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Chair

Mr. Lee Richardson

Standing Committee on Natural Resources

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● (1530)

[*English*]

The Chair (Mr. Lee Richardson (Calgary Centre, CPC)): Gentlemen, we will begin, and I thank you for your attendance today.

It appears we have but one item on the agenda, and that is further witnesses on our oil sands project. We did have a cancellation today. So we have one witness, and that is Dr. Michael Raymont, the president and chief executive officer of EnergyINet.

Without further ado, as I've discussed with colleagues, there doesn't seem to be any further business we need to deal with first.

I'm going to go straight to the witness and ask Dr. Raymont, if you would, please give us a brief overview of Energy Innovation Network before you begin, and then give us fifteen or twenty minutes in terms of an explanation.

This is primarily an information session. We are attempting to build a dossier on the ramifications of the oil sands—economic, social, and so on—prior to a visit by this committee to Fort McMurray and the Alberta oil sands.

Please lead us through that and then be prepared to respond to questions from the committee for about an hour. Because we are without our second witness today, we should be finished by five o'clock at the latest.

Dr. Raymont, please begin.

Dr. Michael Raymont (President and Chief Executive Officer, Energy Innovation Network): Mr. Chairman, members of the committee, thank you for the invitation to come to speak to you this afternoon. It's certainly a pleasure to do so.

Let me start by giving you a thumbnail sketch of my background. I'm a chemist and chemical engineer with too many degrees, who has had a pretty varied career in the venture capital industry as an entrepreneur. I've run a number of technology companies, both in Canada and in the U.S. I spent three years in Ottawa fairly recently as vice-president of technology and industry support for the National Research Council and then as acting president of the National Research Council. I left that and I'm now back running EnergyINet. I can describe a little more about EnergyINet, but one of the themes that's always gone through my career has been one of technology development, innovation, and of course the commercial sides of that through the venture capital industry experience I had as well.

I'm sure you've guessed from my accent that I wasn't born here, but it might be interesting to note that I am a Canadian citizen. I've also spent five years in the U.S. and over two years in China. I'm leaving in two weeks' time for my fiftieth visit to China, and my wife was born there. If you have any questions on China and oil and heavy oil in China, I'd be delighted to address some of those.

Let me talk briefly about EnergyINet, a not-for-profit organization funded by many of the provincial governments, the federal government, particularly supported by NRCan and Environment Canada, and about 25 of the major energy industry companies across Canada.

When I say energy industry companies, that's a very important distinction in the sense that these are not just oil and gas. We have members from the oil and gas community, including such companies as EnCana and Shell and so on, but we also have members in the oil sands, Syncrude and Suncor. Also, we have members from B.C. Hydro, Nova Scotia Power, which are respectively hydro, then an electric power generating company based on coal. We also have Luscar, Canada's biggest coal company, as a member. We also have users of energy as well in the form of Agrium, one of the largest fertilizer companies in the country, and NOVA Chemicals, one of the largest petrochemical companies in the country. We draw our membership from a very wide range of both government and industry contacts, which gives us an unusual breadth and perspective.

I want to make it very clear from the outset that our mandate is technology and the development and acceleration of appropriate technologies in the energy industry. We are absolutely technology agnostic. You will never see me in this town lobbying on behalf of any company, or any company position, or any industry position, as I and EnergyINet will only talk to you about technology and what it can do and what it can't do. I hope we are able to offer a very objective view of technology to present issues that are in the public good.

Before I start the presentation itself, I would like to apologize to the members of the Bloc because part of my presentation is not adequately translated into French. Part of that was due to the fact that some of my slides draw on a PDF format and stuff that's been screened and scanned from other sources, and it was impossible to overwrite that in English. My apologies in advance for that, but I hope you'll be able to follow the content of what I'm about to say.

I understand this committee is particularly interested in oil sands and what it can do and some of the challenges that confront it. I want to start by putting the oil sands in a global context. One of the roles of EnergyINet is not only as a national organization truly across the country, but indeed with strong international linkages. We have over 200 partners worldwide who can provide us with information on what's going on in the energy industry. Again, I emphasize energy industry as opposed to oil industry throughout the world.

Today we're here to talk about oil sands. As I've said, I want to put this in the context of the energy industry in a global sense to start with.

● (1535)

On the first slide you'll see I've presented numbers, which I'm sure you've seen before, addressing the fact that the world will continue to increase its energy demand. Whatever we do about conservation and efficiency, we will not in any way in the next 50 to 100 years make a significant impact on the fact that energy demand will increase.

Now, that's not necessarily a Canadian phenomenon; it is driven in significant measure by developing countries throughout the world, particularly the Chinas and Indias of this world. For example, China puts on a 500-megawatt, coal-fired power plant—with uncontrolled emissions, I might add—every two weeks. You can't fault them for their demand for energy. We enjoy energy, and energy has given us the ability to have the rich society we have today and the social benefits we derive from it. So other countries want their energy supply as well.

Energy demand will continue to increase, and indeed energy will be required for many of the environmental processes we put in place and other things that can help develop underdeveloped countries. For example, desalination requires large quantities of energy. Even environmental measures to alleviate such things as greenhouse gases and so on require large quantities of energy. We must not muddle the facts thinking that energy equals something bad. In fact, energy is a key to solving many of the environmental, social, and economic problems we have in this world today.

On the second slide I indicate that the world actually has plenty of energy reserves, and again you may have seen something like this before. At the top you see the world annual consumption and underneath you see the world's reserves of various different types of energy. As you can see, there is no danger that the world will run out of energy reserves in the near future.

But if you turn to the next slide, there's a bit more of a bad news story. While the world has sufficient energy resources for several hundred years and perhaps indefinitely, the location of those supplies doesn't match the consuming areas, and the extraction technologies that we use today are a major issue, in terms of some of their environmental impacts.

The second point I'd like to emphasize here is that there is no magic-bullet solution to the energy issues we face in the world today. We will need every ounce of conservation we can muster. Every conservation plan has terrific merit, but we will also need every energy source we can muster too. That includes everything from hydro and renewables—wind, solar, and so on—through to fossil fuels and the oil sands, included as part of fossil fuels.

Real energy sustainability is not just about the adequacy of our energy resources; it's also about how we exploit them to make certain we don't damage the planet, damage our environment too much—in fact, at all—in the extraction of those energy resources. The fact is that given the scale by which we produce and use energy in the world today and the infrastructure we have in place, carbon energy sources, fossil fuels, will supply most of the world's energy for the foreseeable future, and by that I mean the next 50 to 100 years.

Now, it will be a transition period, and indeed we need to accelerate renewable energy sources. Those technologies are coming on stream, but even some of the most optimistic projections suggest that they will comprise no more than about 20% of the world's energy supply in 2050.

I'll make some comments a little later in relation to the scale of the oil sands and the amount of renewable energy by way of wind power, for example, that you would need to replace that.

What we need to focus on in particular is the integration of energy supply, of infrastructure. We have many pipes and wires running around the country, so new sources of energy and new locations are great. But how do we get them to the users who want to be able to pump gas in their cars, even if they're doing 50 miles to the gallon, and to their homes for heating, and so on? For the most part, during this next 50- to 100- to 200-year transition period, we must use the infrastructure that already exists.

Building new transmission lines is something that certainly raises concerns in many parts of the world, including in this country.

Even putting in a wind farm in Georgian Bay isn't going to solve Mr. McGuinty's problem of replacing Nanticoke outside Toronto.

● (1540)

We need an energy systems approach. We must not look at things on a piecemeal basis. Oil and gas, coal, nuclear, and electricity have previously been looked at in silos. Part of the responsibility of EnergyINet is to look horizontally across these forms of energy and see how they can be linked into an energy system. Integration goes far beyond energy alone. We must look at how energy integrates into our economy and society.

So we have two scenarios confronting us. On the one hand, we can do business as usual. It's inevitable that we'll see increasing geopolitical tension because of disputes surrounding our oil supply. We see the Chinese, for example, getting very friendly with Sudan, Iran, and Venezuela, because they were unable to secure oil post-Unocal from some sources. We'll see supply disruptions. We'll see deteriorating environmental and climate change issues. And we'll see a very marked increase in market and price instability. I'm not saying it's going up or down, only that it will be unstable. This is if we continue business as usual.

On the other hand, however, we can enter an era of responsible and reliable energy supply. All we need to do is focus on the responsible development of conventional energy resources, with particular emphasis on our lower carbon footprint and reduced collateral resource requirements. By this I mean water and other things necessary to produce energy. We should accelerate the development of unconventionals and alternate sources of energy, including renewables, while emphasizing technology development and deployment. We also need a responsive regulatory environment and, equally important, a more certain and stable business environment, so that the private sector can make and deploy the technology necessary to obtain environmentally benign forms of energy production and usage.

There is a report by some university professors out of Princeton that says we have today all the technology necessary to produce environmentally clean energy. We simply don't have the environment required to encourage the private sector to invest in it.

So my next point is that energy usage per se, energy intensity, is not bad. I'll give you a straight set of numbers on this. If we took every joule of energy produced in the world and converted it to heat —and the thermodynamic principle says that most of it ends up as heat—we would not raise the temperature of this planet more than about a quarter of a degree. It is the by-products of energy production and usage that cause the environmental problems.

Allow me to repeat that, because it is a critically important point. Energy usage and energy intensity per se are not a problem. In fact, they are required. We will not advance as a society or solve our environmental problems without large quantities of additional energy. Moreover, the use and production of this additional energy will not cause global warming. It is the by-products of energy consumption and use that cause the problem.

So if I can produce electricity from coal and capture all the mercury, SOx, NOx, and GHGs, I have clean electric energy that is not going to raise the temperature of this planet. It is the by-products of coal combustion that cause the environmental issues that are beginning to become of increasing concern in the world today.

Have I made myself clear? It's a very important point.

I would argue that Canada has a need, an opportunity, and even a global responsibility to develop more energy in environmentally sensitive ways.

Some of you may be aware that my organization leads a bit of an initiative. I'm glad to see that the Prime Minister and the Minister of Natural Resources are now referring to Canada as an energy superpower, because we truly can be one. That's not the belligerent form of a superpower. It is a responsible world leader showing that we can extract, process, and use energy in an environmentally responsible manner. By transferring that technology to countries operating in an uncontrolled manner, we can do a lot more for GHGs than we can by just using the technology at home. We have a huge export opportunity if we develop the right technologies.

● (1545)

Why does Canada have this responsibility, as I put it, and this opportunity?

If you look at the next page, I have listed most—but even there I notice that I'm missing at least one—forms of energy reserves that Canada has, from conventional oil right down to biomass. The one I'm referring to that I'm missing is geothermal, and it certainly should be part of that list.

If there were Russians in this room, they might disagree with the statement on the right that Canada has more energy resources than any other country in the world, but our analysis to date says that Canada has the world's richest reserves of all forms of energy combined. And that is a huge natural heritage that we have an obligation to the rest of the world to develop in a responsible manner.

Just to give you some idea of the scale, I've tried to put these all in a consistent unit. You'll often hear about barrels of oil, standard cubic feet or cubic metres of gas, gigawatts of electricity, and tonnes of uranium. How do you convert all these into a single energy form so you can see the relative magnitudes of them? I've at least given you some examples here.

You can see now, as we move towards a discussion of oil sands, that oil sands, frankly, dwarf conventional oil, gas, and even coal, combined, in terms of the recoverable potential of energy. Just to give you an idea of the measure of the units I'm giving there, they're in exajoules, and an exajoule is equivalent to about 160 million barrels of oil or the energy produced by fourteen Pickering-sized nuclear power plants every year.

So in terms of energy priorities, then, we need to recognize that we will have to rely on fossil fuels to supply most of the world's energy for the next 50 to 100 years, and I'd be pleased to justify that statement time after time after time. But we must rapidly accelerate the development and deployment of environmentally responsible technologies for the use of those fossil fuels. There is no question about that.

I think Alberta argues strongly that we should explore and introduce value-added fossil fuel and energy technologies. I think that applies to the rest of the country too. The more value we can add to exports of energy, whether that be electricity, gas, oil, or even wood in some form, the more jobs and the more economic value we can create in Canada.

At the same time, as I mentioned before, we are entering a period of transition, and we need to rapidly accelerate the development and deployment of alternate and renewable sources. But it is not a trivial problem to integrate them into conventional energy systems, and by that I mean distribution systems. Here I'm talking about the fact that wind energy.... As I think I mentioned before, you could put a wind energy farm on the Bruce Peninsula, but how are you going to get it to Toronto? There aren't transmission lines to get it there. And by the way, as you well know, the wind blows intermittently. So how are you going to load-level the intermittent supply of energy from the wind?

A perfect example of that is Quebec and how Hydro-Québec is now doing some work to combine hydro and wind, which are a beautiful combination and can work extremely well together. Wind and coal-fired electricity don't work very well together, because you get to the problem of, “Hey, George, the wind is blowing hard, so shovel some coal out of the boiler”, and then, “Hey George, the wind's dropping, so shovel coal into the boiler”. The response time of a coal-fired energy power plant just doesn't work that way.

People will cite Denmark to me, time and time again, as a country that has done great things with wind energy. I will answer questions on that later if you like, but it has actually done a lousy job, and it has very narrow-minded policies. What that has resulted in is higher electricity costs and a minimal reduction in GHG emissions, because they're still having to spin the turbines on their coal-fired plants. So we need to think, as I mentioned earlier, about integration as being critically important.

We do need to encourage the wise and responsible use of energy. That argues for energy efficiency, and we certainly need to do everything we can. But that will not solve energy problems by any stretch of the imagination. Indeed, there's a commonly known phenomenon called the rebound effect, which means that the more you introduce energy-saving products, the more people actually use more of those products.

I will put it to you as individuals. I'll ask how many televisions you had in your house in the 1950s when they were first coming in. I can remember—it wasn't mine, it was my parents—that we had one in 1957, and it was an energy hog. Today I should probably apologize for the fact that I have five TVs in my house. They are five times more energy efficient. It means that I'm still using the same amount of electricity overall in my house.

How many of you have multiple fridges: a beer fridge in the basement, a freezer, a two-door fridge in the kitchen?

● (1550)

And one of the fascinating ones of efficient lighting in London now means that a lot more of London is lit than it was before, simply because they have efficient lighting, so they can light up more of London. So it doesn't result automatically in reduced consumption of energy.

But now let's come to the oil sands, because I realize I've taken ten minutes already and I want to address the issue of why oil sands and why the scale.

First, all sources of energy are not equivalent. We need liquid hydrocarbon fuels. Aircraft won't fly on anything other than kerosene. I met with Boeing about three weeks ago and they were telling me that maybe by 2050, they may have some alternate engines, but it's very unlikely they will be commercial. So we need kerosene. You can get kerosene from coal. It's very expensive, but it will come from fossil fuels. You can't get kerosene from uranium. You must use fossil fuels to get that.

So again, my argument is that we're in a transition period, and for a long time we will be relying on fossil fuels.

The oil sands produce liquid hydrocarbons. It is also the most economical way to provide large supplies of energy in Canada. We're already producing a million barrels a day in the oil sands, and there's the potential to produce a lot more.

In western Canada's sedimentary basin, we are seeing an increasing decline in our conventional oil production, and our ability as an oil exporter is dropping. Therefore, the oil sands balance this off, offset this, and they will maintain our export revenues coming from oil and make certain that our own security of oil supply is maintained.

There's no question that the development of the oil sands provides jobs, opportunities, the export revenues that I've mentioned, and indeed economic stimulus across the country. Yes, it's greater in Alberta than anywhere else, but it hasn't always resulted in a good thing. I can't even get a fast food meal in Calgary now at 10 o'clock at night because nobody wants to work at 10 o'clock at night. There are “help wanted” signs out everywhere. So too much economic stimulus isn't always good.

One other issue that I'd really like to address here is to try to impress on you the scale of oil sands development as it exists already. In the bottom bullet of the slide titled, “But Why Oil Sands, and Why the Scale?”, you'll see it is because we simply can't supply our energy requirements now and into the future 50 years any other way.

I've given you some examples of substitution. For a million barrels a day of oil, which is the current production of bitumen out of the oil sands, it would be equivalent to 85 gigawatts of electric-generating capacity running at 100%. That's 75% of the total installed electric-generating capacity in the whole of this country. That's equivalent to 20,000 wind turbines, which is one and a quarter times the world's total installed capacity of wind energy. And if you look at wind turbine delivery lists, there's a four- to five-year backlog with most of the manufacturers of wind turbines, so it will be five years on a current scale of all the production of all the wind turbines in the world just to replace the oil sands. We couldn't even get on that list for probably four to five years, and there's no way we could be assured of every single turbine produced by every single manufacturer in the world for the next five years after that.

So the practicality of replacing a million barrels a day of oil sands production with alternate sources of energy—I can do the same calculations for other alternates or other fuels—is just not there. We need those fuels, and the oil sands is really the only place they can come from in the foreseeable future.

In doing so—many of you have seen, I'm sure, the next slide—we will bolt from number eight to number four in terms of oil production or as energy producers in the world. Indeed, if you look at energy reserves by country, we are now number two, and some will argue we're number one, because as technology improves, the recoverable percentage of the bitumen in place in the oil sands increases such that many in the business will argue today that the recoverable oil in the oil sands now totals about 320 billion barrels, which would actually exceed all of that supposedly—and I say supposedly—in place in Saudi Arabia. Please do read Matt Simmons' *Twilight in the Desert* for a little bit of a scary ride on whether that oil is in fact really there in Saudi Arabia.

● (1555)

The next slide shows you very clearly the history and the decline from today on of western Canada conventional oil; the contribution from offshore, which will remain relatively constant over the next twenty years or so; and the contribution the oil sands will make as currently regulated and planned in the growth of projects that have been announced and so on.

Clearly there is some variability—and I am not an expert in forecasting production—but it is obviously going to climb enormously.

The next slide, I think, though, is a critically important one here. I have argued—and I think you have heard me argue—strongly for the fact that there really are no other alternatives. Indeed we have a responsibility to develop the oil sands in an environmentally responsible manner, but there are challenges that come along with doing that, and many of those are environmental. I've listed some of those on the next slide, which talks about strip mining and land use. I would say that it's something that over a 20- to 50-year period is remediable, and in fact I'm sure you've all seen pictures of buffalo grazing back on some land that GCOS first started developing originally.

I think that's something we shouldn't worry about too much, but it's something we need to insist be done.

Water usage is a significant problem. Right now it takes anywhere from two to five barrels of water for every barrel of bitumen that's extracted, synthetic crude that's produced. We have large tailing ponds, which don't seem to settle as well as they should.

The Athabasca River has finite quantities of water, and although Canada is blessed with huge resources, unfortunately they are not always in the right place at the right time. So water will be a challenge.

The use of natural gas as a fuel in the oil sands is, frankly—and I'm sure I'm not the first person to say this—like turning gold back into lead. We have a relatively clean fuel in methane that's being used as a fuel source to extract relatively low-grade bitumens and synthetic crudes. The reason for its use is purely historical. That gas was stranded gas up there in Fort McMurray forty years ago. It made complete sense to use it. We did not know about the implications for global warming and so on, and it made complete sense to use natural gas.

But today we have to find replacements for natural gas because there simply won't be enough of it to build the oil sands to the level of three million to five million barrels a day that we're seeing projected.

GHG emissions are also, of course, a significant concern. We need to make certain that we triage fossil fuels in general and oil sands as well, as part of that in terms of their GHG emissions over time.

Infrastructure requirements, workforce availability, access to market costs—I'm not going to address those particularly today, but suffice it to say that it does tax the infrastructure in other ways, and so on. Labour is certainly in acute shortage in Alberta, and it drives up costs, and so on. So we need to set a solid platform under which oil sands development can go forward.

Research and development are aimed at developing those oil sands in an environmentally responsible way and at reducing costs. Indeed, technological innovation can unlock vast quantities of energy supplies.

Just completely apart from the topic of oil sands, the next slide shows how technology alone contributed to the tripling of an oil reserve in the North Sea. It was first discovered in 1986. The area under that curve shows you the amount of proven reserves with the technology existing in 1986.

Over the next decade, the next slice was produced by developments in technology, through which that much additional oil was able to be recovered. A further five years of R and D and technology development allowed the amount of the third slice of reserves to be unleashed from the same field.

Let's turn back to the oil sands. Hopefully, I am convincing you that technology can address many of these problems if it's pushed in the right way. Indeed, potential sources of fuel and hydrogen for the oil sands are very desperately needed so we can use them instead of using natural gas. We have work under way now, anywhere between pilot plant and at semi-commercial scale, to gasify petroleum coke that's produced up there, which will produce syngas, hydrogen, and heat.

You can also use bitumen residues such as the asphaltenes, the very bottom of the barrel that have the lowest value. You can gasify raw bitumen.

● (1600)

We could take coal up there and gasify it, or we could even gasify biomass, at least, possibly, some pine beetle logs in combination with some of those other feedstocks. In fact, biomass has been shown to have some benefit in co-gasification with some of the others.

A study that my own organization is doing right now is actually looking at all these different alternative sources of fuel and trying to, from an engineering and economic point of view, provide the private sector with some of the right answers for replacing natural gas as a source of fuel and hydrogen. Nuclear is an option.

In fact, I just returned from visiting, on Monday and Tuesday of this week, the advanced nuclear reactor in Idaho. It is part of the DOE...800 square miles of territory where I think I was just about stripped naked before I was allowed on there. There is some fascinating work going on there, which we are beginning to participate in, where nuclear could be a very exciting source of heat to process oil sands, coal, and others. It can be used to upgrade coal to liquids and gases and so on. Geothermal is another potential source as well.

On the next page we can see that we do have an issue with GHG emissions, but the industry is working hard to address these, in the sense that you can see that the solid line shows you that emissions per barrel are decreasing over time, but because of the increasing production, we're seeing the total emissions increase over time. We must look to ways to minimize and reduce GHG emissions. Indeed, that's being done through new technologies that are being tested in the oil sands as we speak.

I apologize that these graphs may not appear terribly clear, but I'll just very quickly mention that the THAI process uses no water to speak of at all. In fact it uses underground combustion, driven initially ignited by fuel gas and then driven by air to improve the viscosity of the oil sands and to allow it to be collected in a pipe sitting underneath and pumped to the surface.

Below that is an example of how asphaltenes—this is the very bottom of the bitumen barrel in the oil sands—can be treated essentially like pulverized coke, mixed with surfactants and a little water, and burned in a typical combustion nozzle.

In the OPTI/Nexen plant, which they had the foresight to go ahead and build, they are actually gasifying the bottom end of the barrel, one of the options I showed to produce heat and hydrogen.

The third planned upgrader at Suncor will gasify petroleum coke to do the same thing, so we are making progress in this regard.

If we turn to the next page, one of the problems confronting innovation in the energy industry is.... First of all, a slightly cynical comment that I made at the start: when times are busy and times are good, they're too busy making money, and when times are bad, they have no money to do the R and D. That's not entirely true, but there is some element of truth to this.

Far more important, though, is the capital intensity and the long-time scales of major energy investments—20 to 50 years, major capital, billions of dollars—and those aren't going to be put out there by private sector companies with shareholders unless we have certainty in terms of some regulatory and other regimes in place. That's in complete contrast to the IT sector, where, if they have a bit of a bust product, they can cannibalize that and replace it in six months.

Often, indeed, as you see, we all have these kinds of things. I'm sure mine is out of date, and I only bought it a year ago. So that's the IT industry; it is not the energy industry.

They also have a great deal of difficulty in differentiating their product. The energy industry produces either electrons or gasoline or bitumen or synthetic crude, and it's all the same to a customer. So if you put in a big investment because you go with a highly advanced technology, how are you going to recover that cost when your competitor can put in a really cheap and perhaps environmentally less sensitive process producing the same commodity that consumers treat exactly the same?

The energy industry...particularly the service and small companies are innovative, but they're just not recognized for innovation as much as they are...and perhaps they need a little kick in the pants at times to be a little more innovative. I'm sure there are some things that this committee and government can think of to help them do that, but again, I think it's the certainty of the investment cycle they're dealing with that would help more and more.

● (1605)

The last few slides address the question of innovation. I believe that technological innovation is a key to being able to increase supply in the oil sands, which we badly need, but in a responsible way.

It is my personal position that the innovation system in this country is not working. We put billions of dollars into the front end of research and development, and we are not seeing the benefits coming out the back end. There is a relatively simple reason for that. As the next chart shows, innovation is a supply chain. That shouldn't come as a surprise; any other industry has a supply chain. You have knowledge and idea creators; these are people in universities and government labs. You have the market at the other end, where economic benefit is derived. In between you have many other steps that are complex and difficult, and they cannot be performed by the same performers.

Government labs cannot and should not commercialize. Universities should not commercialize. The private sector shouldn't try to do basic R and D. So you must have this supply chain of organizations with different sets of skills along the way to ensure that an idea is transmitted all the way to a product with an economic benefit.

To show you just how badly Canada is unfortunately doing, working with some international colleagues, including Michael Porter—I can't claim that this is my work, but I am involved with this group—we've developed some benchmarks for international innovation competitiveness. It's based particularly on two metrics: R and D ratio, and high-quality people producing a certain number of opportunities per $1 million of investment in R and D.

The best practice numbers are listed across the top. You can see where Finland is, which is often regarded as an innovative economy, and you see where the U.S. is, according to those benchmarked best practices. If you look at the last line, you can see where Canada is, and above all you can see that the R and D ratio is horribly squinted. The ratio for the private sector is on the left and public money is on the right. So the best practice is three parts of private sector investment to one part public investment. When you look at Canada at 1.18:1, there's a long way to go.

We can't just berate the private sector to do more R and D without any incentive. We need to find ways of encouraging the private sector to do more R and D to improve that ratio. Of course, the alternative would be to cut back on government R and D, but I'm not sure that's a good solution. A balance is important, and these are the ratios we need.

So we're seeing an imbalance in knowledge push versus market pull. We in Canada have what we call supply-side innovation economics: “Discover it and they will come”, instead of “I need it, invent it for me.” We need a balance of those two. For not one moment would I decry money to universities for basic research. We need to do that, but we need those pieces that pull technology from the other end, and very little has gone into that difficult part in the middle.

So we need to integrate the innovation supply chain. We need shared definition, vision, and objectives. We certainly don't have that. We need policies around innovation. I don't know whether it's too harsh a criticism to say they're non-existent, but they're certainly non-holistic.

We have over 200 government programs, federal and provincial, in innovation. Most companies are totally confused as to how to go about applying for them, or they get so little money out of any one that it's not worth applying for. We need to condense those down to perhaps 10 or 12 instead of having this incredibly complex mix.

The organizations involved in innovation are diffuse and uncoordinated. They're not linked in a supply chain way, and the metrics and benchmarks we use are totally out to lunch in most cases. In a lot of measures that are used—unfortunately by government—numbers are more important than quality. You are rewarded based on the number of start-ups you do, not on how many survive and generate billions of dollars for the economy. You are rewarded on input dollars and not on output measures. We must change that kind of thinking. We must integrate there and balance the supply chain for effective product delivery.

Again I want to address part of the problem here, which is the funding dilemma. In the next set of curves, which are perhaps a little difficult to follow, if you look at the line that decreases rapidly from the left axis, that is public sector funding as you move along the curve from idea to product. Private sector funding, however, very low at the idea stage, increases rapidly as you get near to a product with economic benefit.

● (1610)

Set against that, you clearly have increasing political risk—I'm sure everybody around this table understands that better than I do—as you put larger and larger dollars into fewer and fewer projects. I don't think any government, provincial, federal, or whatever else, would want to be putting hundreds of millions of dollars into a project and then see it fail—I'm sure it's the opposition's job to raise questions about that—but somebody needs to do it. You see increasing financial risk as you come earlier in the stage of development in the innovation supply chain as perceived by the private sector.

So you get stuck with this piece in the middle, which is, masochistically, where Energy INet chooses to work. It is the most difficult area to work in because it has reduced public expenditure, for the reasons I've indicated; it has reduced private sector expenditure, for the reasons I've indicated; and the net dollars there for the most difficult part—a pilot plant, demonstration plant, commercialization—make up the most underfunded part of the innovation supply chain.

Let me close by coming back to Canada's responsibility. We at Energy INet have a very strong group of people working with us. In fact, we're simply acting as a coordinating mechanism for a movement that really suggests that Canada has a responsibility to become a responsible energy superpower. The benefits from it are environmentally responsible energy supplies; fully utilizing our rich endowment of all energy resources, as I've talked about; and working to eliminate carbon and other detrimental releases. I think you can see some of the reasons that's justified.

As I said, by doing that we will contribute more than anything else to the reduction of environmental contamination and environmental releases in this world, and we can earn a lot of money in the process. We can earn a lot of export revenues.

That said, I'll turn to my last two slides. The first one explains why Canada should focus on energy and energy technologies. Many of the reasons there are obvious. I've talked about them already.

We also have a surrounding infrastructure in Canada with investors who understand energy and energy technologies and are prepared to invest in them. We have banks and capital raisers who are very skilled at raising money for energy projects. We have universities that are eminently qualified to graduate skilled, technically advanced energy workers. We have great energy R and D and laboratory R and D capability in Canada, and we have an energy industry that has a great reputation around the world. If we focus on responsible energy development, I truly think we have an opportunity in Canada to contribute to global sustainability.

My last slide and my closing comments list my views on government's role in an energy future: to show leadership and embrace the vision of Canada as a world benchmark in terms of integrated energy production, combined with minimal carbon releases; to provide increased certainty for investment decisions, with clearer long-term policy frameworks, so that the private sector can go ahead and make those decisions, make those investments, that it is capable of making today; and to absolutely accelerate the implementation of responsive, simplified, and coordinated regulations, because that's a nightmare for most companies. Again, it's a barrier to companies wanting to introduce new technologies and to make long-term investments.

I also personally believe it is government's role to share technology innovation and implementation risks. I am not sure it is government's role to be part of that in terms of doing, being a performer and a deliverer of technological information. Rather, it should find ways in which the risks the private sector could take will be mitigated by some practice involving the government.

Finally, the government must strengthen Canada's innovation supply chain such that outputs truly do come from inputs, and we get technological innovation that will drive this country forward, particularly in the energy industry, as a result.

Mr. Chairman, I apologize for having taken far too much time. I appreciate your generosity.

I also must apologize to the committee for going on to subjects that are beyond oil sands, but I think it puts them in the right context.

Thank you very much.

● (1615)

The Chair: Thank you, Dr. Raymont. I agree with you that we did go a little over, but it was useful. We're hearing so much information at this committee, I think it was very helpful to put this all together.

I was watching the heads nodding around the table—and no, it wasn't the heads nodding asleep over here—in recognition that the puzzle is starting to come together for many of us at the table. I think you explained some of these things very well. I thank you for your information and for the way you expressed it. It was very well done, and it indicated your breadth of knowledge on the broad issues.

With that, I think we can begin some questions. I'm sure we'll have some from Mr. Cullen.

Hon. Roy Cullen (Etobicoke North, Lib.): Thank you, Mr. Chair.

Thank you for an excellent presentation, Dr. Raymont. Keep up the good work. I think energy innovation is really part of the solution.

You had a slide about energy intensity not being the problem. You could argue, then, that the government's approach to intensity might be misguided. But I don't think you quite meant that, because if you look at the chart on the GHG emissions, the one that shows the intensity coming down—which is a good thing—but the total emissions in absolute terms going up, there is still a gap there. Of course, I think you're also saying that on the consumption side and in transportation and manufacturing, there's a lot of work to be done there as well.

I had a whole bunch of questions, but let me start with the question of innovation. In Canada, we have a very progressive tax regime with respect to R and D, but there are always concerns about the take-up of that. Tax expenditures of some $1.2 billion and $1.4 billion are going to the oil and gas sector.

A case that I've been making is that there's an argument that the $1.2 billion to $1.4 billion could be targeted at R and D innovation, because if we're going to accelerate that intensity so that we can deal with greenhouse gas emissions—which are actually, in absolute terms on this chart, projected to increase with the development of the oil sands—then there might be a case to be made for that.

And I'll just throw in two other questions, if I might. You mentioned and touched on the use of water, and everyone seemed to agree that it's an issue with the oil sands. We heard reports the other day that 90% of the water is being recycled. That doesn't add up in my calculus, because we've heard about the water tables in the Athabasca River region dropping. I don't know how the Athabasca River basin is facing these water table problems if 90% of it is being recycled. In any case, if you have any information on that, I'd appreciate it.

Secondly, carbon capture and sequestration are going to be a key part. Where are we with that technology, and how quickly can it be deployed in actual action in the oil sands, for example?

● (1620)

Dr. Michael Raymont: First of all, let me explain this graph of potential GHG emissions as if we use a business as usual case. If we simply say to continue on with the existing technologies and with more plants, that's what will happen. There will be modest improvements in GHG emissions, but an overall increase in the absolute amount.

But as I mentioned, the industry is already moving to new technologies. My plea is that we need to find ways of accelerating technological information in order to make certain that we bring down that curve, in terms of GHG emissions per barrel, as rapidly as we possibly can. The industry is making progress, but I think it is incumbent on all parties to find ways in which we can work together —and by “parties”, I mean all levels of government and the private sector—to move emissions lower as fast as possible.

With regard to whether tax treatments can drive that or not, I really feel I'm not really the right person to answer that question. We need to provide incentives, and I've certainly given you areas... encouragement, I should say, rather than incentives. I want to get away from the word "incentives". We need to provide encouragement. I think people far more able than me in financial and tax matters might be able to comment on which are the most effective measures.

I can say that, in general, some of the very generous tax measures for research and development in Canada have not alone stimulated the kind of research and development we need to see. That might not be a fault of that generous tax treatment.

It comes back to my point that innovation isn't thought of holistically. What we've done is say that we should have a good tax regime for R and D in Canada. If we did that, combined with a bunch of other things to really make that supply chain robust, it might be a very good policy, but only along with a number of other policies alongside it.

To your question of water, again, the industry is making progress, but the rate at which the industry is making progress is not the rate that will get us to the three million to five million barrels a day of oil sands production that we need to supply our own domestic needs, to maintain some export revenues, and to provide energy security in this country without serious issues, then, for the Athabasca River.

So, yes, they're recycling water, but the difference that you're finding in some of the numbers you're seeing arise simply out of whether it's being recycled in the sense of it going out into the tailings ponds or it truly going back into the Athabasca River. Again, the industry is making efforts in that regard, but only fundamental shifts in technology—I mentioned the THAI process, which uses very little water at all—will get us to the point where we can have three million to five million plus barrels a day coming out of the oil sands without serious water shortages there.

Hon. Roy Cullen: And if I could, the carbon capture and sequestration, how quickly can we get there?

● (1625)

Dr. Michael Raymont: The technology is there today. As I'm sure many of you know, carbon dioxide is being used as an enhanced oil field recovery agent by EnCana in southern Saskatchewan. Interestingly, we're buying the CO_2 from the U.S. when we've got plenty ourselves, but that was the practicality of the situation.

There are a number of proposals to build CO_2 pipelines from the oil sands to the oil fields of Alberta, where it can be used in a valuable manner to recover more oil. The truth is, if you look at the total CO_2 emissions from the energy industry in the western Canada sedimentary basis, it exceeds the capacity of the western Canada sedimentary basis to use it for economic purposes, that is oil recovery.

That said, the geology of the western Canada sedimentary basin is ideal for straight sequestration storage, permanent storage in underground aquifers, but that will be a cost. So if I'm from the private sector, the question is, what are you going to do for me that says this guy isn't capturing CO_2? I'm ready to go ahead and do it, and the technology is there and I could deploy that, but if it's costing me $15 a tonne to stick it down into the ground and helping GHG emissions, what are you going to do for me? How can I build that into some kind of a cost recovery?

So we must be able to provide mechanisms for the private sector to internalize those externalities.

Hon. Roy Cullen: Thank you very much.

The Chair: Thank you.

Mr. Cullen, I should add that we will have water on the agenda. In two weeks, on November 9, we'll have two witnesses to discuss the whole question of water more fully.

I would have liked to have gone quickly, Mr. Tonks. We went over, so I'm going to go to Madame DeBellefeuille.

[*Translation*]

Mrs. Claude DeBellefeuille (Beauharnois—Salaberry, BQ): : Your presentation was extremely clear. I read your slides, which had been translated into French, by the way.

Mr. Raymond, you might think I will ask you a fairly simplistic question, but it has been in my mind ever since we began studying the oil sands. Last week, or Tuesday of this week, we heard from a researcher who told us that the development and growth of oil sands exploration were so fast that innovation and technology could not keep up. Given that situation, even if we invested huge amounts of money into innovation and technology, these sectors still would not be able to keep up, and therefore contribute, through research, to decrease greenhouse gases. Several witnesses said that there should be a moratorium on oil sands exploration to allow research and innovation, as well as technology, to find ways to conduct exploration while decreasing greenhouse gases.

Since my election, I met many lobbyists, particularly those representing the science and technology sectors. Over the last nine months, I concluded that the current government does not seem to want to invest in science and technology or to acknowledge its importance. I read the Library of Parliament information notes, which point to a decline in research and development. In 1983, investments totalled $1.3 billion, whereas it was only $900 million in 2001.

If I was the CEO of a rich oil company and I was just interested in making as much money as quickly as possible, why would I want to decrease my profits by investing in greenhouse gas reduction technologies?

Unless I am mistaken, our system of research and innovation development is based on the funding received by industry. This industry is the oil industry, and its objective is to make a lot of profit, which is legitimate. These companies are not interested in doing anything else, and they must be forced to invest in projects such as yours which would help decrease greenhouse gases. I do not know what you think of this situation. It is a dead-end. The situation is urgent, and there is lots of talk, people are talking about technology as though it will happen one day, whereas we must act now.

● (1630)

[*English*]

Dr. Michael Raymont: Thank you for your comments about the presentation. You've raised some very good points, but I'd like to paint a more optimistic picture than you perhaps outline.

Yes, you're right. There is a rush to develop oil sands, but I don't think we'll see all of the oil sands proposals that have been put forward reach the construction stage, for a whole variety of reasons. That should allay some concerns.

Also, these projects take a long time to plan and put into place. As I say, simply for economic reasons, we are seeing that economics are driving a move away from water-intensive processes and a move away from energy-intensive processes, to some of the new technologies that I've indicated here. Those technologies are actually at the pilot plant commercial scale. If you take something like the Nexen/OPTI process, everything but their upgrader is actually being built as we speak. Their recovery process is about three-quarters complete, but their upgrader is only about 20% complete.

So there are new technologies coming along. I think it would be prudent to allow growth in the oil sands, in keeping with the existing resource capabilities of the area, and to accelerate new technologies. Do both at the same time. But as I say, the most critical step of all of this is to accelerate technology development, because there is actually an awful lot of good technology there that is certainly being developed by the universities or government labs. However, it hasn't moved beyond that because of this awful gap that we see in the middle of the innovation cycle about which I've spoken.

There are certainly technologies beyond this that are now moving into the construction phase. If you provide some regulatory certainty, if you provide long-term opportunity for the private sector to make an appropriate investment in responsible extraction, the private sector will use those technologies.

I do not know one executive in Calgary who says he wants a dirtier planet. Nobody wants a dirtier planet. Sure they want to make money, as you said, but the thing is that if they have the opportunity —and I think many of these companies are becoming, to a greater or lesser extent, very responsible about the environment—we need to encourage them. I'm not the expert on what the right combination of measures is, but it should be put in place.

[*Translation*]

Mrs. Claude DeBellefeuille: Could you tell me how Canada can ensure that its energy policies be at once responsible, sustainable and reliable?

[*English*]

Dr. Michael Raymont: I would say it's part of the reason for hearings like this: for you to hear a variety of different inputs and for you to be able to make your best informed judgments; to synthesize what I say, which I hope you all take as an absolutely neutral, agnostic, best public interest view, bearing in mind economic sustainability as well as environmental sustainability as a balance that must be achieved. You'll certainly hear from industry people who will argue, I'm sure, a little bit more to one side, and you'll hear from environmentalists who will argue very much toward another side.

I would ask you to question particularly the environmentalists on the practicality of the alternatives they offer. The point is that it's all very well to say we should slow down and stop development of the oil sands, but do you want Canada to become a net oil importer? If you do, what are we going to pay for that oil with, and what sacrifices are we going to be making in our hospitals and our schools, on day care payments, and so on and so forth, in order to pay for that imported oil? It's a delicate balance. There aren't any simple answers, but I can tell you that if we do not develop the oil sands and continue to develop them at a strongly measured pace while, as I said before, introducing technology on every level and providing incentives or encouragement to the private sector to do that, I think we risk losing any kind of position of being an oil exporter. You can see that just from the graphs.

[*Translation*]

Mrs. Claude DeBellefeuille: Do I have any time left?

Have you ever assessed how much money would need to be invested in science and technology? You talked about intensity and acceleration. Have you worked out how much government and industry would need to invest to follow growth and to ensure that research does lead to a decrease in greenhouse gases? Do you have this type of data?

● (1635)

[*English*]

Dr. Michael Raymont: I can't give you an absolute number on that, no, but I can give you some feel. Again, I want to come back and say that I'm arguing for technological innovation as opposed to science and technology. There is a bit of a difference.

David Keith is one of the foremost people in the area of greenhouse gas emissions and concerns in Canada, in my opinion. You may have heard from him in this committee. If not, I would recommend him as somebody from whom you might want to hear. He is an academic from the University of Calgary who will tend to speak more toward the CO_2 control side. He will tell you he is tired and fed up with white lab coats and the lab bench, that it's time to get on and do the pilot plant and demonstration stuff.

To more specifically address your question, the issue is that as you enter into that middle stage of the supply chain that I showed you, things get expensive. You're talking about $10 million pilot plants and you're talking about $100 million demonstration plants. In my opinion, the only way to do this is through a risk-shared exercise between all levels of government and the private sector. No one alone will bring that about.

We need to see some new paradigm of crossing that gap in the middle of commercialization. The technology is there, but there isn't the business climate for the private sector to put it in place, and there isn't the money in the middle stage to get it developed, for the most part.

The Chair: Thank you.

That was a very good question, and I appreciate the answer. I think it may be one that becomes the core of our report, Dr. Raymont.

Mr. Bevington.

Mr. Dennis Bevington (Western Arctic, NDP): Thank you, Mr. Chairman.

I, too, appreciate your comments, Dr. Raymont. You gave us a very comprehensive look at a number of topics. I'd like to focus a bit on the tar sands, though.

You mentioned the problem with natural gas. Expanding the tar sands may leave Canadian homes at a point where they have to import natural gas into Canada. It's a toss-up there in terms of our ability to balance the systems we have here. Certainly the problem of natural gas goes back. There are thermal issues with natural gas, but there is also the production of hydrogen, which is essential in this tar sands process. It's not easy to replace hydrogen with other elements, and I don't think it's easy to replace it without increasing the carbon balance.

You've offered up a number of selections there. The nuclear issue we talked about earlier, and that's a carbon-neutral issue. But to produce enough hydrogen for one 60,000-barrel-a-day tar sands plant, you need a 600-megawatt nuclear plant. Those are the figures available through Alberta Energy on the web. You can take a look at them.

Basically, if we're expanding a field of one million barrels, you're going to use a lot of reactors up there to provide that much energy to make hydrogen through electrolysis. That's not acceptable either.

There are issues around this that need to be carefully looked at, and not simply crystal-balled. They need to be looked at in terms of the actual numbers that are involved in the transformation.

On the sequestering of carbon dioxide, the people who came in here yesterday talked about $60 per tonne to take it off the stack. You then have to move it to where you can store it, and then you have to store it. There are three phases in that sequestration.

A very good MIT study identified what it would cost to convert the best coal plants around the world to carbon sequestration. Basically, we saw a doubling in the cost per kilowatt hour from those plants. The doubling of that cost put those plants in competition with, say, wind.

You've said wind is not very good because it's intermittent. You also pointed out that Quebec is interested in this. Well, Manitoba is also very interested in wind, because it has hydro storage. Alberta has put a limit on its wind power at 900 megawatts, although it has applications for 3,000 megawatts. Yet Alberta is sitting right next to British Columbia, which has adequate hydro storage for any amount of wind. So it's more a question of organization and agreement, rather than technological issues around wind.

So there are other answers there, and I'd like you to comment on some of the things I've said here.

● (1640)

Dr. Michael Raymont: I'd be delighted to. I totally agree with you that the use of methane natural gas as a fuel in the oil sands is now a major issue. It needs to be looked at; it needs to be addressed. On the other hand, you can't take an oil sands plant that was built five years ago and has legitimate supplies of its own natural gas and then say you can't have it any more. But we should be doing everything we can to move technology towards the stage where we have alternatives to natural gas. I presented to you a significant number of alternatives for using fuels other than natural gas.

I'm very surprised at the figure of 600 megawatts as the hydrogen need for 60,000 barrels a day. I can't confirm those numbers; I don't believe they are accurate.

As I mentioned, I just got back from DOE's Advanced Test Nuclear Reactor at the Idaho National Laboratory, and we are working with them on the application of nuclear energy as a heat source to co-produce fossil fuel. This might be able to provide the heat to gasify coal, to cook coal and produce liquids. It might be the heat for the oil sands.

One of the issues in the oil sands is that conventional nuclear plants are too big. We need more smaller, industrial-sized nuclear plants that are reliable, safe, and in the order of perhaps 100 megawatts of electricity production, in order to match the right size for an oil sands production of 100,000 barrel a day .

You cannot put a giant nuclear reactor in place in the oil sands, because you can't pipe steam that far. You'll never get 10 leaseholders to agree to the same supplier of steam, hydrogen heat, electricity, and so on—all from what, a utility that sets this purposely? Why not let them have their own reactor that's sized to their project?

Reactors are now being developed and demonstrated that can do this. That's part of the study we're doing with DOE, to look at the whole concept of co-production, of using nuclear to encourage this.

Mr. Dennis Bevington: That figure of 600 megawatts is based on 1.4 gigs per barrel. So you have to convert 1.4 gigajoules of natural gas to hydrogen in order to upgrade the barrel of crude.

Dr. Michael Raymont: The gigajoule is a measure of electricity capacity—

Mr. Dennis Bevington: That would be 1.4 standard thousand cubic feet. So that's how much natural gas you need to convert in order to make hydrogen to inject into a barrel of tar sands oil. That's how you come up with a 600-megawatt figure for the electrolysis of water in order to produce the—

Dr. Michael Raymont: And there are alternatives to electrolysis. There's high temperature electrolysis. There are combined cycle or thermal chemical ways of producing the sulphur iodine system for producing hydrogen from nuclear heat. There are many other alternatives.

Again, the point is that we're not spending enough time on technology. These are reactors that are running. There are 20-megawatt reactors that are running this technology, but we don't have the money to move them forward to full-scale kinds of applications.

You mentioned two times for CO_2 capture. Well, that comes back to my comment about setting the regime such that the private sector can justify investing that money. I don't think it's two times. I'm aware of a coal-fired plant proposal in Saskatchewan. It's 450 megawatts gross, 300 megawatts net, with full carbon dioxide capture and storage and compression. That will be about a 50% greater cost.

Let's not get into numbers. What you're saying is that, directionally, we need to transition natural gas as a fuel to other fuel sources. I agree. Absolutely. We need to do that. And I would argue that there are many candidates out there. I think nuclear is one. Let's not just look at energy in Alberta. Let's look at some of the other innovations around the world that could be safer and cheaper. They may not be Canadian, I'm sorry. I told you I was a technology agnostic. I will bring you the best technology from around the world to exploit our energy resources. If it can be Canadian, great. If the best technology is in Germany or France or in China, let's go get it from there. Let's do this right. I think we can.

With respect to your other comment on wind, the issue is that wind power produces electricity. Where that wind power is best sited does not replace liquids coming from the oil sands into pipelines. We have an infrastructure that exists in this continent of wires and pipes. It will cost more than the cost of renewables to put in new systems and transmission lines and so on, but in the long run....

I remember a very interesting discussion in Alberta with some environmentalists. They were asked what their ideal view of Alberta would be in the future. They said it would be an energy-producing province with energy security and self-sufficiency, but with not one molecule of CO_2 emission and not one gram of fossil fuel being used. Then we heard the industry side. My comment to the person who made the statement in the first place was simply that I agree with you. As long as you're talking, I don't know, 500 years or 1,000 years, we must transition to that. But if you're talking 10 years, you're going to have an absolute fight between the industry and environmentalists. All of our transition is making certain we make it as fast as possible. That transition will occur as fast as possible through technology.

● (1645)

Mr. Dennis Bevington: Isn't it about making the right choices that are most likely to lead to success right now? So far we haven't heard much on carbon sequestration that has led us towards success.

Dr. Michael Raymont: Absolutely. Carbon sequestration can be carried out perfectly successfully. It's been demonstrated. It's being used commercially right now in the Wascana oil fields.

Mr. Dennis Bevington: That's one project. There were five projects funded; one was put on line. The industry hasn't participated in this to the degree that anybody was looking for.

Dr. Michael Raymont: And that's where I say you have to set the right business environment. But it's not for me to say what that business environment is.

What I'm saying is that technologically it can be done. To cite wind as an alternative...I've given you the kinds of numbers and the scale you would need. You can't believe the thousands and thousands of acres that would have to be covered with wind farms just to get to a million barrels. If we're going to get to five million barrels, it's absolutely....

I'm a strong supporter of alternate and renewable resources. We need to bring them on as fast as possible. But you cannot replace a million barrels a day with a wind farm in the next 20 years. Commercially, there are barriers to that. You won't buy the turbines. You'll need to duplicate the total world production of wind energy to do that. Over what period of time? In the meantime, what are we going to do with the declining oil?

It's about wedges and it's about transitions. We have oil sands that will decline gradually as we enter 2050 and beyond when we then see wind and renewables reliably taking over. I'm absolutely in support of that, and I think—

Mr. Dennis Bevington:

But the point is, what do you—

The Chair: Mr. Bevington, we're going to have to move on. But I think we got your point.

Mr. Paradis.

[*Translation*]

Mr. Christian Paradis (Mégantic—L'Érable, CPC): Thank you, Mr. Chairman.

Thank you very much, Mr. Raymond. Your presentation was very interesting. You gave us an overall view of the situation. I will try to condense my question, even though I too have a myriad of questions to ask you.

I have here your last slide, which is entitled: « Why Canada should focus on energy and technologies ». Underneath this heading, you can read the following sentence:

> If Canada focuses on responsible energy development, we have a huge opportunity to contribute to global sustainability.

Can you tell us more about what Canada should do to become an energy superpower, as you indicated?

I can think of two examples to better illustrate what I am saying and to make sure that you follow me.

I have the slide you showed us on the North sea. It compares the prospects for 1986 to those of 1986-1995, which showed an increase, and to those of 1995-1999. You can also see that whenever there were new technologies, an « oil field » became increasingly accessible and it was therefore easier to exploit.

Is this the situation with regard to Canada's resources, given that by 2050, for the practical reasons you set forth, 20% of energy reserves will be renewable energy?

I hope you understand where I am coming from because, as I said, my mind is full of ideas.

[*English*]

● (1650)

Dr. Michael Raymont: Thank you for your question.

First of all, let me try to explain in a little bit more detail what I mean by Canada focusing on responsible energy development. We have a huge opportunity to contribute to global sustainability.

The fact is that we are a fossil fuel society in Canada right now for the most part, and what I'm trying to indicate here is that by developing the technologies that can mitigate the environmental detrimental effects, all that energy production usage, we cannot only clean up our own act, we can make money at it, because those technologies can be sold to those areas of the world where they can make a lot more difference.

Let me give you an example. I believe the number is, if we did everything we could to clean up CO_2 emissions in Canada—let's not debate whether that puts us at economic disadvantage or not, let's just say we did that—we would contribute to a reduction in GHGs of less than 2% in the world, which, frankly, isn't going to make a penny's worth of difference.

The role for Canada is to show leadership and develop the technologies such that countries like China and India—China is putting out 22% of the world's GHGs and it's going like this right now. We can sell and transfer those technologies to China, which will (a) make us money and (b) really contribute to a reduction in world GHGs. If we're truly interested in reducing GHGs around the world, and the only way you're going to do anything for global warming is to reduce world GHG emissions, not just Canadian.... In fact, as I've indicated, Canadian GHGs are just a tiny fraction. We can show leadership in saying we've done it; we can show a tremendous export potential for showing we can then ship these technologies to other parts of the world.

The interesting thing is that China and India are going to rely heavily on coal. Whether we like it or not, that's the reserve they've got, and they want to be a 21st century economy. They're relying heavily on coal, and our coals in western Canada, the Saskatchewan and Alberta lignite brown coals and the sub-bituminous coals, are quite similar to the coals burned in China and India. So the technologies we develop could be enormously applicable there versus this FutureGen project in the U.S., which is focused on bituminous coals that have no applicability in the west and no applicability to China and India. So that's a U.S. initiative. We could take a Canadian initiative, which really shows us as a responsible leader.

We need to be able to show that we can produce and use energy in a responsible manner and that the production and use of energy in a responsible manner is good for society. We can advance our society and we can have a richer society because of it, and we can help other nations do so. It's a fairly global statement.

When you talk about a rapid deployment of technology—and do I think we could reach 20% renewables by 2050? The answer is yes, I think we could, but only if we really focus not so much on the white lab coat end, although we have to keep that up.... Please never say that Michael Raymont said we should cut back funding in universities and for basic research; we shouldn't. The money that goes to some of the applied work should be pushed very much to make certain it is absolutely industry relevant, and there should be money spent to the pull side to make certain we're addressing the right issues there.

The answer is yes, we could be at that level by 2050, but unless we want to suffer some very painful interim step, we'd better press ahead with responsible development in the oil sands to bridge that gap, and well beyond that, because at 20%, they're still not doing a whole lot for us.

The biggest issues with renewables are probably, yes, partly around the technologies themselves, but some of them, as other members of the committee have pointed out, are quite well developed, like wind; it is more around integrating that wind into existing delivery mechanisms to deliver the right type of fuel to the customer who demands it within existing infrastructure. To string new wires around this country and to bury and string new pipe around this country is a task that nobody's even thinking of.

The question on wind, you see, is one of integration. Because the wind blows intermittently, to pair it with hydro is perfect; it is an ideal opportunity for Quebec to exploit. The reason Alberta has put its limits on is quite simply that the rest of Alberta's electricity is coal fired, and you cannot, as Denmark has shown....

● (1655)

Denmark, by the way, after leading in wind energy, very recently put its own limit on the amount of wind power that can be generated there, because they finally realized that when you take a holistic, integrated systems energy look at it, you cannot integrate more than, typically, somewhere between 10% and 20% wind energy into a coal-fired regime. Coal-fired power plants can't respond that quickly to the vagaries of the wind, so you have to have a base spinning load.

I can tell you that Denmark's experience is that they now have over 20% of their electricity generated by wind, but they have seen reductions in greenhouse gases of only 3% to 4%. That's precisely because they're actually keeping their coal-fired power plants running, spinning their turbines so they can turn them on quickly when the wind drops.

With hydro, you can turn them on and off really quickly. You can turn the turbine on, you can turn it off, and when you've turned it down because the wind's blowing, you're preserving your head of water. What's more—even better—when you have the wind blowing at night and you're generating a lot of electricity and nobody really needs it, you can take that electricity and pump water uphill into what's called pumped storage. So the combination of wind and hydro is perfect.

What I'm talking about here is choosing the right combinations and the right integration and the right integration with existing distribution systems. Those will be the keys to whether we can get renewables to 20% by 2050.

[*Translation*]

Mr. Christian Paradis: Thank you.

[*English*]

The Chair: Thank you, Mr. Paradis.

We are at five o'clock, but we had rather longer rounds this time. I think in fairness we'll go very quickly, if we can, ladies and gentlemen, and maybe just keep them short.

I'll start with Mr. St. Amand and then get to Mr. Ouellet, and I'll close with Mr. Harris or Mr. Trost.

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

It was a very compelling presentation, Dr. Raymont.

This is my phrasing, not yours, but you almost categorized it as our obligation as a country endowed with such extraordinary resources—it is almost a moral obligation—to distribute them across the planet. That's my phrasing, not yours. But I presume that I'm not too far off in putting words into your mouth.

Dr. Michael Raymont: That's correct.

Mr. Lloyd St. Amand: I have two questions, if I may. I've heard from some that we have an extremely well-developed oil business. Basically, extracting oil and exporting it are very well developed, but we are lagging rather behind in terms of refining oil. I'm wondering if there are obvious impediments in your field to our refining oil.

Second, and this is totally unrelated, I presume from the tenor and content of some of your responses that you are absolutely convinced that global warming is a pressing, live issue for all of us here in Canada and across the world.

Dr. Michael Raymont: Those are good questions, very deep questions.

Let me address, first of all, the question of oil upgrading. The impediments to oil upgrading have to do with our customers and where refinery capacity is located in the rest of the country. Alberta says, "We want as much value-added in Alberta as possible." The dichotomy is that you have refineries in the U.S. that are still saying, "But I want oil, and I'll take it in any form." Some may say, as you see by the EnCana announcement, "I'll take it out even as bitumen", which is the lowest value to Canada. I've seen estimates that 15% bitumen taken out of Canada over the life of the oil sands will result in a $500 billion loss in economic activity in Canada. So we need to upgrade in Canada if we can. But our customers are saying, "I don't want to buy gasoline and diesel, because I've got the upgrading capability here."

So it's a really market force situation. There is nothing to stop that. You are seeing the construction of upgraders, at least in Alberta, that will convert bitumen, which is the lowest-value product out of the oil sands, to synthetic oil, which is the next stage. There's no reason why we can't refine beyond that to gasoline, diesel, and petrochemical. We could and should continue to build these kinds of industries.

I think you'll see a constant tension between good government intentions—and as a Canadian, I support the intention to see the greatest possible value-added and economic activity in Canada—and the global market that says, "I want to buy the cheapest raw material I can, because I want to do the upgrading to get the economic activity in my country." That's the short answer to that question.

On your question of global warming, I'll answer it this way. Five years ago I wasn't sure. Today, I think there is conclusive evidence that global warming is occurring. What it's due to isn't yet answered. Is it anthropogenic? Is it natural cycles? Is it a combination of both? We really don't know, and we probably won't be able to answer that question for decades. The point is, can we afford to wait until we know the answer when there are some things that we can do something about right now?

We're at 300 ppms CO_2 in the atmosphere right now. Applying a trajectory to what's already built, we're going to hit 450. This amount will definitely have some consequences, as far as the best scientists in the world can tell. Now, this might be coming from nature, man, or a combination. But we can't control nature. We can only control the man-made part.

That's the best answer I can give you on global warming. But let us not think for a minute that it is man who is causing global warming, because nature puts more greenhouse gases into the air than man. Between us, we're causing global warming. Man's the only one who can control it. Nature tends to work a little more slowly, in cycles of a few million years. Just to give you an idea, nature releases vast quantities of methane from decomposition of gas hydrates, marsh bogs, and so on, and methane is 13 to 15 times worse, as a greenhouse gas, than carbon dioxide.

● (1700)

Mr. Lloyd St. Amand: Thank you.

The Chair: Thank you, Mr. St. Amand. That was a good question, and you got a distilled answer. Very well done.

Mr. Ouellet.

[*Translation*]

Mr. Christian Ouellet (Brome—Missisquoi, BQ): Thank you, Mr. Chair.

[*English*]

There are so many things I'd like to ask you, I don't know where to start.

[*Translation*]

I have determined something, which I am sure you will agree with, because you said so in your presentation a little earlier.

The reserves in Saudi Arabia are certainly not what they are claimed to be. They certainly are not according to your slide which breaks down reserves by country.

Incidentally, I fell like telling you this: since you are a capable and intelligent man, I would really like to see you work on other forms of energy, and not just the oil sands, such as the huge sector of solar energy. It would be fantastic if we could benefit from your knowledge in that sector.

But let me come back to what I wanted to say. You know as well as I do that since 1975, 1983, there have been no major discoveries. Only small oil fields have been found. And of the nine fields discovered in the Caspian Sea, six are dry.

Let's add the numbers up. I did the math. In 2005, 30 billion barrels of fuel oil are used throughout the world. That number will increase. However, that could be avoided. I do not understand why you continually talk about the year 2050, or in 50 years, or in 100 years. Nevertheless, I did the math using your numbers, and came up with 975 billion barrels of fuel oil which exist in the world today. The number might be a bit exaggerated, but I used your numbers. Take that number and divided by 30 billion. It is unsustainable, because in tree or four years, 33, 35 or 36 billion barrels a year will be consumed. This means that the earth's reserves will only hold for another 30 years.

I would like you to explain to me why you think the reserves will last until 2050, when I notice that they will last out to 2036 at the latest; it is probably closer to 2030.

● (1705)

[*English*]

Dr. Michael Raymont: Okay. We've certainly done some math there, and I'm just trying to run some other numbers. I'm questioning the 30 billion barrels a day of world production of oil, but again—

Mr. Christian Ouellet: Not a day, per year, 30 *milliards*....

[*Translation*]

"*milliard*" means one billion in English.

[*English*]

30 billion per year....

Dr. Michael Raymont: Okay, that's 18 million a day.

I'm sorry, I don't have a calculator here.

Mr. Christian Ouellet: I think that's generally accepted.

Dr. Michael Raymont: Okay, that may be.

These are current known reserves. Actually, one country that isn't shown on there effectively, and should be, and I apologize for that, is Venezuela.

Again, simply to me, it argues to the fact, as I said somewhere else in the presentation, that we need every source of energy we can possibly find. In fact, one of the things that we may find we have to do is start allocating certain types of energy to certain end-use applications. So as I said near the beginning, you can only fly airplanes on kerosene. So if we run out of oil and we have electricity—bags of electricity maybe, because let's say we develop nuclear fusion—great, we have lots of electricity, but how are we going to fly? We won't have kerosene.

So maybe we need to start thinking strategically. Again, this is a long-term, more of a think-tank type of an issue, about making certain that the right energy source is directed toward the right energy end use.

There's not an infinite supply of liquid hydrocarbons in the world, you're quite correct. I'll get back to you on the numbers, as I best see them. There isn't an infinite supply.

More to the point there, for Canada to be able to exploit the oil sands in a responsible way, to provide those liquid streams, will be valuable to the world and to Canada in terms of our own position and our export position as well, and in the meantime...developing some of these others. And the other technologies, like coal to liquids, will help us in that regard too.

[*Translation*]

Mr. Christian Ouellet: I agree with you, Mr. Raymond, that the 16 000 commercial aircraft which fly the sky today, and the 700 to 800 additional ones each year, will never run on electricity.

However, 40% of Canada's energy is spent on heating and cooling buildings. Even here, in Ottawa, we have just discovered something extraordinary with regard to lighting: we will not spend more energy on lighting.

However, your list does not include geothermics, which uses electricity. In my view, far beneath the earth's depth in Canada there is hot and cold energy, something which we can never get from the oil sands. Indeed, this is an extraordinary source of energy. We could cool buildings and each of our country's cities. I know Montreal and Quebec City very well—perhaps there are others—which are built on bedrock. Geothermics could provide energy not only for 30 or 50 years, but for 200 years, yet you don't mention it at all. I'm surprised.

Your list does include wind energy, solar energy and biomass. These are not necessarily better sources of energy; but geothermics is a used source of energy which could be well adapted to large buildings. It uses electricity, and because of this the electricity needs of buildings could be reduced from 40% to 10%, since that is the percentage of electricity needed to effectively harness geothermic energy.

[*English*]

Dr. Michael Raymont: Mr. Ouellet, we are in entire agreement. The only reason electricity isn't on this list of resources is because it is an intermediary between some of the raw materials. So you see hydro and wind on this list. In fact, all those bottom ones—solar, wind, tidal ocean wave, hydro, and uranium—result in electricity.

Electricity production in Canada is a critical thing that we must move on as well; there is no question whatsoever. I am not advocating oil sands. I would never advocate oil sands development to the exclusion of other forms of energy. Again, I'll come back to my comment about a magic bullet.

It is essential that we develop...and in fact Quebec would be a marvellous region. I think I'm correct in saying that Quebec has announced plans to go ahead with more major hydro development. I'm really gratified to see that. As you heard me say earlier, I am passionate about the fact that Canada and the world can produce and use more energy, and the world will be a better place if we do.

Hydro is a wonderful, clean form of energy. It is not entirely clean because it does take energy to produce cement to build dams in the first place. I know you recognize that.

● (1710)

Mr. Christian Ouellet: You can use clean energy.

[*Translation*]

Mr. Chairman, I still have a brief question which will interest you.

You talked about security a little earlier. That was very interesting.

In this morning's *Calgary Herald*, this is what Mr. Charles Frank said in a long piece which I will not read in its entirety, but only three brief paragraphs:

[*English*]

> In fact, Stanislaw argues that we are headed into a period where the term energy security will take on a whole new, complex, meaning. "No longer does this simply mean security of supply. Energy security goes beyond this to encompass security in the political, environmental, infrastructure and even the terrorism senses as well as the new concerns of sustainable development and climate change."

[*Translation*]

This is not the first time I have raised the issue of terrorism before this committee, but I was never given a good answer. I am sure you can.

[*English*]

The Chair: Thank you for that intriguing observation, but perhaps we'll deal with that at some other committee. Maybe we'll get Stockwell Day to answer it for you.

Mr. Trost.

Mr. Bradley Trost (Saskatoon—Humboldt, CPC): Thank you very much for coming. We've met before, and I appreciated your presentation today.

My staff has a report from someone who was talking about Canada-U.S. energy integration, and it got me thinking. We are trying to apply all our domestic resources, but what sorts of resources are there outside Canada to help develop the oil sands, tar sands, or whatever you want to call them, that we're not bringing to bear in this situation? Are there any, and in what areas are they?

If there are, what are we doing to promote them, and what are the impediments from the Canadian perspective that are slowing down the outside resources that could help us develop our own resources here?

Would you care to elaborate on that?

Dr. Michael Raymont: I'll certainly take a crack at that one. I think there are, unquestionably, other parts of the world that could help us directly with oil sands and that would have a very strong interest in doing so.

I could give you three examples, which just came to mind, on the question of finding an alternative to methane as a fuel. Certainly, these last few days that I've spent with DOE have been particularly revealing. Both of us are doing parallel work, and now I think we're going to do a lot more joint work. I'll come back to the use of nuclear, or the potential use. I don't want to say use at this point; I want to say the potential for nuclear as a heat source and as a hydrogen source for processing the oil sands. In one day's visit and one day of workshops, the word "tar sands", as they still like to call them, was mentioned 20 times. But they have a major program in nuclear combined with fossil fuel, for their own things—for oil shale, for coal, and so on and so forth—but they're also looking at the applicability to oil sands.

Another example would be found in Germany. The Germans are probably the most advanced in some of the engineering, simply for gasification processes, and so on. But you'd be surprised at some other parts of the world that have some interesting technologies. Because of its apartheid days, South Africa made coal gasification work. Germany, in the Second World War, of course, did with its coal-to-liquids program. China has some nuclear reactor capability that might be suited to industrial-sized plants rather than to the really large plants that were talked about here. It also does some work in heavy oil. There will be a joint Canada-China heavy oil conference in Beijing in a couple of weeks, which I'll be at.

Besides technology, we need investment from anywhere. We can use all the bucks we can get in this country. They always help. Whether they're for electricity or anything else, we need all of them. Electricity is a wonderful resource we have in this country to exploit. But from China, it could be labour. That's a huge constraint. In fact I am working with a couple of groups in Alberta now, and I believe the government has some programs in place to allow temporary immigration of skilled workers where there are real shortages. I might want to order 100 pipe fitters and 60 welders, and to have them here for two years. If we could streamline that kind of thing, I think we could accelerate the construction of some of the things, whether we're talking about dams in Quebec, hydro in Quebec, hydro in B.C., or oil sands in Alberta.

● (1715)

Mr. Bradley Trost: The second part of my question is whether you see any current policy, because ultimately as politicians that's what we're going to effect, the government side of policy on this. Do you have any recommendations on streamlining or what we could do to access this? Technology can sometimes be a communications problem, but it can be other problems too. Do you have any comments on that?

Dr. Michael Raymont: I'll put it this way. I had the opportunity to work with our embassies when I was at the National Research Council—to work in a number of our posts—and they do a terrific job. But I think their capability is stretched when it comes to really understanding technology and what technology may be available. And the linkage between that and the private sector is weak. You need perhaps some clearinghouse to be able to work those two sides of it.

We certainly need to be able to facilitate technology cooperation between Canada and the United States, but also Canada and a number of other countries. I think we're a little constipated in Ottawa in the bureaucracy maybe, or generally in Ottawa, in moving forward with some of those agreements. One that I was initially part of in Mr. Martin's day was in trying to sign a science and technology agreement between China and Canada, which has been signed by 60 other countries. Mr. Martin and Hu Jintao agreed that they would like this. My understanding is it's still not delivered. China delivers it very quickly. So we have to speed up our interactions. We have to streamline.

If there is a record being taken, I'll put it on the record, but I want to say strictly in advance that this is third-hand that I was given this information: I'm also told that Canada could have been part of APP, which I think is an interesting initiative, the Asia-Pacific partnership on clean development and climate, with China, India, Korea, the U. S., Australia, and Japan. Japan was only added in later because it was a Kyoto signatory, and Canada was considered as an alternative to Japan and so was Germany. Germany was ruled out for some reason. Canada was ruled out—as I say, I'm told this only third-hand—on the grounds that it would take us three years to make a decision and we would have 57 picky changes to make. Japan signed the APP only six weeks after being officially approached.

We've got to get with it in getting to be part of the global science and technology community on a faster basis. So anything that would streamline that would help, especially when there aren't commitments to resources. Very often these things are joint. I'd go to the Ministry of Science and Technology in China and say, "You put up $1 million, we'll put up $1 million", and we both want to use it for this purpose. We've got their brains; we've got half their money, half their brains, and what are we giving up? We're advancing more quickly. So I think international cooperation is something we're missing out on in that regard.

In terms of labour and other such things outside the technology area, I'm not very qualified to say.

Mr. Bradley Trost: Okay.

Mr. Mike Allen (Tobique—Mactaquac, CPC): I want to quickly go over something on the innovation and the government's role in the economy. Thank you very much for this presentation. We'll wrap it up quickly.

When you talk about the best practice R and D ratio being three to one, private to public sector, and then I try to bring that back to government's role in the future, and I look at saying, okay, if we give the business regulatory certainty, then I wonder how long is their timeframe for decision-making if we give them regulatory certainty. But when you look at the track record, as is pointed out here, that R and D traditionally hasn't been very high and we're going to have an investment of $125 billion out to 2015, even given that regulatory environment, what's my confidence that business is going to move on the R and D to make this sustainable?

● (1720)

Dr. Michael Raymont: I can't tell you. I don't represent industry. I think you have to go and consult with industry: Perrin Beatty's organization, people like that; or in particular, CAPP and the coal guys; the EDG; some of the people who are specifically—and I use this word in a totally non-pejorative sense—lobby groups for the industry and can speak more directly for industry than I can.

But I do believe in free enterprise, and I believe if you provide the right environment they will move relatively quickly to do so; they will move quickly to take advantage of that. I think the big issue is that we can't expect the private sector to ramp up its R and D to get to that three to one in five years—in ten years, probably. What we could do, and I really would like to suggest this for consideration, is have more of the government-funded R and D programs have more private sector pull and governance. Because frankly, I'm not going to name names, but I'm aware of many government labs that industry says are like another university. They get money and they work on what they want to work on. Yes, sometimes it has some relevance to an industry problem, but in other cases it has very little relevance, and they publish papers in journals and they get promoted on the basis of that.

It's purely a personal opinion, but that's not my view of what government should be delivering there. You should be risk sharing with the private sector. One way you could do that and increase the R and D is that while the money itself initially wouldn't come from the private sector, it at least would have the appearance of being private sector money because it would be private sector governed, and the focus of attention and the focus of spending would be on private sector problems and issues.

So that would be a transition method to start that going. If you then found that the government was cost sharing, I think there are ways—and again, it's for those in the finance department who are more expert than I in policy—that the private sector could be required to step up to more R and D, and would step up to more R and D if there was the kind of environment where instead of the moneys being here and here, they saw it more as "Let's put them in a pot in the middle."

But at the moment, you have government spending and you have private sector spending, and there's not enough of it in the middle.

The Chair: Thank you, Mr. Allen.

With that, I will again thank you, Dr. Raymont, for your appearance today. I thought it was a very useful session, and I appreciate your attendance.

Dr. Michael Raymont: Thank you again.

The Chair: With no further business, I declare the meeting adjourned.

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