MANITOBA PUBLIC UTILITIES BOARD

Re: MANITOBA HYDRO

2017/18 and 2018/19

GENERAL RATE APPLICATION

PUBLIC HEARING

Before Board Panel:

Robert Gabor	- Board Chairperson
Marilyn Kapitany	- Vice-Chairperson
Larry Ring, QC	- Board Member
Shawn McCutcheon	- Board Member
Sharon McKay	- Board Member
Hugh Grant	- Board Member

HELD AT:

Public Utilities Board

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Odette Fernandes (np)	)
Helga Van Iderstine (np)	)
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Daryl Ferguson (np)	) City of Winnipeg
Christian Monnin	)General Service)Small, General)Service Medium)Customer Classes
William Haight (np) William Gardner Kimberley Gilson	)Independent Expert)Witnesses)

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--- Upon commencing at 9:02 a.m.

THE CHAIRPERSON: Good morning, everyone. Good morning, Dr. Yatchew, Ms. Gilson.

Mr. Peters, would you like to take us through today.

MR. BOB PETERS: Thank you. Good morning, Mr. Chair, ladies and gentlemen. We welcome Dr. Yatchew to the hearing room today to testify. We also welcome his counsel, Ms. Gilson and Mr. Gardner. And in terms of welcoming people to the hearing room we welcome back Ms. Villegas.

Mr. Chair, panel members, there's a couple of minor modifications to the timetable that's on the screen in front of you. Dr. Yatchew has actually been scheduled for the better part of two (2) hours for his direct evidence and we'll see how that proceeds.

And in terms of time adjustments, there is a previous commitment that needs to be honoured. So the lunch recess today is requested from 11:45 to 1:15, so thank you for that. And we can turn it over to Mr. Simonsen to swear the witnesses -- witness, I should say, and to commence this morning. Thank you, sir.

INDEPENDENT EXPERT CONSULTANT WITNESS PANEL 3:

ADONIS YATCHEW, Sworn

THE CHAIRPERSON: Thank you. Ms. Gilson...?

EXAMINATION-IN-CHIEF BY MS. KIMBERLEY GILSON:

MS. KIMBERLEY GILSON: Good morning, Mr. Chair, panel members. I will just briefly introduce Dr. Yatchew for you and qualify him for this morning for today's proceedings.

Dr. Yatchew, you're an independent expert consultant who's been retained on behalf of the Public Utilities Board in these proceedings?

DR. ADONIS YATCHEW: Yes.

MS. KIMBERLEY GILSON: And the panel has received and submitted as Exhibit AY-3 a full copy of your CV and you, in fact, have prepared a presentation which includes a summary of your CV but to summarize your -- your extensive and impressive experience, Dr. Yatchew, you confirm that you have a PhD in Economics.

DR. ADONIS YATCHEW: I do.

MS. KIMBERLEY GILSON: And you're

currently the professor of economics at the University of Toronto?

DR. ADONIS YATCHEW: Yes, I am.

MS. KIMBERLEY GILSON: You're also the editor-in-chief of a publication called the Energy Journal?

DR. ADONIS YATCHEW: Yes.

MS. KIMBERLEY GILSON: You've written and we will see from Exhibit AY-3 your CV, numerous papers and you've given presentations in many areas which I'll simplistically call the area of economics; is that correct?

DR. ADONIS YATCHEW: Yes.

MS. KIMBERLEY GILSON: And you've appeared and been qualified to give evidence in quite a number of proceedings in regulatory matters?

DR. ADONIS YATCHEW: Yes, I have.

MS. KIMBERLEY GILSON: Thank you. Dr. Yatchew, you can confirm please for us that you prepared the report that has been filed in these proceedings as Exhibit AY-1?

DR. ADONIS YATCHEW: Yes, I have.

MS. KIMBERLEY GILSON: And you also have prepared a presentation that you're going to give to the panel this morning that's been filed and you'll

be speaking to it today and that's Exhibit AY-2?

DR. ADONIS YATCHEW: Yes.

MS. KIMBERLEY GILSON: Thank you. And finally, Dr. Yatchew, you can confirm please that in preparing your report and your presentation, you did not receive or rely on any information that has been identified as commercially sensitive information?

DR. ADONIS YATCHEW: That is correct.

MS. KIMBERLEY GILSON: Thank you. Subject to any other comments from the panel, I'll have you proceed with your presentation. Thank you.

THE CHAIRPERSON: Thank you Dr. Yatchew can proceed with his presentation.

DR. ADONIS YATCHEW: Thank you, Mr. Chair. I'm very pleased to be here. I think I've mentioned earlier, at one point, my father was born just outside of Winnipeg, and he was actually a K.C. So you can imagine how far back that goes. He was a King's Counsel lawyer. So I'm coming back to my roots, so to speak,

Anyway, could we have slide 2, please. I did an undergraduate degree in Economics and Mathematics at the University of Toronto, followed by an MA in Economics also at the University of Toronto. I then went on and did a PhD at Harvard. My thesis

area was in econometrics.

Throughout my career, I've been at the University of Toronto since 1980. I've also had a number of visiting appointments among them at the University of Chicago, at Trinity College Cambridge, Australian National University, Melbourne University and amongst others.

My primary research areas are econometrics, both theoretical and applied and energy economics and related areas. I teach PhD courses in econometrics; undergraduate and graduate courses in energy regulation and environmental matters. And a few years ago I began to teach what are called Big Ideas courses. I teach these now in the school of environment where the primary objective is to try to map out what are the big ideas in energy that everyone needs to know and not necessarily having an economics background. Broad range of audiences.

As Ms. Gilson mentioned, I'm editor-in-chief of the Energy Journal. I've served in various capacities with the journal since 1995. I've advised public and private sector companies on energy regulatory and other matters for over thirty (30) years and have provided analysis and testimony in numerous regulatory and litigation proceedings.

Slide 5. Scope of work. Manitoba Hydro has advised the Board that it needs rate increases of around 7.9 percent for each of the upcoming six (6) fiscal years, followed by an increase of 4.54 percent. The cumulative effect of this would be something on the order of a 50 percent increase, in real terms, over the coming decade.

The purpose of my testimony, in broad terms, is to assess the likely impacts on and responses of various customer groups to rate increases of this magnitude, as well as the implications for the Manitoba economy as a whole.

So proceeding to slide 7. I don't think I need to tell anybody here about Manitoba's endowments, its resource endowments, excellent freshwater hydraulic resources, agricultural lands, various deposits of metals and minerals. Manitoba has an advanced economy. It is well diversified. There is considerable variation in both energy intensity and electricity intensity across subsectors. Some firms are more vulnerable to electricity price increases, while others are more resilient.

Slide 8 provides pie charts comparing Manitoba GDP shares by sectors to that of Canada and the first thing that is evident is that the dominant

portion of GDP, 71 percent, is comprised of the service sector, and that's actually the identical share for the Canada wide -- for Canada wide economy.

Manufacturing is at 10 percent which is also the same as for Canada as a whole. There are some differences. For example, not surprisingly, agriculture -- the agricultural sector in Manitoba comprises 4 percent, which is twice the nationwide share of 2 percent. Mining in Manitoba comprises 2 percent, while Canada wide it's 8 percent and what you're observing in -- in the national figures are -- is -- is the really the Alberta effect primarily.

So slide 9 is -- in my Big Ideas courses this is always one (1) of the top 10 big ideas. This is a very convenient way of illustrating energy flows in particular a location, in this case, it's the -- it's for Manitoba. So first thing, let me just point out that the pipe diameters reflect approximately the magnitudes of the flows.

So let me begin on the left-hand side where there are these multi-coloured boxes. There's one (1) for Hydro, one (1) for natural gas, petroleum and then small ones for -- very small ones for coal and wind. These constitute the sources of energy. What economists call primary energy. The sources of

energy in Manitoba. Now, the numbers in the boxes are actually quantities and these various types of energy, primary energy, are usually measured in different units. So, for example, petroleum or oil is measured in barrels; natural gas in cubic metres; hydraulic energy in kilowatt hours or some multiple of that.

So how do we put all these in the same chart? How are these numbers comparable? What we do is we convert these various sources and types of energy from their units into a common energy unit, and particularly a standard unit in -- in engineering and in sciences is a joule, J-O-U-L-E. And in fact -- so we converted all these various quantities of energy into single types of units, in fact, they're petajoules. And if you sum the numbers in the multicoloured boxes on the left, you'll get the total primary energy for Manitoba, which is in the top left-hand corner of the diagram, that's 334 PJ -- 334 petajoules.

So on the left side of this diagram what you have is supply. On the right side, on the far right side of the diagram, there are these pink boxes and the pink boxes reflect the -- the sectors of the economy that are the recipients of these sources of energy. So the first one is the residential

sector. The second one, commercial, then industrial and I'm going to skip to the bottom one transportation. Those are the four (4) major energy using sectors.

There's also an additional box there called non-energy. And what's that -- that's referring to the petrochemical sector. So oil, natural gas may end up in the -- in the petrochemical sector producing such things as lubricants, but not generating energy per se.

Now Manitoba's successful development of cheap and accessible hydraulic electricity is reflected by the share of total energy that Hydro has. It's the largest source of energy in Manitoba, about 60 percent, and it is also the case that by -- when we go by sector, electricity -- the electricity share is large relative to other jurisdictions. So, about 60 percent of energy used in the residential sector is from electricity sources or the industrial sector, it's about 50 percent, and for the commercial sector it's about -- close to 40 percent.

Now if we take these various end-use sectors and we total up the energy that flows there, you get -- you're going to get a number that's somewhat smaller than the top left 334. And the

reason is that, first of all, some energy is exported, and this is particularly in the electricity sector. So, you can see a little pipe at the top in yellow leaving the electricity box that measures the exports, but even adding in the export quantity to the -- all the numbers in the pink boxes doesn't give you the total 334; that's because there are transmission and distribution losses in the electricity sector. So that's what is making up the difference.

So once again, what is very striking about this, if you compare this energy flow diagram to one for Canada or for the US or for that matter for China, is the very important and large role that hydraulic electricity plays as a primary source of energy.

Staying with this diagram and the -- much of what I'm saying is actual -- actually on subsequent slides that can be referred to, but I'd like to still stay with this -- with this diagram. These are -- these are often called Sankey diagrams and they go back to -- actually early uses were in the 19th century.

This type of diagram also provides a natural departure point for considering impacts of changes in the price of electricity. So if

electricity price increases, where is the -- what's going to happen to demand. If natural gas is available and natural gas is cheap, there will be a shift towards natural gas, for example.

The diagram is also useful in informing discussions of environmental policies, in particular, decarbonization. And in this regard, Manitoba is also very well positioned because of the very large share of hydraulic energy. Coal use in -- in Manitoba is absolutely minimal and the remainder of nontransportation energy sources -- source is natural gas.

One (1) of the important things to keep in mind is that natural gas has half the carbon footprint of coal, as a rule of thumb. So shifting from coal to natural gas, while producing the same amount of energy, cuts your combustion carbon emissions in half. Petroleum has a somewhat higher carbon footprint than natural gas but less than coal.

The dominant share of energy-related carbon in Manitoba is in the transportation sector. Unfortunately, transportation is the most difficult sector to decarbonize. A few more comments. Quite often when I consu -- these -- this diagram was constructed using Statistics Canada data and I -- I

use proprietary software that's -- that's available from a German company that allows one to input numbers and create diagrams like this.

When I construct these diagrams, there is often yet another column of boxes on the far right and that -- those are used to map use -- useful energy, energy that produces services versus energy that is lost. We often call wasted but we're -- it's not -- that's not a correct term, it's just whenever energy is converted from one form to another, some of it is lost in the form of heat -- that's the second law of thermodynamics -- and that's where we want to try to improve efficiencies in order to not only use less fuel but also have a better carbon footprint.

One can also construct sibling diagrams to this type of diagram which maps the amount of carbon that is being produced from various energy sources, and how much carbon is being, therefore, attributed to various energy sectors: transportation, residential, commercial, industrial and so on.

There are Canada-wide energy flow diagrams and carbon flow diagrams that can be accessed on my website. The links for which are provided later on in slide 14. These diagrams are very similar to diagrams that are -- have been produced for many years

at Lawrence Livermore National laboratory's in the States and the US produces these not only at the national level but at a state -- at a state level.

Okay. Let me move on ahead to key trends affecting Manitoba and Manitoba Hydro, which is title slide is 15 -- at -- is at slide 15 and so let's move on to slide 16.

In order to situate a discussion of electricity rate increases and in a -- in a broader framework, it's -- it's very important to understand general trends and energy prices and we've heard even yesterday the importance of understanding trends and natural gas markets. I would also suggest it's very important to understand trends in oil markets as well.

So, why? Why is it important to understand these hydrocarbon mark -- markets in considering electricity issues in Manitoba.

First, natural gas competes with electricity in certain industrial, commercial and residential applications, particularly if the end use involves space heating or process heat. A large increase in electricity prices could lead to loss of electricity load to natural gas, where it is available.

Second, low-price natural gas is the --

it is the most desired fuel for electricity generation in many parts of North America. It's relatively cheap to -- to construct combustion turbine units, and this is particularly the case in -- in the US wherever -- where natural gas prices have been low for some time and we'll look at those in a moment, including in states neighbouring Manitoba and in MISO to which Manitoba belongs. So, natural gas prices affect Manitoba Hydro export markets, quantities, and more importantly, prices. The prices that -- that Manitoba Hydro can hope to get in those markets.

Third, oil prices have an important impact on Canadian export revenues and on exchange rates. A precipitous decline in oil prices which began in mid-2014 has had a dramatic effect on the economy of Alberta, and to a lesser degree on other provinces including Manitoba. Canada has vast reserves of oil, mainly in the form of bitumen. However, these reserves are amongst the highest price in the world.

So what's the outlook for natural gas and oil prices? Let's turn to slide 17. Thank you. Hydraulic fracturing or commonly known as fracking pf Shale has fundamentally revolutionized hydrocarbon markets. First of all, if we look at natural gas

markets, it's created vast new supplies in North America and has led to a sustained drop in prices. Ten (10), fifteen (15) years ago, the US was building natural gas import terminals for importing liquid natural gas, LNG. Now, those are becoming export terminals and the US is now exporting natural gas.

Fracking for gas in the US has fundamentally changed directional flows of natural gas in Canada. The mainline a few years ago was running at half capacity and that's because US have much more gas than they need and in fact, our exports of natural gas have declined.

There is the potential that this new source of natural gas will globalize natural gas markets through LNG. And we'll talk about that more in a moment.

Perhaps the more prominent impact of fracking has been in oil markets. There's a case -- a very serious case that can be made that this oil price drop that began in 2014 is the first major change in oil markets since the '70s when OPEC began to exercise market power. And here's why. Fracking for oil, shale oil, provides a new source of supply, but we had new sources of supply in past decades as well. When OPEC raised oil prices, the North Sea supplies came

online. Additional undersea sources have been brought in over the decades.

So why is this -- why is fracking a fundamentally different phenomenon? And the reason is that it is scalable. So in the past if you wanted to develop an oilfield, you were talking about billions of dollars and many years before you could recover your investment. So you actually had to believe that prices would be high for an extended period of time in order to be willing to put up the capital to make the investment.

What does OPEC -- how does OPEC act in that kind of setting? It can always threaten to lower prices for a period of time to discourage you from investing or perhaps even to drive you out of business. Again, that's because we're talking about multibillion-dollar investments that take years to recover.

Fracking is a very different -- has a very different scale. You can dig a fracking well for a few million dollars, 3 to $5 million. That's three (3) orders of magnitude less than conventional sources of oil.

So now what happens is the entity that has over the years tried to exercise market power has

less leverage. It can no longer threaten you with lowering prices because if prices go down, you just don't dig anymore. You don't drill anymore holes or you -- there are lots of -- there are lots of wells that were drilled, mothballed and then reactivated when prices started to go up since 2014. So it's much more responsive to changes in oil market conditions.

So, this idea of scalability in -- in oil actually has applications in other areas of energy that I'll talk about. But the message here is that, yes, oil prices have risen from their -- from their lows of -- I think it bottomed out at around $25 after the initial drop. They're now in the 60s, but the potential for returning to 100 plus dollars -- dollar oil is pretty slim. That's a fairly unlikely scenario.

Could I have slide 17. I'm sorry, slide 18, please. Thank you. Let me return to natural gas prices for a moment. So the source of this graph is (BRIEF PAUSE) Statistical Review, used to be British Petroleum. They went -- changed their name to (BRIEF PAUSE) officially some time ago and there are four (4) natural gas benchmark prices on this graph. The red one is the US Henry hub price. The -- the -- the two

(2) green lines are European prices; one of them is the German import price, the other one is the UK import price. And the top one, the yellow one, is the Japanese LNG price.

What we observe until 2008 is that there is a fair amount of co-movements amongst these price series. Then in 2009 what we're seeing is the financial meltdown when natural gas prices plummeted as oil did as well. But then look what happens after 2009. European prices recover. The Japanese price actually goes very high, partly because of the Fukushima nuclear accident. And so Japan needed a lot of natural gas.

But the key thing here is that from 2009 the US Henry hub price remains more or less flat and at a very low range, 3 to $5. This -- there are no units on here, this should be a thousand cubic feet, or a million BTUs.

That red graph, what you're seeing there from 2009 and this graph ends in 2016, that's the fracking effect; that's the fracking revolution.

Now, once again, (BRIEF PAUSE) plots for prices here because natural gas markets are continental, they're not global yet, and LNG may very well result in -- we're already seeing a bit of it,

may very well result in globalization of these markets.

So, lots of natural gas supply in North America. We can -- we can talk about what's a reasonable forecast and I know others have presented evidence on that. I have not, as part of this -- as part of my scope but, in general terms, you -- we can expect low natural gas prices for the foreseeable future in North America.

Let's go to slide 19, please. Thank you. There are two (2) series graft here. Oil prices are in blue, and that's what I would like to focus on first. These data are from 2003 to sometime in 2017. And once again, you see the dramatic drop in oil prices as a result of the financial meltdown prior to which time -- and this is using the scale on the left, they exceed $100 a barrel US -- these are oil prices in US dollars. They drop dramatically as a result of the financial meltdown and then they begin to recover. And once again, exceed the hundred dollar per barrel mark in the early part of this decade. And then they drop dramatically in 2014, bottom out not long after, and then begin a slow rise.

So once again, unlikely that we're going to see a hundred dollars plus price for oil in

the foreseeable future. But the other series that's -- that is here is the exchange rate series. And you can see how really quite closely these two -- these are the Canadian dollar, the scales on the right-hand side, how really quite closely the Canadian dollar tracks the world oil price.

So, what's the linkage for the issues at -- at present? If we're thinking about Manitoba export revenues, the US in US dollars, a lower Canadian dollar is beneficial. That's true for other Canadian experts. And if that Canadian dollar is closely related to oil prices than some appreciation of where oil prices are likely to go informs one -- one's thinking about what the Canadian dollar is going to do, and consequentially what the effects are going to be on -- on exports.

So -- and this is summarized in slide 20. Thank you. Where the last point that is being made, expectations about future oil prices inform forecast of Canadian and US exchange rates.

Let me now turn to new energy technologies which begins at slide 21. The costs of new and important energy technologies have been declining rapidly. We've talked about fracking. The costs of fracking have dropped dramatically. But now

here we're going to focus on electricity-related technologies.

Since 2008, the cost of wind generation have dropped by 41 percent. Photovoltaic costs have dropped by more than 50 percent. Battery costs by 73 percent. And LED bulbs by a stunning 94 percent. I believe I recall somewhere Manitoba Hydro noting the -- - the adoption rates for LED lighting. It's a price effect.

Continuation of these trends could have an important impact on Manitoba Hydro domestic and Manitoba Hydro export markets.

And slide 22 actually provides a graphic version of the previous slide, might -- the -- the graph, the source of the -- source of this graph is from the US Department of Energy.

Let me turn now to another important trend in electricity systems and that is decentralization. Electricity systems are facing powerful forces that are decentralizing -- and we talked -- I think yesterday there was discussion about distributed energy resources and those distributed energy resources are not just owned by utilities or companies. It can be owned by individuals such as putting solar panels on your roof.

And this decentralization is, in part, of, again, the scalability phenomenon. Scalability of new generation and storage technologies and the enabling effects of information technologies. Microgrids would be another example.

Manitoba Hydro, on the other hand, because of its vast hydroelectric resources continues to operate with a highly centralized model, relying on massive investments in generation and transmission. This is not surprising. Hydro is not scalable. You really need to go to a large-scale. You can't sort of say, oh, I'm going to bring on a few megawatts here and a few megawatts there. You need to make large expenditures and bene -- to benefit from the economies of scale.

These large investments also have long lifetimes. When I drive through the Niagara area and look at the Adam Beck facilities, they look like they were built at the beginning of the 20th century, and some of them were. They last a long time. But that also means that it takes a long time to recover the investment and long-lived investments in a world where technology is changing rapidly and becoming ever more scalable create risks.

So that concludes the section on major

types of trends that have been affecting the -- really need to be part of the -- a part -- part of the background information.

Let me turn now to demand modelling and elasticities which was a -- a central part of the scope of work. The report goes into some greater detail in categorizing and describing some of the technical aspects of energy modelling and demand modelling without getting into too much of the statistical complexities. But let me at least try -- briefly describe, in general terms, the kinds of models that are out there for modelling electricity demand or energy demand more generally.

When we talk about elasticities, the responsiveness of a particular type of customer say, for example, a residential customer to a change in an energy price. This is not an object of elasticity that can be somehow estimated in isolation. It comes out of a model. It's usually a parameter or related to parameters of a model where other factors are being taken into -- into account.

So, first class of models described at slide 25 are time-series models and time-series models use data for a single geographic area over a period of time. So you can imagine using monthly Manitoba data,

perhaps by a particular class of customer, over a period of ten (10) years; time-series data. This -- so think of that as a moving picture.

A cross-section -- cross-section modelling uses data at a single point in time or a single period across multiple geographic areas. So you're taking a snapshot of what behaviour or what demand is like in different places which face different conditions, different prices, for example, different income levels. For example, observations for 2016 for all Canadian provinces and territories or for all the American US states.

The third class of models are called panel data models and these combine both time-series and cross-section data into a single larger data set. These use data over multiple geographic areas over a period of time. For example, if we take monthly observations for ten (10) years for each of the provinces in Canada. This would yield a large data set.

So, panel data models are usually the most desirable because they have both time-series and cross-sectional features but often you have only access to time-series data. Does it make sense for us to rely solely on, let's say, time-series data in one

(1) location to try to anticipate what's going to happen in the future? Let me give an example. In a completely different setting, suppose you want to know how a population will respond to dosages of a particular drug, okay. And you've observed over time how that population has responded over, let's say, low dosages of that drug.

So you can interpolate, you can say, well, if we increase -- if we increase the dosage by 5 percent or reduce it by 6 percent, you can get a pretty good idea of what the response would be because you've observed behaviour in that range.

Now, suppose you want to increase the dosage by 50 percent and have not chosen that number accidentally. You're going to increase the dosage by 50 percent and you're going to extrapolate from your population, which has never faced that higher dosage; that is going to be -- that's going to limit the quality and reliability of your analysis. At the very least, you would want to look at other populations which have faced these higher dosages. They should also be helpful in informing how your population is going to respond.

So, even very good time-series data for one (1) location that doesn't have the variation in,

let's say, energy prices or electricity prices that is being anticipated or is being considered, even very good time-series data of that type won't be quite as -- you won't be quite as confident as if you've actually tested your -- that kind of modelling against the much more general experience elsewhere.

So, the number of papers on energy modelling, I'm talking statistical papers in peer-reviewed journals where people have actually dug through the data and estimated elasticities, is vast. One (1) of the appendices in -- in the report contains a relatively short bibliography of papers that I identified that might be relevant.

So, how do you look at such a vast literature and try to summarize? Well, one (1) approach and this is an approach that is used by researchers, is to conduct what's called a meta analysis. So now we've got a fourth candidate here on types of energy models because this is -- a meta analysis is itself a kind of an energy model where what you do is you take the results from many studies, look at the -- let's say, the price elasticity -- electricity price elasticity across these many studies and combine them into a single number or range based on statistical tools.

Without getting into a lot of detail, I'd like to at least convey the idea that some studies will give you more precise estimates and presumably, therefore, more reliable estimates of elasticity and others will give you less reliable estimates.

How do you know which ones are reliable and which ones are not? The answer is right in the study itself. So there are statistical -- there are statistics called standard errors which tell you, well, this is my -- this is the confidence level that I have. Can be used to produce confidence intervals for each of these estimates.

So meta-analyses actually -- it's not just somebody sitting down and doing an average of all the studies and a range of all the results. It's somebody actually trying to use this kind of weighting -- weighting better estimates with larger weights, weaker estimates with lower -- with lower weights.

Now, if we actually look at the range of estimates that are out there, they're very, very broad. I think in one of my interrogatories I confirm that Manitoba Hydro's estimates are within the range of the estimates that are out there; that doesn't mean I think they're the best estimates, mainly because they rely on Manitoba Hydro data exclusively.

So if we could go to slide 26, please. I think as I have mentioned earlier, data can be disaggregated by sector, residential, commercial and industrial. Time series models do not benefit from experience in -- in other jurisdictions. What we can learn by looking at how other jurisdictions responded to price changes, for example. Cross-section models do not benefit from changes and trends that occur over time.

(BRIEF PAUSE)

DR. ADONIS YATCHEW: Let's go to slide 27, please. I've already been using these terms. The price elasticity estimates -- estimates the responsiveness of electricity demand to changes in the price of elect -- elect -- of electricity. The income, or GDP elasticity, estimates the responsiveness of electricity demand to changes in economic activity. At a admittedly very simplified level, these are the two (2) elasticities that are most important here.

(BRIEF PAUSE)

DR. ADONIS YATCHEW: So I was asked to review the literature and come up with my recommendations. Here they are. First of all, let me distinguish between a short-term price elasticity and a longer-term price elasticity. So if we were to conduct an experiment and just increase electricity prices, let's say by the 7.9 percent next year, there would be a certain response within a relatively short period of time, but it wouldn't be a very strong response, because first of all, if natural gas is available, that substitution might not take place very quickly.

To the extent that you can acquire more energy-efficient appliances, that also takes time. If you just bought a new refrigerator, for example, you're not going to replace it just because electricity prices go up. But when it comes time to replace that refrigerator, you may very well consider a more energy-efficient one. So the impacts of price changes in energy markets generally and electricity markets in particular take time to realize their full effect.

I think this was the subject -- the subject of some discussion a couple of days ago when there was a question about, why is it that a price at

a single point in time lagged two and half (2 1/2) years was in the model. I -- I believe it was Dr. Grant that was asking those questions.

And the sensor in my mind is that while as a first approximation, using a single lag price, lag because it takes time for the effect to be realized, might make sense, really what you want is a model that captures the response to price changes over time, a dynamic model rather than one that just picks a -- a price at a single point in time. And then you want to see whether your approximation, the one which just uses a single price at one (1) point in time, is reasonable or not.

So that's why here, I'm distinguishing between a short-term price elasticity -- think of that as being one (1) year -- as opposed to a long-term price elasticity -- think of that as being five (5) to ten (10) years. And once again, in this literature, it's not uncommon to see papers that distinguish between short-term price elasticities and long-term price elasticities, and actually try to estimate both of them, try to estimate what is -- what is going to happen in the very short time frame, and what's going to happen over the longer term.

So here are my recommendations. A

short-term price elasticity of minus point one (-.1) across all sectors. That is an electricity price increase of 10 percent leads to a 1 percent decline in electricity demand in the short term. And a long-term overall price elasticity of minus point four (-.4). That is an electricity price increase of 10 percent leads to a 4 percent decline in electricity demand in the longer term. Now, on a sectoral basis, my judgment, the industrial sector is going to be the one that's most responsive. And I would suggest a price elasticity of minus point five (-.5) for the industrial sector, and minus point three-five (-.35) for the residential and commercial sectors.

Now let me turn to the responsiveness of electricity demand changes in economic activity. The GDP elasticity, I'm suggesting a -- a GDP elasticity of point eight (.8). That is an increase of GDP of 10 percent eventually leads to an increase in electricity consumption of 8 percent. I'll have more on this in later slides.

But historically, if we take a look sort of over data -- over decades, for the longest time, electricity demand moved lockstep with GDP growth. Elasticity was one (1). Ten percent increase in GDP. Ten percent increase in electricity demand.

And then electricity demand started to move away, not grow as quickly -- as -- as GDP.

(BRIEF PAUSE)

DR. ADONIS YATCHEW: Now, let me turn to back of the envelope calculation. And we can have the most sophisticated models here, and everybody's eyes will glaze over, including mine, but if -- if you can't do a basic calculation that makes sense based on some sort of summary statistic, is that, as it -- even as a first approximation, and the -- and your numbers flow -- the -- the approximation is flowing from analyses that you've done, then I would be suspect -- suspicious of the actual detailed modelling.

And I write my own code, still, so I can check stuff, and I do often. But at the end of the day, I'm looking for a simple version, a simple analysis that somehow parallels or approximates the technically sophisticated modelling. It has to make sense.

All right. So, given the projected price increases, I would suggest that the basic load is likely to be stagnant for the coming decade. And here's the simple calculation. Suppose the cumulative

increases in electricity prices are about 50 percent, and that the economy grows at 2 percent per year, which would be actually very good if it was -- did that for -- just -- for the -- for the next ten (10) years, given the possibility of a -- of a recession. So what do we have, here? We have 50 percent increase in electricity prices, 22 percent increase in GDP, than the implication of these price elasticities is that electricity demand is reduced by 20 percent as a result of the price increase, and GDP growth increases demand by about 18 percent, and those two (2) are awash, more or less.

So large price increases. And once again, these -- the numbers that I'm recommending here are informed not just by what I've seen in -- in Manitoba Hydro's modelling, but what I'm seeing in the literature. It's actually not uncommon to have a higher price elasticity -- more negative price elasticity estimates than the one I'm using of minus point four (-.4).

(BRIEF PAUSE)

DR. ADONIS YATCHEW: So a simple analysis of where is electricity demand growing --

going depends on a third important component. So far, where a price is going. Seconds -- the second one is where -- where is GDP going. And the third one, what's going on with energy intensity and electricity intensity?

What we've been observing over the last -- and I'm -- and I'm going to begin with energy intensity. Over the last twenty-five (25) years, energy intensity...

(BRIEF PAUSE)

DR. ADONIS YATCHEW: Is this better? My apologies. I'll try to speak up.

So over the last twenty-five (25) years, energy intensity, that is, the amount of energy used per dollar of GDP, has been falling by more than 1 percent per year in Canada. And this figure is quite comparable to the average for OECD countries. Manitoba energy intensity has been dropping more rapidly at a rate closer to 2 percent per year.

And if we could turn to slide 31, this is a graph of world energy intensity trends from the -- from the International Energy Outlook in 2016. Now, of course, if we look at -- we can -- could we go to

slide 31, please? Sorry, 32. My -- my apologies.

What I've graphed here, and again, this is -- this was prepared using Statistics Canada data, are provincial energy intensity trends. And the one that is red with kind of a blurred shaded area around it is Manitoba, and you can see that Manitoba's energy intensity trends have been falling since 1997 with a few upticks here and there. The -- where energy intensity has been growing is Alberta, for example, and Saskatchewan, which is -- actually has the highest energy intensity.

What about electricity intensity, which is what we're interested in here? If we could go to the next slide, please, that's slide 33, patterns of electricity intensity in Manitoba have been mixed. In the service sector, which is by far the largest intensity, dropped by about 25 percent between 2005 and 2012, but by 2015, it had recovered to 2005 levels. Intensity in the manufacturing sector peaked in 2005 and has been displaying a fairly steady decline since that time. Agricultural intensity remained high until 2005, but subsequently dropped significantly.

And these trends should also be part of if not the modelling itself, at least the qualitative

analysis that surrounds estimates of impacts on electricity demand -- projected electricity demand. By the way, these kinds of terms are often -- this is -- elec -- electricity intensity trend is often included in models just by adding a trend term. And while the trends in energy intensity have been fairly monotone, declining energy intensity, the trends in electricity intensity have not been so monotone, as you can see from this. So you would need something a little bit more sophisticated in trying to model these trends. So three (1) components, price effects, income effects and trend effects, should be part of the general -- the broad assessment of -- of projecting electricity demand.

Okay, so now let me turn to energy poverty and distributional effects. At slide 35, what I've reproduced here are National Energy Board estimates of electricity prices -- representative electricity prices in 2016. So the pink bars represent the Provinces, and the second pink bar from the left is Manitoba. You can see that it has the second lowest prices, Quebec having the lowest prices.

At the far right, you have Ontario, with the highest prices amongst the Provinces. Ontario electricity prices have increased by 50

percent -- actually more than 50 percent for a variety of reasons. And then on the left of the -- the three (3) blue bars are the Territories. Not surprisingly, very high prices in some Territories, because electricity is being generated by -- by diesel. I think Yukon Territory has -- has relatively lower prices because it actually has hydraulic resources. But -- so Manitoba is -- has been very well-positioned with its historical investments in hydraulic, and has been -- has experienced low electricity prices. Could we go to the next slide, please.

(BRIEF PAUSE)

DR. ADONIS YATCHEW: All right. Manitoba has a relatively low rate of energy poverty in comparison to some other Provinces, and this is -- if we could actually go directly now to slide 37, please, this is a graphic that was produced also by the National Energy Board using 2015 data. And Manitoba has, according to these estimates, an energy poverty rate of about 7 percent. Alberta is the only one at that time with lower energy poverty rate, and much higher rates of energy poverty in the Atlantic Provinces.

However, the incidence of energy poverty inevitably varies significantly across the Province, and is particularly high in remote communities where prices of many goods, among them, energy, are high. The projected -- or projected by Manitoba Hydro, these -- these kinds of rate increases, which would accumulate to about 50 percent, would inevitably lead to higher rates of energy poverty, requiring programs to -- to remedy.

Sli -- slide 38, please. First Nations -- the impact on energy poverty in First Nations, likely to be especially acute, given the limited possibilities for energy substitution, first of all. Second, and this is a phenomenon that's -- has been studied to some degree statistically, households with low incomes are not well-positioned to make the capital investments, such as improved insulation, efficient windows and doors, in order to reduce their consumption of an -- a fuel, in this case, electricity, that becomes higher priced. Commercial and industrial establishments will also be adversely affected, particularly in the absence of energy substitutes such as natural gas.

Let me turn now to macroeconomic issues. And I -- I know that there will be and has

been other evidence on -- on impacts, sectoral impacts, of projected or possible price scenarios. I asked myself the following question: How can one inform the discussion of electricity price increases from the broader experience that we've had with large energy price increases? And I know there's some discussion about whether these -- the proposed -- the projected rates constitute a shock or not. I could have comments on that as well. Let's just say that we're talking about potentially large electricity price increases that are being considered.

But we've seen energy price shocks elsewhere. And so let's see how large an effect those have had. So, at slide 40, these experiences that we had are helpful in bounding, giving us balance to the likely effects of significant electricity price increases, maybe not predicting them, but at least bounding the macroeconomic effects.

So the first place that one would look at is a natural experiment, I mean OPEC exercise of market power in the 1970s was a unilateral price increase that was very large in 1973, and again later in -- in -- around '79. And they were unanticipated, so they were -- they satisfy that sort of aspect of the word 'shock'. And in -- they lead to economic

contractions of a half a percent or less. So there are -- these are very large price changes. The macroeconomic impacts are significant, but not -- not as large as I would have thought they might be.

If you want to take a look at -- in the cumulative impacts, so once again, there is a impact over time of a price shock. The cumulative impact on US GDP of the oil price shock in the late 1970s, when oil prices roughly doubled in a very short period of time, is estimated to be about 3 percent. So that means that the economy ended up on a 3 percent lower trajectory than it would have been otherwise. And this kind of analysis is -- is done by many macroeconomists, one (1) of the most well-recognized -- well, two (2) of them, James Hamilton at -- at University of California, San Diego, and the Lutz Kilian, that's L-U-T-Z, last name, K-I-L-I-A-N, at the University of Michigan. They've worked through this data. Many, many, many times.

So let's go on to -- one (1) additional comment. There was a long-term effect, but when prices change, eventually the economy responds to it. There may be an initial job losses, for example, and there were, but over time, those resources get reabsorbed in the -- into the economy.

Okay. So risks associated -- and again, these are very important variables, as I mentioned earlier, exchange rates, and also commodity prices. Certain sectors of the Manitoba economy are subject to large and difficult to predict variations in key variables. So first of all, exporters are subject to exchange rate variations. Over the last decade, the Canadian dollar has varied from below seventy cents ($0.70), to well above parity for a time.

Wheat prices, for example, which reached a post-recession high of nine dollars ($9) US per bushel in 2012, have since declined to roughly half that in 2017. So these sectors of the economy really do face quite a bit of uncertainty and fluctuations. Certainly on the -- in this case, on the revenue side, if you look at nickel, copper, zinc, and gold prices have also exhibited large swings.

Slide 42, vulnerable economic sectors. Electricity prices affect all households, forms, institutions, and agencies. However, the extent of a response depends on the electricity intensity and the alternatives available. In the manufacturing sector, the most vulnerable industries appear to be basic chemicals, and pulp and paper, where electricity

comprises a high share of costs; iron and steel mills, foundries and nonferrous metal production also have significant electricity cost shares; in the agricultural sector, greenhouses and animal production have significant electricity cost shares; and in the mining sector, support activities for oil and gas production and extraction of metals also have large -- or at least significant electricity cost shares.

Appendix 4, beginning at page 77 of the report, provides electricity cost shares on an industry basis. Now, where natural gas is available, some of these industries may engage in fuel substitution. Others are likely to carefully consider or reconsider future investment plants and these are difficult to try to quantify ex ante what are -- what are going to be that you -- I mean, you can look at business plans, but what are the likely changes, what are the lost investments that aren't -- that aren't going to occur as a result of a -- of a significant electricity price change?

On the macro side, if we could go now to slide 44, please, we can't ignore the uncertainties associated with the current US administration. We hear most recently news that -- that the US negotiated -- that Trump may very well decide to scrap NAFTA. We

don't know if that's going to happen, because he is very difficult. His -- his actual behaviour is very difficult to predict, what he says and what he does, and that's part of his -- that's just part of his negotiating approach, but the North American Free Trade Agreement is being still apparently renegotiated. I don't know how successful it's going to be.

So at a minimum, this injects considerable uncertainty, and to trade relations with our largest trading partner. The US administration has altered direction on its decarbonization policies, disengaging from the Paris Agreement, and making efforts to revive the coal industry.

The decline of coal in the US is much less a phenomenon of policy as it is phenomenon of price. Coal has declined in the US because natural gas has dropped in price so dramatically. So for example, in electricity generation, it's relatively easy now to move to natural gas, and to think about, in the future, of generating electricity from natural gas rather than coal plants. So I --

THE CHAIRPERSON: I'm sorry, Dr. Yatchew. I'm just wondering -- you skipped 43 in -- that's -- that's the point? You're coming back to it,

or --

DR. ADONIS YATCHEW: That was not intentional.

THE CHAIRPERSON: Okay.

DR. ADONIS YATCHEW: My apologies. I will -- let me finish this slide, and I will return to 43, but thank you for brining my attention to that.

So together, these factors are -- are likely to have a dampening effect on investment. I know that decarbonization policies in the US are very much at the state level, so states may well behave differently from -- from the federal government, and I think we heard some evidence on that yesterday.

So thank you. Let me just back up one (1) slide to four -- to slide 43. In the event that there are large electricity price increases, such pri -- prices are -- I think such increases are improved over the coming years. I realize this is a two (2) year window right now that we're looking at, but if they continue as -- as Manitoba Hydro has indicated it needs, the net effect on GDP eventually may be modest. But in the interim, there are likely to be significant adjustment costs in some locations, particularly those that are heavily dependent on an industry that is sensitive to electricity prices, there could be large

local impacts on employment, on incomes, and on output.

These are not rate increases of the same magnitude as the energy price shocks in oil of the 1970s. However, given that in the short-term, demand for electricity is highly price inelastic, the steepness of the projected rate increases will impose a significant burden, particularly on households, businesses, and institutions that do not have access to substitutes.

Let me also add, once again, looking at experience elsewhere, Ontario has had a large electricity price increases, in excess of 50 percent since 2009. And notwithstanding these increases, as well as the large fluctuations in exchange rates, the Ontario economy continued to grow, and the manufacturing share remained steady at about 13 percent of Ontario GDP.

So you -- one might think that this -- these large swings in -- in exchange rates, for example, would have led to considerable variation in manufacturing output. It didn't. The large increases in electricity, not something that has led to a measurable decline, a measurable impact on the macroeconomy. That's not to say that, again, specific

industries will -- will not be affected.

Okay, so concluding observations begin at slide 45.

(BRIEF PAUSE)

DR. ADONIS YATCHEW: And the first comment I have is on regulatory signaling. The regulatory decision made in this proceeding, which ostensibly deals with a two (2) year test period, will have an important impact on decision-making on industry -- by industry, because it will signal the likely future path of rate increases. If an increase of close to 7.9 percent is approved, that will suggest acceptance of Manitoba Hydro arguments and its time profile of -- its -- its focus on the time profile of future financial ratios, which is part of the core argument that Manitoba Hydro is advancing.

So while we can talk about a 7.9 percent -- 7.9 percent, once you've signaled that, then you're really -- the -- the customer, and certainly the -- the business plans are going to be thinking, This isn't -- this isn't ending. This is going to go on for a while.

Next, slide 47, please. Manitoba Hydro

will have considerable excess capacity. If there are large price increases, there will be a response in attenuation of demand. In a period of excess capacity, such price increases will erode evi -- revenues when the marginal costs of production are very low. So there is a bit of a lack of synchronization.

Forty-eight, slide 48, cost reductions. Manitoba Hydro operates under a cost of service regulatory regime. Many other jurisdictions have move -- moved to a mode of incentive regulation in order to improve incentives for cost minimization. The regulatory regime has worked here, if you look at all -- if you look at Manitoba Hydro's prices in the past. Prices have been reasonable, and there hasn't been that kind of pressure to move from a cost of service to some other mode of regulation.

I realize that this is -- this is not a hearing about what's the right motive, right -- what's the right motive regulation. What I do want to suggest is that in other jurisdictions, when price pressures -- large price pressures all of a sudden emerged, there was a natural response of political and policy -- politicians and policymakers to seek mechanisms for controlling those costs. And that's

what led, in many cases, to a move to incentive regulation. It wasn't just, Let's try something different.

Manitoba has been fortunate to have low electricity prices for a long period of time, and they're -- seem to have not been the necessity to worry about, well, are there other ways of creating cost minimizing incentives? I do note that Manitoba Hydro is implementing a workforce reduction plan, which would eliminate something like 15 percent of the workforce over the course of two (2) or three (3) years, and that there -- just reading the -- the press, there seems to be pressures at -- at the -- at political levels, not just on Manitoba Hydro, but on -- - on the -- the public sector to -- to reduce costs.

Forty-nine. Let me talk about inter- general -- intergenerational fairness. This is a -- there's no short or simple answer to this question, but allow me to make some observations. When you build large, lumpy assets and when they come into rate base, you're going to have cost shocks, and you're going to -- inevitably, there is a -- there's a long-term cycle to the bringing on of -- bringing in large assets, because they are lumpy.

And the reason you're building them is

because they're economies of scale. You can't build them little bits at a time. So these large, lumpy assets don't enjoy the benef -- beneficial scalability features of solar, wind, or natural gas generation, but they have their own benefits. You have these resources here, very clean resources.

So you get these long-term, cyclical pressures on rates. Current customers have benefitted from past investments, particularly those that have been largely depreciated, but remain functional. That's certainly the case in Ontario. Future customers will need to pay for current projects. So this calculus of intergeneral (sic) famous -- fairness is complicated, and -- and I don't think it leads to unequivocal answers.

So what can be done? Slide 50. Rate smoothing is a useful tool for promoting intergenerational equity. The projected profile is more in the nature of a step function over six (6) years, followed by a rapid decline to increases close to the rate of inflation. Some would argue this isn't quite rate smoothing.

Now, the Board may decide that this kind of rate increase is -- is appropriate or warranted for specific reasons, and therefore the

principle of rate smoothing, being just one (1) of the rate-setting guiding principles, is sub -- subsidiary to the main objectives. Perhaps a ramped sequence of increases, and again, perhaps link to a clear demonstration of efficiency gains achieved by Manitoba Hydro might provide a useful framework for promoting internal efficiencies, allowing time to adjust to electricity rates -- customers to adjust to electricity rates, and distributing costs more equitably over each generation of customers.

This is not incentive regulation, but the -- and I'm not trying to suggest that's where you want to go, but simply the idea that, Well, have we tested -- and I have not -- but have we tested the potential for efficiency gains by Manitoba Hydro, and linking those to rate increases, that's a possibility.

Slide 51, please. The effects of large projected increases could, in theory, be mitigated, so one could think of special industrial rates that could be offered to firms that have large electricity cost shares, but this should be viewed as inequitable by other customers, so you have that challenged there, the change in rate design.

Alternatively, the government might implement incentives to retain major industrial

customers, and perhaps that's where a -- a substantial portion of the responsibility belongs. It's not just across ratepayers. There are Provincial benefits to having industries continue and even potentially expand their macro job benefits, and so on.

Slide 52, please. There will be a substantial increase in the number of households facing energy poverty, however it is measured. There are -- I -- I know that Manitoba Hydro has been through and -- and continues to work in a collaborative process on the issue of energy poverty. As I understand it, there's still a fair amount of work that it plans to engage in there. In order to alleviate this -- these -- the potential impacts, will require find -- the funds either from other Manitoba Hydro customers or from government coffers.

And there -- there is -- there's sort of two (2) sides to this argument. One (1) side says that energy poverty is part of the larger poverty question. And so one (1) way to approach it is to ensure that families have sufficient income so that they're not living below the poverty line, and they are able to afford not just electricity and energy, but also food, and other essentials, housing, and so on. So that's -- that's one side.

The other side of the argument says, Well, it's difficult to calibrate these income supports, particularly when cost of living varies a lot by location, energy prices, food prices or other prices may vary. And perhaps these don't -- the -- the -- a system of -- of income supports may not respond quickly enough, so you really do need the -- in an advanced society, the other argument is, what you need is a safety net, and supports for energy is part -- or part of that safety net, not -- the -- the -- not that different from the idea of food stamps, for example, or rent-stabilized housing, three (3) essentials, energy, accommodation, and food. So ultimately, that's a policy decision, which way to -- what -- what's the best way to support people who face energy poverty? But Manitoba does have programs along these lines, as do some other Provinces.

Let me turn to the last two (2) -- the last slides, which are environmental considerations. And this goes back to the Sankey diagram from early in the presentation. From the standpoint of carbon emissions, Manitoba's energy sector is very well positioned. Thirty-seven percent of all energy, including the transportation sector, comes from hydraulic sources, 1 percent from wind generation,

natural gas provides 26 percent of total energy, coal a minuscule .3 percent, and the remaining 35 percent is transportation fuels.

Other jurisdictions are focusing on decarbonizing their electricity sector. You're there. You've been there for a long time. Ontario's initiatives back in -- beginning around 2008/2009, efforts in Ontario were to take us off coal, and the last coal generating station closed in, I think it was 2013/2014. You have been there for the clean electricity for a very long time.

Roughly speaking, about 60 percent of Manitoba energy comes from hydrocarbons. You might think that that's a high number. And that's natural gas and -- and oil. Those are the -- and transportation fuels. You might think does that -- of that as being a high number. It's actually an amazingly low number when you look at the rest of the world, or even Canada. We are still living in a carbon world. Eighty percent of our energy in Canada comes from hydrocarbons, oil, coal, and natural gas. You are at 60 percent.

Now -- but here -- here are my concerns about rising energy prices, both in the electricity sector, and potentially in the natural gas sector via

carbon tax. Economists believe in carbon taxes, or at least a price on carbon. There is a debate between whether it should be a carbon tax, or whether it should be cap in trade, but broadly speaking, economists believe price -- a price on carbon works. Here is my concern about Manitoba. If Manitoba's energy-intensive industries, and they're likely the ones that are going to respond, if they decamp to other jurisdictions, the net effect on global emissions is likely to be unfavourable.

To put it simply, how many industry-friendly jurisdictions are there with an energy mix as clean as that of Manitoba? So in the energy/environmental discussion, this is the carbon leakage problem. We could feel great here in Canada, or Manitoba, or Ontario that we are -- that we've got carbon reduction targets that we're meeting, but if what we end up doing is those -- is incentivizing those industries to move to carbon-intensive jurisdictions -- think China, for example -- we're actually exacerbating, not mitigating, the carbon problem.

And there are -- there -- there is a fair amount of analysis in the literature on -- on how to try to move the agenda on the carbon leakage

problem. But if you were to construct a Sankey diagram for energy and carbon in China, it would be overwhelmingly coal and coal-sourced emissions. So I'm not saying that that's the -- that that is the dispositive argument, or that's a determine -- determinative argument, but I think that it should be part of the -- the picture, environmental considerations. Thank you, Mr. Chair. Thank your panel. Thank you, everyone.

THE CHAIRPERSON: Thank you, Dr. Yatchew. We will take -- we will adjourn until 10 to 11:00.

DR. BYRON WILLIAMS: Mr. Chair, if I -- if I might?

THE CHAIRPERSON: Sure, Dr. Williams.

DR. BYRON WILLIAMS: I'll just indicate that -- as I think I indicated by email to Board counsel last night, I am unlikely to use the full --

THE CHAIRPERSON: Okay.

DR. BYRON WILLIAMS: -- hour, so I'll just let you know --

THE CHAIRPERSON: Thank -- thank you, because we -- we do have to adjourn for the morning by quarter to 12:00.

So thank you. We'll be back at ten (10) -- well, let me ask you, Dr. Williams, how long do you think you'll be? Can we take fifteen (15) minutes?

DR. BYRON WILLIAMS: I would be confident in taking fifteen (15) minutes, sir.

THE CHAIRPERSON: Okay. Okay. We'll -- we'll take fifteen (15) minutes. Thank you.

--- Upon recessing at 10:39 a.m.

--- Upon resuming at 10:54 a.m

THE CHAIRPERSON: Dr. Williams...?

CROSS-EXAMINATION BY DR. BYRON WILLIAMS:

DR. BYRON WILLIAMS: Good morning, members of the Panel, and good morning, Dr. Yatchew.

Just -- we do have one (1) exhibit we'd like to introduce I believe with the consent of counsel for Dr. Yatchew and that is an excerpt from the Alberta Electric Systems Operation -- Operator which we would suggest be marked as Coalition 42.

MR. KURT SIMONSEN: Thank you.

--- EXHIBIT NO. COALITION 42: Excerpt from the Alberta

Electric Systems Operator.

CONTINUED BY DR. BYRON WILLIAMS:

DR. BYRON WILLIAMS: And Dr. Yatchew, let me start by thanking you on behalf of our clients for an informative and also a really interesting presentation. I will testify for two (2) seconds and just say that my colleague, Ms. Dilay and myself, were to Googling your Big Ideas and energy course and seeing if there was a -- we could get a video link to -- to participate. So, if you see an upswing in -- in enrolment from Manitoba we'll be to blame.

Sir, we'll come to this in -- in greater detail in a few moments, but just in terms of Coalition 42 which is an excerpt regarding Alberta's renewable energy program. In your evidence -- we don't need to go there now -- but in your evidence you specifically considered the rapidly declining marginal cost of renewables such as solar and wind, with specific reference to the 2616 (sic) auction results, agreed?

DR. ADONIS YATCHEW: Yes and to results in various parts of the world.

DR. BYRON WILLIAMS: And -- and, sir, while the results of the Alberta auction were not

available at the time you wrote your evidence, you were notified by -- by your legal counsel that I might be making reference to them?

DR. ADONIS YATCHEW: Yes, I was.

DR. BYRON WILLIAMS: And the results are notable, I'll suggest to you, in that they set a record low in terms of the weighted average price for renewables in Canada.

Would that be fair, sir?

DR. ADONIS YATCHEW: Certainly for wind and I would expect most other renewables.

DR. BYRON WILLIAMS: And perhaps if we can just go to slide 3 of your PowerPoint for a second, Dr. Yatchew. I couldn't tell if the photograph was of yourself or me as a young man, perhaps only Mr. Peters and Ms. Ramage would be able to testify that I actually did have hair.

Is it a self portrait, sir?

DR. ADONIS YATCHEW: No, it's not. It's -- it's intended to suggest the enthusiasm of some of my younger students in the Big Ideas courses.

DR. BYRON WILLIAMS: And I didn't mean to touch on the Big Ideas course, sir, it -- it's focussed on a broader global kind of contextual picture relating to energy.

Would that be fair, sir?

DR. ADONIS YATCHEW: That is, yes.

DR. BYRON WILLIAMS: And, sir, in terms of your evidence today and -- and looking at its purpose in assessing the likely impacts on consumers, various customer groups of rate increases of the potential magnitude, your evidence was designed to provide context and -- and give a broader insight into global trends.

Would that be fair, sir?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: And in undertaking your evidence you undertook a review of relevant literature and, as well, relied on your own extensive experience.

Would that be fair?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: And, sir, in terms of where you dug the deepest, if I might suggest to you, it was specifically on issues related to demand modelling and, in particular, insight into the estimates of price elasticity.

Would that be fair?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: And you did that

through a literature review, including a literature review of the meta analysis?

DR. ADONIS YATCHEW: Yes. And, as well, I have estimated models of this type myself, including some unpublished work that's still in -- in progress where I'm looking at panel data over periods of time. And I have estimated demand models of various kinds over the years.

DR. BYRON WILLIAMS: And we don't need to go to but you did attempt a very kind of high level modelling exercise to the extent that you looked at the -- at a high level, the impacts of price elasticity and -- and GDP elasticity?

DR. ADONIS YATCHEW: Yes, and it was really to inform my opinion on the estimates that Manitoba Hydro was providing. And really, I see it as a compliment in the sense that Manitoba Hydro uses its data, what is -- what is happening in other jurisdictions, and would that change my view of the estimates.

DR. BYRON WILLIAMS: And thank you for that. And, sir, recognizing that the specific issue before the Board in this hearing is confirmation of interim rate increases of 3.36 percent, as well as a 7.9 percent proposed rate increase for '18, '19, you

also took a big picture look at the potential implications of successive rate increases of 7.9 percent for a number of years going forward.

Would that be fair?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: And in so doing, sir, you address your minds (sic) to the potential implications of -- and the relative merits of potentially steep rate hikes over a shorter period of time versus smoothing those cost increases over a longer period of time.

Would that be fair?

DR. ADONIS YATCHEW: Yes. I mean tech -- speaking technically for a moment, we can model the dynamic impacts of various price sequences, rate increase sequences, various price profiles and for the purposes of my report, I just did a very simple back-of-the-envelope calculation that anybody can reproduce.

It's certainly possible to model dynamic effects, dynamic price effects.

DR. BYRON WILLIAMS: And, sir, recognizing the role of other experts in this hearing, it would that be fair to say that you did not expressly test the export revenue assumptions of

Manitoba Hydro?

DR. ADONIS YATCHEW: I did not.

DR. BYRON WILLIAMS: And, similarly, you did not expressly test the prudence and reasonableness of any particular expe -- expenditures?

DR. ADONIS YATCHEW: I did not.

DR. BYRON WILLIAMS: And, similarly, you did not expressly test whether a rate increase of less than 4 percent would impede access to the capital markets?

DR. ADONIS YATCHEW: I did not.

DR. BYRON WILLIAMS: And, similarly, apart from what I believe you've described as kind of back-of-the-envelope calculations, you did not expressly model the impact of the rate increase upon the economy.

Would that be fair?

DR. ADONIS YATCHEW: No, I did not. But -- but the report does discuss that to some -- to some degree. So one can think of asking what a price -- what -- what would be the impact of a price increase and model the impact on an industry -- by industry impact of a price increase and the jobs lost, for example.

But what is much more difficult to --

to model is how will the economy than respond to having those resources freed up? And that kind of general equilibrium modelling is actually quite difficult to do. I did neither. But there are -- there are analyses that have been filed with the Board that have done some of that.

DR. BYRON WILLIAMS: Okay. And, sir, in undertaking your assignment, did you examine the specifics of cost of service regulation in Manitoba, including a consideration of whether or not the regulator has the power to specifically disallow capital expenditures?

DR. ADONIS YATCHEW: I did not.

DR. BYRON WILLIAMS: Dr. Yatchew, if you or your legal counsel need a reference for my -- my next suggestion to you, it's paragraph 123 of your evidence, and in particular -- of your written evidence and, in particular, on -- on page 45.

DR. ADONIS YATCHEW: Yes, I have that. Thank you.

DR. BYRON WILLIAMS: And, sir, again recognizing that the issue before the Board in this hearing are interim increases of 3.36, as well as a proposed 7.9 percent for '18, '19, you specifically describe the potential for large increases over a

sequence of years as more in the nature of rate shock.

Is that accurate, sir?

DR. ADONIS YATCHEW: That's the language I've used, yes. I'd be happy to expand on that but --

DR. BYRON WILLIAMS: And definitionally, sir, if you can -- what led you to conclude that this was more in the nature of rate shock?

DR. ADONIS YATCHEW: So there's obviously some debate on -- on what -- what rate shock really means. And I think some of that discussion is really semantic. First of all, one (1) of the sort of rules that's put out there is that anything below 10 percent is not really a rate shock.

Second, it's -- in a certain definitional sense if the -- the rate is announced in advance, how could it be a shock? You know what it's going to be, it's going to kick in next year, that's not a shock, it's just a reality. So there's no surprise element if it's announced and that doesn't -- doesn't -- doesn't happen immediately.

So let me move away from those semantic kinds of debates. The reason I used this language here is because I'm really thinking of the projected

rate increases cumulating to 50 percent. That's a big change. We can discuss whether that -- the word "shock" should be used or not, but a 50 percent real increase in the price of electricity, even if it's entirely justified and that's -- it could be justified on the basis of financial racial arguments, that still is a very large increase and in that sense, it is a shock. I mean, if you're in business and 15 percent of your costs are electricity costs, and there are few instances of industries where that's the case, you're taking a significant hit. It's -- you're going to go back to your spreadsheets and look at your business plans and think about what your capital investments are going to be in the coming years. So that's why use the word "shock."

DR. BYRON WILLIAMS: Thank you for - for the care in -- in responding to my question.

And you use the example of business. Similarly a residential subscriber, I'll suggest to you, heating their home and with no readily available or affordable substitutes would also be taking a significant hit, sir?

DR. ADONIS YATCHEW: Certainly would be and -- and I don't think that the residential customer who is following this in -- in any -- at any

level of detail will just look at, oh, it's 79 -- 7.9 next year, what's the prospect for the future beyond that, what am I supposed to do here?

DR. BYRON WILLIAMS: And sir, you used -- at least as I recorded your -- your comment -- in terms of the cumulative rate increases, recognizing that we're dealing with projections, I think you used the term "real increase in the range of 50 percent" and -- and presumably, what you mean by that is, after we take out inflationary impacts, these are impacts in the range of 50 percent over a period of time, over and above that; is that --

DR. ADONIS YATCHEW: That's correct.

DR. BYRON WILLIAMS: And as I understand the core of your evidence, sir, you look to the potential impacts of potential rate shock level increases and -- and considering their implications in terms of the consumption, production and location choices of Manitoba businesses.

That's one (1) thing that you looked at to some degree, sir?

DR. ADONIS YATCHEW: I didn't specifically investigate industries but they certainly have an impact on those kinds of decisions.

DR. BYRON WILLIAMS: And you've

already mentioned that you looked at the impact, the distributional effects upon consumers, in particular, low income consumers or those lacking readily available substitutes; agreed?

DR. ADONIS YATCHEW: I did not look at it numerically, but I certainly rev -- I did review other -- for example, the -- the collaborative analysis that Manitoba Hydro's been engaged in, the modelling that it's been developing in that area.

DR. BYRON WILLIAMS: And in terms of the prism in which you viewed those issues, sir, would it be fair to say that the primary prism you looked at them from was an economic perspective given your well-recognized expertise as an econometrician and an energy economist?

DR. ADONIS YATCHEW: Yes, my perspective is from the -- from that of the dismal science.

DR. BYRON WILLIAMS: From time to time, Dr. Yatchew, the dismal science puts on some pretty nice-looking bowties.

DR. ADONIS YATCHEW: Well, thank you you've -- you've been very kind but -- but we're actually very good at economics. I understand we've correctly predicted nine (9) out of the last seven (7)

recessions.

DR. BYRON WILLIAMS: I want to draw you to a -- a quote. It appeared in your PowerPoint but I'm going to take you to paragraph 144 of your evidence. Diana, I'm sorry I can't tell you the exact page.

DR. ADONIS YATCHEW: Page 51.

DR. BYRON WILLIAMS: Page 51. Sir, not surprising given our conversation, you conclude that large increases will induce a price response; agreed?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: And drawing your attention to the last sentence of this paragraph, you suggest that in a period of excess capacity such increases may be sub-optimal as they will erode revenues at a time when marginal cost of production are low?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: And we're going to come back to that word "suboptimal" just in a second.

But in terms of marginal costs being low, I take it, sir -- and if you need a reference it's paragraph 30, page 12, of your evidence.

You're referring to the costs, for example, on line 13 of natural gas at high capacity being in the range of $.05 cents US.

DR. ADONIS YATCHEW: So the numbers that are in paragraph 30 are not marginal costs. Those are all-in costs.

DR. BYRON WILLIAMS: Fair enough.

DR. ADONIS YATCHEW: So these are what are usually called in the industry levelized unit energy costs. So that's the costs, you're going to build it, this is what you're going to -- this is what it's going to cost you per kilowatt hour at this particular capacity factor, 39 percent.

DR. BYRON WILLIAMS: Did you make a reference in your evidence, sir, to the marginal cost of natural gas being at $.05 cents a kilowatt hour?

DR. ADONIS YATCHEW: I don't think I would've -- so the marginal cost in natural gas generation is, essentially, the cost of natural gas, the fuel, just the fuel.

DR. BYRON WILLIAMS: Yes. So what were you referring to then, sir? Like, what figure are you thinking of?

DR. ADONIS YATCHEW: When I -- when I talk about the $.05 cents --

DR. BYRON WILLIAMS: Yeah.

DR. ADONIS YATCHEW: -- in paragraph 30? That's the all-in cost. If you -- if you build a natural gas combined cycle generator and you get to sell your full output at 39 percent of the time, that's the cost that it's going to -- that -- that -- that's the cost that you're going to be incurring.

DR. BYRON WILLIAMS: And by the marginal cost, you're referring exclusively to the fuel costs --

DR. ADONIS YATCHEW: Marginal cost are usually --

DR. BYRON WILLIAMS: -- by the embedded costs, sir?

DR. ADONIS YATCHEW: -- mostly fuel costs. So, for example, with a lot of Hydro capacity in place, excess capacity in place, the marginal cost is very low. You've already -- you're already incurring the capital cost whether you're generating electricity or not.

DR. BYRON WILLIAMS: So why are large increases at a time when marginal costs of production are low suboptimal? What do you mean by that, sir?

DR. ADONIS YATCHEW: I'll try to -- not to get too --

DR. BYRON WILLIAMS: And I presume we're going to the lack of synchronicity, but you'll -- you'll --

DR. ADONIS YATCHEW: Well -- so the literature -- I'm sorry, the basic economic argument is that societies are served well when price equals marginal cost. And I won't go into the -- the basic theorems that underlie that argument.

The problem is that in electricity if you tried to price electricity at the marginal cost which, for example, for natural gas would be just the fuel cost, you wouldn't recover the capital costs.

So in regulated industries we don't engage in marginal cost pricing which is socially optimal, we engage in a second best solution which is average cost pricing because Utilities, private or public, still have to recover their costs.

The point that I'm trying to make in paragraph 144, perhaps oversimplifying, but really is just the point. You have an asset. You're paying for it or you have these hydraulic assets, you're paying for the capital costs which are dominant costs for hydraulic facilities, okay, and you're not using or at least you're not using them as much as you would be if the price of electricity were lower rather than

higher.

So, there are -- so average cost pricing, which is the standard in regulated Utilities, is a second best solution, but certainly acceptable.

What I'm saying here is that pricing electricity at high levels if it's higher than necessary, for example, leaves assets underutilized and that's the meaning of the sub -- sub-optimality.

Let me just finally say that with lumpy assets, you're always going to have a period of time when some portion of them are not being used. They're not being fully used; that's just the reality of bringing on a facility that will be fully utilized a few years down the road, but not yet. So there's al -- you're going to have that underutilization problem. The -- the price effect exacerbates that.

DR. BYRON WILLIAMS: Thank you. I'm going to ask Diana to bring up an information response. Manitoba Hydro/Daymark load number 12, and hopefully it's attachment 3 which is the meta-analysis by, for the court reporter, Labandeira, L-A-B-A-N-D-E-I-R-A.

And Dr. Yatchew, you're familiar with this particular document because it was one (1) of the important references for your evidence; agreed?

DR. ADONIS YATCHEW: Yes. I mean, I reviewed many documents but this was one that I thought was fairly recent and did have a meta-analysis. So it -- it in itself did a lot of the work for me by reviewing all these other studies and incorporating them in one (1) analysis.

DR. BYRON WILLIAMS: And you expressly cited in your evidence, both in paragraph -- you'll accept subject to check, paragraph 71, and footnotes -- and -- and a number of footnotes as well, sir, agreed?

DR. ADONIS YATCHEW: I did cite the -- I did cite the report, yes -- or -- yeah.

DR. BYRON WILLIAMS: And I want to draw your attention, first of all, sir, in this report to -- at the bottom on -- on the right-hand side, page 553.

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: And right there, Diana, is fine. And we're going to focus on the -- the last full sentence on page 553 which starts:

> "In terms of specific energy goods, gasoline shows the highest price elasticity and heating oil displays the lowest price elasticity."

Do you see that reference, Doctor?

(BRIEF PAUSE)

DR. ADONIS YATCHEW: Yes, thank you, I've now -- now I'm in the right place.

DR. BYRON WILLIAMS: So -- and you see that reference, sir?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: Okay. We'll come back to it in just a minute. And then if we can just, Diana, at the bottom of this page, we'll see footnote 7, which goes on to the next page. Perhaps you'll just see the reference to substitution, but let's go down to the rest of footnote 7 at the bottom of page 554.

And Dr. Yatchew, you'll agree I've showed you this previously, but you'll take a second to look at -- at this footnote?

(BRIEF PAUSE)

DR. ADONIS YATCHEW: I've scanned it quickly.

DR. BYRON WILLIAMS: And here, sir,

they're -- they're talking about one (1) of the challenges for consumers in substituting for heating systems, in essence, that they have a limited capacity to react to price increases unless they give up comfort?

DR. ADONIS YATCHEW: Yes, and much depends on the availability of alternative fuels.

DR. BYRON WILLIAMS: So the absence of substitutions as -- as well?

DR. ADONIS YATCHEW: Absolutely.

DR. BYRON WILLIAMS: And that goes to the reason that when -- when we're looking at the relative elasticity in terms of energy consumption related to home heating, it's less elastic than other -- other choice -- other -- other situations?

DR. ADONIS YATCHEW: The example that's -- the contrast that is drawn here is between gasoline elasticity and heating oil elasticity, both of which are hydrocarbons, liquid hydrocarbons, but we have the ability to drive less, for example, take more public transit.

And in studies that I've, in fact, I -- I had a paper in the Econometrica with one (1) of my graduate students some years ago. We also found a very high gasoline elasticity. I'm not at all

surprised that the heating oil elasticity is -- is much lower.

DR. BYRON WILLIAMS: And -- and sir, later in this paragraph, being footnote 7, you'll see a reference to electricity being related to uses that are very necessary, such as lighting and cooking, and again, showing a relatively small price elasticity.

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: Do you see that, sir? And that would be your -- apart from this particular report, that would be consistent with your understanding of the literature?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: Going to page 555, on the right-hand side, just above conclusions and policy implications, and specifically, Dr. Yatchew, I want to address your mind to the -- the last two (2) sentences starting "contrarily," and just give you a second to look at that, sir.

DR. ADONIS YATCHEW: M-hm.

(BRIEF PAUSE)

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: So the suggestion

by the authors of -- of this paper, sir, I'll ask you whether you agree or not, is that if clean energy sources face price increases, both substitution and the limited capacity of demand reduction through prices will move in an environmentally negative direction. You see that suggestion by the authors?

DR. ADONIS YATCHEW: I do that -- I do see that, yes.

DR. BYRON WILLIAMS: And sir, is -- is that a -- an issue that you're -- you agree with, have an opinion on?

DR. ADONIS YATCHEW: So at the very last part of the presentation, I talked briefly about -- and tried to make a point that is actually quite related to this. If you --

DR. BYRON WILLIAMS: And that's page 52 of your evidence, sir, paragraph 147?

DR. ADONIS YATCHEW: Yes, sir, that's correct. Yes, and -- and we do have this carbon leakage problem. You increase the price of -- of, let's say, a clean fuel, you're going to very likely cause migration, and that migration may be to less -- less environmentally-friendly fuels.

DR. BYRON WILLIAMS: Okay. And so the conclusion of the authors at page 555 that I just

referred you to, sir, would be consistent with -- with what you're suggesting in par -- in -- in paragraph 147?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: Okay. Sir, my -- my clients certainly appreciate your comments in terms of addressing energy poverty today, and the pros and cons of choosing whether to go to -- through a government-directed approach, or a -- a utility-directed approach, and -- and we have your point on that.

Would it be fair to say that in terms of the -- the government approach, that in terms of administrative simplicity, you would expect that it would be simpler, sir?

DR. ADONIS YATCHEW: A gov -- the -- the government doing it, particularly if the government has access to income tax records, that -- that simplifies that aspect of it.

DR. BYRON WILLIAMS: And -- and would that also be more likely to increase participation or enrolment with -- with the additional information in the government's hands, sir? And if you're not able to offer an opinion on that, that's fine.

DR. ADONIS YATCHEW: I don't -- I

don't have a -- sort of a -- a sound empirical base for answering that question.

DR. BYRON WILLIAMS: Sir, in your evidence, and recognizing that this is not a hearing about regulatory process for the -- the future, you did make reference to, in quotation marks, "incentive regulation"?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: And you'll be familiar, at a high level, at least, with, for example, in the telecommuni -- communications field, price cap --

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: -- regulation?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: And sir, when you're speaking of incentive regulation, presumably you're considering efforts by regulators historically, such as the CRTC before they moved to a more market model to incent efficiency through productivity factors, as well as allowances for technological changes?

DR. ADONIS YATCHEW: Yes.

DR. BYRON WILLIAMS: And near the summative paragraph of your PowerPoint today -- we

don't need to go there, but you talked more -- I'll suggest to you, more about smooth rate increases potentially supplemented by not incentive regulation, but incentives to efficiency. And -- and Dr. Yatchew, I wonder if I can get you to elaborate just a little bit in terms of what you meant by some of those incentives, sir.

DR. ADONIS YATCHEW: I'm -- I realize this is not about changing the model for regulation, but if one thinks about price increases approved by this Board -- or any regulatory board rate increases, boards are often more amenable to approving rate increases if -- if they have -- if they're convinced by the productivity growth and efficiency gains of the regulated entity.

I have not attempted to analyze the -- the efficiency of -- of Manitoba Hydro. They could be, for all I know, as efficient as they -- bare-bones as they possibly could be. On the other hand, what has been empirically found in other jurisdictions is that once incentives are put in place, incentive regulation, there is an initial gain in productivity, and then it levels off.

Now, I'm not sure where Manitoba Hydro would come out on this, but certainly, one would at

least want to consider whether there is the potential for -- for efficiency and cost reductions, or at least unit cost reductions. I know that Manitoba Hydro has -- is in the process of implementing substantial labour force reductions. Perhaps that was, in part, a -- a natural response to the impending pressures that it knew it was facing, or perhaps it would have occurred in any case, but cost pressures often create incentives for utilities to find productivity gains.

DR. BYRON WILLIAMS: And sir, in terms of best practice from your review of the literature, are there examples or models that are attractive to you that -- in terms of incentive approaches?

DR. ADONIS YATCHEW: Once again, this is not about changing the model, but if you ask me what -- what are the models that seem to be the most successful out there, price cap regulation would be the number 1. That would be the -- that would -- that would be the -- the first go-to answer.

DR. BYRON WILLIAMS: Okay.

DR. ADONIS YATCHEW: And the -- it's not as if it's not challenging. I mean, for Manitoba Hydro to actually try to compare itself to other utilities, not on the outcomes, but really on the cost side, is a fairly -- it's -- it's a -- it's a fairly

challenging exercise because of its unique characteristics. That falls under the rubric of benchmarking, and benchmarking is a complicated process, and it's always an evolving process.

DR. BYRON WILLIAMS: Dr. Yatchew, I -- I wish we could talk all -- all day. I probably have a -- a lot more questions, but I -- most of them, you addressed in your direct evidence, so our clients truly appreciate the time. Look for Ms. Dilay and I to enrol online sometime in the future, sir.

DR. ADONIS YATCHEW: Thank you. You've been very kind, too kind.

THE CHAIRPERSON: Thank you, Dr. Williams, and -- and perhaps at the break, you can ask Dr. Yatchew and -- how he does such a fine job on his tie.

I'm just wondering -- we've got fifteen (15) minutes, if the panel has any questions. Dr. Grant...?

Dr. -- Dr. Grant's a little miffed because during the break, I told him he wouldn't be allowed to ask any questions, because we do break at -- - at 11:45, but now -- do you have any questions that will only last fifteen (15) minutes.

BOARD MEMBER GRANT: I have many

questions --

THE CHAIRPERSON: You have many questions. We have a lot of time this afternoon.

BOARD MEMBER GRANT: Boy, where to start. Thanks very much. You've made us all proud in the discipline.

The only thing I do remember is when those ex inefficiencies got driven out of telecoms. They -- the job market for economists went down pretty dramatically or at least the -- one (1) of the favourite places to -- to get hired in

But rather than get too technical, I'm just wondering about that sort of big picture story analy -- say you come back into your ancestral homeland, and you sort look around, and -- and it's obviously a pretty unique place. And I think we all appreciate you said nothing about the weather today. But I get the sense that you think, Here's this -- here's this unique economy with this great energy sector.

And -- and I was thinking with the Sankey diagrams, if you think of the -- the only imports through the system are the -- are the fossil fuels. So it -- it's even, you know, a more remarkable one, but I guess I'm asking what -- what

are you struck by if you're -- you know, we -- if we -- we asked for that view from the outside, does something strike you? Or -- or maybe it's true of all the Hydro utilities in Canada, but is there something that just strikes you as unusual, or that we should be thinking more outside of the box, or why aren't we -- have Google servers, or cloud servers, or electric cars everywhere, or -- I guess that's sort of my big-picture question.

DR. ADONIS YATCHEW: Many responses are possible for that question, but let me -- let me try with one (1) or two (2). The first one is, yes, Manitoba Hydro has made some large investments and some large capital projects, and the timing isn't quite ideal, but there are aspects of the timing that were right. These capital projects were build at a time when interest rates were low; that's what you want to do.

You don't want to be building a Dar -- like the way we built Darlington in Ontario in the 1980s, when interest rates were in the teens, and all of that being capitalized in the projects. So I'm confident that eventually, this investment is going to pay off. It is a very, very clean investment.

My second observation really has to do

with the carbon leakage. I am concerned that you want end up -- that you want industry to be attracted to a jurisdiction that has very clean energy, and you don't want to have that industry departing.

The third observation, if I -- if I can take the time is -- so I -- I wrote a paper about a year or a year and half ago, and it had to do with -- the title was something like 'Rational Versus Feel-good Carbon Policy'. And the idea, in part, had to do with this leakage problem, that yes, we would all like to do our share, in Ontario, and Manitoba, British Columbia. We'd like to do our share, and does our share really mean reducing our carbon output? Well, if we're just exporting that carbon output because of the leakage problem, we're not -- we're -- that's a feel-good policy. It's not a rational policy.

But the second point is that one would like to engage in innovation and programs that actually lead to the export of these technologies. So geothermal, for example, is -- is one (1) of the prospective renewable technologies out there.

The problem is that China would have a very hard time trying to incorporate geothermal on any major scale, because geothermal depends very much on the population density. The larger the energy demand

on a given, let's say, square kilometre, the deeper you have to dig to get enough geothermal energy to serve that area.

So it's not obvious to me that geothermal is going to reach the tipping point where it becomes exportable, where this is a technology that could be -- it could -- it could be adopted in China. I'm not ruling it out, but that's one (1) of the challenges.

On the other hand, electrification of the transportation sector, any progress that is made on that front and any project that Manitoba engages in that actually promotes that transition, and that eventually becomes something that can be adopted in rapidly emerging and rapidly growing economies like China, and India, South America. That has spillover benefits that are potentially huge. And that's what's not measured in the political process.

There is some lipservice given to the idea, Well, we're going to develop this, and then we're going to export this technology. But the primary focus is on, We've got to reduce our carbon content, because we've got to meet our Paris or other accords that were...

(BRIEF PAUSE)

THE CHAIRPERSON: Some -- somebody's got to ask.

BOARD MEMBER MCCUTCHEON: I'll -- I'll ask. I'll ask my question, because I think it's sort of on the same track as what we're talking about, here.

So in your -- in your in your comments about carbon leakage and -- and carbon taxes, which are at a relatively new phenomenon in most jurisdictions in Canada -- in fact, in Manitoba, they're not even in place yet. But I was wondering if there's a role for carbon tax revenues to support an industry like Hydro.

Is -- rather than just look at it, using it for developing other green technologies. When you look at your Sankey diagram, and -- where Manitoba's already a -- in the scheme of things, a pretty green Province, would it be an appropriate use of -- of carbon taxes to actually offset some of these increases because of these lumpy assets that you referred to?

DR. ADONIS YATCHEW: There is a defensible argument to be made there. The -- you

already have an excess supply of green power here, green energy here in this Province, and -- and even when I look at the demand reductions, the electricity reductions, and natural gas reductions in the policy paper put forth by the government here, I sort of wonder, Do you really want to be doing this right now when you've got all this excess capacity?

There can be an environmentally-grounded argument made for the proposition that you've -- that you've put forth, and that is, if you're going to tax, spend it on the green hydraulic electricity, perhaps, subsidizing that. I certainly would not reject that argument out of hand. There is a defensible case to be made.

THE CHAIRPERSON: Ms. Kapitany...?

THE VICE-CHAIRPERSON: Well, my question isn't as poetic as Dr. Grant's, but there you have it. So I'm looking on page 33 of your slide deck, and to better understand the effects of potential rate increases, I wondered if we could just go into this in a little more depth.

And in particular, in talking about the patterns of intensity you spoke about, and in the service sector, I'm assuming that the -- the decline between five (5) and twelve (12) and then the pickup

after that was largely because of the economic downturn?

DR. ADONIS YATCHEW: So the economic downturn is less likely to -- to result in electricity intensity, because it's -- electricity intensity is per unit of GDP. So as GDP declines, the question is -- or -- or as well, electricity consumption will dec -- will -- will potentially also decline.

So electricity intensity is not so much driven by -- by changes in economic activity as things like shifts from one subsector to another subsector. Certainly in the bigger picture, the major shifts in energy intensity are because economies are becoming more service-oriented, which require less energy than they are, let's say, manufacturing-oriented. So there are shifts of that type.

I didn't actually try to determine what the cause of this nonmonotone effects in electricity intensity in Manitoba have been.

THE VICE-CHAIRPERSON: So then in the manufacturing sector, where they peaked in 2005, and then declined since then, I was thinking that was maybe technological changes that would have made the use of electricity less intense.

DR. ADONIS YATCHEW: That's very

likely the case, and that particular sector, that trend is consistent with, for example, trends in the US in electricity intensity.

THE VICE-CHAIRPERSON: But agriculture really puzzles me, because it was high to low five (5), and then dropped significantly. So it sounds like more a -- a stepdown than the more gradual change you've described in manufacturing. And given what I've seen in our agricultural economy in Manitoba, I can't figure that one out at all.

DR. ADONIS YATCHEW: Like, one would have to dig down to see exactly what the uses of electricity were, and -- and why that drop was -- was so significant.

THE VICE-CHAIRPERSON: Part of it could be technology. Again, technological changes, but I don't think that would explain why it's -- it -- there was such a significant drop in '05.

THE CHAIRPERSON: We're getting close to the break, so we'll adjourn until 1:15. Thank you.

--- Upon recessing at 11:42 a.m.

--- Upon resuming at 1:16 p.m

THE CHAIRPERSON: Good afternoon. M.

Hacault, I understand you'll be proceeding?

CROSS-EXAMINATION BY MR. ANTOINE HACAULT:

MR. ANTOINE HACAULT: Yes, thank you, Mr. Chair.

Good afternoon, Dr. Yatchew. The first subject which I'll be dealing is -- relates to what you have on your slide 49. It's on intergenerational fairness. And more, particularly, I'm going take it into smaller bites.

Is it consistent with your understanding, sir, that one (1) of the ways we deal with intergenerational fairness is by introducing a depreciation expense into the rate base with the depreciation expense tied to the life of the assets which are used and useful?

DR. ADONIS YATCHEW: Certainly, the depreciation expense comprises part of the reasonable costs that need to be recovered for an asset, in this case, capital costs. The -- to the extent that depreciation matches -- the depreciation matches the actual -- the actual deprecation or the value of the asset than that is -- one would consider that's being intergenerationally fair but that matching doesn't always occur, just from -- for accounting -- for

sensible accounting reasons.

MR. ANTOINE HACAULT: And when you say "it doesn't always occur," an example where it might not occur for, say, the new generating station Keeyask is that in real dollars the depreciation expense of this new facility which is coming online in 2020 is going to be higher than the depreciation expense in real terms six (6) years from now?

DR. ADONIS YATCHEW: Let me just make sure I understood that. So the -- the depreciation expense on a straight-line basis on annually is an equal nominal amount, but in real terms, your contribution each year is declining, yes.

And there's also the added -- added complexity that it's -- it's often -- well, it's sometimes difficult to predict what the lifetime of an asset is really going to be.

MR. ANTOINE HACAULT: Okay, thank you, sir. Now, if a Utility were able to keep positive net income each year, including the depreciation expense, wouldn't this not be evidence that each generation of consumers is paying their own costs?

DR. ADONIS YATCHEW: I would have to think that through. It's not obvious to me that -- that positive net income is a sufficient condition.

It might be, but I'm not sure I have a -- I'd have to think about that a little bit more carefully.

Certainly, it's helpful.

MR. ANTOINE HACAULT: It's -- it's helpful in the sense that they'll have paid the operating costs in that year, correct? They'll have paid the depreciation costs based on useful life; correct?

DR. ADONIS YATCHEW: Yes.

MR. ANTOINE HACAULT: So we know also they'll have paid the interest cost on that asset; that's another expense that they'll have paid? All of those key factors will have been paid by the ratepayers if we achieve a net income number, correct?

DR. ADONIS YATCHEW: I would agree with that.

MR. ANTOINE HACAULT: Okay. And if, in addition to paying these numbers, we're asking ratepayers to build up reserves, that is a contribution that we're asking from ratepayers over and above the payment of interest, the payment of depreciation and the payment of operating expenses; correct?

DR. ADONIS YATCHEW: If there is a separate reserve that -- that one is attempting to --

to build, I suppose yes.

MR. ANTOINE HACAULT: Okay, thank you. I'll move on to a different area now, Dr. Yatchew, and I'll start with your slide 42 which talked about vulnerable economic sectors.

DR. ADONIS YATCHEW: I have that, thank you.

MR. ANTOINE HACAULT: In that slide you identified basic chemicals, pulp and paper, iron and steel mills and in the third dash, the mining sector.

If we go to other evidence, the only sector of the major industrial users group which is not identified here would be the pipeline sector.

Now, sir, with respect to what you've categorized as vulnerable economic sectors, do you have a sense of what proportion of these vulnerable economic sectors are in rural Manitoba, in northern Manitoba?

DR. ADONIS YATCHEW: I do not. I did not attempt to make an estimate of that.

MR. ANTOINE HACAULT: And do you have a sense of whether, and to what extent, these vulnerable consumers might have the option to do some fuel switching?

DR. ADONIS YATCHEW: I did not make an assessment of the specific -- either technological capability for fuel switching, in other words, whether you -- whether you could switch to gas in your particular use or whether even gas was available.

MR. ANTOINE HACAULT: Okay. Now, by way of specific sector that you've identified here, an electro chemical process because of the very nature of the process would not be able to do fuel switching; correct?

DR. ADONIS YATCHEW: That's -- that's my understanding. You need electricity in order to run that particular type of industrial process.

MR. ANTOINE HACAULT: Now, on the next slide, being slide 42, you make the comment that the Manitoba economy will adapt and it was in the context of that that I wanted to understand whether or not you were able to deal with the issue of whether the northern and rural aspects of the intensive electrical users would be able to adapt.

DR. ADONIS YATCHEW: I did not do any analysis on a locational basis.

MR. ANTOINE HACAULT: Thank you. The next area in which I think there might be a little bit of useful information that we could garner is with

respect to the last point on slide 43.

Do you have any sense, Dr. Yatchew, of how much contraction there was in manufacturing prior to 2009 in the Ontario sector?

DR. ADONIS YATCHEW: Sorry, prior to...?

MR. ANTOINE HACAULT: 2009.

DR. ADONIS YATCHEW: I didn't look back at data prior to that time.

MR. ANTOINE HACAULT: Okay.

DR. ADONIS YATCHEW: I should point out that sort of there was a secular trend of moving towards increasing service sector share in provincial economies, if you go back over a significantly longer period of time. Certainly with the growth of China's economy in the 21st century, a lot of manufacturing has gone offshore.

MR. ANTOINE HACAULT: But would you agree with me, sir, that prior to that time there was also a lot of disruption in the electrical sector in Ontario?

DR. ADONIS YATCHEW: The electrical sector in Ontario went through massive expenditures in trying to turn itself into a competitive market. It spent untold millions and then, unfortunately, cease -

- ceased the experiment and back -- and went back to a, essentially, a central planning type approach to electricity generation.

So yes, there was a lot of change beginning, oh, in the mid-1990s that -- we had this iconic form and -- that everybody knows Ontario Hydro that was, essentially, devolved into distribution -- a transmission and -- and generating entities unbundling is the term. So there was -- there was a lot of disruption but if I -- I'm trying to think back what my general recollection is about rate increases. I don't think the rate increases were -- were comparable to the ones that we've experienced since 2000 and -- since 2009.

MR. ANTOINE HACAULT: And I'd like to see whether you have any recollection or information that you can provide to this Board as to whether or not the 300 largest industrial customers benefitted in Ontario from increases in Hydro rates, which were lower than the 50 percent that you quote on this slide?

DR. ADONIS YATCHEW: I've not done that level of analysis. However, I will -- I can describe in qualitative terms what did happen. Once these electricity price increases started to occur,

the -- the structure of the tariff to large industrials evolved somewhat and the capacity portion of the charge became based -- based on a small number of peak hours when -- when you -- of your consumption.

So by simply avoiding, let's say, the five (5) peak hours in the year, you could substantially reduce your costs -- your electricity bills as an industrial. So, there were devices that were put in place that allowed industrials the opportunity to face lower rate increases or at least lower bill increases. I can't be more specific than that at this time, but there is this kind of differentiation going on.

MR. ANTOINE HACAULT: Thank you. I'll move on to another area, Dr. Yatchew, and it relates to some comments that you made in your report, and more specifically, to regulatory signaling.

So if I could have small roman numeral (v) paragraph 23 of Dr. Yatchew's report. And then there was an actual interrogatory on this subject.

DR. ADONIS YATCHEW: I'm sorry, could you just prefer me again to the paragraph --

MR. ANTOINE HACAULT: It's on the screen right now. It's paragraph 23 --

DR. ADONIS YATCHEW: Yes.

MR. ANTOINE HACAULT: -- of your summary.

DR. ADONIS YATCHEW: That's -- that's in the executive summary then, yes. Yes, I have that.

MR. ANTOINE HACAULT: And we're trying to be very careful in this hearing about a rate request which only comprises one (1) year of 7.9 and a proposal or a forecast which has successive 7.9 percent factors shown in it.

But in the context of only having a rate request for 7.9 percent, but a proposal or a plan going forward for consecutive increases of 7.9 percent, what can you do to help us understand this regulatory signaling issue?

DR. ADONIS YATCHEW: So allow me to simplify. Hopefully, I won't oversimplify and throw away the -- the main point in the process.

But let's say that this Board accepts 7.9 percent and that the -- an important part of the reasoning of why a 7.9 percent rate would be accepted would be the financial ratio targets of, let's say, that 75 percent debt ratio to be achieved within a specified period of time.

Other things being equal, that argument would still apply at the next rate hearing. So, if

the Board accepted the financial soundness argument at this hearing, my anticipation would be that it would be difficult to reject that argument in the subsequent rate proceeding.

So that's what I mean by the regulator accepts that argument signals that, yes, this is a target that we want to achieve. We want to achieve that -- those financial ratios and, and therefore, the customer -- and certainly if I was writing a business plan, I would be putting that as a very serious risk that electricity prices would continue to go up at -- at that kind of a rate.

MR. ANTOINE HACAULT: And if you turn to paragraph 121 on page 45 of your report, I think your going through that very point, Dr. Yatchew -- your reading that paragraph right now?

DR. ADONIS YATCHEW: Yes.

MR. ANTOINE HACAULT: I'll give you a chance to read.

(BRIEF PAUSE)

DR. ADONIS YATCHEW: Thank you, I've scanned it.

MR. ANTOINE HACAULT: So I'm quoting

from the third sentence starting at line 8. And this was talking about some companies that might be negatively impacted.

> "Some will consider very carefully whether to make major new capital investments in the province. Indeed, the specter of increasing rates in the nearer or more distant future may have already discouraged investment."

So this is based on your experience in the electricity sector, Dr. Yatchew, that you're making these comments?

DR. ADONIS YATCHEW: Actually the first -- the departure point for that kind of comment by me would be that businesses when they make their plans have to consider their projections of future revenues and the projections of future costs.

Second. And this is actually related to the elasticity analysis. Some studies, especially cross-sectional studies, find very large differences or responses to electric -- high electricity prices across jurisdictions. Ad in these cross-sectional analyses, you find much more intensive use in one jurisdiction where prices are low, much, much less

intensive use where electricity prices are high.

That's evidence, that's empirical evidence and its quite persuasive that firms will often pick -- part of their decision matrix, as I say here, is picking their locations and their investments, their initial locations and their future plans, and investments based on what they think energy prices are going to be or electricity prices are going to be depending on which kind of energy they're particularly reliant upon.

So that's -- let me just add to that that when they construct these business plans, they don't do it on just what prices are today and yesterday, they form expectations about future prices. That's a standard sort of textbook optimization problem in micro theory that this is how sort of -- the bare-bones skeleton modelling of how the kinds of things that businesses need to take into account.

So there's the theoretical argument, there's the empirical argument based on these cross-sectional elasticities.

MR. ANTOINE HACAULT: Thank you, sir. Would you have any sense, Dr. Yatchew, as to whether this province has sought to attract energy intensive industries based, in part, on low electricity prices?

Do you have any sense of that with respect to Manitoba?

DR. ADONIS YATCHEW: I've -- I've not gone into or trying to understand whether the province or Manitoba Hydro proactively sought to attract businesses.

MR. ANTOINE HACAULT: Okay, thank you. And before leaving the page that's on the screen, at paragraph 123 you talk about what I'll call rate smoothing or gradualism.

Does that also fit into the answer that you just gave us with respect to planning, both from an empirical and theoretical level for major industrial customers?

DR. ADONIS YATCHEW: The variables affecting business plans and business decisions are multiple and complicated and some of them have a lot of volatility as I've pointed out in the study else -- we're talking about commodity prices, I'm talking about exchange rates.

The -- particularly for firms that are electricity intensive stability in at least one (1) of those variables is helpful. It reduces the overall uncertainty. So you at least can say, well, we don't know what exchange rates are going to be three (3)

years from now and commodity prices are crazy. I mean, they can swing -- this supercycle stuff I -- I don't really buy into their -- the large swings in commodity prices for pretty much unpredictable reasons, at least we have an island here somewhere where our -- our prediction variance, error, is smaller.

So I can see how that -- that stability positively affects, favourably affects that -- the decision problem with respect to capital investments but it does not, by any means, eliminate the uncertainty or even perhaps the majority of uncertainty that -- that these kinds of companies face.

MR. ANTOINE HACAULT: And this is just by nature of clarification, in the first sentence of paragraph 23 and I'm quoting you indicated:

> "In the past, electricity -- electricity prices in Manitoba have increased steadily."

Would this be another way of saying, rate stability from your perspective?

DR. ADONIS YATCHEW: At least for the numbers that I've seen, yes, relatively speaking, rate stability and -- although rates have been -- rate

increases have been significantly higher than inflation in many of the instances that I've looked at, there was a kind of predictability to what was -- what was going on.

MR. ANTOINE HACAULT: Thank you. I'd like to turn your attention to MIPUG Interrogatory Number 3b - b as in Bob - that's -- it was a MIPUG interrogatory to yourself, Dr. Yatchew.

DR. ADONIS YATCHEW: Yes, I have it, thank you.

MR. ANTOINE HACAULT: And I'm going to try and contextualize and understand that answer to the question. So first of all I'll read the question:

> "Is it Dr. Yatchew's view that a time of large surpluses and low marginal cost that declines and uses are our suboptimal?"

And you gave a very concise answer, Dr. Yatchew: "Yes." So I'll try and take that in little bites and try to understand that in the context of, let's say, for example, DSM spending, which creates additional surplus.

So firstly, would you agree with me that we are entering with this large generating station, Keeyask generating station, a period where we

have quite of -- surplus energy.

DR. ADONIS YATCHEW: Yes, that's my understanding that it would take a significant period of time to absorb that additional capacity.

MR. ANTOINE HACAULT: And I don't want to get too hung up on capacity and energy, but it'll give us some of both as a generating station, correct?

DR. ADONIS YATCHEW: Well, it will give you lots of capacity. The question is how much energy you'll be getting out of it for useful purposes if there's no demand here and the export market isn't picking up enough of it.

MR. ANTOINE HACAULT: Okay. And in a very general way, when we do demand side management spending, we are freeing up, amongst other things, surplus energy?

DR. ADONIS YATCHEW: That's correct.

MR. ANTOINE HACAULT: Okay. So in the context of freeing up further energy, what does that tell us about utilizing the surplus energy of Keeyask generating station?

DR. ADONIS YATCHEW: You're delaying the point in time in the future when it is operating and providing services at close to its capacity and you've already incurred the capital cost.

MR. ANTOINE HACAULT: And I'm trying to understand your answer as to whether that's a suboptimal situation.

Does that answer also apply to how much DSM spending we're doing and whether that's -- ends up being a suboptimal result?

DR. ADONIS YATCHEW: So that's -- that's potentially part of the story here. And again, I think I've used this language here before, it's this -- the difference between rational and -- and feel good policies. Yes, we can pat ourselves on the back that we're reducing our -- our electricity consumption. And it's also -- there's also natural gas element to this through carbon taxes, for example. It's great that we're -- we're reducing our energy consumption, but we're reducing -- if we're reducing our energy consumption, in this case electricity consumption of a very clean source that is other -- otherwise just spilled water, then -- and we're spending money to do that and the money that we're spending may also put pressure on total costs for Manitoba Hydro, then you want to take a look at each DSM program and see whether it is not just feel good, but is it rational.

In this case, if it's creating

additional excess capacity then one has to make a pretty convincing case of why the money is being spent.

MR. ANTOINE HACAULT: Okay. Thank you very much, Dr. Yatchew, for doing your best to answer my ineloquent questions. It was a pleasure to have this discussion with you and those are all my questions.

DR. ADONIS YATCHEW: Thank you, sir.

THE CHAIRPERSON: Thank you. Mr. Monnin, are you up next -- sorry, Mr. Cordingley?

MR. DAVID CORDINGLEY: Thank you, Mr. Chair. With Mr. Monnin's indulgence I'll jump in here now.

CROSS-EXAMINATION BY MR. DAVID CORDINGLEY:

MR. DAVID CORDINGLEY: Dr. Yatchew, I -- I'm going to be debrief with you. I have fifteen (15) minutes allotted and I have a number of topics that the Green Action Centre is very interested in and -- and looking for a little bit of further information from you. So I apologize if it's a little bit disjointed.

I'd like to start with your -- your two (2) models of bill affordability. And you -- you

propose two -- two (2) models of delivering a bill affordability program; one through the government through an income type assistance program, the other through the ratesetting process or this -- this regulation process.

Are you with me? Are you with me so far?

DR. ADONIS YATCHEW: Yes.

MR. DAVID CORDINGLEY: Okay.

DR. ADONIS YATCHEW: Can we -- should we just turn to the portion of the report. Would that be helpful?

MR. DAVID CORDINGLEY: Sure, that would be fine with me or your slides, whichever you prefer. If we're at your report, I think we're at --

DR. ADONIS YATCHEW: I think it's page 39, paragraph 104.

MR. DAVID CORDINGLEY: Yes.

DR. ADONIS YATCHEW: I think that's got a little more detail than the slides.

MR. DAVID CORDINGLEY: You -- you present the arguments for -- for both cases in your report, as I see it, and conclude both cases have validity. One of the points you make at your paragraph 106 and that My -- My Friend Dr. Williams

asked you about was whether the first approach might be more transparent and simply administer -- simple administratively.

My follow-up question for you on that point is: Have you -- have you looked at or are you familiar with jurisdictions that administer a -- a rate -- a rate affordability program through nonprofits as opposed to through the government?

DR. ADONIS YATCHEW: That's an interesting proposal. And now I apologize, I did not look at that -- at that -- at that route.

It would have been nice to receive an interrogatory because that would have forced me to focus on that particular variant.

MR. DAVID CORDINGLEY: Yeah, I -- I don't have any particular information that I'm going to grill you on, Dr. Yatchew, I -- I -- I understand there are at least one (1) jurisdiction, perhaps Minnesota, that does it and I was just wondering whether you had any insight into that potential administration process and where it fell in terms of simplicity and transparency. But I'll move on if -- if -- if you're not familiar with that.

DR. ADONIS YATCHEW: Can I at least -- allow me at least to sort of extemporaneously offer

some observations within the perspective that I take on these kinds of programs.

And I didn't mention it in the report but it -- this is something that I've -- has certainly informed my thinking about -- about how programs are delivered and in general -- and more generally, institutional structure, and it's something called the principle of subsidiarity.

The principle of subsidiarity says that, given a certain -- given a hierarchy, you want decisions and actions to be taken at the lowest level in that hierarchy where they can be competently executed.

Now, for example, you don't want the federal government to be in charge of waste and recycling collection for your city; that -- that's -- that normally resides as a city responsibility, as a municipal or local responsibility. There's no reason to elevate that to the federal level.

Conversely, you don't want defence to be a local -- a local decision-making and -- and service delivery. That's a national, a federal. So how does your question fit into that framework?

The delivery of the -- of support through income -- overall income support rather than

specifically targeted for -- for energy, that's -- that's the discussion at 104 paragraph (a). That argument can be supported by the view that people should have enough money to make purchases of how they choose and they shouldn't be below the poverty line. But people should make those choices themselves. There shouldn't be a direct support for one -- one (1) particular class of commodities or another.

The opposite argument in paragraph (b) is the safety net argument. It says that we need a safety net because these sort of overarching income support programs are insufficient and may very well let people fall through the cracks.

Now, you've described yet another alternative here which is rather than having -- or put -- and perhaps not rather than but augmenting the delivery of these kinds of supports outside the governmental level and the Utility level. Now, you've got NGOs doing this.

I actually like that idea because it's consistent for me with this idea of subsidiarity. It's not -- it's not at the governmental level, it's -- it's at the level of groups of individuals seeking to improve society, and helping some who could fall through the cracks not.

So, this is really just a thumbnail sketch of -- of my interest in institutional design generally, and in this case, the delivery of programs.

MR. DAVID CORDINGLEY: Yeah, but --

DR. ADONIS YATCHEW: I'm -- you -- I mean, you'd have to take a look at the efficacy, the success and so forth of these kinds of programs, but civil society is a very important part of a healthy society.

MR. DAVID CORDINGLEY: Thank you for that, Dr. Yatchew, it was more than -- more than I expected and very helpful. I'm going to -- as I warned you, I'm going to jump around. I'm going to do right now.

In your presentation you discussed fuel switching and -- and with respect to agriculture and greenhouses switching from -- from electricity to natural gas and -- and my question for you is -- is -- have you -- have you -- have you had a chance to look at or are you familiar with biomass programs in Manitoba or nationally and how that might fit into decision-making processes for industry that -- that needed to -- to heat, particularly agriculture?

DR. ADONIS YATCHEW: That needed to heat?

MR. DAVID CORDINGLEY: Yes.

DR. ADONIS YATCHEW: I can offer some general, but very general observations.

To the extent that biomass is replacing hydroelectric electricity, for whatever other reasons it's not -- in my view, it's not sort of -- it wouldn't be my first choice. I would rather be using hydraulic electricity relative to biomass.

It also depends on how that biomass is being obtained and produced. So the biomass argument, in very broad terms, is that its -- its carbon footprint nets to zero because whatever you're burning and, therefore, putting the carbon dioxide back in the atmosphere, it gets sucked back out of the atmosphere during its growing stage. So that's essentially the net zero argument.

There's a fair amount of slippage there depending on the kind of biomass; how it has to be collected; how it has to be transported and so on and so forth. So, it's not quite net zero. There is some contribution.

Now, if you told me biomass -- you're going to bring in biomass to replace hydrocarbon fuels like coal, for example, that's an easy choice. Natural gas also have the net effect on the -- on the

atmosphere is -- is favourable.

I'm not sure if that's the direction you wanted me to go on but...

MR. DAVID CORDINGLEY: No, that's -- that's -- that's fine for my purposes. I'm going to jump to your slides, if I could, please. We're going to look at your slide number 53, please, Diana.

DR. ADONIS YATCHEW: Yes.

MR. DAVID CORDINGLEY: It's your fourth -- your fourth dashed point on this slide, Dr. Yatchew.

DR. ADONIS YATCHEW: Yes.

MR. DAVID CORDINGLEY: You make the point that Manitoba should be proud in so far as we are particularly already green ahead of the national average.

I just wanted to ask you with respect to those numbers you give us, 60 percent of Manitoba energy is from hydrocarbons compared to 80 percent of the Canada-wide domestic energy.

Do you -- do you know how that breaks down per capita or per GDP by province?

DR. ADONIS YATCHEW: So, the sank -- so that 60 percent is -- I'm rounding from the Sankey diagram, at slide 9. That's where I got that 60

percent from.

I have done some energy flow Sankey diagrams for some of the other provinces. Obviously, Alberta is going to have a much higher share of -- of total energy and hydrocarbons. Quebec, I'm guessing probably is pretty good. So I don't -- I don't have specific numbers for you and I can't even assure you that your number one. It might be Quebec.

But again, from an environmental policy point of view, ideally once the tech -- once the technological innovation comes along, your target would be -- I would think would be the transportation sector. That's the one that you -- that's the hardest nut to crack. And that's the --- that's the one that you want to decarbonized.

MR. DAVID CORDINGLEY: I -- I -- that's a good segue. I do have a question for you about electrifying transport but -- but before we leave this point, if I were to call it carbon intensity, does that mean anything to you in particular? I'm thinking along the lines of per province energy carbon production per capita or per GDP. Is that -- is -- are those stats that would be available to you?

DR. ADONIS YATCHEW: Yes, they are and

I have seen these and they're usually produced by federal agencies. So they are out there. I don't have them at hand immediately.

MR. DAVID CORDINGLEY: Well, sub -- subject -- I'll look to your counsel on this, would that be an undertaking you'd be prepared to give in terms of providing what I'll call carbon intensity, but we can clarify per -- per province?

DR. ADONIS YATCHEW: So on a -- on a -- on a good faith basis, I'd be prepared to -- to try to find these answers for you. I know I've seen them but I -- but I just want to be sure that they're sort of reasonably up-to-date.

MR. DAVID CORDINGLEY: Sure and if your answer to me is they're -- they're not available to you, that's -- that's fair enough. You have your information. Unless your counsel has anything to add or wants to clarify.

MS. KIMBERLEY GILSON: Yes, if I could, Mr. Chair, could you just clarify specifically for Dr. Yatchew what it is that you're asking him to provide.

MR. DAVID CORDINGLEY: Sure.

(BRIEF PAUSE)

MR. DAVID CORDINGLEY: What we'd be looking for is -- is tons of CO2 per capita and tons of CO2 per hundred thousand dollars of GDP for each province of Canada.

DR. ADONIS YATCHEW: On my best efforts.

THE CHAIRPERSON: Yes, I just want to make it clear that the undertaking is to use best efforts.

DR. ADONIS YATCHEW: Thank you. Thank you, Mr. Chair.

MR. DAVID CORDINGLEY: That's fine. Thank you.

--- UNDERTAKING NO. 49: For Dr. Yatchew on a best efforts basis to advise re: tons of CO2 per capita and tons of CO2 per hundred thousand dollars of GDP for each province of Canada.

CONTINUED BY MR. DAVID CORDINGLEY:

MR. DAVID CORDINGLEY: If we could

turn to your slide 54, please. You make the point here, Dr. Yatchew, quite interestingly about feel-good policies for the environment, and whether, in fact, you may only be causing companies to decamp, in your words, to other jurisdictions which may not be as carbon friendly.

I'm going to start with a broad -- a broad question for you: Which jurisdictions would you fear Manitoba companies might be moving to if -- if electricity prices go up?

DR. ADONIS YATCHEW: I'm not in a position to actually provide the specific industrial alternatives, locational geographical alternatives.

The point I make here is that there are very, very few jurisdictions where electricity is as clean as it is. If we're talking about something like manufacturing and the production moved to China, China is a -- is a growing economy where only now is some attention being paid to the air quality and so on. It's a very, very heavily -- it's very heavily dependent on hydrocarbons and unfortunately coal, which is the one with by far the largest footprint. So if you asked me where would I not want to see this stuff go to, that's the -- those are the -- the -- the leakage destinations that would be least

productive on the -- on the decarbonization agenda.

MR. DAVID CORDINGLEY: If I narrow the question to Canadian jurisdictions, cause we do have some evidence in your data about energy prices in Canada and the sources of those energy.

Are there -- which jurisdiction in Canada would -- would -- would have lower energy costs, assuming -- assuming this rate increase is -- is approved?

DR. ADONIS YATCHEW: Well, Quebec right now has, at least based on the National Energy Board.

MR. DAVID CORDINGLEY: Would -- and would their energy be, in fact, dirtier, to use a colloquial term, than -- than ours?

DR. ADONIS YATCHEW: I -- I've not constructed or if I have I don't recall the details of their energy flow and carbon flow diagrams so I couldn't -- I couldn't answer that. But Quebec is very, very hydraulic. The question is: What portion of its -- of its let's say industrial makes that pink box on the right, what portion of that energy is coming from hydraulic electricity as opposed to carbon sources which would be natural gas and possibly goal. I just don't know without actually looking at the --

at the numbers.

MR. DAVID CORDINGLEY: Would the data with respect to the carbon intensity and Hydro, would that be available to you, from Hydro-Quebec?

DR. ADONIS YATCHEW: The carbon intensity...

MR. DAVID CORDINGLEY: You know what, Dr. Yatchew, that it might be covered in the -- in the undertaking we've asked for in terms of CO2 emissions per capita per province so I'll --

DR. ADONIS YATCHEW: For dollar and GDP ---

MR. DAVID CORDINGLEY: -- you can ignore that last -- the last question.

THE CHAIRPERSON: Mr. Cordingley, you've got a few more minutes.

MR. DAVID CORDINGLEY: Thank you, Mr. Chair.

(BRIEF PAUSE)

CONTINUED BY MR. DAVID CORDINGLEY:

MR. DAVID CORDINGLEY: Mr. Yatchew, I think were -- I'm -- I'm winding down here. I'd like to show you a document you likely haven't seen yet.

It's Manitoba Hydro's Exhibit 104 and your counsel may glare at me but I -- I just want to -- I don't need you confirm anything in here.

I just want to show you three -- three (3) perspective rate scenarios. They're at the top. This is a document Manitoba Hydro has filed as an exhibit. And you'll see looking across the page the top three (3) lines, there's three (3) different rate scenarios, rate per year from 2018 through to 2036.

DR. ADONIS YATCHEW: Yes. Yes, I see that.

MR. DAVID CORDINGLEY: Okay, and you can -- for -- for my purposes, you can ignore everything below it. So the first rates scenario, as I understand it, is a straight 3.95 percent rate increase annually. The second rate scenario below that is a 7.9 percent rate increase for the first five -- six (6) years. And then a -- followed by 4.54 percent followed by 2 percent going forward. And then the final rate scenario is 7.9 percent for the first six (6) years, followed by a 4.54 percent, followed by a 2 percent, a subsequent 2 percent and then a drop by minus 19.75 percent --

DR. ADONIS YATCHEW: Could I ask just one (1) clarifying question here?

MR. DAVID CORDINGLEY: Yep.

DR. ADONIS YATCHEW: So if -- if I -- I have this recollection that the third one has to do with maintaining a stable debt ratio subsequent to 2026/'27 and that explains the almost 20 percent drop.

Is that -- is that the --

MR. DAVID CORDINGLEY: I'm likely not in the position to -- to -- to speak to all the factors behind that rate scenario, I was going to ask you a much hopefully simpler question.

DR. ADONIS YATCHEW: Okay. I just wanted to understand where we're getting the 20 percent but that was my reflection.

MR. DAVID CORDINGLEY: The -- and you likely are correct but for my purposes, you -- you -- you were speaking about rate stability. You also spoke about the concept of rate smoothing within the intergenerational issue.

Given -- given a choice between these three (3) scenarios and -- and -- and balancing those -- those -- those principles with respect to rate stability and rate smoothing, do you have a preference for a scenario?

DR. ADONIS YATCHEW: I think you're asking me for a question that -- that the Board is --

is --

MR. DAVID CORDINGLEY: Okay, let -- let -- let -- maybe I'll --

DR. ADONIS YATCHEW: We'll have to --

MR. DAVID CORDINGLEY: -- I'll ask you a simpler question that you might be in a position --

THE CHAIRPERSON: Mr. Cordingley would -- would find it easier if you were making our decision but you can ask -- I guess he can ask your opinion in terms of rate smoothing or --

CONTINUED BY MR. DAVID CORDINGLEY:

MR. DAVID CORDINGLEY: I'll break it down per concept.

DR. ADONIS YATCHEW: I would not find that easier, if I had to make the decision so.

MR. DAVID CORDINGLEY: Mr. Yatchew, does either of these three (3) conform to -- to the principle of rate smoothness, in your view, in a better way than another -- the other two (2)?

DR. ADONIS YATCHEW: Well, while the -- the first one is the smoothest. I mean, it's a flat line. So yes, from the perspective of rate smoothing that certainly the smoothest one.

But as I said earlier, rate smoothing

is not the only consideration that regulators incorporate into -- into their decisions and -- or it's weight considerations differently, including rate smoothing and -- and financial soundness and other objectives that they might have in mind.

MR. DAVID CORDINGLEY: Thank you, Dr. Yatchew, those are all my questions.

DR. ADONIS YATCHEW: Thank you.

THE CHAIRPERSON: Thank you. M. Monnin...?

CROSS-EXAMINATION BY MR. CHRISTIAN MONNIN:

MR. CHRISTIAN MONNIN: Thank you, Mr. Chair, members of the Panel.

Dr. Yatchew, I'm behind the pillar over here.

DR. ADONIS YATCHEW: Good, thank you.

MR. CHRISTIAN MONNIN: Dr. Yatchew, I'm legal counsel for General Service Small, General Service Medium customer class and Keystone Agricultural Producers. I'm sure you already know this but general service small is comprised of nonresidential, predominantly small commercial customers using utility-owned transformation. And there's a demand and non-demand subclass in there.

DR. ADONIS YATCHEW: Could you please just speak up a bit because --

MR. CHRISTIAN MONNIN: Sure, I'm a low talker and I think we're both low talkers so we'll do what we can this afternoon.

As I was saying, general service has subclass -- general service small there's two (2) subclasses, demand and non-demand and general service medium, that class includes nonresidential predominantly large commercial customers using utility-owned transformation with a billing demand exceeding 200 kilowatts.

Representative groups of -- of the subclasses whom I'm acting for would be the Canadian Manufacturers and Exporters Association, Hotel Association Manitoba and Building and Owners and Managers Association Manitoba.

Keystone Agriculture Producers, Dr. Yatchew. I know this is your ancestral grounds, but to give you a little bit of context, Keystone Agriculture Producers represents -- is an organization that initiates and advocates foreign policy changes promoting the interest of over seven thousand (7000) farm families and twenty-three (23) commodity associations.

I'm going to do my best not to -- keeping with the agriculture theme, I'm going to do my best not to go over well tilled soil. My colleagues have asked you excellent questions today. You've answered those questions. I won't tell you which -- if I found they were excellent answers or not but they were answered. And I'll do my best to circumscribe my cross-examination.

Now, Dr. Yatchew, in broad terms, the purpose of your testimony is to assess the likely impacts on and responses of various customer groups to rate increases that are being proposed, as well as the implications for the Manitoba economy as a whole.

Is that correct?

DR. ADONIS YATCHEW: Yes.

MR. CHRISTIAN MONNIN: And when you're referring to the impact of these rate increases in your report, in your evidence, it's fair to say that you were considering the impact of all of the proposed rate increases by Manitoba Hydro and not just the rate increases that are presently before this Board in the application?

DR. ADONIS YATCHEW: I took the longer term perspective.

MR. CHRISTIAN MONNIN: And it's

through that perspective, that's the prism that you've provided your testimony and your evidenced through today and in this -- these proceedings, correct?

DR. ADONIS YATCHEW: Yes. And that's based on the idea that come -- firms and individuals make their decisions on -- over longer-term expectations than just what's going to happen next year.

MR. CHRISTIAN MONNIN: And you -- I had a series of questions for you on the issue of rate shocks and regulatory signaling but that's been well canvassed.

But the takeaway from that, at least my understanding is, assuming that the Board accepts the proposed rate application in this General Rate Application, that is, in your evidence that will telegraph to the public and to the ratepayers that we're likely falling down the path of -- of all of the -- the rate increases that are being proposed?

DR. ADONIS YATCHEW: Not with certainty, but that's -- that would -- that would form a -- a certain expectation. And again, just referring to an answer that I gave earlier, it -- once you've accepted that -- that the primary objective here is a target -- financial ratio within a certain timeframe,

if that's the rationale for the -- primary rationale for accepting this 7.9 in this application than that rationale one would have to try to appreciate why that rationale changes the following year.

(BRIEF PAUSE)

MR. CHRISTIAN MONNIN: I'd like to ask you a few questions about the issue of rate smoothing, or smoothing of rates as set out in your -- your report. You had some discussion with that, most recently with My Friend Mr. Cordingley, for the Green Action Centre.

You state in your evidence -- and if you -- if you want to track it, there's no need to go there, but that's at page 43, paragraph 117. You state in your evidence that in the past, electricity rates in Manitoba have increased steadily but relatively smoothly over similar time frames. And -- and -- I am taking that's a comparison to what's being proposed. What you mean by that statement?

DR. ADONIS YATCHEW: I -- I'm sorry, which paragraph are you at?

MR. CHRISTIAN MONNIN: I believe it's

paragraph 43.

DR. ADONIS YATCHEW: Forty-three. I'm sorry. I'm in the wrong place.

(BRIEF PAUSE)

MR. CHRISTIAN MONNIN: I'm sorry, page 43, paragraph 117.

DR. ADONIS YATCHEW: Page 43.

MR. CHRISTIAN MONNIN: I told you I'd make you jump around today.

DR. ADONIS YATCHEW: Paragraph 117.

MR. CHRISTIAN MONNIN: And perhaps I'm mistaken on that. Try para -- page 45, paragraph 123.

DR. ADONIS YATCHEW: Yes, that's now -- now I'm in the right place. Thank you.

MR. CHRISTIAN MONNIN: Sometimes I can't even read my own notes. And here, you're referring to the historic -- I -- I understand the historic rate increases in Manitoba. Are you able to advise today whether what's being proposed, the universe of the rate increases, would those be relatively smooth increases?

DR. ADONIS YATCHEW: The 7.9 percent over --

MR. CHRISTIAN MONNIN: Correct.

DR. ADONIS YATCHEW: -- the coming sequence of years? Well, you have this discontinuity, or close to a discontinuity initially, and then you have a fairly rapid ramping down after. So arguably, during that period, 7.9 percent is a flat line, but it is really a step function. It goes up, stays high, and then comes down, so.

MR. CHRISTIAN MONNIN: So your evidence where you say, in the past, electricity rates in Manitoba increased steadily but relatively smoother -- smoothly over similar time frames, that's looking back. Where we stand now going forward, would you apply that same comment to what's being proposed?

DR. ADONIS YATCHEW: I don't recall seeing the magnitude of jumps in the past, something that's 7.9 percent, or close to that in -- in the past.

MR. CHRISTIAN MONNIN: Thank you, Dr. Yatchew. And without getting into the discussion of what defines a rate shock, you canvassed that with My Friend Dr. Williams, what would be your position? And you -- you touched upon this a bit, but I just want a bit more clarity from you, Dr. Yatchew.

What would be your position with

respect to someone stipulating that these proposed rates can't be a shock because they're being well-broadcasted or telegraphed to the public at large, and to ratepayers?

DR. ADONIS YATCHEW: So I -- I suggested earlier today that -- that becomes somewhat of a semantic discussion. How can anything that you know a year in advance really be a shock? But taking -- taking for -- as a departure point, that regulators set rates, would there ever be such a thing as a rate shock? And I would -- and I was -- okay, so I was careful in the way I used my language. Something akin to a rate shock, I think that was sort of the nature of the language.

This is a substantial increase over a period of time because cumulatively, it increases rates by on the order of 50 percent. So if I take a longer time frame, then yes, it's a large increase. If I've -- my business planning requires capital investments, or my residential expenditures require substantial capital investments, then this is a -- this is a lar -- this is a large increase that I'm really considering.

I -- I don't want to sort of quibble about the -- word 'shock', but if there is such a

thing as a -- as a shock in regulatory settings, this would not be that far from it. I can think of worse ones, but this -- this would not be -- this would not be far from a 50 percent real increase over the coming years.

(BRIEF PAUSE)

MR. CHRISTIAN MONNIN: Dr. Yatchew, if you could please go to page 27 of your report, paragraph 76. And I just wanted to clarify something. On our last exchange on these rate increases, and throughout your evidence, you seem to refer often to the 50 percent, and here you -- you referred to a cumulative nominal increase about 65 percent. And could you explain the -- explain the gap there --

DR. ADONIS YATCHEW: Yes, the -- the --

MR. CHRISTIAN MONNIN: -- please?

DR. ADONIS YATCHEW: -- key word there is "nominal." So that increase -- that cumulative increase has not been adjusted for inflation. The 50 percent I'm doing in real terms, so I'm adjusting it for expected rates of inflation. That's essentially the difference.

MR. CHRISTIAN MONNIN: Thank you.

Now, I had a series of questions for you on oil and natural gas markets. Those have also been substantially covered, but I just want to touch upon one (1) particular point, and that's that fuel switching.

You -- you seem to put a lot of emphasis on these -- these rates would possibly lead some ratepayers, some of my clients, for example, in -- in agriculture, or manufacturing to -- to go to different fuels, natural gas, in particular. Is it safe to say that for your report, you didn't really get very granular and to the ability of the agricultural sector to -- to switch to -- to fuel?

DR. ADONIS YATCHEW: No, I -- I did not.

MR. CHRISTIAN MONNIN: Natural gas, rather.

DR. ADONIS YATCHEW: And that's certainly an analysis that can be done, but it was not done in the context of this report.

I -- there's a fair amount of territory that I was trying to cover here, and there was all kinds of detailed analyses that could be done, that are useful to do, that are not in this report.

MR. CHRISTIAN MONNIN: And -- and I

appreciate that. And -- and you'll probably appreciate, having done this -- this exercise before, that most of the folks in my racket, that is, in the law profession, when we do cross-examinations, we tend to ask questions where we hope we know the answer to already, and that's why I put that one to you, sir.

And -- so the same question would be, you didn't do that exercise for the ability of the -- the hotel industry for fuel switching, correct?

DR. ADONIS YATCHEW: That's correct.

MR. CHRISTIAN MONNIN: And the same for manufacturing, you didn't do that same exercise, correct?

DR. ADONIS YATCHEW: That's correct. I -- I -- the information that I was trying to bring forth is these -- the -- the massive empirical evidence that exists out there for response to prices -- electricity prices, and what I didn't really mention here, and did not talk about in the report, but is relevant, it's what's the cross price elasticity? How does the demand for electricity change with changes in the price of natural gas and vice versa? That's another useful to know.

But my analysis was -- was to bring -- relied on those kinds of empirical studies, which, as

I've said earlier, I think can inform the discussion here. However, the distributional effects on a -- the -- the best information that I can -- that I was able to provide relatively easily was the electricity shares of costs on a -- on an industry basis, and that's in Appendix 4.

MR. CHRISTIAN MONNIN: And -- and we'll get to Appendix 4 a little later on in my questions, but I appreciate the answer. Thank you.

I'd like to ask you a -- a few questions about the issue of emerging technologies, which you touched upon in your report.

DR. ADONIS YATCHEW: Yes.

MR. CHRISTIAN MONNIN: And again, I'd -- I'd -- there's no need to go there, but if -- if you do want a reference, starting at page 12, you made mention to the fact that the cost of emerging technologies which are transforming electricity have been dropping at a rapid pace. And the point here, Dr. Yatchew, is these alternatives or emerging technologies, would you agree with me they may erode the demand for Manitoba Hydro's electricity?

DR. ADONIS YATCHEW: They may, yes, both domestic demand and -- and its export demand or prices, the prices that it can -- that it can obtain

in export markets.

MR. CHRISTIAN MONNIN: And -- and you've also made comments that the -- these hydroelectric projects are large investments that have long lifetimes and face financial risks in a world of rapid technological innovation. Is that correct?

DR. ADONIS YATCHEW: Yes.

MR. CHRISTIAN MONNIN: And have you turned your mind -- and -- and -- or can you provide any comments on -- are there any concerns about these emerging technologies taking over, or -- or replacing entirely these -- these hydroelectric project -- values of electric dams? For example, we're looking at fifty (50) years out for these dams to be revenue positive. Is there a concern that there might be a technology that might render these a stranded asset?

DR. ADONIS YATCHEW: Yes, there is a concern, and one (1) of the big ideas in those ten (10) big ideas that I teach in my Big Ideas courses has to do with transitions, energy transitions. You're asking about a fifty (50) year time -- timeframe. Energy transitions in the past have taken half a century or longer, talking about the transition to coal, and then the transition away from coal.

The -- the transitions that are

forthcoming, and they're very likely to occur, very hard to predict when they will occur, but there could be a tipping point. I don't think it makes sense to -- - to try to build that into the current rate-setting and planning process. The potential for some -- at some point in the future where everybody's going to have solar on the roof, and a storage battery in the basement, and an electric car in their driveway, because if that -- if there -- if we do reach a tipping point, then you'd still have this enormous asset, the hydraulic generation. At that point, you're just going to have to eat some of the fixed costs and lower the price so it's still competitive with -- with the domestic alternatives.

And that happens. It's -- these are write-downs of assets as opposed to completely abandoning the asset. So that can happen, but I don't think it makes sense to build that into their current rate-setting process. The risks are there, though.

(BRIEF PAUSE)

MR. CHRISTIAN MONNIN: Dr. Yatchew, I had some questions for you regarding regulatory considerations. However, those were canvassed by --

by Dr. Williams, My Friends at the Coalition. I also had a series of questions for you on price elasticities, but they've been mostly well-canvassed, but I have, I will touch upon a few points.

On page 27 and 28 of your report, again, that's just if you want to go and -- and fact-check the question I'm putting to you. In this -- is this still under the section of elasticities, you state:

> "Manitoba Hydro is projecting rate increases of 7.9 percent through 2024, followed by 4.54 percent for a cumulative nominal increase of about sixty-five (65). If realized, it will have a significant impact on elec -- electricity sales and all residential, commercial, and industrial sectors."

Now, this is a very broad, sweeping question, but are you able to advise or elaborate what you mean by "significant impact"?

DR. ADONIS YATCHEW: So the -- the first approximation is in the elasticities that I recommended. There are short-term elasticities of -- that I'm recommending of about minus point one (-.1).

So that's a year out. An average long-term elasticity of minus point four (-.4), and then long-term elasticities separately for the residential, commercial, and industrial sectors.

So -- and -- and again, we're talking about -- when I'm talking about long-term, I'm talking about five (5) to ten (10) years. So that's what I mean by "significant." It's -- it's embedded in those elasticities.

MR. CHRISTIAN MONNIN: Thank you.

(BRIEF PAUSE)

MR. CHRISTIAN MONNIN: At paragraph 120, page 45 of your report...

(BRIEF PAUSE)

MR. CHRISTIAN MONNIN: You state that:

> "The implication for an electricity price increase as projected by Manitoba Hydro is that they are not likely to have a disastrous impact on aggregate macroeconomic activity."

And what I want to clarify with you is the comment in the second sentence here:

> "This is further reinforced by the fact that over 70 percent of Manitoba -- the Manitoba economy provides services, and electricity in the sector comprises of a relatively small proportion of total costs."

DR. ADONIS YATCHEW: Yes.

MR. CHRISTIAN MONNIN: And if you can go to page 51, please, in particular, what's really -- 50 and 51, but -- in particular, paragraph 142. And it's just to -- to clarify the point -- to qualify the footnote of -- at 91. You -- you do qualify your previous statement about 70 percent being service industry, and electricity being a small component of that.

And that footnote:

> "We do recognize that there are also portions of the service sector that have high electric -- electricity cost shares."

Correct?

DR. ADONIS YATCHEW: Yes.

MR. CHRISTIAN MONNIN: Okay. And you -- you set out which -- which of those particular -- those particular service sector -- subsectors are. Do you know, of the 70 percent, are you able to advise which ones are -- are -- would -- are -- are comprising footnote 91?

DR. ADONIS YATCHEW: So if we turn to page 78 of the report, which is in Appendix 4.

(BRIEF PAUSE)

DR. ADONIS YATCHEW: And this portion of the table in Appendix 4 deals with electricity shares --

MR. CHRISTIAN MONNIN: Okay.

DR. ADONIS YATCHEW: -- by various industries within the broader service segment. And you can see that there are -- that there are a few that have a fairly large electricity share, not comparable to, for example, chemicals, but 2 percent or higher. In fact, there's a few there that have surprisingly high shares, social assistance, for example, dry cleaning and laundry services. That's perhaps not surprising. Educational services, and so on.

So this is -- these are the numerical basis. If you're asking me, construct a pie chart for the shares of these various service sectors within the broader's service total, I have not done that.

MR. CHRISTIAN MONNIN: Thank you, Dr. Yatchew. Diana -- and again, I apologize to everyone involved, and I am making you bounce around. Can you go back to page 45, please?

DR. ADONIS YATCHEW: I was the one that took you away from where you were.

MR. CHRISTIAN MONNIN: Well, it's because I was asking you the question, so it's really my fault. Paragraph 121 is -- is -- so at one point, you -- you -- in paragraph 120, you -- you say, "That's not likely to have a disastrous impact." Paragraph 121, you qualify that. You say:

> "However, it's not to say that certain industries will not be negatively impacted, possibly severely."

What do you mean by possibly severely, Dr. Yatchew?

DR. ADONIS YATCHEW: So when I say "severely," it -- it's possible that very high electricity in increases will either reduce -- cause

some industries to reduce their -- their output, or perhaps even no longer continue production. Certainly, if you give -- if you -- if you should have sufficiently high electricity increases, if -- on the order of 18 percent of your cost or elec -- or electricity, then at some point, they decide to go elsewhere. That is severe.

For industries where, you know --

MR. CHRISTIAN MONNIN: And -- and if I could just stop you, the -- tho -- that -- and then those -- that's for -- for sectors that are -- are able to pick up roots and move, correct?

DR. ADONIS YATCHEW: Yes.

MR. CHRISTIAN MONNIN: For example, those in the agriculture wouldn't be -- you -- you'd agree with me that they likely wouldn't be able to do that?

DR. ADONIS YATCHEW: Well, you've got some very good agricultural land here, and that's part of the -- that -- that's why there's agriculture here, and you can't do that agriculture in the Northwest Territories or in the Rockies. So yes, you're right. There are -- there are multiple reasons why you are located here.

In other cases, a service industry like

drycleaning, you still need drycleaners. What's going to happen there if they face higher costs? They're going to have to either cut other costs or increase the prices they charge. So -- and then their sales will depend on the elasticity of demand for drycleaning. So there are various ways that an electricity price increase plays itself out.

MR. CHRISTIAN MONNIN: So let -- let's see if we can explore that a little bit more. And -- and we're getting into the short strokes, here. You'll appreciate that. I -- I also appreciate that it's -- it's a Friday afternoon.

Page 59 and 60, please. In particular, point 9, at page 59. You're -- in the context of the proposed rate increases, this -- this is what you're -- the scope of your work:

> "With the benefits of the latest Statistics Canada input-output tables for Manitoba and/or other relevant sources, identify and provide comment on the electricity-intensive sectors of the Manitoba economy, including the following: Whether the Province would be at risk of losing major electricity-

consuming firms to other North American jurisdictions."

Now, you touched upon that with -- with My Friend Mr. Cordingley from the Green Action Centre. Now, I'm going to try to string this together. If you take that point of your scope work and then go to page 50 of your report --

DR. ADONIS YATCHEW: M-hm.

MR. CHRISTIAN MONNIN: -- where you have electricity share -- a table of electricity shares by major GDP sector. Would you agree with me that you state here that manufacturing is the most electricity-intensitive (sic) sector, here, at 1.23 percent?

DR. ADONIS YATCHEW: It's very close to agriculture.

MR. CHRISTIAN MONNIN: And I appreciate that. But sticking with the manufacturing being the highest, and I believe at page 72, again, no need to take you there, but would you agree that your evidence was that basic chemicals, as a manufacturer, was identified -- along with pulp and paper -- but as a manufacturer, basic chemicals was identified as the most vulnerable of the industries?

DR. ADONIS YATCHEW: It has the

highest electricity share of total costs --

MR. CHRISTIAN MONNIN: And we -- we'd find that at your Appendix 4, correct?

DR. ADONIS YATCHEW: That's correct, 18.1 percent in Appendix 4.

MR. CHRISTIAN MONNIN: And pulp and paper would be 6.98 percent, but sticking with -- with the -- the basic chemicals --

DR. ADONIS YATCHEW: M-hm.

MR. CHRISTIAN MONNIN: -- and at page 60, lines 21, 24, you note that the exchange rates in commodity prices would affect these vulnerable industries, correct?

DR. ADONIS YATCHEW: Yes.

MR. CHRISTIAN MONNIN: And keeping in mind your scope of work and keeping in mind what we've just gone through, would you consider basic chemicals to be at risk of moving to another North American jurisdiction?

DR. ADONIS YATCHEW: I would have to take a look more carefully at what are the other reasons for being located here. You gave agriculture, for example. You're not to move agricultural and agricultural industry. The -- you might not be as competitive.

So I don't know without actually -- I wouldn't know without actually looking at what the options are on a very specific -- in fact, probably company basis rather than just industry basis. It certainly would seem to me that -- that there is -- there would be risk, there.

(BRIEF PAUSE)

MR. CHRISTIAN MONNIN: Dr. Yatchew, thank you very much. Those are my questions --

DR. ADONIS YATCHEW: Thank you, sir.

MR. CHRISTIAN MONNIN: -- Mr. Chair.

THE CHAIRPERSON: Thank you. We'll -- we'll take the afternoon break for fifteen (15) minutes right now. Thank you.

--- Upon recessing at 2:34 p.m.
--- Upon resuming at 2:54 p.m.

THE CHAIRPERSON: Okay, if we could resume. Dr. Yatchew, you met Dr. Williams before, now you're going to meet Mr. Williams. And the reason Dr. Williams -- Dr. Williams here is because we have a second Williams and Mr. Williams will now be asking

you some questions.

CROSS-EXAMINATION BY MR. KEVIN WILLIAMS:

MR. KEVIN WILLIAMS: And I don't have my PhD so. Thank you, Dr. Yatchew, I'm rep -- counsel to the -- to the business Council of Manitoba. I have twelve (12) questions for you, some of which I expect you may have some commentary on; some of which you may not. My questions are general in nature because the Business Council's interests in this proceeding is -- is rather narrow and so my questions are primarily focused on interest rate and bond rating issues.

Do I take it, sir, I don't mean any disrespect by this, that -- that you are unable to comment on what level of reduced earnings Manitoba Hydro would need to experience before bond rating agencies would conclude that Manitoba Hydro was no longer a self-supporting entity?

DR. ADONIS YATCHEW: That -- that's correct. I don't feel comfortable commenting on that. This is actually a very specialized area of analysis and many of my students go on to -- to work in -- in institutions where they -- where they do this type of analysis, but it very much depends on an understanding of how debt is evaluated and creditworthiness is

evaluated. It was a very specialized kind of expertise.

MR. KEVIN WILLIAMS: All right, thank you. So that I take it then, sir, you also would not be a position to comment on what level of reduced earnings Manitoba Hydro would have to experience before the bond rating agencies for Manitoba Hydro in the province of Manitoba would downgrade Hydro and/or the province's credit ratings?

DR. ADONIS YATCHEW: That's correct.

MR. KEVIN WILLIAMS: Would you agree with me, sir, that interest rates have been histor -- at historic lows for a number of years?

DR. ADONIS YATCHEW: Oh, yes.

MR. KEVIN WILLIAMS: Would you agree with me that the probability that market interest rates will increase over the near term is greater than the probability that the market interest rates will decline over the near term?

DR. ADONIS YATCHEW: Yes, and we've been waiting for those increases for a long time and they haven't happened so. We'll see how quickly they do happen.

MR. KEVIN WILLIAMS: Thank you. Would you agree with me that increases in Manitoba Hydro's

borrowing costs will negatively impact on its earnings?

DR. ADONIS YATCHEW: Yes.

MR. KEVIN WILLIAMS: Would you agree with me that if Manitoba Hydro's earnings decline, it increases the probability that its credit rating will be downgraded?

DR. ADONIS YATCHEW: In general terms, yes. The only additional qualification I would put in is that Manitoba Hydro, as many large corporations, hold a portfolio of debt staggered over various maturity dates. So with an increasing interest rates, it might not translate that quickly in terms of the costs that Manitoba Hydro has to incur in servicing its debt.

MR. KEVIN WILLIAMS: Fair enough. And -- and other people have spoken to the -- to the debt management strategy at Hydro and -- and -- and your response is completely consistent with that.

Would you agree with me, sir, that rate increases by this Board would reduce the potential risk of a credit downgrade to Manitoba Hydro when compared to the risk of such a downgrade in absence of a rate increase, if you held all other factors equal?

DR. ADONIS YATCHEW: That's key,

holding all other factors equal.

MR. KEVIN WILLIAMS: I added that right at the last moment.

DR. ADONIS YATCHEW: Let me just ensure that I know what you're holding constant here. So, let's say that there's a high rate increase and just to think -- think in terms of the longer-term --

MR. KEVIN WILLIAMS: Yep.

DR. ADONIS YATCHEW: -- the 50 percent real increase. That also has an impact on sales. So, it might -- it's not clear whether it's going to have -- how much of -- how much of an impact that would have on net income. An increase in rates increases revenues, but a reduction in sales reduces -- reduces revenues. So, on balance because of the inelastic demand, yes, I would -- I would expect that revenues would increase as a result of an increase in rates, but there are some offsetting things that you can't really hold constant when you're increasing rates.

MR. KEVIN WILLIAMS: Right. But I take it, sir, that you would agree that the -- that the larger the increase that's granted that -- that there's a lower risk of a credit downgrade associated with that?

DR. ADONIS YATCHEW: In general terms

lending agencies are very much interested in whether you can pay -- whether you can pay the interest costs. And if you have a larger cushion that risks goes down, the risk of a downgrade goes down, but we're really talking here in very abstract terms.

MR. KEVIN WILLIAMS: Right.

DR. ADONIS YATCHEW: Abstract in the sense that we'd have to put a lot of numerical analysis which financial analysts do, including the overall health of the Manitoba economy and the understood fact that it's backing the debt.

MR. KEVIN WILLIAMS: Right, but I guess my -- my principal is -- is -- is very general and it's essentially the larger -- the higher the rate, the greater the revenue, the lower the risk of -- - of a credit downgrade if -- if other factors are equal?

DR. ADONIS YATCHEW: And then you'd want to -- as I said, it's a qualitative argument that's -- that you're asking me to confirm, and my hesitation really relies on -- lies in, well, is this really going to be a material -- is there likely to be a material impact on -- on -- on credit rating -- credit rating and then, therefore, any premium that it pays for a -- for a slightly lower credit rating.

MR. KEVIN WILLIAMS: Sorry, I missed the last two (2) words that you -- you backed away from the microphone.

DR. ADONIS YATCHEW: I'm sorry.

MR. KEVIN WILLIAMS: Yes.

DR. ADONIS YATCHEW: And whether there's a material impact on the credit rating as a result of these kinds of hypothetical scenarios really.

MR. KEVIN WILLIAMS: Okay, fair enough. Thank you. Those are my questions, Dr. Yatchew, you have a nice afternoon.

THE CHAIRPERSON: Thank you. Mr. Bedford...?

CROSS-EXAMINATION BY MR. DOUG BEDFORD:

MR. DOUG BEDFORD: Good afternoon, Dr. Yatchew. My name is Doug Bedford and I am Manitoba Hydro -- Hydro's legal counsel du jour and I'm sitting with -- sitting with my colleagues from Manitoba Hydro, Ms. Morrison and Mr. Laramee and I believe you've met them both in the past, from time to time.

Could we, please, return to appendix 4 of your report.

DR. ADONIS YATCHEW: Yes.

MR. DOUG BEDFORD: I can tell you that I've noticed in looking through the two and a quarter pages that's made up of -- of appendix 4 that in all but six (6) of the subsectors, in all but six (6), less than 5 percent of the money businesses and organizations in Manitoba are spending from year to year is on electricity. And in many cases it's well under 5 percent.

So, conversely, can I conclude that from year to year, with the exception of the six (6), that over 95 percent of the money businesses and organizations in Manitoba are spending to make a profit or to carry on is spent on items other than electricity?

DR. ADONIS YATCHEW: The way you've put the question, yes. There's a -- there's a somewhat finer distinction here on variable costs, for example, but -- let me confirm that, yes. The electricity seems to be a relatively low share of many business activities. The service sector, on average, for example, would be such a case for which the average I think is less than 1 percent.

MR. DOUG BEDFORD: So it strikes me that, surely, the costs of all those other items or particular components or choices from those other

items, are more significant to those businesses and organizations when they have to make decisions about expansion or about cutting back or emigrating to China?

DR. ADONIS YATCHEW: Some of them would be more and some of them -- some of those components of cost might be less if they have a smaller share than their electricity share.

But, collectively, you were talking about all of these other factors together comprise a much larger share of costs than electricity, and in fact, the largest share here is the 18 percent in the chemical industry.

MR. DOUG BEDFORD: Thank you very much, Dr. Yatchew.

THE CHAIRPERSON: Thank you. Mr. Peters...?

CROSS-EXAMINATION BY MR. BOB PETERS:

MR. BOB PETERS: Thank you. And Dr. Yatchew, as counsel to the Board, du jour, I too will be asking you questions and I will endeavour to not ask for a repetition and if I've misstepped, you can certainly correct me.

I'd like to start with what has been

marked as Manitoba Hydro Exhibit 89 and this was a -- an undertaking response that was made to the Chair and to Board Member McKay. And on the next page we see -- and if we can scroll please to the -- maybe even magnify that a little bit would be appreciated.

And Dr. Yatchew, you've used some words and you've caught a couple of my -- my colleagues off guard. When you talk about a 50 percent real rate increase, that's an increase over and above inflation, correct?

DR. ADONIS YATCHEW: That's correct.

MR. BOB PETERS: And if we can scroll up on this chart that's on the screen, near the bottom of the page we're going to see -- there we see some additional domestic revenues and if we can try to fit it all on to the screen, the entire collection. Thank you very much.

The additional domestic revenue percent increase line item is shown near the bottom of the screen on this exhibit, Dr. Yatchew.

Have you located that?

DR. ADONIS YATCHEW: Yes, I have.

MR. BOB PETERS: What makes this one different, sir, from the ones you may have seen is that the first column and the first column that's

depicted is the actual results from the year 2017, and you will see that in 2017 and, more particularly, it was on August the 1st of 2016 that this Board approved a 3.36 percent rate increase.

Do you see that?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And that's one of the rate increases that Manitoba Hydro has asked this Board to -- to confirm?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: Now in the next column you see again in 28 -- 2018 column, it's another 3.36 percent, and that was an increase that was granted on August the 1st of 2017 and you're aware of that, sir?

DR. ADONIS YATCHEW: Yes, I am.

MR. BOB PETERS: All right. And that leaves the -- the next item is the 7.9 percent is the rate increase that the Utility has asked for effective April 1 of 2018?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: Now, when the Board looks at this and they look at the cumulative percent increase underneath those individual rate line items, it accumulates to the end of the page to the 2027 year

at 83.37 percent; correct?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: Now, this will be a little bit different than what you looked at because it -- it contains two (2) extra years, if I can; one at the front-end and one at the back-end.

But you're telling the Board that over the horizon that you looked at you called it a 50 percent real increase because you stripped out the inflation impact?

DR. ADONIS YATCHEW: That's correct, yes.

MR. BOB PETERS: Now, the inflation impact you stripped out was approximately 2 percent a year?

DR. ADONIS YATCHEW: That's about right, yes.

MR. BOB PETERS: So on this sheet in front of you, if we take that 83.37 percent and strip out the inflation, that inflation that -- of 2 percent a year would compound and I think you compounded it to 22 percent in your materials?

DR. ADONIS YATCHEW: That sounds correct.

MR. BOB PETERS: So we'd have about a

61 percent real increase over the next eleven (11) years that are shown here?

DR. ADONIS YATCHEW: Okay.

MR. BOB PETERS: And I'm just asking, you were using the number 50 percent real in some of your discussions.

Does changing it to 61 percent real change any of the evidence you've given today?

DR. ADONIS YATCHEW: It -- it does not in terms of -- what it would change is if you did a -- a back-of-the-envelope calculation of a kind that I've done of the impact of the price change on -- on demand.

I can provide the actual calculation that I did to arrive at 50 percent real and nominal to ensure that we're working -- that it's clearly understood which timeframe I used and which increases I had incorporated in there.

MR. BOB PETERS: No, I won't ask for that, Dr. Yatchew. I think I can replicate your work by, like I say, by truncating the material in front of us because I think that's the information you were provided at the time your report was prepared.

This information has just been put on the record, I guess, on December 22nd so that's the

origin of it.

Now, Dr. Yatchew, you had a discussion with our friends from the Consumers Coalition and it slipped over to marginal cost.

Can you provide the Board with your working definition of what marginal cost is?

DR. ADONIS YATCHEW: I'm assuming that -- that you you're -- is there a particular place in my report that you'd like me to reference or are -- are we just having a general discussion about --

MR. BOB PETERS: Let's keep it general, please.

DR. ADONIS YATCHEW: Okay. So normally we -- economists think of fixed costs versus marginal costs. So once you've, let's say, incurred the capital costs of a facility, what are the ongoing costs that you need to pay to produce different levels of output? So, for example, for a -- for a gas generating unit, you purchase the unit and now your marginal costs are primarily fuel costs, perhaps operating and maintenance costs which you pay -- at least the fuel costs are proportionate to the level of output whereas the fixed costs are already sunk and you've incurred them.

MR. BOB PETERS: So you're trying to

tell the Board what is the cost of the next unit produced, whatever that unit is?

DR. ADONIS YATCHEW: The unit of electricity?

MR. BOB PETERS: Well, you've made it a unit of electricity, but --

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: -- it could be a widget for all I would know.

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And it's just that the -- it's the cost of that next unit that's produced?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And so in the gas turbine industry that you talked of with Mr. -- or Dr. Williams, you indicated that you don't include any fixed costs but rather you just look at the marginal costs which would be the cost of the electricity that came from a gas turbine and you would base that on the variable fuel price?

DR. ADONIS YATCHEW: So in one (1) part of the report I talk about the costs of new natural gas turbine generation and let's say it's about $.05 cents a kilowatt hour. That is the --

that's not just marginal cost, that's the total cost.

The marginal cost would be, as you've pointed out, mostly the fuel cost of actually running the -- I mean, so you could have this thing sitting there and working maybe 20 percent of the time, you still have to incur the full capital costs, but your fuel costs would be relatively low because you're not producing much electricity.

MR. BOB PETERS: All right, keeping it at a fairly high level still, Dr. Yatchew, how would you suggest the marginal cost of Manitoba Hydro's energy be calculated?

DR. ADONIS YATCHEW: Well, marginal cost of hydraulic facilities is very low. I mean, I could go line by line, depending on how -- what kind of payments are required based on production, whether it's to the province, whether there is any additional OM and A costs involved. If you run the facility as opposed to don't run the facility. But the fuel costs for hydraulic generation are either very low or nonexistent or very low depending on whether you're paying, for example, royalties or some sort of fees to the province based on the level of production.

So marginal costs for a hydraulic facility are very low.

(BRIEF PAUSE)

MR. BOB PETERS: I think -- I think that's as far as I want to go with you on that, sir.

One (1) comment you did make was tied to a few areas that -- perhaps I'll take you to Board counsels' book of documents, volume 4, page 21.

And while your Big Ideas class had a favourite or top 10 graphic, here's -- here's one on my list that you may not be familiar with. But this comes off of the Manitoba Hydro website and if we can see the annual space heating costs, this is my understanding of being Manitoba Hydro's information on annual space heating costs in the province of Manitoba for an average single-family residence.

And I'd ask you to accept that as the basis of my questions. Is that satisfactory?

DR. ADONIS YATCHEW: Yes, sir.

MR. BOB PETERS: And what you talked about in a couple places was fuel substitution.

Do you recall that discussion with the counsel opposite?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And that fuel substitution would be a factor for not just the

residential class, but it would be for -- for all of the classes of customers in Manitoba; correct?

DR. ADONIS YATCHEW: That -- that -- there is the potential based on availability of gas and tech -- and technological feasibility.

MR. BOB PETERS: All right. And so we look at this chart again and we see that the electricity cost to heat an average single-family residence in Manitoba is one thousand three hundred and sixty-one dollars ($1361) and that compares to the five hundred and sixty-eight dollars ($568) that the high-efficiency furnace, the natural gas furnace burns in this province.

Do you see those numbers?

DR. ADONIS YATCHEW: Yes, I do.

MR. BOB PETERS: So when I'm -- so when Dr. Yatchew wants to build his next house in Manitoba, to come back to his roots, Dr. Yatchew is going to have to make a decision as to how he's going to heat -- space heat his home.

And based on this chart, what's your answer?

DR. ADONIS YATCHEW: Natural gas and -- and just -- I just would like confirmation because it is the first time I've seen this chart.

These costs include the capital depreciation costs? In other words, the installation of the furnace or these are just the fuel costs? This is just the natural gas -- the cost of fuel bills and the cost of the -- and your electricity bills. So there's no capital cost in these figures?

MR. BOB PETERS: The best person to answer that question is sitting beside Mr. Bedford, but she's not on the microphone so I'm going to turn to page 22 of this document, Dr. Yatchew. And it's a good question and I think your answer's in the paragraph at the top left corner of the page that we're just looking here at the amount of energy required to heat the home and there's no capital costs and there's certainly no conversion cost built into this. This is simply the fuel costs.

Can we proceed on that basis? Your fine with that?

DR. ADONIS YATCHEW: Yes, sir.

MR. BOB PETERS: And you're still going to put natural gas heat in your house in Winnipeg?

DR. ADONIS YATCHEW: I would.

MR. BOB PETERS: And you're going to feel good about it?

DR. ADONIS YATCHEW: In the environmental sense or in my pocketbook sense?

MR. BOB PETERS: Well, that -- that's the point I want to come to is you've told us here Manitobans who -- who switch funerals can either feel good about it, or they can be rational about it.

And how does -- how does a Manitoban wrestle with that dilemma that they can go from electricity space heat to natural gas and for 50 percent of the cost. But then they -- they feel terrible looking in the mirror because they've increased the carbon footprint here in Manitoba.

DR. ADONIS YATCHEW: Judging by human behaviour elsewhere, they might feel a little bad but not bad enough to cause them not to switch to natural gas. The savings are just so so large and certainly in Canada there -- and in -- and in Ontario there'd be even much higher.

MR. BOB PETERS: So what - does that answer apply, Dr. Yatchew, whether the customer is a residential customer or a commercial or an industrial customer? They can feel bad for a moment but after that they'll be smiling all the way to the bank?

DR. ADONIS YATCHEW: First of all, commercial and industrial customers have to compete

and so they have to try to cost minimize if they're going to -- quite often just to stay competitive. So it's a -- it's a rational business decision to -- to do that.

The residential -- and I do not -- I know people who purchased electric cars when they were very expensive still or hybrids when they were quite a bit more expensive and did it for environmental reasons.

But generally speaking, the empirical evidence suggests that people are not prepared to pay that much to compensate for their carbon footprint.

An exercise that I have my students do is this, those of you who fly, for example, Air Canada and book a flight might remember there's a specific page that allows you to buy back your carbon -- the carbon that you've produced. I'm seeing some people nodding their heads.

So what we did with one (1) of my Big Ideas course is, well, how -- how much do people actually -- how much -- how much do people -- how frequently do they actually respond to this page. From Air Canada on their website you can get information about the number of miles that have been bought back through that page on an annual basis.

It is absolutely tiny. It rounds to zero compared to the total miles travelled. I see that as a pretty -- pretty strong empirical evidence of people make decisions.

MR. BOB PETERS: Well, would it give you any comfort and make you feel even better about your decision on your heat source in Manitoba, if you were in -- informed that the electricity that you did not use to heat your home was being exported to your cousins in Minneapolis and they are no longer using as much coal generated energy?

DR. ADONIS YATCHEW: If -- if -- the system was tight and I was -- basically the stuff I wasn't using was being -- was being sent to the States so I was replacing clean electricity with natural gas, but saving coal generation in the States, which has twice the carbon footprint, yes, I would feel better.

MR. BOB PETERS: You talked on a larger scale with My Friend opposite about carbon leakage as it pertained to -- to larger industrial type customers.

Do you recall that?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And in essence, I understood that carbon leakage to mean that an

industrial customer may decamp out of Manitoba and locate somewhere else where they could reduce their energy costs, regardless the source of energy.

DR. ADONIS YATCHEW: Yes. They could decamp or they could simply shut down and their -- their production be replaced by production by some other firm and some other location, yes.

MR. BOB PETERS: But if they decamped or they relocated, they could be increasing their carbon footprint because you were quite effusive with your praise of Manitoba in being one (1) of the greenest jurisdictions of which you're aware?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And so by relocating out of Manitoba to a different jurisdiction, that means that they're likely going to be increasing their carbon footprint elsewhere?

DR. ADONIS YATCHEW: Yes, sir.

MR. BOB PETERS: Have -- have you any advice to give the panel as to how economists would solve the carbon leakage problem maybe by what's happened elsewhere as to stop these customers from leaving Manitoba and increasing their carbon footprint elsewhere?

DR. ADONIS YATCHEW: Let's see if I

can sort of organize my response. There is the -- the very large problem of carbon leakage that we face in Canada, we face in the US and -- and very much in Europe, where countries in Europe, in particular, have implemented much more aggressive decarbonization policies than pretty much anywhere else in the world. This has lead to carbon leakage where the -- their production has shifted to more carbon intensive economies.

And -- and some of the arguments out there say that you have to come up with a global solution. So, that provides no advice to this Board because this Board is not going to -- is -- is not part of a global process, so to speak.

So the -- the tools available to this Board would really be rates. How do you keep businesses here and that becomes a question of rate design. And there is -- there's actually technical literature on -- on this, sometimes called Ramsey pricing where you want to charge lower prices to those customers that are most likely to leave.

From an equity point of view that -- one might argue against that, though there are -- the allocation of costs across customer classes cannot be done unequivocally based on cost causality. There are

all kinds of vaguenesses in rate design that -- that would, in theory, allow a regulator to say, you know what, we can charge lower rates in this -- in this sector for some specific reasons and higher sector, and it still doesn't violate the principle of cost causality.

But it makes it difficult from an equity point of view. Let me add to that. That's why in this -- in this report -- and I do mention this changing rate design, the alternative is really to try to have the government implement policies that in some other way ensures that these industries stay here or locate here.

Part of that reasoning for the government is not just a macroeconomic argument, but could very well be environmentally motivated in part -- part of the -- part of the calculus.

MR. BOB PETERS: Could you give me an example or give the Board an example of -- of those government inducements that might over -- might compensate for not having the lowest energy bill?

DR. ADONIS YATCHEW: Tax advantages are often a device, tax breaks. And industries seeking to locate in one (1) place or another will often try to get the jurisdictions to compete against

each other. Who's going to give us the best tax break and over what period of time.

MR. BOB PETERS: I'd like you to remember this chart as long as you want to while we turn to page 76 of this same exhibit. And we're going to turn our discussion to demand-side management and you had, again, some discussions with My Friends opposite on this issue.

And I took from your discussion that the decisions on demand-side management investments by the Utility should be made on -- on a rational basis and not maybe a feel-good basis.

Have I stated your evidence correctly, in my words?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And so when you -- when -- and I don't want to put -- get you too involved on -- on this chart because I appreciate it will be something you haven't reviewed.

But in essence, here's a whole portfolio of demand-side management programs in Manitoba and those programs are listed on the bottom and the funding for them is shown in the bar charts where the Utility, in blue, puts in the money or the customer, in green, puts in the money.

You can see that?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And there's a lot -- there's some -- some metrics on the page, such as the average levelized marginal value and there's also the portfolio levelized resource cost on the far right-hand side and the levelized utility costs.

You can see those numbers?

DR. ADONIS YATCHEW: Yes, I can.

MR. BOB PETERS: Can you clarify for the Panel that when you're making a rational decision on demand-side management, is it -- is it rational -- does it have to be rational to the consumer or is it rational from the Utility's perspective?

DR. ADONIS YATCHEW: So when I speak of rational, I really mean, what are the -- whether the policy itself is rational. And the consumer, herself or himself, is presumably making rational decisions. I won't get into the potential for deviation from what are optimal rational decisions.

But yes, we're really talking about, is it rational from the perspective of the decarbonization policy; is it rational from the perspective of -- of the Utility's revenues and costs?

MR. BOB PETERS: Is there a screen

that you could recommend as an economist to how do you -- how do you screen for what is rational and what isn't?

DR. ADONIS YATCHEW: I -- I can't comment specifically on these -- on these DSM programs here.

MR. BOB PETERS: I appreciate that. And I -- I'm not asking you to do that. I'll ask you in a general way, please.

DR. ADONIS YATCHEW: But in the present context, when you've got lots of excess capacity and the marginal cost of producing electricity from that source is low, is very low, then it's hard to justify reducing consumption, expending expenditure -- having expenditures on -- on reducing consumption when the environmental consequences of that consumption are minimal.

I'm -- I'm hesitating to give you a -- a formula, but the first thing I would probably look at is: How much are you -- what is the cost of reducing consumption by 1 kilowatt hour measured against the cost -- the marginal cost of producing that electricity?

So it's the marginal cost of producing, in this case, green electricity against the cost of

reducing that consumption by 1 kilowatt hour. That would be my instinctive and, let me just say, very provisional answer.

MR. BOB PETERS: No, I thank you for that. I'm going to follow a little bit further and I've reviewed material again that I -- I don't expect you will have reviewed in any detail or maybe even at all, Dr. Yatchew, and that's information that was authored by an organization called the Boston Consulting Group.

And in their materials, they refer to rate increases as the ultimate DSM program. And if you think about it, there's zero resource cost needed from the Utility. There's au -- you know there's a hundred percent participation by your customers and you're telling us today that there's going to be a price elasticity impact.

So from that perspective, these rate impacts can accomplish what some DSM programs would be aimed to do? Do you accept that?

DR. ADONIS YATCHEW: Yes. And in fact, that's why I was careful in the language that I used in the report because these price increases will themselves capture DSM effects. These price increases will capture DSM effects.

In fact, when you look at all these elasticity modelling studies, very, very few of them actually try to filter out the -- the effects of DSM programs on demand versus the effects of price. The Utilities try to do that because Utilities are being required in many places to produce DSM -- measurable DSM program results.

MR. BOB PETERS: So I interpret your answer, Dr. Yatchew, to be telling the Panel that it's not appropriate to think of Manitoba Hydro's rate changes in the manner of a DSM program because, as you've said, there's lots of excess capacity and there's a low marginal cost, and therefore, it would be hard to justify on a rational basis spending of money to reduce consumption to generate even more surplus?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: Dr. Yatchew, on slide 8 of your slide deck of today which is marked as Exhibit AY-2. It could just be -- even enlarge this a little bit, please. Thank you.

Is there any -- is there any advantage to Manitoba for having a GDP pie chart that, in essence, mirrors the Canadian GDP pie chart?

DR. ADONIS YATCHEW: I'm -- I'm not

sure what you mean by "advantage." I mean, it's certainly the service sector is almost ident -- is -- is identical in terms of its share and the manufacturing sector is, but the agricultural and mining sectors are substantially different.

MR. BOB PETERS: All right.

DR. ADONIS YATCHEW: I'm not sure what you mean by "advantage." Could you help me out here?

MR. BOB PETERS: Well, perhaps maybe I was just struck when I saw them to say, hmm, you know, kind of wonder, why is that? Why is Manitoba mirroring the Canadian GDP model, and I'll take the exceptions out except for mining and agriculture? What does that do for Manitoba?

Does that make us more immune to price changes or we are -- are we losing our diversification so that our economy doesn't feel the highs and lows that other jurisdictions do?

DR. ADONIS YATCHEW: Certainly diversification helps when there are either business cycles or, for example, commodity price -- commodity price fluctuations that are -- are very large. There are economies out there that are very dependent on certain commodity prices and have experienced disastrous impacts as -- as a result of that

dependency.

Perhaps the most extreme case right now is Venezuela, which for various reasons, but partly the -- was brought to the brink by the collapse in oil prices. But your economy is actually well diversified and largely the service sector.

MR. BOB PETERS: All right, just -- and nobody asked I don't think forwarded an Information Request from you, but in -- in contrasting Manitoba to Ontario, are you able to tell this Panel what would be a significant difference between Manitoba and Ontario, other than the agriculture and perhaps the mining?

DR. ADONIS YATCHEW: Without actually getting the numbers out and I could do that easily, if you -- if you -- if you desired. Agriculture is probably much smaller in Ontario; manufacturing is somewhat larger and Ontario. But I don't know about the service sector. The service sector might actually be even larger in Ontario.

MR. BOB PETERS: And the information and I won't ask for that as an undertaking but thank you, Dr. Yatchew.

The GDP shares in Manitoba, this -- the source data, if I recall the footnote, this came out

of the provincial budgeting material, the provincial government material; is that generally where you would have sourced this material?

DR. ADONIS YATCHEW: I'd have to check to make sure what the -- where the data came from but I would have -- so the -- the Canadian figures are from Statistics Canada. And as are the Manitoba figures.

And as I recall I did compare them to the provincial -- Manitoba provincial economic outlook shares and they seem to match pretty closely.

MR. BOB PETERS: And just picking on agriculture for a minute. You're talking here about the -- the products that have been generated through the agriculture industry and giving rise to the -- to the gross domestic product share?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: If a -- if a producer in Manitoba was to sell some land that you said is very fertile, that's not to show up as an agricultural activity, that's going to show up as a services activity in the real estate section?

DR. ADONIS YATCHEW: The sale of the property, yes.

MR. BOB PETERS: But whatever's grown

on that land will show up under the agricultural section of the pie?

DR. ADONIS YATCHEW: Yes. So the agriculture would certainly include crop production, but also greenhouses and nurseries, animal -- animal production. I've got forestry and logging actually listed under the agricultural sector in appendix 4.

MR. BOB PETERS: All right. Well, maybe we should just turn to the appendix 4, that you're looking at. It's, again, your report and at the bottom of page 77 of your report you deal with the agriculture.

And so the panel is oriented to this. These are sectors of agriculture and the percentage of that sector that is spent on electricity?

DR. ADONIS YATCHEW: Yes, and then it flows over into the next page.

MR. BOB PETERS: Right, and I know My Friend Mr. Bedford had counted a lot more of it than I did in terms of doing the ninety-five five (955) numbers, but one (1) of the questions that the Vice-Chair asked you -- and I'll come to it, but what it was to -- to understand from an energy-intensive basis, she asked you why agriculture has declined in intensity. Do you remember that question?

DR. ADONIS YATCHEW: I do. And this has to do with electricity intensity in particular, as you've pointed out.

MR. BOB PETERS: And your answer that I recalled was basically you're not really sure. You'd have to look at the subsets of agriculture to see where that intensity may have lightened up?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: This isn't going to help you answer that question, is it --

DR. ADONIS YATCHEW: No.

MR. BOB PETERS: -- what's on the screen?

DR. ADONIS YATCHEW: No.

MR. BOB PETERS: This is --

DR. ADONIS YATCHEW: This is a snapshot in time.

MR. BOB PETERS: Yes.

DR. ADONIS YATCHEW: And so we'd have to go back histo -- historically to the -- to the -- over the last fifteen (15) years or so.

MR. BOB PETERS: Okay. And so -- and maybe the take-away that I'll take from this is that agriculture includes trees?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: Okay. And by looking at this subset list, Dr. Yatchew, under crop production, for example, which excludes the greenhouse nursery and the floriculture production, the agricultural expense on electricity is less than 1 percent?

DR. ADONIS YATCHEW: In crop production?

MR. BOB PETERS: Yes, sir.

DR. ADONIS YATCHEW: Yes, sir.

MR. BOB PETERS: Can you think of any way that that number could have been higher before, and now it's been reduced, or what would give rise to less intensity for that sector of it?

DR. ADONIS YATCHEW: I don't know enough about agriculture to be able to comment on that, and I don't know whether activities like grain drying, for example, are embedded here, or somewhere else in these tables, but that's a fairly energy-intensive activity.

MR. BOB PETERS: And so it may be that -- and interesting you'd say that. We -- we had a presenter, I think a week ago today, who indicated that his grain drying activity was not on electricity, but on an alternate fuel. I think there may been some

reasons for that, but that's an example that you could cite that maybe people have gone away from electricity to dry grain to some other source of fuel?

DR. ADONIS YATCHEW: I cannot cite that with certainty, but I'm speculating that that could be.

MR. BOB PETERS: All right. When I look back on that -- that coloured sheet from Manitoba Hydro home heating expenses, I wouldn't be sure what -- what fuel expense would be -- what would be cheaper, other than natural gas, and I don't know if that would even be available in some of the farm areas.

DR. ADONIS YATCHEW: I do know that in Ontario, for example, some of the establishments -- industrial establishments that are off the natural gas grid rely on propane, for example, because firstly, prices are so high in Ontario, propane, which is quite a bit more expensive than natural gas, though its price has dropped is -- is a -- is a viable fuel in some areas of -- of Ontario.

MR. BOB PETERS: I suppose I -- I should apologize. I was thinking -- I -- I couldn't make sense of your answer. But if I do look back to the Board counsel book of documents, Volume IV, page 21, and we look at that home heating chart, just in

relative terms on page 21, I -- I see your point on propane has come down, and it's -- it's not that far away from electricity, depending on the capital cost to convert your systems?

DR. ADONIS YATCHEW: Right. And these are Manitoba electricity prices. If we had Ontario electricity prices, they would be a lot higher. Propane --

MR. BOB PETERS: And you're suggesting to the panel that the Ontario prices could be almost twice what Manitoba's are?

DR. ADONIS YATCHEW: Subject to check, there -- I did provide a chart, but the -- the chart is very general. I mean, we'd have to -- we'd have look at industrial electricity prices in Ontario.

MR. BOB PETERS: All right. Thank you, sir. One (1) of the other comments that you made in your -- your report is that there's low per capita debt in Manitoba. Do you recall making that comment, or do I need to pull that up for you?

DR. ADONIS YATCHEW: I do recall it.

MR. BOB PETERS: But you'd like to see it --

DR. ADONIS YATCHEW: I would --

MR. BOB PETERS: -- on page 2 --

DR. ADONIS YATCHEW: I -- I --

MR. BOB PETERS: -- I believe of your report. Yes, on page 2 of the actual report, paragraph 4?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: I noted that comment -- and when you're talking low per capita debt, are you adding into that the Manitoban's -- each Manitoban's share of the debt of Manitoba Hydro?

DR. ADONIS YATCHEW: I would have to go back and check. This information was based on the Manitoba Provincial budget and -- and supporting documents. So I would have to go back and check that.

MR. BOB PETERS: All right. But your low per capita debt that you're talking about is -- is relative to other jurisdictions?

DR. ADONIS YATCHEW: This would have been relative to other Provinces.

MR. BOB PETERS: And which Province, in -- in particular -- or which Provinces, plural, in particular, do you recall were being much higher in per capita debt?

DR. ADONIS YATCHEW: That's something I would have to go back and check.

MR. BOB PETERS: Okay. Then maybe I -

- I will ask Ms. Gilson for an undertaking to have Dr. Yatchew you provide his information on the low per capita debt in Manitoba relative to the other Canadian Provinces. Would that be acceptable, Dr. Yatchew?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: That information's relatively available to you?

DR. ADONIS YATCHEW: I -- I should -- so that information won't be in this document to which I'm referring, but that's certainly data that are -- that are available through Statistics Canada.

MR. BOB PETERS: Okay, thank you. And if you can while you're checking that data, if you can provide an additional column for the per capita debt, including the share of the debt for the Crown corporations in that Province, that would be helpful as well.

DR. ADONIS YATCHEW: On a best-efforts basis, I'll see what's available.

MR. BOB PETERS: All right. Thank you. That would be acceptable.

--- UNDERTAKING NO. 50: Dr. Yatchew to provide his information on the low per capita debt in Manitoba

relative to the other Canadian Provinces and to provide an additional column for the per capita debt, including the share of the debt for the Crown corporations in that Province

CONTINUED BY MR. BOB PETERS:

MR. BOB PETERS: On slide 9, as well as in your report, you introduced us, or certainly me, to the Sankey diagram. And I want to just make sure the panel, in your absence, will be able to interpret this. The -- the supply side is the left side of the page, correct?

DR. ADONIS YATCHEW: Yes, sir.

MR. BOB PETERS: And the uses of the energy is on the far right-hand side?

DR. ADONIS YATCHEW: Yes, and we can think of that as the demand side.

MR. BOB PETERS: And in terms of the uses of energy, you've tried to screen whether that energy source came from, for example, Hydro, or natural gas, or petroleum to the various end uses?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: So when we follow the Hydro through, Hydro starts off at 125 petajoules, as I see it here?

DR. ADONIS YATCHEW: Yes, sir.

MR. BOB PETERS: And then somehow it becomes a hundred and thirty (130), and that's because of the coal and the wind adding into it?

DR. ADONIS YATCHEW: The wind is the larger one there, yes.

MR. BOB PETERS: And then from that, there are some exports, 33 petajoules on the export side --

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: -- and the balance is then distributed to the -- to the demand sides in Manitoba?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And where is agriculture in that mix on the right-hand side of the page?

DR. ADONIS YATCHEW: So agriculture would be in the industrial sector here, and it's actually not common, when I've seen the Sankey diagrams out there in the -- in the literature, to

separate out agriculture. There are few instances where agriculture is -- attract its own box on the demand side, so to speak.

MR. BOB PETERS: And now we're looking at electricity in the yellow pipeline, if that's the -- the analogy that we're looking at here. And you're saying to the panel that 30 petajoules goes to residential?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: Is that petajoules, or is that percentage?

DR. ADONIS YATCHEW: That's petajoules.

MR. BOB PETERS: Okay. So 30 petajoules to residential, nineteen (19) to commercial, thirty-three (33) to industrial, and we -- we see, I think, 4 percent going down to transportation.

DR. ADONIS YATCHEW: Four petajoules.

MR. BOB PETERS: Sorry, 4 petajoules to transportation, correct?

DR. ADONIS YATCHEW: And -- yes. And then there the exports of thirty-three (33).

MR. BOB PETERS: And I'm sure that'll add up to the hundred and thirty (130), less any

transmission line losses that you've talked about to--

DR. ADONIS YATCHEW: Yes, exactly.

MR. BOB PETERS: All right.

DR. ADONIS YATCHEW: You have to subtract all those.

MR. BOB PETERS: I -- I have your point. The -- the other point you made here is you were telling Manitoba Hydro to do whatever they can to get more electric vehicles in Manitoba?

DR. ADONIS YATCHEW: It's a challenge.

MR. BOB PETERS: Why would it be a challenge on a day like today?

DR. ADONIS YATCHEW: Exactly. Precisely. So, unfortunately -- so bat -- battery technology has been improving a lot, but batteries don't -- don't have the same levels of output in cold weather as they do in -- in warm weather. So as you said, on a day like today, with very cold weather, your battery might not give you the same number of kilowatt hours, even if it's fully charged, than it would on a summer day. So it is a challenge.

MR. BOB PETERS: I want to -- I think I'm going to jump to your -- back to your report, page 21. I just had a couple of questions that I don't know that were answered on the elasticity issues.

(BRIEF PAUSE)

MR. BOB PETERS: In terms of your advice to the panel as to -- as to the elasticities themselves, you went with me earlier to see that on August the 1st of 2017, this Board approved a 3.36 percent rate increase, and a further seven point nine (7.9) has been requested April 1. If we add those together, and we're over 11 percent over that eight (8) month period, do we apply your short-term price elasticity number as to what we can expect in terms of a demand decline?

DR. ADONIS YATCHEW: Demand decline, roughly one (1) year -- demand decline, roughly one (1) year after that second price increase, but the impact would be larger over, let's say, you know, if that were the only increase, the impact would be larger over the five (5) to ten (10) year period.

MR. BOB PETERS: And when you say increase is going to be larger over the longer period of time, is that increase larger because of the industrial customer more so than the residential customer?

DR. ADONIS YATCHEW: I -- I should correct my -- my language, here. The decrease in

demand is going to be larger, but you're right, in -- in absolute magnitude. Based on the literature, I'm suggesting -- I'm recommending an -- an industrial elasticity of minus point five (-.5), which is a stronger response than the commercial and residential sectors.

MR. BOB PETERS: And it's a larger response than what I think Manitoba Hydro provided to us, and you show the chart in your material, so you're aware that your numbers are -- are higher than Manitoba Hydro's?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And so for example, if we can turn to page 27 of Dr. Yatchew's report --

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: -- and we look to the chart in the middle of the page, we see that Manitoba Hydro's price elasticity for residential is shown as negative zero point two-eight (-0.28), correct?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: Your short-term number is negative zero point one (-0.1)?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And that's the one (1) year number, but you're saying it will, in the

long-term, somewhere between two (2) and five (5) years, probably migrate to negative zero point three-five (-0.35) for the residential?

DR. ADONIS YATCHEW: Yes, sir.

MR. BOB PETERS: What do you make that your elasticity number is -- is greater than Manitoba Hydro's?

DR. ADONIS YATCHEW: First of all, if I've understood the models that were estimated by Manitoba Hydro, they are based on Manitoba data, so they're not informed by experience elsewhere. They're also -- and -- and I have no objection to simple models.

The models that they've put forth are readable, they're simple, but perhaps in some respects, they could be augmented, because the price effect in their models -- and again, I would have to confirm this, but as I recall, are -- are based on lag prices two (2) or two and a half (2 1/2) years ago. So a single impact of lag prices, rather than sort of a time profile of impacts.

There doesn't seem to be a distinction there between short-term and long-term elasticities, which I talk about here and exists in the literature. If I were to be convinced by the Manitoba Hydro

numbers, I would at least want to see what -- a more -- a -- a richer specification would result in something that models the -- the effect over time on demand rather than on a single snapshot based on a price two (2) -- two and half (2 1/2) years ago.

I'm sorry if I'm providing too much technical detail. Sure Dr. Grant understands -- understands this and --- and the other economists as well, but I do apologize to -- to Board members who I can't presume have -- have suffered through economics.

MR. BOB PETERS: Dr. Yatchew, you show the demand response in your materials, and you've just explained how you understand Manitoba Hydro has calculated theirs. That demand response from Manitoba Hydro and from your calculation is based on a one (1) time increase of 10 or 11 percent. Is that correct?

DR. ADONIS YATCHEW: That's how one would apply, for example, this elasticity, yes.

MR. BOB PETERS: So what happens in a situation where there's a 10 or 11 percent cumulative rate effect on April 1 of 2018, and then the next year, there's another 7.9, and then the next year, there's another 7.9, and the next year, if there was another 7.9? And I know a lot of this is hypothetical at this point, but do these elasticities of demand

become cumulative or cascading?

DR. ADONIS YATCHEW: The -- the simplest way to -- to look at this -- and this is the way I tried to describe it in -- in the report itself, is, well, what's the cumulative increase over, let's say, a period of time, seven (7) years was the -- I think the -- the sequence of relatively higher rate increases, and then what's -- so if the -- the prices go up in real terms by 50 percent, apply the long-term elasticity of that number.

Having said that, that's an approximation about what's going to happen, let's say, over the decade. A more refined model would calculate the cascading effects on an annual basis. So this year's price increase is going to have an impact over a number of future years. Next year's will have an impact over a number of subsequent years, and so on.

So there are richer specifications, but the simplest way to -- to treat this is you take the elasticity, you take the -- the projected rate increases, or the -- the rate increases that you expect, and apply it just to the cumulative amount, and I -- I find that as a useful way -- I find that to be a useful way of looking at the problem, again, if -- if end users form the expectation that prices are

going to increase by 50 percent in real terms was sort of the reference point. Once they form that expectation, they're no longer surprised by future rate increases of 7.9 percent. They've already -- they're already -- begin embedding that. You're going to have to bite the bullet and switch to that gas furnace, or we're going to have to insulate the windows, or replace the windows, insulate the house better.

MR. BOB PETERS: All right. I have your point. I'd like to turn to -- maybe your slide 18 for just a second. There was one (1) point that I want to make sure the panel is -- has on the record for you.

On your 18th slide of the Exhibit AY-2, you showed natural gas prices and four (4) benchmark prices, correct?

DR. ADONIS YATCHEW: Yes, sir.

MR. BOB PETERS: And the conclusion that you left the panel with was there's going to be low natural gas prices for the foreseeable future?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And the foreseeable future, how far into the future are you seeing? Is it -- is it five (5) years, ten (10) years, twenty (20)

years, thirty (30) years, or are you able to give us what that foreseeable future is?

DR. ADONIS YATCHEW: I would be comfortable with the five (5) to ten (10) year range on that. And when I say, low natural gas prices, I don't mean necessarily at three dollars ($3), which is that last point there. Anything three (3) to five dollars ($5), I consider to be low natural gas prices by historic standards.

MR. BOB PETERS: Was that calibrated in dollars per gigajoule, or was that to MMBTU, or do you remember?

DR. ADONIS YATCHEW: This would have been in per -- per million BTUs, or per 1,000 cubic feet --

MR. BOB PETERS: Okay. And --

DR. ADONIS YATCHEW: -- roughly the same.

MR. BOB PETERS: -- and your suggestion also to the panel is that because of the LNG capabilities that are developing and being utilized around the world, you expect there to be some -- some focus of the price, and maybe coming together a little closer than what you see on this chart in 2016?

DR. ADONIS YATCHEW: There's certainly the prospect of convergence, greater convergence of prices and price movements in these -- what used to be continental markets. Though LNG prices will always be at a premium, because of the fairly high cost of liquefaction, transportation, which is actually the cheapest part, and then the regasification.

MR. BOB PETERS: At slide 32 of what we have in your presentation, there's energy intensity trends. And you pointed out how Ontario and British Columbia were showing the greatest decline in intensity, correct?

DR. ADONIS YATCHEW: That -- that looks -- that looks to be correct, yes.

MR. BOB PETERS: Can you provide to this Board some indication as to what has caused, or resulted in this -- the energy intensity to decline in those Provinces more so than in Manitoba?

DR. ADONIS YATCHEW: I -- I cannot provide that on a -- sort of an accurate basis right now, but these declines over time have been in part, and maybe even the major -- the -- the larger part of these declines has -- have occurred as a result of the shifting GDP mix. As you increase the service sector, the size of the service sector, you become less

energy-intensive, because the service sector is generally low in terms of its energy intensity. But in terms of the differentials, I cannot give good reasons for that.

MR. BOB PETERS: All right. Thank you. I'm turning to energy poverty for a few questions that I don't think have been covered. Perhaps -- perhaps one (1) of them is on your slide 37 --

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: -- you provide National Energy Board 2015 information, correct?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: And are you aware in this proceeding, Dr. Yatchew, that the there was a bill affordability process that was supported by this Board that embarked on various meetings and provided materials to this -- to this hearing?

DR. ADONIS YATCHEW: I'm aware of the process, and I've had a brief look at the document. In fact, I looked -- saw the document quite early in the process after first meeting with Manitoba Hydro back in September. Yes.

MR. BOB PETERS: All right. If we could put on the screen from Board counsel's fifth

book of documents, page 165, that would be Manitoba -- PUB Exhibit 42-5, page 165. We have an extract from an information request from the Assembly of Manitoba Chiefs to Manitoba Hydro.

Have you had the opportunity to -- to look at this document before?

DR. ADONIS YATCHEW: I don't -- I -- I may have seen it briefly, but I don't -- I -- I don't have an intimate knowledge of this.

MR. BOB PETERS: Okay. Well, let's start from this premise that -- and I'm -- and I don't need a -- an intimate knowledge of the materials, but the National Energy Board numbers that you provided -- provided a definition of energy poverty as household income actually spent on energy being 10 percent or greater?

DR. ADONIS YATCHEW: That's correct. And that's nontransportation energy.

MR. BOB PETERS: All right. And then on the screen in front of you, from the information request from the Assembly of Manitoba Chiefs, there's a different definition, and that's the percent of low income cutoff 125 households that spend 6 percent or more of their household income on energy. Do you see that?

DR. ADONIS YATCHEW: Yes, I do.

MR. BOB PETERS: So now we've got competing definitions of what is energy poverty?

DR. ADONIS YATCHEW: Yes.

MR. BOB PETERS: How should this Board consider the appropriate way to define energy poverty?

(BRIEF PAUSE)

DR. ADONIS YATCHEW: So the -- the most commonly used definition of energy poverty that I've seen in -- in other jurisdictions is -- is the -- the first one, the simp -- simpler -- simpler one that -- that the National Energy Board uses. If you're spending more than 10 percent of household income on energy, that's energy poverty.

Some people use the 6 percent number. That would be the departure point for the discussion, but not the end point. One (1) of the difficulties with this type of measure is that there may be households out there who are spending less than 10 percent, but that's because they've got more pressing needs, and their -- and their -- their homes are at too -- too-cold temperatures to begin with.

So one (1) of the alternative

approaches is to ask, given a particular, let's say, residential dwelling and family configure -- family constellation, what's a reasonable level of expenditure on domestic energy by this household? And if you cannot achieve that based on your income, then -- or if you're spending -- if -- if that reasonable amount -- reasonable expenditure is more than, let's say, 10 percent of your income, that would be the benchmark. That's sort of the next iteration, and probably a fairly good one.

I -- I believe as -- in response to one (1) of the interrogatories by the -- by the Board -- or Board staff, I included -- I was asked to include this very large energy poverty document that's -- that's -- that is produced in the UK. And that's where they -- that's where they go. There -- there's a huge literature on this, and it -- it has -- there's no shakeout yet on what's the best way, but those two (2) would be, I think, pretty sensible places to start.

MR. BOB PETERS: Thank you, Dr. Yatchew. And Mr. Chair, I'd like to thank Dr. Yatchew for his answers to my questions. Those conclude my questions. Thank you.

DR. ADONIS YATCHEW: Thank you.

THE CHAIRPERSON: Thank you. We -- we need to adjourn by 4:30 as a -- a member of the panel has another obligation, but I've got a question, and I ask the panel for questions.

Diana, can we go to page 43 of the presentation. Can you keep -- scroll down to the last bullet. Okay.

Dr. Yatchew, I want to talk to you about Ontario. And -- and to frame the issue, it's the issue of obligations of the government versus obligations of the Utility. When I read this -- when I read the -- the last sentence, it seems to indicate that there were fluctuations in rate increases, but the economy continues to grow, and the manufacturing sector remained steady, above 13 percent.

As I understand it, there was almost a revolt in Ontario from increases in Hydro prices. Would that be a correct assessment?

DR. ADONIS YATCHEW: There was certainly a lot of concern and pressure from the industrial customers, for example. The residential customers were rather less organized in this, but certainly, it -- considerable concern there, yes.

THE CHAIRPERSON: Okay. But there were stories about the impact on residential customers

when rates went up?

DR. ADONIS YATCHEW: Yes.

THE CHAIRPERSON: Okay. And the response of the government more recently was to transfer some debt from Ontario Hydro to the Provincial Treasury. Is that accurate?

DR. ADONIS YATCHEW: Yes.

THE CHAIRPERSON: And as I understand it, the debt is now thirty (30) year debt, and the government is going to pay an extra $160 million in interest as a result?

DR. ADONIS YATCHEW: Yes.

THE CHAIRPERSON: So --

DR. ADONIS YATCHEW: That sounds right, I -- I can't confirm --

THE CHAIRPERSON: Yeah. I mean, you can check that but I'm -- I'm going by memory.

DR. ADONIS YATCHEW: Yeah.

THE CHAIRPERSON: Do you know if any manufacturers left, or any businesses left Ontario as a result of the -- of the increased Hydro rates?

DR. ADONIS YATCHEW: I do not have specific knowledge. I would be surprised if there weren't departures, but there's also a normal cycle to -- to industry.

I would also add -- and this is -- this is anecdotal to a degree, but -- but let's just say several sources have confirmed this for me, that because of the concerns by the industrial community, there was this decision to change the rate design for large industrial customers in order to base the capacity payments -- the demand portion of the bill on the -- the high -- your highest five (5) days of -- five (5) hours of consumption. And that, in turn, was seen by some as a -- a way to -- to mitigate the impact on industry, because they could actually respond by reducing their demand at those -- at those -- and predicting what those five (5) hours would be.

In fact, it's a small industry in Ontario trying to predict what are the five (5) highest hours of consumption, and selling that to --

THE CHAIRPERSON: So -- so it's moved to a time-of-use rate design in some part?

DR. ADONIS YATCHEW: It -- there -- we do have time of use rates, but -- but this really is sort of the demand charge. What's the maximum demand that you put on the system as opposed to the energy charge? And if it occurs at peak hours, then that is something that -- that increases your bill very substantially.

THE CHAIRPERSON: Is there a way to determine what the financial impact is on the economy for adding $160 million in debt versus the reduction in the Hydro rate? Has anybody looked at what -- what the impact was when -- when the provincial government decided to take on that debt?

DR. ADONIS YATCHEW: I mean, I have not seen that type of -- I've not seen that type of analysis.

THE CHAIRPERSON: Okay. Part -- part -- and as I understand it, the provincial government runs -- and use loose terms -- a bill affordability program, a bill support program for low income users.

DR. ADONIS YATCHEW: We do have.

THE CHAIRPERSON: Would I be correct that as part of the Utility regulation, there's the principal that ratepayers pay for the rate set by the Utilities?

DR. ADONIS YATCHEW: Rate --

THE CHAIRPERSON: The cost of the Utilities?

DR. ADONIS YATCHEW: Yes, that -- the cost recovery type principal, yes.

THE CHAIRPERSON: Okay. So I guess where I'm leading to is: Would I be correct now that

there's blurring of the obligation of Utilities versus the government by the shifting of programs relating to the payment of rates to -- to a provincial program?

DR. ADONIS YATCHEW: Yes, but that blurring has -- has occurred in other ways --

THE CHAIRPERSON: Okay.

DR. ADONIS YATCHEW: -- in the past. So one -- one ideally would like to think of a regulator as having an -- of having an arm's length relationship with the government. The government sets policy; the regulator makes decisions and recommendations that are not subject to the political cycle. That -- and -- and I say that because this -- this change, this reduction in our electricity rates financed by -- by borrowing is -- I see it as essentially a political decision; not one that's based on economic optimality.

THE CHAIRPERSON: Well, the regular -- the regulator did not come up with that decision, did they, Dr. Yatchew?

DR. ADONIS YATCHEW: They did not.

THE CHAIRPERSON: It was the provincial government?

DR. ADONIS YATCHEW: Correct.

THE CHAIRPERSON: So would you see the

incentive program -- you referred to a tax incentive program for business?

DR. ADONIS YATCHEW: Yes.

THE CHAIRPERSON: As a way to induce businesses to say -- stay even if rates are increased.

Would you see that as sort of the blurring where the government decides that it will, on the one hand, give money to business so that -- so that the rates can be reduced?

DR. ADONIS YATCHEW: I don't necessarily see that as a blurring because the arguments that one can make to retain business is a macroeconomic argument, rather than an -- an energy policy argument. It may be motivated by increases in -- in -- in this case, electricity costs. It may be motivated by other reasons.

THE CHAIRPERSON: Okay.

DR. ADONIS YATCHEW: But that's -- I mean, business retention is -- is I think a proper province, so to speak, for -- for provincial -- provincial governments. We could have discussions on industrial policy; whether we -- this is good or bad to -- provincial governments to be doing it at all, but it's not indefensible.

THE CHAIRPERSON: Okay. Thank you,

Dr. Yatchew, I'm just wondering if any of the other panelists have questions? No? Sorry, you do?

BOARD MEMBER GRANT: Well, I have many. I still have a lot -- I've learned a great deal today but there's still a lot of holes to plug and I'm not sure what I can -- I'll limit myself to one (1) question I think.

But it's to follow up on this sort of policy discussion a bit where -- I think what struck me today is we encountered or -- the issue about the role of the Utility versus the province around things like demand-side management programs or it become -- becomes quite clear in terms of low income or energy poverty. But I guess what I hadn't thought about was the externality affects of, you know, some of the macro benefits from higher/lower prices and such.

And -- and that leads to this whole other potential domain for policy outside the Utility so much. It seems like the Utility's being asked to do a lot and I guess I'm just wondering: Is there a best practice example in Canada for keeping all politics aside, or maybe you want to use American jurisdiction but are there -- is there any jurisdiction you could point to that's sort of done interesting ways of trying to integrate policy and...?

DR. ADONIS YATCHEW: I'm hard-put to -- to -- to give a best practice example and it -- this is a -- this -- this -- the task is like that of Sisyphus in mythology, it's -- this rock keeps rolling down the hill and you have to push it up and the next day it rolls down again and you have to push it up again.

There is constant tension between governments who want to influence energy decisions made within the province, for political reasons because they face the election cycle and regulators would like to be able to make independent decisions that are -- that -- that are rational beyond the short-term cycle. So that -- that problem is there all the time and the best that we can do is to be aware of it on a continuous basis.

Every once in a while a government makes some serious mistakes because -- because of meddling in regulatory decisions. A good example would be the cancellation of -- of natural gas generation in Ontario a few years ago which led to hundreds of millions of dollars of -- of additional costs to customers and that -- those cancellations were made by politicians and based on political decisions.

And as a result of that then the next government comes along and says, okay, we're going to leave the regulator to act independently and then that gets forgotten and then they get into again.

BOARD MEMBER GRANT: Can I ask you one (1) quick supplementary -- I think that's what they say in parliamentary language. I was -- the earlier question about the carbon tax and whether there was any argument for some of the revenue coming back specifically to the energy sector.

I would have thought if -- if you felt you priced carbon correctly, so you'd captured the externality perfectly, wouldn't the -- I can say knee-jerk response, but wouldn't most economists say, you priced it right, walk away, let the market work now as opposed to -- so that if you then took some of the revenue and turned it specifically back to that sector there may almost be like a double treatment of it.

Is there still --

DR. ADONIS YATCHEW: So the approach to these carbon taxes has been different in different jurisdictions. In order to -- the reason the carbon taxes have such a difficult time getting passed, even though economists keep insisting are -- these being rational approaches is because they are a tax and

people get to realize that once a tax is in place, it's there forever.

Canada instituted a temporary income tax during the first world war, temporary. I'm still waiting for them to rescind it. So I file at the last minute each year in the vain hope that they will, this year, okay, we're announcing it. No more income tax.

So, there's a lot of resistance but one of the ways that some politicians have tried to market the carbon tax is saying -- is that it's going to be revenue neutral. We're going to collect the carbon tax but we're going to return it to you, let's say, through lower income taxes or some other measure; that makes it somewhat more palatable, though, given its success rate, not entirely.

Most governments aren't -- once they see the possibility of additional revenues, they might think, ah, we can spend on infrastructure, we can spend on something else. It becomes a policy decision by the government to where they're going to spend that money. It would not be unpalatable for the government to say, well, okay, these electricity prices are going up. We've got to make it through the hump. We're putting in a carbon tax because that's what's environmentally sensible. Let's assume that that's

the case, and we're going to use that to reduce the increases in electricity prices because we do have all this excess capacity. It's green energy. So it has no environmental or minimal environmental impact.

So there is some rationality to that. These dividing lines are -- are certainly not clear.

THE CHAIRPERSON: Ms. Gilson, any re-examination?

MS. KIMBERLEY GILSON: Thank you, Mr. Chair, no re-examine.

THE CHAIRPERSON: Okay, on behalf of the Board, it's been very informative session and on behalf of the Panel, I'd like to thank you, Dr. Yatchew, Ms. Gilson and Mr. Gardner for appearing today and your attendance and assistance have been very valuable. Thank you very much.

We're adjourned until 9:00 a.m. Monday morning. Thank you. Have a good weekend.

(PANEL STANDS DOWN)

--- Upon adjourning at 4:19 p.m.

Certified Correct,

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Cheryl Lavigne, Ms.