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**EVIDENCE**

## Tuesday, February 28, 2012

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## Chair

**Mr. Merv Tweed**

# Standing Committee on Transport, Infrastructure and Communities

**Tuesday, February 28, 2012**

● (0850)

[*English*]

**The Chair (Mr. Merv Tweed (Brandon—Souris, CPC)):** I call the meeting to order.

Good morning, everyone. Welcome to the Standing Committee on Transport, Infrastructure and Communities. This is meeting number 23.

Our orders of the day are, pursuant to Standing Order 108(2), a study of innovative transportation technologies.

Joining us today from the Department of Natural Resources is Mr. Geoff Munro. He is the chief scientist and assistant deputy minister, innovation and energy technology sector. From the National Research Council Canada we have Mr. Ian Potter, vice-president of engineering, and Mr. Paul Treboutat, director general, Centre for Surface Transportation Technology.

Thank you for being here. I'm sure you have been advised as to the process: you'll make your presentations, and then we'll go for rounds of questions from the committee.

Whoever wants to go first may do so.

Go ahead, Mr. Munro.

**Mr. Geoff Munro (Chief Scientist and Assistant Deputy Minister, Innovation and Energy Technology Sector, Department of Natural Resources):** Thank you. I appreciate the opportunity to discuss this topic with the committee.

I am joined here today by two colleagues who may come to the microphone if the opportunity calls for it. One is Mr. Marc D'Iorio, who is the director general of our Office of Energy, Research and Development. The other is Ms. Paula Vieira, who is the director of alternative fuels policy and programs from our Office of Energy Efficiency.

I have distributed a deck and I will walk through it quickly. Then, as suggested, I am more than willing to respond to questions.

Natural Resources Canada is obviously not the transportation organization of the Government of Canada. On the second slide, you see a number of drivers, and the one for us is the environmental driver. It is the third bullet down, and highlighted.

Reduction in energy consumption has a direct effect on emissions of traditional internal combustion engine vehicles, which of course make up a large majority of the current fleet. As such, innovations targeted to improve fuel efficiency continue to be importantin that they achieve emission reductions. Also, the transition to an electric fleet has a strong positive impact on emissions over traditional internal combustion engine vehicles and will become increasingly important in meeting emissions targets. The challenge, of course, is the cold weather in Canada. There are some specific challenges associated with it that are part of the innovation challenge.

On the next slide, slide 3, you get a picture of why transportation innovation is necessary from an energy R and D perspective. The transportation sector is the second-largest consumer, after industry, and represents close to 30% of total energy demand. I will also point out that transportation is, at the tailpipe, the largest contributor to our greenhouse gas emissions, representing about 37% of Canada's contribution to emissions.

The technology that can help reduce both of those generally falls into three categories. There are game changers, and I would categorize the electric vehicle as a game changer; there are new vehicles that are already in the pipe—things such as gas direct injection, lightweighting of vehicles—and then there's the legacy fleet. There are things we can do there as well. The innovation around tires and tire tread, tire design, tire pressure, the aerodynamics of vehicles, driver training, and intelligent traffic systems can all help with the current fleet.

One of the questions we were asked is what federal programs there are to support research, development, and demonstration of transportation technologies. They are listed on slide 4. The six sub-bullets under Natural Resources Canada are programs that, through a period of time, we have delivered. They add up over a five-year average to an investment of about $70.5 million. There are other federal programs listed below those. I'm not sure I have captured them all, but they're all windows to innovation identified through other federal programs.

The next slide, slide 5, speaks to the investment levels, and governments are identified at the top left of the slide as having invested $118 million over the period of 2009-2010, whereas industry has spent almost $180 million. Again, you can see the breakdown at the bottom left of the departments that have been involved on the federal side. The slide gives you on the right a bit of a breakdown on fundamental research, applied research, and pre-commercialization, and then the technology development and demonstration, which is the way we break the innovation system up into its component parts.

If anybody wants to do the math, you'll recognize quickly that the $42 million in the bottom left of the chart doesn't add up to the $62 million in the top right. That's because of a $20-million investment by the Canadian Foundation for Innovation that is not captured in the R and D expenditures in the bottom left.

From an NRCan perspective, I want to open the door today to a conversation in three areas: the electrification of vehicles, technology options for the integration of lightweight materials, and how we can get natural gas to serve as a fuel that can be deployed into the heavy and medium-weight vehicle fleet, which is an exercise we have under way.

The first is the electric vehicle technology road map. I will be speaking to road maps. I'll open the door to it now, but I'm happy to answer more questions.

We found this to be a very effective tool. It brings the whole system together. By system, in this case, I mean the value chain right from the producers of electricity through to the automakers through to people who have to deal with things such as charging stations—what the codes and standards would have to be in your house in order to plug in a car, etc. By bringing the whole community together, you get a road map that says what the barriers are to achieving that objective. As you can see on the slide, we did it through the process of four workshops that were pulled together.

I brought a document called “The Electric Vehicle Technology Roadmap”. I'll leave copies for all members of the committee.

The recommendations from that particular road map fall into the four categories listed on slide 8. They are technology, codes and standards, studies and assessments, and education and outreach. I want to stress at this point that these recommendations are not aimed at government exclusively; they are aimed at that full community that gets together. There is a role for industry, a role for government, a role for the purchaser, etc.

Integration of lightweight materials is slide 9. As the slide states, the pathway to achieve vehicle fuel consumption and emissions reduction involves a number of things, but lightweighting is a very important one, particularly if we are going to make a move to electric vehicles, because there is a weight compensation issue associated with the heavy batteries that are necessary to have those various forms of electric vehicles work. The challenges with new materials are also real in the case of corrosion protection, or being able to join different metals together and not have a crash test that is inferior to the standards that have been set for the country, or understanding how the materials affect vehicle performance, etc.

The technology themes for integration of lightweight materials, on slide 10, fall into those three categories. You can see the sub-bullets underneath. The goal is to end up with a vehicle that is lighter, obviously, and it's done through the various efficiencies that can be generated through those various components.

Moving on, the third area is natural gas. We basically understand the technology; the issue is deployment in the Canadian situation. We took a road map approach there as well and brought the whole community together, but there it's geared to understanding the barriers to deploying natural gas in an operational way. The road map focuses on heavy vehicles in heavily used corridors and on return-to-base vehicles such as municipal vehicles, garbage trucks, delivery vehicles, postal vehicles, etc.—things that can go back to a central place to be refuelled when necessary.

The targeted recommendations on slide 12 basically break down into the four areas that are identified. The four key recommendations include de-risking investments and early adoption, addressing information gaps, increasing capacity to sustain markets, and ensuring ongoing competitiveness.

In the case of both the electric and the natural gas vehicles, harmonization of standards across the country and with the U.S. is critical to making sure that fleet users aren't limited by either interprovincial or international barriers in terms of the codes and standards associated with their use.

We also work in an international context. I've identified three international collaborations: with the International Energy Agency, Canada is quite active not only in transportation but also in other energy areas; we are quite active with the Canada-U.S. clean energy dialogue, which has a transportation component; and we're in the process of developing a collaboration with China in the joint S and T committee. That has not been confirmed in terms of the transportation piece yet, but it is under negotiation.

In conclusion, research, development, and demonstration programs have already contributed to the advancement of Canadian transportation technologies right through from concept to commercialization. Road maps, both the deployment style and the technology approach, have been very useful policy instruments for us in making sure that the full community is aware and involved and owns the results. We're starting to see implementation in both those cases as efforts are being made by the industry, by our colleagues in the provincial governments, and naturally by our own departments.

Thanks very much.

● (0855)

**The Chair:** Thank you.

Go ahead, Mr. Potter.

**Dr. Ian Potter (Vice-President, Engineering, National Research Council Canada):** Good morning, Mr. Chair. Thank you for inviting me to address the committee today.

Joining me is my colleague, Paul Treboutat. As was mentioned earlier, Paul is the director general for our Centre for Surface Transportation Technology. To give that a context, that is what I would call the heavy goods types of vehicles, such as trucking, the rail fleet, military types of vehicles, as well as other vehicles such as first responders—police, fire, ambulance, and that sort of area—as opposed to automotive, which is a separate group.

I welcome the opportunity to inform you about some of the technology innovations being developed at the National Research Council of Canada to improve the safety, energy efficiency, productivity, and sustainability of our country’s air, surface, and marine transportation systems, both in urban areas and in remote communities such as those in the north, and even further north into the Arctic.

As you may be aware, the NRC is an agency of the Government of Canada. Its mandate is set out in the National Research Council Act. Under the NRC Act, the NRC is responsible, amongst other things, for undertaking, assisting, and promoting scientific and industrial-based research in different fields of importance to Canada.

To that end, NRC's research and development capabilities span a wide spectrum of disciplines from aerospace and construction to information communications technologies and ocean engineering. We work with our private and public clients and collaborators to develop and deploy business-based solutions that address national science and technology priority areas and help Canadian businesses tackle critical issues that affect our future prosperity, such as economic growth and industrial competitiveness, urban and rural community infrastructure, natural resources, the environment, health, and security.

Our programs are designed and executed in terms of strong value propositions, unique positioning in the value chain, market pull, and timely deployment paths. We have clearly targeted outcomes within our program timeframes of three to eight years, hence delivering in a scale of time that is relevant both to our clients and to our collaborators.

Part of NRC is the industrial research assistance program, or IRAP, as it's colloquially called. This is a very important mechanism for economic development and prosperity for Canadian small and medium enterprises. Delivering technological and business advisory services as well as financial contributions, at the moment the program supports approximately 8,600 companies per year in all of Canada's industrial sectors, including the transportation industry.

How, then, does NRC address the complexities of our national transportation infrastructure and lead to a safer and more environmentally responsible transportation environment for Canadians?

As you're aware, transportation-related research and technology development permeates many of our activities specifically at NRC. We're actively engaging with industry in the air, on the surface, and in the marine transportation areas to develop technology-based solutions to meet current and future challenges.

Moreover, we occupy a unique and privileged position between the regulatory bodies, such as Transport Canada and the Department of National Defence, by providing objective scientific, technological, and engineering expertise in support of their policy decision-making.

In the area of air transportation, for example, NRC, in conjunction with industry, conducts approximately $55 million worth of research per year and works with more than 300 companies per year to find solutions to increase the safety and the environmental performance of aircraft and reduce the weight and cost of aircraft and their components.

We also work with the original equipment manufacturers and small and medium enterprises, often forging links between them and offering them access to scientific expertise across multiple disciplines and to unparalleled infrastructure, including world-class testing and validation facilities such as the recently opened Global Aerospace Centre for Icing and Environmental Research, or GLACIER, a new cold-weather aircraft engine testing facility in Thompson, Manitoba.

We are also exploring sustainable, cost-effective alternatives to fossil fuels. We think that algae could efficiently and profitably convert carbon dioxide emissions at the source and recycle those emissions into valuable products—especially biofuels, including jet fuel—without consuming fresh water or displacing food crop resources.

In the area of surface transportation, NRC works to ensure that the Canadian road and rail transportation systems are safer and cleaner, as well as more secure and cost-efficient.

Operating on a full cost recovery basis—for example, earning an average of $22 million a year for the past three years—we work with world-class domestic and international clients to develop and test products and services for the rail and road transportation industries, the Department of National Defence, Transport Canada, and a wide range of vehicle and equipment manufacturers.

We develop and deliver vehicle mobility technologies to reduce the incidence of rail track derailment in the freight rail transportation system and to improve the operational capability of heavy-duty vehicles under all environmental conditions.

● (0900)

In addition to addressing challenges in wheel and track performance, our current technology priorities include silent watch and idle reduction in heavy-duty, specialty, and rail vehicles; off-road mobility; and heavy-duty and rail vehicle body dynamics and durability.

NRC is also developing, validating, and deploying lightweight and advanced materials technologies and innovative design solutions to build more effective fuel-efficient vehicles for both the automotive and the passenger rail industries.

In collaboration with industry stakeholders all along the supply chain, we expect to achieve a 10% weight reduction in vehicles by 2025 with the introduction of innovative lightweight components based on aluminum and composite materials—these can be biocomposite, by the way—in cars and in other ground transportation vehicles. This reduction should lead to approximately a 7% decrease in fuel consumption, an average saving of about 1.5 billion litres of gasoline per year.

NRC is also investigating the use of the lightweight materials in terms of their potential benefits to the aerospace industry.

Finally, NRC is investing to help find safer, more effective, and less environmentally damaging methods for shipping durable cargo to Canada's northern regions. NRC will lead the development of an integrated system of technologies, including performance-based navigation decision tools that will work to reduce the cost per tonne of shipping to communities by about 20% and double the frequency of shipments without increasing the assessed risks to society or the environment.

The prospect of alternative technologies such as heavy-lift airships is also an intriguing possibility for some cargo, such as super-sized mining equipment, for locations that are inaccessible by road or water.

I welcome your questions. I thank you for your time this morning. It has been my pleasure to share a little bit of the NRC work and the initiatives that are under way in looking into Canada's transportation infrastructure.

Thank you.

● (0905)

**The Chair:** Thank you very much.

Mr. Sullivan, you have seven minutes.

**Mr. Mike Sullivan (York South—Weston, NDP):** Thank you, Mr. Chair.

Thank you, all of you, for such wonderful presentations.

I note that both of you talked of lightening the load, as it were, and making the manufacture of lightweight materials a focus of much of the way to reduce the energy consumption of vehicles. Are you working with the Department of Transport in regard to the rail industry, and the passenger rail industry in particular, with regard to the FRA compliance rules as to whether there will be some kind of direction to reduce the weight load on passenger rail vehicles?

As you may know, FRA compliance requires huge, expensive, and very bulky transportation vehicles, because they have to be able to withstand a crash. It's a safety issue that is not used in Europe; it's used in Canada and in the United States. As a result, our manufacturers have difficulty competing for the manufacture of these vehicles because they're set up for Europe. We don't have that here.

Is there some discussion going on with Transport Canada about these regulations?

**The Chair:** Go ahead, Mr. Treboutat.

**Mr. Paul Treboutat (Director General, Centre for Surface Transportation Technology, National Research Council Canada):** Mr. Sullivan, regarding your question on the lightweighting of rail vehicles, I can tell you that in terms of NRC's role and how we fit within the innovation chain within the government framework, my technology centre has been operating as a full cost recovery organization for 16 years. Typically, our role has been to work with Transport Canada as a trusted technology partner in assisting that department in moving forward a number of policy areas where they feel that they can improve safety for public transportation systems in Canada and, as well, that they can advance other initiatives related to S and T priorities in Canada.

Therefore, although we do participate with Transport Canada to the best of our ability on such meetings, frameworks, or arrangements—such as the Railway Research Advisory Board, for example, where we understand what the industry needs are and we also understand where policy is going—in the end our role tends to be more in the realm of an enabler of technology. We go to great pains to identify different approaches, options, and analyses. As well, we have the engineering know-how to be able to bring solutions into what we would call a TRL 5 or TRL 6 level, a technology readiness level, which is a protocol that is widely used in R and D circles.

However, typically we do not get ourselves involved in working to influence policy. That's not a role that we see ourselves playing, because we have to continue to preserve ourselves as a trusted technology partner that brings scientific and engineering rigour to the forefront. We purposely stay out of the policy domain.

● (0910)

**Mr. Mike Sullivan:** We've talked a bit about some of the barriers to implementing new technologies. One that I've been made aware of is the lack of a national building code with respect to charging stations for electric vehicles.

If the hype from the manufacturers is to be believed, there's going to be an electric car in every garage and two chickens in every pot very soon.

**Voices:** Oh, oh!

**Mr. Mike Sullivan:** What are we doing, from both perspectives, to ensure that not only are we going to have natural gas refilling stations where necessary, but we're also going to have a system in place that can safely keep electric home vehicles charged and ready?

**Mr. Geoff Munro:** The technology road map I described gives you the flavour of all of the partners playing. We've taken the same approach on trying to figure out how we implement the recommendations that come from the road map. You've actually picked on one that's quite specific, the codes and standards. They're not unique to the building, although that's certainly part of it. There are other codes and standards needed as well, so we're working quite closely with CSA, the Canadian Standards Association, to develop the understanding of the technology and what is required in the various cases.

Charging at home will most likely end up being a 220 volt charge, the same as the dryer or the stove in your house now. The standard will be very similar to the standard for the kinds of electric infrastructure that's already there for wiring it appropriately to the garage and taking into account the temperature differences, etc.

The public charging stations are much more likely to be at a much higher level, stage 3, which can charge much faster, and there will be a higher voltage associated with that. Again, we're working with the Canadian Standards Association to ensure that those codes and standards are developed.

When I say “we”, I'm certainly speaking on behalf of NRCan, because we do participate in those processes, but again it's the community that's involved, so we're talking to utilities and we're talking to the original equipment manufacturers, the people who are actually going to build the cars. We're talking to the full spectrum of the innovation chain to make sure that CSA has everything it needs to fashion those codes appropriately.

**The Chair:** I'll have to stop you there, Mr. Sullivan.

Go ahead, Monsieur Coderre.

[*Translation*]

**Hon. Denis Coderre (Bourassa, Lib.):** Thank you, Mr. Chair.

Mr. Munro, I have a practical question for you.

My honest opinion is that the public investment figures are very low. You will probably like my question. If it is true that the transportation sector is the largest consumer of energy and that reality will make us change technology, is spending only 20% on fundamental research and 38% on applied research justified by the fact that you have to deal with the current budgets and that more investments are needed?

The reality is that

[*English*]

it's an ongoing issue, and you will truly need more resources to make sure of the "doability" of what we'll provide afterward.

As legislators—and we will make some recommendations, so I'm very pragmatic here—we are in a kind of pre-budget, and I believe we should invest more in R and D.

Do you truly have what it needs right now? What more do you need to be even more efficient? I ask because this is the future.

**Mr. Geoff Munro:** I can't give you a specific dollar value on each of the items in the road map by example, but I would point out that the Government of Canada is certainly one of the investors. The chart that I gave you talks about the federal government investments, as you point out, but there are moneys in academia and there are moneys in industry. That's why I keep pushing the road map approach: it's because it not only pools the ideas and the knowledge associated with what the barriers are, but it also pools the money. You get an investment that's collaborative between NRCan, potentially NRC, Transport Canada, and whoever the right partners are within the federal government. However, we also link very effectively with industry, with academia, and, on many occasions, with provincial governments.

To answer your question properly, we'd have to go back and look at the full scale of investment that is going on—and I don't have that with me—in order to look at what the investments really are in the country in regard to what this committee is trying to achieve.

● (0915)

**Hon. Denis Coderre:** One of the issues here is that if we want to be that efficient, the federal government has to be the leader in that private-public pact. If we're not there, we cannot just relate it to the private sector, because then you will have in your road map everything regarding regulation.... If you want to be a leader, you need to put up the resources too, and I frankly believe it's not enough.

If you have some figures, I think it would be appropriate for us to receive them, because there will be opportunities later. We'll see what we can do. The Liberal Party certainly always put forward money for that priority and specifically also in our relationship with the universities. I think it's the most important thing.

[*Translation*]

Mr. Treboutat, I understand your role and find it acceptable, but my questions are about your approach. If my understanding is correct, you establish priorities on new technological methods and identify different options so that those who have to make decisions afterwards can do so on their own. Therefore, you are not influenced by any pressures in terms of policy, and I think that is a good thing.

However, I would like to go back to the protocol readiness. Hydroelectricity is important, especially in Quebec. Last week, I saw a report on the issue of lithium in electric car batteries. How do you ensure that safety accounts for a significant portion of your research? How does it work, specifically?

We actually saw that one of the problems is really the lithium battery and not the electric car itself. The battery may overheat and cause problems.

As a researcher, what is your protocol and the mechanism for ensuring doability when it comes to safety so that the next step can be taken in terms of marketing?

**Mr. Paul Treboutat:** That is actually a very good question.

We are not experts on batteries at my technological centre. Experts and researchers from other NRCC sectors would conduct research to find solutions in line with safety standards regarding lithium batteries.

Our centre is mainly focused on mobility technologies—where wheels come into contact with a given surface, be it rails, terrestrial surfaces or even lunar surfaces. We are also working on lunar rovers for the Canadian Space Agency.

**Hon. Denis Coderre:** So you are on the moon these days.

**Mr. Paul Treboutat:** Yes, mainly. That area of interest is very important. It also goes to show you that our ability to act proactively has no limits.

**Hon. Denis Coderre:** So there is hope for weight transfer. Is that what you are saying?

**Mr. Paul Treboutat:** Yes.

[*English*]

**The Chair:** Go ahead, Mr. Poilievre.

**Mr. Pierre Poilievre (Nepean—Carleton, CPC):** Mr. Coderre said he believes the federal government needs to be the leader in this field of transportation technology.

I had our analysts produce a report on the last 200 years of transportation inventions that people actually use. This report demonstrates that, aside from making military purchases, government has had almost no role in producing the technologies that people use to move themselves around and that in almost every case, transportation technology has been invented and commercialized exclusively by the private sector. The only major exceptions appear to be for space and the military. In the military it was done through purchases that created a demand pull, not through R and D programming.

That historical insight guides the way to the next generation of breakthroughs, so my opening question is a broad one, but I'm asking you to answer as succinctly as you can.

Is government really the leader in innovation, or, in fact, is it private sector entrepreneurs?

● (0920)

**Dr. Ian Potter:** That is an excellent question, and yes, 200 years of history show many things.

Whether we like it or not, the military and the wars that we go through are strong drivers of innovation. Also, in parallel to that, is the role of different fuels. Coal was the main fuel 200 years ago. Then we went into oil and nuclear, so fuels drive a lot of the economy decisions.

I will give you a very simple example of how things are taken from the military and transposed. Originally, about 110-112 years ago, submarineswere actually gasoline-powered, and that was dangerous. Safety was an issue, and so they converted to diesel engines. The first engine was actually converted to a diesel engine for submarine use; submarine use actually drove diesel use, which was then replicated in automotive vehicles. There were a lot of challenges.

Going specifically to your question, succinctly, while military and government-type initiatives for things like space are out there and while governments do invest heavily in those particular sectors, the role for the R and D community is to actually take that military technology and get it down into a cost-effective area where it can be done commercially. That is what much of the work that NRCan and NRC do involves: helping hand-hold those commercial companies through the cost de-risking challenge and actually making those products further applicable to commercial and public use.

**Mr. Paul Treboutat:** I can offer an example. About a year and a half ago we worked on a project for National Defence. They were very interested in expanding their silent watch capability for armoured vehicles that were in Afghanistan in a covert type of operation for which electronic surveillance activities needed to occur without detection and without being noticed. They inquired about the possibility of integrating a hydrogen PEM fuel cell onto a vehicle. We were able to do that successfully, working in collaboration with a couple of other institutes inside of NRC, and we demonstrated the technology.

The interesting thing is that the technology and the on-board auxiliary power and power management systems that were integrated into the vehicle's on-board systems then presented an opportunity for the Ottawa Police Service to experiment with us on some idle-reduction technology to help them to save budget on their fuel costs.

**Mr. Pierre Poilievre:** Is this technology actually being used on a broad scale?

**Mr. Paul Treboutat:** It's currently at a TRL 6 level, so it's still in a demonstration stage. We're hoping that DND will be able to invest more money into developing that opportunity further as we see inroads for silent watch capability into idle reduction for specialized fleets of vehicles such as police vehicles, ambulances, and command posts, as well as on construction sites for generators and so on.

**Mr. Pierre Poilievre:** We're getting a little bit too specific for the question.

One of the concerns I have about these programs is that often they fund pilot projects and demonstration projects, but because they are not commercially viable, they never take root or become broadly used anywhere. I think, for example, of the enormous resources the federal government invested in hydrogen fuel cell technology. The latest reading I've done on that technology said that isolating the hydrogen fuel consumes more electricity than the fuel itself produces. I'm not aware of anywhere in the world where hydrogen fuel cell technology is commercially viable on its own, even after all of those massive public investments.

When we have these distortions of government spending of other people's money on ideas, that money goes to things that lack commercial viability and therefore never become widely used. How do you respond to that?

● (0925)

**Mr. Geoff Munro:** I'll take the first response and let my colleagues add to it.

That's why I am such a champion of the road map approach: because it involves—as in the case of electric vehicles, for example, or in the case of natural gas, the two I've left for your consideration today—the OEMS, the original equipment manufacturers.

The electric vehicle one involves the utilities, so we know they are thinking about what the electricity draw is and whether they are going to be able to meet it if in fact there are electric vehicles in every garage. The full value chain of the economic sector is involved in the discussion. If we're talking about an OEM like GM or Ford, they're not going to spend money working on the introduction of electric vehicles unless they're going to introduce electric vehicles.

By taking that approach, you focus the Canadian government investment on the gap that may exist, whether it be codes and standards or whatever the actual specific might be that comes out of that road map area, and you look at the federal role in the innovation system so that Government of Canada dollars are invested only in a Government of Canada role but within the context of something that will be used.

I take your question very seriously in the context of whether we should be investing and where. When we respond in that fashion, there is a much higher likelihood that the technology that gets developed will be implemented in the marketplace.

**The Chair:** Ms. Chow is next.

**Ms. Olivia Chow (Trinity—Spadina, NDP):** Thank you, Mr. Chair.

Dr. Potter, I saw in your National Research Council report on side guards that there would be a reduction in fuel consumption of at least 5%, and that the benefit for Canada, if these aerodynamic side guards were in place for all the tractor-trailers, would mean a saving of 401 million litres. I just calculated, and for 401 million litres, that would be savings of $561 million. That's a lot of money.

Then I looked into it even more. Of course, your report also said there would be an annual reduction of 1.1 million tonnes of CO2 emissions, meaning they would not only save money but would also be good for the environment. Because they're relatively lightweight, they would reduce the 10% wind-tunnel drag.

I looked at other reports from other countries. Krone, in Germany, has aerodynamic side guards that have 7% lower fuel consumption. They did another study, a long-distance trial, that showed fuel savings of 20%, and a British design leads to an average reduction in fuel consumption of 10%, so the 5% is fairly conservative, given all the other figures from European countries as 20%, 10%, etc.

I assume the lifespan is about 20 years for these things, give or take, and that "light weight", because they are pretty advanced, means around 220 kilograms, so I would imagine that if they saved fuel, even at 5%, the installation of these side guards would have around a two-year payback, because they're about $1,000 or so.

Am I right in all that? You had this big report. I went through it and then I looked at other European studies, and those seem to be the findings. Am I correct? I've shared that information with the trucking alliance, the trucking association. They were looking at side skirts, and they didn't realize that side guards—the closed side guards, not the rail type—would save even more money. They seem to have fuel reductions that are even higher than those for side skirts, which are 4%.

Am I correct in the reading of the NRC report?

● (0930)

**Dr. Ian Potter:** The short answer is yes, without getting into the numbers exactly. I don't have all the numbers in my head. I can check on them if you like, but yes, the numbers sound reasonable.

The differences come about for a couple of different reasons. The main one is the drive cycle that you would undertake in Europe, as opposed to that in Canada, for example. Canada has long stretches of highway; in Europe, a long stretch of highway without a traffic jam doesn't really exist, so those trucks actually have to tolerate different drive cycles in the way they operate.

As a result, we use different drive cycles for testing. There are standard drive cycles, and the tests are based on them. You can apply different drive cycles to the testing technique. Those tests were actually done in our facilities here in Ottawa. We can actually get a whole semi and drop it into a wind tunnel and look at what the drag is on the vehicle. We can actually do that research and help the companies. A lot of the work around the trucking cycle was actually done also within Paul's group in terms of how thick and how heavy those skirts have to be and where the cost savings are.

Other technologies go even beyond that, such as mudguards on the wheels. There's this big flap of plastic that stands behind the wheel that keeps stones and chips from coming up. New designs have aerodynamic louvres in them. This is a Canadian-based technology whereby you can actually reduce the drag and improve fuel efficiency while safeguarding against stone chips coming up.

There are a lot of innovations going on within the trucking fleets in Canada, and I think some of those will be transportable—no pun intended—to the European market.

**Ms. Olivia Chow:** Were the side guards I was talking about, which you used to do the test, the state-of-the-art European ones? They keep coming out with new styles. We don't seem to manufacture them in Canada, and if we end up using them, we'll have to bring them from Germany or other countries.

Do you see a possibility...? Were the ones you were using manufactured in Canada, or were they brought in from elsewhere?

**Dr. Ian Potter:** That was prior to my time at the National Research Council. If my colleague knows....

**Ms. Olivia Chow:** I would appreciate it if you could look at my figures to make sure they are correct, because I got them from the report and extrapolated.

**Dr. Ian Potter:** It would be my pleasure.

**Ms. Olivia Chow:** Thank you.

**Mr. Paul Treboutat:** Regarding the side guards that were used for the tests, unfortunately I don't recall exactly where we sourced those from, but I can definitely follow up with that information after the meeting.

The work we did in this regard was, again, in response to a direct request we received from the regulator that holds the responsibility for the Canadian motor vehicle safety standards, Transport Canada. This was in response to their desire to understand if these side guards would meet a variety of different questions they were looking to answer.

If I recall, there was a slight issue in that we observed an increased temperature on the braking system, though. The reduction of airflow over the brakes had to be looked at as well, as part of the overall possible implementation of side guards on trailers. I can follow up on that if you would like.

**The Chair:** Thank you.

Would you please present any documents you have through the clerk? We'll distribute them to the committee.

Just for the committee's reference, I went back to Ms. Chow before I recognized Mr. Holder, so I will go to two questions on this side.

First is Mr. Holder.

**Mr. Ed Holder (London West, CPC):** Good morning.

I'd like to welcome our guests this morning. I appreciate your testimony in front of the committee. I think it's very helpful for me to better understand emerging technologies in transportation.

Mr. Munro, if I might start with you, please, I think the deck was helpful in giving us some sense of priorities and the road map you've discussed.

This is not intended as an obvious question. I heard you say in your testimony that cold weather in Canada causes different challenges, but you didn't elaborate. For the purposes of the committee, could you just explain what you meant by that comment, please?

● (0935)

**Mr. Geoff Munro:** Yes, I will, happily. The cold weather in Canada has a number of impacts on a conventional vehicle, but the specific reference I was making was to batteries and battery life—battery durability—in the context of an electric vehicle. There is a testing centre in northern Ontario where vehicles are left out in the miserably cold winter weather and then tested according to standard. It's not done by us.

I'm not sure if NRC is involved in that. It's being indicated that they are, along with Transport Canada.

A lot of the facilities to do the testing exist in that colder northern climate, but that reference was specific to the electric vehicle battery situation.

**Mr. Ed Holder:** Okay.

You did reference three things as being the three leading technological issues that are currently being developed. One was the electric car. The second was changes in industrial policy, such as polymers and those sorts of things—

**Mr. Geoff Munro:** That

That's the lightweighting. Yes.

**Mr. Ed Holder:** Yes, lightweighting is in my note here.

The third was the legacy fleet. You made reference to tires and aerodynamics and all of that. Of those three, which do you think is the most significant factor? Are they equally weighted, do you think?

**Mr. Geoff Munro:** That's a bit of a tough question. I'm not sure I can put a quantification on it.

Part of it has to do with how long the existing fleet is going to stay on the road and how far ahead the equipment manufacturers are in things that are already in queue, such as the direct injection technology for gasoline, for instance. I think we are all familiar with fuel injection, but fuel injection has been improved to the point where the fuel is going to be injected directly into the cylinder head, compared to going through an injection process. Well, that's going to increase efficiency yet again.

That technology, to my understanding, is already in stream in terms of the planning. I'm not sure in which model year it will come out as an operational thing, but my example is that those things are already in play. Of course, we don't have the inside knowledge as to which technology what company already has in their planning cycle.

I identified three categories. The first was the game changers, as I called them. Electric vehicles are going to change the game. If we actually do have electric vehicles, even with the range challenges we have in them today, and if they are used as local commuting vehicles in town, that potential game changer will be significant in terms of energy use and emissions.

Then there was the planning that's going on now by the OEMs, the equipment manufacturers, in their existing plans. Then there's the legacy fleet.

All three have different parameters associated with them. I suppose I identified all three because to improve energy efficiency and reduce greenhouse gas emissions from automotive transportation, we need to look at all three, but I'm afraid I can't give you a quantification on which one is more or less important.

**Mr. Ed Holder:** You know, I come from London, Ontario,—

**A voice:** It's the tenth-largest.

**Mr. Ed Holder:** —the tenth-largest city in Canada; that's actually quite correct.

Our university, Western, is arguably the greatest university in this country. I say that with a bit of bias, but one thing I really appreciate about what they do is that their research and development initiatives are geared toward commercialization. We work with NRC; they happen to have a shop in London.

Western has recognized the whole issue of lightweighting as one of those game changers you've discussed. Through our university we've made a significant investment with a company to put in a Dieffenbacher press from Germany, aimed toward having lighter weight in auto manufacturing, aerospace, and so on. The potential is quite significant, so your reference to lightweighting is rather interesting, since it's one of the game changers they agree with.

I want to come back to something you referenced in your presentation about clean energy investment. Obviously we all know the importance of clean energy. I sit on the Standing Committee on International Trade, and I happened to be in Brussels and France in November. German representatives there gave us a great presentation on how they're moving towards clean energy, but I was shocked and quite surprised when they said that as they move away from nuclear, they're going to coal.

Frankly, every one of us on our committee, from all parties, just stopped and said, “What do you mean, you're going to coal?” That was their transition piece between solar and all these other things. It was because it's clean coal, whatever that means. I must admit that our whole committee was shocked by that piece of information.

We're not going to create an international incident and ask you to comment on their approach, but do you see coal coming back into Canada as a response to the need for clean energy? Do you have any thoughts about that?

● (0940)

**Mr. Geoff Munro:** Canada has an awful lot of coal—

**Mr. Ed Holder:** Sure we do.

**Mr. Geoff Munro:** —and “clean coal” is actually a term that's now gaining recognition in the context of two particular technological innovations. One is how you burn it: the pressure, the temperature, and whether it's with or without oxygen. A number of combustion experiments are going on to try to fine-tune how the coal is actually burned.

Of course, coal is not coal, coal, coal; depending on what seam of coal it's taken from, it will have different characteristics, different pollutants, etc., so there's a fine-tuning effort associated with that part of it.

The biggest concern on clean coal is being able to take carbon from the burn, capture it, and store it. We know how to do that technologically. The problem, of course, is that the capture step of that CCS, as it's known, is considerably expensive. Figuring out how to reduce the cost of capturing carbon is an initiative that a number of us are involved in, both inside government among the various departments and among colleagues in other parts of the innovation system.

Clean coal, if it's going to truly be clean, will be burned to as clean as it can be; then the pollutants will be captured, and the carbon dioxide, being the biggest component, will be captured and stored.

**The Chair:** Thank you.

Go ahead, Mr. Toet.

**Mr. Lawrence Toet (Elmwood—Transcona, CPC):** Thank you, Mr. Chair.

Before starting, I wanted to thank you for the great printed pieces you left us with. When I got it freshly out of the box, it brought back reminders of my previous life in the print and communications business. To have that reminder every once in a while is a great thing, so I did appreciate that.

I wanted to talk a little about innovation challenges in the context of innovation versus bringing that innovation to market. That's one of the key challenges we face throughout the world, I think, and it's one of the challenges the Canadian industry faces. The commercial viability issue always has to come back into this. There has to be a commercially viable need or requirement for that particular innovation in order for it to go to market. That also involves, obviously, the public deciding that they want to invest in it, and not just in a monetary way; they also want to invest in that technology for them to use.

What is happening with regard to the industries themselves being involved in helping to bring their innovations to market? From your perspective, what are you seeing out there in Canada through the different industries that are innovators? How are they working to bring innovations forward as very marketable commodities in the end?

**Dr. Ian Potter:** That's an excellent question.

With regard to the role of innovation, as you are aware, there have been numerous attempts to codify how you actually move it forward successfully over the decades. Unfortunately the parameters around which it's done at any one time always move. The global economic situation and the local challenges are always changing.

Specifically on the commercial side, where I see a lot more of NRC's work going is that a lot of that innovation is actually happening in the companies themselves—with the people on the shop floor, if you like. I know NRCan is also involved in this sort of thing. A lot happens in universities, and it's about how you bridge the difference between academic research and innovation by the companies. That's where NRCan and NRC come in, with our particular roles in particular sectors.

For me it's about how you bring those companies in earlier to connect with those ideas. If there's an idea in academia, how do you actually bring the companies in pretty much on day one and tell them that you have something that might be of interest to them—not tomorrow, but maybe five, 10, or 15 years down the road—while at the same time they're training their future employees?

That way they take ownership of it. They can see it and nurture it. They can advise where appropriate, as opposed to having me say, "I do this great work in my lab, and it's wonderful. It's the best kept secret I've ever had; here's the report, and I'm going to make you really happy, but I'm not quite sure how".

We have to get away from just giving them the report and instead actually bring them in earlier.

Some of that is the "skin in the game". Is it money? Is it just their time? Time is money to these people, so we need to bring them into the discussion earlier and have them sit on advisory committees and boards and that sort of thing.

The other challenge that Geoff and I were talking about just last week is investments. That challenge comes back to the earlier question on demonstration. Having a demonstration just for the sake of a demonstration is good, but it has to go beyond that. How do we transfer that knowledge to the broader community? How do we make sure that the learning from that activity is not just a report and that people are involved and that we can actually transfer the demonstration knowledge that's been built up to the translators?

Most of it's actually not in the report. It's the journey that you've gone on, hence the road map type of activities. How do you take that to the broader innovative communities and those companies that you know are desperate for innovation? There are a lot of them out there, as opposed to people who are just what I would call parasitic, the followers rather than the leaders. How do we nurture those followers more effectively?

I think there is a role, and I think the government labs are pretty much on that journey to help capture that value we put in through R and D investment.

● (0945)

**Mr. Geoff Munro:** I certainly concur with what Ian has said. If you dig into the innovative activities of the federal government laboratories, the ones that are primarily in the non-regulatory role, you'll find that the integration with the industry is—I don't know what kind of timeframe to put on it, whether it's five or 10 years—getting stronger and stronger all the time.

I'll admit I sound a little bit like a broken record when I repeat the road map reference, but clearly that tool works very effectively for us. However, it's not the only one. We have a materials technology lab in Hamilton that is one of the focal points for the lightweighting discussion we were having a few minutes ago. In Hamilton you have steel and automotive; when you walk the shop floor, you're not sure if the person there is a university employee or student, a Government of Canada lab employee, or an industrial R and D person unless you stop and ask them. That kind of integration of thinking in how we use something is how you make sure that the S and T investments and the R and D investments are going to be relevant to the operational use.

One other point I would make is that often it's not the major companies in a discipline that are the principal innovators; rather, it's those in their supply chain. For that reason, we have to continue to work not only with the majors that want innovation but also with the small and medium-sized enterprises where a lot of innovation takes place. Those are the guys on the shop floor who say they can do this in a much better and smarter way, and we have to facilitate their integration with this community of innovation activity as it's unfolding.

**The Chair:** Thank you.

Before I recognize Mr. Nicholls, I just want to say that I too, in a previous life, was in the car business, and it seems as though they've been lightweighting cars for the last 25 years. You mentioned matching power to the size of the vehicle. You can have a lightweight car that gets no mileage if you don't have the right engine and transmission in it. I believe that's how we got the doughnut spare tires in the late 1960s. It was to lighten up the car.

Is it true that products are being held back that could actually be more efficient? I ask that as a question.

**Mr. Geoff Munro:** I can't speak to that. I don't know.

I do know that there's lots of work on lightweighting going on that has the potential to be in the marketplace. Whether somebody has something hidden away in a backroom, I don't know; certainly, we don't.

**The Chair:** We've all heard of the 100-mile-per-gallon carburetor. You've obviously never found that out, eh?

Go ahead, Mr. Nicholls.

**Mr. Jamie Nicholls (Vaudreuil-Soulanges, NDP):** Thanks, Mr. Chair.

I was listening with interest to the parliamentary secretary's comments about the 200 years of innovation. I'm interested in innovation in terms of building Canada's competition in the world. I looked at the World Economic Forum to see where our weaknesses are. One weakness I found in Canada's economy was that we're 49th in government procurement of innovative technologies. There are other economies lapping us on this issue. I know that we have the CICP program, and hopefully, with time, that will pick up and will improve our ranking in the world.

It's often been said that government is not good at picking and choosing winners and losers in innovative technologies. All the same, governments still do it. They do it in transport, in terms of modes of transport that they choose to privilege over others.

My first question is addressed to Mr. Treboutat. What proportion of services do you provide for automotive transport compared to rail, and how is the allocation of resources by mode decided?

● (0950)

**Mr. Paul Treboutat:** Thank you for your question.

Just to clarify, are you asking what percentage of CSTT resources is allocated or dedicated to trucking?

**Mr. Jamie Nicholls:** I mean automotive transport as compared to rail.

**Mr. Paul Treboutat:** Okay. Concerning automotive transport, are you referring to freight trucks?

**Mr. Jamie Nicholls:** I think it's service transport, freight trucks, and automotive—road transport.

**Mr. Paul Treboutat:** Okay.

As we mentioned in the opening speech, CSTT operates on a full cost recovery basis. In simple terms, that means we're focused on key areas of surface transportation technology, but more so on the engineering consulting side of the business to leverage the unique testing infrastructure we have on site on our campus. It's a 45-acre campus east of the Ottawa airport.

Over the years, the breakdown in business activity that we've undertaken, road versus rail, has been, if I recall, about 80% on what we define as the road vehicle side and about 20% on what we define as the rail side. That percentage is not based an allocation of money from CSTT or through any program. It's based on market attractiveness, meaning market pull from clients we've been able to identify who are interested in the unique testing infrastructure, skills, knowledge, and capabilities that CSTT possesses.

Of course, in every piece of business we do in transportation, we're always keen on looking for an opportunity to enhance our value with that key client and to working toward a contracted type of R and D scenario.

**Mr. Jamie Nicholls:** My next question goes to Mr. Potter.

The Library of Parliament submitted to us a list of federal organizations that distribute funds for transportation R and D. The Government of Canada has a number of research programs in which the NRC participates. The Automotive Partnership of Canada, the Institute for Aerospace Research, and the Institute for Ocean Technology are some of them.

Why is there not an equivalent institute for rail, and do you see this as potentially a gap in current support for R and D? I know there's a rail division of the NRC, but it's unclear how much research they actually do.

**Dr. Ian Potter:** The institute's structure has existed for several decades now. As part of the revised strategic direction, which the minister will be talking about, I believe, in the new fiscal year, we are looking at refocusing many of our activities. Surface transportation will remain within what was the NRC Centre for Surface Transportation Technology. Rail is a critical function within that. We need to see how we can grow that and what the needs are. There is no point in just doing stuff because we think it's a good idea; there has to be a need driving it. One of those challenges is the needs for tomorrow as opposed to the needs in 15 years, or what the time frame of innovation is. Some things we may stop. That's the strong program development function we will be building at NRC.

We are also putting a major focus on automotive. The GDP contribution of automotive to the country is huge. That permeates many different areas at NRC at the moment, but there is not an institute I can point you to that is the automotive institute; it's embedded in many others.

Focusing on the sectors that are critical to Canada is one of the main areas I think NRC will come forward with, and I hope that the minister will support this and that it will be endorsed.

● (0955)

**The Chair:** Thank you.

Mr. Richards is next.

**Mr. Blake Richards (Wild Rose, CPC):** Thanks, Mr. Chair, and my thanks to all of you for being here today. We have a very knowledgeable panel down there.

I want to ask some questions about electric vehicles. I don't have a very good understanding of electric vehicles and their technology.

We talk about all these new technologies, new types of fuel, and new ways of powering vehicles. Can anyone tell me why there is not more research done on our existing gasoline-powered engines to try to make them more energy efficient? We already have all of the infrastructure there for these vehicles. They are commonly used. It seems to me it would make common sense to look at ways we can improve their efficiency. I'm wondering why there is not more research done on improving them. Over the last quite a few years now, there haven't been any significant advancements in improving the efficiency of gasoline-powered motors. Why could we not be looking more at how to improve their fuel efficiency?

**Dr. Ian Potter:** For whatever reason, you always hear about electric vehicles. You hear about fuel cells, because it's all about flavour of the month, but it's been the flavour of the last couple of decades.

There will be electric vehicles and there will be fuel-cell vehicles, but the guts of our economy are still the reciprocating engine. There has been a lot of movement in technology for that system. Jeff mentioned types of fuelling systems. There have been other things, such as on-board computer diagnostics, that drive efficiency. I used to do my own engine maintenance; I don't go near it now, because I need a computer to do so. It's a very high-technology piece of equipment.

I'll give an example on the lightweighting aspect. People think about lightweighting in terms of the vehicle body, but they're wrong. The engine block is a big chunk of metal, and it's very heavy, as anybody who has ever lifted an engine can tell you. How do we use aluminum as an engine block? That's some of the research we are doing at the moment. How do you make aluminum into a lightweight engine block?

There is a lot of internal combustion engine research going on. There are new cycles of reciprocating engines coming out every day. Part of it is testing. There are some great labs in Canada. Jeff has some, and I have some. There are industry labs. Ford has a major engine lab in Windsor. It has 12 of the best test cells you will ever see, and it's in our own back garden. There is a lot of innovation, and I think there's still—pun intended—a lot of mileage in research on internal combustion engines.

**Mr. Blake Richards:** I apologize if I phrased the question in a way that discounted the great stuff that is being done. What I was trying to get at is that when we talk about mileage, it seems that the focus is always on trying to have hybrid vehicles or electric power.

Are there not ways we can find efficiency in terms of our mileage, our fuel economy, with gasoline power? Is there research being done in that specific area? Is there hope that gasoline engines can meet the challenges we're looking at alternative fuels for?

● (1000)

**Mr. Geoff Munro:** The simple answer is yes. When I was talking about the three aspects of the technological advancements that can take place—the game changers, the things that are already in stream, and the legacy fleet—the latter two both involve the internal combustion engine. It can be the engine itself—and there is work going on there—or the automobile that the engine is driving, because it has to be looked at as a full unit, obviously.

It can be lightweighting or aerodynamics, and even driver training, believe it or not, can make as much as a 10% difference in fuel economy. Whether that driver training is actual training or vehicle control technology that deals with how fast a car can accelerate and that kind of thing, they can all play towards an overall more efficient automobile that is using an internal combustion engine. It's both the engine and the car in which it's being used.

**The Chair:** Thank you.

Go ahead, Ms. Morin.

[*Translation*]

**Ms. Isabelle Morin (Notre-Dame-de-Grâce—Lachine, NDP):** I want to begin by thanking the witnesses for joining us today.

Mr. Munro you talked a lot about vehicle electrification. Could you tell me if you are talking about only cars or trains? What types of vehicles are you currently conducting research on?

[*English*]

**Mr. Geoff Munro:** The two subjects...as a matter of fact, all three that I've talked about—electric vehicles, lightweighting, and the natural gas road map—are focused on the on-road vehicles at this point in time. We're not involved in the rail or marine or aircraft areas at the moment.

Taking a segue, if I might for just a moment, one of the things we are looking at in the context of the natural gas road map is other modes of transportation that might take advantage of natural gas being a cleaner fuel than conventional diesel or gasoline, but that work has not started yet.

[*Translation*]

**Ms. Isabelle Morin:** So you plan to study how natural gas could be used in trains, but no research is currently being conducted on rail electrification. Is that right?

[*English*]

**Mr. Geoff Munro:** No, that's not in my sphere of responsibility. I do know that GE has developed an electric train engine, largely for the demonstration of the capacity to do it. They've got it on their research campus in Albany, New York. You can actually see an electric train do its job as a full-size engine, but I'm not involved in any research that would take that forward. Is the NRC?

**Dr. Ian Potter:** Actually, yes, we are. I'll give you an example of looking at integrating a fuel cell into a light rail transit train that would generate electricity that would then feed motors to drive the wheelset.

There are similar sorts of areas with fuel cells in airplanes. In some work we just completed with Boeing, we put in a fuel cell to drive the auxiliary electrical load for a plane. It fits into a plane like a cargo container. The fuel cell sits in there with the self-contained fuel and provides auxiliary power. Again, that's electrical generation.

Much of the work in shipping is moving more towards what I would call the hybrid electrical system, in which you have internal combustion engines and battery sets in parallel, or some form of storage. That way they can put the power system higher up in the ship and they can remove the ducting for the exhaust and the air supply systems that have to go all the way through to the bottom of the ship.

There are a lot of crossovers of this technology into other transportation modes. Electrical drives are becoming fairly common in most transportation vehicles. The prime mover for that is still a question. It may be internal combustion, fuel cell, or battery, but the electrical motor seems to be becoming a more common method of driving the actual wheel itself.

[*Translation*]

**Ms. Isabelle Morin:** I really liked the expression you used when you answered my colleague emphasizing the fact that electrification has been popular for a few years.

Just this morning, I received an invitation from a Montreal group holding a seminar on the electrification of mass transit in Quebec and on how quickly that transition will happen. This is really something people are talking about. In my riding, we have the western train, which is a very important project for my constituents' public transit needs.

The Direction de la santé publique recently published a report stating that train noise was more detrimental to health than airplane noise. That is really something we have been hearing a lot. In addition, I was wondering, Mr. Munro, whether you think you should conduct more research on developing electric rail transport. We know that it is more environmentally friendly. As for the issue of health and the noise study, R & D on that would be worthwhile.

I am wondering whether the private sector is not doing too much research in that area, when yours is an organization that should be conducting that research.

● (1005)

[*English*]

**Mr. Geoff Munro:** We're all involved in many potential avenues to varying degrees. As I said in my introductory remarks, to date the work that we're involved in is driven largely by the GHGs and the energy usage factor, so given the impact of automobiles and on-road transportation, that's where we focused.

I certainly accept your premise that there's more to do. NRC has work going on in many of those areas, so we've not overlapped. We try to collaborate whenever we can and wherever we can, and to date we've not been involved in the other modes. As I said, there is certainly potential there, but we can't spread it too thin or we'll end up a mile wide and half an inch deep; then we wouldn't be effective in bringing innovation forward, so to date, we've stayed on the road.

**The Chair:** Thank you.

Go ahead, Mr. Watson.

**Mr. Jeff Watson (Essex, CPC):** Thank you, Mr. Chair, and thank you, of course, to our witnesses.

Would you characterize the focus of your priorities, the three you laid out, as tackling climate change? I hear that seems to be some of the focus here.

I'm going to back up, though, first. We're talking about research and development. Can you give us a sense, first of all, of where Canada ranks with respect to public research and development investment globally, and where it ranks with respect to private research and development dollars? Can you give the committee a sense of those two barometers?

**Mr. Geoff Munro:** Let me start by giving you a vague answer, which I apologize for. I can certainly follow up with more specifics. I'm happy to do that, and I'll work through the clerk's office, just to be clear.

I would suggest Canada ranks higher in public investment research than we do in industrial, if you use the OECD country yardstick, but I don't have the numbers as to where we rank, although we can certainly access those and make sure the committee is made aware of them.

**Mr. Jeff Watson:** What challenges or obstacles exist to more private research and development in Canada?

**Mr. Geoff Munro:** At the bottom line, there are a number of obstacles, including the economics of how quickly and how competitively we can introduce new technology to the private sector and the access the private sector has to the work we do and the work the academics do.

I would argue that we have a somewhat fragmented innovation system in this country. It is getter better and better every day in terms of developing collaborations to make sure we are making the knowledge we are creating available. As Ian has said a couple of times now, having an innovation driver coming from industry is the way that balance can be improved. If they see an opportunity to remain competitive or enhance their competitiveness, whether it's keeping up with someone else or whether it's taking the edge so they can export a technology, a product, a service domestically and internationally, certainly they're going to do that. To sum up, I think it's access to the knowledge combined with maintaining the competitive edge of a given company.

● (1010)

**Mr. Jeff Watson:** Is government itself a hindrance to private research and development, either through high-level policy decisions or through compelling changes in research and development that otherwise might have been conducted? Is there an argument to be made that government, at times, can be a hindrance to where private companies are going with their own research and development?

**Mr. Geoff Munro:** That's an interesting question—

**Mr. Jeff Watson:** For example, let's talk about climate change. Perhaps companies are not necessarily trending in a direction where they're concerned about fuel efficiency. I'm just throwing some ideas out and doing thinking-in-progress, but does the imposition of high-level policy directives aimed at climate change boring down into industrial sectors change the focus of where innovation goes? Now you're playing a pragmatic game against a timetable, for example, to become more fuel efficient. What drives that? This is why lightweighting becomes a key focus of research and development: it's lower-hanging fruit than real breakthrough innovations, if you will.

That's where I'm going here. I'm asking whether—

**Mr. Geoff Munro:** I think I didn't really get the context until your supplementary question, and now I'm beginning to understand.

There is no question that the work we're obligated to do has competitive focus, in that we work with industry to have things brought to commercial use to maintain competitiveness. There's also another whole side to the work we do, which is driving public good. That public good does get characterized by government in the context of the directions we're going to take as a society.

I operate on the premise of a fairly simple formula: the science and technology we do helps to drive innovation, innovation can drive both competitiveness and the public good, and the combination of those two maintains the wealth and health of Canadians, the quality of the life we live.

Is there ever conflict between the public good and competitiveness? I would argue that we could probably ferret out examples, yes, but I don't think the general trend is towards an increase; we see it working hard to decrease.

**The Chair:** Thank you.

Ms. Young, welcome.

**Ms. Wai Young (Vancouver South, CPC):** Thank you so much to the panel today. I sure learned a lot, so I appreciate your presentations and this discussion.

I noticed that this document you handed out, which gives excellent information, has no date on it. Do you have a sense as to what year it was produced or when the research was done?

**Mr. Geoff Munro:** Now you're going to test my memory. This document was actually released at the annual conference in Montreal. That would have been about 18 months ago, so the document was published about 18 months ago.

**Ms. Wai Young:** That's very interesting to me.

I'm actually a member of Parliament from Vancouver South, and I believe Vancouver is one of the leading cities in this whole movement. I was very pleased and proud to make an announcement last week: through the green municipal fund, from which the federal government provides $550 million to FCM, the Federation of Canadian Municipalities, we actually funded the City of Vancouver for $330,000 to put in 67 electrical charge public sites throughout the city, forming our first grid. In addition to that, in our city it's now part of the building code that you have to put in an electrical charging outlet for cars whenever you build a new home.

I think we are at the forefront of a lot of what is being presented in this document, which is why I was interested in the year it was produced. I'm wondering if we're a little ahead of the game, or a little behind the game, or where we are with this.

Maybe that would be my first question, in fact. Maybe I can just turn that into a question for you.

Thank you.

● (1015)

**Mr. Geoff Munro:** Well, let me respond.

I would concur with your assessment that Vancouver is one of the leading cities in terms of the utilization of electric vehicles, with things like the charging infrastructure. BC Hydro does sit on our implementation committee as one of the utilities represented there, and it has been progressive in trying to see the use of electric vehicles. It doesn't escape my notice that the temperatures in Vancouver are different from those in some of the other Canadian cities. As I said earlier, there is a cold weather challenge in some parts of this country, but that said, it doesn't take away for a moment from the fact that Vancouver is doing all you say.

Part of that is a function of the document you have in front of you, because it has been such a key player in this process right from the beginning. The document was published a year and a half ago, but the work was done prior to that, obviously, and some of the institutional contributions have been there from the beginning.

**Ms. Wai Young:** That brings me to page 34 of this document. Obviously the document was produced and the research done a number of years ago now. I'm wondering if these projections have been attained or where they are in that process. I draw your attention to table 4 on page 33, “Present comparison of the consumer costs of an ICE-based vehicle and an EV”, compared to the future comparison, which is on page 34. I found this comparison really interesting, because we're obviously a consumer-driven society and this lays out quite clearly some of the choices available to people. Given that we're building the grid in Vancouver and that we're quite far ahead, I think that is certainly a plus here. Where are we in terms of these two tables?

**Mr. Geoff Munro:** I would say that we are still working towards the objective. We're not there yet.

As you may know, the commercial uptake—the public purchase of electric vehicles—is still quite nascent in the country. Volume, as in many consumer products, will have an impact on price. There is no question that a premium is still associated with an electric vehicle in terms of initial purchase; however, when you compare the initial purchase and then compare the fuelling costs, you start to get your money back. I can't tell you at the moment what the payback period is, other than to say that it's becoming shorter as the price for the individual purchase goes down and as cities such as Vancouver put charging infrastructure in place to make it easier and simpler to charge your vehicle.

It doesn't escape my notice, when I go to the gasoline pump with my own vehicle, what it costs me to fill up. A high-volume charge for an electric vehicle can cost as little as $4 or $5. If you compare filling up your tank to $4 or $5, you see the payback over time.

**Ms. Wai Young:** Well, that's—

**The Chair:** I have to stop you there. I'm sorry. Thank you.

Mr. Sullivan, go ahead, please.

**Mr. Mike Sullivan:** Thank you.

Mr. Poilievre suggested that governments don't have a lot to do with innovation, but my recollection is that in fact it's government regulation that drives a lot of innovation. In New York City in 1908, trains burning fossil fuel were banned and only electric trains were allowed, so electric trains had to be built and had to be made reliable. That happened over a period of about two years as a result of regulation. The U.S. has led us in terms of electric trains ever since. We're the poor cousin of the world, I think, when it comes to electric vehicles.

We have a situation now in which 440 diesel trains a day will be going past homes, schools, and hospitals in Toronto because there's no regulation preventing it. There's no drive from a federal perspective or from a provincial perspective to put in electric trains to replace those vehicles. They are going to be diesel, and they are going to pollute.

The regulation concerning Tier 4 in the diesel world—I'm sure you're aware of it—is driving innovation, because the industry has to build diesel engines that are capable of scrubbing themselves almost clean of nitrous oxides and particulates to a huge extent. That innovation, of course, is now going to be carried on in the U.S. because the Canadian manufacturer, EMD, has moved. I'm not sure whether the folks in the National Research Council are actually working on any of this, but I'd like to know.

The other regulation that drives innovation is greenhouse gas reduction. You've mentioned several times that it's part of what drives you, but it's not just government money that's driving that innovation; in fact, it's the government regulation driving the overall reduction. Could you comment further on how, for example, electric trains were driven in the U.S. by regulation?

The other emerging technology that nobody has said anything about is the contactless electric trains that are being used in Europe. Perhaps they would be ideal in Canada as light rapid transit vehicles without overhead wires. Are we anywhere with those kinds of things? Is there any need for those? Is there any innovation coming from industry and/or you folks?

● (1020)

**Mr. Paul Treboutat:** Mr. Sullivan, thank you for your question.

I don't think I could speak for the purchasing decisions on a local level that municipalities or transit commissions or transit authorities undertake, but I too share your concern about the impacts of emissions from diesel engines, particularly in dense urban environments.

Within my organization we're working to get a project afoot with a Canadian company that manufactures light rail railcars for high-density urban applications globally, as well as in Canada. We're looking at getting them partnered with a fuel cell company and to look at the prospects for leading a shift in the way hydrogen is viewed in the context of a people-mover solution in densely populated areas. The hope here is that potentially that could help to drive the creation of a more localized hydrogen infrastructure at the municipal level as well, which then creates other opportunities, but, again, the basis for all of this is the electric drive system. The hydrogen is just the energy source; the drive system is still electric.

There is some work, and we're going in that direction. I have to remind people that my organization is full cost recovery, so as we have resources and bandwidth, we try to work towards that agenda.

The other thing you mentioned was the contactless electrification of passenger rail. I believe it's a Canadian company that owns that technology.

**Mr. Mike Sullivan:** They don't get to deploy it in Canada.

**Mr. Paul Treboutat:** Passenger rail is not something that is regulated by Transport Canada. It's something that is done on a municipal level, as I understand it, in the industry. We've increasingly been working with transit authorities to help them around challenges that they continue to have in the wheel-rail interface with the smooth operation of their equipment and with capital costs.

**The Chair:** Thank you.

Go ahead, Monsieur Coderre.

**Hon. Denis Coderre:** Thank you, Mr. Chair.

Mr. Munro, I have a question regarding efficiency in your report on the road map regarding electricity. As a matter of fact, it's to compare natural gas versus electricity.

They're saying, rightly, that if you're using an electric motor, it would transform up to 90% of the energy into traction energy. They're saying here that if we're using

[*Translation*]

gas and a gas engine, only 30% of the energy would be transformed into traction energy.

[*English*]

If you look at the difference between the electric motor versus the natural gas motor, do we have some numbers on the efficiency of those natural gas motors?

● (1025)

**Mr. Geoff Munro:** Yes, we do, but if you have both documents, I think you'll find the specifics in there.

**Hon. Denis Coderre:** I just received it. I'm sorry.

**Mr. Geoff Munro:** Fair enough.

I don't have the figures off the top of my head.

A natural gas motor is not going to convert the energy at the same rate, but there are range challenges associated with using electricity to drive major route trucks and that kind of thing. Looking ahead at innovation in the transportation sector, we saw natural gas being an appropriate and significant interim step until we get to the point where we can use other forms of drive.

The percentages should be in this document, and if they're not explicitly there, I'll make sure they're provided to the committee.

**Hon. Denis Coderre:** Personally, I think we should use both. In relation to efficiency, would it be okay to suggest that for local or public transport, it would be more efficient to use electric motors, while for longer runs and bigger transportation, it's more efficient to use natural gas? I mean aside from the environmental issue, and just based on efficiency.

**Mr. Geoff Munro:** Just based on efficiency, the general trend of what you've just said is correct. The only additional parameter I would include would be weight.

What weight are you carrying? What are you trying to move? If you're trying to move a fairly large vehicle—think of garbage pickup in the urban environment—you may find that you don't have an efficient overall capacity using an electricity-driven truck. Hence, you might want to use natural gas, just because of labour time and the efficiency of the actual function you're trying to put together.

If you did a truck-for-truck comparison, it might be more efficient, but if you look at the function, it might not be, because of the weight you're carrying. Therein lies the rationale for why we looked at the two basic functions of return-to-base vehicles for natural gas in the medium- and heavy-duty area and then the long-haul heavy-duty vehicles.

Largely, as the technology advances for infrastructure, carrying heavy weight, and range, the switch to electric may come. It's hard to predict when electric vehicles might be capable of doing those heavier-weight but local jobs. As I said, I think natural gas is a legitimate transformation now from gasoline or diesel, but it is interim in terms of moving to a longer-term solution.

**Hon. Denis Coderre:** The longer-term solution would be electricity—

**Mr. Geoff Munro:** Yes, that's right, with what we know today.

**Hon. Denis Coderre:** —because it's renewable?

**Mr. Geoff Munro:** That's right.

**Hon. Denis Coderre:** Thank you.

**The Chair:** Go ahead, Mr. Poilievre.

**Mr. Pierre Poilievre:** My questions will start on natural gas-powered vehicles.

What is the unit per kilometre cost comparison between natural gas and diesel? You don't have to be down to the penny; I know that these prices fluctuate based on the daily markets, but give me a....

**Mr. Geoff Munro:** They do. You're right. However, to get the same amount of energy as is in a litre of diesel from CNG, compressed natural gas, you're basically looking at just a bit under a cubic metre, which would cost about 35¢ less than a litre of diesel, so—

**Mr. Pierre Poilievre:** In percentage terms, that's what? Give me a ballpark figure, if you can.

**Mr. Geoff Munro:** Well, if you did one-for-one on the energy you need, it's going to be 35¢ less per litre, so—

**Mr. Pierre Poilievre:** Okay. What's diesel trading at per litre now?

**Mr. Geoff Munro:** It's at $1.20, I would say, or something like that.

**Mr. Pierre Poilievre:** Then we're talking about a 25%—

**Mr. Geoff Munro:** It's a reduction of 20% to 25%.

**Mr. Pierre Poilievre:** When were those data...?

**Mr. Geoff Munro:** It's a relatively current price. It's within the last few weeks.

**Mr. Pierre Poilievre:** Okay. We have natural gas levels in our North American continental market at extremely low levels right now, at $3 or $4 or something like that, or even lower—

**Mr. Geoff Munro:** They're certainly trending lower.

**Mr. Pierre Poilievre:** —and an enormous, ubiquitous supply all over North America. Given the growing supply and a price advantage of 20% to 25%, why is the use of natural gas-powered vehicles in a decline over the last decade in North America?

● (1030)

**Mr. Geoff Munro:** Infrastructure would be my first response. There has not been an investment in infrastructure in North America —in Canada and the U.S., and in Mexico, to a degree—that would make it as easy to fill up at the corner station as you can now with your conventional gasoline-driven internal combustion engine.

The cost advantage and the supply advantages that you're talking about are also relatively new. As recently as five years ago, we did not have 100 years' worth of natural gas supply, but new technology has been created that allows for access to natural gas that was not economically accessible in the past. That has helped to drive the price down.

It's a combination of those factors that makes the equation you create very viable and perhaps will help motivate the shift. It certainly is in the work we're doing with the return-to-base and corridor vehicles.

**Mr. Pierre Poilievre:** Two parts of your answer need to be converged as we look into the future.

You talk about the absence of infrastructure. You talk about the recent nature of the price advantage. Shouldn't we be worried about absorbing a large infrastructure cost, given that the price advantage is a new phenomenon and therefore might not be permanent? That is to say, we change the infrastructure to make it possible to use natural gas-powered vehicles to take advantage of a 20% price advantage, but then that price savings does not last, and we've spent all this money on infrastructure. Is that money then wasted?

**Mr. Geoff Munro:** That is a potential scenario, for sure, but it's to lessen that risk that we have focused on return-to-base vehicles and corridor vehicles. We're not, in the context of what we're doing now, looking at putting natural gas filling stations on every corner in the way gasoline filling stations exist today. If you're a return-to-base, you'll just do that. You'll return to base to get filled up, so you're talking about one installation. We already have fleets on the road that do that.

I'll take as an example the Windsor-Montreal corridor, or all the way to Quebec City, where there is an awful lot of heavy fleet traffic. If we do decide to go with infrastructure, you would strategically locate the infrastructure. It doesn't escape my notice that both marine and rail tend to follow that same corridor, so if and when other modes get to that same use of that product, maybe we would have a multiple gain for a limited infrastructure investment.

To respond to your question, we're not proposing a huge investment in infrastructure similar to the one we have now for gasoline or diesel, but there are challenges associated with the equation you create.

**The Chair:** I have to stop you there and go to Mr. Holder.

**Mr. Ed Holder:** Thanks very much. I appreciate that, Chair.

I didn't have the opportunity to speak to our guests from the National Research Council. As I was looking through your document and trying to understand better the work you do, I looked at your presentation. In terms of responsibility, it said things such as "undertaking, assisting, or promoting scientific and industrial research". You said, "we develop and deploy business-based technology". You said later on that you actively engage with industry. In another part you said that you conduct approximately so much in terms of research—$55 million, in fact—and you work with more than 300 companies.

I'm just going to take it to the end, sir, where you say that you develop and deliver vehicle mobility technologies. You also say that you develop, validate, and deploy lightweight and advanced materials technologies.

I think what I'm trying to understand, just for my purposes, is NRC's role. Where are you in this chain? Are you the folks who provide the funding for industry to do this? Do you provide the scientists who work with various companies to help them develop?

Can you explain NRC's role in that? I'm a little bit confused.

● (1035)

**Dr. Ian Potter:** The answer is, in short, yes, yes, and yes. It's one of those clever things about NRC. NRCan has a similar sort of model, in some respects.

NRC has IRAP, the industrial research assistance program, which helps, as I mentioned, over 8,000 companies a year. That is a funding mechanism for those companies, small to medium enterprises, to get their technology moving in the marketplace, but it's not just funding; it's also the advisory part of it. I like to call them the hand-holders, if you like. A lot of it is managerial advice, market advice, and that sort of thing. They are fundamental business practices. Money doesn't solve all the problems, unfortunately, although money helps.

I have 1,600 people who work in the engineering group. There's a life sciences division and a national frontier sciences group, as well. Our role is really to take that science and transpose it into practical technologies the industries have a need for. Some of that is working with them to develop their own areas. Some of it is helping them through future policy development challenges by using a lot of the infrastructure we have.

**Mr. Ed Holder:** Is that independent of the moneys that I heard about in your presentation earlier? You had a statistic about investing some 40% into various enterprises in 2010. That's independent of your staffing and all the rest.

**Dr. Ian Potter:** Those are the NRCan numbers.

**Mr. Ed Holder:** Right. Well, I'll come back, then. Beyond the staffing support that you provide, do you become the funding mechanism as well?

**Dr. Ian Potter:** No, we don't, not in the direct science and technology. The money that we use drives our own staff. We also lever that against industry funding and other government funding as well. If I'm looking at a strategic direction, that may be 100% internally funded. If I'm looking at something that is needed by industry today, they will pay 100% for it.

There's a bit in between where there's shared risk. In this case, we try to actively encourage what I call pre-competitive consortia, whereby companies come together and all give a little bit of money; it's not a high risk, but it's a high reward if it goes right. We try to get those consortia working together and we act as a facilitator, a catalyst, and a research organization to do that, again working with our colleagues in other departments.

**Mr. Ed Holder:** I appreciate that clarity.

There are two things I would ask. First, how do you pick the winners? Second, could you and NRCan explain the collaboration between NRCan and NRC in terms of how you do work collaboratively for the Canadian greater good, if I might be so broad?

**Dr. Ian Potter:** Picking winners is always a tough one. The casual response is that markets dictate at the end of the day, so we look at the market for a particular technology and try to understand the markets.

The difficulty is the long-term market. Where is it going? Even then, sometimes technology doesn't go the way you think it's going to go. The VHS and Betamax video formats were a classic example of that in technology selection.

In sum, we try to work with companies.

**Mr. Ed Holder:** Which did you pick?

**Dr. Ian Potter:** It pre-dates my time, allegedly. I was on a ship in the middle of an ocean somewhere. I didn't even have a video.

We try not to pick. I think we try to focus, and that's different. We try to focus resources. Geoff was talking about not being able to do everything. There are lots of things to do out there, so we have to focus. I wouldn't call that picking; I call that cycling.

For this particular round of programs, we'll have a three-to-eight-year program tranche, and that will be continuous, so the programs we do today won't be the same as the programs we do in five years' time. It's a continuous evolution.

**The Chair:** I have to end it there. I'm sorry.

I have to go to Ms. Chow.

**Mr. Ed Holder:** Can I direct, through you, Chair?

**The Chair:** On a point of order, you can ask me a question.

**Mr. Ed Holder:** Could I ask you, then, to please direct our guest to provide us with some summary of the companies they've worked with? I'm trying to get an assessment of how you determine their effectiveness and the results associated with their great work.

**The Chair:** I'm sure they've heard the request. Please do so through the chair.

Go ahead, Ms. Chow.

**Ms. Olivia Chow:** I'll ask a question through you, Mr. Chair.

Once you've built the infrastructure, you have to maintain it, and then there's the operating cost. On this question of diesel refuelling versus natural gas, natural gas buses or trains are maintained in ways completely separate from diesel buses and trains. In the experience of the Toronto Transit Commission, which tried the natural gas buses, there was a huge amount of operating cost associated with them. Once the infrastructure is built, it needs to be maintained so that it has a state of good repair.

If the federal government starts off with the capital budget, would your research also then calculate the dollar amount needed over a 20- or 50-year life cycle for the state of good repair plus the separate operating costs in order to service the fleet? Using TTC as an example again, they rebuilt their buses. You would have to hire the people and train them to rebuild those natural gas buses. You have to maintain them to make sure they don't fall apart, or when they fall apart, you have to know how to upgrade them or fix them.

Does any of your research calculate all of that cost to show what the operating life cycle is, plus the impact it has, say, if it's a private trucking industry or a transit authority?

● (1040)

**Mr. Geoff Munro:** The simple answer is yes, but it's not just us; it's the consortium we work with. In the development of that technology, or at least the deployment road map on natural gas, there was a component of detailed business modelling done to assess, analyze, and rank potential end-use vehicle applications. It was a full life cycle of the end users' needs associated with everything you've talked about. What is the infrastructure cost? What's the maintenance? What highly qualified people are necessary to be able to do the repairs, etc.?

As we go into implementation—and we are starting into it—we're using the same full-spectrum consortium, so that when we have an example of a trucking firm that has chosen to shift to natural gas, we can get real-time value information associated with that company and actually apply it then in a more generic way.

**Ms. Olivia Chow:** The trucking companies are saying that something as simple as having Transport Canada allow them to install an electronic recorder so that the truckers don't have to.... Right now everything is on paper. It's very outdated. Not having that tracking system really hurts the industry. They've been pushing for several years now to have something on the trucks so that they can track electronically. If they don't even have that, how would you be able to...?

Transport Canada is very behind in allowing, or in pushing forward, something as fundamental as tracking devices so that there is voice recording and all that, so that things are not recorded just on paper. European countries have had them for a long time. If they don't even have that, how would you be able to work with them in order to track efficiencies or how much money would be saved?

**Mr. Geoff Munro:** The early fleet investments are relatively small. There are long-haul truck investments. We have a company that has chosen to switch to natural gas. There are also cases in which an individual municipal garbage truck has been purchased, or more than one, so we're not talking about massive amounts of information yet, but I would support your call for a more sophisticated way of collecting that information.

We're doing the same with the electric vehicle agenda for the same reasons. What is the actual range associated with given conditions, given vehicle weight, etc.? The only way you can do that is through some kind of automated system.

**Ms. Olivia Chow:** Which we do not have.

**Mr. Geoff Munro:** Which we do not have operationally today, no.

● (1045)

**The Chair:** I'll have to interrupt there.

I apologize to the committee members. I was leaving 15 minutes at the end, but I realize that we started 15 minutes early.

I will thank our guests for being here today. We appreciate your input. I'm sure you'll forward whatever has been requested.

With that, I thank you for being here today.

Ms. Chow, do you have a point of order?

**Ms. Olivia Chow:** Yes.

This morning I thought we had a motion in front of us. I understand that this was a session that we didn't want to interrupt, but I think there was a motion from my colleague Jamie Nicholls—

**Mr. Pierre Poilievre:** I'm sorry; I don't mean to interrupt Ms. Chow, but I do have a request for the witnesses before they leave.

**Ms. Olivia Chow:** No, go ahead. Why don't you do that first?

**The Chair:** Go ahead, Mr. Poilievre.

**Mr. Pierre Poilievre:** Again, I'm sorry to interrupt.

I'm just wondering if you could produce a table for the committee indicating the commercially viable technologies that people are actually using that your agencies have helped bring into existence—

**Ms. Olivia Chow:** That would be helpful. Perhaps you could also name the municipalities or the jurisdictions or regions that are in fact using them—

**Mr. Pierre Poilievre:** —and what precise involvement you had in making it happen.

Thank you.

**A voice:** Thank you. I appreciate it.

**Ms. Olivia Chow:** As well, would they be able to look at the Transport Canada regulations that would be a barrier? Sorry; that would be Transport Canada.

**The Chair:** We're running out of time here, Ms. Chow.

**Ms. Olivia Chow:** Sorry.

**The Chair:** I will advise you that the motion is on record, so it can be brought forward at any time.

**Ms. Olivia Chow:** I believe they want to deal with it on Thursday morning at the beginning, so we could just get it done first thing and then have the witnesses.

**The Chair:** It will be on the order paper for sure.

The meeting is adjourned.

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