MUN - Department of Economics Speaker Series
Stan Marshall, President & CEO, Nalcor Energy
Understanding Muskrat Falls
February 15, 2018 – 7:30 pm – 9:00 pm

WADE LOCKE: Good evening and welcome to the latest economic series. And we have a pleasure to have Mr. Stan Marshall tonight talking about understanding Muskrat Falls. I'll give you a little introduction to Mr. Marshall in a second but I just want to remind people that you're here as our guest as is Mr. Marshall is and we hope that people behave as our guests and be respectful and courteous Mr. Marshall will speak for about an hour. Then he will take questions from the audience for about a half an hour. Please keep your questions to about a minute or and for the media, Mr. Marshall agreed to answer questions after that period of time down here in front. This is one of many kind of things that we do in department. So we next Friday we're going to have a speaker come down to speak about marketing and regulation of marijuana simply because it might be of some interest to people and on the 7th of March we have something called a Forum of Health Care Outcomes and Health Care Costs what we can afford and that will be an all day event and that will be available publicly as well. So Mr. Marshall has kindly agreed to come and speak to us helping us understand Muskrat Falls and we are very appreciative of him for finding the time to come. Mr. Marshall is as those are you may not know he is the CEO and President of Nalcor Energy and he served on the board of directors and CEO of Fortis in the past. He has a lot to say about Muskrat Falls and has a lot of knowledge that will

help us understand that. We do these kind of things because we want people whether or not you agree or disagree with our speakers take or that we take. We want to do this because we think having more information is helpful in terms of making our own decisions about where you want to go to. That's our that's our perspective on this. Mr. Marshall I will stop here, but he's a member in good standing for the Law Society of Newfoundland and Labrador and a registered Professional Engineer of the province that has been working in the energy sector in lots of different ways for many, many years. So I'm going to let Mr. Marshall give his talk and he will answer your questions as you go through it if we need a moderate, we will moderate at that point in time. So please try to keep your questions to a minute. Mr. Marshall thank you very much.

STAN MARSHALL: Thank you very much. I'm a retired member of the Law Society in good standing. I don't want to give the impression I'm still practising law, although the lawyers are doing very well with this project. I could've done better. So if you all hear me, thank you all for coming. I'm sure you've all heard every day for the last five years something on the media about Muskrat Falls. There's always some article there. And as I've gotten involved in the last just under two years now, the thing that always strikes me is that the debate is about some small part of it almost ad nauseum, and what I want to do this evening is try to address what I think is a great deficiency and that is very few people even from the beginning have understood the big picture of Muskrat Falls. And you know when I was a young boy I just loved doing picture puzzles, you probably don't do them

anymore. And so I get these big box of puzzles. I dump it on the floor or on the table maybe two or three thousand pieces. You see them there, little pieces of different parts or colors and you wonder how you'd ever get them all together and the thing that was absolutely essential to get them together in any short period of time was to see the picture on the box. If you didn't see that picture there's no way to organize the little pieces and get them done. And so that's what I want to do for you, attempt to do tonight - give you a bigger picture. I know some of you have questions about little parts of it and they have been exhaustively explored, let me assure you. The big picture I seldom here from anybody.

So let me give it a stat. Now most of you know the project is about – let's see if my pointer works here, so you start at Muskrat Falls itself the generating plant most of the discussion is about generation at Muskrat Falls. It is not the biggest part of this project and that's the first mistake that was made. This is primarily a transmission project. Totally lost from the beginning and led to a lot of problems. If you look at, in a lot of discussion for example it don't include the costs of the Maritime Link which while it's being built by Emera in Nova Scotia, we are essentially paying for by giving free power - about 20 percent, 25 on the power from Muskrat Falls for 35 years. So in fact we are paying for this. And when you add that into the total capital costs as we'll see later on there's no question in terms of dollars it's primarily a transmission project which doesn't add one kilowatt hour to our energy. It gives us opportunity. It's an important asset, but it's important to understand this

because one of the first things I did when I came here was to recognize we had to separate generation from the transmission of that part of the project to get control of it. One individual was trying to handle all was totally overwhelmed. I split it in two. At the time when I announced that the media said “Oh, cosmetics”. It really wasn't really a secret. If you're going to get control of the project, divide it in two to recognize there are two entirely different projects, different skills required, different time lines, different factors involved. And as I'll show you later, we're on the verge of bringing the transmission line operation two years ahead of the generating plant.

So different components Muskrat Falls, everybody knows about that. I'll talk to them about that the line goes back to the existing plant at Churchill Falls. We call that the Labrador transmission assets and that was to ensure that anything we generated here could be transmitted back and forth from Churchill Falls to the plant here which itself is tied into the Quebec system and has been for a long time and we have had access through Quebec to approximately 250 mega, 250 megawatts of power in an agreement with them and open access they have in Quebec. So we have the opportunity to export power through here.

This project gives us the opportunity to export power through here, Nova Scotia and onto whatever we consider to be the markets at this point. The Labrador-Island transmission link, 11 hundred kilometres of DC line going from Muskrat to Soldiers Pond just outside of St. John's. I'm going to talk about each one of these components individually but I

wanted to get the picture in your own mind what we're talking about. The link to Nova Scotia, the Maritime Link does not tie in with this directly. This starts at Muskrat Falls goes to Soldiers Pond, the DC link, is a terminal station there, from a terminal station to a terminal station here just outside the city. The Nova Scotia link goes back to Bottom Brook and ties into the Bay D'Espoir system which ties into a whole grid of the island but it's not fit to be tied together other than through the Newfoundland Hydro system so I am going to talk about all these, get a picture your mind – the Labrador transmission assets, the Muskrat Falls, the island link, the Maritime link, Muskrat Falls.

A big takeaway for you tonight - we've had a tremendous successful year in 2017. When I came to Nalcor in April, 2016 we were in crisis facing imminent collapse within months. I saw a chaotic crisis situation. 2016 - a very difficult year: occupation of the site; leaky coffer dams; faulty cable; the fact that Astaldi was going to go bankrupt by July - the main contractor. Someone used the analogy I took over command of the Titanic after it hit the iceberg. I wouldn't go that far but there are certain analogies to that, in that when you're in that situation you got to focus on the immediacy of saving the ship. That was the only focus. No time to worry about painting the gunnels. Not only did we save the ship, we got her back on her own power and we're heading for a safe harbour. We have our challenges but in the last almost year and a half we have gone from a crisis situation to a very well run mega-project with it's challenges to the point that other people working on other mega-projects in North America have come to us to see how we did it. We did it with the same

people. I flew back recently from Muskrat Falls with some of our senior people and one of them turned to me and laughed and said “You know I don't understand it. What did we change?” A lot changed - how things were organized, the approach to the project. The whole approach changed but it began as I said earlier with a recognition we're dealing with two projects, at least two projects. So as we finish 2017 we went through 2017, there was no interruption, no occupation, no interruption of any kind. Astaldi alone poured 130 thousand cubic meters of concrete, about the same they were doing on the Hibernia platform before that in one year. Another more than 100 thousand cubic meters of concrete went into the North Dam which is now shut down for the winter but within budget and ahead of schedule. Last year when I gave my update the big change was we had to go back and talk to all these contractors about the two-year delay, all the claims that came back from all the things have gone on in previous years but by the end of the year we had resolved it with all the major contractors.

Astaldi we brought forward to the end of 2017, in other words they couldn't go back and claim anything prior to that. They had a very successful year. Andritz, who had been suing us agreed to come back. We got together and decided how we're going to proceed and they are in, I’ll show you pictures later, they are in now installing the turbines. GE some of you know they're facing great difficulties corporately in the United States. We've had been dealing with them. So we've taken care of the big ones. Now we still have some smaller ones. Some of them will have to go to arbitration. But right now everything was in within

the budget I gave you back in June. It seems so long ago now but we've got a 2.9 billion dollar additional loan guarantee from the federal government that meant that we, our demands on the province were reduced by 2.7 billion dollars. It meant that rates could be reduced by 1.5 cents per kilowatt hour which offset the cost we had with settling with the contractors. In summary, as I stand here now you know I gave an update last June, there's no reason to think that I should change it at all. We're within the parameters I talked about both in terms of time and money. It was an outstanding year. It's a tribute to those people who worked on it whether they are our employees, contractors or Aboriginal partners - everybody worked together. I say to them your best defence in the inquiry is how you perform in 2017. You can do this. You've done it. You've done as good as anybody could anywhere on this project. And I want you all to understand that. Now it is still a mega-project. We constantly have these challenges. We are constantly dealing with contractors. Any day there could be some big issue come up but right now there's been no change in schedule or money since last June.

So let's go back and talk about the different components - power generation, Muskrat Falls you hear all about it, the smaller part of the project. I want to get this picture because it is the most recent one I have. It doesn't give you as clear a picture of some of the others we have that were taken in the spring because a lot of things are covered in snow. But I want to explain to you what it's all about. The first thing you notice is that the generating plant is covered in. Nobody thought we could have that plant covered for the winter. It was

covered in. They are now working inside on the generators. These parts have been covered up so they work on the generator inside. These two are also covered up now. But I want to describe what this project is all about. So here's the Churchill River coming down. This natural flow came down here to the Upper Falls, the Lower Falls and came down through here. So up until 18 months ago the water was coming down here. This is the rocky knoll, the North Spur on either side. I have a picture later and I'll show that to you. The different components. There's an earth-filled dam down here which is finished now. You can't see it for the snow, you'll see it later. There's a dam here made of earth – finished. A spillway basically, that's been in operation since about summer of 2016, late summer. The North Dam shut down for the winter. Now well out of the ground started last spring. Last spring we started with a dry riverbed. So it's out now, well up as I said are ahead of schedule - the spillway and generating plant. When you look at this think to notice this plant, the lower part of this plant is actually more than 30 meters below the level of the river. Last year at this time we were very concerned because we had diverted the river to spillway, this cofferdam was leaking. We didn't have a boom across here. This is a boom. The purpose of that boom it has a safety attribute to prevent people from coming into the forebay and going into the spillway. But it's main purpose is to establish an ice sheet up here which you see has actually happened here. It wasn't there last year. We had a very serious concern. Our concern was water coming out here without a stable ice sheet here the water becomes super cooled and when it goes up the air and it's 30 below it freezes and creates a natural dam of ice down here which could have caused the water to back up

into this hole. It would have cost us billions. So we had to spend extra money to put more cofferdam here and here. We are working on this cofferdam here to grout it in February. I was up there 40 below putting grout into that dam. But we got that done and allowed us to start this dam first thing in the spring. Very crucial to all this. So this is 30 feet below the level of the river, the river an elevation say four or five meters above sea level. As you see it there now its about, the water's been backed up just above the upper falls and backed up about to a level about 24 meters, 22 meters where it's starting to build up, back up into the river and the North Spur. People think the North spur contains all the water. It doesn't, about half the head is from here to here before even backs up into the North Spur, but this was a natural flow. It's been diverted. It allowed us to work here and on the river this year we've done that and ahead of schedule. The other thing I should point out this is a lot of water going through, there's about 30 per cent more than goes through the Upper Churchill because there's tributaries downstream. But the head is a very low. The head in the Upper Churchill is about a thousand feet here it's about 100 feet. When this reservoir is full the upper level will be about here and the lower levels right here, it is about 100 feet. So when this is finished this along will be removed, the water will come up to about this level here and the water will be coming in through here, through the turbines and being discharged. So it's a very low head plant, very high volume as contrasted with the Upper Churchill. The flooding very little. You can see the banks of the river very high on either side. You can also see that there's been slippage and it's basically sand and soil which has been giving away since the last ice age thousands of years ago. I'm not sure if there's a picture

of downstream either, very little flooding. The amount of flooding here in this project is about one sixtieth of what was done in the Upper Churchill. For example the methylmercury is proportional to the amount flooding so will be one sixtieth of what was in the Upper Churchill. Nobody died from the flooding of the Upper Churchill and I expect nobody will die when one sixtieth of the flooding with this one. Incidentally there's been no case in the world over the last two years that building reservoirs where it has been demonstrated that anybody has suffered serious harm from methlymercury in building a reservoir. Get this picture in your head. I'll start talking about some of this a little later.

Now, so the capacity of this plant is 4 units of 206 megawatts each for a total of 824 megawatts. That's the maximum it could produce. It won't be producing that 24 hours a day, 7 days a week, 52 weeks - on average it's going to produce 4.9 terrawatt hours of energy. There's been total confusion between capacity and energy. There's 8760 hours in a year if you want to take that and multiply it by that you could say that at 100 percent capacity it would fuse over six, close to seven terrawatt hours. So on average it's going to operate sayabout 550 megawatts. It'll operate at full capacity probably in the spring because like I said as 30 percent of the flow comes in downstream of the Upper Church which you can't put no control on. The control is on the Upper Churchill and in the winter months Hydro-Quebec once it's doing that full out and then late on a year we cut back. So that will dictate how we operate on a day to day, week by week basis. So just again to

remind you what the number was, the number I gave you last year which is still the number I'm using. I remind you that initially basically two years behind on the power and also remind you that Emera is entitled about 20 percent of the energy for 35 years because of the Maritime Link. An addition 5 five percent for first five years basically of this 824 they are entitled to 165 megawatts on peak. So when the power is at the most are entitled 165 megawatts which works out to 1.4 terrawatt hours. You should also note that not new capacity to the island. The first thing is that there are line losses. There's about 70 megawatts to be lost transmitting from the power plant to Soldiers Pond. Then you've got the 170 megawatts, 165, 170 megawatts you're going to get to Emera and we're going to be shutting down Holyrood which is for 490 megawatts. So Holyrood on average produces say it has for 490 megawatts, it probably produces 1.5 terrawatts hours of energy an the average year. So replacing a thermal plant what a hydro plant. Net you're probably only getting about 100 megawatts in terms of capacity, you're going to gain a hell of a lot of energy as you'll see later, but there's only a hundred megawatts of capacity which limits the value of the energy you're selling because you can't sell it on peak normally. And it also means that we don't have this, while we have a lot of energy to sell we can't be bringing in these big processing, what do you call them the bitcoin things which operates 365 days a year and uses a massive amount of energy but require the capacity too. We have to target what we're going to do with the excess energy to maximize it's value.

So what have we done last year? North Spur, we'll talk about later on. The work is finished on the North Spur. The float dam which I talked about earlier down here. As you can see it here pretty clearly is an earth-filled dam, you can see the top of the dam, you can drive a truck across of it which you do another thing over here – that's done. The powerhouse is enclosed. The boom has been put up for the winter. The north dam is 40 percent finished ahead of schedule and within budget. It's been a great year. Still, so overall 70 percent complete. What we're seeing now is a transformation. Up to this point in time the big focus has been these big outdoor civil works pouring concrete, putting in big towers into swamps, stringing lines, blasting rock, moving soil, all exposed to the elements. The only piece left like that now is the north dam, I'm going to go back, which is like I say is not on the critical path, is ahead of schedule, no problem. So we're transitioning from those big civil works open to cold, exposed the elements to basically putting in equipment, doing terminations and testing things inside. Like in the powerhouse now they're putting in… the biggest part that is putting together the turbines and whatnot. Yes there's some concrete work inside even though it's say zero degrees Fahrenheit outside it's 10 degrees Celsius inside. And the other works is in the terminal stations inside. A big transformation. Our workforce peaked. We're going from 5000 maybe down this year to about 1200 with camps.

So now just to show you what this is all about. This is the intake of the powerhouse. There is actually a big hole down here. They're still doing some work up here on the top of the

critical path where the gates close and open here to let water go through the turbines. When the reservoir is filled the water will probably be up to here. So you're looking downstream now at the intake. Now you're downstream looking up. you're back where that berm was directing the river downstream, looking upstream. So here you see the powerhouse, spillway, up on top they're still working on some of the gates, the south dam. Here you can see where the water will be. When this berm is taken out of it and this work is done, the level of the river will be about here. On the other side of the powerhouse the reservoir will be up to here. This is about 35 metres, about 100 feet. That's all we're talking about. Not a big hit. A lot of flow. Now you're up on this rocky knoll you're looking to the south. Here is the North dam which is shut down for the winter. You can see that a little over a year ago the river was coming down here. You built the cofferdam, poured rocks in the river basically shut off the flow and divert the water to go through the spillway. You can see water coming through here now and later the water came up. Here is a cofferdam and here's a North dam under construction. When this is finished the water will overflow this and this will be the dam up to this level here. So the North dam, spillway, powerhouse, south dam.

Now we're looking inside. This is inside the powerhouse there are four units, that I told you earlier. Unit one is here you can't you can't see - two three and four. This is unit 1. They're installing the liners into the spillway. The turbines will go about right here in this one. So they are working on all four now inside. It goes back and forth between the two

contractors. Andritz, the turbine manufacturer installs their liners and whatnot. Astaldi comes back and pours cement and hands it to back to Andritz. Back and forth, back and forth but it's inside, under control and they are working on all four units.

The North Spur. So, here we are; we're looking upstream again. Here's the spillway; this was taken last spring. So, the powerhouse wasn't even close. They were just starting to work on the north dam. And here, and here they're doing the remedial work on the North Spur. Here's the rocky knoll. I gotta remind you that the water level up here is going to rise about half of the distance here. So, you're talking about, I think we're up to, right now, roughly 22 metres; we're going to go to 39 metres. Say, 50 feet. The water to be retained behind North Spur is about 50 feet. You can see...just take last spring. The remnants of the ice that built up; we got away without any problems last winter. But, there was big...when we had the river open, you had this build up of super-cooled water, (inaudible) ice, and the water would...this ice would build up 50 to 100 feet, and could have flooded the works. It didn't, and now, we're in good shape.

So, I'm going to talk about the North Spur. You're looking upstream now; its a natural feature. You see we've done a lot of work here on this side, and on the other side. Now, you're upstream looking back down. So, here again, you've got the powerhouse over here, you've got the north dam, you've got the rocky knoll, and North Spur. You see it at the narrowest point here; this is rock. This is fairly wide up here. You see that the work has been going on to put materials along here, to reshape the contours of the Spur itself. You

get a better view here. Now, there's a...again, we're looking down south; you see a truck right there. Also, you see along the river here, where the bank has been collapsing over time. The one we had earlier the week was around here; nothing new. It's been collapsing for thousands of years. It had nothing to do with North Spur; it's been on the go; no problem. Nothing to do with North Spur; nothing.

I mean, the whole concept is, the North Spur...the North Spur had to be stabilized because, in its natural state, it was unstable. This work started over four years ago. So, for at least 40 years engineers have been studying this feature. There have been dozens of specialized geotechnical engineers doing the studies. There were wells put in here to pump water to make sure it's remained stable for...until now. And, whole groups of engineers designed the remedial work required. Very qualified geotechnical engineers designed it. It was reviewed by another firm of geotechnical engineers; it was supervised by geotechnical engineers; that work was reviewed by other geotechnical engineers. When I came in the job, because there had been concerns raised about this, I reviewed all the work that had been done. I'm not a geotechnical engineer. I am an engineer; I know enough when I read it, the principle of what we're trying to do. I wanted to ensure first of all that there had a number of qualified engineers work on this project; that none of them expressed any concerns about design or execution, and that everything had been reviewed; everything had been done properly.

So, you get one geotechnical engineer from Norway who voices a concern, okay? The rest

of the world is out of step except him. So, recently, what I did, after the latest words he expressed...well, again, the independent engineer was retained by the Federal Government (inaudible) looked at this; we retained a panel of four PhD's in geotechnical engineering, including one of them from this institution here, to do a peer review of what this chap in Norway was talking about. We filed that review today. I saw it last week for the first time, so I reviewed and its on the thing now. Basically, they say this guy doesn't know what he's talking about. He's not really familiar with the facts. Some of the suggestions he makes, and faced with the fact, would make things worse. The man...I know that he is honest, but he's not really familiar with the terrain or anything else and so these four people,experts in the field, reviewing the work he had done, says that he's not there.

So, we look at this. We will talk about the components. So, we've reshaped the spur to make it more stable. We've put materials on the banks...rocks...to make sure it is more stable. What you can't see here, at the narrowest point up here, we've put in what we call a cut off wall with these...rocks; this rocky knoll here, along here, over here. This is poured in place. You use big clamps to dig down; as they go, cement is poured into the hole. Its not intended to be totally like a big concrete dam; that's not required. What it does do is to control the water level in the spur; make sure that nothing can happen. A lot of work has been done, and this has taken more than a year; this is what it looks like today. So, if we look at it today, what do you see? You see all these materials we've put in here to make

sure that the level of the upstream will remain stable. Here, you can see the outline with a concrete wall that was put in along here, and covered with impermeable material. And, you get a sense of what we're talking about. So here, we're probably, as I say...say we're at 23 metres here; the water level will only come up to here. This is 39 metres of it right here. So, the water level is level...the difference between, say, 24 and 39; basically 50.

Are we confident in the design? Absolutely; 100%. The other thing that people don't understand is, dams just don't collapse overnight. In fact, I can't remember in my career a modern dam collapsing anywhere. But, if you go back into the 1920s and earlier, before they perfected a lot of this geotechnical work, the dams that did fail showed evidence of failure for a year or more. In this design, what we have, the whole spur is monitored. There are wells drilled; there had been wells drilled there to...in case its necessary to pump in some water, in case that the water level in the spur got too high; they will be repaired and reinforced. And then, we installed meters that remotely sensed the pressure in the spur. So, if there is any change in the water pressure within the spur, it would be detected. There are a number of things you can do. You can pump some of the water out, to make sure you're not endangering the spur in any way. In absolute worst case, it ain't going to happen overnight. If you were detecting a very slow level water in the rise in the spur, which you didn't want to pump out, in the absolute worst case, you bring the water level down, which would probably take...total level will probably come down in two days quite easily, because its a very small reservoir. So, nobody is going to drown downstream; nobody. It's

a totally modern design dam; the basic technology...and the panel we had, reviewed this. Its plain as day. You can go online and read it. It uses the latest technology, totally within everything's experience.

This is not a unique, by the way, soil; its very common throughout North America and in Norway. This is where the chap in Norway got it wrong. This is very similar to glacial deposits throughout North America and Scandinavia. So, it's well studied, well known, well design, well executed. I had no concerns about it whatsoever. Incidentally, when you're looking here now, these are the towers coming down from the Upper Churchill, going across the river; they'll tie into the plant. The island link is basically...basically done. We're done. We're just tying it now; we're in fact, what we're doing now is, you know, energizing different parts of it, with a hope that we will be getting first power by mid-year; maybe not full time...intermittently as we start it up. These things are very complex. We're tying together a system in Quebec, as system in Labrador, a system in Nova Scotia. So, we'll start...we'll be bringing this on stream...and then, the pole. This is...the DC line is two poles...two big wires and a grounding station. We can operate with just one, but there are two. So, we'll start off with just one; we want to import power, because we want...what we want to do is save money. We're bringing power from the Upper Churchill, and will cut back on Holyrood. We can save hundreds of millions of dollars before Muskrat comes on stream. The other feature here...Emera's part of the deal...they have put an equity contribution into the line. They put in about $600 million; along with interest, its $800

million. And, they're entitled with that investment to earn a rate of return similar to what Newfoundland Power will earn, which is only 8%...very expensive. I should add: when I came here, you got a whole construct of contracts, regulations, legislation, that was put in place, that didn't envisage early infeed, because it was always assumed this would come on stream with the power plant. All that's in place, and now, I want to save money by bringing it in early, and to do that, but it was never contemplated. So, I'm operating in a bit of a void. We're running off the PUB, who are not really having difficulty dealing with this. They really see money being saved and are cooperating but, what we really need to do at some point is go back and straighten all this up. At this point, I have to assume I've got to work with the contracts, and with the legislation in place. So, everything I say hereafter is based upon having to deal with what's there. We've got to go back at some point in time and straighten this up.

I think this is the last tower. You can see the size of the tower relative to the size of the people. The huge towers; you see them going across the island. There's two main lines...DC...running wires and communications cables. This is the plant outside of St John's...Soldier's Pond. I call it my 'electric forest'; you see the vehicles here. This part here is AC. What happens is that the line from Muskrat Falls comes all the way down here...DC...it comes into here, and it goes into converters to convert back to AC. These are solid state converters, which means we have software; a lot of software, which is one of our big risks now. We have people in London or England right now as I speak working

on it. Software is a risk; a big risk we face in the next little while. Will the software work? We do a lot of work on it, but you see how...how our risks have changed. We're no longer worried about working out in the snow and the rain; we're working inside, terminating things; we're working in offices getting a feeling for the software.

So, power comes in, goes through the converters. There's two; everything's in duplicate...two poles. We're gonna start operating on one. It comes in; converts to AC; this is the high voltage AC area. These are synchronous condensers. These are basically just like turbines, that just keep turning around. They're like flywheels; electrical flywheels, in a sense. They provide the momentum to make...to keep the system stable. We're also going to use at least one of the units at Holyrood as a synchronous condenser, to provide more stability; we might even get two. But, they're not going to generate anything; they're just going to keep spinning around, given what we call a 'reactive power', and stabilize the system. Not only is this finished, it's energized. So, all the lines coming from Baie D'Espoir, Western Avalon, from Holyrood are now coming into here, and coming into the city. This has been turned over to Newfoundland and Labrador Hydro; this is a controlled area here; this is operational; this is being finished as we speak.

This is a similar unit at Muskrat Falls. What we have here; the power coming down from the Upper Churchill, coming in; the power coming from Muskrat Falls itself, going into these switching controls here gas-insulated switch they call it, gets conditioned. It comes into the two converters; big transformers. Remember the two transformers we had to bring

in last spring, that nobody said we were ever going to get them through Cartwright? They came in, no problem. We had to wait a year. Great cooperation from our First Nations people; we're working well together now. So, the power comes in, is converted to DC at 350 volts, and is sent to Soldier's Pond outside of St. John's, going across the Strait of Belle Isle. Again, we're in the process of energizing switch in these areas.

Going back to the connection from Muskrat to Churchill...again, this is finished. What we did actually last fall; we weren't ready to energize the whole thing, but the old line going from the Upper Churchill to Goose Bay was falling down, and we jury-rigged part of this line to feed from Churchill down to Muskrat Falls, and, we're after using it to Goose Bay, and we're going to, as you'll see later on, we're now going to feed Goose Bay from...again, the numbers I gave last last year; still valid.

This is the switchyard up at Churchill Falls. This area up here is where the existing high voltage lines...the 735 KV AC going into Quebec. We had to tie into that system, and bring it over here, convert it to the 315 KV we use on the line going down to Muskrat...you see the towers going down. Again, we're in the process of energizing this now. The Maritime Link, being built by Emera...it is...I won't say its finished, because we started using it the other day, and they had trouble with some of their machines; the very one that brings the power. We wanted to start bringing the power now from Nova Scotia, again, to save money. They have coal-fired plants; they can generate a lot cheaper than we can using oil at Holyrood. We have an agreement that we'll bring the power in, and it's saving, until, you

know, as long as we need this. But, right now, they get their start up phase; some of their equipment had to be...another week before we can do that. But, in another week, we will be buying power from Nova Scotia, and saving the money. This is a 500 megawatt line; there's two cables, 250 each.

This is a chart you've seen last June, reflecting the cost. This is the original investment; apples to apples comparison. Sometimes, it didn't include interest during construction, because the interest goes up. This reflects the delay; two year delay. So, you're comparing 6.2 to, again, 12.7. I never had the time nor inclination to go back and find what kind of...what the problem was before I came along. I do know enough, and its my position...not a proof, but I'm telling you now that it was never going to be debt free; never. In fact, I would say that, if you were starting today, with the perfect knowledge we have, it'd probably be close to this, even with the cost overrun. So, you're probably getting what you paid for. You may have done...you had perfect knowledge, maybe a year earlier; maybe you could have saved a billion dollars. Don't know 10%. The fallacy is, it was never going to be built for this. The problem is not the cost overrun; that's the first thing to understand.

You see the different components here. This is Muskrat Falls, Labrador transmission, Labrador feed. On the sheet, I don't have Maritime Link, because right now, its being financed by Emera, but that would be 1.5 billion on top of this. So, even from the get-go, you'll see that, in dollar terms, transmission is more than generation. The scientific

method...if any of you study science, you know the scientific method. You start with a hypothesis. I studied science; I'm an engineer. When you're trying to prove something in science, you say, 'Okay, let's observe what we know. Let's put that hypothesis in place and then test against the hypothesis.' And, if we discover something different, we'll revise our hypothesis. So, for an inquiry, and for all you folks, this is my hypothesis...I'm very confident in this; I haven't gone back, but I've seen enough; I said this within two months of coming into Nalcor; almost two years later, I have no reason to change it. What's the problem? The problem are, the original estimates were wildly optimistic; the risks were underestimated. Risk has impact on costs, but also time. No question that a lot of the contractors were not used to work in our environment. There are good contractors; Astaldi is a world class contractor. They never worked in this environment. They've built hydro plants in South America and Chile. And, as we've seen this past year, once they got the experience, when they got the right people working together, we achieve remarkable results. Nobody could have done better than Astaldi this year; nobody.

Then, the poor execution. Again, we all talked about the dome and everything else. Yes, that was a fiasco; a reflection of some of this. But; you know what? They paid for that. We paid for it at the time. But, when we revised this contract to complete it, one the principles I said, it took a long time. We started off with Astaldi; we've done it with the other contractors. There's two basic principles. I said, it took three years to dig this

hole...don't think you're getting out of it anytime soon. That's one. The second principle was, we're going to share the pain. I'm sharing the pain; the people of this province are sharing the pain, but, you're sharing the pain, too. I took time to establish that, but they did, as proved...some of these contractors have lost hundreds of millions of dollars on this project. So, if you've got an image of people at Nalcor, or contractors, gone with their black masks on and with bags of money, forget it. When a project like this goes bad, almost everybody loses, except for lawyers and accountants, and, they're doing rather well. There's been more studies, there's been more inquiries, there's more supervision on this than I've ever seen. I have seven separate boards of directors. There are so many of them, I had to bring them in to an auditorium like this, and just give one presentation. Otherwise, I spend all my time talking to boards. And then, we have the Oversight Committee, the Environmental Assessment Committee; we have ministers coming in, we have civil service coming in. This has been the most over-governed project ever. And, you know what? Everybody focused on those little pieces. Nobody saw the big picture; nobody! Nobody suggested when I came in what we were going to split this project in two for better control. Nobody! Nobody suggested to me we should bring the transmission line back on stream, so we could make money for two years before Muskrat come on stream; nobody! They were focused on those little pieces with their microscopes on. That's the big picture! And now, we have an inquiry. I always knew it was coming. We had to come; day I went in there, it had to come. I mean, you couldn't have a fiasco like we've had without having an inquiry. All my hope was always, we have it after I finished, because the last

thing I need is more people coming in for an explanation. Now, I've got all my key people distracted about what they did two or three years ago, rather than being focused on what they should be doing tomorrow.

But look: I understand this; its the real world. But, you have to understand me, too. Yes, I'm as interested as you are in how all this came about. But, my task is to get the job done, and by God, that's what I'm going to do. When you get all these studies, and these things, one of the things you're worried about is, 'what are the requirements? How much energy do you really need?' So, people are doing studies for 40 or 50 years. Can you imagine? I can't predict what the energy load is going to be two years from now, but, you've got to assume something. Well, they assumed something; the assumptions were reasonable, but, you know what? You dropped about 80 terawatt hours. As you'll see later, if we're going to collect the costs of this thing based on energy, now, we've got fewer kilowatt hours to spread it over. So, one of the assumptions has been this; now it's down to here.

So, what does all this mean? What I'm talking about here is the delivery of energy, energy from Muskrat Falls. So, this is what Hydro needs to serve the people on the island...the bottom line. This is what Emera's entitled to; this one. The first five years are different than later on, but, let's concentrate on this, and what happens in years out here we'll worry about then. This light blue is what Hydro initially thought it wanted to serve the island, but, because of that load drop in load, we now have to sell in the open market, in addition to what we always thought we had to sell. So, this is what we actually need...about one

third of the energy of Muskrat is what we need; one third. About 25% goes to Emera for building the line; so, no revenue there. Then, we got 40% to make up. The big assumption that went wrong here; another big assumption. I've said this...I've said all this before, by the way. This is nothing new. I said that the big assumption in the Upper Churchill was the energy prices back in the 60s, which were low, would stay low forever. There was the big fallacy assumption in the Upper Churchill. When this deal was done, the underlying assumption that high energy prices of seven or eight years ago; they were high back then... not only would they remain high, they would continue to increase, which meant that, as you went to sell this energy up here, you would make all kinds of money. Energy was selling about 7 cents a kilowatt hour; going up.

So, where's energy today? We probably get 2 cents a kilowatt hour, and no prospects of going higher, because of cheap natural gas in the United States; if you got natural gas, you can make electricity. So, we made the assumption that energy prices are going to keep going up; they've gone down. You built something three times as big as you needed; you leveraged; you bet that the prices to sell are two thirds going to go up; it went down. The analogy would be: you need a new house; your mother in law is going to move in. You have an option: 'I can do my basement at my house', but, you have a great idea. Housing prices have been going up. You say 'Okay, what I'm going to do...I'm going to build, not one house; I'm gonna build three new houses. I'm going to sell; I'm going to give one to the contractor who build it, then I'm gonna sell the third one, and make all kinds of money,

and I'm going to be doing great. I speculate as to the housing prices going up; housing prices collapsed. Now, you're stuck with three houses. You speculate; you didn't need to do it, and that's where we are today.

When I came here, I was two years...I said 'How do I convey this to people?' You don't understand billions of dollars. Billions of dollars. You don't understand. You don't understand megawatts, gigawatts, terawatt hours. People don't understand that. What they do understand is kilowatt hours; cents per kilowatt hour. So, I came up with this methodology, and this is exactly what I gave last June, to help make people understand what this is all about. So, I translated it all into cents per kilowatt hour. So, you look at the first pie chart. The purple represents the cost of generation at Muskrat Falls; its 7 cents a kilowatt hour. So, if everybody who's buying the power at the bus in Muskrat Falls, and paying the same thing, they'd pay 7 cents a kilowatt hour; a bargain. If someone could build a hydro plant, and level out your cost next 40 years, say, 7 cents a kilowatt hour, you'd take it. So, the problem here is not the cost of Muskrat Falls. It's a very attractive plant in its own right. Even with the cost overruns, the price of energy at Muskrat Falls bus is very attractive. But as I pointed out earlier, you've got a transmission system which in cost terms is bigger than the generation. You've got two, you go Labrador in-feed, you've got the – the Labrador transmission assets. So, power that costs 7-cents on the bus at Muskrat Falls, brought to Soldiers Pond outside of St. John's, if everybody is going to buy the energy now, and pay the same price, we are all going to pay 17.5 cents outside of

St. John's. Well, if I could take 17.5 cents, I'd take it. That's not bad. Levelized price the next 40 years. I mean, you're paying right now to Holyrood, you're probably paying 13 cents for fuel. Not bad, right? No. That's made up - you look at a different way, where is this cost coming from? You've got – you got – you got the depreciation to pay for the assets, you've got the interest payments on the loan, you've got operation maintenance costs, you've got to pay – you've got to pay Emera for the investment on the Labrador link, and you get a little bit of profit here. That profit, by the way, the Province is close to $2.7 billion invested – about $2.7 billion equity. So you need that to give to the Province just to pay the interest. Yeah, there's profit there - for Nalcor. Now, there's a public policy seemed to be made by Province, how much is going to be taken dividends, how much will be subsided rates, but that basically was just enough to cover the interest of the province. Okay? So now we're up to 17.5 cents. Okay? We're all going to buy power at Soldier's Pond for 17.5 cents. But don't forget the Newfoundland consumer, Internet-connected consumers on the island is going to pay – get one-third the energy, but is going to pay the full cost. So the 17.5 cents had to be multiplied by three because Nova Scotia going not going to pay 17.5 cents and we're only going to get about 2 or 3 cents or some of the rest of it, which is pretty well nothing. So if the Newfoundland consumer is going to pay for it all, will only get one third, the Newfoundland consumer is going to pay close to 50 cents. That's the problem. It got nothing to do with the fact that this was a real expensive generating plant. Yeah, it didn't help, the cost overrun. But you got a contract that bound - bound you in for at least 35 years and you're stuck. So what does that translate into?

So when this thing was sanctioned this was the estimate of costs. Don't forget now, when Hydro - Hydro is going to take the energy from Muskrat Falls, but it's going to alter cheap sources on the island so it all gets blended in. And Newfoundland Power got to get - get its costs paid. So when you add all this up, this produces a rate of about 22, which is what I said first year I was here. Changed a bit because we've got a federal loan guarantee that brought it down, we got cost increases for something from the contractors have brought it up. So we are basically back where we were. Don't worry about this out here; it was assumed that Nalcor would make more profit, and this is all a pipe dream. So when I took the job I was - my mandate was do two things: bring Muskrat Falls under control, bring it to good finish; do what we can. There's no question we had to finish it. We are about 80 per cent committed. You just can't go back and say, “I don't want that contract; give me my money back.” Even if you did you have to - you're still going to replace Holyrood. You had to finish it. There's no other way of getting through it. So, what did we have to do? We had to get more money for the loan guarantee, otherwise the Province is going to go bankrupt - really. That was done. We're now working on bringing transmission in-feed in the vast of Muskrat Falls. You know, we can save maybe, you know, hundreds of millions of dollars, depending on energy prices here and energy prices in the Maritimes, bringing in the power. See we're selling the excess power from the Upper Churchill - we'll only get about 2 cents net by the time we pay Quebec. Energy prices have collapsed. So we're getting 2 cents per kilowatt hour, fuel at Holyrood alone is costing about 13 cents. So we can save more than 10 cents a kilowatt hour for every kilowatt we bring in. It adds

up. Then, note this word “targeted”. Remember I said earlier, we don't have a lot of capacity. So we have to find customers whose needs match what we have and maximize its value. Not only that, but we want to bring in, like, we're doing - we're going to do next week. Right now, Nova Scotia generates electricity cheaper then at Holyrood; they're using coal. We will buy power from them, displace the oil. So instead of using that link to export, we'll import. And we're going to be buying power because we're not selling it. I mean look at Ontario. Because their nuclear plants are based, loaded, we can't just turn back the dial on a nuclear plant. If in a given moment in time, they don't need that power – actually, Ontario pays Quebec to take their energy. They pay Quebec to take the energy, Quebec backs off its hydro plants, its reservoir, and get paid for taking it. We have access to some of that, too. We have, don't forget we have a 250 megawatts through – through Quebec and we’ve been talking to Ontario. So we will be trading power - if we get, as regulatory contractual constructs sorted out, and we will.

So, where are we? 2018. What do we want to do? Remain safety-focused. I haven't spoke about safety. You know what? This project has been outstanding to safety, absolutely outstanding, long before I came along. Right from the get-go, this was safety-driven. No fatalities. The culture at Nalcor is outstanding in safety, has been – always - that's the first thing we can think about. So we want to maintain that. Then we want to complete the transmission line and have them energized. Basically one pool operating intermittently by mid-year. We have our challenges. But right now we're on track. Generation – again, safety

focused. We want to install those turbines and generators for 2019. First power 2019. Don't forget, now, the way the contracts are written, Newfoundland gets the benefit of the first two units - total economic benefit. Nova Scotia only starts to get the benefit when the third unit comes. The fourth unit is almost, basically, you know, back-up. The first unit is very important to us. A lot I had – I wanted – I had tend to say and have cut off because of time constraints, but I tried to do that as I went along. But I hope by now, you know, if you start to see a big picture. And when I said - you know, you look up the definition of "boondoggle" on Wikipedia, it uses my quote as an example. Man you've made it. You've really made it when you're used by Wikipedia as an example in a definition. So, is Muskrat Falls a boondoggle? If it is, is it because of the cost overruns everybody's focused on? You know, a boondoggle doesn't require a cost overrun. A boondoggle's a thing which is a big project, behind schedule, usually driven by public policy with no economic advantage. There's benefits to this. The problem's not really cost overruns. I think you see that now. The problem is the - the construct - the construct that was entered into. I spent 40 years in utility business. The fundamental principal – you know, electricity is essential to our society. Because it's essential, your mandate is to provide electricity very reliable at least cost. That's what your focus is. Was this developed to do that with this construct? Or was this a public policy decision? If it was a public policy decision, and that's - it's perfectly valid for a government to say we want to develop a resource because they're going to create jobs and positions for the future, make us an energy warehouse, excluding the PUB. The PUB doesn't have the right to be - that public policy thing. This is a – this is a public

policy, broad public policy. The politicians have the right to do and should do. Maybe it was done for that reason, which is fine. You can't argue with that. We elect governments, they make decisions, civil servants execute. If it was done for that reason, fine. If it was done as a public utility exercise then you have serious trouble. Because this was never going to meet that mandate. You know, it's very difficult to make projections per year. A lot [inaudible] made projections for 40-50 years. The thing you do when you make those type of projections, you should know you're going to be wrong. Right? You know you're going to be wrong. So the question becomes what flexibility did you give yourself to respond when things change? When you lock into long-term contracts with others, you have no flex. If you build something for your - meet your own immediate needs - if you built the one house instead of three, you wouldn't have been exposed when the market collapsed. So as I said, the assumptions in Muskrat Falls – that high prices of oil electricity would go on forever, the demand for electricity in this province would keep on rising. Of course, when the prices collapsed in the United States, everything was set up for the boondoggle. The project was too large for our needs. We took an enormous risk. This is a huge compared to the economy in Newfoundland. So we speculated and lost. So, rather than become the answer to a problem, Muskrat Falls became the problem. It was not the fault of the people who were called upon to execute. Although, there problems of execution; no question about that. To a large measure, the contractors have been called upon to bear the burden of a lot of that and you're basically getting what you're paying – paid for. Things change; it doesn't have to be a boondoggle forever. Sydney Opera House

was called a boondoggle when – no longer viewed that way. There's things we can do to mitigate the cost of this. There's other advantages we could achieve. In 20 years, the – the Upper Churchill come back to us. The skills we are going to acquire now with High Voltage DC. All these controls, all this experience we'll have with the cables - will be useful when that happens because it gives us more options. So, don't despair. We're making progress - making real progress. But it's a marathon, not a sprint. And for goodness sake, stop focusing on the minutia, and look at the big picture.

So, in closing, mega-projects. I – I've express - sometimes expressed as five sometimes expressed as six. If it's governed, you'd sometimes talk about seven. A mega-project starts off wild enthusiasm. Can you remember that? Big announcements, followed by endorsements from everybody. It's wonderful. But then comes disillusionment. The reality sets in as forecasted budgets go out the window. This starts before the first spade goes in the ground. Then, third – confusion, panic, hysteria. Who are you going to call? Whatever happened to Stan Marshall? Anybody got his number? Four is the search for the guilty. Who's responsible for the boondoggle? No one's going to admit it. Not me. That's where we are now, right? So, going forward, we look at steps five and six. Number five - the punishment of the innocent. The people who created this and were responsible are long gone. So let's punish those who are left trying to correct the problem. And finally, phase six. After project is finished, it's time to reward the uninvolved. Well, as Dr. Bruneau, my former boss who this building is named after used to say, “the adoration of the uninvolved”.

Everything that has been - could be done to fix their problem has been done. Bring up the carpet, hang the banners – lights, cameras, we're done. Except if you're Government. Government sometimes says a sixth = seventh phase which is - because governments have an inverse learning curve. When they make a mistake, they – the conclusion is “we couldn't possibly have made a mistake; we better try all this again.” So, questions. I still got a few minutes.

WADE LOCK: [inaudible] ask the questions, put your hand up and move to the microphone.

UNIDENTIFIED: $135 per barrel of oil going on for 50 years. What else was there? Making wind power illegal. There was a number of steps to Muskrat that passed the bounds of credibility and go straight into what appears to be a fraud. Now, the question I have for you guys is - because it's not just you; we have the previous management, we had the PC party, we have the Liberal Party. And I'm wondering if you guys understand that a person who wilfully and knowingly poisons an entire population, puts thousands of people at physical risk and risk of death; and destroys the future of a province based on what appears to be a longstanding and systemic lies and fits the textbook definition of what used to be called a sociopath and is now called an antisocial personality disorder.

STAN MARSHALL: What's your question?

UNIDENTIFIED: Do you understand that? Like, do you -

STAN MARSHALL: I understand what you're saying but what's the relevance?

UNIDENTIFIED: Well, it's -

STAN MARSHALL: There's no relevance in this project.

UNIDENTIFIED: No, I'd say there's a fair amount.

STAN MARSHALL: We're not poisoning anybody.

UNIDENTIFIED: What's that?

STAN MARSHALL: We're not poisoning anybody or putting anybody in jeopardy.

UNIDENTIFIED: The Harvard study suggests otherwise.

STAN MARSHALL: Anybody got a real question? Here.

UNIDENTIFIED: Thank you for your presentation. Mr. Marshall, you said not one fatality resulted from this project, but I can think of at least three. There was one on the West Coast and two here on the East Coast after a line collapsed. So, I just wondered if you can speak about those? Were they different parts of the project? Is that just a confusion? And if - if you're wrong about that, what else are you wrong about?

STAN MARSHALL: No, I'm not wrong about that at all. The two fatalities were on line

267, the line from Bay d'Espoir to – to Western Avalon. They're not part of the – this project. And the other part was on Emera's line. So they weren't involved – the Maritime Link, but they weren't on this project, they're separate. Yeah, but I mean, I'm fairly clear that [inaudible] Muskrat Falls. The safety – the safety record of this project is in international terms with projects of this size – outstanding. --- On our work, but not at Muskrat Falls or in the lines coming into Labrador. There are two questions over here.

UNIDENTIFIED: You mentioned the cost could be 50 cents a kilowatt hour for Muskrat? In your presentation three times or 70.

STAN MARSHALL: Yes.

UNIDENTIFIED: Could you expand on that?

STAN MARSHALL: I thought I did. What happens is that the line coming - the power from Muskrat alone is about 7 cents. When you pay for your transmission, it becomes 17. And because Newfoundland consumers are taking one-third of it, but paying for it all, you multiply it by three. So, that's what, in fact, the Newfoundland consumer is paying from the energy from Muskrat. That's not what the Newfoundland consumer's going to pay because it will be blended with other costs. When you get a blend with other costs, it's going to be around 22 cents. Now, they're trying to reduce that; that's their mandate. We're going to do something there. But you can't - because of this construct, you can't change the big picture. We'll chip away at that, do what we can. But, you know, it's a contract.

You've built something three times as big as you need it.

UNIDENTIFIED: Thanks. One - I've heard that the monopoly legislation that was put in place for the sake of the loan guarantee is in conflict with the FERC regulations governing energy in the U.S. Can you tell us a little bit about that? Is that - is that a worry for you? Is this going to be resolved?

STAN MARSHALL: I don't follow you.

UNIDENTIFIED: The monopoly legislation that was put in place by -

STAN MARSHALL: Yeah, the monopoly is that the - no one else can sell to Newfoundland & Labrador Hydro. Generate and bring in here. Let's make sure you – look, if Newfoundland consumer is going to pay for it, if somebody else going to come in – The Newfoundland consumer is going to pay for this. You're going to pay for it; I'm going to pay for it. Are you going to make it worse by allowing somebody else now to come in and - with cheaper energy and add to your problem? We've got too much energy and we're trying to sell it. Now, are we going to allow somebody else to come in because we're stuck with this construct at high price and it gives us more energy, we've got to sell it local – So, we end up buying power, say, at 7 cents, and selling it at 2?

UNIDENTIFIED: I understand that's - that's - that's a troubling possibility, but – but I've heard that FERC requires that Newfoundland Hydro be able to -

STEVE MARSHALL: Well, see, the whole construct was there to underpin and provide security to the lenders to make sure they got paid. That's what all this is about. That's why the constructs are in place that you had to do this and nobody could interfere with it because the thing was very difficult to finance. I mean, you couldn't have financed this without the federal loan.

UNIDENTIFIED: So you don't see any conflict with the FREC regulations and [inaudible] legislation, as some people have said in the media.

STAN MARSHALL: No. Not a conflict.

UNIDENTIFIED: Mr. Marshall, you made no reference to water management. There's no reference demand compression as a consequence of the, you know, of rates hitting 17 cents plus, in particular, you referred to enthusiasm primarily in the context of the original estimate. Now, enthusiasm is typically not something that engineers would ascribe to a pretty detailed process and sign off - that would be conducted over a lengthy period of time involving probably a good many engineers and probably reviews at the executive level. Do you really ascribe enthusiasm to the original project estimate?

STEVE MARSHALL: No, I didn't use that word in that context. I said – I was talking about the phases – well, enthusiasm, I was talking about – not the engineers who were working on this, but the people who were making the announcement. There's a bit of humour here, too. You don't be – don't get too deep into this.

UNIDENTIFIED: We're not laughing anymore.

STEVE MARSHALL: Always keep your sense of humour. Or try to anyway. No, no. The engineers worked a long period of time. There's an interesting article posted by – today – Ed Hallett - you might want read that - on – I saw it on – where'd I see it? Ed Hallett's blog? The reference there? Its in amongst the papers there. He was making recommendations for the Inquiry. He was talking about some of the stuff. The real question, you know, in all this is - what was a political decision? What was an engineering and utility decision? I don't know. But that's – that's going to be core to what the inquiry has discovered, so it's, I mean, that's I think that's the point Ed was making today. I mean, this doesn't didn't start in 2010. People have been looking at developing Lower Churchill since they built the Upper Churchill. --- Go ahead.

UNIDENTIFIED: Stan, with reasonable estimates of demand elasticity for electric power, is there any likelihood that we're going to find ourselves in a situation where we got big power plant and Muskrat Falls and no demand for that power whatsoever. What – I mean, what assumptions have Nalcor made with regard to the demand for electricity? Because what I've seen - I've seen a number of estimates from other jurisdictions, some research been done in Newfoundland not yet in the public domain, but it suggests to me that demand elasticity is such that if you get a doubling of prices, what's going to happen is you're going to make - have a massive collapse with electricity demand so that instead of 7 terawatt hours, we could be facing a collapse down to 4 terawatt hours. What how how

can we deal with that kind of a situation?

STAN MARSHALL: We are trying to deal with that. The first thing we do is try to mitigate - pre-mitigate the costs and throw a - build up a pot of funds that you can actually faze any increases. Risks – actually, rates are rising. I mean, you talk about 22 cents as outrageous. But Nova Scotia is already up to 17 cents. Ontario - if Ontario were facing the full cost of electricity now, they'd probably be there already. So, you know, electric rates are rising. When we did the analysis there I think we were assuming that prices around 17 and 18 cents a kilowatt hour. But it is the price elasticity, no question. But I think we're going to phase in this increase to avoid a disruption. My experience over years, you know, different jurisdictions we operated in at Fortis – I mean, I saw prices as high as 50-cents a kilowatt hour in the Caribbean. Yes. The big thing is to get people is sudden changes. People learn to live over time and rates are rising everywhere except the United States because of shale gas, but in Canada because of misguided public policy like you see in Ontario, big time. Rates that are there, are rising, and we're subsidizing rates and they're gonna - that can't go on forever. So rates are rising everywhere. I think a reasonable target for us is rates comparable to Maritime Canada. There's things we can do to mitigate. There's things we can do to phase in the increase. And we still have time to do some of those. We're working on it.

UNIDENTIFIED: ... about the North Spur?

STAN MARSHALL: Yup.

UNIDENTIFIED: I wanted to ask you what does due process look like in your eyes? You have talked about this Norwegian expert who happens to be a Swedish expert and there's not just one of them; there's a - there's at least three of them. But, you – what – we talk about due process, you talk about a – an expert panel that you have appointed. That expert panel has decided they're going to put out a three-page paper within the last few days basically telling the world that these Swedish people have no expertise. They haven't had an opportunity to come and speak across the table. I mean, I have a background as a chairman of a quasi-judicial board. And what I would like to see is I like to see independent experts who were not hired by the proponent and I'd like to see cross-examination. I'd like to see these Swedish experts being cross examined so they have an opportunity. So they're not marginalized, they're not marginalize. When you talk about the fact you may have all the confidence in the world that the North Spur is safe, and you have more expert engineering expertise than I have. But I don't take yours - your word because I don't believe in your definition of due process. And I – what I – what I would like to do is I'd like to sit in your office across the table and talk about due process as it relates to the North Spur.

STAN MARSHALL: You've been in my office twice. My office – I've got an open-door policy. Everything has been examined by so many people. Everything we're not going to do is not to be gone before some judicial inquiry and analyzed. We have a quality – highly qualified engineers there as we did to the design of the turbines, the generators, every

other piece. I see no difference in it. Your man is the one man out of step, so be it. Now, if you want to pay for it, go right ahead. My task is to keep - try to keep the costs here under control, which is very difficult when everybody wants to study everything else to death. Where do you stop? What's reasonable? When you've got four highly-qualified PHDs in this area reviewing it, viewing it, living with it. Look, yes – and we want more of this come and not pay for it. And I'm going to pay for that, you're going to pay for them, too. So, they're always going to pay. Does that make them professionals biased?

WADE LOCKE: David, there's another question in the back. David?

SPEAKER 1: Is it working? Okay, My name, again I've only been working in the power business for at least as long as you have. When I saw the first discussion in the paper about North Spur, I was quite concerned because Gilbert Bennett who was reported on was giving the information didn't seem to appreciate the problems that could arise with sensitive clays. My advice at that time was that Nalcor should hire the best experts in the world to support them on this design. I also asked that these people be introduced to the public that we know who they are, what their backgrounds are. And I was hoping that we'd have a chance to hear them talk in public. Nalcor has never given me that courtesy of naming these people in public. You talk about experts who are they? Experts have names, they have reputations...

STAN MARSHALL: Are you talking about the North spur report, the review?

SPEAKER 1: I have followed it off and on.

STAN MARSHALL: It's on our website. The names are there.

SPEAKER 1: I have asked that their names were made public. And I was hoping that it would be done in the Evening Telegram as a matter of fact. I know who the names are now but that's not the point. I think the point is that there will be a lot more confidence in what Nalcor is doing if you are more frank in explaining to the people how you approach these things and who you have engaged to help you along the way.

STAN MARSHALL: I can't see how I could be more frank than I have been here this evening. A question over here? Here too.

SPEAKER 2: Hi. First of all thanks Wade for the Department of Economics for organizing the session. It's fantastic so thank you for doing that and thank you Mr. Marshall for offering yourself to the public like this. I think it's important to in a democracy for public servants to answer questions. We appreciate it. When you took over the role did you think about cancelling the project and if you did and didn't cancel it what would have been the reason? Would it be because you thought the project was still good going forward? Was it because there was kind of a poison pill involved there were too many contracts signed you couldn't back out of it or there were loan guarantees? Why would you have continued with the project that you thought was very difficult?

STAN MARSHALL: That was a possibility I considered when I came into it. But when

you considered that Holyrood had to be shut down and you need something to replace Holyrood first of all, you need something. You've committed to supplying Nova Scotia with 160 megawatts of energy for 35 years. So you got to replace Holyrood, you've got to get energy for Nova Scotia. You look at the contracts that have already been signed for all these things. And so you are committed to paying about 80 to 90 percent of the cost anyway. So if you cancel it that means it's a total loss and you had to start over do something to replace Holyrood, something to supply Nova Scotia for free for 35 years. So it's pretty obvious you had to finish it. No question.

WADE LOCKE: We have time for about three more questions.

STAN MARSHALL: Some up here?

SPEAKER 3: Mr. Marshall, you talked about the economics and you talked about how great this project is but I have to ask you have you considered the ramifications for the people who are living downstream. The people who are constantly living in fear not sure what the North Spur is going to do or is it going to move or if it's going to stay put. What have you done to reassure these people downstream that their lives are not going to be in jeopardy? The other thing is, the other question I had was I would love for the public to be able to view the core samples that came out of the nine holes that were drilled in different sections of that area you know what I'm talking about right?

STAN MARSHALL: No.

SPEAKER 3: Well Randy, you heard about Randy this morning - Randy was an engineer that worked on that. And Randy was saying that you went down 420 feet but you could not find bedrock. Did you acknowledge the fact that there are aquifers that run underneath that North Spur? Are you aware that that the drainage is all the same portion of land where the slide occurred? Listen I'm no engineer I'm no expert but you need to start having more empathy and putting faces with these numbers and these statistics. Newfoundlanders and Labradorians are paying a dear price for this. There are people suffering right now for this project, senior citizens. It's all hooked into the same thing. You say there's a detachment between Muskrat Falls and what's happening in this province. You put this province - Nalcor has put this province on its knees and there are people begging to have some sense of purpose in this province and Muskrat Falls has been the ruination...

STAN MARSHALL: What is your question?

SPEAKER 3: Well you've got a question, you heard my question.

STAN MARSHALL: Have I considered it? Yes.

SPEAKER 3: You can talk down to me.

STAN MARSHALL: Let let me answer the question.

SPEAKER 3: Condescending, your attitude is very condescending to a lot of people.

WADE LOCKE: Okay thank you for your question.

SPEAKER 3: My question is can you reassure those people downstream their lives are not in jeopardy?

STAN MARSHALL: Yes. I have. I go up to Labrador. I was up there in December to talk to the Circle. All that work has been done by many highly qualified Geotechnical engineers, many of them. All these factors been taken into account the design. I've talked about some of them the single most important thing what we do is safety not only for our workers, for the public including the people downstream. I've been in this business 40 odd years. I've never put people in danger. I'm not doing that now. Why would I? Why would I knowingly put people in danger? And by the way I didn't start this project. I came here to help out. Yes I'm responsible for it now, it's totally my project now and everything that all these things that we're asked I've investigated and satisfied myself and my responsibility is to do what I can. Look people, yes people are live in fear. I can't help them. All I can say is everything reasonable that can be done to protect their safety, according to experts who worked on this. I personally see no danger. We have greater danger of being killed by a plane falling from the sky and you are of flooding from the North Spur.

WADE LOCKE: So we have time for two more questions. There are two people there Sean and some other?

SEAN: Thank you Mr. Marshall. Am I on? This is not so much a question as a comment but I think comments are justified aren't they? We listened to you for an hour and a half, I

have about a one minute comment. You told us to stop looking at the small things the minutia but look at the big picture but it seems to me that you're looking at the minutia. That is that you've told us that you've done your job and I don't doubt that you have – you took the boondoggle and you brought it into order. You did that and you've done it safely and you brought the project to its completion. But isn't that just the minutia? Isn't the real issue here a couple of things you haven't mentioned – environment, the erosion of Newfoundland democracy I mean at its absolute lowest right? This project if anything else was a complete disaster for democratic process in Newfoundland Labrador it brought us to a point of hunger strikes a year ago for example, absolute confusion, a lockdown on an information flow to the point where nobody really knows what's going on and we all have to come in here and have you explained the project to us after it's ballooned to 12.7 billion dollars. More or less condemning everybody in Newfoundland and Labrador to a future of deep economic uncertainty. These are the issues. That's why we came out not in order to hear you explain how you brought the boondoggle to order but to understand something of what's going to happen to example for to the Innu and the Inuit whose lives are forever changed by this. How did we get here and what are we going to do to reconstruct our faith in democracy in Newfoundland and Labrador after something like this can happen? You speak about about how we needed to replace Holyrood. Certainly we needed to replace Holyrood but do we need such a dam to replace Holyrood? And exactly whose coffers are being filled by this project? It's certainly not the people here, well perhaps it's people in the room I don't know who these people are but the people in this province you know so

I mean these are the issues that I thought we were going to discuss tonight. Instead we heard that you've done a good job. Well congratulations.

WADE LOCKE: Thank you Sean. There's one more question here.

SPEAKER 4: In 2040 I noticed a lot of your chsrts go to then and that's when the contract with the Upper Churchill ends. I'm wondering if you could do a bit of crystal ball gazing and tell us what you see happening in 2040. It's right around the corner as far as I'm concerned. And do you see any possibility of something like an east-west grid. Churchill Falls - Muskrat Falls all tied into North American power distribution source?

STAN MARSHALL: Finally a question, thank you. Yeah I think, that's the other thing we all need would be considered here is look at a lot of stuff was done of analysis of 40 odd years failed to recognize in 20 years we have all this power back from the Upper Churchill. So it really it should have all been done til we have access to the Upper Churchill and a lot of power and capacity. I spoke at the Eastern Premiers and New England Governor's back in August in PEI and we had the Premiers from Quebec there and PEI and the North East. And I spoke about this and said look in 2041, 5500 megawatts of power is going to have to be repriced. That we know. And let me tell you it's going to be a whole lot higher than .2 cents a kilowatt hour. And that's going to change the whole dynamics in the northeast. And when you look at Quebec, people don't really understand even today that Quebec has a lot of energy. The problem we got here a lot of energy and no capacity. They are running out of capacity too and they can't afford to lose 5500 megawatts. So it has to

be discussion long before 2041 because as you see here it could take a decade to build a new hydro plant. So 20, 23 years away is not long. There will be discussion, there has to be discussion but I'm not aware of any.

WADE LOCKE: Okay. Just before we thank Mr. Marshall for a frank discussion. Just so you know if you're interested. He's gratefully agreed to allow his presentation to be available for you tomorrow. So we will send this out on our Twitter account tomorrow and you can look at. And we will put it on our website as well. And just so you know this has been taped so we will have this available on our website within three business days or something like that so we'll do you know about that as well. And I want to thank Mr. Marshall for his enlightening talk. Whether you agree with talks or comments that people make is kind of irrelevant I mean the issue comes down to you need to have a discussion as part of a democratic process, Sean right? So you know we don't have a problem with what was discussed here tonight or what the questions were either for that matter. Thank you for coming to drive safely at home bye.