That's my concern with model 2.

Model 3 begins with model 1, so now again we have

customers and volumes as the outputs on the numerator of the index and we're back to kilometres and O&M costs on the denominator of the index. But Dr Lawrence realised that that ratio could be distorted by differences in customer density and there was an attempt made to adjust that measure for differences in both customer and energy density and what was done there is one of the companies in the sample AGL was at approximately average levels, sample average levels for customer density and energy density, and AGLGN essentially became a kind of benchmark within the sample.

What Dr Lawrence did was he adjusted the customer numbers and the volumes and kept the kilometres of line the same for each of the companies, but adjusted the numbers of customers and the volumes for each of the other sample companies so that they were equal to the N over Km ratio for AGLGN and the V over N ratio for AGLGN, and he also recognised that in doing that, by adding output essentially to each of the other companies in the sample there would be costs associated with that and to recognise those costs the O&M costs for each of the sample companies were adjusted by 0.86 times the change in customer numbers that were applied to each company and by 0.14 by the change in volumes. Those O&M costs then appear in the denominator of the multilateral TFP index formula. So it was an attempt to make a proxy adjustment so all companies in the sample in a sense were similar, so that they were operating at similar levels of customer density and energy density.

Slide 10 now. I have a number of concerns with that. One is that the 0.86 and 0.14 weights in fact come from a

study that we did in Victoria about three years ago and those weights do not refer to the relationship between outputs and O&M costs, they refer to the relationship between outputs and total cost. You can derive weights for outputs and O&M costs but it's more complicated. So in fact I understand this is just kind of a rough and ready proxy but the way the weights were used don't really reflect the actual weights that appear in our study.

In fact the actual relationship between cost and output is much more complicated than those first order coefficients. I'm going to talk about PEG's cost model and show a little bit of some of that complexity in terms of how we model the relationship between cost and various cost drivers, but one real problem with that again is that it doesn't reflect economies of scale, it's kind of positing this linear relationship between changes in customers and changes in volumes and how that would affect changes in costs.

If companies are realising scale economies then that relationship isn't going to be linear. For relatively small companies, if you change customers and you change volumes they're realising scale economies, so their costs are going to rise less rapidly than the changes in those outputs. For other companies that might be close to minimum efficient scale then there might be a linear sort of change. So the relationship is more complicated and it's going to vary from company to company depending on how large they are and the scale economies that they have.

I guess a more fundamental sort of point, and I think this was an interesting exercise, and I've never seen it done before and I did think it was interesting, but I

almost feel like what's been done here is kind of bringing the mountain to Mohammed instead of bringing Mohammed to the mountain. When you think about it, what benchmarking is designed to do is you're focused on coming up with a technique, or a formula that you can use to evaluate the efficiency of enterprises, but you know that efficiency can vary for a number of factors beyond companies' control and you want to be able to control for those factors, you want your technique to be able to control for that.

So the way to do that and the way it's typically done is you develop a technique, then once you have this formula or model developed you would take the conditions of the companies themselves, the specific business conditions they operated under and put those into the model and when you do that you get a benchmarking measure that's tailored to the conditions of the company, it reflects each company's specific conditions.

Here almost the opposite was done. AGLGN was the benchmark and what was done was that rather than having the benchmark reflect the company's data, the company's data was adjusted to reflect the benchmark, the benchmark company for the sample. That's really not the same thing because you're not basing -- the measures that are ultimately constructed, the multilateral TFP numbers that are constructed in the end aren't based on the company's own data, they're based on hypothetical data, and again economies of scale can make a difference in terms of the impact that this sort of approach can have on the benchmarks for individual companies, and I actually just noticed this in the report this morning, but Dr Lawrence also noticed that and on page 49 he talked about what the

potential impact of that, of not controlling for scale economies in the model 3 multilateral TFP indexes and I'll just read this quote it said:

"it should be noted that this approach is likely to be conservative as it does not allow for economies of size. If there are economies of size then operating and maintenance expenditure would change by less than the weighted average of the two output components".

I agree with that.

"all else equal this would provide an advantage to the smaller distributors".

That statement is not true because if in fact cost is going up by less than the cost change that's computed for this proxy, then remember that O&M costs appear in the denominator of this ratio and if you have a smaller number in the denominator then that's going to raise the ratio, that's going to lead to a higher computed multilateral TFP index.

So it's true that economies of scale are important and I think it's not true that this is a conservative approach that's going to tend to favour the smaller New Zealand companies, it really is a bias that works against them, and it's an unfair bias.

Moving now to slide 11, final concern I had with the Meyrick study is the data themselves and not the quality of the data because I'm sure that, and in fact the report said that the reason a single year's worth of data were chosen was that the data become more reliable over time and they wanted to use the best available which are the most recent data, so that certainly is a legitimate reason for focusing on a single year's worth of data.

But there's a problem when you're only using one year's worth of data to construct a benchmark, there can be a number of factors that can affect both outputs and inputs in that single year, and I think that's particularly true for gas distributors. Gas distributors' volumes in particular fluctuate quite a bit from year to year more typically than electric distributors and the fluctuations go in both directions. In particular gas demand is very sensitive to cold weather.

I don't know that this is the case but it's a possibility that could be affecting the results in the Meyrick study because the Victorian companies tend to do very well in the multilateral TFP indexes that are computed and it's possible that there was just a very cold winter in Victoria and that raised space heating demand. So there are a lot of volumes associated with that year and that in and of itself is going to raise the TFP index in that year, it's a possibility. Again that is not a real reflection of efficiency that's just obviously a random effect that's affecting the company's output.

Another issue is there might be changes in cost allocations in a given year and if you're just basing your benchmark on a single year's worth of data that benchmark is going to be more sensitive to cost allocations, and cost reallocations. Again, anything else that might be excluded from the model that you're not controlling for, the probability that any of those excluded variability is going be affecting a single year's worth of data, the impact of that excluded variable in that single year is going to be magnified. It's likely that any sort of excluded variables might tend to cancel out over a multi-

year period.

So just a single year's worth of data, I don't think it's as serious a problem and obviously there is a competing concern in terms of data quality and that's why a single year's worth of data was used, but there are some concerns in terms of the impact that that might have on the results that are generated.

The Meyrick study does say that robust benchmarks could be obtained using the larger data sets that are available in the US. I agree, I think the real limiting factor in this analysis is the underlying data, not the quality of it but just the lack of it. There are only 14 observations available and when you only have 14 observations you don't have enough data to undertake more rigorous sort of benchmarking techniques like economic risks, you're essentially forced to use non-statistical approaches like TFP indexes to construct productivity and efficiency measures. The problem with those types of techniques, the TFP level index techniques is that they can control for these factors which are very important in New Zealand, the scale of the output and customer density in particular.

If you turn instead to US data, you have both a much larger cross-section of available companies and a longer time series of data and both of those things allow for econometric tools to be used and that's what we were trying to do, we were trying to look to alternative sources of evidence, apply more rigorous benchmarking techniques to that evidence and then use that to come up with benchmarks for the New Zealand companies.

CHAIR: I might just interrupt you there for just a second, Dr

Kaufmann. You'll know from having been here we would have interrupted you long by now if we didn't have to deal with the video, but I would like to just stop for a minute and see if anyone would like to ask questions at this point rather than wait until the end, so just let me check with my colleagues first.

DR LAWRENCE: You've raised quite a few issues there, and I think it's probably useful if we go through some of those now. Just firstly before we move on to your study. Firstly a point of clarification, you raised an issue regarding economies of scale and a statement that we'd made actually on page 42 of my printout and we said "all else equal this would provide advantage to the smaller distributors". In fact what we meant there was the way we model that provides an advantage to the smaller distributors, if indeed there were economies of size, this may be not expressed clearly in the paragraph, but it's actually consistent with what you're saying, but perhaps not expressed completely clearly.

Having said that, though, I also note that in the model 3 results that you're talking about there it's actually one of the small distributors, namely Envestra Albury which is actually quite a small operator which performs best on that measure. I think economies of size are unlikely to be a major issue in that aspect of the analysis.

If I could go back and perhaps go through quickly the order of issues that you've raised there in your presentation, so starting with the growth paper; you note that, or you refer to NGC being a relatively small proportion of the industry, it's actually 25 percent of

customers and a third of throughput. So I just start off, as you are aware there are four New Zealand distributors one of which is very small, Wanganui, that is somewhat atypical, but there are three large ones. I was wondering whether you thought NGC's characteristics were atypical of the three large distributors.

DR KAUFMANN: I didn't notice anything atypical in terms of their characteristics relative to the others, no.

DR LAWRENCE: If you're doing this sort of exercise you've got the alternative of basically no information or you've got a sample available that represents between a quarter and a third of the industry. Wouldn't it be fair to say that's a pretty good basis for getting a representative, or at least an indicative result for the industry.

DR KAUFMANN: I'm not saying you shouldn't have done it, I think it's fine, but I guess my concern is how much weight do you put on that and can you project from that result from that one company to the other two companies. In terms of the -- you talked about the characteristics, I think in terms of the sort of characteristics that we expected for benchmarking I didn't see any differences, but we didn't look at things like capital investment and changes in output for the different companies and obviously that's what's going to be relevant for TFP growth, so I don't know how Vector and Powerco compare to NGC on those counts.

DR LAWRENCE: That actually leads into my next question because you actually make some comments there that the company's TFP may be highly volatile from year to year. I was just wondering why you made that statement because we certainly don't see any evidence of that with NGC. I

would have thought that with distribution or utility industries in general, but particularly distributors they're actually characterised by very stable performance over time and that's one of the reasons they're very attractive to investors because they actually provide quite a steady return, they're not subject to a large amount of volatility, so I was just somewhat surprised by that statement. Even if there is some degree of volatility in a growth study we're actually calculating a trend rate of growth, so any volatility that may be in there is indeed removed by calculating the trend rate of growth. So I was just wondering why you made that statement.

DR KAUFMANN: Because I think there is volatility on both the output and input side. On the output side in particular for volumes. When we do gas work we're very sensitive to what's happening with volumes, we examine that very carefully because volumes do fluctuate from year to year up and down depending on the weather in particular. So on the output side that obviously matters and on the input side the timing of investment can also matter, that can be varied from year to year and that can impact the TFP growth rate.

DR LAWRENCE: You would appreciate that with regard to investment we're actually using capital stocks rather than investment flows in calculating input quantities, so even if there's an increase in investment the impact on that on the capital stock is very muted and takes time to show up, so, I don't think investment flows are a big influence on TFP figures in the short term. I'd refer you to figure 1 in the growth report which actually plots the output

trends, inputs and TFP. You'll see the TFP trend there is quite stable over time, it's certainly not characterised by a high degree of volatility.

If we could perhaps move to the levels study and go through the points that you've raised there. You start off by talking about TFP indexes do not generally control as well as econometric techniques for differences in scale and I guess there's two ways of approaching this sort of a problem. Firstly you can have samples that are fairly similar in terms of their characteristics which makes these operating environment conditions such as scale less important, or you can have a much more diverse sample that gives you the luxury of more observations, but it makes adjusting for these operating environment conditions much more important, and I guess we have adopted the former strategy rather than the latter and you have attempted to adopt the latter in your work.

But while econometric techniques in principle, or in theory, can adjust for some of these things I think the practical experience with those sort of techniques is actually quite different and I think it's fair to say that experience with cost function type techniques has shown that particularly multicolinearity problems really severely limit the number of operating environment conditions you're able to include in those sorts of studies and other statistical difficulties as well such as lack of variation in the data on key characteristics.

So I was just wondering in your experience have you encountered these multicolinearity problems that have in fact limited your ability to include more than a small number of operating environment conditions.

DR KAUFMANN: Sometimes multicolinearity is apparent between different cost drivers and if that's true then the model will, when you try to include a cost driver like that, the econometric will tell you that the variable isn't significant. That doesn't mean that it's not really significant in an economic sense, but like you say, if there's multicolinearity it's hard to distinguish separate impacts from two variables that are highly correlated.

So it's somewhat of a -- it's obviously a concern and this isn't an exact science, it will never be an exact science, but in terms of the amount of variables that we're controlling for in our studies we're getting R squareds of 98, 99 percent, something like that, we're picking up almost all the variation in the dependent variable. So it's not to say we're not missing some things, but I think we've got a very complete model.

DR LAWRENCE: We'll come back to the statistical properties of your model after your presentation. I'll just ask you another question related to that. I think it would be fair to say it's much more important to accurately adjust for economies of size differences when you're comparing New Zealand to the US than when you're comparing New Zealand to Australia; in other words the New Zealand utilities are much closer in terms of their size to the Australian distributors than they are to the US distributors.

DR KAUFMANN: They're closer, but I still don't think they're all that close. I think the sample of ten from Australia has two companies that are smaller than the New Zealand companies and that was Albury and I believe Country Energy are both smaller. There are a couple of companies that

are about the same size and those are the distributors in Queensland, At2(?), in relative terms it's still a relatively -- it's still 60 to 70 percent larger but it's relatively close to those companies in terms of size. But then the other five or so are much bigger, they have half a million to 800,000 customers, so that really is a fairly big difference in the size of operations. I think even in that sample it's an important issue.

DR LAWRENCE: I was going to raise this later but seeing that you've raised it now we might as well go through it now. Actually in our database five of the ten distributors are smaller than the larger New Zealand distributors in terms of customer numbers which you identify as essentially the key output variables, the largest New Zealand distributors on that basis is Powerco. The largest distributor in the Australian database Multinet has about six times the number of customers of Powerco.

I think it's instructive to compare that with the database you subsequently use in your study where the average, well go back to the absolute values first, there is only one distributor in your database, I think that is Central Hudson Gas & Electric that is actually smaller in terms of customer numbers than the largest New Zealand distributor Powerco, and indeed the average of your sample on this basis is actually eight times larger than Powerco and indeed you have a quarter of your sample that is over 10 times larger than Powerco and your largest distributor which is I think Southern California Gas is over 50 times larger than Powerco, so I think that puts in perspective the relative difference in sizes that we're talking about between New Zealand versus Australia and New Zealand

versus the US.

DR KAUFMANN: Yes, and I think that's an advantage actually. The fact that there is such a wide dispersion of available sizes in the US from over 5 million customers of Southern California Gas to about 55,000 for Central Hudson and all different sizes in between does give you quite a range. When you have data points that are kind of distributed along that range it gives you more confidence that you really are capturing the relationship between cost and customer numbers.

Let me just say with respect to Powerco, Powerco isn't in the study. I was referring to both Vector and NGC when I made that comment in terms of how they compared to the rest of the sample.

DR LAWRENCE: I think we'll come back to the statistical implications of those very large differences in the size of the distributors in the various samples after we've gone through your study because they have some very important implications for how valid it is to extrapolate outside of your estimation range to extremely small distributors in New Zealand or Australia for that matter.

DR KAUFMANN: I should add that the two New Zealand companies were in our sample, we included them as well when we estimated the model. So there are actually 40 US companies and the two New Zealand companies.

DR LAWRENCE: But you've got two outliers in terms of the two smallest companies in your sample and there are certain features of the estimation procedure that you use which will bias your results toward the very large end of your sample, but I think we should come back to that later.

If we could just move on to another issue that you

raised; you were talking about the adjustment we did on operating and maintenance costs using your earlier results. I think it's fair to say that using the first order coefficients to get implied output shares of costs is a reasonable first order approximation, would you agree with that?

DR KAUFMANN: It's a reasonable approximation to the impact on total cost?

DR LAWRENCE: First order approximation is the term I used.

DR KAUFMANN: Not necessarily because I do think again that the impact is going to vary from company to company depending on where they start and the sort of implied costs that would be needed to get them to the sample mean. So I do think it depends, it depends on where the company is, and the potential scale economies that they might realise is moving to the sample.

DR LAWRENCE: I think you have a statement in your report which I can't locate off-hand, but you sort of actually draw attention to the role of the first order coefficients and you actually state that they actually provide important -- they have an important role in your model --

DR KAUFMANN: They do.

DR LAWRENCE: -- in terms of providing a reasonable approximation to the results of the sample mean.

I think you also made the point regarding second order coefficients and perhaps it would be desirable to include those. I think, if I'm correct, in your model you actually normalise the data relative to the mean for each variable, is that correct?

DR KAUFMANN: Yes, we do.

DR LAWRENCE: I think that greatly reduces the importance of

second order coefficients, it means that you will be picking up most of the relationship from the first order coefficients.

DR KAUFMANN: It does blunt the impact, yeah.

DR LAWRENCE: You also raised the issue of O&M costs versus total costs and indeed you'd be aware that, I think I'm correct in saying that from the published, or the report that we had available from your Australian study we were only able to obtain the relationship for total cost, I think I may be -- correct me if I'm wrong, but I think to actually get the O&M relationship we would actually need the data for the utilities as well as the actual coefficients.

DR KAUFMANN: I don't believe that's correct because the study we did for them was an O&M benchmarking study I believe, from recalling correctly. So we did have the total cost coefficients and we also had the O&M cost share coefficients there. So it would have been possible, it would have been messy but --

DR LAWRENCE: Certainly much more complicated.

DR KAUFMANN: -- it's possible, yeah.

DR LAWRENCE: I think would it be fair to say, though, that O&M costs are mainly influenced by customer numbers rather than throughput?

DR KAUFMANN: Yeah, I believe that's true.

DR LAWRENCE: It's fair to say that using the total output relationship is going to be a reasonable approximation for the O&M cost relationship?

DR KAUFMANN: Yes, leaving aside the issue of scale economies.

DR LAWRENCE: Okay, can we just move on quickly to the issue of using the AGLGN benchmark, or using that as a sort of a

numerare(?), if you like, for normalising the customer and energy densities; I think you would have to agree it's sort of a common technique in benchmarking approaches, particularly multi -- well, it's actually a feature of multilateral index approach that you actually compare everything relative to an average of the sample, that's how the technique works, that's how it makes it invariant, so what we're doing is essentially roughly consistent with that indexing procedure that we're using to calculate the productivities in the first place. I acknowledge that it's quite different to a cost function based approach but it needs to be, to be consistent within this particular methodology that we're using.

DR KAUFMANN: Yeah, it is true that in the multilateral TFP method that -- it is expressed relative to the sample mean, that's correct.

DR LAWRENCE: You make some comments about hypothetical benchmarks and how that's different to using own data, but I'm a little bit confused by that because the way you report your own results essentially utilises the hypothetical concept. In other words you're reporting your actual costs relative to a predicted cost based on your sample, which is itself a hypothetical construct, or hypothetical figure. So I'm just a little bit confused there. It's fair to say you're using essentially a similar hypothetical concept.

DR KAUFMANN: I think that's an important point. I think there is a real distinction. Because what we're using, is we're making -- our approach does make estimates of the fundamental cost drivers, or the relationship between cost and various variables that are driving cost and that is

what we try to estimate, and I think that's fundamental.

But what we do then -- and that process does construct a hypothetical, I suppose you can say, cost measure for an average firm, but what's important about that is that hypothetical cost measure can be tailored to reflect the individual conditions of each firm, so what's fixed in your approach are the coefficients themselves, the underlying cost drivers, what's inherent in the technology that relates cost to the variables. That's what's fixed and that's what we hold fixed and that's what we estimate and then we take the data from the company itself, that goes into the model and those data reflect the company's own conditions and then the model projects a cost figure which again is tailored to the company's conditions and all the interactions between those business conditions.

In that sense that's the difference, the benchmark that comes out at the end reflects the company's own conditions and not the conditions of the sample mean.

DR LAWRENCE: The point is they both use a hypothetical construct and there are different ways of getting to, if you like, a way of trying to standardise for a range of operating environment conditions, or in this case customer and energy densities within the sample.

DR KAUFMANN: Yeah, a benchmark is a hypothetical construct, any benchmark will be. I think the real issue is does the benchmark reflect the company's own conditions.

DR LAWRENCE: We might just move on. You also make some comments, I think you acknowledge this in your presentation about the trade-offs involved in using a single year's data versus multiple year's data. I think some of the comments you make in your paper reflect, if I

can put it this way, a North American perspective, where you've got the luxury of a much larger database over quite a number of years, it's much more mature, it's much more stable.

I think you'd be well aware that in New Zealand and Australia we don't have that luxury because the data is still in its relative infancy and it's still being refined quite rapidly over time, so I think you would have to agree that it's a reasonable approach to use the most recent year's data in that circumstance because it's going to be much better quality, it's going to be much more refined and hopefully more accurate data than earlier year's data which, particularly in terms of asset valuations and the like, is still quite variable.

DR KAUFMANN: Yeah, I absolutely agree with that. That's not a major point, I think that's a very reasonable sort of approach to take in general.

DR LAWRENCE: I think that's the major points I had at this point.

CHAIR: Why don't we proceed then, Dr Kaufmann, with the presentation, I believe we're on slide 13, is that correct?

DR KAUFMANN: Yes, that's right. I've already talked a little bit in general terms about our benchmarking approach and I'm not going to go through all the gory details of this, but I do think it's important to try to give the Commission a better understanding of exactly what it is we're doing so that hopefully you can have some confidence in what ultimately comes out of the process.

So I am going to go through this and touch on a few technical details here and there just to present those and

to kind of put those on the record and give you something to mull over in terms of what it is that we're actually doing. Basically what we've done is we've developed an econometric cost model and that cost model relates cost as the dependent variable to three sets of independent variables or cost drivers, and those three sets of variables are outputs, input prices and business conditions, other business conditions.

This is a very well developed sort of approach, it comes right out of economic theory, so it's got a very strong grounding in the literature. Then given that sort of basic model what we've done is we've estimated that model with US gas distributor data and what we attain is estimates of the underlying cost drivers, so the impact that changes in output, changes in input prices and changes in these other business conditions have on a company's costs. This basic approach has been used and accepted in a number of regulatory proceedings that we've been involved in and others as well in the US, Canada and Australia and increasingly in other countries as well.

Turning to slide 14 the basic data that we used, again we've been developing this database for over ten years and it's different than the electricity industry in the US in that there's not a centralised source of data that you can go to. In the electricity industry FERC collects FERC Form 1 data, it's been doing it for 50 or 60 years, so there's a very solid and well accepted sort of template and series of data for the entire industry.

That's not really the case for gas. You can look to different publicly available sources but you have to look in a lot of different places and pull the data together

and that's what we've done, relying on a number of sources like uniform statistical reports which was a file that companies used to file fairly regularly and many don't any more.

A number of State Regulators have separate mandatory data filings for their gas distributors and in those cases we get those reports from the State Regulators, and FERC does have something called FERC Form 2 which is for the gas industry but it's limited because it's -- that only refers to companies that are FERC regulated, so there it would be companies that have some interstate gas operations which is a relatively small subset of the industry.

So we've been developing this database from a number of sources and checking and rechecking, it's not at all uncommon for us to use two different data sources for the same company and check and double check figures against each other just to make sure that we have real confidence in the underlying data.

So right now our database includes about 40 companies that we feel have quality data and it's a very heterogeneous sample in terms of things like size of the companies, input prices they face, the different regions in the country that they operate in, and other things like that, customer density, urbanisation, factors like that.

On slide 15 this actually presents the sample of companies that we use and Denis has already talked about some of these companies and some of their characteristics, for example you've got companies as large as Southern California Gas with over 5 million customers. The smallest company in our sample is Central Hudson which is about the

size of Vector and NGC, but as you can see there aren't many US companies that are about that size.

Even though it's only 40 companies, that still accounts for over 52 percent of customers and even more of that in terms of volumes served in the industry, so we feel that it's fairly representative as well but obviously not completely representative.

Moving to slide 16, one of the things we tried to do was to come up with a measure for gas distribution costs that was comparable with the measure that's been considered in this inquiry. And that measure would include the gas distribution service itself and also meter ownership, but it would exclude meter reading billing and collection and other costs that are related to retailing operations and that's the measure that we constructed for the US companies. The database that we have is disaggregated enough that we can take out meter reading costs, billing collection costs, other things like that and we did in fact remove those costs which we'd otherwise include in our distribution measure. We took those out of the cost measure so it was comparable to the cost measure that's being considered here.

Administrative and general costs, both expenses and plant, we allocated those to between gas and other operations, particularly electricity, based on relative share of expenses, of the non-administrative and general expenses so that they were proportionate.

Moving to slide 17, capital costs, we followed a fairly standard sort of approach to measuring capital costs and again we have to construct -- cost is our dependent variable, so we do have to consider the costs

associated with capital ownership as well as O&M costs when we're evaluating overall performance. What we did is we have a quantity of capital in a given year and then we multiplied that by a capital service price that applies in that year, we constructed the quantity of capital through this equation that's the third from the bottom on this page, this is sometimes called perpetual inventory approach to capital accounting, and essentially all you're doing is you're taking the capital stock in the last period, taking off depreciation, adding investment to it and then deflating that investment by a deflator that reflects inflation since the base year. We've been doing that -- our capital addition series goes back about 20 years so we have a base year capital in 1983, we add up capital addition, we apply this formula to capital additions since 83 and develop a capital stock in all of those later years.

The asset price deflator we use is something that's estimated from a company called Handy-Whitman which develops a number of different indexes for construction and asset price inflation for different utility industries and we use the Handy-Whitman index for gas distribution to deflate the capital additions.

On slide 18 we used a very simple user cost of capital -- sorry, a capital service price in this study which just has three components. The first component there reflects the opportunity cost of capital; essentially it's like the return on capital, it's very similar to that. The second component reflects depreciation and then the third component is capital gains. All that is is the change in inflation from year

to year. This is something again that kind of comes out of theory that says that there should be this capital gains component. We smooth that so that we actually take a moving average of capital gains over the time period. Then we apply the same deflator, the Handy-Whitman deflator so it also reflects inflation as well.

So that's our cost measure, the sum of capital costs and O&M costs, again tailored to be consistent with the set of services that are considered in the inquiry, and for the independent variables or the cost drivers, on the output side we've got customer numbers and volumes which are the same outputs that were used in the Meyrick study. Input prices, we've got the capital service price that I just mentioned, the price of labour which here is an employment cost index for the US electric gas and water sector, that comes from the Bureau of Labour Statistics.

The price for other inputs is a very difficult thing to pin down. There are some companies that estimate that, but we found that those rates of -- if you use those sort of tailored estimates they don't really vary too much from, say, broader inflation measures like change in the GDPPI. So we just use GDPPI as the deflator for other O&M inputs. We apply that same deflator to all companies.

Then there were two other business conditions in this model, one is the miles of distribution main and this is designed to pick up the customer density issue. If you have both customer numbers and miles of main in the model then by having both of those in the model then you're considering the relationship between customers per miles of main, so you don't need to have that explicitly. We've got them both in there so we're accounting for customer

density. Also because we have volumes in customer numbers we're also accounting for energy density or volume per customer.

Then finally the percent of main that is not cast iron, we found that having a very cast iron intensive system can be very costly, those were typical of very old systems, they leak a lot and have higher maintenance costs, so we include that as an independent variable as well. The reason this variable isn't percent of main that is cast iron, is that there are some companies out there that have no cast iron at all, it just so happens if we use a value of zero our model won't accept a value of zero because it's a log model and the log isn't defined at a value of zero.

Let's move on to slide 20. This is the cost function itself and --

CHAIR: Our non-economists are enjoying this slide a lot.

DR KAUFMANN: I thought they might. This looks like kind of a beastly thing, but --

CHAIR: We're going to let Commissioner Bates who's a lawyer ask the questions on this slide Dr Kaufmann.

DR KAUFMANN: Okay. Let me just explain some of the intuition behind this and not grind through the math, but what this is designed to do is it's designed -- you have to have this type of complexity if you're going to pick up economies of scale, for example, because when you're talking about economies of scale you're not talking about a linear relationship. You've got costs on the one hand and output on the other and at very low output levels, costs rise relatively slowly and then they start to rise a little bit faster as you start to approach the minimum

scale, so you need something that reflects that relationship, you need non-linearities and you also need to consider the interaction between these different variables. It's not just the amount of variables, but the mix, or the amount of outputs, for example, that companies are providing but the mix of outputs. You need to consider that to really get at customer energy and energy density, for example.

What we have here is this first line just reflects what Denis was referring to earlier as the first order of conditions. We've got on the left-hand side we've got costs as the dependent variable and then on the right-hand side we have all these cost drivers and that first line reflects the first order term, so this, if we stopped at this line it would be a log linear model, but all the stuff underneath that reflects the interactions between outputs and the -- what are called the quad rat I can terms in outputs are essentially the square terms.

So just to let you know that this is the model we used, it's a very well-defined, well accepted kind of model, in fact it can be shown that this model is an approximation to any underlying production technology, and that's really the real fundamental rationale for using this, is that it doesn't restrict the underlying technology. We don't really know the underlying technology and how firms are combining inputs to produce outputs. It just so happens this cost function which is called the translog cost function is a very flexible and non-restrictive sort of approach that doesn't restrict that underlying technology.

Slide 21, and this I promise is the last technical

kind of slide, but again just to let you know what it is that we did, what we actually estimate is a system of equations, so we have cost and we also have the share equations for O&M and for capital costs. Those are again developed through a well developed approach called Sheperd's lemma and we estimate all three of those things simultaneously. There are good reasons to do that as well.

But one thing I'd like to point out, and it may not be recognised and in fact I don't think I really made explicit mention of it in the report is that we have an estimation procedure that's designed to control for something that's called heteroskedasticity, and what that means is that the variance terms of the errors differ from company to company. In general if you have heteroskedasticity, if your information procedure suffers from heteroskedasticity then you're not going to be making proper inference on the coefficients on what's a significant cost driver and what isn't.

This is important, and the reason I'm telling you all this, is because we do have a very heterogeneous sample and when you have a sample that's that heterogeneous then you might expect that even after you -- you might expect that the variance of the error terms that are associated with any individual observation in the sample are going to differ from company to company, it's a legitimate concern.

So we developed an estimation procedure that controls for heteroskedasticity. There's well developed ways of doing that, but usually only in a single equation case, so if you're only estimating a single equation. It took a long time for us, in fact we had an econometrician working

on this for about a solid two months to work out the right way to implement heteroskedasticity corrections in a multi-equation system. So just to let you know that we do have a procedure here that's designed to control for what might be considered a potential problem with applying econometrics to these samples. That's the end of the technical discussion.

Slide 22, here are the results that result when you apply this translog model to the data that we used, and we do have the first order terms here highlighted. So let's go to the right column first and at the top there we've got N, and N is the customer numbers. That coefficient there, just on that first order term, represents the estimated impact of a 1 percent change in customer numbers on a company's total cost, holding everything else constant. That's also true for each of these other coefficients, the first order coefficient. The same thing on V which is the impact of volumes, that coefficient, 0.071, again that's the percentage impact on estimated cost of a 1 percent increase in volumes.

You can see that the number of customer coefficient is quite a bit bigger than the volume coefficient which indicates that customer numbers is a much bigger cost driver than volumes, and in fact the relative proportions of these two outputs as cost drivers is similar to the 86 percent that we found in the Victoria study and that Denis mentioned before.

One other thing I should mention is that the Victoria study did not use that heteroskedasticity corrected estimation procedure. I tend to think of that as obsolete. We implemented that, it worked for Boston Gas

in 2002, 2003, and all our work since then uses that procedure.

The coefficient on NI, that's the coefficient on the non-cast iron variable, and that's negative. All of these are significant, by the way, they're all statistically significant. So what that indicates is that as your system becomes less cast iron intensive, as the percentage of your pipes that are not made of cast iron declines, then your costs go down. So your costs decline as your sensitivity -- as the percentage of cast iron pipes -- as the percentage of non-cast iron pipes increases then your system becomes less cast iron intensive so you have lower costs associated with that.

That's the same thing as saying that cast iron pipes are costly. If you have more cast iron then costs will increase.

CHAIR: What's the logic for the relatively low parameter estimate on volume? Why do you think you get that result?

DR KAUFMANN: I think if you step back and you think about a gas distribution network and what's really driving the cost it mostly does depend on the customers and where they're located. Essentially you would lay a distribution main and then you'd have services coming off that main with meters associated with each customer and those costs are mostly fixed and they're mostly driven by the customers that you're serving and where those customers are located.

CHAIR: Isn't this being driven mostly by customer numbers? Am I not reading this right?

DR KAUFMANN: Yes, that's right. It's being driven by customer numbers and that last variable in that column,

that's the miles of distribution main, that's the coefficient on the positive distribution. So these are the two main things that are driving on the output and location sort of issues. It's the road sort of analogy that Denis uses sometimes, that the real costs are with building the road and the traffic that comes down the road doesn't have that much impact on the company's cost. The volumes there are obviously the traffic and the road.

On the other side, the left-hand column the first shaded term is the price of labour and the second shaded term is the price of capital. Again, the interpretation of these is that this is how much costs would increase given a 1 percent change in these variables, holding everything else constant. You can see the price of capital has a much bigger impact than the price of labour because these are in fact capital intensive businesses, most of their costs are driven by capital.

The other variables there, these are interactions terms and square terms, so these are the other sort of elements of the translog cost formula. But just looking at the shaded terms and the business condition terms gives you -- it kind of conveys the real, I guess the essence of the model but -- it's certainly not unimportant that there are these other terms because those other terms do drive the relationship between costs and economies of scale for example, so they're all there, they're playing an important role but just to kind of give the essence of what we have, you can just look at the first order terms.

This final number on the right-hand side, that's the system Rbar-squared, that's the R square, that's the fraction of the variation in cost that's captured by the

variables on the right-hand side. That's going to be a number between 0 and 1, so as it approaches 1 -- if you had a number equal to 1 that means you're capturing 100 percent of the change of cost, in this case, by the variables you're considering, and you can see here we're capturing about 97 percent of the change in costs by the variables in our model.

CHAIR: Why on the first order volume estimate would you not expect it to be negative? Wouldn't you have expected, as volume increases, costs to reduce? Am I looking at that wrong?

DR KAUFMANN: You're thinking of the second order term in a sense, and that is negative, if you look at the VV underneath it, that's a negative term. I think what you're thinking there is kind of the relationship between, say, volume per customer, holding customers constant, then if you increase volumes so one company has more volumes per customer than another, that's kind of the VV term and that is in fact negative.

So those are the results from our econometric model and turning to slide 23 we then applied this model to the New Zealand companies by taking these parameter estimates and then taking specific values for each of these business conditions, price of labour, price of capital, customers throughput, percentage of main that's not cast iron and miles of main and all the interactions between those things; we put those exact values into the model and then we generated a cost prediction.

So for that part of the exercise we got data from the companies on each of these things and tried to divide things as comparably as we can between the US and

New Zealand to make sure that we have the most appropriate measures there and then we took each of those variables and placed them in the model and generated a prediction and a T-statistic which you can use to judge the statistical significance of that prediction.

For customers and volumes those are pretty straightforward, defined pretty much the same in the US and New Zealand, kilometres of gas main and percentage of main that's non-cast iron, again pretty straightforward. The labour price measure that we used, that was data from Statistics New Zealand on the electric gas and water sector wages.

For other O&M prices what we did was looked to data from Mercer which is an international executive placement company and they have a number of data on what the cost of living is in a number of cities throughout the world and it's all expressed relative to New York and there was data on Wellington and I believe Auckland, and we used that data to construct relative cost of living indexes relative to our US sample and New Zealand and then we used that as the basis for the O&M price level. So that's how we linked to O&M prices in the US, to other O&M prices, to other O&M prices in New Zealand.

CHAIR: What does the Mercer study use, the current exchange rate, is that what it does?

DR KAUFMANN: I'm not sure, it's expressed in index numbers and it looks like a PPP type of rate.

On slide 24, this is the capital service price and what we did there is we -- there are three elements of that price that we needed to develop that for New Zealand and then to link that to the US. One is to come up with a

rate of return, and what we did there is we looked to the economy-wide return to capital for the New Zealand economy, we computed that using national income account data. Depreciation, we assumed that was equal to 4.5 percent, I believe that's the same assumption that was used in the Meyrick study and we also again needed to link this on a levels to levels basis with the US, and there is a company called Richardson which is an engineering company which has compiled a lot of data on the cost of building different types of facilities in different parts of the world and they don't have any data for New Zealand, but do have data for Australia, again expressed relative to the US.

So what we did as a first cut at this was to take the Richardson data on construction cost levels in Melbourne relative to the US and we used that as an estimate of the differences in construction costs between the two countries.

CHAIR: There's nothing in the national accounts that would be more appropriate to New Zealand?

DR KAUFMANN: We didn't see anything. We couldn't find anything more appropriate. I should say, though, that we were a bit under the gun for this study, we didn't have as much time to investigate all these issues as we normally might.

CHAIR: I wouldn't necessarily think the construction costs would be similar for Melbourne and New Zealand; but you've done sensitivity analysis, does it make much difference?

DR KAUFMANN: No, it doesn't, that's right. So we did a sensitivity analysis where we assumed no construction costs differentials between Australia and New Zealand.

What Richardson actually shows is that construction costs tend to be much higher overseas than in the US when you factor in differences in productivity of labour, that tends to raise construction costs overseas. So the Richardson data showed that construction costs are higher in Melbourne and our sensitivity was essentially to assume that away and to assume that construction costs were the same.

CHAIR: That translation of those construction costs in Melbourne to the US were done on what exchange rate assumption?

DR KAUFMANN: That's on a purchasing power parity exchange rate. In fact the model does generate predictions in US dollars, it's estimated with US data so it's going to give you a US dollar prediction for costs. What we did then is we compared that prediction to the company's costs which was converted to US dollars using the purchasing power parity exchange rate.

CHAIR: I just ask that question because when we've done this work in telecommunications the result is practically driven by what exchange rate you choose to adopt. To say we have had extensive debate on that is an understatement.

DR KAUFMANN: We did look at the exchange rate that was used in that decision, and if we would have used that rate the company's actual cost in US dollars would have been about 20 percent lower.

CHAIR: I'm not surprised. I saw that in the paper I'm not surprised. It makes a big difference to the result. We had contended for the spot rate or the PPI which even increases the difference more, but anyway, please go ahead.

DR KAUFMANN: Okay. Slide 25 presents data on each of these variables, for the US and for the two New Zealand companies. What this slide shows is the values for costs and each of the cost drivers for the US relative to the two, well both the US sample average and how the two New Zealand companies compare to the US. It's pretty clear that these two companies are quite small relative to the average US company, 6 and 8 percent of customers served, 5 and 8 percent of the computed gas delivery costs. So that implies that the cost per customer is lower, or equal, for the New Zealand companies compared with the US sample average, without controlling for anything else.

The total throughput, even smaller than customers relative to the US, 4 percent and 5 percent. That implies that volume per customer is lower in New Zealand than in the US. If we kind of go to the entry, the second to last entry from the bottom, the miles of distribution main, there we've got 14 percent for NGC and 26 percent values for miles of main relative to the US.

That indicates that since that is so much greater than the customer fraction, that miles of main per customer for both of the New Zealand companies is much greater than for the US companies. So that's equivalent to saying that there's less customer density for the New Zealand companies than in the US sample. Both customer density and volume density are factors that tend to work against companies, so it's important to control for those and both of the New Zealand companies are disadvantaged by those factors compared to the US sample.

Looking to price of capital, price of labour, price of

materials, price of labour and price of materials are similar. Materials are a little bit lower, reflecting a slightly lower cost of living in Wellington compared to the US, at least according to Mercer and price of labour slightly higher. That surprised me a little bit, but I think that might reflect the fact that there's been much more out-sourcing -- in part there's been much more out-sourcing in New Zealand than in the US industry, so the composition of the workforce that remains tends to be managerial and higher skilled and higher paid.

CHAIR: Those costs in the US must vary very significantly across the US don't you think?

DR KAUFMANN: Sorry, I missed that.

CHAIR: You use an average for the US on these costs or prices, they must vary very significantly across the US, is that right?

DR KAUFMANN: They do, that's right.

CHAIR: Does that cause us any concern?

DR KAUFMANN: This is just kind of descriptive data, just to give you a sense of the average in the US and the two companies. What might be most surprising here is the price of capital services that shows that it's quite a bit higher in New Zealand than in the US. That is mostly driven by the Richardson assumption on higher construction costs in Melbourne, again we tested the sensitivity of that.

CHAIR: I think Commissioner Bates had a question Dr Kaufmann.

MS BATES: I just wanted to clarify with you what you said about the price of labour and I think I understood you to say that it was higher in New Zealand than in the US, right?

DR KAUFMANN: Correct.

MS BATES: You thought that was because of out-sourcing?

DR KAUFMANN: Yes, this is the price of labour in the industry, that's right.

MS BATES: But does it matter -- I mean you mean out-sourcing, work to be done by contractors obviously?

DR KAUFMANN: That's right.

MS BATES: Does it matter whether the labour is supplied inside or outside of the company, because you still have to engage the labour whether it's in-house or not in-house?

DR KAUFMANN: That's right, a lot of those out-sourcing contracts obviously are labour but this is a labour -- but the companies report that as other O&M expenses, so this is a labour measure, as I understand it, within the industry that reflects the labour employed in that industry and not out-source labour.

MS BATES: Where is it picked up in this then, in your table?

DR KAUFMANN: What, the out-sourcing?

MS BATES: Yeah.

DR KAUFMANN: That's reflected in other O&M costs, and here the price of those other O&M costs is the price of materials.

MS BATES: So that comes in there, right?

DR KAUFMANN: That's right.

MS BATES: So is the price materials correspondingly different in the US?

DR KAUFMANN: Yes. The measure that we're using here is a lower price of materials in New Zealand.

MS BATES: Thank you.

DR KAUFMANN: Turning to slide 26, I think we've already gone

through that, the table shows that the importance of scale and volumes per customer and customer density, all those things are very important to control for in a benchmarking model because there are such differences in the scale of output, and to a lesser but still important extent there are differences in customer density and energy density between the New Zealand companies and the US companies.

On slide 27 this is the result of our model where we inserted these various cost drivers into the model and came out with cost predictions. The model also produces T-statistics which are testing the statistical significance between any difference between what the model predicts as cost and what the companies actually have as cost.

You can see that, and we did this for the entire 1997 through 2002 period for both NGC and Vector, and you can see that for both NGC and Vector our model shows that after you control for these very important factors like scale of outputs and customer density and things like that, that the predicted cost for each of these companies is lower than the actual cost that they have and that difference is statistically significant. For Vector it's 21 percent lower and for NGC it's 30 percent, just over 30 percent lower.

That result implies that these companies are effective in keeping there costs below what would be expected. Here below what would be expected, this is kind of the benchmark, this is the cost that an average US gas distributor would have if it faced the same exact business conditions as these companies. So an average gas distributor, if it was operating in NGC's system, would

have costs about 30 percent higher. Vector, again an average US gas distributor would have costs about 2 percent higher for Vector's system. That was the result that we obtained using the model.

Slide 28, this records some of the sensitivities that we considered. We start with the base case predictions and consider the one scenario we already talked about which is there's no differential between construction costs in New Zealand and the US, and we also looked at differences in the opportunity cost of capital, or -- I didn't use this term and I hesitate to use this term -- but differences in the WACC, this is what I'm really talking about here and whether that would really make much difference for the results.

In all these cases what we found is that those changes had very little impact on the results. NGC stayed close to 30 percent below predicted cost, Vector stayed 20 to 21 percent below predicted cost, so the results aren't sensitive to those assumptions, the results are robust to changes in those assumptions.

To conclude on the last slide, what we were asked to do in this proceeding was to provide some evidence on the company's efficiency using what I consider to be more robust techniques and techniques that are really designed to control for issues that are very important for these companies, like economies of scale and customer density. Econometrics is able to do that, the multilateral TFP indexes can't do that nearly as well, and our results show that NGC and Vector are in fact pretty good cost performers, very good, significantly below what would be expected for a US firm.

That conclusion isn't really affected by the assumptions we've made on the capital service price or exchange rates. If we used different exchange rates then that 20 and 30 percent would be something more like 40 and 50 percent.

CHAIR: Can I ask you, Dr Kaufmann, when you look at the results for the US companies that either significantly under-perform or over-perform from the average, what's the variation look like for those that are significantly better performers or under-performers, how much variation are you seeing across the US companies?

DR KAUFMANN: There are about 40 companies in our sample and if the model is telling us that any company is more than say 30, 35, 37 below predicted cost we tend to question the model, that just doesn't seem like a plausible sort of result. And in fact that's what we tend to find in this model, is that a result of close to 30 percent below predicted cost is just about -- that's at the high end of what we're seeing for the US companies, there are one or two US companies that are a bit higher than that, but similar, and on the other side there are some companies that are 20 to 25, 30 percent above predicted cost; so it's fairly symmetric in that sense.

You can divide the sample in three types of companies in terms of the significance of the results. There's going to be a number of companies that are grouped around -- where their actual costs are equal or close to their predicted cost and you're not going to be able to find any statistical significance in the difference between actual and predicted cost. Those bounds tend to be within 8 to 10 percent, so if you're within plus or

minus 10 percent of predicted cost, that tend to be the range in which -- you can't really discriminate between actual and significant costs, or actual and statistically different predicted cost.

In terms of, say, the sample of 40, I think about 15 companies or so tend to be in that range, so we find about 15 out of 40 companies are about what you'd expect, and maybe 10 or so, 10 or 12 are significantly superior and 10 or 12 are significantly inferior.

CHAIR: How do you decide that a company was showing actual costs 35 percent lower than what you predict would cause you concerns about the model, but if it's up to 30 it doesn't? I mean what is it about 35 as opposed to 30 that says to you you'd want to think again about your model?

DR KAUFMANN: Well, there are a number of things that go into evaluating a model when we think about it, that's just one of them. It's just kind of a reality check or a sanity check to see if you're getting results that seem plausible. Anything beyond say -- it is a judgment call.

CHAIR: What's plausible about 30 percent that isn't plausible about a 35 percent difference?

DR KAUFMANN: It's a judgment call, there has to be some number at which things start to look implausible.

CHAIR: Sure, but it's based on something that judgment, the point at which you get concerned about the realism of the results. This is very significant variation across this study, isn't it?

DR KAUFMANN: It's within the range of what we see in the US. I guess I would say it's kind of years of doing this and kind of seeing what come out of these models and what seemed to be a plausible range in models that are behaving

well and what seem to be results that look implausible for models that we know aren't behaving well, so it's kind of -- I just have to say it's a judgment based on years of experience of looking at these things.

CHAIR: I guess that you get that range when you look within the US, but when you think about the difficulty in coming up with comparative data across border, not to mention problems like exchange rate and other things, you start feeling a little bit more nervous even about the outliers that happen to be the two companies from outside the jurisdiction where you have to make your -- your input data isn't probably as comparable, you've had to use far more -- you've had to look and try to find comparative data, but how close you get is a question, and you've done sensitivity testing. But I always find these studies very hard to deal with from a regulatory perspective, having been through long debates in other industries on these things, it's very troubling because in every hearing you get completely opposite results presented to you depending which side is presenting.

I guess my question to you really is, I mean you've made the comment that these approaches are used in the US, but I'd be most surprised if -- even though it's accepted to look at benchmarking and that it's used and we all reach to these things, I'd be most surprised if there weren't extreme debates going on about the actual results beyond just the general model and its application. Is that a fair comment about the US regulatory debates that happen on benchmarking as well?

DR KAUFMANN: I think any time benchmarking is introduced anywhere there's going to be debates and unfortunately

it's a technical issue and I think you're right to be a bit skeptical of any benchmarking result. I say that, I don't have any problems saying that, I do these things all the time; I'm not necessarily an advocate of benchmarking, I think benchmarking can be done well, it can be done badly, it can be used well, it can be used badly.

I think you have to have some understanding of the quality of the study and you have to interpret the results of the study with care. I think that might be one of the points is that I was trying to reach to data that allowed for a more rigorous sort of benchmarking technique that in turn I think would lead to more reliable and robust results.

CHAIR: You said that you were a bit pressed in terms of timing to do this; if you had more time what would you look into further?

DR KAUFMANN: I would do my sensitivity analyses, that's for sure. I think I would look to some of the input prices as well, the construction costs that we've talked about, whether there are any sort of deflators we could use for construction costs within New Zealand, maybe re-examine the wage data as well, the wage data in New Zealand. I think those are some of the biggest issues.

MS BATES: You said that New Zealand costs are 20 to 30 percent higher than US costs and that was on the basis of which way you decide to calculate the exchange rate, and as I apprehend your reasons, or the reasons for this, you think their economies of scale, low customer density and low volume density; are those some of the reasons you think that the costs are higher?

DR KAUFMANN: Well, we didn't find that the costs were higher

in New Zealand, in fact what we found was that the costs were lower, even if you come up with very simple --

MS BATES: Sorry, I've got that wrong, you say 20 to 30 percent lower?

DR KAUFMANN: That's right, lower than predicted, lower than predicted. The factors that -- if you just kind of take a naive, if I could use that word, comparison.

MS BATES: You can with me.

DR KAUFMANN: If you look at costs per customer for these two companies relative to the US you'd find they're a little bit lower, but those cost per customer measures don't control for differences in economies of scale and differences in customer density, for example, and once you do control for those things you find that those factors tend to disadvantage the companies. If you take proper account of those factors then you would expect the company's costs to be much higher than they actually are. So what that shows is that the companies are actually successful in keeping their costs below what you would expect, given the conditions that they're operating under.

MS BATES: I see, I haven't understood you properly, so now I do. What about the cost of capital, is there any -- because you said that was an important factor, didn't you, in the costs?

DR KAUFMANN: Yes.

MS BATES: What about the cost of capital comparison between US and New Zealand?

DR KAUFMANN: It was somewhat higher in the US but we did some sensitivity analysis, so we varied that by plus or minus 1 percent and found it had almost no impact on the results.

MR STEVENS: I've just got one question really, it comes down

to your sample of the US firms. Are the US firms in your sample more vertically integrated than the New Zealand firms? The reason I ask it is how did you deal with the assumptions on the allocation of joint cost when you're working through your samples.

DR KAUFMANN: Some companies are stand-alone gas companies and some are combination gas and electric companies, so for the companies that are combination gas and electric we did allocate administrative and general expenses and plant based on the relative shares of other O&M costs between electric and gas, for example. So let's say a company had 80 percent of its O&M costs in electric and 20 percent in gas, which is about right for a lot of companies, then we would take those A and G costs, administrative and general costs, and we'd allocate them 80/20 between electricity and gas.

MR STEVENS: Do you believe that introduces more of an arbitrary judgment as opposed to Australia where it's less vertically integrated?

DR KAUFMANN: Australia or New Zealand?

MR STEVENS: Australia compared to the New Zealand comparisons. I guess what I'm trying to reflect is whether your sample introduced any more variances that you had to allow vis-a-vis comparisons with the Australian sample.

DR KAUFMANN: I don't think so, because I know -- for one thing a number of the Australian companies are vertically integrated, they have electricity distribution and gas distribution. Energex does, TXU, United Energy, they all have electricity and gas and Envestra is a company that has multi-jurisdiction gas companies and I believe there

could be some very severe cost allocation issues there in terms of how those costs are allocated. So I think they're different but I don't think that the cost allocation issues are necessarily any more severe in the US.

MR STEVENS: Thank you.

CHAIR: When you used the 20 percent did you use that for Vector as well, the cost allocation?

DR KAUFMANN: No, we did experiment with different allocations of common costs, but we found that that didn't make much difference as well, so rather than complicate the results and have a lot of different costs for the companies, we just used the ACAM costs.

CHAIR: I'll just as Dr Lawrence please to ask questions.

DR LAWRENCE: Larry, we've been through some of these issues before, but just briefly, you mentioned some of the flexibility properties of the translog functional form that you use in your cost function, I think you'd agree that the multilateral TFP function that we use and also the Fisher index that's used in the productivity growth study are both what we call superlative functional forms, in other words they're equivalent to flexible technology so they have essentially the same property as the translog cost function in terms of ability to approximate any underlying cost structure.

DR KAUFMANN: Yeah, I certainly agree with that in a theoretical sense, there's no doubt about that. I think, though, as a practical matter and as a practitioner the exact correspondence between what you would get out of a translog function and what you might get out of a multilateral index, in practice they often aren't the

same, and they're usually not.

DR LAWRENCE: The translog functional form that you use, it's fairly dated functional form now in that most of the more recent studies use things like generalised quadratic that are able to approximate curvature conditions globally. One of the problems that's often found with translog cost functions is that they don't satisfy some of the key curvature conditions, particularly concavity in prices. I was just wondering if you've checked the concavity conditions on your model and all the observation points.

DR KAUFMANN: Yeah, we have. Yeah, we always do that. I don't think it was 100 percent satisfaction but it was very high. I could check into that if you'd like.

DR LAWRENCE: It's important that it does satisfy those conditions if it's going to provide an accurate representation.

Moving on to the issue that I raised earlier regarding the way you calculate your cost function and the implications of that for the characteristics of your sample, as I understand it you estimate your cost function on pool data and you've actually made a change in this study in that you've actually included the New Zealand firms in that estimation process, is that correct?

DR KAUFMANN: It's panel data it's not pooled.

DR LAWRENCE: I mean pool time series cross-section, so panel data in other words.

DR KAUFMANN: That's correct, yeah.

DR LAWRENCE: I think that has some important implications given the fact that what you're looking at here are the smallest and the third smallest distributors in your sample based on your main output measure customer numbers

and you've got an extreme range in the size of the sample, it's very skewed towards large distributors. You've got a quarter than are 10 times bigger, actually even more, probably 15 times bigger than the largest of the two New Zealand distributors that you've included and you've got one that's even 50 times larger.

When you use pooled data, panel data, in other words you're pooling all the distributors into the one data set, given the characteristics of regression techniques, the large distributors are going to actually have what I would argue is a disproportionate weight in the coefficients that you estimate, because essentially given the quadratic nature of progression techniques, the large observations in the sample get a disproportionate amount of weight relative to say using market shares costs, for instance, which is probably a more conventional way of doing it.

You're probably aware that in the electricity work we did we actually, for that reason, similar situation where you had a large skewness in the sample with some large distributors and some very small ones, we actually estimated individual cost functions for each distributor and that gives you probably a better representation for the small distributors compared to your pooled approach of including the very large distributors which then get most of the weight effectively in forming the coefficient. Have you thought about how to handle that?

DR KAUFMANN: Yeah, we had -- you're right, the large companies get a bigger weight, that's certainly true. The issue I think is whether that's disproportionate, as you say. I think it's not unreasonable to expect to place more weight on certain companies. We did have a very

thorough review of our econometric approach as part of the Boston Gas Project and what came out of that review was that the main concern we had with our estimation technique was heteroskedasticity and that we weren't correcting for that and that again is going to be related to the influence that large companies have on the estimates.

Variance is going to be much higher, variance in the error term would be much higher for the larger companies relative to the smaller ones. We did correct that. I do think that the heteroskedasticity corrected estimates do lead to -- they do take care of a lot of the issue and the impact that those companies might be having on the estimates.

DR LAWRENCE: I'm not familiar with the exact characteristics of Boston Gas, but I suspect it's considerably larger than the New Zealand utilities, it wouldn't be either the smallest or the third smallest utility in your sample for instance.

DR KAUFMANN: No, it's not. That's why we added the companies to the sample, we thought it was important to do that, and you're right it's much more difficult to make good inferences out there on the tails of the distribution like that. But that is going to be reflected in the confidence intervals and the T-statistics, they do tend to widen as companies get further and further from the mean. So the fact that we've got relatively wide confidence intervals for these companies and they're still significant, in a sense we're taking care of that issue through the estimation technique.

DR LAWRENCE: You're partly addressing, I wouldn't say you're necessarily taking care of it completely.

If I could move on to another point. I'm somewhat surprised to see the very small number of operating environment variables that you've included in the study. We have in Vector's submission, for instance, that they think some of the key things that should be accounted for in doing international comparisons are things like colder weather, greater population density, no mature gas reticulation networks, access to abundant quantities of gas and environmental considerations.

On Monday we had Mr James, the CEO of NGC, make the observation that the US and New Zealand were very different, particularly because of the influence of climate in the US, much colder temperature, particularly in northern US I guess, and what he called a culture of consumption. I think what he meant by that was the lifestyle characteristics.

I know when I lived in North America it was quite unusual to see people in the winter having their houses heated up to about 25 degrees walking around in t-shirts inside when there's 4 foot of snow outside, it tends to be very different lifestyle in the southern hemisphere where you tend to heat your houses not near as much in the winter and you actually where a jumper inside in the winter. So those sorts of things are going to have an impact on the international comparisons that you make.

I don't see how those sorts of very important considerations enter into your model when effectively the only operating environment conditions you are including as a measure is one measure of size and I think cast iron pipes or something. While that might be similar for important for fairly similar types of utilities, I think

in the overall scheme of things in regard to international comparisons is probably a third order issue.

I appreciate there are statistical difficulties why you mightn't include some of these things, but I think you'd have to acknowledge they're very important in this sort of study.

DR KAUFMANN: I do acknowledge that. I think a number of these things are reflected, maybe not explicitly but implicitly, like the wasteful sort of North American culture. If that's in fact true then that would be reflected in volumes and we've got volumes as an output in the model.

DR LAWRENCE: The difficulty there is that doesn't distinguish between the operating environment and, say, another utility that's situated in the southern hemisphere that's similar to NGC or Vector but just happens to be larger. You're probably aware in previous studies that have been done of gas distribution networks people quite often include things like degree days as a measure of those sort of extremes of climate which is probably pretty important to include.

DR KAUFMANN: That's right, we tested heating degree days as a variable that didn't -- it wasn't significant, so we did try that.

DR LAWRENCE: That probably reflects my point, when you come to do a lot of these things econometrically you're actually running into a lot of multicolinearity problems, and problems in terms of estimation, where particularly if you don't have a large number of years I guess, where these things are essentially entering almost like constants, it's like a set of dummy variables almost. In

other words you're not getting a lot of variation in these key operating environment variables from year to year, which makes it hard to estimate an econometric cost function that takes those things into account and come up with significant results, even though those sorts of influences are very important.

DR KAUFMANN: Well, another thing that we have tried, which is correlated with heating degree days, and we tried to do this in New Zealand as well, but the data weren't there, was frost depth. Frost depth, that's obviously going to be correlated with heating degree days, but it has a more direct relationship to the gas distribution business which is if you have a lot of frost then -- if you're operating in an area where the frost depth is greater then that tends to get into pipes and lead to leaks and things like that. So it tends to raise costs at the same time that it might tend to raise consumption, or be correlated with factors that raise consumption.

So we have control for influences like that in some of our other US work. I agree some of those things can be important. The data weren't there to implement those types of variables in the New Zealand context.

I guess as a general matter I do agree that, like I said earlier, this is an imperfect science, we're never going to get everything, we're never going to be able to quantify every cost driver and get an independent estimate of how much every potential cost driver is independently affecting cost. So it is imperfect and I think that's one of the things you have to keep in mind with any benchmarking study. But having said that, I guess it's really just a matter of magnitude of those imperfections

relative to what we've done because we are picking up 97 percent of the variation in costs here.

DR LAWRENCE: You're using some statistical measures to reflect the characteristics of your cost function, but you haven't really included the sort of information that we would normally look at ourselves in doing econometric studies, and that is, for instance, a plot of residuals I think is usually your first line of examination of the reasonableness of your model to try and identify outliers, and it would be good if you included some of that sort of information in your report.

But that leads me to the next point that I was going to make, or question I was going to ask you, and that is from a Regulator's perspective it's very important that these sorts of studies be transparent and reproducible, and you've put up the translog cost function earlier and you make the statement in your report that that is a general form of translog cost function. We don't actually see the exact estimate equations that you've used.

You also made the comment that it took one of your staff a couple of months or something to implement the heteroskedasticity adjustment. I guess the thing that concerns me about econometric studies in this sort of context, particularly in terms of reproducibility, is even if you've got the same data set that the analyst is using, there are so many ways in which the results can be tweaked, if I can use that term, or -- I mean quite apart from that there are different econometricians will have different ways of implementing their equations, they'll use slightly different versions of the cost function, they'll include variables in a slightly different way and

importantly they'll have different error structures and so forth which is what you're talking about with heteroskedasticity.

So although you make the statement in your report that you think your approach gets away from being a black box, so to speak, I think econometric approaches in general still suffer significantly from that in that they are fairly subjective in many ways, and I'd go a step further and say, I think you'd have to agree, that any econometrician worth their salt given sufficient time can usually come up with a specification that's going to make even a relatively poor performing utility look pretty good depending on how you specify things. In that sense econometric techniques, they're neither particularly transparent nor reproducible.

I guess the second dimension relates to data. I believe your database is a commercial product that's not normally made generally available, so even if we have the exact specification of the econometrics that you've implemented it still makes it difficult to reproduce; just wondering if you wanted to comment on those observations.

DR KAUFMANN: In terms of the econometrics I don't agree that it's possible, even for the most gifted econometrician, to make a really bad company look good. There's only so much you can do. What we find, and I don't mean that in a pejorative or any sort of -- I wasn't putting any spin on that, if an econometrician was dedicated to making a bad company look good they might be able to make them look better but you're never going to be able to make them look great.

There's an expression in the US, kind of a rural

expression which is that you can put lipstick on a pig and it's still a pig, and unfortunately I think that's true about some of these companies is that the underlying truth is going to be invariant to the econometric specification that you choose. You can affect things on the margin, but if a company's bad enough then it's going to continue to look bad.

We find as we do this over and over again for a number of clients that the same companies tend to appear over and over as the good performers and the same companies appear as the bad performers. Even as we change specification from application to application as we update the database, we do see similarities in terms of who's good and who's bad. So I wouldn't deny that if you're a really dedicated, results-driven econometrician that you have some ability to influence the results, but I don't think it's absolute, I just don't think that's the case.

In terms of the database you're right, we have developed that, we can make that available under very strict confidentiality guidelines, we've done that in the past, but we typically don't do that because, I'm sure you understand, it's kind of a sensitive product and we don't want to kind of just give that out.

DR LAWRENCE: We may come back to you on that, we certainly won't make a call on that at this stage.

I just wanted to -- I want to make the contrast that there is scope for delivering calculations of efficiency using the econometric methods even from the same database. Index number methods are more straight up and down in the sense that it's more transparent what's been done and it's more easy for a third party to come in, use that database,

use a general description of what's been done and reproduce the results exactly. It typically won't be the case with econometrics.

Speaking of the databases, though, I just wanted to move on and ask you a couple of questions, because I note we're running short on time, on your database. You mentioned in the report that you assemble the database from a wide range of sources, I think you made that point in your presentation as well.

I guess my concern there is how confident are you that you've been able to assemble these widely different say consistently, and in particular have you gone back and checked the data in your database, the US firms that is?

DR KAUFMANN: Yes, we typically have to contact the companies directly to get the data and we do. All 40 companies, and more, I mean there are more companies that we stay on a consistent basis with in terms of actually collecting the data so we're in constant contact with them and constantly updating the database, so we do have a direct line of communication with the companies, and if we see a series that don't look right, and that's one of the reasons we look to a couple of sources of data to the extent we can, and in most cases there are two sources of data, that helps to provide some context and some ability to judge whether the data we're being provided are accurate or not and we will follow-up with the companies to clear that up.

DR LAWRENCE: One thing that concerned me about the way you've constructed capital, the way you describe it in the report is that you make a comment that you weren't able to get exactly the same approach given the US data you'd had given the way the New Zealand data is constructed, namely

using straight line depreciation whereas most perpetual inventory type capital measures like the one I believe you use are constructed using declining balance. Given that capital is a -- it's a pretty important input in this industry, I was just wondering how confident you were that your US approximation is consistent with the New Zealand data.

DR KAUFMANN: I'm not sure what your concern is, because we do have a capital cost treatment and a depreciation rate that is based on a straight line depreciation and so we've constructed that for the US to be a straight line depreciation which is the same thing that they use in New Zealand. The one thing we couldn't do and we'd never be able to do, is the sort of inventory based approach towards developing the initial capital stock, the ODV type capital measure; so we haven't done that and we couldn't do that, but we do base that on a series of capital additions, again going back 20 years, book value additions that we apply straight line depreciation to which I think reduces the concerns with comparability.

DR LAWRENCE: You mentioned in your presentation about the 1983 starting point 20 years; we're actually hearing yesterday from a number of the presenters that the pipelines here have an estimated life of 65 years, so 20 years is a relatively short period compared to overall length of the pipeline, which means you're going to have a certain degree of inconsistency in the way, or non-comparability in the way the two capital stocks are constructed.

DR KAUFMANN: Obviously we'd like to go back 6,500 years, that's not feasible. But what we do is we apply to the

benchmark year, the 1983; we don't just take that as -- that number in and of itself is not the starting point for the analysis. What we do is we apply, you're probably familiar with this -- a triangularised weighted average of asset price indexes to that capital stock and that's a way to deflate it and to reflect the pattern of additions and a pattern of depreciation up to that point, up to that benchmark year.

What we use is we use a 40 year life of asset -- 40 year triangularised weighted average which then reflects 40 years of asset price inflation that are weighted in a different way to reflect, according to the triangularisation formula which you can show is equivalent to a straight line depreciation rate. That's kind of a roundabout way of saying that I think we do reflect implicitly in our methods not just the 20 years of additions, but the 40 years of additions that are reflected in the benchmark. We're treating those in a consistent way with respect to depreciation.

DR LAWRENCE: Yeah, but as I understand it you, by necessity, have to use some type of historic cost as your starting point in constructing your asset value in 1983.

DR KAUFMANN: That's right.

DR LAWRENCE: Then you'd use a perpetual inventory method from there on.

DR KAUFMANN: Right.

DR LAWRENCE: Whereas the New Zealand data is constructed in quite a different way, in that it's like a current valuation when the ODV is done. That's going to introduce some degree of non-comparability, in fact I'd argue a potentially significant degree of non-comparability

between the capital stock series for the US and New Zealand.

DR KAUFMANN: It's definitely different and there is really no way that we can control for that.

DR LAWRENCE: I have a number of other questions, Larry, but I think I've covered the main ones, so given the time constraints.

CHAIR: Ask him to have them responded to in cross-submission rather than here if you want. Do you want to at least put them on the table and ask Dr Kaufmann to come back on them. We might suggest, Dr Kaufmann, that Dr Lawrence put the questions to you but you respond to them in cross-submission because we've got an issue with time, but we do want to give you the opportunity to respond to any questions that we might have.

DR KAUFMANN: That would be fine.

DR LAWRENCE: One of those is I think you've made the point in regard to our study that we weren't able to construct a system capacity variable and it would be desirable to do that, it's obviously hard to do that given the available data and I notice you've used the simple kilometres or miles of line as the proxy for system capacity in your study. It would obviously be desirable to have a system capacity measure in there that took account not only of length but also size of pipe and pressures and the like. It would be interesting to get your thoughts on what implications that approximation are for your estimates.

The second point was covered by the Chair earlier related to using the Melbourne construction price as a proxy for New Zealand costs. I was very surprised by your finding that the results are fairly insensitive to that,

because being a capital intensive industry the price of capital is going to enter into your -- the construction price of capital is going to enter into your capital price that you include in your cost function, it's going to have a fairly major influence on that variable that you actually use in the cost function.

So I would have thought that it was potentially sensitive to the construction price that was used, and I have a number of concerns as to how representative Melbourne construction costs, how accurately they reflect New Zealand construction costs, given differences in the size of the Melbourne market, for instance, higher growth rates that have been experienced in Australia and quite a number of other factors. So perhaps it would be useful to do some more sensitivity analysis if possible on the influence of that variable. That's all my questions for now.

CHAIR: I'll just see if their are further questions from anyone else.

MR SELL: As with Dr Lawrence's questions and in the interests of time I think I'd be happy if these were answered in cross-submissions. My first question is really following up on a question that Commissioner Stevens asked you about making sure that the scope of the businesses that you're comparing in the US is equivalent to the scope of the businesses here in New Zealand. I think you answered the question by talking about how some of the US businesses were electricity and gas business, but I didn't hear a very clear answer about the scope of the gas businesses.

I guess the point I'm getting at here is the fact that these are distribution businesses and they don't really

have a retail activity, certainly not on the scale down to the mass market of the retail activities of the US businesses. I guess what I'm wondering is whether for the US businesses you had cost data from which you were able to easily isolate the distribution-only activities, or whether you had to do some sort of allocation process.

DR KAUFMANN: That's right, I can answer that now, that doesn't have to be a cross-submission; the cost definition that we computed was in fact designed to be consistent with the definition of distribution in New Zealand, so we did take out the cost of retailing, we took out meter reading, we took out customer information and service, we took out billing and collection, all that kind of stuff. We did have detail on that data for the US and all that is taken out of the cost measure and the costs that we used in the econometric study. So we are estimating the cost drivers associated with distribution and not distribution and retail.

MR SELL: Thanks for clarifying that.

Second question is on capital base that you used and it's really a follow-on from the question Denis asked earlier about the ODV valuations that are used here. I must admit I'm still a little bit confused about how the capital base has been determined in your study for the New Zealand businesses vis-a-vis the US businesses. I guess it's not clear to me. I understand that for the US you've been able to build up the capital base using historical data. For the New Zealand businesses I guess I'm assuming that you didn't have access to the same level of historical data and you probably had to use something like the ODV valuations. If that were the case I don't

understand the significance of the capital cost indices that you use, the Melbourne index that you used.

DR KAUFMANN: What that is, the ODV valuation that's a stock. What we need to do is we need to develop a cost associated with that stock and we needed to do that for both the US and the New Zealand companies and since we're going to be comparing the New Zealand companies to the US companies we have to find a way to link the two. So that's where those elements come in about the return on capital, depreciation and the construction cost which is a way of deflating the capital measure and since we need to link that -- the price of construction to both, on a levels basis in the US to New Zealand, that's where the Richardson construction cost factors come in. We only had those for Melbourne, and a couple of other cities in Australia I believe, but nothing in New Zealand.

MR SELL: Okay, maybe in the interests of time we could just as you if you're able to explain those adjustments a little more in your cross-submission, because I guess the major concern we would have is that we're comparing perhaps historical cost asset bases from the US with what are effectively replacement cost asset bases being used here in New Zealand.

My third question is, I'm aware you've done studies in the Australian context, and I would presume that those were using the similar econometric model that you've described to us today to compare Australian utilities with US utilities and I guess we'd be interested in the results of those, because potentially I guess it gives us an opportunity to triangulate, if you like, and compare the Australia versus New Zealand study that Dr Lawrence has

done. Any information that's in the public arena that you're able to share with us on that would be helpful. Again I'm sure in your cross-submission.

DR KAUFMANN: I'm certainly willing to do that, we do have a number of things in the public domain. I know, and I'll mention this in my response in the cross-submission, I would definitely interpret those with some caution, because as I discussed in the presentation we've made a number of refinements in our method, in fact we're always updating and upgrading methods, and the heteroskedasticity adjustment was the biggest sort of update and I don't believe any of our Australian work reflects that. So it will be different in that sense and that's a very significant difference. I'll talk about that in my response.

CHAIR: We do need to break now, Dr Kaufmann, but I wanted to ask you one question, and that is whether we use your benchmarking work or we use the work done by Dr Lawrence, or some variation of one or the other or both, you will be aware that in the Draft Determination we talked about the benchmarking study being indicative rather than definitive information and in the end we didn't factor it in in any way to quantitative analysis.

I guess the question we're left with is interesting as these debates are, but a judgment to be made about the weight to be put on information that comes out of one benchmarking study or another. I'd like to hear your thoughts on that matter because at the end of the day we can debate everything here around the approach and specification and the reliability and all sorts of other issues, but then we must go away and decide what weight

will we put on the evidence that comes out of it.

So I wondered if you had any thoughts on that, and I'll use my prerogative of the Chair and ask you to respond now rather than in cross-submissions.

DR KAUFMANN: Thoughts on the weight in general that you should place on benchmarking studies, is that your question?

CHAIR: Yes, well in the context of this inquiry.

DR KAUFMANN: I don't want to punt on that question. I know this is a complicated inquiry and I know you're considering a lot of different issues and I'm really not up to speed on the full debate, on the full set of issues you're considering. So it is difficult for me to say how much weight you should place on benchmarking as opposed to the other evidence you're considering because I don't really know what that other evidence is. I don't know, does that satisfy you?

CHAIR: Not particularly no, but I accept that you may not be aware, so perhaps we'll ask you to give a consideration once you've had a chance to see and come back. I think because of your experience in forums such as this the Commission would value hearing your considered response to it, and at the end of the day this discussion has been very interesting, but the real issue is going to be how much weight do we put on any bit of the evidence before us and what would be the considerations that would lead us to decide one way or the other about how much weight to put on different bits of evidence.

You've presented a set of evidence and I think it probably is appropriate to ask you, given the questions we have to answer, how should that evidence be used and how

much confidence can we put on it in the context in which we're trying to use it. So I'll ask you to look at the context a little more widely and possibly come back to us on that.

I do need to have a break now, particularly for the transcripter. I would like to thank you, Dr Kaufmann, I always find it a very significant benefit to the Commission to have access to your expertise and advice, so we are grateful to you once again and we've gone a bit over time, so I hope that hasn't caused you any difficulties.

We'll look forward to your cross-submission. I know there's a number of issues we haven't had time to discuss here but hopefully we'll get a comprehensive response from you on the outstanding issues, so we'll thank you and also Vector and NGC for sponsoring the work that you've done for the inquiry. So with that we will break until 5 past 11, please, when we resume with Powerco. Thank you very much.

Adjournment from 10.50 to 11.05 am

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