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• (1110)

[English]

The Chair (Mr. James Maloney (Etobicoke—Lakeshore, Lib.)): I call this meeting to order.

Welcome, everybody. We're grateful for your attendance at the first meeting of this new study. I'd like to welcome our four groups of witnesses, and I'll get to them in a moment.

This is meeting number two of the House of Commons Standing Committee on Natural Resources. I don't think I need to go into any detail on how the committee process works, because all of our witnesses have done this before many times, I'm sure. I'll just remind you that because it's a virtual meeting, wait until whoever you're speaking to or whoever is speaking to you finishes so that we can allow the translators to do their thing without any unnecessary challenges.

We're going to go to opening remarks for up to five minutes each. I don't think that's standard across every committee. I'm the policeman, which means I have to enforce the time limits on people and interrupt sometimes to stop them if we're going over time. I'll try to limit that as much as I can, but I will apologize in advance. Thank you.

We have four groups of witnesses today. We have the Department of Agriculture and Agri-Food, the Department of Natural Resources, the Department of the Environment and the National Research Council of Canada. Thank you all very much for taking the time to be here. We look forward to hearing your opening remarks and your answers to our questions.

I am going to proceed on the order that's set out on the agenda, which means that Steve Jurgutis, the director general of the strategic policy branch from the Department of Agriculture and Agri-Food will start us off.

Sir, the floor is yours.

Mr. Steven Jurgutis (Director General, Strategic Policy Branch, Department of Agriculture and Agri-Food): Thank you for inviting me here.

My name is Steve Jurgutis. I'm the DG, the policy planning and integration director, at Agriculture and Agri-Food Canada.

I'd like to talk to you a little bit about the critical role of the agriculture and agri-food sector in producing low-carbon fuels in Canada.

The Canadian agriculture and agri-food sector produces healthy food that supports a healthy environment and a healthy economy. The domestic production of low-carbon fuels represents an important opportunity for farmers and will help the agriculture sector contribute to Canada's climate change commitments. Low-carbon fuels derived from agricultural feedstocks are a commercially viable, made-in-Canada way to meet Canada's ambitious climate plan. The agricultural biofuels sector in Canada is a mature, stable market for Canadian farmers.

Clean fuel regulations built on current renewable fuel regulations will accelerate the production and use of low-carbon fuels, including agricultural-based clean fuels. The agriculture sector is well placed to help meet that demand and play an important role in the transition to clean fuels in Canada. Increased demand combined with expected increased investments in Canadian low-carbon fuel refining capacity will have an important positive impact on Canadian farmers by allowing them to diversify their markets, promoting value-added opportunities and encouraging rural renewal.

While traditional biofuel production derived from grains, oilseeds and animal by-products is expected to continue to play an important role in meeting clean fuel demand, agricultural wastes and by-products can also be transformed into low-carbon-intensity fuels. For example, there are over 60 anaerobic digestion facilities in operation today in Canada, transforming manure and food processing waste into biogas and renewable natural gas, which can be used on site to generate heat and electricity or be sold to natural gas or electricity grids.

The international export market for low-carbon fuels and feedstock also presents significant opportunities for the Canadian agriculture sector and for value-added products. In 2020, Canada's exports of canola seed to the EU were valued at \$1.3 billion and primarily used in biodiesel production in France, Germany, Belgium and Portugal.

I will continue in French.

[Translation]

Low-carbon fuels are part of a broader overall effort the government and the agriculture sector are making to continue to improve the sector's sustainability. Canadian farmers are responsible stewards of the land and the government recognizes they are an important part of the climate change solution.

The agriculture sector in Canada is a world leader in innovating and adopting new technologies to improve environmental performance, reduce greenhouse gas emissions, and store carbon in agricultural soils. The government is investing in programs, science, and innovation to develop solutions that will help the sector grow sustainably and create better opportunities for farmers, businesses and Canadians. The Canadian agricultural partnership provides up to \$414 million in cost-shared funding with the provinces and territories to help producers address soil and water conservation, reduce greenhouse gas emissions, and adapt to climate change.

As part of this partnership, Agriculture and Agri-Food Canada supports two clusters of research projects that work on low-carbon fuels and other bioproducts, for a total of \$20 million. Canada's agriculture emissions represent 10% of Canada's greenhouse gas emissions and as a result of improved practices and efficiencies, agriculture emissions have remained relatively stable for two decades, even as production has increased.

For over 20 years, Canadian farmers, particularly in the Prairies, have increasingly adopted no-till and conservation tillage seeding techniques which has helped to transform agricultural soils in Canada being a significant carbon sink since 2000.

• (1115)

[*English*]

In closing, I would like to reiterate that the agriculture sector wants to continue to play an important role in meeting our climate change objectives. The clean fuels opportunity ahead of us will allow the sector to build on its solid foundation of biofuel feedstock production while creating economic growth and promoting renewal across the country.

Thank you for your time. I'm happy to take your questions.

The Chair: Thanks, Mr. Jurgutis.

As I should have mentioned at the outset—I apologize that I didn't—there was an agreement among the witnesses that three of the witnesses were going to reduce their opening remarks to four minutes and give the Department of Natural Resources an extra two minutes.

Mr. Jurgutis, I gave you a little bit of time beyond the four minutes. I don't know if it was just me, but there appeared to be some problems with the interpretation. It was coming through, but it was going in and out at times. Did anybody else have the same problem?

I see that we did, a little bit. Okay.

On that note, I will turn the floor over to Mollie Johnson.

Ms. Mollie Johnson (Assistant Deputy Minister, Low Carbon Energy Sector, Department of Natural Resources): Good morning, everybody. Thank you very much for the opportunity to speak today about the important role that low-carbon fuels will play in Canada's move to a net-zero future.

The Government of Canada is committed to reaching net-zero emissions by 2050. To get there, we know our economy will need to be powered by two key pathways: electricity and clean fuels.

Today, clean fuels are less than 5% of Canada's total energy supply. Even with ambitious electrification, we know that 60% or more of our national energy demand will need to be met with low-carbon fuels to reach our net-zero goal.

Clean fuels represent the most effective way for hard-to-abate industries, such as cement, steel, heavy-duty transport and oil and gas, to lower their emissions and meet their goals. These sectors represent upwards of two-thirds, or 65%, of Canada's emissions.

For this reason, December's strengthened climate plan emphasizes new and enhanced measures to increase demand for clean fuels, including the pollution price and the clean fuel standard. It also includes the commitment to a \$1.5-billion low-carbon fuels fund to enhance the production and use of clean fuels in Canada.

Before we look at the opportunities they present, let me take a moment to define what clean or low-carbon fuels mean. When we talk about them, we're talking about a range of fuels with significantly lower carbon content than conventional fuels. We're talking about hydrogen, advanced biofuels, renewable natural gas and synthetic fuels. They're made from a variety of sources found abundantly in Canada: agriculture, which we just heard a bit about; forest and municipal waste; clean electricity; and natural gas or petroleum when it's coupled with carbon capture and storage techniques.

The fact that modern biofuels are often produced from wastes presents environmental benefits. For example, the Canadian Forest Service, which is here with us today, estimates that if we were to use just half of the 65 million tonnes of wood residues that go to waste annually, we could heat more than four million homes in Canada and reduce our net emissions by 6.6 megatonnes each year.

Clean fuels are at various stages of market readiness. We have all been buying ethanol-blended gasoline at the pumps for years. However, other clean fuels have limited domestic production, and more research, development and deployment are required to drive down costs and open more end uses. This allows for a transitional approach. We can get emission reductions today from market-ready clean fuels, and even more reductions over the coming years as the next generation of fuels becomes more widely available.

The federal government has been playing an important role in establishing a clean fuel sector in Canada for decades. This support has helped build a number of world-leading companies, such as Ballard Power, Hydrogenics, Enerkem and Carbon Engineering. Through decades of research and programming, NRCan and the Government of Canada have helped get the clean fuels industry to where it is today. Our provincial and territorial partners, as well as indigenous businesses and communities, also see the benefits of advancing the clean fuels economy, knowing it will create jobs and opportunities in every region of our country.

Clean fuels offer a crucial low-carbon pathway for Canada's conventional energy sector. For example, Canada's vast natural gas and petroleum reserves, as well as our expertise in carbon abatement, can be levered to produce hydrogen, which can in turn be used as feedstock in oil and gas production processes, further reducing emissions in this sector.

The skill sets required in the fossil fuel industry and the low-carbon fuels industry are often directly transferable. By 2050, the hydrogen industry alone could employ over 350,000 Canadians, and many of these workers could come from oil and gas industries or build on their skill sets. Similarly, refinery facilities can be repurposed to produce clean fuels.

Clean fuels also represent a tremendous export opportunity for Canada. Take hydrogen as an example. The hydrogen strategy that was released in December aims to make Canada a supplier of choice for clean hydrogen, and the technologies to use it, in a global market that's expected to reach almost \$12 trillion by 2050. If we seize the hydrogen opportunity domestically, by 2050 it could make up 30% of Canada's energy mix, resulting in 190 megatonnes of emissions reduction and contributing more than \$50 billion to the GDP.

Many other countries also see hydrogen as a major component of their energy and environment strategies and are making significant investments. Over the last 18 months, more than 20 countries have released their own hydrogen strategies and have committed more than \$80 billion to this.

That's why we're working with governments around the world. Through initiatives like the Clean Energy Ministerial, where we co-chair the hydrogen initiative and the biofutures initiative, Canada's policy leadership and technology leadership are showcased on the world stage. These initiatives help us foster strategic partnerships that are essential to grow global demand for clean fuels, open new export opportunities and attract more foreign direct investment.

- (1120)

We know that Canada needs to continue to thrive as an energy nation in a global low-carbon economy, and to do so, we must seize the opportunity of clean fuels as a key pathway or risk being left behind.

I'm very grateful to be here today and to be joined by two experts from our ministry, who can also respond to your questions. Dr. Anne-Hélène Mathey is the director of economic analysis from the Canadian Forest Service, and Dr. Aaron Hoskin is a senior manager from the fuel diversification division.

I'll pause there. I look forward to answering your questions.

Thanks very much.

The Chair: That's great. Thank you.

Next, from the Department of the Environment, we have John Moffet.

Mr. John Moffet (Assistant Deputy Minister, Environmental Protection Branch, Department of the Environment): Good morning. My apologies for holding things up. Those who know me won't be surprised with respect to the technical challenges.

I am happy to be here along with colleagues from Environment and Climate Change Canada and from across the federal government. We are very pleased to discuss some of the government's policies that relate to the low-carbon and renewable fuels industry in Canada.

As you all know, in December 2020 the government released "A Healthy Environment and a Healthy Economy". This plan is intended to drive reduced emissions across the Canadian economy, both in the near term and towards the target of net zero by 2050, in ways that stimulate economic transformation and development.

Investors, consumers and governments around the world are increasingly accounting for low-carbon considerations. The government's climate plan is intended to help ensure that Canadian workers and businesses are well positioned to respond to and benefit from that demand.

To accomplish those goals, the strengthened climate plan takes an integrated approach to climate and economic policy. This approach uses a mix of policies and programs to support the development of low-carbon solutions and domestic supply chains for low-carbon products. The investments noted by Ms. Johnson will work together with various regulatory measures to be delivered by Environment and Climate Change Canada to incent the production and use of clean fuels.

Let's start with carbon pricing, which, as you know, has been in place throughout Canada since 2019 and before then in various provinces. Carbon pricing sends a broad signal across the economy to spur the lowest-cost greenhouse gas reductions wherever they may be found. As part of its strengthened climate plan, the government proposed to increase the price of carbon by \$15 per year, starting in 2023, rising to \$170 per tonne in 2030.

This increasing carbon price will spur demand for cleaner fuel, which in turn is already leading to investments to increase the domestic production of cleaner fuel, which in turn should make them more affordable.

The clean fuel standard complements carbon pricing. The CFS is expected to lead to increased use and production of cleaner fuels and technologies while reducing emissions by up to 20 megatonnes at the end of this decade.

The clean fuel standard will require producers and importers of gasoline, diesel and home heating oil to reduce the life-cycle carbon intensity of their fuels. This life cycle approach will reduce the emissions associated with extracting, processing, distributing and using that fuel.

The CFS is a market-based tool. It creates a credit trading system and gives regulated parties flexibility in how to meet their requirements, as compliance credits can be created in various ways. Importantly, for the purpose of today's discussion, producers and distributors of fuels can comply by blending low-carbon-intensity fuels such as ethanol with gasoline and renewable diesel with diesel. This allows clean fuel producers to generate credits and make money by producing clean fuels that are sold to fuel producers for blending with fossil fuels. In turn, the increased incentive for use and production of clean fuels will create a market for feedstock providers such as farmers and foresters.

Using clean fuels in transportation will be a key part of Canada's transition to a low-carbon economy, given that transportation is responsible for about a quarter of our emissions.

I emphasize this because this multi-faceted approach to transportation emissions is illustrative of the overall approach the government is taking to address climate change through an economic development lens. We will influence product design by continuing to establish increasingly stringent emissions regulations for vehicles and engines, most of which will be aligned with the U.S. standards in recognition of our highly integrated markets.

We've put in place market-based regulations like carbon pricing and the CFS to influence consumer decisions and fuel production composition. We complement those measures with various programs such as those being delivered by NRCan to support increased research and development and investment in the increased production of clean energy, low-emitting products and clean technology.

In conclusion, the global energy sector is undergoing a significant transition and there are significant opportunities for Canadian-made clean fuels. The strengthened climate plan seeks to establish an integrated approach to reducing greenhouse gas emissions in ways that enable the low-carbon transition of Canada's important energy sector.

We look forward to contributing to and learning the results of the committee's review of this important issue.

• (1125)

Thanks.

The Chair: Thanks, Mr. Moffet. I appreciate that. There's no need to apologize for any potential technical challenges. We all have them several times every day, I can assure you.

Last up is Dr. Jennifer Littlejohns from the National Research Council of Canada.

Dr. Jennifer Littlejohns (Director, Advanced Clean Energy Program, National Research Council of Canada): Thank you, Chair and members of the committee, for the invitation to appear before you today.

My name is Jennifer Littlejohns. I am the director for the advanced clean energy program at the National Research Council of Canada. My educational and professional background is in the field of biological engineering and chemical engineering. Prior to my current role, I spent a combined 12 years as a researcher in the private sector and in federal laboratories, where I worked in the area of biofuels production from waste.

The National Research Council of Canada is Canada's largest federal research and development organization. Uniquely placed in the Canadian R and D ecosystem, the NRC is able to leverage relationships and build partnerships between academia, industry and the public sector. The work includes working with other departments—for example, those participating in today's panel. Through these partnerships, the NRC takes research impacts from the lab and brings them to the marketplace. Each year our scientists, engineers and business experts work very closely with thousands of Canadian firms and help them bring new technologies to market. In that vein, the NRC partners with many academic institutions, industry, and government organizations on a range of projects within the biofuels as well as the hydrogen space.

The NRC has been working in the area of bioenergy and clean fuels for over three decades and has provided R and D solutions to many industrial partners. Specifically, over the last eight years the NRC has worked with more than 30 industrial partners through the bioenergy program. These activities range from helping with the development of new technologies for pre-commercial advanced biofuels to also optimizing commercial processes.

Today I'll speak about two NRC programs focused on clean fuels production: the advanced clean energy program and the materials for clean fuels challenge program.

The advanced clean energy program examines greenhouse gas emissions reduction through emerging clean energy technologies. This program is supported in part through Natural Resource Canada's office of energy research and development. Through this program, we're researching areas that include the production of bio-gas, renewable natural gas, bio-crude and synthesis gas. The program has a focus on using problematic waste feedstocks for clean fuels production, including industrial waste water, food waste and municipal solid waste. Their use for clean fuels production can aim to both reduce waste while producing low-carbon fuels.

Besides waste, many feedstocks need to be exploited for clean fuels. Therefore, we are working with other federal labs, such as Natural Resources Canada's CanmetENERGY, which is working on complementary technologies for clean fuels production from forestry materials.

Hydrogen production technologies are also of interest under this program. The NRC is exploring longer-term opportunities in Canada through zero-emitting processes. An example is electrochemical processes. We also continue to work with counterparts at NRCan who are exploring options such as converting natural gas to hydrogen. Finally, we have activities on life-cycle analysis to identify the greenhouse gas intensity of various clean fuels. We work with other federal partners on that.

The materials for clean fuels challenge program is supporting technologies to convert waste carbon dioxide into net-zero fuels and the production of clean hydrogen using renewable electricity. The focus of the program is on early, high-impact, high-reward research in such materials as catalysts and membranes. There are currently 16 collaborative projects across four countries with partners from academia and promising Canadian start-ups.

Looking ahead, I welcome the opportunity to work with colleagues from NRCan as they establish and launch the clean fuels fund announced in budget 2021. I'd also like to state that the International Energy Agency has identified that biofuels and hydrogen are very key parts of the global effort, along with such other technologies as electrification, to meet greenhouse gas emission reduction targets.

With that, I'd be happy to any of your questions.

• (1130)

The Chair: Great.

Thanks very much to all our witnesses.

Mr. McLean, I will turn the floor over to you.

Mr. Greg McLean (Calgary Centre, CPC): Thank you very much. Thanks so much to the witnesses. It's going to be an informative panel. I really appreciate your being here.

The first question I have goes to Mr. Jurgutis at Agriculture Canada.

Regulation around Canadian input of biofuels into our fuel stream has been around since 2010, yet we still import a significant amount of our biofuels from outside the country. That seems to be potentially politically sensitive to our trading partner, the United States.

Can you tell us why we should expect to see more biofuels produced in Canada going forward than we've seen in the past?

Mr. Steven Jurgutis: Sure.

I would say a few things. For a number of years there has been ongoing research as well as collaboration with industry to be able to advance the markets. I think that we've started to see an increase in the capacity to do this within Canada.

I think as well, as was mentioned as part of the other witnesses' testimony, that there are a number of programs in place that are going to be helping with this aspect over the next number of years. Chief among them would be the agricultural clean technology program, which is \$165 million over seven years. This is going to help transform clean technologies and help farmers have the option to be able to help contribute to that.

I would say, based on the history of—

Mr. Greg McLean: I'll go back to the question. Can I interrupt for a second?

The question actually is, how much are we actually importing at this point in time? How will that change going forward in terms of producing more of our biofuels in Canada?

Mr. Steven Jurgutis: I don't have specifically the data in terms of how much we're currently importing. I can see if I can quickly find it.

Mr. Greg McLean: It's more than half the biofuels, isn't it?

We've been in this program since 2010, eleven years, and we still import more than half of our biofuels for our own consumption from the United States.

Is this correct?

Mr. Steven Jurgutis: Again, I think I would have to look at it specifically. I wouldn't want to misspeak before the committee in terms of the numbers. I don't know if other colleagues might have the answers for that.

I can certainly endeavour to find out specifically.

Mr. Greg McLean: Okay, let me move on to one of the others. I appreciate it. Thank you.

NRC—

• (1135)

Mr. John Moffet: Can I provide an answer to Mr. McLean?

Mr. Greg McLean: Yes, absolutely.

Mr. John Moffet: Sorry, I don't have the volume, but there is a very significant difference. There is a policy initiative the government has recently introduced that explains why we are confident that we can change this flow of clean fuel.

The current regulations in provincial—with the exception of B.C.—and federal jurisdictions are volumetric regulations, so you just have to blend a certain volume of renewable fuel—

Mr. Greg McLean: Okay. Mr. Moffet, my question asks about how much is being imported right now as a percentage.

Mr. John Moffet: I thought your question was why is this going to change.

I'll tell you why it's going to change. It's because the current regulations are volumetric-based. Whereas Canadian clean fuels are typically of lower carbon intensity but more expensive, we're now moving to a carbon-intense deregulation that gives priority to low-carbon-intensity fuels. We're going to stop exporting our clean fuels and importing higher-carbon-intensity clean fuels from the U.S. and create a market for them here in Canada.

Mr. Greg McLean: Okay.

Mr. Moffet, we'll go on here as well, if you can. I was going to go to the National Research Council, but you're on point here. Let's look at this in terms of life-cycle emissions, if you will, from these greenhouse gas amelioration facilities and products.

In a tank of gas, let's go with an 80-litre tank in a car. How far will it go on a full tank of non-diluted gasoline as compared to a tank of clean fuels diluted gasoline? Could you just give us a notion there, please, just quickly?

It's safe to say that 80 litres of pure gasoline, whatever the octane, is less productive with clean fuels in it, correct?

Mr. John Moffet: It will be somewhat less productive, yes.

Mr. Greg McLean: Yes, okay. Then there is a trade-off here in terms of how much we're actually consuming and power efficiency. The trade-off is between efficiency and cleanliness at the end of the day. I appreciate your input on that.

I'd like to go to the National Research Council and Ms. Littlejohns.

Mr. John Moffet: When we measure life-cycle emissions, we account for that difference. If a fuel gets a better life-cycle score, for example, we've accounted for the associated emissions per unit of energy.

Mr. Greg McLean: Thank you. I'll go to the National Research Council now.

Ms. Littlejohns, we talk about the life-cycle analysis. I'm glad you're involved in that; that you have experience in it. Can we talk about the life-cycle analysis in the short term here? Let's go with the next 10 years—so I guess we'll call it the medium term—of the greenhouse gas emissions involved in producing biofuels, and then the greenhouse gas emissions in constructing the facilities that will be used in producing biofuels. Can you give us some enlightenment on that, please?

The Chair: You're going to have to do it very quickly. We're right on our time.

Dr. Jennifer Littlejohns: Specifically, the NRC typically conducts life-cycle analyses on specific situations to understand the GHG impact of gathering feedstocks to a specific location to make decisions on the scale and location of a facility. A broad question like that would be best answered by somebody making the larger policy decisions, rather than—

Mr. Greg McLean: Yet that's your job.

The Chair: Thanks, Mr. McLean. We've moving to Mr. Weiler.

Mr. Patrick Weiler (West Vancouver—Sunshine Coast—Sea to Sky Country, Lib.): Thank you, Mr. Chair.

I'd like to thank all the witnesses for joining today's discussion. There's a lot to cover, lots of different areas.

I'd like to start with some questions for Ms. Johnson and Dr. Hoskin. In the budget this year we announced a \$1.5-billion clean fuel standard. There were also a few other very large investments in this budget, including the net zero accelerator fund and some support for clean tech. I'm wondering if you could tell me how this fund and these other two funds are going to support the production and distribution of low-carbon and zero-emissions fuels.

● (1140)

Ms. Mollie Johnson: I will start, and then I'll pass it over to Dr. Hoskin.

As Mr. Moffet laid out, the objective of the clean fuels fund is to complement and help build that domestic supply of clean fuels within Canada so that we are in a position to build that to ensure that Canadians have access to clean fuels within the market. There's also the net zero accelerator; the \$1.5 billion within the clean fuels fund. Our objective is to try to support the growth of supply and demand together.

We also know that building the domestic supply is the best way for us to have a capacity to support the export side, the supply and demand of global markets as well. Many jurisdictions want to buy from Canada because we're seen as a reliable trading partner. Building that production is going to be a great opportunity for us.

The next piece is with the \$8 billion in the net zero accelerator. That is also going to support the government in looking at those high-scale opportunities that will support a very quick transition of large emitters in helping them drive down their emissions.

I'll pause there.

Mr. Patrick Weiler: Thank you, Ms. Johnson.

I appreciate the shout-out to some of the leading clean-tech companies. One of them you mentioned, Carbon Engineering, is in my riding and is doing some very interesting work with direct air capture into fuels. Also, it's working on grants with NSERC on looking at green hydrogen as well, and some of the processes there.

With the clean fuels fund, I understand it's \$1.5 billion overall, but what's the structure of that fund going to be, loans or grants? How will companies be able to access that to do what you just mentioned in building supply and demand in the country?

Ms. Mollie Johnson: We're in the process of working on program design right now, but we have had experience with this in the past. I'll pass it over to Dr. Hoskin to talk a little about how we're going to be building that, and the opportunities. It will be a competitive process. There will be opportunities.

Dr. Aaron Hoskin (Senior Manager, Intergovernmental Initiative, Fuels Diversification Division, Department of Natural Resources): Thank you.

As with many of our other programs, Natural Resources Canada projects, as Mollie said, will be solicited by a competitive process and then enter into a contribution agreement whereby Canada shares the cost of the project with the private sector or with indigenous organizations. That will likely be repayable. If any profit is generated from the revenue or any revenue is generated from the facilities built, that would be repayable over a certain time frame.

Mr. Patrick Weiler: Great. Thank you so much for that.

I would like to talk specifically about hydrogen here because, as was mentioned, it's definitely something that has a lot of buzz right now. There are countries all around the world that are investing in their own hydrogen strategies. Canada has its own hydrogen strategy as of December of last year.

Ms. Johnson, I was hoping you could walk us through the strategy, the different types, and where you see the competitive advantage for Canada in hydrogen, particularly with some of the export strategy you mentioned in your last answer.

Ms. Mollie Johnson: There are maybe a couple of things about the hydrogen strategy. We really see this as a call to action for all of Canada in terms of the opportunities for our nation to move forward and catalyze our hydrogen opportunity.

We're already known worldwide as being a leader in hydrogen technology. B.C.'s Lower Mainland has about 50 clean-tech companies that are known worldwide for the work they do. When we're meeting with our European partners and other jurisdictions, it is Canadian technology that is out there.

The hydrogen strategy, I think in about eight areas, sets out 32 recommendations of the things we need to be doing to capture that advantage. It's everything from codes and standards so that we can ensure, when you're going to a fuelling station, that you're able to plug in and get what you need, and ensure that's not just domestic but is also international and that we're working with everybody I mentioned, those international partnerships and multilateral organizations. We need to be doing that work together.

It's ensuring that we are creating those opportunities to secure foreign direct investment. We have partnerships with jurisdictions like Germany, Portugal, the European Union and Japan. We're building government-to-government relationships to ensure that we are creating the right structures and also focusing on the business-to-business opportunities, because we do want to be building the right market and relationships for Canada as well.

There are many other pillars of the hydrogen strategy, but it really is trying to ensure that we are securing the opportunity to grow this market by 2030 and 2050, building on Canada's natural advantage, which is the know-how of our energy sector and the natural

resource base that we have, and bringing all of that together so that we're able to grow a secure energy supply for the future.

• (1145)

The Chair: Thanks, Ms. Johnson. Thanks, Mr. Weiler.

Mr. Simard, we go over to you.

[*Translation*]

Mr. Mario Simard (Jonquière, BQ): Thank you very much, Mr. Chair.

My thanks to the witnesses for their presentations.

My question is for you, Ms. Johnson. I talked to a number of experts about the so-called grey hydrogen. I haven't heard from any of them that it's a transitional form of energy. It is important to note that producing one tonne of grey hydrogen generally means releasing 10 to 11 tonnes of CO₂. So a number of people think—and I tend to agree with them—that this strategy provides opportunities for the oil industry. Actually, that's what I'm gathering from your answer because your 32 recommendations are seeking foreign outlets for this much-touted hydrogen strategy.

Basically, my question is quite simple. On which scientific study are you basing your presentation of grey hydrogen as a solution for a transition to a low-carbon economy?

[*English*]

Ms. Mollie Johnson: With regard to the colours of hydrogen and the approach for the hydrogen that's being produced in Canada right now, it is, if we use the colour code, grey hydrogen. We're also producing blue hydrogen. We also have some of the largest electrolyzers in the world and plan to build more in Varennes that will produce green hydrogen.

Our objective, as part of this transformation or transition pathway, is to move towards the lowest carbon intensity of hydrogen, and that's how we move forward. The price points right now—and Dr. Hoskin can speak to this more—for the cleanest hydrogen, the green hydrogen and the blue hydrogen, are more expensive, but we know that over time, as more is produced and as technology advances, it is going to come down, and that's what really gets us to its being a viable transition strategy.

In the hydrogen strategy for Canada, our focus is on carbon intensity and reducing carbon intensity, and when we talk about hydrogen that is being produced from oil and gas, it really is with carbon capture and storage, so it is to reduce that carbon intensity and build on the strength of our energy sector in that way.

I'm happy to turn it over to Aaron to provide more details, if that's helpful.

Dr. Aaron Hoskin: As Mollie mentioned, Canada has opportunities to produce very low-carbon, low-cost hydrogen between now and 2030 or 2040 and 2050. A number of investments made in the budget this year will also support significant investments in carbon capture, utilization and storage. The tax breaks for green hydrogen production equipment, as well as tax breaks for CCUS, will all help to drive down the cost of clean hydrogen production.

The strategy doesn't focus on colours, as Mollie mentioned, and we're working internationally to develop an international standard for carbon intensity that will be recognized around the world. It's an international methodology to determine the carbon intensity, so that as hydrogen becomes a globally traded commodity, we're all using the same starting point.

You can't standardize colours, but you can standardize the methodology to determine the life cycle and carbon intensity of hydrogen. Canada has all of the advantages for every pathway to produce low-cost, low-carbon hydrogen.

[Translation]

Mr. Mario Simard: I'm a little confused because, based on your answer, my understanding is that you have no indication that grey hydrogen is a transitional form of energy and you have no indication to that effect from scientists.

I am not a scientist. When I wanted to learn about this, the first thing I did was to ask people who know about it. I was told that a number of people did not consider grey hydrogen to be a transitional form of energy.

First, has the department ever conducted or commissioned this type of study to find out whether grey hydrogen could be considered a transitional form of energy?

Second, if I understand your reasoning correctly, you are saying that we will go through grey hydrogen because it is easy to market and it may make green hydrogen competitive. This is what I understood earlier. The process gets to a level of abstraction, to use a ten-dollar word, which I think is quite high.

To be clear, I would like to know whether you have had any studies clearly demonstrating that grey hydrogen is a transitional form of energy. Does the department have that sort of study, and is that part of your reflection on your wonderful hydrogen strategy?

• (1150)

[English]

Ms. Mollie Johnson: I'll pass this over to Aaron. There have been many studies, and he can run you through them.

Dr. Aaron Hoskin: I was the lead on the development of the hydrogen strategy. The strategy itself was more than three years of work, with more than 15 different studies that looked at production pathways across the country. It looked at end-use opportunities and supply chain requirements across the country.

All of these studies culminated last summer. We had 14 targeted stakeholder sessions where we spoke to more than 1,500 experts across the entire hydrogen value chain, from production to distribu-

tion to end use to codes to standards to awareness. All of those studies were rolled into the development and finalization of the hydrogen strategy.

As Mollie mentioned, the strategy doesn't focus on colour, but it does focus on carbon intensity.

Mr. Simard, the carbon—

[Translation]

Mr. Mario Simard: Sorry, Mr. Hoskin, I just want to—

[English]

The Chair: I'm going to have to stop you there, Mr. Simard.

[Translation]

Mr. Mario Simard: Do you or do you not—

[English]

The Chair: Mr. Simard, I was going to let him finish his answer, but unfortunately, we're out of time. We'll have to move to Mr. Cannings.

Mr. Richard Cannings (South Okanagan—West Kootenay, NDP): Good morning, and thank you to the witnesses for being here today. There's so much interesting material here, and I'm having trouble figuring out where to begin.

I'll begin with Mr. Jurgutis to get some clarification on some figures you had right off the top about canola exports to Europe. They were about the percentage of our canola exports and what they were used for. I was a bit surprised by the numbers and I want to make sure I got that right.

Could you expand on that?

Mr. Steven Jurgutis: As part of the opening comments I had, Canada's exports of canola seeds to the EU were at about \$1.3 billion in 2020. A large portion of that was used in biodiesel production, primarily in France, Germany, Belgium and Portugal.

Mr. Richard Cannings: Did you say 60% or something like that?

Mr. Steven Jurgutis: I might have mentioned as well in terms of....When I was talking about 60, I was referring to the number of anaerobic digestion facilities in operation in Canada. That's more of the secondary transformation of manure and food processing waste and that kind of thing into biogas and renewable natural gas.

Mr. Richard Cannings: Okay, but just to be clear, are you saying that a large proportion of our canola exports are used for biodiesel, or is it for cooking oil?

Mr. Steven Jurgutis: There's a combination of the two. I'll have to get back to you specifically on the breakdown in terms of what goes for fuel versus what goes into the production of canola oil.

Mr. Richard Cannings: Thank you.

I'm going to turn now to Ms. Littlejohns.

One of the real concerns here—and, I think, one of the important points—is the life-cycle analysis of all of these processes when we're producing biofuels of any sort, the actual greenhouse gas emissions over the life cycle of the processes. You said that your department or group does those analyses on various streams, whether it's forestry waste, canola, or corn for ethanol. Can you give us some of those figures, the life-cycle stats for each of those waste streams of agricultural products?

• (1155)

Dr. Jennifer Littlejohns: Thank you for your question.

Just to clarify, regarding the life-cycle analysis that the NRC completes, it's typically related to developing tools for industry and other government departments to make decisions on specific scenarios for biofuel production relative to a baseline. Often the baseline would be fossil fuels, so specific applications of our life-cycle analysis are related to utilizing feedstock for biofuel production to make decisions on what the best orientation of technologies would be, rather than making more global estimates of what the impact of changing the sector would be, which I believe Environment Canada has better information on.

Mr. Richard Cannings: I guess whoever is on this can best answer it. I think it would be really important to know, with all these possible sources of cleaner fuels, which ones are better than others in terms of that life cycle. Which ones are going to create the best future for us in terms of reducing our emissions? Should we go all in on canola? Should we really emphasize forestry waste? Should we really go in on landfills?

I'm just wondering if anybody here can shed some light on that.

Mr. John Moffet: Maybe I can jump in.

There is a fairly standard life-cycle analysis tool that's been in use in Canada for quite a few years. Environment and Climate Change Canada is in the process of developing a new tool, and we're working with provinces and the private sector and academia. Our goal is to develop a tool that can become a standard tool for assessing the life-cycle carbon intensity of different fuels. We have sort of a prototype now, and we have the goal of rolling out that tool by the end of this calendar year. That's where we are in terms of the analytical approach.

Your question is a little more general. Well, it could be a little more specific.

What's the best fuel? I don't think any of us is going to give you a direct answer on that. Instead, I think what you're hopefully hearing from us is that the government's overall approach to clean fuels is one that is focused on creating incentives for the lowest carbon intensity possible, but not picking winners. We'll want to create market incentives that both drive and support research and development and production of lowest possible carbon-intensity fuels across their life cycle, recognizing that we are going to undergo a transition over the next few decades. We're not sort of putting a gold star on one or another but instead emphasizing that the lower, the better.

The Chair: Thank you, Mr. Cannings.

We're now moving into the second round for five minutes of questions, starting with Mr. Lloyd.

Mr. Dane Lloyd (Sturgeon River—Parkland, CPC): Thanks, Mr. Chair.

I couldn't agree more with what Mr. Moffet said there at the end. We shouldn't be choosing winners or losers.

The future of my community and communities in places like Alberta, northern B.C. and Saskatchewan will lie with hydrogen, but also with low-carbon fossil fuels. Something that sort of disturbs me, listening to all the witnesses, is that there hasn't been one mention of low-carbon fossil fuels. We're talking about biogas, hydrogen and renewable fuels, but where's the talk about our low-carbon fossil fuels? Why have those been excluded from the formula here?

Mr. John Moffet: I think the simple reason is that we kind of riffed off the notional subject matter, which is focused on clean fuels. The government's approach to climate change absolutely envisages a future for oil and gas and absolutely has a number of measures in place to work with provinces, academia and industry to—

• (1200)

Mr. Dane Lloyd: Do you think fossil fuels can never or cannot be clean fuels?

Mr. John Moffet: The challenge will be to achieve life-cycle net-zero emissions, and so we—

Mr. Dane Lloyd: We have great examples of oil companies in Saskatchewan. Whitecap Resources is actually a net-negative carbon producer because they sequester more carbon in their wells than the oil that they produce would burn.

Why aren't we championing our net-zero or net-negative producers, like those companies?

Mr. John Moffet: There are a couple of issues there. One is the measures we have put in place. The other is the overall government rhetoric.

I won't get into political rhetoric. I—

Mr. Dane Lloyd: Does the \$1.5-billion clean fuels fund include low-carbon fossil fuels? Is there any plan to include that in the \$1.5-billion clean fuel fund?

Mr. John Moffet: I'm going to let Ms. Johnson answer that, but the CCUS incentive is—

Mr. Dane Lloyd: That's important, yes.

Mr. John Moffet: The net zero accelerator has a major focus on enabling decarbonization projects by oil and gas producers, and the blended finance measure is intended to be available to oil and gas producers.

We are spending a lot of time working with provinces on a bilateral basis, including the provinces of Alberta and Saskatchewan, trying to develop joint measures to support—

Mr. Dane Lloyd: Thanks, Mr. Moffet.

Maybe we'll move on to Ms. Johnson now to finish answering the question, as you suggested.

Ms. Mollie Johnson: Thanks very much.

As envisioned, the low-carbon fuels fund is not talking about low-carbon oil and gas, but there are other measures, as Mr. Moffet was suggesting, such as carbon capture and storage. There are also measures like the emissions reduction fund and others that are focused on reducing the carbon intensity of the oil and gas sector.

Mr. Dane Lloyd: We just said we don't want to choose winners and losers. If we can have oil and gas like Whitecap Resources... Sturgeon Refinery in my riding has already sequestered over a megatonne of carbon dioxide in less than a year of operation.

Why is the government choosing winners and losers here by excluding low-carbon oil and gas from the \$1.5-billion clean fuels fund?

Ms. Mollie Johnson: It comes down to growing a source of fuels that is low carbon intensity. I think that is the definition as we've been moving forward with the clean fuels fund.

Mr. Dane Lloyd: As we've seen in cases like Whitecap Resources with the production of oil and gas and the Sturgeon Refinery in the refinery aspect, these companies are actually net-negative producing. They're sequestering more carbon than they're emitting, so they're net-negative producers.

Shouldn't that be the Holy Grail here for government funding on this clean fuels fund?

Ms. Mollie Johnson: There are other tools, like the net zero accelerator, which has \$8 billion in it. There are other tools. The clean fuels fund is not the only tool in the kit that is going to support the transition and support emissions reductions. I'm not sure that it is just about one tool in the kit.

Mr. Dane Lloyd: I'm just so worried that we have this great resource in our country. We have the best carbon capture in the world. We've invested billions of dollars into developing it and it's sequestering carbon right now.

Yes, we see that there has been a tax credit in the budget. I'm just concerned that we are picking winners and losers here and we're excluding our low-carbon oil and gas industry, which I think has a very strong future in this country.

Thank you, Mr. Chair.

The Chair: Thank you, Mr. Lloyd.

We'll move on to Mr. May.

Mr. Bryan May (Cambridge, Lib.): Thank you, Mr. Chair.

I wanted to come back around to Ms. Johnson and Mr. Hoskin. I'm very excited about the prospect of hydrogen. I'm the member of Parliament for Cambridge, right smack dab in the middle of Waterloo region. I attended a virtual town hall that was put on by Sustainable Waterloo Region on Thursday. Developing a hydrogen hub

was one of the top priorities identified in this town hall. That, combined with the fact that I have Toyota in my backyard and their focus for the last number of years has been on moving away from EV to pursue hydrogen options for vehicles means that in this region there's a lot going on in this area. I'm very pleased to be a part of this committee under this Parliament, as I'm learning a lot more about the other end of this, and not just on the ground, but in terms of how this process works.

My thought with the federal government's strategy on hydrogen is that it's like the Wayne Gretzky line that you skate to where the puck is going to be, not to where it is right now. I'm wondering if maybe you can speak a little more about the conversation you had with MP Simard, who is focused on the colour scheme and grey hydrogen. I understand that this is sort of what we're producing, but this isn't where the puck is going to be. We're looking at focusing not just on a colour issue, but on the low-carbon side. I really want to open the floor to you to maybe clear that up a bit.

• (1205)

Ms. Mollie Johnson: Thanks very much.

When we talk about the potential for low-carbon-intensity hydrogen in Canada, there are a number of regions in our country. I think that's one of the opportunities: that hydrogen clean fuels, when we talk to our provincial and territorial counterparts, are an area where everybody sees an opportunity to buy in, where everybody sees an opportunity for a future for energy for our country. Waterloo, Ontario, and Quebec see opportunities, as do the Atlantic regions, with their vast electricity and clean power, and also British Columbia, and then, as we've been talking about with agriculture, we have British Columbia forestry and the agriculture in our Prairie provinces. It is where we are headed.

When we talk about green hydrogen, it really is based on the electrolysis and water-based process. I'm going to pass it over to Aaron, though, to talk a bit about the grey to blue to green and what we're talking about in terms of a carbon intensity pathway in that regard.

Dr. Aaron Hoskin: Sure. Thank you.

Maybe we'll step back and just do a bit of the fundamentals. You can produce hydrogen in a number of different ways. By taking natural gas and hitting it with steam at a high temperature, you produce hydrogen and CO₂. That's traditional grey hydrogen. If you add some form of carbon abatement to that, then that's blue hydrogen.

Again, the strategy itself doesn't focus on colours, but it does focus on driving down the carbon intensity of that hydrogen over time, regardless of the production pathway. We know that whether it's going to be used domestically as part of our path to net zero or internationally as part of more than 30 different countries' path to net zero, that carbon intensity has to be driven down over time, whether that's through clean electricity or through converting natural gas or petroleum with carbon abatement to very low-carbon-intensity hydrogen over time. All of these options are an opportunity.

That said, we know that right now the supply of low-carbon-intensity hydrogen in Canada is pretty low, so we need to grow the supply of clean hydrogen while we also grow the demand for clean hydrogen. The two need to grow together. Globally, the same holds true.

As we grow the demand for these fuels, we can concurrently drive down the carbon intensity of the pathway. The two need to happen together. That's kind of what the strategy focus is on: ensuring that both work together and that over time, through innovation—through cleaning up the power grid, for instance—the carbon intensity is driven down.

Mr. Bryan May: That's excellent.

Ms. Littlejohns, you spoke about hydrogen in your opening as well. Do you want to elaborate on the role that the NRC has in this as well?

Dr. Jennifer Littlejohns: Yes, I'm happy to. Thank you for the question.

The National Research Council has a focus on what we're calling “green hydrogen” in this conversation, which is the production of hydrogen from renewable energy specifically. The role of the NRC is really to look at emerging technologies and where we're heading in the future. We're looking at barriers to more widespread electrochemical processes for hydrogen production. We're looking to drive down costs through development of new materials and catalysts and activities like that.

Mr. Bryan May: What are some of those barriers right now?

The Chair: Thanks, Bryan. I'm going to have to stop you there, unfortunately.

Mr. Bryan May: That's all right. Thank you, Mr. Chair.

The Chair: Nice try, though.

Mr. Simard, we'll go over to you for two and a half minutes.

• (1210)

[Translation]

Mr. Mario Simard: Thank you, Mr. Chair.

I would like to have a simple answer.

Is the government's hydrogen strategy part of the green recovery and the \$17.6 billion announced in the budget?

I would like a simple answer, either from Ms. Johnson or Mr. Moffet. Yes or no?

Mr. John Moffet: Yes.

[English]

Ms. Mollie Johnson: Yes.

[Translation]

Mr. Mario Simard: Okay.

Thank you, Mr. Moffet.

So the hydrogen strategy is part of the green recovery. Now, in your strategy, which type of hydrogen will you support financially? Earlier, Mr. Hoskin said it's not about colour codes, but it matters a lot if we're talking about a green recovery. Let me repeat what I said earlier. One tonne of grey hydrogen produces between 10 and 11 tonnes of CO₂. According to most experts, it is not a transitional form of energy. In your green recovery plan, if you only support grey hydrogen, I think we have a problem.

[English]

Ms. Mollie Johnson: It is not focused on grey hydrogen. It's focused on the production of low-carbon-intensity hydrogen, which will be either hydrogen produced with carbon capture and storage—which is set out in budget 2021—or green hydrogen. That would be the pathway through which the government will be supporting this in the strengthened climate plan.

[Translation]

Mr. Mario Simard: Ms. Johnson, by saying that, I'm sorry to tell you, but you have just disqualified grey hydrogen, which has a considerable carbon footprint. If I am to believe everything the experts say, grey hydrogen would not qualify as part of a green recovery plan.

Have you already projected the type of hydrogen you will support under the strategy?

[English]

Ms. Mollie Johnson: Maybe just to differentiate, the hydrogen strategy for Canada sets out the pathway to 2030 and 2050 to take advantage of the opportunities that we will be moving forward with. When we talk about the trillion-dollar market and the job opportunities, that's where we want to get to by 2050. The fund that would be enabling that is the clean fuels fund, which is the \$1.5 billion.

As the government is setting up and structuring this, I note that we're still working on the program design to move that forward, but the objective is to be supporting low-carbon intensity. There are the tax measures. There is the clean fuel standard. There are all the approaches whereby the government is moving towards lower-carbon-intensity pieces moving forward.

With regard to your question about disqualifying grey hydrogen, we have all of these mechanisms on the regulatory side that are moving forward to try to find opportunities to move towards cleaner sources of energy. This is part of that package.

The Chair: Thank you, Ms. Johnson. Thank you, Mr. Simard.

Mr. Cannings, we'll go over to you.

Mr. Richard Cannings: Thank you.

I think I'll go back to Mr. Jurgutis again with a more general question about agriculture and the concerns that many Canadians have.

The pandemic has really highlighted our food security in the world. Many Canadians are concerned about using agricultural land, using agricultural products, for fuels, no matter how clean they might be, when we should be using that land and those products for food. It's a real concern for many people.

I'd like to know what the clean fuel standard or any of these government programs might be doing to drive up that percentage of our agricultural production into fuel production rather than into food. What percentage is it at now? What percentage is it in the United States, for instance? Where are we headed with this?

I think we're all in favour of clean fuels and we're all in favour of converting forestry waste and landfill waste to fuel. I think that makes sense to most of us. However, using agricultural land and food to create fuel is something that a lot of people are very concerned about. I just wonder if there's any projection on those percentages.

• (1215)

Mr. Steven Jurgutis: Thank you for the question.

Ensuring safe, quality food remains a priority for agricultural production in Canada. Canadian farmers have long grown food and raised commodities for a range of different end uses, including energy use, without compromising food security for Canadians and for customers around the world as well. It's not as much a debate about food versus fuel but about how to have that balance of food and fuel.

In Canada, we're not expecting the clean fuel regulations to drive any shift in land use or crop production. We don't expect a change in the price of agricultural commodities due to the increased demand for low-carbon fuels either. We anticipate that there will just be more domestic marketing opportunities, which means some Canadian grains that would normally be exported could be processed in Canada, for example, with value-added jobs that improve Canadian incomes.

Also, analysis is showing that we don't have any measurable impact on food prices for Canadians, so I think that's another important consideration.

As you mentioned, crops such as corn and canola will continue to be transformed into low-carbon fuels, but increasingly there are more agricultural by-products, such as animal fats, that are important feedstocks for biofuels and biodiesel. These products would otherwise be discarded, so I think that's another way to help look for opportunities to contribute to more of a circular economy, and that's more the direction things are heading.

The Chair: Thank you, Mr. Jurgutis; and thanks, Mr. Cannings.

We'll go over to Mr. Zimmer.

Mr. Bob Zimmer (Prince George—Peace River—Northern Rockies, CPC): To our witnesses, thank you again for coming.

I want to follow along the same line as my colleague Mr. Lloyd. I represent an area in northern B.C., and we have a whole bunch of

natural gas. Conservative estimates are 200-plus years of supply at our current export levels and current domestic consumption levels, yet we have this focus on renewable energies. That's laudable, but I would just say that it seems we're overlooking the obvious. We have this huge potential to reduce global emissions, if it's realized, to get our natural gas to markets that are using higher-emitting sources of energy.

I see this as sort of strange. Why would we develop a bionatural gas or renewable natural gas when we have fields of this stuff for the next couple of hundred years? It's a bit of a mystery to me. I could understand maybe blending some of these renewable forms of fuels to make that more efficient. That makes sense to me.

I will get to questions.

Following along the lines of what Mr. Cannings has said, I was on the agriculture committee for four years prior to this and saw the pressures already on food crops to be used for biofuels. That's a concern. What you're all saying here on the panel today is that there's going to be a dramatic increase, or there would have to be a dramatic increase, in biofuel production to really make a dent. That would mean a dramatic increase in the shift from use of food crops for biofuel crops. For Steven from Ag Canada to say it's not going to have any impact, to me that seems strange.

I have a question about the use of wood waste for fuels. We've all seen the potential. We've seen the burn piles that are often set fire to after forestry has come in and taken timber and different things off those sections of land. The biggest challenge has been to get those residual elements to a place where you can process them to produce something efficiently.

In the example I would use, we have burn piles that are 200 miles up the highway from where I live, but to truck them all the way down to a facility that could even do anything with them would probably use up any advantage you would ever gain by doing so.

My question is about the efficiency of using biofuels, especially this biomass that's normally in burn piles and would be considered wood waste, almost unusable wood waste at this point. How efficient would that process be, and what are the plans to make that an efficient process?

Ms. Mollie Johnson: On the opportunities around growing biofuels at this point in time, I would just note that with world markets increasingly demanding clean energy sources when they're looking to invest, building more clean fuels with more electrification is going to help Canadian natural gas, Canadian oil and gas, become more competitive, because it's going to lower the inputs as they're being produced. Therefore, I think there are co-benefits to some of—

• (1220)

[*Translation*]

Mr. Mario Simard: I'm sorry, Mr. Chair. We lost the interpretation. I think the sound quality is a problem.

[*English*]

Mr. Bob Zimmer: It's very poor. I don't know if your connection can be rectified, Ms. Johnson, but maybe you can have somebody else answer that question.

Ms. Mollie Johnson: Absolutely.

The Chair: Yes, it's very choppy.

Mr. John Moffet: Maybe I could jump in.

The Chair: Okay. Do you want to try?

Mr. John Moffet: You have raised a couple of really important issues.

One is a repeat of the question about whether increased incentives for biofuels will have an impact on what we use our crops for and on their availability for food.

The clean fuel standard has explicit criteria built into the regulations such that we will not provide credits for crops or forestry products that displace or expand into high-biodiversity areas. We have seen no impact over the last decade, as my colleague from Agriculture and Agri-Food indicated, and we don't expect to see that kind of an effect. What we do expect to see is more efficient use of the kinds of wastes that you talked about.

Now, not all wastes will—

Mr. Bob Zimmer: Excuse me, but if you're talking about using something like mustard seed or canola, and you're saying that's not displacing—

Mr. John Moffet: No, it's not, because it's—

Mr. Bob Zimmer: Well, canola is used, as you know, for food around the world. We export it for uses as food around the world, so how can you say that?

Mr. John Moffet: It's because we already have an established supply of canola for this use. We are exporting a lot of it for the production of clean fuels. We want to use that production in Canada. We're also going to use crop waste more efficiently. We're going to use forestry waste more efficiently.

To your second point, absolutely we will not be able to obtain all waste efficiently. That's why, again, we come back to the importance of life-cycle analysis. The tools we are using and are developing will account for the full emissions associated with producing, acquiring, processing, and then using those fuels. There will be a scale of fuels that are ranging from virtually zero to very high emissions—

The Chair: Thank you, Mr. Moffet.

Mr. John Moffet: —and all incentives will be focused on the lowest life cycle as possible.

The Chair: Thank you, Mr. Zimmer.

Mr. Lefebvre, we go over to you.

Mr. Paul Lefebvre (Sudbury, Lib.): Thank you, Mr. Chair.

[*Translation*]

My thanks to all the witnesses for being here.

It's very interesting. It's a very important topic in light of what's happening in the environment. At the same time, the spotlight is on the economy. We want to ensure that, as we transition, our low-carbon energy will meet the economic needs and allow us to reach our 2030 and 2050 targets.

[*English*]

I've had the pleasure of sitting on the panel at the Clean Energy Ministerial in my past life as parliamentary secretary to the Minister of Natural Resources, with respect to hydrogen, and listening to world leaders and looking at Canada as a world leader in this sector.

It was interesting, because in our history in Canada back in the 80s, with Ballard, I recall watching the news with my dad back then and hearing about these new hydrogen fuel cells and how they would change our world. Here we are today, 30 years later or more—I'm dating myself here—and still, because of the ebbs and flows of hydrogen that have gone on over the past decades, people are looking at Canada as a world leader in this sector.

Either Ms. Johnson, if she's still there, or Mr. Hoskin, with regard to the economic opportunities for Canada in this sector—not just within Canada, but in the world—why are people looking at Canada? What are the economic opportunities that this represents for us in Canada and around the world?

Dr. Aaron Hoskin: Thank you.

My apologies; I think Mollie dropped off. Maybe her house went through a tunnel.

Anyway, the hydrogen strategy points to both economic and environmental opportunities across the entire country. It's a great point. It really positions us to be the world leader for hydrogen and the technologies that use it. We're already providing our technologies to pretty much every country in the world that's deploying hydrogen.

That economic opportunity has changed significantly in the past year. Projections a year ago were that the global market would be about \$2.5 trillion, and by September 2020, those projections led to \$11.7 trillion. More than 20 countries have released their own hydrogen strategies in the past year as well, backed by more than \$80 billion in guaranteed investments and upwards of \$200 billion in total investment.

Canada continues to provide the technologies into that market, but countries—you're right—are looking to us to also provide clean hydrogen.

You may have seen about a month ago that we entered into an agreement with Germany to look at opportunities for Canada to provide clean, low-cost hydrogen to the European market. Recent studies show that upwards of 25 to 35 megatonnes of hydrogen could be produced in Quebec, in Canada's east coast, that could be exported into the European market. Again, that's an \$11.7-trillion global market.

Similarly, our natural resources—natural gas and petroleum with carbon abatement—can provide sources of large quantities of clean hydrogen, which could be exported into Asia or also into the United States. We're already exporting hydrogen into the United States, which is produced in Bécancour, Quebec, for instance, by Air Liquide. It's low-carbon-intensity hydrogen.

You're right that it's not just the technologies; our companies are exporting their fuel cells. Look at any country in the world that's using hydrogen right now, and they're using Canadian technology: buses in California, in Japan, in Europe; and light rail in Europe. They're looking to Canadian technologies to keep going forward. The hydrogen story has been a Canadian story for more than a century, and we'll keep pushing forward.

• (1225)

Mr. Paul Lefebvre: It's certainly something that I knew, but it was really amazing to be sitting with 20 other countries and hearing them talk about our technology. Sometimes we need to leave Canada, even virtually, to realize the amazing technology and the amazing people we have here, and what they've accomplished and how we are contributing.

The other question I have is very simple.

Mr. Hoskin, again, why is hydrogen important to reaching our 2030 targets and our 2050 targets? I know you mentioned it, but it's so important that in the report we highlight why hydrogen will help us meet our 2030 targets and our 2050 targets. Why is that?

Dr. Aaron Hoskin: The hydrogen strategy modelling done for the strategy shows that by 2030, if hydrogen makes up 6% of our energy source, it could drive down emissions by 45 megatonnes. That number will grow by 2050. If hydrogen reaches 30% of our energy source, that results in 190 megatonnes of emissions. That takes into account every production pathway and the average carbon intensity, regardless of production pathway, of that hydrogen over time, so it's 190 megatonnes.

It drives down emissions in those hard-to-abate sectors, industries like steel and manufacturing, and in on-road transportation, especially medium-duty and heavy-duty, as well as mass transit. It's also a key feedstock into things like oil sands upgrading.

As the carbon intensity of Canada's hydrogen mix is driven down, that inherently reduces the carbon intensity of our conventional oil sector as well. It comes with significant emissions reductions across the economy, but also across the country in marine ports, in rail, in mining, in different applications in transportation. It really drives down emissions, but it also presents that economic opportunity.

Mr. Paul Lefebvre: Thank you.

The Chair: Thank you, Mr. Lefebvre.

Mr. Patzer, we'll go over to you.

Mr. Jeremy Patzer (Cypress Hills—Grasslands, CPC): Thank you very much.

I'm going to go to Mr. Jurgutis here.

I'm wondering whether there are established targets for how much canola production there's going to need to be in Canada to meet the requirement for this new biofuel standard.

Mr. Steven Jurgutis: I might turn to one of my colleagues on this as well. I think, in principle, it's not looking at specific inputs or crops in order to reach targets.

There's an opportunity for it to be done partly through canola. However, in terms of looking at it from the lens of the inputs, I think it's not really what the approach would be in order to meet the targets.

I'm not sure whether any other colleagues want to add anything.

Mr. Jeremy Patzer: Quickly then, what other crops are you considering? Is it canola, corn? Are there others? What are we looking at there? What are the crops that are going to be used to meet this demand?

Mr. Steven Jurgutis: I would say that certainly the big ones are canola and corn, as you've pointed out, and corn in particular on the ethanol side, but increasingly, as I was talking about as well, it's moving into increasing the amount of input that comes from what we've traditionally been seeing as waste. A higher degree of effort and programming has been put in place to help drive that as well, to make advancements in that area so that we can start to take advantage of those opportunities rather than just the inputs from what would have been seen as some of the more traditional types of commodities.

• (1230)

Mr. Jeremy Patzer: I guess what I'm trying to get at here is that right now we're growing canola and corn, and farmers also grow a lot of wheat, durum, peas, lentils and mustard. There's a whole other variety of crops that are out there, and those crops are needed around the world, especially when we look at the pulse crops. Overall we provide a majority of that to the rest of the world.

As we pursue biofuels here, how much of those crops is going to be replaced by biofuel stock just simply to pursue clean fuel?

Mr. Steven Jurgutis: You're right that there are a number of other sources that are being grown and used. To go back to a little bit of the answer that I was providing before, I don't think what we're seeing is much of an issue of trading one for the other in terms of food security or food availability and the opportunity that exists now.

Increasingly, as I said, looking at rendering fats, manure and other opportunities into biogas, you start to see more of the opportunity to meet those targets coming from those additional sources, but, as was stated earlier, not a situation in which we're seeing crops grown for food being displaced in order to meet or be part of a solution to help reach some of those targets.

Mr. Jeremy Patzer: Based on what you just said, we don't have to increase the canola and corn we're growing in Canada as of right now to meet this growing demand that you suggest is there for biofuels. We're looking to expand and grow the biofuel industry, but you're saying we don't have to grow any more acres of canola and corn. Is that correct?

Mr. Steven Jurgutis: What I would say is that there could be opportunities there, and ultimately I think some of those are going to be decisions that will be made by producers in terms of what they see as opportunities to sell their crops. In terms of what we're seeing, we're not anticipating necessarily a larger footprint of those products being used as sources for clean fuel.

I see my colleague Dr. Hoskin has his hand up. He might want to add something as well.

Dr. Aaron Hoskin: I think it's important to also note that the type of biofuels that we're looking at are advanced biofuels that can take the by-product, so yes, you can harvest all of your food crops, and the leftover waste or crop pieces can also be converted to advanced ethanol and advanced biodiesel. It's not just about the beans or the corn; it's what's left over after that food is used and distributed as a food product. There's still agricultural waste that's there that can be converted to biofuels.

Mr. Jeremy Patzer: Do we have the plants in place right now to create ethanol, or is that what we're talking about here? Do we have the capacity right now to convert waste into ethanol?

Mr. Steven Jurgutis: As I mentioned earlier in my comments, a number of opportunities and facilities for certain things already exist in the country. I think part of the funding and programs that are in place now are also to help facilitate that as well, to create greater opportunity within Canada to have more of that value-added product happen here, particularly with what would be thought of as food waste. Part of that is to look to encourage a bit more of a circular economy as well.

There are some in place, and increasingly those are the areas that we're looking at to make continued investments to be able to take advantage of that further.

Mr. Jeremy Patzer: Do you know—

The Chair: That's time, Mr. Patzer.

Mr. Jeremy Patzer: Can I have one quick question?

The Chair: We're already a bit over time. We have to move on. Sorry.

Next is Mr. Serré or Ms. Jones. I'm not honestly sure.

Mr. Marc Serré (Nickel Belt, Lib.): I can take it, Mr. Chair.

The Chair: Okay, it's all yours.

Mr. Marc Serré: Thank you.

I want to go back to what we talked about earlier, low-carbon fuel and gas that's excluded from the government's emission reduc-

tion fund and the tax measures for the carbon capture strategy. I'll be asking my question to Dr. Hoskin.

With regard to the net zero accelerator with the huge \$8 billion, when we look at clean-fuel tech, we see we're not supporting cleaner oil and gas in this transition. I wonder, Dr. Hoskin, if you could clarify the government's position on this, please.

• (1235)

Dr. Aaron Hoskin: Absolutely. You're exactly correct. Many of the investments that are being made and announced in budget 2021 are really about driving down emissions from our conventional oil and gas sector.

The carbon capture, utilization and storage tax credit, the CCUS investments for RD&D, will ensure that the next generation of CCUS plants are up and running and are effective and efficient, and it will also be significant in driving down emissions from our conventional oil and gas sector.

As you mentioned, there is also the investment of \$8 billion in the net zero accelerator, which is meant to drive down emissions. The department also delivers the emissions reduction fund, which is driving down methane emissions from a number of facilities on Canada's west and on the east coast as well.

There are a number of programs already in place. We mentioned that getting the supply of low-carbon-intensity hydrogen up in Canada inherently drives down the emissions of our conventional oil and gas sector as well. Hydrogen is a key component of oil sands upgrading, for instance, so as that carbon intensity is driven down, it drives down the emissions of our conventional oil and gas sector.

Blending of hydrogen in the natural gas stream is also a mechanism to drive down the carbon intensity of Canada's natural gas system. You can produce hydrogen from natural gas, so it provides a new competitive market for Canada's natural gas reserves, but then blending it into the natural gas stream provides a mechanism to basically decarbonize our natural gas stream. There are many opportunities.

[Translation]

Mr. Marc Serré: Thank you, Mr. Hoskin.

We heard Mr. Simard express his concern about green hydrogen, the colours, and everything else that was not necessary for the transition.

Mr. Hoskin, could you tell us more about the transition with respect to hydrogen?

[English]

Dr. Aaron Hoskin: I'll quantify a bit what the hydrogen strategy points to, and what some of the analysis that was done for the strategy points to as well.

Right now, grey hydrogen, conventional hydrogen production in Canada, has about 100 grams of CO₂ produced per megajoule of hydrogen. If you add carbon abatement to that, meaning carbon capture utilization and storage, the carbon intensity is driven down to 31 grams per megajoule. That's a 60% reduction.

If you go to electrolysis and if your electricity grid is clean and zero-emitting, as 80% of Canada's grid is, then that can be as low as 10 grams per megajoule or even less. That's current carbon intensity. As improvements and efficiency of CCUS grow, that carbon intensity of conventional hydrogen production with CCUS will also be driven down.

The strategy itself points to how the carbon intensity of Canada's overall mix has to be driven down over time. Near term, we're looking at 36.4 grams of CO₂ per megajoule. That's a mixture of conventional and low-carbon production.

Over time, as I mentioned before, as we approach net zero, then that carbon intensity needs to be driven down toward zero. We know that electrification is part of that and the amount of renewable energy that is used to produce the hydrogen is part of that. The advancements in CCUS that will be made through investments that are being made in RD&D will also drive down that carbon intensity over time.

Mr. Marc Serré: How much time do I have?

The Chair: You have about 30 seconds.

Mr. Marc Serré: Thank you to the witnesses for all the work you've done. We're going to continue this conversation, because it's hugely important for the economy and the investments made in Canada, as indicated earlier.

The Chair: Next we have Mr. Simard.

[*Translation*]

Mr. Mario Simard: Thank you, Mr. Chair.

I'm quite surprised by what I've just heard, because we have seen this movie before.

Streamlining the process to reduce the carbon footprint of oil through research and development reminds me of what happened in the early 1970s with oil from the tar sands. We didn't have the technology to extract it. We had to invest massive amounts of capital to do so.

We have a major problem. When I look at the European Commission's strategy and the German government's strategy, they always talk about renewable hydrogen. In your strategy—I had a quick look in the document you released—the word “oil” appears 15 times. That gives me the impression that the objective of your hydrogen strategy is to find opportunities for the oil and gas sector. In this sense, one issue seems essential to me.

In your strategy, have you ever thought about prioritizing a specific type of hydrogen, one that would perhaps have a smaller carbon footprint and one that doesn't involve a lot of capital investment in research and development, to do what we call greenwashing the oil and gas industry?

Mr. Hoskin, does this strategy prioritize a certain type of hydrogen?

• (1240)

[*English*]

Dr. Aaron Hoskin: The strategy prioritizes low-carbon hydrogen regardless of production pathway, whether that's using natural gas or petroleum with carbon abatement. As I mentioned, we actually know now that there are technologies and companies that can produce very low, almost-net-zero hydrogen by using petroleum with carbon abatement. That technology exists in Canada now.

Similarly, we can leverage our renewable electricity—our very low-emitting grid on the east coast, for instance—to produce almost net-zero hydrogen now. The difference is the price point of that.

Also, we know that in the long term, given the fact that Canada has also committed to prioritizing small modular reactors, there are opportunities to link clean electricity produced from nuclear reactors to produce very low-carbon hydrogen as well.

All of these production pathways are what the strategy focuses on, not looking at one pathway over another, but looking—

[*Translation*]

Mr. Mario Simard: I'm sorry to interrupt you, but I don't have much time.

So if I understand you correctly—

[*English*]

The Chair: In fact, you have no time. I'm sorry about that, Mr. Simard.

Mr. Cannings is next.

Mr. Richard Cannings: Thanks again.

I'm not sure if Ms. Johnson's technical problems have been solved. Perhaps she can give this a try. If not, Mr. Hoskin can. It's regarding hydrogen as well.

I was talking to someone in the hydrogen sector recently. She pointed out that one of their problems is that they... As we know, Canada leads the way in hydrogen technologies in the world, but to really advance those to the next step, we have to build out an infrastructure to move that hydrogen around to make it available to industries, to trucking or to whatever sector is using it. She likened it to the business of developing new computers: If we don't have any electricity infrastructure, any electricity grid, they're useless.

Where she thought the government could really make a big difference was to make the big investments in hydrogen infrastructure so that we could roll out those benefits quickly and broadly across the landscape. I'm wondering if somebody could comment on that.

Ms. Mollie Johnson: Mr. Chair, we hear and understand that same challenge as well, which is why this strategy recommends taking a hubs approach. This is why we look at trying to place and grow our hydrogen economy around hubs or nodes. There are different ways that folks talk about this.

The government announced a first investment in Alberta's industrial heartland earlier. What the hub concept means is that you're going to look at growing supply and demand at the same time. You're going to build on existing infrastructure and look at opportunities so that you have your production and your transportation all happening together. It really is in that hub approach where we're starting to bring folks together to think about where we need to be, not just today but in five, 10, 20, 30 years.

You can think about this a little bit like the gateway concept we had in the ports previously. It's thinking about how we need to be, as you say, bringing the whole economy together to capitalize on these opportunities.

The Chair: You have about 15 seconds left, and you're on mute.

• (1245)

Mr. Richard Cannings: Well, I'll unmute myself just to say thank you.

The Chair: There you go. Perfect. Thanks, Mr. Cannings.

Mr. McLean is next.

Mr. Greg McLean: Thank you, Mr. Chair. I'm going to go back to Mr. Jurgutis at Agriculture and Agri-Food Canada.

Mr. Jurgutis, I think you created a bit of confusion today in suggesting that we're going to have a biofuels industry created from Canadian-source biofuels material, and yet we're not going to have to break any more land for agriculture in the process. We're all realists here. We know that you don't get something for nothing.

In reducing one input to an energy source, you're going to have to create a different energy source. We all know that. I guess what I'm asking now—and I hope that you were there eleven years ago and can answer us—is this: Exactly what were the projections for the biofuels industry in Canada to produce its own biofuels at that point in time?

Mr. Steven Jurgutis: Thanks for the question.

We wouldn't have been in this position or working on these types of issues 11 years ago, and I don't have on hand comparisons in terms of projections from a number of years ago versus what they might be now. However, it might be helpful for you to know that industry in Canada has itself been looking at this, and the view, particularly from canola growers, is that canola grown in Canada can meet this increased demand.

Canada produces about 20 million tonnes of canola each year and aims to grow production to 26 million tonnes by 2025. Even at the full 5% of renewable content for biofuel and diesel, that will require 3.2 million tonnes of seed and reduce greenhouse gas emissions as well.

The other thing to point out, as mentioned before, is that we are not just looking at those traditional sources, such as canola, corn or wheat, but increasingly at the secondary-use products that tradition-

ally would have been waste. We are looking to expand further into those areas where we can see potential for larger growth as well.

Mr. Greg McLean: Thank you, Mr. Jurgutis.

It is safe to say that if we're going to continue to be a passenger on the U.S.'s political corn industry, providing all kinds of biofuels as Canadian input at this point in time, we're not going to replace 1.4 billion tonnes per year of biofuels.

Mr. Steven Jurgutis: There is an amount of exchange that goes on between Canada and the U.S. in terms of inputs into biofuels, as there is with other countries as well. There is potential for that to shift as we're able to increase our capacity in Canada.

Mr. Greg McLean: Okay. Thank you. I'm going to shift now to Mr. Moffet.

Mr. Moffet, I know that some significant modelling has gone into the clean fuel standard on how much it will actually reduce CO2 emissions over its intended lifespan of, let's say, 10 years. Are you willing to share that modelling with other government departments or even with this committee?

Mr. John Moffet: Well, yes, when we published the draft regulations, we published a regulatory impact analysis statement. That included a detailed summary of the modelling that we undertook at that time.

Mr. Greg McLean: It was a detailed summary of the modelling, but what I'm asking for is the actual modelling.

I worked in the finance industry before coming here, and we know that every financial model is obsolete from the time it hits the ground, because events unfold that change everything from the moment things start to happen. The main thing we want to look at in the model on the clean fuel standard is exactly what the assumptions are. Those haven't really been explained to anyone yet, including other government departments.

Can you explain why, please?

Mr. John Moffet: Actually, they have been explained. They are explained in considerable detail in the RIAS, the regulatory impact analysis statement, and I'm happy to answer any questions that you have about the assumptions.

Mr. Greg McLean: Yes, I know, they're explained in detail, but can you release the financial model, please, so that we can look at the numbers that are actually going to be reduced?

Mr. John Moffet: I don't know what you mean by "release the model". Sorry.

Mr. Greg McLean: Well, the model will have to show that we actually do have some CO2 reductions. We are looking at CO2 reductions, and they are all premised on some assumptions that will have to be made. We're hoping they will be better than the assumptions that have been made on the number of biofuels that have been produced in Canada over the last 10 years, but we need to look at this to ensure we are actually accomplishing something with all the changes we are undertaking.

• (1250)

Mr. John Moffet: The model itself is a CGE model, but the results of the modelling that we undertook are—

Mr. Greg McLean: Sorry; what is a CGE model?

Mr. John Moffet: It's a computable general equilibrium model. It's detailed computer software.

The results of the modelling done for the CFS are provided in detail in the RIAS. We are happy to share the RIAS. After you have read it, maybe we can come back and answer any questions that you have.

The Chair: Thank you, Mr. Moffet. Thank you, Mr. McLean.

We'll go over to Ms. Jones.

Ms. Yvonne Jones (Labrador, Lib.): Thank you, Mr. Chair.

I'd like to thank all of our guests this morning for an interesting discussion. I want to thank you for all the work that you did before you got to this committee around energy innovation and our climate plan around clean fuels in Canada, renewable fuels. I think it's really changing our direction and where we're going. It's this kind of work that will really provoke new opportunities, new initiatives in Canada. You've given us some great blueprints to work with based on the idealism that has been generated.

There has been a lot of very broad discussion this morning. I think where I'd like to go is really with Natural Resources Canada to talk a little bit about some of the investments that the government has made under the electric vehicle and alternative fuel infrastructure deployment initiative. Maybe you could walk us through what some of those investments are under that program and speak to how it's benefiting Canadians, and also what the plans are to broaden those services as we go forward.

Ms. Mollie Johnson: Maybe I'll take a crack at that, and if others want to jump in, I'll turn it over to them.

On zero-emission vehicles, we know that the government has set some pretty clear targets: 10% of light-duty vehicle sales by 2025, 30% by 2030 and 100% by 2040. Our role at Natural Resources Canada is to provide that enabling infrastructure. That's where we get involved. We administer a number of programs in our clean fuels branch that support the rollout of ZEV infrastructure across the country. There is \$150 million in the strengthened climate plan to support that as well.

At this point, there are currently about 13,000 publicly available EV chargers in Canada, but thousands are being added every year. The approach that the government has taken is to build out that infrastructure so that Canadians have access to it where they work, live and play. Doing that provides opportunities for Canadians to continue to take advantage of purchase incentives and tax writeoffs.

It's so that the infrastructure is there and is reliable for people to use. We look forward to having more requests for proposals in the near future so that communities can continue to roll out their infrastructure.

I'll just note that there are hydrogen pieces there as well, so clean fuels are part of the mix.

Ms. Yvonne Jones: Did anyone else want to respond to that question? No? Okay.

I have another question. I'd like to ask about the path to net-zero emissions. Over the last little while, we've heard a lot about the government's plans to reduce greenhouse gas emissions. I know we've talked about this a bit this morning, but in order to do this, obviously we have to have co-operation from all the provinces and territories in Canada. How is that moving forward? Do we have that buy-in from the provinces and territories? Are we seeing willingness by all the stakeholders across Canada to move forward with these initiatives and with the plans that have been outlined?

Ms. Mollie Johnson: Maybe I could start in the clean fuels and some of our electricity space.

In Natural Resources Canada, under our minister, we have the EMMC, which is the energy, mines and minerals conference, I think. I'm the worst bureaucrat, because I forget my acronyms, but it's the architecture we have for working with provinces and territories. Under that, we have a table to work on hydrogen, as I think I referred to a little earlier. It's one of those areas where there's a tremendous amount of opportunity for jurisdictions to come together to see what the art of the possible is. Depending on where you live, the opportunity is a little bit different, but there are pathways to support decarbonization.

Electrification is another opportunity. The government recently announced \$964 million for a smart renewables program with storage and power, called SREPs, and this is another one that I've gotten wrong. It's again an area where provinces and territories are working with the federal government to bring more clean power onto the grid.

Together, those two mechanisms—more clean fuels, more clean power—are going to help industry become more competitive and help households have more access to clean fuels and clean power. I would say those are areas where we are seeing a lot of partnership, and in the EV space as well.

• (1255)

The Chair: Thank you, Ms. Johnson and Ms. Jones.

That completes this round. We only have about three minutes left, so I don't know that we have time to start another round. Absent any strenuous objections, I suggest we adjourn the meeting today.

At this point I will say thank you to all of our witnesses. This was the first day of our new study, and as almost all of our mem-

bers indicated today, it was a very good start. We're very grateful to all of you for providing so much valuable information. Thank you very much.

On that note, I will see everybody later in the week.

The meeting is adjourned.

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