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(9:10 A.M.)
CHAIRMAN:
Q. So there are no preliminary matters I understand. Is there, madam?
MS. GLYNN:
Q. No, there is not, Mr. Chair.
CHAIRMAN:
Q. So we have Mr. David Adams. Sir, do you wish to make a presentation?
MR. DAVID ADAM IS HEARD
MR. ADAMS:
A. Yes, I do, yes.
CHAIRMAN:
Q. And we all have copies of it. So sir, you are on.
MR. ADAMS:
A. Okay, thank you. I'm not sure if these are on. They're on?
UNKNOWN SPEAKER:
Q. Yes.
MR. ADAMS:
A. I guess just an introduction. My name is David Adams. I'm an electrical engineer. I graduated from MUN, registered here locally

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with the Professional Engineering Association. I'm here as an individual today, not tied to any organization or business. Mr. Johnson asked me to present – he was aware of some metering I was – or comparisons I was doing on my own house, a comparison between mini-split heat pumps and baseboard heaters, and thought it would be useful to present this information today. So this information is very recent. I only got the metering – I've had the heat pumps in my house for maybe three, four years, but I've only had the metering device in a week - for a week. So it's very recent information that I have. It wasn't done over the coldest parts of the winter; just over a few cold nights that we've had in the last week or so. So some – and my house, I guess it's about ten years old. R2000, it's a registered R2000 house. So it was already fairly energy efficient to begin with. Heating costs for the house would be much lower than a normal house, heating approximately 4,000 square feet, including

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my basement and my garage. I maintain a continuous temperature in the house of 22 Celsius. Unlike conventional wisdom, I don't set it back at night. It's the same temperature day and night. The house was originally built like a lot of new homes with baseboard heaters and there's about 20 kilowatts of baseboard heaters installed. I retrofitted the house in 2012. I started in 2012. I installed a couple of units. I was pleased with the performance of them and I added an additional unit in 2014. So now my house is completely heated with mini-split heat pumps, all levels including the garage. The brand I use is Panasonic which is not the top – it's not probably the best units out here, but it's not – it's probably one of the higher ends, but it's certainly not the top unit, probably mid-grade brand name. And I've not used my baseboard heaters since November 2014. I also have the bonus of the air conditioning in the summertime, and the capacity there of the heating system that's installed, the heat pumps are rated for an

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output – the combined total output is 18 kilowatts, but that's at eight degrees Celsius, reduces to about nine kilowatts at minus 15 degree Celsius. They are rated down to minus 15, but they have operated below that and have not shut down. I'm not sure what temperature they would shut down at to be honest. They have never shut down for a cold temperature. And the maximum heating demand is 20 kilowatts for the baseboard heaters, just a comparison, and only 5 kilowatts for the mini-split heat pump. So that's the input power to the mini-split heat pumps. It's much less than the output heat. Just so everyone can understand kind how it's laid out in my house, this is a room in the basement. You can see two baseboard heaters. They were part of the original construction, and I've got an indoor unit on the wall there, and then you can see outside, outside the window, is the outdoor unit hung off the side of the house. So inside there's six of those heads I'll call them hung in various

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rooms. There's two in the basement, two on the main level, one upstairs, and one in the garage. The out – and there's three outdoor units. So each outdoor unit serves two indoor heads. In terms of control features, these things come with a remote and you – and they've got lots of different features on them, but I basically just put them in auto. They're most efficient if they're placed on auto and let – you set the temperature and just let it run. There's different features such as quiet mode and you can slow down the fan speeds and things like that, but they actually make the units less efficient. I don't – as earlier – as I said earlier, I don't use the night set-back. And the baseboard heaters that I do have, they're all controlled from programmable thermostats that I used to use I guess. So for the testing setup, I purchased a metering device and I think the very last slide there kind of shows you the package that I bought. It's from a Canadian company called Efergy. So it's meant for

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the most part for residential purposes. I guess there's probably more of interest in that in Ontario and probably other jurisdictions than there is here, but they do seem to sell a very good product. I was quite impressed with it when I opened it up. I think I received it last Wednesday. It wasn't very expensive, and it – I can even monitor my power on my phone. It's that smart I guess. And it records power at one-minute intervals. The testing was done overnight, and the reason for that is because there's no effects. You can kind of negate the effects of the sun and any other household activities. There's no televisions on, things like that, and I also switched off all major appliances. Just so everyone – so you can see the direct comparison between the heat from the mini-splits versus the heat from the baseboard heaters. So I - basically around 11:00 p.m. I would switch off everything, turn on the heat pumps, or I shouldn't say turn them on. They were already on.

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(9:15 a.m.)

A. Leave them on and then in the middle of the night I would get up, and I would turn off all the heat pumps and I would turn on the electric baseboard heaters, and with the goal of trying to maintain the house at the exact same set point, and I was fairly successful in that goal. There are some fluctuations because the thermostats probably measure a little bit differently than the mini-split heat pumps, but for the most part the intent was to maintain the house at 22 degrees Celsius for both minis-splits and the baseboard heaters. So I did the text over three nights. The 7th of April, so it was zero degrees overnight. I did again last night, minus three, and I also did it the very night that I had it at minus eight. It was the coldest night, but I did the test – I guess the first time you do something, you learn what worked and what didn't work. So I do have the information there for the night of the 6th in the back as well. So for the performance at zero

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degrees Celsius - so there's several lines here on this chart. At the bottom are the time stamps basically. So this device did record at one-minute intervals. I also created a 60-minute average of those 1-minute intervals. That's the red line. The one-minute intervals is the blue line and the green line there is the outside temperature. So the bottom is time, the left is watts. So that's how much power the device is consuming, and on the right is the temperature, the temperature recorded from Weather – Environment Canada at the airport. So on this graph we have – this one is from the night of the 7th. The mini-splits were consuming approximately one kilowatt of power to heat my house, maintain it at 22 Celsius. There's a few spikes there that I've got noted that represent when the – a unit would occasionally go into defrost. Defrost is not really – when the units are lightly loaded, it's not really an issue in terms of performance. It doesn't happen very often. When the – at around 4:00 a.m.

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for this night I turned off the heat pumps and turned on the electric baseboard heaters, and you can see an instant jump in demand. Basically the heaters, the electric heaters, required approximately four kilowatts of power to maintain the same household temperature. And as noted up in the top right there, basically if night setback was used, the baseboard heaters, if they all came on at once in the morning like most people have them set for, the power would jump to 20 kilowatts, which is actually off the scale of this chart. I do have a chart later on that shows it. If the mini-splits were all turned on maximum at once, they would only consume six kilowatts or 6,000 watts. The main difference is that will basically take a little bit longer to heat up your house with the mini-split heat pumps versus electrical baseboard heaters, but the mini-splits consume much less power. This is last night; similar kind of results. Mini-splits were consuming one kilowatt of power. I noted one defrost cycle there

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occurred at probably 2:30 in the morning. At around 3:15 I shut off the heat pumps, turned on the electric baseboard heaters and there was a jump as well. It went up to about 3.75 kilowatts, and at – just let me see what else I have. That's probably it for that slide. This was also done this morning. So this simulated - basically at the end of the test this morning, I went around the house and turned up every thermostat. So it was basically to simulate a morning warm-up. If everyone has their – the conventional wisdom is you turn back your thermostats at night. You can turn back your thermostats in the daytime when you're at work, and they automatically come on or you turn them on manually when you come home. The effect of that is shown here. So the demand basically of turning on all heaters at once causes them all to come on, and you start drawing the maximum capacity of those heaters which in this case is around 18,000 watts or 18 kilowatts. This is performance from the 8th. It was a

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colder night, probably blowing around 40 or 50. It kind a represented a good winter's night. This was the first test I did and I wish I kind of swapped the – did the mini-splits first versus the electric heaters. I would have had less up-and-down variations and things like that, but at first you can see the electric baseboard heaters were on and they were drawing about five kilowatts. I turned off the baseboard heaters at around 2:00 a.m. and turned on the heat pumps. Eventually I realized the heat pumps – I had to turn up the temperature on the heat pumps a little bit and basically they were warming up the house at this point in time because the house had cooled off actually with the just the baseboard heaters on, and the heat pumps were working a bit harder. So you can see how the curves go up, but they do start to settle down towards the end and it came down as low as – they were approaching – they were probably approaching two kilowatts towards 6:00 a.m. or 7:00 a.m. in the morning, but at this point in time, you

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know, 6:30, we're getting up. We've got to turn things back on just for the house to do its daily functions. So I had to end the test at that point in time. And the following is a summary of the results. So the first table there is to summarize. The red line, so we've got our three temperatures. I added wind speed, because basically the last – you know on the first, on the night of zero degrees it was windier than last night at minus three and the results were fairly similar. So the baseboard heaters were, say for the first night at zero degrees, drawing four. Well actually so the amount of heat required to heat the house because as electric heater is 100 percent efficient, the amount of heat coming out of the baseboard heaters is required to maintain the house at 22 Celsius, that's four kilowatts. The baseboard heater puts out four kilowatts to meet that four-kilowatt demand. The mini-splits heat pumps also puts out four kilowatts, but it only requires one kilowatt

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to do that, and that gives you a coefficient of performance which is a term used for these heat pumps of 4.0. Last night's test, fairly similar results. It worked out to a coefficient of performance of 3.5. The test at minus eight which again I'm not – I don't think things were fully settled out in terms of the loads on the heat pumps. I think they would have come down more, but based on these results I got a coefficient of performance of 2.5. And the peak demand for the various tests are shown as well. So there's – the mini-split heat pump demonstrated a savings in each case, roughly about 50 or 60 percent. So conclusions, I guess a mini-split heat pump can effectively heat an entire house if it's – and it should be I guess suitably sized for low temperature extremes. And some of the – at least with the units I have, the performance I'm seeing is you'll get two to one. Based on the data sheets anyways you'll get two to one at say minus 15 Celsius, so two times more efficient than electric baseboard

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heaters. Four to one at zero Celsius which is a more common average temperature here in Newfoundland or at least St. John's which over the year adds up to significant energy savings. At zero degrees Celsius we're seeing are seeing 75 percent lower energy use, 65 – 60 percent lower peak demand, and I guess the mini-split heat pump at least certainly for my house, the connected maximum demand of mini-split heat pumps is – always has to be lower than the equivalent for baseboard heaters. I have, you know, roughly 20 kilowatts of baseboard heaters installed; and the heat pumps, if you turn them all on at once, all at maximum, will only 6 kilowatts. Defrost cycles appear to have little or no effect on the efficiency of the units or household comfort, and night setback shouldn't be used with these units. It doesn't add to the efficiency or the comfort of your house. It actually makes them less efficient. And the rest is just backup material, so just information on the units I have. I have three of the same

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brand. Some data sheets, some performance curves. And this is the metering unit that I purchased. It's the company website. Very easy to buy and install. It comes with a local monitor you can lay on your desk. It comes with a box so you can connect it up to the internet basically. I could log on here and demonstrate how I can – I can't log on here with the computer or I can log on with my phone and basically meter my house right now and show trends over the last number hours, number of days. That was it.

CHAIRMAN:

Q. Anybody have any questions?

MR. DAVID ADAMS, CROSS-EXAMINATION BY THOMAS JOHNSON, Q.C.

JOHNSON, Q.C.:

Q. Yes, I have a few questions for Mr. Adams. Mr. Adams, the cost to install one of these units - you've done it recently.

MR. ADAMS:

A. Yes.

JOHNSON, Q.C.:

Q. What sort of cost are you looking at?

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MR. ADAMS:

A. The cost – I'll give you two costs. When I built my house in - I built it R2000. That cost about 2½ percent of the cost of the house in 2005. That was about 2.5 percent add-on. My mini-splits heat pumps which is added to the house over the last couple of years that was about a 3½ percent add-on the value of the house. It was around $15,000 to install those units and it works out to about a 3½ percent of the cost of the house to add those units.

JOHNSON, Q.C.:

Q. So the units themselves if – lots of people put them in like one by each.

MR. ADAMS:

A. Yeah.

JOHNSON, Q.C.:

Q. That type of thing.

MR. ADAMS:

A. Yeah.

JOHNSON, Q.C.:

Q. But what sort of cost, or do you know about the cost of those on that type of –

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MR. ADAMS:
A. I mean I've got – two personal examples I'm aware of, my in-laws have a smaller house in Petty Harbour. They had one unit installed down there, probably what everyone is more familiar with, one unit, one indoor head, heating a small house and their install cost was around $2,000.
JOHNSON, Q.C.:
Q. Right.
MR. ADAMS:
A. Two thousand or $2500. Mine, I've got bigger units, so the cost was in the four-to-five-thousand-dollar range per unit.
JOHNSON, Q.C.:
Q. Right. In terms – you've mentioned that yours, you reckon yours was sort of like a middle-of-the-road type of unit. So I guess are you aware of more efficient units out there than yours?
MR. ADAMS:
A. Yes, there are definitely more efficient ones out there than mine. Fujitsu, Mitsubishi I think, Daikin are probably some

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of the higher end units that are out there. Mine are – I think LG is common brand that's around.
JOHNSON, Q.C.:
Q. Yes.
MR. ADAMS:
A. Mine is probably in the same tier as LG, and there's lots of lower end ones that people should just stay away from.
JOHNSON, Q.C.:
Q. So in terms of the level of efficiency that yours has compared to the ones that are better on the market, what sort of difference would we be looking at?
MR. ADAMS:
A. I don't know if I can speak about that. Well, I do know they operate at much lower temperatures. They'll go down to minus 20, maybe even better now, maybe minus 25. I'm not quite sure how far down they go in terms of operating, whereas mine is rated for minus 15.
JOHNSON, Q.C.:
Q. Right.

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MR. ADAMS:
A. And they're more efficient, but I can't say for sure how much.
JOHNSON, Q.C.:
Q. Right, is – are you aware of much of a price difference between the minus 15 rated and the minus 20 or –
MR. ADAMS:
A. I'd just be guessing. Maybe it's 10 or 20 percent premium. I can't quite say for sure.
JOHNSON, Q.C.:
Q. All right, the – in the coldest nights that you've noticed them, I guess you go by normally you'd feel ambient air coming out of them, would that be normal, in their normal operation? It wouldn't feel warm to the touch, is that right?
MR. ADAMS:
A. No, it's – on a cold night it's always warm to the touch, absolutely.
JOHNSON, Q.C.:
Q. Warm to the touch.
MR. ADAMS:

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A. Yeah.
JOHNSON, Q.C.:
Q. Okay.
MR. ADAMS:
A. Yeah.
JOHNSON, Q.C.:
Q. And is there any like auxiliary that would have to cut in if it got too low?
MR. ADAMS:
A. No, no.
JOHNSON, Q.C.:
Q. No.
MR. ADAMS:
A. No.
JOHNSON, Q.C.:
Q. Okay.
MR. ADAMS:
A. Never.
JOHNSON, Q.C.:
Q. You mentioned the set-off.
MR. ADAMS:
A. Or the setback, maybe?
JOHNSON, Q.C.:
Q. The setback.

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MR. ADAMS:
A. Yeah.
JOHNSON, Q.C.:
Q. I'm sorry. Do they – do these machines give any suggestions as to whether the setback should be used with them or not used with them?
MR. ADAMS:
A. My in-laws have a different model and that comes with a feature for setback. You can set it back. I think it'll automatically setback by one or two degrees Celsius. Mine actually doesn't even come with that feature. Mine comes with like a timer, so I can turn it off for periods of the day if you wanted to. In terms of recommendations in the manual, I can't say I've read them.
JOHNSON, Q.C.:
Q. Yes.
MR. ADAMS:
A. Or that they're there. I mean there are features. The features are described as they are, you know. You can - they basically tell you that you can turn your

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unit off, on and off with a timer or you can turn it off at night by using these setback features if your unit has that feature available. It doesn't necessarily recommend that you do it.
JOHNSON, Q.C.:
Q. Right. So you don't bother to use to the setback at all?
MR. ADAMS:
A. No.
JOHNSON, Q.C.:
Q. You find it more efficient not to?
MR. ADAMS:
A. Correct, yeah.
JOHNSON, Q.C.:
Q. Okay.
MR. ADAMS:
A. Yeah.
(9:30 a.m.)
JOHNSON, Q.C.:
Q. All right. You also indicated in your presentation that you don't use quiet mode and you don't use the manual indoor fan speed control et cetera?

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MR. ADAMS:
A. Yeah.
JOHNSON, Q.C.:
Q. And why did you make that choice?
MR. ADAMS:
A. Because I'm – the machines basically work harder if – it's just properties of heating air and things like that. If a machine is trying to maintain a certain temperature with a – I guess a couple of properties of heating space with air is – one is volume of air and the other is the temperature of the air. So if you reduced the airflow by turning the machine down in speed, it has to try and increase the temperature that's coming out of the unit. And therefore the machine basically has to work harder to increase those temperatures.
JOHNSON, Q.C.:
Q. Okay.
MR. ADAMS:
A. So they're just not as efficient in those modes.
JOHNSON, Q.C.:

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Q. Yes. So when you were doing your testing, you turned off all other major appliances, did you?
MR. ADAMS:
A. Yes. So, just because it would show up on these graphs. You know a hot water tank, that's a three-kilowatt load. So if that was on, you'd see spikes throughout the night for the hot water tank, just trying to maintain its temperature. Fridges would be cutting in and out; deepfreeze would be cutting in and out, those types of things. So all those things were turned off for this test, for roughly a 12-hour period. So all you see in this graph is heat.
JOHNSON, Q.C.:
Q. Okay.
MR. ADAMS:
A. All the lights are off. I mean people are in bed. All the lights are off. The televisions are off.
JOHNSON, Q.C.:
Q. Okay, all right. Thank you very much, Mr. Adams.

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MR. ADAMS:
A. Yes.
JOHNSON, Q.C.:
Q. Those are the questions I have for you.
CHAIRMAN:
A. Anybody else have any?
UNKNOWN FEMALE SPEAKER: (21:13)
Q. Thank you, Mr. Adams.
MR. DAVID ADAMS, CROSS-EXAMINATION BY CHAIRMAN
CHAIRMAN:
Q. No, I've got a couple of questions. So this was a new house? When did you build your house?
MR. ADAMS:
A. 2010. Sorry, it's ten years old, so two thousand and – it'll be 11 years this year.
CHAIRMAN:
Q. And what did you have in it?
MR. ADAMS:
A. So 2005.
CHAIRMAN:
Q. What did you have in it originally? What did you start out with?
MR. ADAMS:

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A. The baseboard heaters that's shown in the – one of the – I don't know if the slides can come back up there.
CHAIRMAN:
Q. So you had baseboard heating?
MR. ADAMS:
A. Yeah.
CHAIRMAN:
Q. So if I was to build a new house, I've got a choice between baseboard heating, heat pumps or –
MR. ADAMS:
A. It's on your screen there, the baseboard heaters. They're –
CHAIRMAN:
Q. No, I want to talk about cost.
MR. ADAMS:
A. Yeah, yeah.
CHAIRMAN:
Q. So I've got – I'm building a new house. I've got – I can use baseboard heating?
MR. ADAMS:
A. Yeah.
CHAIRMAN:

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Q. I can use heat pumps?
MR. ADAMS:
A. Yeah.
CHAIRMAN:
Q. Or I can buy a conventional furnace, fuel furnace, you know?
MR. ADAMS:
A. Yeah.
CHAIRMAN:
Q. What's the difference in cost?
MR. ADAMS:
A. I'm not – I don't know if I can really speak to that that well to be honest. I mean my baseboard heaters were embedded in the cost of my house when it was built.
CHAIRMAN:
Q. No, I understand.
MR. ADAMS:
A. Yeah.
CHAIRMAN:
Q. I mean you retrofitted.
MR. ADAMS:
A. I retrofitted the – I can tell you what the heat pumps cost. It was in the range of

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$15,000. What the electric baseboard heaters cost me to install ten years ago, I couldn't tell you.
CHAIRMAN:
Q. Yes, and I – yes. And how much are you saving on your electricity bill?
MR. ADAMS:
A. To heat this house a year is costing me about $2700. So that's about $240 a month for a 4,000 square foot house.
CHAIRMAN:
Q. And what would it be if you used conventional baseboard heating?
MR. ADAMS:
A. Probably in the three thousand – well probably in the 350, 300 to 350 dollars a month. I'm probably saving in the range of $100 a month, somewhere in that –
CHAIRMAN:
Q. A hundred dollars a month?
MR. ADAMS:
A. Yeah. My house is not – in terms of savings, my house is probably not the best example because it was already R2000, if you

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understand what I mean.
CHAIRMAN:
Q. Yes.
MR. ADAMS:
A. Like it was already a very efficient house. It already had low heating costs.
CHAIRMAN:
Q. Yes.
MR. ADAMS:
A. Right?
CHAIRMAN:
Q. Oh okay.
MR. ADAMS:
A. Right, so -
CHAIRMAN:
Q. But that's – yes.
MR. ADAMS:
A. I'm saving – I have – my annual power consumption is around 20,000 kilowatt hours. My house compared to some other house, a small proportion of my – of that 20,000 kilowatts is heat for my house.
CHAIRMAN:
Q. Yes.

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MR. ADAMS:
A. Before I had the heat pumps put in, because it's already an R2000 house. It's heated better. Another example I have personal experience with is my in-laws' house in Petty Harbour. It's an older home. It's maybe seven or eight hundred square feet, and they're saving 25 percent off their annual bill. So they've seen significant savings.
CHAIRMAN:
Q. What's their capital cost though?
MR. ADAMS:
A. Theirs was about $2,000. They had it paid back in about four years.
CHAIRMAN:
Q. Okay.
MR. ADAMS:
A. And these people are on fixed incomes. Very pleased about it, tell all their friends about it.
CHAIRMAN:
Q. So I saw some heat – when I was going out the road the other day, they're advertising

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these mini-splits for around 1600 bucks. I mean are -
MR. ADAMS:
A. You'll see advertisements for these more and more around the city.
CHAIRMAN:
Q. Are they good at 1600 bucks a pop?
MR. ADAMS:
A. Maybe not.
CHAIRMAN:
Q. Yes, that's what I kind of figured.
MR. ADAMS:
A. Yeah.
CHAIRMAN:
Q. When things are too good to be true, they usually are.
MR. ADAMS:
A. These are an appliance. I compare these to an appliance.
CHAIRMAN:
Q. Yes.
MR. ADAMS:
A. Like a television. There's good TVs. You can buy your Sonys or you can buy your – you

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can go into Wal-Mart and buy some brand name you've never heard of before.
CHAIRMAN:
Q. Yes.
MR. ADAMS:
A. So with these units, you need to buy quality machines to get the performance, so they work at low, low temperatures, so they operate efficiently. And they need to be sized correctly for the house as well. They can't be undersized or they'll work harder.
CHAIRMAN:
Q. Yes, I guess the –
MR. ADAMS:
A. They'll work less efficiently.
CHAIRMAN:
Q. I guess the problem now is with the price of oil where it is, the major competitor to heat pumps is in fact oil.
MR. ADAMS:
A. Yeah, yeah.
CHAIRMAN:
Q. Yes.
MR. ADAMS:

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A. I'd suspect someone could heat their house cheaper with one of these. If someone had a furnace, they could probably heat their house cheaper with electricity with these units than they could with oil.

CHAIRMAN:

Q. How many square feet have you got?

MR. ADAMS:

A. Me? Four thousand.

CHAIRMAN:

Q. Wow, okay. Okay, thank you. Very interesting, and I think we're going to move to Mr. Henderson now, are we, sir?

KELLY, Q.C.:

Q. Yes, Mr. Chairman.

CHAIRMAN:

Q. Okay. Thank you, Mr. Adams. That was interesting.

MR. ADAMS:

A. Thank you.

CHAIRMAN:

Q. Good morning, sir.

MR. HENDERSON:

A. Good morning.

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CHAIRMAN:

Q. Are you swearing on the Bible, or are you –

MR. HENDERSON:

A. Oh I can swear on the Bible. I go to church occasionally you know.

CHAIRMAN:

Q. Good man. Highly recommended; good for the soul.

MR. HENDERSON:

A. The right? This way or this way?

CHAIRMAN:

Q. It's up to you. You can handle that.

MR. LORNE HENDERSON (SWORN) EXAMINATION-IN-CHIEF BY IAN KELLY, Q.C.

CHAIRMAN:

Q. Okay, sir. You are sworn. Mr. Kelly.

KELLY, Q.C.:

Q. Thank you, Mr. Chairman. Mr. Henderson, I understand you're the director of Revenue and Supply at Newfoundland Power?

MR. HENDERSON:

A. Yes, that's correct.

KELLY, Q.C.:

Q. Which section of the company's evidence will you address in your testimony this morning?

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MR. HENDERSON:

A. I'm appearing at this hearing to address the Consumer Advocate's questions regarding Newfoundland Power's Conservation Plan. In particular I will address questions regarding the company's programming associated with ductless mini-split heat pumps. For convenience, I'll refer to this as mini-splits. The Five-Year Conservation Plan is provided at Tab 1 in the Report Section of Volume 2 of the company's Pre-filed Evidence.

KELLY, Q.C.:

Q. Do you adopt the conservation evidence including the Conservation Plan as your testimony in this proceeding?

MR. HENDERSON:

A. Yes.

KELLY, Q.C.:

Q. Could you outline for the Board your role in developing the company's Five-Year Conservation Plan?

MR. HENDERSON:

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Q. As director of Revenue and Supply my responsibilities includes the economic evaluation methodologies used to assess the company's various conservation programs. I also assist our Conservation Planning staff in assessing the impact our conservation programs have on our customer energy and demand forecasts.

KELLY, Q.C.:

Q. How does Newfoundland Power evaluate potential conservation and demand management technologies and programs, Mr. Henderson?

MR. HENDERSON:

A. Our evaluation of customer conservation technologies and programs involves three main steps. The first is assessing potential conservation measures; the second is the development of preliminary design and cost estimates for specific conservation programs; and the third step is the economic evaluation of the programs.

KELLY, Q.C.:

Q. Okay. Let's look at each of those steps in turn then. How does Newfoundland Power

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assess potential conservation measures?
MR. HENDERSON:
A. The first step in the assessment of energy conservation measures is the completion of a conservation potential study. Newfoundland Power periodically engages energy conservation experts to conduct such studies on our behalf. The potential study identifies conservation measures and technologies that may be cost effective for Newfoundland Power and its customers. Among other things, a potential study evaluates the energy savings that might be achievable and provides preliminary market information that can be used in the development of the company's conservation programs. The economic evaluation of a conservation measure or technology involves the determination of cost per kilowatt hour of expected energy savings. This is known as a technologies cost of conserved energy or CCE. The CCE is then compared to the electrical system cost that would be avoided by using a more efficient technology.

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KELLY, Q.C.:
Q. How does Newfoundland Power develop the preliminary design and cost estimates for its conservation programs?
MR. HENDERSON:
A. We start with the potential study which identifies potential viable conservation measures and technologies. Then we conduct local market research to identify any barriers to customers' adoption of the conservation measure or technology in our service territory. The market research also determines the extent to which customers are already adopting the technology without encouragement from an incentive program. Our market research involves consultation with market stakeholders, trade allies and customers as well as discussions with other utilities. Once our market research is complete, we develop a program strategy to address market barriers. We also estimate program participation and the potential impact of the program on energy use and system peak demand. The preliminary cost

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estimate is based on the program design strategy and the expected participation. Consideration is also given to the cost of similar programs currently being undertaken in Newfoundland and conservation programs being offered in other Canadian jurisdictions.
KELLY, Q.C.:
Q. How do you evaluate the economics of a proposed program?
MR. HENDERSON:
A. The cost effectiveness of a conservation program is evaluated using a number of industry standard tests. Two cost benefit tests used by most utilities are the total resource cost test and the program administrator cost test. The settlement agreement reached in this GRA recommends that the total resource cost test and the program administrator cost test be used by Newfoundland Power to assess the economics of conservation programs. A program will only be considered for implementation when it passes both of these tests. This ensures

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the company's customer energy conservation program achieves cost effective energy savings consistent with the least cost provision of electric service. As technologies and markets evolve, the economics of a particular program can be re-evaluated.
KELLY, Q.C.:
Q. What has Newfoundland Power done to evaluate the mini-split heat pump technology?
MR. HENDERSON:
A. The conservation potential study completed in 2015 included an evaluation of the mini-split technology. Newfoundland Power has also completed its own detailed study of mini-splits in the Newfoundland context.
KELLY, Q.C.:
Q. What were the conclusions on the mini-split heat pump technology?
MR. HENDERSON:
A. The potential study estimated the current cost of conserved energy or CCE of mini-splits at about eight to ten cents per kilowatt hour. This represents a levelized

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cost per kilowatt hour of energy saved over the life of a mini-split. The mini-split CCE is roughly equivalent to current marginal cost of energy at Holyrood which is about ten cents. However, it is double the current estimates of four to five cents per kilowatt hour for marginal cost of energy following interconnection to the North American grid. So from a total cost perspective mini-splits will not be an economical viable conservation measure following interconnection.

KELLY, Q.C.:

Q. Can you please describe the evaluation of mini-split heat pumps recently completed by Newfoundland Power?

MR. HENDERSON:

A. Yes. The evaluation of mini-splits we completed in 2015 had three primary objectives. First, to assess the current mini-split market in Newfoundland; second, to evaluate the use of mini-splits as a heat source in our climate; and third, to understand the potential impact of mini-

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splits on the electricity system. The evaluation included a review of related research conducted by other North American utilities and government agencies. In addition we interviewed local suppliers and installers to learn more about the technology and the experience in the local market. The company conducted customer surveys to assess broader customer awareness and to understand the experience of customers who have already installed mini-split heat pumps. We have analyzed the electric bills of these customers to assess the changes in their electricity consumption. Finally we collected load data from homes heated with mini-split systems during the 2014-'15 winter season, and analyzed this data to better understand the energy use and peak demand impacts.

KELLY, Q.C.:

Q. Next could you briefly describe the mini-split technology?

MR. HENDERSON:

A. Sure. A ductless mini-split heat pump heats

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a building by exchanging heat from the outside air to the inside of a building. Mini-splits can also provide cooling by pumping heat out of the building. A mini-split can be very efficient in the right conditions. A baseboard heater requires one kilowatt hour of electrical energy to produce one kilowatt hour of heat. By comparison under certain circumstances a high-efficiency mini-split can require as little as one kilowatt hour of electric energy to move 4½ kilowatt hours of heat into a building. The superior performance of a mini-split compared to baseboard heating can provide a customer with significant energy savings.

KELLY, Q.C.:

Q. You indicated that mini-splits are very efficient in the right conditions. What are the limitations?

MR. HENDERSON:

A. Some of the limitations include, you know as was noted in the previous presentation, as outdoor temperatures drop, the heating

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efficiency of a mini-split declines, and so does the amount of heat it can move. At an outdoor temperature of minus 15 degrees Celsius, the amount of heat by one kilowatt hour of electricity is reduced to around three kilowatt hours compared to the four kilowatt hours previously mentioned. Outdoor temperatures also impact the heating capacity of a mini-split. For some heat pumps the heating capacities drop by upwards of 40 percent between plus 8.3 and minus 8.3 degrees Celsius. Given the reduced heating capacity of mini-splits at low temperatures, it is recommended that homes have a second heating system.

KELLY, Q.C.:

Q. What were your findings regarding the current market for mini-splits in Newfoundland?

MR. HENDERSON:

A. The information Newfoundland Power has been able to gather suggests that there's around 5,000 mini-split heat pumps installed in Newfoundland. About 1,000 units are being

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installed each year and that number appears to be growing. Information from suppliers and installers indicate the availability of mini-split installers in rural Newfoundland is very limited. There's a concentration of installers in the northeast Avalon. Surveys of homeowners generally indicate a low level of awareness of mini-splits. Customers who have mini-splits are generally satisfied with the product. However, some customers did report concerns. These concerns were generally related to issues with system installation and servicing and performance at low temperatures, and some customers report they were disappointed with the level of energy savings they experienced.

KELLY, Q.C.:

Q. What's the potential for the mini-split technology to reduce customers' energy consumption?

MR. HENDERSON:

A. Our research indicates that on average a customer who currently heats their home using baseboard electric heat can achieve savings in the order of 5,000 kilowatt hours

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per year from a mini-split installation. At a rate of 12 cents per kilowatt hour, including taxes, this represents a savings of about $600.00 per year for a residential customer. However, savings vary widely. The actual amount of savings will depend on the size and design of the home, where the mini-split is located in the home, how it is operated, and the efficiency of the mini-split itself. From an energy perspective, the 2015 potential study indicates that the aggregate energy savings achievable by 2019 could be as high as 256 gigawatt hours or about 4 percent of the total energy sold to Newfoundland Power's customers in 2015.

KELLY, Q.C.:

Q. Just explain what the potential is for mini-split technology to reduce system peak demand?

MR. HENDERSON:

A. From a system perspective, Newfoundland Power expects limited, if any, peak demand reductions as a result of the use of mini-splits. There are a number of reasons for this. Due to a low efficiency and capacity

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of a mini-split at cold temperatures, the second heating system, for example, electric baseboard heating, seems likely to be also required to operate when the weather is really cold. In additions, customers are expected to install mini-splits in locations that are not currently heated, such as garages and sheds. Customers who currently heat using oil and wood are also expected to install mini-splits to supplement their existing heating systems. The consultant who carried out the 2015 conservation potential assumed no peak demand reductions in Newfoundland as a result of customers use of mini-splits.

KELLY, Q.C.:

Q. Can you summarize the key factors determining Newfoundland Power's approach to mini-split technology as a conservation measure, please?

(9:45 a.m.)

MR. HENDERSON:

A. Sure. Three key factors impact Newfoundland Power's approach to mini-splits. First, the marginal cost is estimated at around four to

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five cents per kilowatt hour beyond 2019. The electricity savings associated with the mini-splits would not pass the total resource cost test. The second consideration is the current customer demand for mini-splits. At current electricity rates a customer who now heats their home with electric baseboards could be economically better off with a mini-split. Customers demand for mini-splits is already growing and will increase further with anticipated increases in customer electricity rates. The third factor is that the limited number of qualified installers available would be insufficient to support significant additional demand for mini-splits.

KELLY, Q.C.:

Q. What then is Newfoundland Power's approach to mini-split technology as a conservation measure?

MR. HENDERSON:

A. Mini-splits do not currently meet the requirement of utility economic testing. That means from a system perspective, the

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cost of mini-splits could not be recovered from the system savings. Nevertheless Newfoundland Power recognizes that customer demand for mini-splits will increase as customer rates increase. To support customer needs, the company's five year conservation plan includes a program to address customer education and installer capacity. We will also provide on bill financing for mini-split installation. Our program is similar to other utilities mini-split programs except it does not include any rebates.

KELLY, Q.C.:

Q. Please briefly describe the Newfoundland Power's mini-split program then?

MR. HENDERSON:

A. The program, which was actually rolled out in March, will provide information to customers on equipment selection, qualified installers, and best operational practices. This information will be made available on the Take Charge website. It will also be distributed via brochures, bill inserts, and online advertising. Information on mini-splits will also be included in the

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company's outreach activities at home shows, in store retailer events, and presentations to various customer groups. The information resources developed through the program will also be made available to suppliers and installers of mini-splits for use in dealing with their customers. The program also includes on bill financing for residential customers, and to be eligible for financing customers must install a high efficiency mini-split heat pump using a qualified installer.

KELLY, Q.C.:

Q. Is Newfoundland Power's work regarding mini-splits continuing?

MR. HENDERSON:

A. Yes. While the initial customer information was made available in March, the campaign will ramp up for the next winter heating season. The company's Take Charge staff continue to meet with mini-split retailers, distributors, and installers to ensure we remain current with the technology and with developments in the local market. We are also working to raise awareness among

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suppliers and installers and to obtain their support in providing consistent information to customers. Newfoundland Power is also participating in a working group with other Atlantic Canadian utilities and Provincial Governments. This group was set up in 2015 to share information on mini-splits. The working group will also be reviewing equipment standards for cold climate operation and reviewing standards for the certification of installers.

KELLY, Q.C.:

Q. Does that conclude your testimony?

MR. HENDERSON:

A. Yes, it does.

KELLY, Q.C.:

Q. Thank you, Mr. Chairman.

CHAIRMAN:

Q. Mr. Johnson, sir.

MR. LORNE HENDERSON – CROSS-EXAMINATION BY JOHNSON, Q.C.:

Q. Thank you. Good morning again, Mr. Henderson.

MR. HENDERSON;

A. Good morning.

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JOHNSON, Q.C.:

Q. Just to start out with that five year conservation plan which is at Volume II of the materials for a second, and just go to page 1 of that, if you could. In the third paragraph on this page in the Executive Summary, it indicates that, "The 2016 plan represents both growth and evolution of the utility's joint customer energy conservation program portfolio includes new behavioural based program for the residential sector expansion of existing programs, commercial programs, and the reshaping or discontinuation of several programs. The approach outlined in this plan will remain flexible to address the changing provincial landscape in terms of customer expectations, market conditions, energy efficient products, and electrical system costs", and could you – how will changes be made to the program as things progress and, for instance, you know, we look at the world post-interconnection and that sort of thing?

MR. HENDERSON:

A. Basically, the plan itself was based on the

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conservation program and our evaluation, which included the then current forecast of the transition between Holyrood being on the marginal cost to using market-based marginal costs going forward. Hydro, a month or so ago, provided another marginal cost estimate post-Muskrat. The numbers were fairly similar to the previous one, so it didn't give us pause to have to go out and completely review our programs immediately. However, we still need to go through that process to ensure that everything looks okay. Part of the information flow between us and Hydro right now includes the potential projection of those marginal costs going into the future, and that affects obviously how things will look over the next 15/20 years for these programs. So we'll be moving forward with doing a level of re-evaluation once we fully understand all the matters related to marginal costs during the forecast.

JOHNSON, Q.C.:

Q. So in terms of looking at the mini-split study that Newfoundland Power has done, and

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perhaps, I guess, first of all maybe we could just go to the 2013 Conservation Demand Management Report that was filed with the Board, and I sent that over as Cross Aid 2 a little while back. It's Cross Aid 2 on the March 29th letter.

MS. GLYNN:

Q. We'll enter that as Information #35.

JOHNSON, Q.C.:

Q. Thank you. Samantha, it's Item 2 on my letter of March 29th.

MS. GLYNN:

Q. As a housekeeping, while we're waiting for that to come up, we didn't enter the presentation just given by Mr. Adams, so we'll enter that as Exhibit DA 3, and I think we have the report there now, Mr. Johnson.

JOHNSON, Q.C.:

Q. Thank you. So at the time of the filing of this report on March 31st, 2014, if we could go to page 11 of that document, I take it this is where the company was providing a bit of an update as to the company's ductless mini-split heat pump research that

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followed out of the Board's Order in Newfoundland Power's last GRA, is that right?

MR. HENDERSON:

Q. That's correct.

JOHNSON, Q.C.:

Q. And at that particular point in time, the mini-split heat pump study had not been done, but it was going to be done, is that right?

MR. HENDERSON:

A. That's right.

JOHNSON, Q.C.:

Q. Okay, and then if we go over to page 12 at the top, it's indicated that, "Based on the final phase of the study which will be completed in 2015, Newfoundland Power will make determinations regarding the potential for the mini-splits to impact the electrical system".

MR. HENDERSON:

A. That's right.

JOHNSON, Q.C.:

Q. Okay. Now in terms of going back to the five year plan for a moment that we just

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looked at, if we could go to page 15 of that, the first full paragraph on that page where you're indicating, "Newfoundland Power completed research on ductless mini-split heat pumps from 2013 to 2015. The objectives of this research were to assess the current MSHP market in Newfoundland, use of the MSHP as a supplementary heat source, and the potential of MSHPs on the electricity system. The results indicate that MSHP are more efficient and do save energy compared to electric baseboard heat. This analysis also shows there's not likely to be peak demand reduction on the electricity system from installation of MSHPs", and I take it, Mr. Henderson, that this finding in particular that there's no likely to be peak demand reduction, that's based on Newfoundland Power's internal mini-split heat report that you referenced in your discussion with Mr. Kelly, is that right?

MR. HENDERSON:

A. Yes.

JOHNSON, Q.C.:

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Q. So in terms of that report, if we could just ask a couple of questions about that, who authored the report, who was responsible for putting that report together?
MR. HENDERSON:
A. Our Take Charge staff.
JOHNSON, Q.C.:
Q. Was the report done by an engineer?
MR. HENDERSON:
A. There were a couple of engineers involved in the project, yes.
JOHNSON, Q.C.:
Q. I notice the report is not signed off on by an engineer. Normally, I see reports from you guys – I shouldn't say you guys, Newfoundland Power, Hydro, in matters such as this that they would actually be signed off by a professional engineer. That would be normal practice?
MR. HENDERSON:
A. That is certainly normal practice for a submission to the capital budget program. It's not necessarily always done for every report, but I regard that as being probably an oversight somewhat on our behalf just

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because, you know, it came out in this form.
JOHNSON, Q.C.:
Q. Okay. So this report, when did it get finalized?
MR. HENDERSON:
A. Largely, it got finalized in October/November, and I know the report itself, I would call it more than anything, got tweaked for some presentation issues prior to the submission here.
JOHNSON, Q.C.:
Q. Prior to it being filed here?
MR. HENDERSON:
A. Yeah.
JOHNSON, Q.C.;
Q. Okay, and so does Newfoundland Power regard this report as sort of the authoritative piece of work that it has to say that these mini-split heat pumps are not going to be valuable from a system peak point of view?
MR. HENDERSON:
A. No. You know, these devices are always changing and improving with time. The study results that we had showed that they're very comparable and, you know, one of the issue

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with the mini-split technologies when I started looking under the hood for this particular presentation and appearing here, I talked to the engineers about some of the issues that are going on with capacity, and one of them is that the standard testing for these products are at 8 degrees and –8 degrees Celsius. So the performance below –8 degrees Celsius is not part of the standard testing regime for these things. As David Adams mentioned, and we've seen it also, is some manufacturers are producing numbers below that down to –15. We're not sure the extent to which they are extrapolations which are allowed under the CSA standard, or whether they are actual testing results, and it's actually part of the conversations going on with the Atlantic utility group is reviewing the standards and possibly seeing if we can get out there with a standard that will look at much colder temperatures, -20, you know, and those types of things because peaks in this part of the world often happen at those types of temperatures; in St. John's, a little less

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so; in western Newfoundland, much more so. So we've got to understand that dynamic when we look at the overall impact. The other thing weighing on us, as I mentioned in my presentation, is the fact that these things are being installed in places that are not ordinarily or often not ordinarily heated, like garages. I think Mr. Adams, he has heaters in his garage. I got mine turned down quite low in my garage. So that's new heat. Similarly, with oil customers in most jurisdictions in North American, these things are being promoted to their existing heating base which is more often than not oil, possibly natural gas. I'd say New Brunswick might be more like us, but in Nova Scotia, you know, they're mostly coming off oil and going into these things. So it's actually – from a utility perspective, it might even have a load building effect. For those reasons, you know, taking mini-splits as a whole going into our marketplace, we don't expect to attribute any demand savings to that technology coming into our marketplace.

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JOHNSON, Q.C.:
Q. In part, based upon the fact that people who are not now on the electricity system for heating load could -
MR. HENDERSON:
A. That's part of it, and also the other part is the uncertainty associated with the real low temperatures because that type of information is not so readily available, and there's more work that needs to be done in that area. We know that Nova Scotia Power is now trying to deal with a peak demand issue and has a study ongoing in which they installed metering in January to hopefully get a – so they can get a better understanding of what impact it may have on their peak. Now in Nova Scotia, because there's much fewer amount of baseboard heating, I'm not quite sure how applicable that would be for our jurisdiction, but there may be something that will come out of that that will enhance our understanding in that area.
(10:00 a.m.)
JOHNSON, Q.C.:

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Q. And I'll turn to the Nova Scotia and New Brunswick in a few moments time, but I just want to go back first of all to the five year conservation plan that was done, and that was sent over as a cross aid. That would be Item 1 on that March 29th piece of correspondence.
MS. GLYNN:
Q. That will be Information #36.
JOHNSON, Q.C.:
Q. If you could turn up page 90, and for the record, this is the Newfoundland and Labrador Conservation Demand Management Potential Study, the residential one dated June, 2015, by ICF International, and at Section 8.6, if you go down, and this is under the category or under the heading, "(unintelligible - coughing) for Energy Efficiency". I just want to raise up with you, Mr. Henderson, the fact that ICF indicates in that – starting from the top, "Exhibit 49 presents a summary of the peak load reductions that would occur as a result of the electric energy savings contained in the economic potential forecast. The

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reductions are shown by milestone, year, and region. In each case, the reductions are an average value over the peak period and are defined relative to the reference case presented previously in Sections 4 and 6. Exhibit 50 shows the same information graphically for the winter period". Then they go on to say, "Exhibit 49 and Exhibit 50 only approximate the potential demand impacts associated with the energy efficiency measures because they are based on the assumption that the measures do not change the load shape of the end uses they affect. This is not always correct. For example, most of the heat pump measures are assumed not to produce any peak demand savings because during the winter peak period the heat pumps and mini-splits are expected to revert to backup electric resistance heating", and then they provide a footnote, which we'll get to. "Therefore, there would be no net reduction in space heating peak demand for these measures. Accordingly, demand reductions for the heat pump measures have been manually filtered

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out of the results presented in these exhibits", and then if we go down to the footnote, Footnote 29, they're speaking there in terms of that assumption about they're not producing any demand savings. They say, "In fact, this is a conservative assumption for the Island Interconnected region. Although the peak demand occurs on the coldest winter days in a climate such as that of St. John's, the temperature is typically not very extreme on those peak days. Therefore, many heat pumps will continue to work in heat pump mode and not revert to electric resistance. In this study, we have retained a conservative assumption that they do not provide demand relief". I guess, it seems to me in reading the report that ICT obviously are calling that a conservative assumption that is being made about demand reduction, and I'm just wondering what discussions went on with ICF for them to decide to manually filter out the reductions for heat pump measures? Can you fill us in some colour on what happened there?

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MR. HENDERSON:

A. I'll apologize first, my answer might be a little bit technical. Where they say "no change in the load shape for the end use" means that, let's say – I'm going to try to keep the numbers simple. The electric heat, the peak load factor let's assume it's 50 percent, so it means that your average load is half of what the peak load is, okay. When you get to your annual use, that's the load shape effectively. For mini-splits, we know that, let's say, the electric heat portion is going to drop by a third, a COP or efficiency of three times, okay. So the energy drops to one-third of the value, right, but we know at very cold temperatures that the impact on peak is much less. Let's say, if they're operating through peak and the house is designed such that no areas of the house do you have to turn on baseboard heating, assuming that, then at –15, I think the COP numbers might be around two times, your peak only drops by a half. So your peak is dropping by a half, and your base is dropping by a much larger amount, so load

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shape changes. When they say that the model is fairly simple because it's using the average load shape for the average use going forward, means that if you didn't do anything, that's the effect that the program that they're using would have. You would basically overestimate the peak savings, given if these things even operated right through peak. So they have to go in there and manually adjust that. The experience with many types of heat pumps is that they have resistant heat backup built into it, so when they reach, you know, cold temperatures and they're no longer able to heat the full house, the baseboard heating kicks in. I had a look at the data from the sample that we had, and it was very clear that a certain portion of the customers where clearly the backup heating was kicking in because you could see that the load is going along and all of a sudden for a few intervals it went up and then it came back down again. So it's very clear that the people were getting uncomfortable in their homes and they were turning on presumably their electric heat in

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some form in that house. So the backup heat will kick in, or people will use it once the house obviously gets cold, and they're part of the concerns associated with it. What they're talking about here, there's no question in St. John's, as I mentioned earlier, the coldest temperatures in St. John's tends to be less than it is on the west coast of Newfoundland. We recognize the majority of the loads in St. John's rather than others, so, yes, heat pumps can be designed to go through. I agree with the assumption that – I shouldn't say the assumption, but the assessment that they have that assuming for switching from baseboard heating to electric in St. John's, it's certainly potential that you could design your system, if you designed it specifically to meet the coldest temperatures, yes, you could probably get a heat pump system to go in there and do it. You're going to need a lot of systems in your house to heat all the areas of your house, and I'm not sure if it's the most economical way to do it because you've got

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to get the right mix of savings and number of heat pumps, but, you know, it makes sense to me that assuming there's none is probably a conservative assumption. The extent to which that's the case, I'm really not sure.

JOHNSON, Q.C.:

Q. That statement that they make that, "Many heat pumps will continue to work in heat pump mode and not revert to electric resistance", is that something that Newfoundland Power agrees with, that assessment?

MR. HENDERSON:

A. For some heat pumps in St. John's, depending on the design of them, yes, I would agree with that. Obviously, I believe Dave Adams indicated that he hasn't had to resort to his baseboard heating, and I don't know if he's ever been uncomfortable during the winter peaks we've had, but, you know, obviously he didn't turn it on.

JOHNSON, Q.C.:

Q. In terms of the type of heat pumps that are more likely to continue to work in heat pump mode and not revert to electric resistance,

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has Newfoundland Power looked at which types would be more likely to fit into that category?

MR. HENDERSON:

A. We know the ones that are more high efficient, you know, like he was mentioning the Daicon units and some other units that are quite good in cold temperatures. What we don't know is how they operate in extreme load conditions, right. We do know in the sample we had, some people were reverting back to baseboard heating. So we do know that the extent to which there's any, if any savings overall, it's going to be very limited. From a system planning perspective, we know these, like I mentioned before, are going to go into all kinds of places because they're a very effective heating source. As a result, you know, it's not something I would want to count on that that's going to reduce our demand. We took a hard look. You know, when we saw the results for these, I was really surprised it didn't pass because there's discounts being operated in other jurisdictions, so what

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makes us different, you know, that sort of stuff. You know, our assessment of running a program had a total resource cost test of around .5, which is really measurable. Really what part of that is that on top of this 9 cents per kilowatt, 8 to 10 cents, or whatever for CC, we have to load on the cost of actually doing the program. So the cost actually becomes a little bit higher. It came out at .5. We went in there and we tested it and said, okay, if we stick in – assume they have a load factor equivalent to baseboard heating, which we know they don't, which is a real conservative estimate, there's no way could we get it to pass. So as a result, testing these types of things suggested that we can't make it economic for Newfoundland Power to invest in because of the minimum investment that we have, but we also recognize that given the retail pricing, yeah, they're probably economical. If you do a real well designed unit, it's probably economical for most everybody in this room to stick one in if they design it well for their retail rate. The problem is

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we won't save enough money to offset those – the cost you're sticking in, we're not going to experience enough savings to cover off those costs, so on average everybody is kind of potentially worse off once Muskrat Falls comes in, because once it's in there, we have lots of energy capacity coming into the system and it's really only valued at what we can sell it for, for the most part.

(10:15 a.m.)

JOHNSON, Q.C.:

Q. In terms of the Nova Scotia experience, and then we'll turn to New Brunswick, if we could just go to my letter of April 11th, which is yesterday, the efficiency Nova Scotia material, Mr. Henderson, if you could just take a look at that.

MS. GLYNN:

Q. And that would be Information #37.

JOHNSON, Q.C.:

Q. Thank you. If you go to the first page there, they're indicating, "Please note rebates for heat pumps are not retroactive. Heat pumps purchased and/or installed prior to October 1st are not eligible for rebates

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or financing", and then if you flip the page, they go over to what their rebate amounts are. They offer fairly small rebate for the ductless mini-split heat pump of $300.00, certainly small relative to some of the other incentives they use, all the way up to $1,900.00 for a geothermal heat pump. If you look at overall program eligibility, the home's heating system must be set up to provide all or a majority of the home's heating by electricity. So they would target that to electricity heated homes, and is there any present – I know you're working with Nova Scotia Power, at least interacting with them. Have they indicated to this point whether they view these items as having an impact on their winter peak?

MR. HENDERSON;

A. There's uncertainty. That's the reason why they're doing the testing. Well, this is Efficiency Nova Scotia. I stand to be corrected. It may be Nova Scotia Power that's doing the study. I'm not sure if it's Efficiency Nova Scotia. There's two entities doing programming there. The

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utility is offering, I think, financing, while the Efficiency Nova Scotia is offering rebates.

JOHNSON, Q.C.:

Q. So what's the status of the Nova Scotia study?

MR. HENDERSON:

A. They installed meters in January. I'm not certain when they expect to get results, whether it will be later this year, or whether they're planning two winter seasons of data collection.

JOHNSON, Q.C.:

Q. And that study is targeted at finding out if there's peak demand reductions of these mini-splits?

MR. HENDERSON:

A. Yes. The thing that I'm not sure is the targeted – from conversations I had with some of our staff recently, they weren't quite sure whether it was targeting – it should be targeting, given that's what their eligibility requirements are, but for the whole market from a system perspective, you really got to know what the impact of these

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things are on the broad market because in Nova Scotia, these things are going in primarily for oil heat customers and that sort of stuff.

JOHNSON, Q.C.:

Q. Yes, they're not giving rebates to just everybody. They're giving rebates only to those who heat their home primarily or a majority by electricity, I take it there?

MR HENDERSON:

A. Right, so obviously that's their targeted group.

JOHNSON, Q.C.:

Q. If we could, Mr. Henderson, just have a look at the New Brunswick model for a second. That's Item 4 on my March 29th letter that I sent over.

MS. GLYNN:

A. And that would be Information #38.

JOHNSON, Q.C.:

Q. Thank you. The first document is, "NB Power launches Smart Habits Ductless Heat Pump Rebate". I guess, this is October, 2015, where they're announcing that there's going to be a $500.00 rebate on high efficiency

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cold climate ductless heat pumps, amongst other items, and I see on the next page – if you flip over to the overview section, New Brunswick Power is saying installing a high efficiency cold climate heat pump is a smart habit to get into and NP Power is ready to help beginning October 1st, 2015. This is 4B in the letter, but it's all there on the screen, that's fine.

MS. GLYNN:

Q. Okay, but we've only entered 4A as 38.

JOHNSON, Q.C.:

Q. Okay, I'm sorry, so maybe we should just enter in 4B as well.

MS. GLYNN:

Q. And that would be Information No. 39.

JOHNSON, Q.C.:

Q. Thank you very much. So they're talking about a $500.00 rebate on Energy Star certified CEE Tier III rate, a cold climate -20 and lower. Ductless mini-split heat pumps purchased through one of our participating heating contractors and they make the note, the next paragraphs, "Heat pumps are increasing in popularity as a

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supplementary heating system. For many NB households they can supply heat using much less energy than electric baseboards or other common heating systems. Offer significant savings on hearing cost, also provide the benefit of air-conditioning." Then they go on to say, "But not all heat pumps are the same. The goal of this program is to encourage homeowners to install heat pumps which are best suited to New Brunswick's climate and our winter peaking electricity system." And I guess when I read that, I took it to mean that they had already determined that—and I understand New Brunswick is a peaking winter system like we are, that they have already made the determination that these things are worth the candle from the point of view of demand savings, is that your understanding?

MR. HENDERSON:

A. They are also a member of this group and I understand they are also interested in peak demand savings, but you know, there's no question the Tier III heat pumps, which are the ones that we're promoting also, you

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know, the published data is that they should be able to give you some savings down to minus 20 degrees Celsius, right? The justification for heat pumps or being provided a discount in all these areas or all these utilities, we understand in those jurisdictions they're passing total resource cost tests, so obviously their marginal cost is calculated for their region is going to be—it's higher than what we're expecting it to be. So that's a big part of the difference with regard to offering discounts. With regard to peak, I'm not sure if peak is the reason why they're being able to justify it, but there's no question that at cold temperatures, some heat pumps do have the potential capability of doing it; however, the certainty and how much we can count on is something that's part of the issue with regard to, you know, standards testing and that type of stuff, to ensure that below certain temperatures how are they going to perform, and you know, that is somewhat still an outstanding issue.

JOHNSON, Q.C.:

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Q. New Brunswick probably would be colder, I've lived there and I can tell you it was much colder in the wintertime than what you typically experience, certainly here on the Avalon and would certainly rival Central from my experience. So you don't know whether or not they have definitively found that there's a peak savings.

MR. HENDERSON:

A. For their overall system impact, I don't know.

JOHNSON, Q.C.:

Q. And they're part of this group that's assembled?

MR. HENDERSON:

A. Yes, hopefully through the group we'll get a better sense of that.

JOHNSON, Q.C.:

Q. Who is on that group?

MR. HENDERSON:

A. Subject to test, I believe Krista Langthorne is on it, she's in the back of the room.

JOHNSON, Q.C.:

Q. I meant by company.

MR. HENDERSON:

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A. Oh, sorry. Do I have a list? I don't think I have a list, but I know New Brunswick Power, Maritime Electric, Nova Scotia Power Inc., Efficiency Nova Scotia, the Department of Natural Resources here, and the appropriate provincial government departments from each of the provincial governments from all the regions, and the group which just met once so far, had presentations done at the time from the Federal government department responsible for, you know, the equipment standards and that type of stuff.

JOHNSON, Q.C.:

Q. And so the heat pump that they are looking at incenting, that's a similar type to the one that Newfoundland Power is prepared to finance, is that right?

MR. HENDERSON:

A. Yes, and we would be promoting it through our information and items and discussions with our suppliers and all that sort of stuff. Our program, we'll be trying to get them to all promote that unit because that's the best unit to maximize the saving.

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JOHNSON, Q.C.:

Q. So the financing that Newfoundland Power provides, that's going to be applicable to people who presently have oil heat as well?

MR. HENDERSON:

A. That would be applicable to anyone, yes.

JOHNSON, Q.C.:

Q. Okay. In terms of that mini-split study, as you know, Mr. Winston Adams has asked that I convey a number of questions to Newfoundland Power pertaining to that study and I'm happy to do that and have done it, and perhaps what I'd like for you to do first, just so, because the study has been sent over by way of a cross aid, maybe it would be helpful to get the cross aid up, that mini-split heat pump research report of November 12, 2015. If we could do that, Mr. Henderson?

MS. GLYNN:

Q. And that will be entered as Information No. 40.

JOHNSON, Q.C.:

Q. Thank you.

MS. GLYNN:

Q. No. 3 from the March 29th correspondence.

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JOHNSON, Q.C.:
Q. That's right. And I guess Mr. Henderson, it might be helpful if you could sort of outline the methodology that was used here for making the conclusion that this unit would not have offered demand savings?
(10:30 a.m.)
MR. HENDERSON:
A. The methodology was very much based on, first of all trying to get a sample of customers and that was a little bit of a challenge in and of itself. We had around 128 customers that responded to our customer survey as being those who had units installed themselves and we got some pretty good data on how they operate those units and that type of stuff, and they're the ones we've benchmarked in order to determine this 5,000 kilowatt hours, which is largely consistent with industry norms on what to expect.
With regard to the peak one, we went out and we were very hopeful that we could possibly do some type of experimenting which we would have the customers use their heat pump some

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evenings and not use it for other evenings, similar to what David Adams did, but just on a more gross home basis, but we found that people weren't willing to participate if they had to do that type of testing, so we were left with having monitors, monitoring the poled home, interval meters gather data every fifteen minutes and we had these 18 homes and we use them to get the best sense of how their load shape would be during the winter and get what information we glean out of it. What we also had in place during the same winter season was interval data being collected on a program, our direct hot water control program, so as a result we had a benchmark group and we had this mini-split group that would allow some level of comparison between the two of them. And basically that's what we did, we compared those. We went in and we looked at the data to see how the load shapes would vary, you know. Since coming on the stand, I looked under the hood of it, you know, I recognize in hindsight that there might be some flaws in regard to the interpretation of it. As a

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result, I think the assumption where we stated this can be expected to contribute to a higher overall peak for those putting in mini-splits into baseboard heating, I think is overstating what might happen. But it's clear in the data that we have, which is on people who have them existing, is that some customers were certainly switching over to electric backup during periods during the winter, so we were seeing some of these spikey kind of peaks and, you know, the overall comparison for this group, as you can see, suggests that the average for those homes are very comparable.
JOHNSON, Q.C.:
Q. Do you want to refer us to where you are in that regard, Mr. Henderson, we can bring it up on the screen, if you wish?
MR. HENDERSON:
A. Yeah, we can turn to let's say load profile that's on page 32 and the colours don't show up on this copy but the line that is generally lower is the mini-split heat pump line and the one that's generally higher, that's the best way to say it, is the

Page 84

electric sample and some of the spiking is especially during that morning period. I had a look at to what's kind of causing some of the spikiness in the mini-split heat pump. Part of it is the fact that it's a very small sample, so as a result you're going to get a much more noisier load shape and part of it was that, you know, I noted a couple of times during the day some of the customers were certainly switching to the electric heat backup, so it was causing some more of the spikey stuff. I think probably the one that was at 7:00 may have been, you know, a couple of customers went to their electric baseboard heating backup and clearly turned it on, so it suggests to me that they were probably, and we know some customers are doing it, they're turning off all the breakers for their heat and when it gets really cold, they turn them back on in order to heat the place up, then you see a little bit of a spike at that point in time.
JOHNSON, Q.C.:
Q. So you indicated that you approached customers in terms of participation in a

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study that had certain requirements of them but they weren't willing takers of what you're suggesting, what sort of—what would you actually have liked to have been able to observe, as opposed to what you got?

MR. HENDERSON:

A. I guess ideally you'd love to be in there—as an engineer, had all the money in the world, I'd love to be able to do what Dave Adams did for every single home through the coldest winter period and hope that you get a severe peak this winter, it's about one in every five years we seem to be getting the severe weather peak where the combination is such that a peak is quite a bit higher than what it otherwise would be and that's what we got to size the system for, so as a result, you know, ideally I'd love to be able to do what David did, collect that kind of data, probably collect even the data that Winston Baker put in his questions, which is a huge amount of data on the operation of each one. As an engineer, I'd love to have that data and I'd love to have it operating through these really cold periods that

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happen, you know, every once every few years, but those types of studies can be expensive, you may have to wait for that time period, you know, and maybe you'll get the results out of it. Generally speaking, knowing these things are being installed in so many jurisdictions, we are primarily focussed on getting data that's available from industry, you know, knowing that this stuff does not pass the total resource cost test. We think it wouldn't necessarily be looked upon too highly if we're not doing what's least cost for our customers and as a result, we will deem it our spending, I think our budget for this is one hundred thousand bucks. We'll do our best to get all this information out for one hundred thousand dollars to everything. Our program doesn't include television advertising because that stuff is starting to get expensive and we want to show clear results from it, so we'll do what we can to help move the market towards where we need to go. Obviously this is a very important end use, electric heat is a big end use for us and

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making sure we're doing the right thing by customers is what I think the Public Utilities Board would expect, so we will continue to monitor it and do what we can to make sure the right things go and get installed, but to offer heat pumps—you know, discounts and all that sort of stuff is, might be a little bit too far to go, especially since it's not passing these tests.

JOHNSON, Q.C.:

Q. What sort of peak type of benefits, you know, what order of magnitude or peak benefits, you know, relative to if someone is now heating with electricity baseboard to go into one of these, would you have to see, do you think, in order to say, yes, that's worth incenting these from a demand perspective?

MR. HENDERSON:

A. From our numbers we couldn't get it to pass the total resource cost test, throwing in peak savings that were equivalent to the load shape for electric heat; in other words, if we could get efficiency gains at

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peak the same as the efficiency gains you're getting on average for heat pumps, we kind of tried those types of numbers to see if that would make it pass and it didn't. Maybe once we get out into the future and we find out that the marginal cost, the market base cost or the amount of value that we would get from savings increases enough to justify putting rebates on it, you know, we'll probably consider it. The only thing I caveat that with is that if the market is doing well anyway, I don't think we need to be wasting money on it because the market is doing well and these things are coming in. If the market needs a push and the market barrier suggests that the cost of the unit is a barrier, then yes, we would consider it, so you've got to, you know, look at all those things. The other piece we mentioned was installers. We don't want to be out there saying, bang, bang, everybody should install these, they're absolutely fantastic and it would save us money, reduce your bills and all that kind of stuff and they get frustrated because they can't find

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anybody to install them or anybody to service them, which is a big issue for whole home heat pumps right now, you know, it's—all those considerations got to get into place before we do that.

JOHNSON, Q.C.:

Q. In terms of some of the questions that Mr. Adams, I think you indicated Winston Baker, but I think it's Winston Adams, obviously, just for the record.

MR. HENDERSON:

A. Do that all the time, I apologize for that.

JOHNSON, Q.C.:

Q. His ears are burning. He had a question as to whether or not the homes that were assessed out of your consumer group, if there was any assessment in terms of whether the mini-splits that they were using were good, bad, middle of the road units or just, my understanding is that there was no assessment of the type of unit that they had, what type of efficiencies, et cetera they were expected to have at the manufacturer, would that be –

MR. HENDERSON:

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A. No, that's right, we captured the manufacturer, the model, I guess, but we didn't capture the details associated with it. The manufacturers themselves certainly give you an inkling of the quality of the units that are being installed and there's no question there's certainly a fairly wide range of quality going in there and hence, we want to move the market to the Tier III heat pumps, you know, and our study did not try to attempt, and I doubt if we'd get particularly strong results to see the extent to which the manufacturer type might be correlated with savings. We didn't do that.

JOHNSON, Q.C.:

Q. Or capacity type, you know, some of the good, better and the best—good, better, best type of approach, you know, minus 15 versus minus 20, so that we don't really have any insights into what they were using in that regard, I guess.

MR. HENDERSON:

A. No.

JOHNSON, Q.C.:

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Q. And I guess he was interested as well as to, and I take it the answer is probably no, but was there any assessment as to the appropriate sizing of the heat pump in regard to each house? I take it, there wasn't?

MR. HENDERSON:

A. No, the study that we are trying to do was having a look at what the impact might be given the existing market conditions. It would contain a full range of operating issues, you know, that sort of stuff, you know, with customers. We know that there's customers out there using them totally inappropriately, poor coordination with regard to the thermostats, you know, we know that certain products and people are having problems with defrost cycles and those types of things, so in your buying of your heat pump, you should make inquiries about the defrost and making sure it defrosts properly because these things can get stuck in a defrost mode and just continuously chuck away trying to get the ice off the machine and having no luck with it.

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JOHNSON, Q.C.:

Q. So I guess similarly there was no data as to whether they had them in set-back modes or if they were using them properly or anything like that, I take it?

MR. HENDERSON:

A. Yeah, in our survey of the 128, the customer survey, we did collect a certain type of behavioural data. For instance, the set-back mode, I think I might have already mentioned it, I'm not sure, 55 percent of the customers or the people we surveyed never used the set-back mode. I would say on average there's a general understanding you shouldn't.

JOHNSON, Q.C.:

Q. You shouldn't, just leave it there.

MR. HENDERSON:

A. You shouldn't right. A lot of the changes were very small, it's like one or two degrees, while there's other people that were clearly shutting them off overnight, things like that.

JOHNSON, Q.C.:

Q. In the report in terms of the energy

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savings, some people had low energy savings; some people had exceptionally high energy savings. I take it that there wasn't any assessment as to what would have caused each, you know, who did well and who didn't?

MR. HENDERSON:

A. That's right, the extent to which the surveys capture data from the customers that could explain it, it will be explained, right. As noted in the report, we took the assessment and we said anyone who got somewhere between +7 percent and maybe -7 percent, we're going to say they're breaking even with this thing, right. Those above 7 percent, we're going to say they're really saving from it and vice versa for the other group. I think it was fifty-odd percent or more were getting savings. Most of the people who, their bills were going up, were people who were heating—was new heating loads to Newfoundland Power, you know, to electricity. Most of them were coming off oil and that type of stuff, right, and the ones in between, our explanation is, you know, the data wasn't strong as to how to

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relate those to any of the data they provided to us.

JOHNSON, Q.C.:

Q. In terms of the work that's ongoing at Nova Scotia Power in terms of their study on peak demand impacts of these mini-slits, the report may not be ready, but I wonder would it be possible to see if we could get a scope of what they're looking at as an undertaking, in terms of how they're going about that study?

MR. HENDERSON:

A. Yeah, I know we already asked them a question, we had Krista talk to them and they did provide some information on it. I don't think it was that detailed, so I'm not sure to what extent there is a detailed scope document, but we can certainly provide what we know they have that we can get our hands on.

JOHNSON, Q.C.:

Q. Yeah, if it's something along the lines of how they're going about their study, it might be helpful.

MS. GLYNN:

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Q. We'll note that on the record.

JOHNSON, Q.C.:

Q. I understand that the heat pump defrost is an issue in terms of affecting their load, they kick in every so often to defrost, is that right?

MR. HENDERSON:

A. That's right.

JOHNSON, Q.C.:

Q. And in terms of that issue, how big an issue was that in terms of their impact on the demand on the system, say?

(10:45 a.m.)

MR. HENDERSON:

A. All I can say about it is we know it is an issue for some customers. We have not evaluated or from the evaluation we did, we could not determine in particular the extent to which that was having an effect on the results that we were getting.

JOHNSON, Q.C.:

Q. And I suppose in the aggregate, let's say if there's 5,000 of these units, they're defrosting at different times from a system point of –

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MR. HENDERSON:

A. That's right, so there would be a certain level of diversity between them all and all that kind of stuff. We know that the, if you're talking about energy, part of the testing that goes into these heat pumps includes something called the heating seasonal performance factor and it tries to capture the impact of the frost on energy savings and the extent to which there is electric heat, a backup necessary for the typical type of installation, those types of things, so you know, that data is kind of available but that's pretty broad based, you know. We would, four our environment and I know Dave Adams didn't seem to think it was much of an issue for him, but in all periods during the winter season, how often are we going to get fairly high loads when there's a lot of moisture in the air, a lot of, you know, fine snow firing around and all that kind of stuff and the extent that's going to have on the defrost cycle, all those are issues with performance. It could be a non-issue at the end of the day. We know our

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peak, it's typically a grey day, blowing a gale, you know, unless we've come off a period of snow beforehand, the ice is probably compacted and frozen in place, so it may not be blowing around, you know, that type of stuff. So for all those types of complications with these operations, counting on savings which utilities will need to do in order to be assured that we've got enough in place to supply customers, you will tend to want to take a conservative approach to it.

JOHNSON, Q.C.:

Q. I sent over a question as well regarding the cost of this mini-split study, did you say it was a hundred grand?

MR. HENDERSON:

A. No, that study itself, just a minute now, subject to check, I'm pretty sure I got it right off the top of my mind, I looked at those numbers yesterday, it was around $51,000.00.

JOHNSON, Q.C.:

Q. And then there was a question as well about the cost of the hot water pilot study?

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MR. HENDERSON:

A. Yeah, that was around 620,000.

JOHNSON, Q.C.:

Q. 620. And that study determined that or that pilot study, I take it, confirmed that I guess there was limited utility in going forward in a broader fashion, is that right?

MR. HENDERSON:

A. Yeah, basically for the savings that's attributable to hot water tanks of .6, the technology cost was too much. You'd have to find more savings than that in order to make the technology work.

JOHNSON, Q.C.:

Q. I guess, how would you compare the rigor of the hot water pilot study to the mini-split study?

MR. HENDERSON:

A. With the mini-split heat pump study had a number of objectives, the piece itself related to peak, the level of detail in the direct hot water control was way higher.

JOHNSON, Q.C.:

Q. There was a question as well regarding the cost of the ICF International Study work?

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MR. HENDERSON:

A. Yeah, it cost Newfoundland Power—Newfoundland Power's expense is around 200,000 and we know that Hydro contributed roughly $100,000.00 to the completion of the report itself, basically the contract with ICF. We're not sure what Hydro's other expenses would be, so you can kind of think of it as being roughly $300,000.00 project.

JOHNSON, Q.C.:

Q. And he was interested in whether the hot water tank pilot study was there a similar study done some 25 years ago?

MR. HENDERSON:

A. We did do a study quite a few years ago on hot water tanks. I would say at that point in time it was much more, I apologize for the wording, but bleeding edge technology at the time and there was technology issues associated with it and one of the matters that happened during the period in which we were doing it, it was in the early '90s, late '80s in which there was—Hydro was expecting to have to add a bunch of capacity to the system and ERCO came off the system,

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200 megawatts came off the system, so the need for this type of program practically disappeared, so as a result, you know, it would have no economics and the technology was a challenge. You know, with the new one, we know that other people are doing it, it's gaining a lot of traction in the market, having—using this type of technology and so as a result certainly a new study is warranted because technology has improved lightyears since then.

JOHNSON, Q.C.:

Q. In terms of—there's some questions as well, as you're aware, regarding peak demand reductions to 2017. I guess in that regard I guess we can turn to the Demand Management Potential Study again, Mr. Henderson, if you wouldn't mind.

MS. GLYNNE:

Q. Information 36 that was.

JOHNSON, Q.C.:

Q. I think Mr. Henderson, he was—the question pertained to Exhibit 49 on Page 91. It would show, I think, for 2017 a 242 megawatt reduction of demand on the Island

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Interconnected System. And I think that was based on 47 separate measures, none of which included the heat pump. Is that the proper understanding?

MR. HENDERSON:

A. Yes, that's correct.

JOHNSON, Q.C.:

Q. Okay. And then apparently Exhibit ES7. That's at page IX. Exhibit ES7, Peak Demand Reductions by Milestone Year for the Three Scenarios, 2017, 485 Megawatts. In terms of the economic potential, that would be—the economic potential would be what, Mr. Henderson, anything that would meet the economic test or –

MR. HENDERSON:

A. Anything that would meet the economic test is practically assumed to be installed immediately.

JOHNSON, Q.C.:

Q. Okay, alright. And where does the—and I guess there's no heat pump demand reductions embedded into that economic potential obviously?

MR. HENDERSON:

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A. That's correct. The difference is the peak load reductions from the Potential Peak Load Reduction programs. You can find that on Exhibit 54 if you want to turn there.

JOHNSON, Q.C.:

Q. Okay, sure.

MR. HENDERSON:

A. So, this table would explain the differences between those two tables that you brought up.

JOHNSON, Q.C.:

Q. Um-hm.

MR. HENDERSON:

A. And this one is what the Potential Study suggested might be economic to do as a peak management measure. The first one being the direct hot water cycling. It passes the economic test because they only use the cost of installing a control box for the hot water tank. It doesn't include any program costs or communication costs which can be substantial for these programs. The next one is Electric Heat Cycling Program which is really looking at cycling customers' electric heat itself, similar to air-

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conditioning that use down in the States. The particular item itself was quite substantial and even the next one and in the sessions we had with customers, you know, trying to assess—part of doing the program itself, they were pretty well al quite adamant that they wanted to have absolutely nothing to do with that type of program where we're shutting down their electric heat for periods of time. So that largely was the reason why we didn't pursue any of that.

JOHNSON, Q.C.:

Q. Mr. Chairman, it's handy to 11, I think what I'd like to do is just have the break now, if we could and then I'll resume for a some short questioning, I think, following the break.

CHAIRMAN:

Q. Okay.

JOHNSON, Q.C.:

Q. Thank you.

(RECESS – 10:58 A.M.)

(RESUME – 11:30 A.M._

CHAIRMAN:

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Q. So, Mr. Johnson, sir?

JOHNSON, Q.C.:

Q. Thank you. Again, Mr. Henderson, if you could just turn to your Customer and Energy Forecast for a moment? It would be Tab 4 of Volume 2, Page 5.

MR. HENDERSON:

A. I apologize, I don't have—oh, put it on the screen, okay. I don't have the hard copy of that.

JOHNSON, Q.C.:

Q. If you could go to Page 5, sir. Just scroll down a little bit further, if you will, yes, thank you. Just before the topic "General Service", Mr. Henderson, the materials indicate that the combined impact of increased numbers of customers and changes in average use will result in growth and domestic energy sales on the proposed rates of .7 percent in 2016 and .4 percent in 2017. Okay. And I take it that those would reflect elasticity effects from the proposed rates increase?

MR. HENDERSON:

A. Yes, they would.

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JOHNSON, Q.C.:
Q. And those assumptions would be based on the assumption that the full 2 ½ percent increase would get passed along.
MR. HENDERSON:
A. That's correct.
JOHNSON, Q.C.:
Q. Okay. So, can we assume that if, for instance, the Board were not to accept that Newfoundland Power's return on equity would go to 9.5 percent, that we could possibly see further growth in domestic energy sales under the rates in 2016 and 2017?
MR. HENDERSON:
A. Yes, it would be a small increase, yes.
JOHNSON, Q.C.:
Q. Okay. And in terms of a cross aid that was—and I guess that will be figured out in a compliance application once the Board gives its order, right?
MR. HENDERSON:
A. Yes, that's right.
JOHNSON, Q.C.:
Q. Okay. And in terms of a cross aid that I sent across, Item No. 1 on my April 11th

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letter. This is one that I previously provided to Mr. Smith.
MS. GLYNNE:
Q. This would be entered as Information No. 41.
JOHNSON, Q.C.:
Q. Thank you. I don't believe it was a point that I had raised with Mr. Smith when I sent over that cross aid with him. I just wanted to raise it with you for a moment, page 4 of this document. For the record, this is the introduction evidence of Newfoundland Power's May 2007 filing. And at page 4 we see, at line 8, the company indicating that since 2002 customer rates have increased by over 26 percent that was taken on a compound basis.
MR. HENDERSON:
A. That's correct.
JOHNSON, Q.C.:
Q. Okay. And then if we could go over next to the cross aid No. 3 on that same document.
MS. GLYNNE:
Q. We'll enter that as Information No. 42.
JOHNSON, Q.C.:
Q. Yes, Mr. Henderson, this, just for the

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record, is CA-NP-406 in Newfoundland Power's GRA and I take it you can confirm that at that time the company was confirming that if the application was approved as filed that the percentage by which customer rates would have increased on a compounded basis since 2007 would be 28 percent, 31 percent since 2008 and 21 percent since 2009?
MR. HENDERSON:
A. That's correct.
JOHNSON, Q.C.:
Q. You were probably responsible or your team was responsible for providing that reply?
MR. HENDERSON:
A. That's right.
JOHNSON, Q.C.:
Q. And finally, can I just turn to CA-NP-177, Attachment B. This is one of the ones that came over in the stranded site. Attachment B, page 317 or 418. I believe this is taken from Newfoundland Power's most recent filing with the Board in terms of its quarterly report. And just to confirm, if we go down on the 2015, keep on going down further, Samantha. So, sales growth in 2015 was at 1

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percent and there was 2.3 percent in 2014, do you see that?
MR. HENDERSON:
A. Yes.
JOHNSON, Q.C.:
Q. So, the sales growth, is this like kilowatt hour sales growth in 2015.
MR. HENDERSON:
A. This is, yes, electricity sales, on the line above gigawatt hours.
JOHNSON, Q.C.:
Q. Right, okay. And in terms of—if we see the 2.3 percent in 2014 and I take it in terms of the customer and energy forecast, it refers to the 2009 to 2014 period on page 5 as being, reflecting a robust economic performance of the Province's economy. Just go back there for a moment. I'm referring there now, Samantha, to the Customer Energy Demand Forecast again, the first revision. Yes, towards the top, you see it highlighted or shaded there, during 2009 2014 period the robust economic performance of the Province's economy resulted in an average annual customer and energy sales growth of

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1.6 and 2.2. Just to put that in perspective, Mr. Henderson, you joined Newfoundland Power as a young man, probably about 30 and you're still a young man.

CHAIRMAN:

Q. He is from up here, I can speak for me, not for this crowd here, but he looks pretty young to me.

JOHNSON, Q.C.:

Q. When you wore a younger man's clothes.

MR. HENDERSON:

A. I think this is the same jacket.

CHAIRMAN:

Q. Oh, you're frugal.

JOHNSON, Q.C.:

Q. So, just to put that in perspective, like, we just saw the 2014 on that previous chart was 2.3 percent sales growth; 2015 was 1 percent and then we're talking about that period of 2009 to 2014 being robust. Now, just put that into some perspective for us in terms of what sales were—how robust was that compared to what Newfoundland Power was used to over a long period of time?

MR. HENDERSON:

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A. During the '90s the economy was—through the '90s it was very weak. Our sales growth during the '90s was below 1 percent. I don't know, it might have averaged .7 or .6 percent. During that time period things like household income didn't go up very much. Since 2000 the growth rate has been improving. You know, there's a bunch of dynamics over this period which are probably noteworthy is once we hit the 2000s, oil started going up in cost, the economy started doing quite well and our sales growth went up quite a lot. You know, that's the way I would characterize those couple of decades in the most recent decades. The economic forecast as I see them over the next five years as far as a forecast goes looks, as far as growth in, let's say, customer income, is worse than what it was through the '90s. So, that kind of gives me pause when I'm looking forward as to what we're going to be facing over the next, you know, four or five years. So, I'm not sure if I answered your question, but those are kind of the things that I see.

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JOHNSON, Q.C.:

Q. I guess, in terms of your forecasting out like that, the ability to be accurate five years out, can you offer any insights on that?

MR. HENDERSON:

A. Obviously, five years out is a fair distance. We primarily do short range forecast out five years. Hydro does a much longer one, and we do review it with Hydro, our short term to make sure we're generally in sync with each other over the short term. We tend to use for forecasting out that far, Conference Board of Canada forecasts. Generally speaking, the accuracy of our forecast very directly reflects the economic impacts, inputs that we are given. As a result, you know, the errors looking out five year tends to have always reflected the errors that you're seeing in the economic forecast that we receive. One area that I'm sure everybody here is kind of aware of was when the economy was picking up, the housing starts forecast we were receiving for quite

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a few years was always lower than what actually happened. Now the forecasts that we're seeing are probably more in line with what we're seeing, and I can't say so far as to whether they're high now because we've come out of a growth period, and as a result the economy is turning over, but it is a risk, and that's the type of risk we kind of see in the forecast is the accuracy of, I'll say, the general view, if you want to consider that being the Conference Board of Canada's view. It's a general view of how the economy is doing.

JOHNSON, Q.C.:

Q. I guess, to put the 1 percent sales growth in 2015 in perspective, that's 1 percent on a fairly sustained period of well above normal growth?

MR. HENDERSON:

A. Yes, when we say "well above normal", our average is doing quite well. The big turnaround we're seeing is that while housing starts is declining, our average use is declining, and it's been quite a long

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time since we've seen that, and I don't even think in the early 90s we saw negative growth, but so far this year, you know, we're kind of scratching our chin and keeping our fingers crossed that we get the amount of growth that we see in the forecast that we have here, and there is downside risk and we're seeing that in the current forecast. Recently, I think, there was an article in the paper talking about customers that are dual-use, basically they have the option of electric versus oil, and, you know, we're starting to think the drop off in load that we're seeing is possibly as a result of dual-fuel switching, you know, giving up using their electric heat in whatever form they have and moving back over to oil.

JOHNSON, Q.C.:

Q. And that's something you read in the paper, is it?

MR. HENDERSON:

A. Yeah, there was a newspaper article, I think, by the Home Heating Association of

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Newfoundland.

JOHNSON, Q.C.:

Q. Just in terms of the forecasting just generally at Appendix D of your load forecast, this is from 2006 to 2015, is there anything about how you've gone about forecasting that would make us think that your ability to forecast going forward would be any less reliable than how you forecasted in the past?

MR. HENDERSON:

A. No, there's nothing. As you can see, during the period of greatest robust growth when things were ramping up in the late 2000s, our forecast tended to be low, right, and more recently our forecast tended to be high. So there is some underlying issues with, I'll say, the figures that we're able to get from Conference Board of Canada. It's the best that they have, it's the best thing that we can use. So as a result, there are certain risks, I suppose, that you could say there's a trend underneath it. Other than that, we don't see anything within the

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methodology that would suggest the forecasts are going to be inherently off, right. We do know that one of the elements of the load forecast which really hasn't been an issue in the past is our elasticity forecast, and I think right now it's .2 percent change in the load growth, and presumed 1 percent change in growth. That behaviour is based on evaluation of previous pricing changes and load changes with the mix of the economics and all that sort of stuff. Going forward, when you see large price changes, you know, if that's – we haven't experienced it in the past especially over potentially a short period of time. There's a lot of uncertainty in our potential forecast given how is it going to change, given a 50 percent or a big change in rates that may occur over a number of years.

(11:45 a.m.)

JOHNSON, Q.C.:

Q. So, for instance, when we saw that rates had increased, say, 30 percent over 2002 to May of 2007, and then a further forecast of 28

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percent, did your elasticity models -

MR. HENDERSON:

A. During that time period, it was – I think it's 12 years average annual change in price of around 4 percent per year, averaged over that period. During that period, there was a substantial expansion of the economy. I had a quick look at this period. The personal disposable income or household disposable income, I think, increased – just a second. The household disposable income increased 5.7 percent, so the customers ability to pay for the increase in the rates over that period, you know, is reflected in their household disposable income. Home heating fuel price increased during that time period. It was like 6.5 percent, so that indicated that it wouldn't have impacted our home heat competitiveness, that sort of stuff. The CPI over the period was 2.1 percent on average. So given all that, there wouldn't have been any particular drop in our average use. We saw increases in our average use, which is consistent with fuel

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prices being higher, increase in the price of electricity, and people's disposable income going up, so they're building bigger homes and all that kind of stuff. So all that is reflected in the historical period. Looking forward, you know, we all are aware that the economy is not growing. The forecast, I know, for household disposable income is the lowest I've seen it looking back historically, and home heating fuel cost and alternate fuels have dropped a lot, and in that piece you've got mini-splits, you've got pending distributed generation that customers might be interested I installing like solar and all that sort of stuff. So there's lots of pressures that we see going forward which means that looking over that time period and the increases over that time period is really not a very good indicative period to consider how we're looking forward.

JOHNSON, Q.C.:

Q. Thank you, Mr. Henderson. I appreciate that.

MR. LORNE HENDERSON – CROSS-EXAMINATION BY GREENE,

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Q.C.:

Q. Good morning, Mr. Henderson.

MR. HENDERSON:

A. Good morning.

GREENE, Q.C.:

Q. I first wanted to talk to you about the estimates of marginal costs you gave us earlier this morning. I believe you indicated that the current marginal cost for the Island Interconnected System is tied to Holyrood, is that correct?

MR. HENDERSON:

A. That's correct.

GREENE, Q.C.:

Q. And that it's roughly 10 to 11 cents kilowatt hours?

MR. HENDERSON:

A. It's in that range. I think that's based on a $64.00 a barrel fuel price. Currently, I understand it's a little bit lower than that.

GREENE, Q.C.:

Q. And you indicated that after the interconnection with Muskrat Falls, you

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anticipate that the marginal cost will be about half of that, roughly 4 to 5 percent. Can you explain the basis for that estimate of marginal cost post-Muskrat?

MR. HENDERSON:

A. It's based basically off information we've received from Hydro, and it's reflected primarily on the economic – the opportunity cost for selling power outside of province, basically, benchmarked off the Northeast U.S. I understand they may sell it to Nova Scotia for, you know, market based price, that sort of stuff. So that's the range of figures that they've published.

GREENE, Q.C.:

Q. So it is not related to recovery of the supply cost associated with Muskrat Falls, but to what they are losing by not selling in an export market?

MR. HENDERSON:

A. That's correct.

GREENE, Q.C.:

Q. And is that one of the issues that will be considered in the cost of service hearing

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before this Board as to what is the right way to determine the marginal cost post-Muskrat?

MR. HENDERSON:

A. Yeah, I can only presume - marginal cost studies typically look at – they can look at marginal cost, but typically they look at an imbedded cost of service study and the allocation of existing cost. Hopefully, it'll be one of the topics that we included.

GREENE, Q.C.:

Q. Okay. You also indicated that your current five year CDM plan was based upon the marginal cost that was provided to you at Hydro at that time for the time frame of the plan, is that correct?

MR. HENDERSON:

A. That's correct. I think it may have had the change in marginal cost in 2018, but now it may be later than that, and I think the energy cost at the time was more in the order of 5 cents, while the current study is suggesting something lower, and I noted in Hydro's annual report, I think, they even

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had – what they got in cents per kilowatt hour from this past year was more in the order of 3/3.5 cents.

GREENE, Q.C.:

Q. So again it's based on the opportunity cost which will be further studied?

MR. HENDERSON:

A. That's right, and consideration for that marginal cost which Hydro has in it somewhat is, you know, infrastructure cost on the island for the transmission grid, those types of things. So they're going to add to the opportunity cost of selling.

GREENE, Q.C.:

Q. And I think you've also indicated that Newfoundland Power is still in the process of reviewing the marginal cost study that was filed by Hydro, is that correct?

MR. HENDERSON:

A. That's correct.

GREENE, Q.C.:

Q. Do you anticipate at this time or is it too early to say whether that will impact in any way your current five year plan for CDM

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initiatives?

MR. HENDERSON:

A. It certainly will impact it, right, because it's a different set of numbers, so inevitably it's going to impact it at some level. You know, we have a number of programs, such as the small technology program, or the instant rebate program, and that's one in which we're forecasting that to potentially drop off the table given the reduction in the marginal cost. The actual timing of that will certainly be dependent on what the numbers actually look like when we get to that decision point. So these marginal costs as we're getting will impact those types of decisions going forward.

GREENE, Q.C.:

Q. Okay. Turning now to another topic which was the elasticity impacts, and you had indicated that – was it a .2 percent change in load?

MR. HENDERSON:

A. That's right. The current forecast methodology is suggesting a 1 percent change

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in price will result in a .2 percent change in sales over a period that is more in the order of two years. It's not instantaneous or in one year, in particular.

GREENE, Q.C.:

Q. I think you've also just recently talked about this a little bit with Mr. Johnson as to what we can expect going forward. Has Newfoundland Power considered what the impact will be of the recovery of the increased supply cost that Newfoundland Power, as Mr. Smith has indicated, for example, that Muskrat Falls is about 9 billion in investment, and I believe Mr. Kelly said that as well in his cross-examination of Dr. Cleary, the impact of the recovery of those supply costs on what your sales growth would be in the longer term?

MR. HENDERSON:

A. Yeah, the forecast that Ron does and the elasticity impacts which do become part of conversations with Hydro, both of us are modelling elasticity generally speaking in that area of .2 to .3 percent and 1 percent

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price change. In both companies, my understanding would be that's based on historical experience within the variances of what we've seen in the past. What we're going to see in the future is something dramatically different. Obviously, you know, the future is the future and there's always uncertainties associated with it. Elasticity is certainly one of the elements which there's quite a bit of uncertainty around, and, you know, given the change in technology that's going on and opportunities for customers to save money, you know, off their bills, you know, they all constitute a fair bit of uncertainty as to where we'll be in six or seven years times.

GREENE, Q.C.:

Q. So you really can't offer an opinion at this point in time as to what the impact might be?

MR. HENDERSON:

A. That's correct.

GREENE, Q.C.:

Q. Thank you, Mr. Henderson, that concludes my

questions.
CHAIRMAN:
Q. Do you have any?
KELLY, Q.C.:
Q. No re-direct, Mr. Chairman.
VICE-CHAIR WHALEN:
Q. No questions that I can see.
(12:00 p.m.)
CHAIRMAN:
Q. Just a couple of quick questions. So what you're telling us that I understand that these customer initiatives, they're not going to reduce – basically, you don't think they're going to reduce peak demand?
MR. HENDERSON:
A. When you consider mini-splits going into Newfoundland Power service territory which has, I don't know, I think it's – Newfoundland Power itself, I think, is 65 percent electric and everybody else, let's say. We recognize that this is an advantage to everybody, so as a result all customers are liable to be installing it. Those who are installing it that currently don't use

electricity for heating may use electricity for heating. Those with baseboard heating will switch over to this. They may or may not, in and of itself, get decreases. There certainly might be depending on the quality of the installation and all that stuff we kind of talked about earlier. So as a result, on average, to me there's certainly risk that it's going to actually increase peak even though it's reducing – well, I'm not sure what the energy is, I'd have to think about it more, but, yeah, there's risk that this technology coming to the market is not necessarily going to do anything to reduce peak.
CHAIRMAN:
Q. So basically what we're saying is that the collective cost, the fixed cost, which are rising apparently considerably, are not going to – it's not going to be impacted at all by these improved efficiencies in energy delivery?
MR. HENDERSON:
A. If there's a lot of fixed costs, and the

costs are very small, the higher the load, the lower the price, you know, you got that dichotomy coming up.
CHAIRMAN:
Q. And Muskrat Falls is, of course, a high fixed cost, isn't it?
MR. HENDERSON:
A. A huge fixed cost, yeah, and Hydro's reported estimate based on 9 billion dollars of investment is, I think, a price somewhere in the order of 19.8 cents, you know, within a few years –
CHAIRMAN:
Q. Let me stop you there. Now that 9 billion, does that include IDC, interest during construction?
MR. HENDERSON:
A. Yes.
CHAIRMAN:
Q. Oh, that's in there now, is it?
MR. HENDERSON:
A. Yes, basically, the numbers that Hydro – the number of 9 billion dollars you will find in a footnote to a report that was done by the

Oversight Committee, so it's not a Hydro report per se, it's in the Oversight Committee, and it's in a footnote in which in the full document they talk about the construction cost, which is what Hydro is using, which doesn't include IDC. The 9.03, I think, would include the IDC.
CHAIRMAN:
Q. And that's as of – well, whenever that was produced?
MR. HENDERSON:
A. It was last fall, I think.
CHAIRMAN:
Q. Last fall?
MR. HENDERSON:
A. Yeah.
CHAIRMAN:
Q. And they're two years behind – do you know how far they're behind schedule, is there any public information on that?
MR. HENDERSON:
A. I haven't actually studied the most current information. All I would be aware of is that there's pressure in particular on the

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plant as to when it's going to be installed. Hopefully, next week we'll have some more answers on that.

CHAIRMAN:

Q. The people taking up these – making these conversions, heat pumps, et cetera, I mean, they're at the higher end of the income scale, are they, or do you have any data? I mean, it seems to me that that would be the case, the top 1 or 2 percentiles in the income distribution stream would be the ones who would be taking advantage of these subsidies or rebates or switching over. Do you have any data on that, do you know?

(12:00 p.m.)

MR. HENDERSON:

A. I really don't know. Like, he installed it for his retired grandmother, so that obviously is someone who has a lower income and all that sort of stuff.

CHAIRMAN:

Q. Yes, but his retired grandmother apparently was the benefit of a personal subsidy, she didn't pay herself?

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MR. HENDERSON:

A. I don't know, but, anyway, we don't have any particular information to suggest anything. We have this financing program out there. I suspect the fellows who are quite wealthy will be able to get a better financing rate somewhere else. For those people who have less ability to purchase these things, they may want to take advantage of it because it might represent a better way for them to pay for it, it's on their bill, you know, it's amortized over five years and it might make it work for them because presumably they'll get some offsetting energy savings to do it. We are offering it out there, so as it would enable a broader group of participation in the getting these things in place.

CHAIRMAN:

Q. Do you have any information, any studies done on, as costs increase on ability to pay? Like it seems to me that the forgotten consumer in this whole thing are the people at the bottom end of the income scale, the people at the first percentile and the

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second percentile, the lowest income, they're not in a position to take advantage of these rebates but they're going to have to pick up all the costs, including if there are subsidies, for instance, or rebates, as taxpayers they will be paying for this, but they're not going to be able to avail or be in a position to avail.

MR. HENDERSON:

A. That's right.

CHAIRMAN:

Q. Especially if they're older people, I mean, the long run for me is six months, I put away my winter boots, am I going to need them again I said to the crowd inside. I mean, what we're seeing in Newfoundland with the aging society or demographics is that that's the most rapidly rising part of the population who would not be interested, I'm not interested in investing in an energy system that I might get my money back in 10 years, even if it's a good investment in a 10-year timespan, you know, people are not going to do that.

MR. HENDERSON:

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A. Well these heat pumps at that point in time might get down to, if prices go as high as Hydro is estimating to be, you know, the payback on that will be within five years, so you might have a chance for that. But there's no question –

CHAIRMAN:

Q. I like him.

KELLY, Q.C.:

Q. You asked the question, Mr. Chairman.

CHAIRMAN:

Q. Mr. Kelly, I like condor.

MR. HENDERSON:

A. Anyway, there's absolutely no question that one of the big challenges to the price increases that are going to be seen is that the economy is doing poor, the support for low income people who this is a real affordability issue is a major concern and, you know, I don't know what the solutions will be for that, but I guess it's going to, depending on how it turns out, it's going to be a real matter for the politicians and society to have to deal with.

CHAIRMAN:

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Q. And I think the most interesting, one of the most interesting figures came up here, for me, was the decline, the negative decline or negative GDP numbers. I mean, 5.2 percent and 2.4 I think it was in two years?

KELLY, Q.C.:

Q. 2.9 and 5.4, Mr. Chairman.

CHAIRMAN:

Q. 2.9 and 5.4, so that's, you know, you're closing in on a 9 percent decline in your GDP. I mean, that's –

MR. HENDERSON:

A. And I always have a hard time with GDP just because it's so caught up in the export of materials and the influence that has on us, if it's not affecting the salary levels coming in for the people who are actually doing the work –

CHAIRMAN:

Q. So do you think GDP is overestimated?

MR. HENDERSON:

A. No, it's just interpreting the effect that the GDP may have on the economy, you know, I equate the GDP more for, especially in the resource industry, more in the area of

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royalties.

CHAIRMAN:

Q. Uh-hm.

MR. HENDERSON:

A. With respect to the impact on Newfoundland Power, we're most concerned about the household disposable income and the service sector GDP, which often, you know, aren't quite as cyclical or dramatically variant as the GDP will be with the resources sector that we have.

CHAIRMAN:

Q. So would you consider, for instance, the growth in government presence in the economy, would you consider that to be an addition to GDP or –

MR. HENDERSON:

A. I'd say you're starting to get beyond what I can really comment on with regard to GDP and its influence on, you know, I'll say the macro economic level.

CHAIRMAN:

Q. Thank you, sir. So I guess that is it, is it? We have exhausted the agenda.

JOHNSON, Q.C.:

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Q. Just for the record, there was an issue yesterday as regards, getting clarification on the calculations that went into the interest coverage and offline we have agreed that I would put something very specific to Newfoundland Power and I'm committed to do that and I'll provide the Board with what I provide them and they will provide me an answer to the specific question.

KELLY, Q.C.:

Q. I'm assuming it's a matter of how Newfoundland Power does the calculation and we'll get the question and then determine the response.

CHAIRMAN:

Q. We find Newfoundland Power reliable.

KELLY, Q.C.:

Q. Thank you, Mr. Chairman.

CHAIRMAN:

Q. Adjourned.

(12:08 p.m.)

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CERTIFICATE

I, Judy Moss, do hereby certify that the foregoing is a true and correct transcript of a hearing in the matter of a General Rate Application by Newfoundland Power Inc. to establish customer electricity rates for 2016 and 2017 heard on the 12th day of April, 2016 at the Public Utilities Commission office, St. John's, Newfoundland and Labrador and was transcribed by me to the best of my ability by means of a sound apparatus.

Dated at St. John's, NL this
12th day of April, 2016

Judy Moss
Discoveries Unlimited Inc.

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