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Chair

Mr. Lee Richardson

Standing Committee on Natural Resources

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● (1535)

[*English*]

The Chair (Mr. Lee Richardson (Calgary Centre, CPC)): Order, please.

We will begin this, the 51st meeting of the Standing Committee on Natural Resources.

I have a couple of housekeeping details to discuss with the committee, so I'm going to ask our witness today to bear with us just for a moment. I apologize for that. But we have a bit of a change in the upcoming schedules and I just want to get the views of the committee before making decisions on those matters.

The first one is that we were expecting a visit next Tuesday from a delegation of Mexican parliamentarians, and their trip has been delayed one day, which certainly can be accommodated with regard to their meeting with us. We had suggested we were going to get together on Tuesday for a separate meeting of about an hour and then go to dinner on Tuesday night, if you'll recall. I think we could make arrangements to incorporate a presentation into our Wednesday meeting, because we are just going to be discussing the report, in any event. And perhaps following that, if they came to the second half of the meeting, we could then go for dinner on Wednesday night, if that fits people's schedules.

The one obvious concern would be that there might be votes, but even at that, we could have them make a presentation for an hour, until 5:30, and we could go to vote and then maybe reconvene at 6:30 for dinner.

Let me leave that with you for a minute, if you want to check with your offices over your BlackBerrys or whatever during the course of the meeting, and we could maybe make a decision at the close of the meeting.

Mr. Christian Ouellet (Brome—Missisquoi, BQ): Is it this week or next week?

The Chair: It's next week. June 5 and June 6 were the days in question. June 5 was the day they were to appear; they now will be in Canada on June 6.

I'll leave that with you. We'll discuss it again at the end of the meeting, but I just wanted to give you those parameters so that we could accommodate them in that regard.

In addition to that, I think we will have the first draft of what we've heard so far from witnesses available tomorrow or Wednesday morning. We're getting the translation completed. We'll try to get that out tomorrow so you can at least have a quick look at it, and then we'll start consideration of that on Wednesday of this week.

I think that's all the housekeeping business we have for the time being.

We welcome our first witness today, Christian Vachon, from Enerconcept Technologies Inc., pursuant to our study of the greening of electricity consumption in Canada.

Mr. Vachon will begin with about a 10-minute presentation and then be open to the committee for questions.

Please begin.

Mr. Christian Vachon (Engineer, Business and Technological Development, Enerconcept Technologies Inc.): Thank you, everybody, for inviting me. It's my second time here with you, as I was here last year in June.

Talking more specifically about solar energy in Canada, I think there's enormous potential. Most of don't think there's enormous potential for a northern country like ours, but there is and it is untapped. I would like to show you today what this potential is, what technologies are there, and whether we can do something to improve our situation relative to the rest of the world.

I was asked first to show you what I've done in the past personally. I'm an engineer, and I lived in Austria from 1991 to 1995. That led me to learn a lot more about solar energy because it is widespread over there. Following that passion, I did a master's degree, specializing in that very field of solar heating, at the University of Melbourne in Australia, and then I started my own company in 1998. That leads to about 15 years' experience on the ground for solar energy projects, mostly solar heating, and I will tell you a bit more about that later. Over the years I was also involved very much with the Canadian Solar Industry Association and the various committees of the department. We do work internationally as well in the Caribbean, Europe, and also in Africa.

I'll go on to the next slide. I don't know if you can count the number of zeroes followed by kilowatt hours, but if you look at the amount of solar energy we get on the planet in 20 minutes, the sun gives us as much energy as the whole world spends in 20 minutes. That's basically what it amounts to.

Is there an abundant resource there? There is. To tap into this abundant resource there are three technologies. Sometimes we tend to mix them up, but the first one is photovoltaics and it makes electricity. So that's one technology: “photo” for light and “voltaics” for producing electricity. Then there's water heating. Of course we can heat water, and also we can heat air with the sun. Basically, those are the three main technologies.

If you look at how it applies in Canada, here you have the energy needs of typical Canadian homes. You will see that most of the energy that we need from one ocean to the other, of course with variations, is for space heating. Again, it will vary from province to province, but it accounts for about 60%. This is where solar air heating or water heating can help. There is 22% now going to water heating in general. If you look at the bottom, you'll see that lighting and using computers and appliances accounts for about 20%. That's where each technology can fit it in: photovoltaics for making electricity, and solar space heating by water or air.

Specifically for space heating, do we have good conditions or not? The answer is yes, and it's climatic conditions that we're talking about. The graph is pretty clear, for example, when you look at numerous cities in the world and then Canadian cities. On the axis below, the further right you go the more heating needs there are and the colder it is. The further you go to the right, the more heat you need.

The axis, going up, shows winter radiation. The further up you go, the more sun there is in the winter. For example, in Helsinki, Oslo, and Moscow you can see they need a lot of heat, just like us in our major cities, but they don't have as much sun as we do. If you look at Flagstaff in Arizona, there is a lot of sun, but they don't need as much heat as we do.

The upper right-hand side of that square is basically where we stand. Toronto and Halifax are good, Montreal is even better, and Edmonton and Winnipeg are probably the best spots in the world for solar heating. I think that is something very important that we need to keep in mind, to have a worldwide perspective. We're probably, along with Siberia, the best place in the world to have solar heating.

● (1540)

If you look at the unit cost of each of these technologies.... It was meant to be a PowerPoint presentation, so you can see the little arrows coming down, but I think it's fairly clear the way it is. On the one side I put PV, for photovoltaics.

Sometimes we tend to mix up the technologies and say it is expensive. If you look at solar electricity, the current state is that it costs 30¢ per kilowatt hour to make electricity with solar. If you look at all the other technologies—SDHW, which is solar domestic hot water, solar pool heating, solar air ventilation, and passive solar—they're all under the 5¢-per-kilowatt-hour mark. That's using, of course, the method devised by Natural Resources Canada here to calculate the cost per kilowatt hour. They basically take all the energy produced by the collector over 20 years. The initial cost, divided by all the energy produced, gives you a cost per kilowatt hour. That's it. They put a maintenance cost on that, an interest rate, and all accounted for, that's what we come down to.

That is with current technologies with no subsidies. So the only barrier to the full expansion of solar technologies, basically, is the initial investment hurdle. That's all there is to it.

I often use the analogy, for example, of a major dam in Quebec. If we build a major dam and it costs $2 billion, the day the dam is finished, do we charge every single citizen in the province $15,000 to get the dam into operation? We don't. We just transfer the cost over the next decades, and what we get is a fixed cost per kilowatt hour.

Solar energy is the exact opposite. Customers who want to go for it have to basically pay up front and then benefit from the savings.

Surprisingly, some countries have really taken a major lead in the world, and not the sunniest countries, as you will see. This curve here shows the progression of solar domestic hot water systems in Austria and in Canada. Some of you may remember that in the 1980s there were generous subsidy programs in Canada, so basically an industry developed up until the mid-1980s, and I think the magnitude of this industry was an $800 million turnover in North America; the same curve of solar applies for the U.S. So we were ahead of European countries at the time. And then the subsidies just dried up.

But in countries like Austria, and Germany later on, they kept going. But you see the curve for Austria here, a country of 7.5 million people, with about two-thirds of the sunshine we have; it developed into a multi-billion dollar industry.

If you happen to go to Frankfurt in mid-March or to Intersolar in Freiburg, Germany, at the end of June, where we're going to be an exhibitor...you're talking about a major industry. We're talking about trade shows that look like the heating and cooling industry in North America. It's huge.

Most of us, I find, don't realize that it's become a multi-billion dollar industry over there. Countries like Austria, Germany, Sweden...France is now picking up. Spain is doing really well, and Italy is really going up.

If we look at another technology called photovoltaics—again, just giving information on the three technologies—and if you look at OECD countries, we rank at number 15 in Canada on a per capita financing basis for IEA, International Energy Agency, countries. The International Energy Agency is a branch of the OECD. This is where we stand on a per capita basis.

On the next slide, to tell you about the magnitude of what they do in Germany, if you go to solarbusiness.de you will get this graph, which does show that currently there are more people employed in the renewable energy industry in Germany than in what we call traditional or conventional energy sources, for example, coal and nuclear.

● (1545)

For solar and the rest of the renewable energy technologies, including wind, biomass, heat pumps, and things of that kind, there are about 130,000 people employed right now in Germany for this. If you go there, again you will see that we stand where they stood in 1975, before they really started building up a consciousness about adopting solar on a large scale. In terms of dissemination, of course, technology is available here, but in terms of proliferation, this is where we stand. We're about 30 years behind.

If you look at the economic benefits of having decentralized power with solar energy, you will realize that if you put collectors everywhere, that creates a lot of jobs per gigawatt hour or per energy unit produced. There are tables like that including all energy technologies. If you compare with nuclear, for example, or if you compare with hydro, or if you compare with thermal energy, you create about 4,000 jobs per 1,000 gigawatt hours of solar energy produced as opposed to 72, for instance, with nuclear. So there is a lot of job creation there, and they benefit from it a lot in Europe.

This is a map of the Canadian natural gas network, basically to show that from the source to the end-user there's a long distance, whereas if you look at this lower slide, if you put a solar collector on any given building it does produce heat on the spot; it's energy saved right on the spot. It doesn't need wires, power lines, pipelines; it's really where energy is used. To simply give you an idea, on each one of your homes you get as much solar energy as you will consume in a year. Simply calculate the number of kilowatt hours per square metre for your home times what you use—look at your electricity bill—you will find that there is as much as two to three times as much solar energy in your home than what you actually consume in gas or electricity.

Of course, that eases pressure on the network. It could be for the grid or gas lines. Each energy unit produced, of course, can be exported.

And if you look at national security issues, solar energy presents no danger. You don't need to fear an attack on one single central station whereby the whole country would be immobilized. Being decentralized, it's of course a major plus with respect to national security issues.

What I wish to raise as a conclusion is that basically, if you compare it to other countries and you compare even within the energy industry, there's chronic underfunding for solar energy. You can correct me if I am wrong—you probably know the numbers better than I do—but you're looking at maybe $40 million for the next four years in solar energy development. I think it's about $1.5 billion or $1.4 billion that we spend on helping the fossil fuel industry, basically also keeping in mind that it's also solar energy but stored in the planets for thousands or millions of years.

To create new technology and also for the proliferation of existing technologies, not only does research and development need to be done, but existing technologies also suffer from lack of incentives, and again, to overcome this initial investment barrier, Canada certainly could and should lead the world—especially for space heating, as I've tried to show you. It fits very well in a global renewable energy mix with wind power, geothermal energy, and with biomass as well. Solar fits in. It's easy to integrate. And of course, it's a sure bet to reduce greenhouse gas emissions. Every single solar collector out there that does bring in 700 kilowatt hours per square metre is a net saving in greenhouse gas emissions.

I do hope this gives you some insight into promoting this rather unknown and untapped technology.

Thank you.

● (1550)

The Chair: Thank you, Mr. Vachon.

We'll begin questions with Mr. St. Amand.

Mr. Lloyd St. Amand (Brant, Lib.): Thank you, Mr. Chair.

I have just a couple of questions and I will defer to another colleague. I'd like to leave in about six to seven minutes' time.

Thanks for coming, Mr. Vachon. I believe it was you who, in a pretty compelling fashion, told us about a year ago about the comparison between Gleisdorf, Austria, a town of 35,000 people, which has installed solar heating capacity commensurate with all of Canada, with our 32 million people. So it's not a lack of the resource. It's abundant here in Canada. Presumably it's not a lack of technology or expertise, because however little known it might be, it does exist, clearly. You have considerable experience with the Austria example in particular, because you were there for some four or five years, according to your little biography.

So I'll use a hypothetical scenario, as childlike as this question may sound. You become next week the Minister of Natural Resources. What do you do as the Minister of Natural Resources to get us to the point where we're no longer 30 years behind Germany and probably an equivalent number of years behind Austria? What do you do?

● (1555)

Mr. Christian Vachon: Well, I would certainly try first, I guess, to look at the overall energy policy of Canada and to see where we as ministers have to push, where we want to push. It wouldn't be worth fighting against other agendas. Do we have a clear agenda here to introduce solar? Are we serious about it or not? So of course I would pump in more money and more resources there.

One thing I also said a year ago is that I would be very stable. I would go for a long-term commitment in supporting solar energy development and solar energy deployment, definitely, and not for sunset programs, or two and a half years one way. We have seen in other countries that what really does work is government support that is steady. So let's make it safe, make it smaller, make it steady. That's certainly one way I would go.

Again, on a long-term vision, I would certainly envisage looking at the energy mix again, because the goal here is not to try to have the whole of Canada switching to solar energy; it's to have the whole of Canada having a coherent energy policy that does include all technologies—a phase-out, if possible, of fossil fuels, because we'll have to go there anyway. We'll have to phase out of this anyway within the next 100 years, so we might as well begin and get a headstart on that.

I would certainly try to move away from the fossil fuels with that energy mix as quickly as we can do it without hurting the economy. Again, without hurting the economy, I think countries like Denmark with wind and Germany with solar have proven they can build wealth out of renewable energy. It's not a theory; it's actually a fact. So I'd try to move away from that. With the resources that Canada has at hand, we could actually move towards that. I can see we would have 25 by 25—25 gigawatts by 2025. I would try to go that way.

So that would build a solid solar industry here, and we could actually export our technology, like the Germans and the Chinese do right now, to the rest of the world. I think we could do it, especially for space heating.

Mr. Lloyd St. Amand: If you're familiar enough with the programming over the years in either Germany or Austria, what was it that the federal governments in those countries actually did by way of money, incentives, tax grants, subsidies? Or are you familiar enough with the mechanics of how the money was infused into the...?

Mr. Christian Vachon: I'm more familiar with Germany and Austria. They have federal programs and they've also had provincial programs, so they tie the two. First, they have been very steady. Also, they've been looking at each technology and not putting them all in the same pack. They say, okay, for solar water heating, for example, we'll give so much per square foot, per square metre; for solar space and water heating, we'll give a little more. And all companies involved in the solar business do benefit from the same grants. So that's one of the things they did to make it successful.

Some tried going into carbon credits and some also did go into leasing, making sure that utilities could lease solar collectors, so that overcomes the initial investment barrier. Some went into guaranteed buyback energy programs, as has been the case now in Ontario, for example. They tried that over 10 years ago.

So they've tried all sorts of ways, but recipe number one was stability—commitment and stability, definitely.

Mr. Lloyd St. Amand: Thank you, Mr. Chair.

If there's time left, I'll defer to my colleague.

The Chair: Sure. There are a couple of minutes.

Mr. Mark Holland (Ajax—Pickering, Lib.): Thank you, Mr. Chair.

I'm probably going to have to pick up when we come back for the second round of questioning, but how does this technology compare to, say, geothermal, as an example? There's a lot of talk as well about utilizing geothermal technology for individual homes. Could you talk about the relative advantages?

I understand that obviously you're more involved with solar, so you'd have more knowledge on that, but could you provide a little bit of contrast to us from your perspective?

Mr. Christian Vachon: I also have a fair amount of knowledge on geothermal energy. We can actually couple both; both help each other. If we tie a solar system to a geothermal system, you'll get more benefits from the geothermal system and you'll get good benefits from your solar system, so one with the other is very good,.

What I would say is that solar is certainly more applicable in the building and geothermal is more applicable around the building—if you dig into the ground, and so on—so the two compare.

If you look at one single building, what do you do? Do you look for the solar aspect of it? Could they be integrated architecturally? Geothermal doesn't need to; as long as you have land, you can dig. It's easy to do.

Sometimes it is more expensive than solar. Also, geothermal is very sensitive to installation—very sensitive. It's been said by the geothermal coalition, based here in Ottawa, that about 40% of geothermal systems work optimally, and the others don't—not because the technology is not mature, but because installation is not mature.

The same would happen in Canada. If we start going widespread now, at first the same would probably happen as happened in other countries with installation. The technology is there; the installation is sometimes more difficult at first. We do need some training.

If I compare both technologies, I would say geothermal is basically solar energy stored in the ground. You get it straight away from the sun, passively or actively, or you get it from the ground.

● (1600)

Mr. Mark Holland: As a follow-up to that, one of the things I find very interesting is that the conservation authorities in Ontario—and particularly the one in my region, the Toronto Region Conservation Authority—have begun to move into planning for new build, not just for conservation measures that pertain to the environment or ecosystem, but also in terms of how those homes are going to be utilizing electricity, which is obviously something new.

When you're talking about new build, one of the things they're looking at is geothermal. That's why I ask about it. A community of roughly 60,000 people is going to be built, slightly under 30,000 households, and they're looking at placing geothermal throughout it. How critical do you see that type of early planning before building occurs—laying out certain requirements for solar or geothermal, and putting that in front of any new build that might occur?

Mr. Christian Vachon: It's very critical to be there when the building is being planned, and it's very difficult for a geothermal energy supplier or a solar energy supplier to be there when it is being planned. It's much easier to go and retrofit, where you have somebody who's already paid his bills and realizes he can save energy from that. But it's better to do it while the planning's in process.

One of the things we could suggest—and we've already suggested it to you—is to make it mandatory for a geothermal analysis and a solar energy analysis to be done on any new institutional building. That would force the architects and the engineer, the professionals involved in the product, to agree that while it's not compulsory to do it, they would be provided with a report on what you've seen and the manufacturers that you've talked to, and at least it will have been looked at.

Your question is very critical.

Mr. Mark Holland: Very briefly, how do you think it is best to go about it? What would you think would be best, as an example? One of the advantages, obviously, is that over the lifespan there's a recovery period of the reduced energy costs paying off the technology; the difficulty for the builder is that initial up-front cost.

Would you see something by the federal government—a loan, as an example—to help pay off the up-front costs? Then the consumer could pay it back; their electricity costs may be even slightly lower than normal, and after a certain period of time, bang, the whole thing's done. Would that be an effective federal program?

Mr. Christian Vachon: I think it would definitely be a very effective federal program. It's been tried. It's been tried in Australia and it's been tried in Austria. It's actually being tried also by Gaz Métro in Montreal. An interest-free loan to get you started is really a good thing, definitely. I think it would work, yes.

The Chair: Thank you, Mr. Holland and Mr. Vachon.

We'll now go to Mr. Ouellet.

[*Translation*]

Mr. Christian Ouellet: Thank you, Mr. Chairman.

The first point I want to make clear is that solar and geothermal energy are attractive options for producing electricity and heat, but they are not just for houses. This is the turn the discussion has taken just recently, and I find that unfortunate, because it may give committee members the impression that solar and geothermal energy are mainly for use in housing. They are important for housing, but in my view, they are more important for other large buildings, and not just new ones. We have talked about new developments, and you mentioned that this type of energy should be used in each new project. But why not talk about all the existing buildings in Canada that could some day depend on solar or geothermal energy? This could be added to existing buildings.

● (1605)

Mr. Christian Vachon: Well, there is no doubt that it is more difficult to use geothermal energy than solar energy in existing buildings. It is not impossible, but it is much more difficult. It is easy to retrofit a building for solar energy.

In any case, 95% of the projects in which our company is involved are non-residential. You were right. We find that projects that offer a good return on investment are mainly in industry. So what could be described as the low-hanging fruit are really the large industrial and institutional buildings, where the need to heat the air and water is greater.

Mr. Christian Ouellet: There are some very large solar energy and geothermal energy developments at the moment. Spain is manufacturing solar collectors to produce energy. Even Ontario appears interested in doing this. So it is on the same scale as nuclear production.

Mr. Christian Vachon: Yes.

Mr. Christian Ouellet: I think you made a small mistake when you were speaking about geothermal energy and said that digging was required in order to use it. I think that is a little out of date, since drilling is done to depths of 3,000, 4,000 and 5,000 feet. A geothermal well can provide electricity for an entire community.

Do you agree with that?

Mr. Christian Vachon: It is not used to produce electricity, but rather to replace the electricity that would be used to produce heat. That is true. Geothermal energy produces heat. Ultimately, people will save on electricity, without doubt, particularly if they heat with electricity, which 32% of homes in Canada do. So people will save on electricity.

In addition, I agree that the new drilling techniques allow for much more shallow drilling, and thus make it possible to serve a much larger area, rather than having a system for each house, which is more costly.

Mr. Christian Ouellet: Could you talk to us briefly about the attempts that have been made in Canada? I remember particularly that Philips installed vacuum tubes in a large number of buildings, but then they disappeared. I also remember Solarwall.

What mistakes did the government, companies or others make in your opinion? Why are there almost no more of these tubes around?

Mr. Christian Vachon: It is true that vacuum tubes are not the most cost-effective technology per square metre. There was a peak period in the 1980s, but since the technology was quite expensive, it fell into complete disuse once the grants ran out.

The Government of Canada put all its eggs into one basket—Solarwall, a solar heating system. There are about five or six different technologies available for heating air. One of them was really favoured—I believe several million dollars were invested in it—and it is controlled by a company that really did not break through into the market. So I do not think the government can do anything about this.

However, it could accept other technologies more easily and stop putting all its eggs into the same basket. I think that would be good for the other manufacturers and would allow them to break into the market much more easily.

Mr. Christian Ouellet: What needs to be done to encourage the government to diversify and invest in systems other than Solarwall?

Mr. Christian Vachon: In 1998, the Canadian government took part in a task force with the International Energy Agency. A study was done of the six existing technologies for solar collectors. We were involved in that and efficiency curves were developed for each collector, among other things.

Solarwall was not the most efficient system nor the least efficient one. It fell somewhere in the middle. Then programs such as RETScreen International, Solar Air Heating Project Analysis Training Module and SWift were established. They're available throughout the world, but they do not include this technology. That was a very good idea, a very good product, but we made the mistake of promoting this technology only, and of disregarding all the others. As a result, solar space heating did not take off as we would have liked.

So the time has really come to go back to the work the International Energy Agency was involved in, to look at what is available and to incorporate it as quickly as possible into all our programs.

Mr. Christian Ouellet: So you think this could be done right away.

Mr. Christian Vachon: Absolutely. I have been making this point forcefully for three or four years.

● (1610)

Mr. Christian Ouellet: If I understand correctly, if we calculate the cost of this type of heating in kilowatt hours, it is less expensive than the electricity we buy.

Mr. Christian Vachon: Exactly. If Natural Resources Canada's method is used, where energy is produced by air solar collectors, which you talked about, the cost is 3¢ per kilowatt/hour. That is much below the cost of electricity, gas, propane and oil in Canada.

Mr. Christian Ouellet: You talked about the fact that solar energy could be incorporated more easily at the local level, since there is no main plant distributing electricity. But would there not be problems within the network because of the fact that electricity is produced only during the day, when the sun is out, and not during the evening?

Mr. Christian Vachon: That does not cause any problem. This is done everywhere, including Germany. It is very easy, technically speaking, to incorporate this electricity into the grid. When solar energy is being produced, dams, nuclear power plants and coal-fired plants produce less energy. There's simply no technical problem involved in doing this. It can be done now.

There will be no problem if we introduce legislation whereby consumers who decide to use solar energy will get a return on their investment in the form of solar kilowatt/hours. There will be a leverage effect in the market. This will be done automatically, as happened in a number of European countries in particular.

Mr. Christian Ouellet: Thank you.

[*English*]

The Chair: Thank you, Mr. Ouellet.

Ms. Bell.

Ms. Catherine Bell (Vancouver Island North, NDP): Thank you.

Thank you for your presentation. It's good to see you here again.

You were talking about other European countries. I was looking at your grid showing that they are using more solar. Are they using more per capita than we are in Canada? I would imagine that they are.

Mr. Christian Vachon: Is that more in Canada than in other countries?

Ms. Catherine Bell: No, in the European countries on your grid, they are using much more per capita.

Mr. Christian Vachon: Yes. We are away behind, definitely.

Ms. Catherine Bell: We're talking in Canada about reducing our greenhouse gas emissions, and European countries are much further ahead in that respect as well. Given that they're using more per capita, do you think their reduction in greenhouse gas emissions is a result of their using more solar energy than fossil fuel energy?

Mr. Christian Vachon: Yes, definitely. Not all their greenhouse gas emission reductions have been reached with the implementation of solar, but solar was part of the mix of increased energy efficiency, with more energy coming from biomass, wind, geothermal, and of course solar, both thermal and photovoltaic. It is quite clear.

They say that in Germany, for example, one square metre of installed solar panel equals 800 litres of oil per year. You can see that on solarbusiness.de; it's a very interesting site on which to have fun. It's a country that has less sun than we have. It's one of the reasons they have reached their targets in some cases.

Ms. Catherine Bell: When asked what you would do, given the hypothetical scenario—or maybe not so hypothetical—that you were the Minister of Natural Resources, you said you would put more investment into solar. Have you seen an increase in the investment in solar in recent years?

Also, given that the federal government has introduced its ecoENERGY program, I'm wondering whether it is in any way going to get people more involved in using solar.

Mr. Christian Vachon: When I started in the business about 10 years ago, there was not much interest from industry, from people who own buildings, to go solar. As we have now reached that critical mass, and word of mouth is passed around, and people have been satisfied with their systems, they are becoming more and more interested. The government program at the time helped make that happen.

Now I would say that people want solar energy more than the government does. That really is my perception. I hear every day, for example, on the residential level, “There is nothing available right now; can we do something?” There is a 10-year payback, they are told. “Well, government should help.”

In industry it's the same. People know about it now because of the government programs. I think the government programs that have been reinstated, such as ecoENERGY right now, have based themselves on the old REDI program. I think there should be more funds and more promotion and there should be easier access to all the manufacturers to make the technology proliferate. It should be pushed more, and certainly not interrupted the way it was.

When I was here last June I said, please, don't interrupt the program. It was interrupted, and it causes hiccups in the market. Maybe from your side it's hard to see the consequences, but it creates hiccups and distortions in the market. Right now we're grappling with this.

● (1615)

Ms. Catherine Bell: I have one last quick question.

You said that there are 4,000 jobs for 1,000 gigawatt hours of electricity created. Are those long-term jobs or short-term—for example, in just building the product, or is it installation and maintenance and all that? If we were to increase our use of solar energy, I wonder what kind of job creation we could see in that.

Mr. Christian Vachon: When you produce a gigawatt hour of energy with solar, you have to produce a new panel; you don't have to burn more fuel. You don't add a job by adding nuclear nuggets or more coal into your plant. The plant has been built. If you want to add capacity with solar, you want to have more panels. Having more panels involves more manufacturing. It's more labour intensive. Of course, if we had more solar technology we would create more jobs, just as I showed for Germany. They probably surprised themselves at how many jobs it creates.

So yes, we would benefit from that too, definitely.

Ms. Catherine Bell: Would the price per gigawatt hour increase because it's more labour intensive? I'm just curious to know if—

Mr. Christian Vachon: No, it's the opposite. You have economies of scale. The more we produce, the larger the industry, the lower the cost.

Ms. Catherine Bell: Do I have any more time?

The Chair: We're not going to get a second round, so you'd better take it now.

Ms. Catherine Bell: I will.

I have one more question. What are the specific needs of the renewable energy sector in terms of training and skills and the technological part?

Mr. Christian Vachon: If Canada were serious about really pushing the industry, one of the things we did.... As the president of CanSIA, I signed a $400,000, over two years, contribution agreement with the industry. We were trying to establish an industry training program with that. You're talking very minimal amounts here. If we're serious about it, we could train people. We could train plumbers. We could train people, again, as they've done across the pond. We could train ventilation people to install that, so it is not something mysterious for them. We need that training and we need a unified, structured industry that is accredited. A mature industry has accredited contractors doing the jobs. That's part of the industry expansion process.

The Chair: Thank you, Ms. Bell.

We're going to start on this side with Monsieur Gourde.

[*Translation*]

Mr. Jacques Gourde (Lotbinière—Chutes-de-la-Chaudière, CPC): Thank you, Mr. Chairman.

How many thousands of kilowatt/hours are required to make the first phase cost-effective for an average family with two adults and three children living in a single-family dwelling? Would it be 20,000, 30,000 or 40,000? You talked about 3¢ per kilowatt/hour, which would be very cost-effective, but what level of consumption is required to get this price?

Mr. Christian Vachon: I'm talking here about an industrial context, where a great deal of air is required. In such cases, the heat produced by solar collectors costs 3¢ per kilowatt/hour. If we do the same exercise for the residential sector, we find a production cost of 5, 6 or 7¢ per kilowatt/hour to heat a home of the type you described. As I said, the heating season in Canada is long, but there is a lot of sun. Using existing technology and the software and calculation methods of Natural Resources Canada, we can produce energy at a cost of 5 to 7¢ per kilowatt/hour, without any subsidies.

However, I should point out that the cost of such a system is $5,000. You will be paying 7, 8 or 9¢ per kilowatt/hour for your electricity, so it is slightly more expensive. That means that it would take 10 or 12 years to recover your investment. But since Canadians change houses every seven or eight years, according to the statistics, they are not interested in this. We need to develop incentives, a program that will eliminate this barrier for people who want to try solar energy.

When people realize they will have to spend $5,000, their reaction is that they could spend this money on other things. They're very pleased to find out that the cost is 5 or 6¢ per kilowatt/hours, but they become discouraged when they find out they have to spend $5,000 and only recover that amount over 12 years. The cost is already going down. What we have to take into account is the cost of producing the energy. It becomes possible to consider this option if we look at it in these terms, rather than in terms of recovering one's investment.

● (1620)

Mr. Jacques Gourde: Solar panels produce a great deal of energy when the sun is out during the day, and produce less during the night. Is this energy stored in the home, does it go back to the grid, or is it stored using hot water or batteries?

Mr. Christian Vachon: All those options exist. Storing energy can often extend the payback. The technology I am talking about is solar collectors installed in homes with no storage capacity. The energy produced costs 5, 6 or 7¢ per kilowatt/hour. In Canada, we need a lot of electricity and heat over the long winter season. So there is no need to store the energy.

Technically, these are gadgets that make it possible to lengthen the period of time during which the collectors can be used during the year, but we do not need them. Personally, I avoid these gadgets, because they increase the cost per kilowatt/hour and require more maintenance, which suggests that this is an expensive technology. That is precisely what I am trying to tell you today: the existing technology is not expensive. Technically, solar energy can be stored. This option exists. Is it an advantage? I think so. Is it cost-effective? Not necessarily in all cases.

Mr. Jacques Gourde: You spoke about maintaining the panels once they're installed and connected to the electrical system of the house during the day.

Mr. Christian Vachon: The panels are guaranteed for 25 years and require almost no maintenance. Since they have no moving parts, they make no noise. In addition, they do not produce any smoke or anything else.

The same goes for air collectors. The famous Solarwall collectors or other types of air collectors require no maintenance. They do not freeze, they do not overheat in the summer, and the only moving part is a small fan. Only water systems require maintenance, and the Canadian industry has no training to do this. The local plumber would not know what to do with a system of this type, which requires having specialized training.

If the objective is to provide 22% of the hot water needs to the industries that require it, that is entirely possible. So maintenance is simply something that does not need to be taken into account for the institutional and industrial sectors. A solar system does not require more maintenance than a hot water heater in order to produce hot water, certainly not in the institutional sector.

Mr. Jacques Gourde: Can solar be adapted to any conventional heating system, using electricity or any other form of energy?

Mr. Christian Vachon: Yes. If someone says that it cannot be adapted, that is because they don't want to adapt it. Something can always be done.

Mr. Jacques Gourde: If solar is cost-effective, why are Canadians so reluctant to take the leap and move to solar energy? If it takes 10 years to recover their investment, very little is required to make this technology really attractive.

Mr. Christian Vachon: The obstacles are not technical in nature. Some programs need to be reviewed and better funding is required. The Canadian government could provide support by offering some funding. The length of time required to recover the investment is long, but, as I said before, the cost of producing energy with no subsidy is lower than the cost of producing electricity or natural gas.

Let's put solar energy on an equal footing with other types of energy, which are allowed to advertise the initial investment. No one has to pay $15,000 to pay for a dam the year it is opened. People living around Pickering, Ontario, do not get a $15,000 bill for the nuclear power plant. The situations are the same. Let's put the same mechanisms in place for solar and let the market forces do their job. Then, there would be maximum uptake for solar.

Mr. Jacques Gourde: So if a family living in a single-family dwelling spent about $5,000 initially, it would save between $500 and $700 in electricity costs each year, with the time required to recover the investment—

Mr. Christian Vachon: That is a reasonable assessment.

● (1625)

Mr. Jacques Gourde: If people want to save even more, the installation cost would be between $15,000 and $20,000.

Mr. Christian Vachon: Yes, but once again, I come back to the cost of producing the energy. For the next 20 years, the system would produce energy at a cost of 5 to 6¢ per kilowatt/hour, which is less than the cost of electricity. It would not be unreasonable to say that the time required to recover the investment is 10 years.

Mr. Jacques Gourde: Can the excess electricity be put into the grid at the moment?

Mr. Christian Vachon: That can be done in some provinces.

Mr. Jacques Gourde: That is all I have.

[*English*]

The Chair: Thank you, Mr. Gourde.

We have a couple more minutes on this side.

Mr. Harris, do you have a quick one?

Mr. Richard Harris (Cariboo—Prince George, CPC): Yes.

Mr. Vachon, if technology and interest were such that solar energy sources could be made popular, then we would see them all over the country by now, I guess. So obviously there's a void there somewhere. I suggest that maybe research and development and selling the idea are needed to make solar heating and solar energy household names.

You're saying that the government has a responsibility, so let me ask you this. How many years of research, development, marketing, and selling the idea are you talking about? How many government dollars are you suggesting over that period of time to make this become something that we see on every street?

Mr. Christian Vachon: To make it something that you see on every street, right now, for research and development, I would say you need zero dollars. That being said, I wouldn't put nothing for new technology development in Canada; I certainly would, but research and development is not where we are at right now, as we were in 1975. There are mature technologies out there, again, markets of billions of dollars in other countries. So for this to happen here, I would suggest, for example, how about putting as much money into solar energy as we put into fossil fuels and nuclear? That would make a very good amount to work with.

Mr. Richard Harris: Granted, we have some tax payment incentives, the way they structure their payment of taxes. Are you suggesting something like that for those who are manufacturing, developing, and installing solar energy panels as well, or are you suggesting direct dollars into the industry?

What I want to know is, if it's such a good idea and will work so much, why isn't industry just jumping all over it? For the solar industry, with private investment in getting the.... There are tax incentives for research and development, and for marketing and stuff, but it's all based on how much of the product is being sold.

Mr. Christian Vachon: Yes, exactly.

Again, you're right, it's how much the product is being sold. But because the consumer needs to outlay the initial money, and because energy prices are not that high in Canada, what you call the payback is long. But the cost of energy production, again, with solar is lower.

So basically we need to remove those initial hurdles, and then we will see that we benefit from technologies that do provide kilowatt hours at a very low price.

The Chair: Thanks, Mr. Harris.

We're going to move on now. We're going to go with a couple of really quick ones from Mr. Tonks and Madam DeBellefeuille, but if you could, keep it really tight. We have another witness for you.

Mr. Alan Tonks (York South—Weston, Lib.): Yes, in terms of the question Mr. Ouellet asked with respect to the interface or integration between geothermal and solar, you have spoken to micro-applications on water heating and so on. But on a macro level with respect to the same level of energy sources coming from nuclear and traditional sources, unless you have a geothermal interface or a large hydro interface—and it's not to underestimate these applications—is that not where the research and development should go, in terms of an interface between solar and geothermal? We had Okotoks, which is building subdivisions with 200 homes, and we have applications across the country, but there's always a solid interface with another technology.

So I'd like you to respond to that.

● (1630)

Mr. Christian Vachon: Yes. I always say myself that solar is always integrated with another technology. If you try to size solar to supply 100% of demand, you're probably over-sizing and you have too much investment for nothing. The best, again, is an energy mix. It could be supplied with extra fossil fuel or a gas-fired system—it's always the case, anyway. You always have to look at doing the first job with solar. It really is where it counts the most.

So if you can preheat your water or your air with solar, that's the way it works best and that's where you have the lowest cost per kilowatt hour. Don't try to have 100% of the system work with solar, because for example, in summer you have overcapacity. That's where Okotoks, for example, is a good example of storage over a longer period.

However, I must say, they've tried district heating like that in many places in Europe, and the industry has not caught on because of the non-financial issues. It's not really an industry that works that much. I wouldn't say there is such an industry in countries like Austria and Germany of district heating; it's more localized, decentralized heating systems that you see.

Mr. Alan Tonks: We could do more research in that in particular, the commercialization.

Mr. Christian Vachon: We certainly could.

Mr. Alan Tonks: Okay, thank you.

[*Translation*]

Mrs. Claude DeBellefeuille (Beauharnois—Salaberry, BQ): Thank you for your presentation, Mr. Vachon.

Later on, we will be hearing from the nuclear energy specialists. For the last hour, you have been talking about the benefits and the cost of solar energy.

Why do you think that the discussion about energy at the moment involves a new focus on nuclear, rather than other types of energy such as solar energy? Why is that? Who are the players involved? What are the issues? Why is the emphasis being placed on nuclear rather than on developing solar energy? What is your political analysis of this issue?

Mr. Christian Vachon: If we compare the solar energy lobby in Canada—if there is such a thing—to the lobbies for conventional sources of energy, you can only burst out laughing. So that is a first point.

Have I taught you anything about solar energy this afternoon? I imagine I have. This option is not being considered by Canada at the moment. We are going to show it off, and people will think it is quite cute. I don't think the solar energy option is being considered widely in Canada.

Nuclear energy, for its part, received a lot of subsidies in the 70s, if I remember correctly. However, I have no figures to prove that. The industry is more well-known throughout the world, and that is why we are hearing about this again. If we stop for a moment to consider the potential offered by solar energy and what could be done, I think this option would be considered.

I do not think that decision-makers are necessarily familiar with solar energy. You have to give us an opportunity to talk to you more about it—and that is what you are doing here this afternoon, and I thank you for that. In Canada, the industry is in the embryonic stage, if we compare it to what exists in other countries. If a trade mission were to be organized, for example, and a number of you went to see Intersolar or other major trade fairs in Germany, I think you would all be surprised to see how far advanced the industry is. It is incredible, I swear. You would be surprised, and you would come back delighted.

It is really an issue about the lobby and the size of the industry. It is like the chicken and the egg. At some point, someone has to make a decision. The cycle has to start somewhere, and then solar energy will grow. The Canadian Solar Industries Association is made up of small industries that really do not have the—

Mrs. Claude DeBellefeuille: —resources of the big lobby groups.

Mr. Christian Vachon: Exactly.

Mrs. Claude DeBellefeuille: Thank you.

[*English*]

The Chair: Thank you, Madame DeBellefeuille.

Thank you, Monsieur Vachon.

With that, we'll conclude. We are short of time today. I appreciate your coming and your responses to the questions. Thank you very much.

[*Translation*]

Mr. Christian Vachon: Thank you very much.

[*English*]

The Chair: We are next going to hear from Atomic Energy of Canada Limited. While we're changing, I want to get the attention of the committee again for one brief discussion regarding logistics and future meetings.

It had been our intention to begin consideration of a draft on Wednesday, two days from now, but I think because of the timing and the translation and getting it to you, it may not even get to you until Wednesday morning. Mr. Holland has suggested we might try to hear a couple more witnesses. We haven't heard from anyone on storage, which might be of interest, and he has a suggestion with regard to an economic viewpoint on this as well, perhaps an environment economist. Because I think Wednesday would be a day when we wouldn't have had time to peruse the draft, I'm thinking that if we can get these witnesses by Wednesday we will table the draft so that everybody has an opportunity to look at it, but we won't begin discussion of it on Wednesday because we really haven't gotten into it. If we can get a couple of witnesses to round it out, I'm going to ask the researcher to do that.

Are there any comments?

Monsieur Ouellet.

● (1635)

[*Translation*]

Mr. Christian Ouellet: Mr. Chairman, would it be possible to consider that this first version provides us with some knowledge about what we have and have not heard?

Our mandate is to look at the future of the grid. It is my impression that we have looked mainly at energy production, not at how this energy can be incorporated into the grid at night, during the day, and so on in the future. In fact, I think this is the first time we have talked about that. No one has talked to us about what the network will look like in the future, with all the new electronic components. I had suggested some names, but these individuals did not agree to come.

We will be making decisions about the grid without really hearing from witnesses on this issue. As I said, we have heard more from witnesses about electricity production, rather than production and distribution.

[*English*]

The Chair: That is a little more than I wanted to get into at this moment. They are very valid points, but I think it would evoke a little longer discussion than I wanted to have right now.

It may be that we have more time in this session of Parliament than we had originally expected. To be safe, we were planning on wrapping up by the first week of June. That is apparently less likely, so we may have an extra meeting. Let us discuss that on Wednesday. I think it's a good point.

In the meantime, so we can carry on here, can we proceed with the thought of trying to get a couple more witnesses for Wednesday and start a report?

Mr. Holland, did you have something?

Mr. Mark Holland: My office has a number of suggestions for the clerk on witnesses of that type. We haven't dealt with storage of electricity, but it's an important component in dealing with demand and greening supply. There have been a lot of developments, so I think it would make sense to talk to someone there. But whoever we can pull in on short notice—

The Chair: Perhaps you can get those to the researcher.

Mr. Mark Holland: Yes.

On the environmental economist side, we haven't looked a lot at the economics of this. I think it's important to do that, whether it's with Mark Jaccard or somebody else of that nature.

The Chair: Mr. Harris.

Mr. Richard Harris: Mr. Chair, I'm sure you want to get as many witnesses as we require for input to the committee. I have some concerns, given some past experience, about the security of our drafts. I'm wondering whether this committee or you have any suggestions on how we're going to achieve the security that's warranted from this committee on any report we're about to table.

The Chair: I get the point, Mr. Harris. As a matter of fact, the clerk has already come to me with the suggestion that we not e-mail the draft. It will be presented to you in hard copy. I'm sure he'll have it micro-encoded so we can trace any leaks.

Thank you for your input.

I'm pleased to see that our witnesses are now in place. From Atomic Energy of Canada we have David Torgerson, vice-president of technology. Thank you for appearing.

We have Howard Brown and Tom Wallace from the Department of Natural Resources. Thank you, gentlemen, for appearing again.

We are a little tight on time today, so I'm going to ask you to start briefly with opening remarks. We'll get quickly to questions and probably make a little better effort to keep the questions and answers to five minutes each as we proceed.

Mr. Brown, do you have opening statement as well?

● (1640)

Mr. Howard Brown (Assistant Deputy Minister, Energy Policy Sector, Department of Natural Resources): We have a deck. Mr. Wallace is the brains of the operation, so he's going to take us through it. I'm sure he can do it in five minutes.

The Chair: There's quite a compliment, Tom.

We're going to hear first from Tom Wallace, director general of the electricity resources branch at the Department of Natural Resources.

Mr. Wallace.

Mr. Tom Wallace (Director General, Electricity Resources Branch, Department of Natural Resources): Thank you.

I have a brief, 10-page deck that I'll try to go through very quickly just to provide members with an overview of the role of nuclear in Canada. First I would like to outline the role and the potential role for nuclear in Canada, what the role of the federal government is, a bit of a broad overview of the policy framework, and then some important developments in the last few years.

Nuclear energy is really part of our history, and we've had really sixty years of leadership and scientific excellence. Nuclear meets about 15% of Canada's electricity supply, and over 50% in Ontario. The industry is very much concentrated in Ontario, as I think members will be aware—at least the power reactor side of the industry—with 22 CANDU reactors in Canada, 20 in Ontario, and one each in Quebec and New Brunswick. The estimates of greenhouse gases displaced annually range from 40 megatonnes to 80 megatonnes, depending on whether you assume coal or natural gas would have been otherwise constructed.

We have six reactors constructed in China, Korea, Romania, and Argentina, and we are a very important supplier of medical isotopes to the world. We have 50% of the world's market, and we're the world's largest uranium producer.

The next slide just shows the three nuclear reactor provinces and the percentage of mix. You can see nuclear represents a big portion in Ontario; a fairly small percentage, with the one reactor in Quebec—which is of course a hydro-dominated province—and then almost 30% of New Brunswick's electricity.

The map shows the concentration of the industry across Canada. Of course the uranium industry is very much concentrated in Saskatchewan. There are very high-quality resources. Ontario is, as I mentioned, the home to 20 of our nuclear plants: eight in the Bruce Peninsula, eight at Pickering, and four at Darlington. Then there are two other reactors: one in Gentilly, Quebec, and one in Point Lepreau.

Our major research facilities are in Whiteshell and Chalk River, but the Whiteshell facility is in the process of being decommissioned, with its activities being transferred to Chalk River as a result of a decision made some years ago.

We see that nuclear power will be an important part of our energy mix for decades to come. It's virtually an emissions-free source of electricity. At the plant, there are emissions associated with uranium mining, which people will point out, but in terms of greenhouse gas emissions, there is virtually zero at the plant. It does enhance our energy security and help to add to a more diverse supply. It's increasingly critical to meeting Ontario's electricity challenges, in particular as the existing fleet ages.

Additional opportunities in western Canada haven't come to fruition yet. It's been talked about on and off in Saskatchewan as a possibility, but the size of the grid in Saskatchewan is such that it's difficult to make nuclear economical without integrating the system more with adjacent provinces. Increasingly there is interest in its possibilities for the Alberta oil sands.

New Brunswick has already made a decision to refurbish one reactor and is now undertaking a feasibility study of the possibility of constructing another one. A lot of that will depend on market opportunities, particularly in the New England market.

Of course, there are major opportunities for uranium production in Saskatchewan with the very recent escalation in prices.

The federal government has quite a dominant role in nuclear, not one that it exercises alone. We establish policies for the nuclear sector. We regulate all activities to ensure health, safety, security, and environmental protection. We support our economic and environmental objectives by advancing nuclear science, and of course we're the sole shareholder of AECL.

● (1645)

The next chart gives you a bit of a picture of the complexity of the industry and how the federal government needs to really work with provincial governments to make it all happen.

The Government of Canada, of course, owns essentially the Canadian Nuclear Safety Commission and AECL. The blue lines are really regulatory lines. The CNSC regulates a broad spectrum of the nuclear industry, and AECL in turn has contractual relations with many of the same entities. The provincial governments, of course, own the universities and hospitals and the public power utilities, and the public power utilities in turn own the Nuclear Waste Management Organization, which has the management and funding responsibilities for dealing with nuclear fuel waste.

So I think you can see that to make all this fairly complex array of relationships work requires a lot of federal-provincial cooperation. It's sort of endemic to nuclear.

Our policy framework is not really written down in one document that says, “This is Canada's nuclear policy”, but it can be distilled, I think, from a series of some formal policy statements, and others can be distilled from observed behaviour.

On the formal side, we do have a very strict non-proliferation policy and sanction nuclear cooperation only with countries that have made a binding commitment to non-proliferation. We have strict and independent regulations through the CNSC. The CNSC reports through our minister to Parliament, and that is in the legislation basically to give the CNSC a degree of independence from the government.

We have a very well-articulated nuclear waste management policy that really is an embodiment of, I guess, polluter pays. It's a policy under which the federal government is responsible for setting the policy and the regulation, but the funding and the management of the solution are the responsibility of the industry that generates the waste. That concept is embodied in pieces of legislation like the Nuclear Fuel Waste Act, which requires the utilities to set up the Nuclear Waste Management Organization to propose options to the government for the long-term management of nuclear fuel waste, once the government makes the decision to get on with the job of funding and managing the solution.

We have a uranium ownership and control policy that reserves new developments for ventures that are 51% Canadian owned or Canadian controlled. Of course, we've supported nuclear research since the inception of nuclear energy through Atomic Energy of Canada Limited. We've historically championed CANDU technology, both in Canada and abroad. Our whole program is developed in cooperation with provincial governments. However, we currently do not have any policies in place to provide direct support for nuclear stations, whether they be refurbished or new builds. In the early days, to get the industry going, we did provide loans for half the cost of the first reactors in a province, but that policy is no longer in existence.

To conclude, there's been a lot of talk about nuclear renaissance recently, both internationally and increasingly in Canada, and there have been some major developments over the last couple of years. First is that the existing CANDU fleet is aging. It's nearing the end of what I would call its half-life. So what we've seen in the past two or three years are a significant number of new major refurbishment contracts. Pickering A was the first, in the last year or year and a half; and in New Brunswick, Point Lepreau and Bruce units 1 and 2, there have been decisions made to refurbish. There are studies under way on Gentilly 2 and Pickering B.

So there's a major wave of investments happening on the refurbishment side.

● (1650)

The second sort of newsworthy event in the last couple of years has been Ontario's decision to set the stage for at least 1,000 megawatts of new nuclear. Pursuant to that policy, the environmental assessments have been launched by Bruce Power and Ontario Power Generation. None of those proponents have yet made a decision on technology.

Finally, one recent development is the Nuclear Waste Management Organization, set up under federal legislation, as I mentioned, to investigate long-term options for the management of nuclear fuel waste. They were required by legislation to study at least continuous storage at the reactor sites, centralized storage, or long-term geological disposal.

In November 2005 they submitted a report to the government, as required by legislation. It's a concept called adaptive phased management, which is essentially a hybrid of the three concepts in the legislation: storage at reactor sites; optional centralized storage, if that makes sense, some decades down the road for either technology reasons or social reasons or economic reasons; and ultimate disposal in a deep geological repository in a willing host community.

There's a lot of activity on the international side. I could probably go on and on, but I thought the committee would find it useful to have just a bit of an overview of the policy framework, the role that nuclear plays and is likely to continue to play, and some of the most important developments in the past couple of years.

Thank you very much.

The Chair: Thank you, Mr. Wallace. As usual, you were concise. I'm sure you've answered a lot of the questions. I appreciate your anticipation.

We're going to go now to David Torgerson, senior vice-president of technology at Atomic Energy of Canada.

Ten minutes?

Mr. David Torgerson (Senior Vice-President, Technology, Atomic Energy of Canada Limited): Perfect.

The Chair: Great. Thank you, David.

Mr. David Torgerson: Thank you for the opportunity, Mr. Chairman and committee members, to talk about my favourite topic, nuclear energy.

I have prepared a deck, and the first slide is just an overview of how a nuclear reactor works. If you look at the upper left-hand corner, you will see a fuel bundle about the size of a log, which contains one million kilowatt hours of electricity. That's enough electricity for you and your family for about 100 years. So this is a very condensed form of energy. The fuel bundle is made up of rods, and these rods contain a solid ceramic material, uranium oxide, which gets burned in a nuclear reaction. That fuel is put into a fuel channel—which you can see in the upper right-hand corner. The fuel goes into a fuel channel, into a pressure tube. There are 12 of these bundles in each of the pressure tubes. Then at the bottom right-hand corner, you can see that these fuel channels are put into a large vessel we call the calandria.

The way it works is that the fuel heats up due to the nuclear reactions. The cooling water flows through the fuel, through the pipes. Hot water comes out of the pipes and goes into—as you can see on the left-hand side—some tall yellow structures. These are called steam generators; they're just large kettles. The heat from the nuclear reaction causes water in those kettles to boil, makes steam and turns the turbine. So that's as simple as it is; it's simply burning nuclear materials in order to create heat to make steam to make electricity. Of course, it does so without emissions from the fuel; the fuel looks the same when it comes out of the reactor as when it went into it.

This is all part of the CANDU evolution. On page 3, the generation II reactor, the CANDU 6, is now in operation in five countries. We have two of them here in Canada. The advanced CANDU reactor, which I am going to discuss, is a generation III+ reactor, the next step in innovation. Beyond that we have even further innovations, called the CANDU super critical water reactor, but I'm not here to describe that. I can only say this is a national program and an exciting new area of innovation for the young scientists and engineers coming out of our universities; speaking of which, we have hired about 900 of these young scientists and engineers from all over Canada over the past year. The nuclear business is really booming.

Let's move on to the ACR-1000. On page 5, I'd like to point out that nuclear power, as Mr. Wallace mentioned, has a large impact on emissions. Each twin station of the advanced CANDU reactor could prevent up to 15 million tonnes of greenhouse gases per year, by displacing coal. We also believe that the ACR is the least expensive and the only large-scale technology for avoiding large-scale carbon emissions for various applications.

On page 6, I indicate the heart of the reactor, the core. I'm again showing you all of the channels I showed you before for our flagship product, the CANDU 6. This is a 700-megawatt reactor. Over on the right-hand side is the ACR-1000, which is a 1,085-megawatt reactor. It's a lot larger, but it's hard to tell the difference between the two because the ACR is basically built on the CANDU 6. It's an evolution of the CANDU 6, but there's 57% more power. Everything we know from 50 years of nuclear research and development in Canada has gone into the design of this reactor.

The enhancements on page 7 are in safety, economics, and operability. On safety, if you address slide 9, there are many defence and in-depth safety features of this reactor. One of them is to surround the core with a lot of heat sinks so that if the cooling to the core is interrupted, there are many other ways of taking heat out of the core. This is a rather unique feature of CANDU, because the vessel in which those fuel channels fit is a large vessel called a calandria. That calandria vessel has to be full of water—in fact, heavy water—because when neutrons are born they're moving very fast, and you have to slow them down, so they're moving very slowly before they can be reabsorbed into the uranium.

● (1655)

It's done in the calandria vessel. In the vessel, 250 tonnes of water sit around the core. Heat can be transferred into the water if the normal cooling system and the emergency cooling systems are not available.

We have a large shield tank around the calandria vessel, which is shown at point number two, on page nine, and it is a 600-tonne body of water. It is again passively sitting there, waiting to take heat out of the core.

To back it all up, we have an even larger tank at the top of the reactor that is called the reserve water tank, which is shown at point number three. There are 2,500 tonnes of water that can flow by gravity down into any part of the core where it's required.

These are passive systems. You don't have to activate anything, and it just happens. Water flows downhill.

We've taken advantage of all those kinds of features in the design of this reactor. I've been in the reactor safety business for a long time, and this is an extremely advanced reactor with respect to safety enhancements.

We've also designed a very strong containment. This containment will withstand the largest airplane crashes. We haven't found anything that can penetrate this containment.

Constant improvements are very important. You can have the best reactor in the world, but if it's not economical, no one will build it.

First of all, there's delivery. On building on the CANDU 6 success, I'd like to point out that AECL and its Canadian partners in Team CANDU have a record that is second to none in terms of delivery. AECL has never built a reactor in Canada, but we have built all the CANDU 6 reactors outside Canada on time and on budget.

I said we've never built a reactor in Canada, but we've been a subcontractor to others. We would do the design of the nuclear island, but it was always built by others.

When we build these reactors, we bring them in on time and on budget. Our latest completed project, Qinshan, in fact came in at 10% below budget and four months ahead of schedule.

We know how to build these reactors because we spend as much time on product delivery and the technology for product delivery as we do on the technology itself. You need good technology, but you have to be able to deliver it. And the third thing is that you have to be able to operate it well. Those are the three keys for being successful in the nuclear game. I think some vendors concentrate an awful lot on the technology, but they forget about the delivery and the operability.

On the Cernavoda unit 2 in Romania, I'm pleased to say this reactor started to operate two weeks ago. It's in the process of being commissioned now and will be synchronized to the Romanian grid sometime near the end of the summer.

In the interests of time, Mr. Chairman, I'll skip over some of the technologies we've been developing in order to reduce the cost. I will move on to the third topic and the third thing that is important for a nuclear reactor, which is enhanced plant operations.

Our flagship product, the CANDU 6, compares very well to any other products out there today. On the lifetime capacity factor of the CANDU 6, it's operating in five different countries by large utilities that operate light water reactors, different types of reactors, as well as CANDU reactors, by utilities that only have one reactor, and by utilities that have many reactors and, of course, many different operating cultures. The lifetime capacity is nevertheless 86%.

There's not another single model of reactor that has a capacity factor as good as this one. It's partly attributable to the fact that we do not have to shut down the reactor to refuel. We can keep putting fuel into these channels and taking off the used fuel at the end of the channel.

We have 86% now, and we have set a goal for the ACR to be greater than 92% over its 60-year life. We think we can do this, and the way we're going to do it is partly shown on page 17.

The reactor itself sits around four divisions, and this is called a quadrant design. In order to operate the reactor, you only need to have three of the four parts of the reactor working at any one time. You can take one of them offline in order to do maintenance. These are all the auxiliary systems that take the power out of the reactor, but you only need to have three of those four operating. We can send crews to do maintenance, leaving the reactor on, rotating from quadrant to quadrant. In addition, we can get inside the reactor building itself, and as shown on the right-hand side, while the reactor is operating there are many areas of the plant that we can get into and actually do maintenance. The red areas you cannot get into. That's the reason you have to shut the reactor down once every three years to do maintenance.

● (1700)

The final thing I'd like to say is that we have put an awful lot of thought into advanced operations and the technology. One of the things that have been on my mind for a number of years is, seeing that the nuclear renaissance was going to take off and there were going to be many nuclear plants, how we get the expertise that is in the nuclear laboratories into the plants themselves, because there are simply not enough nuclear chemists, for example, to go around all the nuclear plants. You can't find them. So if you can't put the expert into the plant, can you bring the plant to the expert? That's what we've been doing.

Shown on this slide is an expert who knows all about steam generators and their performance. He can sit in the lab, and on his screen, using the smart CANDU technology, he can actually evaluate what is going on in the plant and assist the operator in keeping the plant operating very well.

So we have a number of these technologies, and we're going to use our content experts, sitting in our laboratories, to actually analyze these plants and anticipate ahead of time what preventive maintenance would have to be done to ensure that the plant is operating within its parameters. It's very exciting technology.

I would like to say here that there's a whole bunch of exciting technology going on in our national nuclear laboratory, which is only two and a half hours down the road. Mr. Chairman, I would invite any members of the committee to come and visit us. It's an exciting place to visit. Every lab you go into, you'll see some really wonderful innovative work by our scientists and engineers.

I would like to end with a comment on managing the waste. With the ACR-1000, the amount of nuclear fuel waste will be reduced by about two-thirds, because we'll get more energy out of every bundle by enriching the fuel and leaving it in the reactor for a longer period of time.

Mr. Wallace talked about the waste management process that is going on in Canada. I'd like to say that, to me, there's a very nice symmetry here. We take uranium out of the ground, a ceramic material; we put it into a fuel bundle; we then put it into a reactor, and we get huge amounts of energy out of it, without environmental emissions; it then comes out of the reactor and stays in water for about six years for cooling, but there's been sufficient radioactive decay over that period that you can then put it into dry storage, which is a passive way of storing it. Then, after some length of time—although dry storage would last for many, many decades—the plan would be to put it back into geologic formations where it came from.

So there's a nice cycle. You take it out of the ground, you extract lots of energy from it without emissions, and then eventually you put it back into the ground. If anything, you are putting it into an engineered state that is far more stable than the formations that the original ore came from. This ore has been stable for over a billion years in the deposits we have here in Canada.

Mr. Chairman, I apologize. I took a little bit longer, but I did try to give you a little sense of what a reactor is and some of the excitement that we have around our latest product, the ACR-1000.

Thank you for your attention.

● (1705)

The Chair: Thank you, Mr. Torgerson. Again, you were very thorough, and we appreciate it very much. The only difficulty is the lack of time we have to pursue this at length, so we're going to have to be pretty tough with the time.

Let's try to do five-minute questions and answers. I'll start with Mr. Holland, and we'll try to get through everybody.

Mr. Mark Holland: Thank you, Mr. Chair.

Thank you to the witnesses.

I'd like to start, if I may, on the issue of nuclear waste. I have within my community, obviously, the Pickering facility, which has a very good relationship with the community. I think they're doing a commendable job, although there have been some issues with cost overruns with refurbishment.

My concern is the fact that since November 2005 a report has gone to the minister from the Nuclear Waste Management Organization, submitting a plan for dealing with nuclear waste. As we're contemplating new facilities or continuing to use our existing facilities without that long-term solution in place, it creates some understandable concern.

If you know, can you tell me what the status is and when we can expect cabinet approval of that? Have you received any direction in that regard?

Mr. Howard Brown: The government is still studying that report. I think people are conscious that we have had it for a while, but when a response will be forthcoming, I really can't say.

Mr. Mark Holland: And you haven't been given any kind of timeline for it at all.

Mr. Howard Brown: We've had a number of discussions within government on it. So we're moving ahead with it as quickly as we can.

Mr. Mark Holland: At the risk of making a comment, I would just say that is key, because obviously we're looking at nuclear as a future option, and as part of a collection of things that are going to be the solution to our energy needs as we reduce greenhouse gas emissions, we have to know what we're doing with waste. Hopefully we're going to be hearing back from the government on that.

Mr. Howard Brown: If I could make a comment on your comment, I agree completely with that.

Mr. Mark Holland: Thanks.

I'm wondering if you could talk about nuclear versus clean coal, as an example, and some of the other emerging technologies that are going to be competing with the methods of producing energy. We have a lot of plants that are going to be turning over. Between 2012 and 2020 we have a lot of plants that will need to be replaced. We need to give clear direction on what we're going to be replacing it with. Can you give me a comparison both in terms of overall costs—and I'm talking about full life, right from creating the station to decommissioning it, versus something like clean coal and how it kind of compares in terms of greenhouse gas emissions as well as cost?

● (1710)

Mr. Howard Brown: That's a really difficult question to answer. I'm sorry if I sound evasive, but the reality is that there are no third-generation nuclear plants operating today. There's one under construction in Finland. I believe it's AREVA, the French company, that is working on that. It's behind schedule and over budget. Where the final cost will be is kind of hard to say.

Similarly, there isn't a lot of large-scale coal gasification infrastructure in place. I think the answer to that will be that there's room probably for both technologies, and it will depend to a large extent on the geology in the surrounding territory and the availability of the resource.

If you're in western Canada, particularly Alberta and Saskatchewan, there are a lot of opportunities for enhanced oil recovery, which makes the economics, as I'm sure you know, of clean coal better, and a lot of opportunities for storage. The geology is a little less favourable in Ontario for sequestration of carbon, and there you might see nuclear as maybe a more important source going forward.

The bottom line is that we're really waiting for these technologies to prove themselves and to show what the operating costs would be in a full-scale setting.

Mr. Mark Holland: I know it's always difficult to comment on where commodities are going. I'm wondering if you can give us a quick overview of your sense of uranium deposits in Canada and the stability of uranium prices within the foreseeable future, because obviously that's going to impact the competitiveness of nuclear. I know that's speculative. I'm just asking for your best guess; it's nothing I'm going to hold you to.

Mr. Howard Brown: My track record on forecasting things like commodity prices is...maybe I should disclose that, and then you'd know how much weight to put on my comments.

There have been problems, as I think many people know, with production in Saskatchewan, and I think that's having an influence on prices in the short term. There hasn't been a lot of new development or exploration going on in the industry, because prices were quite depressed for a lengthy period of time. My own guess would be that prices would come down from where they are, and perhaps come down substantially. Nonetheless, I think the uranium industry has many years of exciting performance ahead of them.

Mr. Mark Holland: I'm wondering if you could also give us an update on what the prospects are for the ACR-1000 technology, if there's any pickup in terms of interest in moving forward with the project either domestically or abroad.

Mr. Howard Brown: Dave Torgerson would be better placed to answer the question in terms of the specific discussions. I guess I'd say on behalf of the government that we're very excited by the technology. We think this is really the future of nuclear in Canada. We think it's worth the investment the taxpayers are making. We think there are really good prospects.

Mr. Mark Holland: Thank you.

The Chair: Mr. Torgerson, would you like to respond?

Mr. David Torgerson: I just wanted to mention that on the fuel supply it's important to understand that the fuel is a very small percentage of the cost of nuclear power. You can double the fuel cost and it doesn't have much impact on the cost of the power. Also, in terms of supply, in the much longer term we are looking at the possibility of burning thorium in CANDU reactors after uranium. We have three times as much thorium as we have uranium in this country. I do not see an end of the fuel for this particular technology.

The Chair: Thank you.

Madame DeBellefeuille.

[*Translation*]

Mrs. Claude DeBellefeuille: Thank you, Mr. Chairman.

You told us, Mr. Wallace, that nuclear energy produces almost no GHG emissions. According to the information we have, it takes about 10 years to build a new nuclear power plant in Canada, because of all the tests that have to be done, and so on. So we could not actually use nuclear energy to reduce our greenhouse gas emissions until 2020. Building or refurbishing nuclear power plants has no immediate consequences; we're talking rather about the long-term impact. Using nuclear energy will not help us meet our Kyoto targets.

You spoke about the need for nuclear energy in Canada. Is the intention to increase the number of nuclear power stations or to modernize those we have already? I am not including the idea of using a reactor in the tar sands.

● (1715)

[*English*]

Mr. Tom Wallace: I think we probably have to do both. Certainly if you're talking about a new nuclear plant, you're right, with the regulatory process and the construction process, I think the earliest you could bring a new reactor on stream would be probably 2015 or 2016. The refurbishments are happening now, and of course, there's a much tighter timeframe on those projects. They are expected to come on stream in 2009, 2010, or 2011, that time period, which can be quite helpful in near-term reductions in greenhouse gases.

I guess the other dimension of this is just that in the day-to-day, to the extent we can keep the current plants operating efficiently, which has happened recently—the plants in Ontario, after some years of difficulty, are performing quite well now—the more juice you get out of your nuclear plants, the less you have to burn coal in provinces such as Ontario and New Brunswick. So that can be helpful as well.

The reason I say “both” is that if you look at Ontario, for example, which is the key market, they are certainly looking very seriously at refurbishments. There are already two done at Bruce and one at Pickering, and another two at Pickering that are under review. But even with all these refurbishments foreseen, Ontario believes it needs at least 1,000 megawatts of new nuclear, and I think some of the utilities actually think they're going to need more than that, which is why both Ontario Power Generation and Bruce have, on the drawing boards, construction of the four stations.

[*Translation*]

Mrs. Claude DeBellefeuille: Excuse me for interrupting, Mr. Wallace. You are talking about refurbishing and modernizing nuclear power plants that are no longer in operation. You want to reactivate them, but that is not increasing the number of new facilities.

[*English*]

Mr. Howard Brown: Perhaps I could take a stab at answering the question.

I think whether the solution is clean coal, new nuclear, large-scale hydro, or a combination of all those things, and more energy-efficient buildings, it takes time. That really was the key point behind the econometric analysis that was done by the government. In the short term, before you can build new nuclear plants, before you can build clean coal, before you can build large-scale hydro, the only thing you can do to really make a huge dent in emissions is reduce your level of output.

It takes time to build large-scale industrial facilities. You have to do the design, you have to do the engineering, and you have to do the environmental assessment. All those things take time.

So in the period between now and the end of Kyoto, 2012, our options are, frankly, very limited. If we'd started 10 years ago, it might be different, but we didn't.

[*Translation*]

Mrs. Claude DeBellefeuille: Could nuclear energy exist in Canada without the financial assistance of the Government of Canada? I would like to know, and I think Mr. Trost wants to know this as well, how much nuclear energy is costing taxpayers. Is the investment in nuclear energy a good deal for taxpayers, given that we know that solar energy, if it had the same financial support, could develop and produce energy without GHG and with no risk to the environment as nuclear energy claims?

Mr. Brown, can you tell us how much nuclear energy costs per kilowatt/hour? I see there have been some cost overruns. Refurbishing a nuclear power plant, and costs related to safety and waste management, amount to several billion dollars. Nuclear energy is costing taxpayers a lot of money, whether they live in Ontario, Quebec or Saskatchewan.

[*English*]

Mr. Howard Brown: Sure. I can try.

Once again, I don't want to seem evasive, but it's a very complex question for the following reason. AECL engages in three kinds of activities. There are commercial activities, and ACR-1000 is a good example of that. There are discretionary public policy activities, such as research being done to support the existing CANDU fleet. And then there are things that I would call non-discretionary public policy activities. This includes managing the waste that is left over from the Cold War, when we were closely cooperating with the Americans on nuclear matters, for example.

The cost of managing that legacy waste, the leftover waste from the Cold War up until the present, was recognized on the government's books...last year, Tom, or was it the year before?

● (1720)

Mr. Tom Wallace: Two years ago.

Mr. Howard Brown: The last year or two, and it was about $2.7 billion. So we've recognized the cost of that up front.

The commercial activities, I believe, could stand the commercial test.

So when you're asking are the activities of AECL profitable or could they be commercially viable, it's a little bit like asking whether the activities of General Motors are sustainable and commercially viable. Probably not all of them, but there is probably a core of things that are.

Mr. David Torgerson: I would just add that AECL's commercial business is a very strong business, but the business in fact is used to subsidize some of the policy areas that we carry out. No other nuclear vendor operates a national nuclear laboratory. Only AECL does that. The commercial side of our business could stand on its own, and it's a very profitable business.

The Chair: Thank you.

Now we're going to move along. Ms. Bell.

Ms. Catherine Bell: Thank you.

Thank you for all your presentations. It's very interesting. I've learned a few things about nuclear waste, but I have a few questions.

Regarding the heavy water, I think I read in one of your documents that you've reduced the amount of water that you use, but I want to know what happens to that water after you're finished with it. Does it go back into the aquifers, or is it safe? That was one of my questions on the waste, and I think I'll ask them both together so you can answer them together, because they might fit together.

You talked about the spent fuel, and you said that you're reducing nuclear waste by two-thirds. That was Mr. Torgerson's report. I just wondered what the percentage was before the two-thirds reduction—so that I have an idea how much was there—and also what current research is taking place that would hopefully bring us to near 100%? Because I would imagine that you're trying to get to a goal of not having any waste at all.

Mr. David Torgerson: First of all, the heavy water, in fact, is reusable. It's in a sealed tank, and the water costs about $300 a kilogram, so it's a very valuable commodity. The plan would be to simply keep recycling that heavy water and reusing it and processing it to remove any radioactivity that is in the water. It's worth doing that because of the high cost of the water.

In terms of the fuel, we in Canada have generated enough fuel waste over the last 50 years to fill a soccer pitch probably to a height of about four feet, so the amount of waste is actually very small and very manageable—about 6,800 cubic metres of spent fuel. One of the reasons it's relatively easy to manage the waste is that it's in small quantity and it's solid, and over time the radioactivity is decaying away, so the amount of heat that the fuel puts out is going away rather rapidly. Ninety-nine percent of the radioactivity external to the fuel has decayed away after the first year the fuel has come out of the reactor. So the radioactivity is decaying away with time.

With the new reactor, there's only one particular type of uranium in the fuel that actually produces the energy. It's called uranium-235. In the new reactor, we have increased the quantity of that uranium in the fuel so we can actually get three times more energy out of that fuel bundle than we can with the old fuel bundles. We have reduced the volume of waste for the amount of energy that we will actually get out of the fuel. In the longer term, I think what you're talking about is whether it's possible to recycle the fuel. The answer is yes. It is technically possible to take the fuel and recycle it back into the reactor and reburn it.

For example, in our existing CANDU reactors, we could take the waste from another type of reactor called a light water reactor, which has more fissile content in it at the end of its life than does the fuel that we start with. So it's an excellent fuel for burning in a CANDU reactor and for reducing the amount of waste and getting more energy out of it.

There are plans in the longer term to look at these advanced fuel cycles and look at recycling in the field.

● (1725)

Ms. Catherine Bell: That's interesting.

You were talking about nuclear's not having emissions. So how many nuclear energy plants do you think it would take in Canada to make us virtually emissions free?

Mr. David Torgerson: We currently emit something like 750 megatonnes a year, I believe. So each twin ACR plant would save, if it displaced coal, about 15 million tonnes. If you could build 10 of these twin ACR stations, then that would provide sufficient hydrogen to fuel probably all the cars and light trucks in Canada, and that would be, I suppose, something like possibly 100 megatonnes. So I think if you started using nuclear to make hydrogen, to get into the hydrogen economy, coupling that with renewables like wind and intermittent renewables such as wind and solar to make hydrogen, coupled with a base load like nuclear, you could have quite an impact on reducing our emissions over time.

But the reality is that we're going to be dependent on fossil fuels for some time to come, for our economy. We will have to do all we can to reduce, but it's going to take time to come up with those reductions.

Ms. Catherine Bell: I'm sorry, I didn't hear if you said how many.

Mr. David Torgerson: An ACR station, which is composed of two reactors, would displace about 15 million tonnes of CO_2 a year.

Ms. Catherine Bell: Do I have any more time?

The Chair: I'm sorry, we'll have to get back to that one, because I want to give other people a chance.

Mr. Allen.

Mr. Mike Allen (Tobique—Mactaquac, CPC): Thank you, Mr. Chair.

Thanks, gentlemen, for your presentations.

I have three questions. One is about the fuel in our reserves, with respect to being able to sustain this. I know that future reactors will be able to use less. A company named Geodex Minerals, I think, has made a discovery in New Brunswick that potentially.... There are some uranium resources there as well. Do we believe there are the reserves there—ignoring the price aspects of it—that will sustain us for however many years? We know for oil, and we kind of have an idea of how long we could sustain ourselves with the oil sands. But do we have an idea for the reserves?

Mr. Howard Brown: Dave or Tom may know how many years of current level of production we have. I guess I'd say, though, that the majority of uranium produced in Canada is exported.

As to the question of energy security, it's difficult to be energy secure in one country by itself, because as any kind of energy supply becomes more expensive, that's going to be reflected in global markets.

Do you have the specific answer, Tom?

Mr. Tom Wallace: I know that on a worldwide basis, the Nuclear Energy Agency, which is located in Paris, has looked at this question about the adequacy of uranium supply and I think have concluded that given reasonable expectations of what reserves are and how quickly they could be discovered, it goes until 2050. They think there's enough uranium to last that long.

I could dig up the report that was written on uranium reserves, if it would be of interest to the committee.

I think the conclusion of the analysis that's been done is that probably a lot of uranium is still out there to be discovered. One of the big challenges has been bringing it to market in a timely way. And all over the world we see a lot of very complex regulatory processes and a long timeframe for development, and that has been the challenge of bringing on uranium supply to match demand. It's more bottlenecks at the development stage as opposed to forecasts of the near-term shortages of reserves.

● (1730)

Mr. Mike Allen: Okay.

It seems to me this technology represents a significant export capability for us. Having been with NB Power when we first sent people to Terra Nova back in the early nineties, I know it created a significant revenue stream.

You've talked about the 900 engineers we have too, which is no insignificant amount to the economy. Do we have any idea what kinds of numbers we've brought in by doing these service projects and that type of thing for China, South Korea?

Mr. David Torgerson: A lot of the 900-engineer increase is due to the refurbishment contracts we have signed here in Canada and the ones we're going to be doing offshore. I would say every time we carry out a project offshore, that probably creates something like $1.5 billion worth of goods and services that are purchased out of Canada, and $1.5 billion creates an awful lot of jobs.

From our part, I can see we're going out and hiring a lot of people, but I imagine Canadian industry is doing this as well. And I know our partners, such as SNC-Lavalin, hire people. I know our manufacturers, such as Alstom, also in Quebec, have to manufacture the calandria vessel for us. So I imagine quite a bit of employment, and very high-level employment, is created by these projects, just by the large influx of money into the country.

Mr. Mike Allen: Thank you.

The Chair: Do you have another question?

Mr. Mike Allen: No, I'll be fine.

The Chair: All right.

I'm sorry we couldn't go on for another hour. It was fascinating. And if there are any further questions, I'm sure we could direct them to you through the clerk.

Again, I thank you very much for both presentations. It was very useful. I'm sorry to have kept you for a little extra time today, but thank you again for your appearance.

With that, we are adjourned.

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