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CANADA

# **HYDROGEN'S POTENTIAL TO REDUCE GREENHOUSE GAS EMISSIONS**

**Report of the Standing Committee on Public Accounts**

**John Williamson, Chair**

**FEBRUARY 2024  
44th PARLIAMENT, 1st SESSION**

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### **Reports from committees presented to the House of Commons**

Presenting a report to the House is the way a committee makes public its findings and recommendations on a particular topic. Substantive reports on a subject-matter study usually contain a synopsis of the testimony heard, the recommendations made by the committee, as well as the reasons for those recommendations.



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# **THE STANDING COMMITTEE ON PUBLIC ACCOUNTS**

has the honour to present its

## **THIRTY-SIXTH REPORT**

Pursuant to its mandate under Standing Order 108(3)(g), the committee has studied the Report 3, Hydrogen's Potential to Reduce Greenhouse Gas Emissions, of the 2022 Reports 1 to 5 of the Commissioner of the Environment and Sustainable Development and has agreed to report the following:







# HYDROGEN'S POTENTIAL TO REDUCE GREENHOUSE GAS EMISSIONS

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## INTRODUCTION

### Key Findings of the Commissioner of the Environment and Sustainable Development

- Natural Resources Canada overestimated hydrogen's potential to reduce greenhouse gas emissions.
- Environment and Climate Change Canada relied on policies not yet announced to justify that its plan was sufficient to meet the original 2030 target.
- Both departments used unrealistic assumptions for modelling the potential of hydrogen to reduce greenhouse gas emissions.
- Natural Resources Canada's modelling did not factor in how the supply of hydrogen and associated costs would be deployed to meet the projected demand.<sup>1</sup>

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1 Commissioner of the Environment and Sustainable Development (CESD), Hydrogen's Potential to Reduce Greenhouse Gas Emissions, Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, [At a glance](#).



**Table 1—Summary of the Committee’s Recommendations and Timelines**

Recommendation	Recommended Measure	Timeline
Recommendation 1	Based on the updated modelling, Natural Resources Canada (in partnership with interested stakeholders) should provide the House of Commons Standing Committee on Public Accounts with a detailed progress report about publishing a hydrogen market development roadmap to track progress and outcomes of the deployment and adoption of the hydrogen technologies in Canada.	31 May 2024
Recommendation 2	To improve consistency across departments, Environment and Climate Change Canada (in consultation with other federal departments) should provide the Committee with a detailed progress report about adopting a standard framework to estimate emission impacts of proposed policies, clean technologies, and fuels.	31 May 2024
Recommendation 3	ECCC should provide the Committee with a detailed progress report about publishing results for scenarios that:  A) includes a detailed list of measures and assumptions considered; and B) shows a clear distinction between  (1) scenarios based on existing policies and measures and; (2) exploratory scenarios that include proposed or aspirational policies and measures; and C) includes the source of the data used for these scenarios.	31 May 2024
Recommendation 4	In order to better inform decision making, ECCC (in coordination with NRCan) should provide the Committee with a detailed progress report about improving its pathway modelling by using reasonable, cost-effective, and technically feasible assumptions.	31 May 2024

Recommendation	Recommended Measure	Timeline
Recommendation 5	To improve quality, transparency, and trust in climate change modelling, ECCC should provide the Committee with a detailed progress report about developing a formal review framework where its modelling would be subject to enhanced peer review; formal consultations with stakeholders; formal periodic quality assurance control; and public scrutiny.	31 May 2024

## BACKGROUND

Hydrogen is the lightest and most abundant chemical element in the known universe. It is a carbon-free energy carrier that produces no pollutants and releases only water vapour and heat when it is burned. Furthermore, burning one kilogram of hydrogen releases three times more energy than burning the equivalent amount of gasoline. Thus, hydrogen could help to both reduce the dependence on high-carbon fuels and meet net-zero greenhouse gas emission targets.<sup>2</sup>

Hydrogen can produce energy in two ways: by being combusted (for example, in an engine or a turbine) or by being supplied into a fuel cell to produce electricity.<sup>3</sup> Unfortunately, hydrogen exists only in complex molecules, such as water or hydrocarbons, meaning that to be used in its pure form, it first has to be produced and stored. And unlike the process of combusting hydrogen, producing it requires large quantities of energy and, depending on the energy source, can itself result in greenhouse gas emissions.<sup>4</sup>

Given the possibility for supplying clean energy, the “potential role hydrogen could play in net-zero energy systems and decarbonization is gaining significant global interest. It’s also an option in applications where electrification is not technically or economically feasible, such as in energy-intensive industries.” Examples include:

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2 CESD, [Hydrogen’s Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, para. 3.1.

3 Ibid. For additional information about hydrogen fuel cells and the “hydrogen economy,” refer to Dillan Theckedath, [Where’s the Hydrogen Economy?](#), Background Paper, Library of Parliament, February 2010.

4 CESD, [Hydrogen’s Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, para. 3.2.



- Long-distance transportation that requires high-power generation (trains, ships, aircraft, long-haul trucking and buses)
- Mining vehicles
- Small stationary power-grid systems (especially in remote areas)
- Power production and storage (storage and release of surplus renewable energy, commonly known as power-to-gas)
- Heating fuel for industries that need high-grade heat (for example, in the oil and gas sector or in cement and steel manufacturing)
- Fuel for space and water heating for buildings (as an alternative to natural gas)
- Feedstock for industrial processes (petroleum refining, bitumen upgrading, ammonia production, methanol production, or steel production)<sup>5</sup>

Hydrogen's potential for decarbonization depends on how it is produced and used. Recently, a colour-scheme has been developed to identify different methods of hydrogen production and their carbon intensity:

- “Grey” hydrogen is produced from natural gas through steam methane reforming without capturing carbon dioxide emissions.
- “Blue” hydrogen is produced from fossil fuels with the use of carbon capture and sequestration technologies to reduce carbon dioxide emissions.
- “Green” hydrogen is produced by electrolysis using renewable electricity without releasing carbon dioxide into the atmosphere.

Notably, grey hydrogen represented 99% of global hydrogen production in 2018, while the production of green and blue hydrogen was still emerging.<sup>6</sup>

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5      Ibid., para. 3.3.

6      Ibid., para. 3.4.

A 2020 comparison of the costs and emissions of hydrogen with those of natural gas (a widely used energy source in Canada) reveals the scale and range of variation.

- Grey hydrogen was the cheapest hydrogen to produce and 4.4 times the price of natural gas.
- Blue hydrogen and green hydrogen from hydroelectricity were in the middle range.
- Green hydrogen from solar and wind was much more expensive, at about 16 times the price of natural gas.

Green hydrogen has no emissions while grey hydrogen has 2.2 times the emissions of natural gas.<sup>7</sup>

Additionally, as “the price on carbon pollution increases, the relative price of the different types of hydrogen could change, depending on their carbon intensity and capture rate. This is because the market price reflects some of the costs attached to the emissions.”<sup>8</sup>

Recently, several countries and jurisdictions have developed strategies to leverage the potential of hydrogen. In December 2020, Natural Resources Canada (NRCan) published the [Hydrogen Strategy for Canada](#). It is also mentioned in Canada’s strengthened climate plan ([A Healthy Environment and a Healthy Economy](#)), which was released the same month. Alberta, British Columbia, Ontario, and Quebec have also taken actions in recent years to create frameworks for the development of hydrogen.<sup>9</sup>

Table 2 highlights the strategy’s long-term emission reductions in key areas of the economy.

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7 Ibid., para. 3.5.

8 Ibid.

9 Ibid., para. 3.6.



**Table 2—Potential long-term emission reductions in key areas of the economy identified by the Hydrogen Strategy for Canada**

Sector of the economy using hydrogen	Reduction in greenhouse gases in 2030 (megatonnes of carbon dioxide equivalent per year)	Reduction in greenhouse gases in 2050 (megatonnes of carbon dioxide equivalent per year)
<b>Blending with natural gas</b>	1.7	57.4
<b>Oil and gas</b>	25.0	22.3
<b>Industrial processes</b>	3.3	24.4
<b>Transportation</b>	14.8	61.5
<b>Low carbon fuels</b>	0.2	24.4
<b>Total</b>	<b>45.0</b>	<b>190.0</b>

Source: Commissioner of the Environment and Sustainable Development, [Hydrogen’s Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, Exhibit 3.3 (data provided by Natural Resources Canada).

Environment and Climate Change Canada (ECCC) and NRCan are the Government of Canada’s key departments for developing and implementing Canada’s hydrogen framework.

ECCC helps with the development and implementation of Canada’s climate change policies, programs, regulations, and plans to reduce greenhouse gas emissions to achieve Canada’s 2030 and 2050 climate targets. It does this by engaging with other federal departments, Indigenous partners, provinces and territories, and other stakeholders, as follows:

- Developing credible science-based emission-reduction plans—also known as pathways—to achieve each target announced by the government
- Supporting and coordinating the implementation of Canada’s climate plan; working to reduce greenhouse gas emissions; driving clean growth; developing regulatory instruments; helping businesses and Canadians adapt and become more resilient to climate change; and contributing to international climate change actions to increase global benefits

- Designing and implementing Canada's approach to pricing carbon pollution.<sup>10</sup>

NRCan leads the development and implementation “of the Hydrogen Strategy for Canada, including providing analysis and modelling results and advice to the Minister and the Government of Canada on hydrogen in Canada’s energy system.”<sup>11</sup>

In 2022, the Commissioner of the Environment and Sustainable Development (CESD) released an audit that examined whether ECCC and NRCan “comprehensively assessed the role that hydrogen should play as a pathway to reach Canada’s climate commitments. The audit scope considered the 2030 emission reduction target—to reduce greenhouse gas emissions by 30% below 2005 levels—that was in effect at the time of the development of the Hydrogen Strategy for Canada.”<sup>12</sup>

On 2 December 2022, the House of Commons Standing Committee on Public Accounts (the Committee) held a hearing on this audit, with the following in attendance:

Office of the Auditor General of Canada—Martin Dompierre, Assistant Auditor General, and Philippe Le Goff, Principal

NRCan—John Hannaford, Deputy Minister, and Sébastien Labelle, Director General, Clean Fuels Branch

ECCC—Christine Hogan, Deputy Minister; Douglas Nevison, Assistant Deputy Minister, Climate Change Branch; and, Derek Hermanutz, Director General, Economic Analysis Directorate, Strategic Policy Branch<sup>13</sup>

Table 3 provides a glossary of the key terms used in this report.

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10 Ibid., para. 3.10.

11 Ibid., para. 3.11.

12 Ibid., para. 3.12. CESD is part of the Office of the Auditor General of Canada.

13 House of Commons Standing Committee on Public Accounts, *Evidence*, 1st Session, 44th Parliament, 2 December 2022, [Meeting No. 42](#).





**Table 3—Definitions**

<b>Greenhouse gases</b>	Gases in the atmosphere that warm the earth by trapping infrared radiation. They include carbon dioxide, methane, and nitrous oxide.
<b>Decarbonization</b>	The process of reducing and removing carbon dioxide output from a country’s economy.
<b>Carbon intensity of hydrogen production</b>	A method for comparing the end to end life cycle of greenhouse gas emissions of hydrogen as it moves from a primary energy source to a delivered energy commodity.
<b>Steam methane reforming</b>	A process in which methane from natural gas is heated using steam, usually with a catalyst, to produce a mixture of carbon monoxide and hydrogen.
<b>Carbon capture and sequestration</b>	The process of capturing carbon dioxide from facilities (including industrial or power applications), compressing it, and transporting it to be permanently stored in geological formations underground (for example, saline aquifers or oil reservoirs).
<b>Electrolysis</b>	The process of using electricity to decompose water into hydrogen and oxygen gas.
<b>Megatonne of carbon dioxide equivalent</b>	The amount of a greenhouse gas that has the same warming potential as a million tonnes (a megatonne) of carbon dioxide over a specified period.
<b>Carbon capture, utilization, and storage</b>	The process of carbon capture and sequestration when the captured carbon dioxide is used to create products (for example, concrete and low carbon synthetic fuels) or is stored underground in geological formations.

Source: Commissioner of the Environment and Sustainable Development, [Hydrogen’s Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, Definitions.

## FINDINGS AND RECOMMENDATIONS

### Hydrogen’s Potential to Reduce Emissions Was Overestimated

NRCan used a fuel pathway approach to inform policy options, which is the journey taken by energy where it begins as a raw natural resource and ends as a refined fuel.<sup>14</sup> It

<sup>14</sup> CESD, [Hydrogen’s Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, para. 3.19.

“conducted modelling exercises to obtain insight about the role hydrogen could play in the decarbonization of Canada’s energy system, as well as about the potential size of hydrogen demand; they explored two scenarios:”<sup>15</sup>

- THE INCREMENTAL SCENARIO: This is a bottom-up, aggregated demand model based on a business-as-usual approach, which employs known regulations and technologies and light policy measures, representing a slower adoption and the lower-end demand for hydrogen.
- THE TRANSFORMATIVE SCENARIO: This is an aggressive model that assumes the most favourable future regulations, technological developments, and adoption growth rates will be in place to achieve net-zero emissions by 2050.<sup>16</sup>

The transformative scenario projected hydrogen could represent up to 15% of the emission reductions needed to meet the 2030 target. In contrast, the Commissioner found that one of the departments’ incremental demand reports projected that in 2030, hydrogen will contribute only 0.5% of the 2030 target and 5.5% of the 2040 target. NRCan did not find this estimation compelling and chose to use more aspirational numbers in the Hydrogen Strategy for Canada model.<sup>17</sup>

CESD noted that the Hydrogen Strategy for Canada assumed that several provincial measures and policies would need to be in place in all provinces. For example, NRCan “extended the concept of blended natural gas to apply it to hydrogen and to all provinces. However, if the proposed Clean Fuel Standard were to be adopted as is, its exclusion of gaseous fuel would not support this expansion of a blending mandate to other provinces. The proposed Clean Fuel Standard would promote blending for liquids, but not blending of hydrogen in natural gas.”<sup>18</sup> Moreover:

- The strategy assumed that zero-emission vehicle mandates that apply only in British Columbia and Quebec would be adopted in all provinces in a similar way; and

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15     ibid., para. 3.22.

16     ibid., para. 3.23.

17     ibid., para. 3.27.

18     ibid., para. 3.29.



- The strategy assumed the federal government would implement a zero-emission buses mandate similar to the one in California.<sup>19</sup>

The report concluded that these “assumptions were unfounded because they were not backed up by either provincial or federal policies.”<sup>20</sup>

Additionally, the Commissioner found the following:

- Unrealistically low production cost assumptions;
- Supporting infrastructure costs not considered; and
- Overly ambitious assumptions of technology uptake.<sup>21</sup>

For example, when assessing opportunities to generate hydrogen using electrolysis, NRCan assumed a very low price of electricity across all provinces; namely, “it assumed an electricity price of \$40 per megawatt hour across all provinces. This was well below the recent prices observed in Canadian provinces in 2020, which ranged from \$52 to \$124 per megawatt hour for large-power customers. This meant that the department overestimated the opportunity of electrolysis to produce hydrogen at a low cost.”<sup>22</sup>

Consequently, CESD recommended that “Natural Resources Canada should perform a comprehensive bottom-up modelling for the use of hydrogen. This modelling should account for the following:

- emission reduction efficiencies by sector (cost of emission reductions per megatonne of carbon dioxide equivalent)
- substitutional fuels (for example, biofuel, electrification, credit systems)
- feasible deployment of technologies and supporting infrastructure.”<sup>23</sup>

In its Detailed Action Plan, NRCan stated its agreement with the recommendation and acknowledged “that the modelling undertaken did not include a specific cost per tonne, given the focus was on hydrogen’s full potential for use across the economy, as opposed

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19 Ibid., para. 3.29.

20 Ibid., para. 3.29.

21 Ibid., paras. 3.31–3.33.

22 Ibid., para. 3.31.

23 Ibid., para. 3.34.

to focusing on the cost and impacts of a specific measure or combination of specific measures,”<sup>24</sup> and committed to the following:

- Modelling of the full economic and environmental potential of hydrogen use in multiple sectors of the Canadian economy is updated to include the most comprehensive data available. This will be made public as part of the first biennial Hydrogen Strategy Implementation Progress Report (identified in response to Recommendation 3.35, below).
- Modelling will be updated by 31 December 2022 and 31 December 2024 and will continue to be updated every two years, shared across the Government of Canada, and the results will continue to be made public.<sup>25</sup>

At the hearing, there were several questions raised as to whether NRCan overestimated hydrogen’s potential in the government’s hydrogen strategy. In response, John Hannaford, Deputy Minister, NRCan, stated the following:

[We] were engaged in a very specific exercise, which was to identify the full potential of hydrogen at a point in time. That exercise arrived at the figures that we've been discussing. That was intended as a call to action. It was not intended as an analysis, other than of the full potential of the technology.

We continue to refine this. We have a series of committees that we have stood up that aim to draw from the wisdom of the private sector and other forms of experts—and with the provinces and territories—to make sure that we better understand this technology as it evolves and its potential. That will result in an update report next year, which will give our most recent picture of what the potential of the technology is.<sup>26</sup>

In March 2023, Natural Resources Canada provided the Committee with a copy of its comprehensive updated modelling that was based upon the following three scenarios:

TECHNOLOGY NEUTRAL—a base case with parameters reflecting a neutral approach to the range of values in the literature. Relative to the original modelling done for the Hydrogen Strategy for Canada, this scenario could be considered closest to the ‘incremental’ scenario.

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24 Natural Resources Canada (NRCan), [Detailed Action Plan](#), p. 1.

25 Ibid.

26 House of Commons Standing Committee on Public Accounts, *Evidence*, 1st Session, 44th Parliament, 2 December 2022, [Meeting No. 42](#), 1325.



HYDROGEN SUPPORTIVE (i.e., more favourable)—a scenario showing results if more supportive conditions for hydrogen were to exist, such as lowered costs, greater policy support, or technological innovations. Relative to the original modelling done for the Hydrogen Strategy for Canada, this scenario could be considered closest to the ‘transformational’ scenario.

HYDROGEN CHALLENGING (i.e., less favorable)—a scenario showing results if more challenging conditions for hydrogen were to exist, such as lesser cost reductions over time, or other policy or technological limitations. There was no equivalent to such a scenario in the Hydrogen Strategy for Canada.<sup>27</sup>

Moreover, the “analysis also explores specific hypothetical scenarios based on market developments that have occurred since the publication of the Hydrogen Strategy” and “includes exploring the impacts of significant levels of hydrogen export, greater hydrogen use for space heating in buildings, and greater conversion of natural gas infrastructure to hydrogen.”<sup>28</sup>

In light of receiving the department’s comprehensive new modelling information, the Committee makes no recommendation in this area.

CESD also recommended that, based “on the updated modelling, Natural Resources Canada, in partnership with interested stakeholders, should publish a hydrogen market development roadmap to track progress and outcomes of the deployment of the hydrogen in Canada.”<sup>29</sup>

In its action plan, the department stated its agreement with the recommendation and explained that it is “already advancing work on blueprints in partnership with provinces and territories and key stakeholders” and “has provided technical and financial support to the development of several regional strategies that have been released or are currently under development, including those in British Columbia, Alberta, Ontario, Quebec, and the Atlantic region.”<sup>30</sup> It also noted that it is “also working on the development of the reporting framework for the biennial progress report, which will track progress on the

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27 Natural Resources Canada, [Modelling hydrogen’s potential across multiple sectors of the Canadian economy](#) (March 2023), document provided to the Committee and to the Commissioner of the Environment and Sustainable Development.

28 Ibid.

29 CESD, [Hydrogen’s Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, para. 3.35.

30 NRCan, [Detailed Action Plan](#), p. 2.

recommendations outlined in the Hydrogen Strategy for Canada, as well as data and market analysis related to the expected growth in Canada and globally,<sup>31</sup> and committed to the following milestones:

- Regional blueprints have to be released for key jurisdictions by 1 April 2023.
- The first biennial Hydrogen Strategy Implementation Progress Report to be released by 1 April 2023.<sup>32</sup>

The progress report will “include key metrics pertaining to the state of hydrogen production, distribution and end-use across multiple sectors of the Canadian economy, as well as for export. It will also track progress on the 32 recommendations outlined in the Hydrogen Strategy for Canada and present the state of play of hydrogen production, distribution and deployment in other key jurisdictions around the world, to serve as a comparison to status in Canada.”<sup>33</sup>

At the hearing, when asked whether this approach was similar to how other federal organizations address other clean technologies and should it consider including consumer and industry buy-in metrics (e.g., willingness to adopt, implement, etc.), Sébastien Labelle, NRCan provided the following:

Yes, absolutely. As we think about the full potential of hydrogen in this case, we want to develop that in collaboration with people in the sector who are making investments, who are buying hydrogen and who are generating hydrogen. It's absolutely consistent with how we would, I imagine, work with other sectors of the economy and other energy sectors, yes.

[...]

In the context of our clean fuels fund, for example, we have an awareness component to that. We provide a little bit of funding to promote that public awareness and confidence in fuels like hydrogen and other clean fuels.<sup>34</sup>

Therefore, the Committee recommends:

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31     ibid.

32     ibid.

33     ibid.

34     House of Commons Standing Committee on Public Accounts, *Evidence*, 1st Session, 44th Parliament, 2 December 2022, [Meeting No. 42](#), 1415.



## Recommendation 1—A Market Development Roadmap

**That, by 31 May 2024, based on the updated modelling, Natural Resources Canada (in partnership with interested stakeholders) provide the House of Commons Standing Committee on Public Accounts with a detailed progress report about publishing a hydrogen market development roadmap to track progress and outcomes of the deployment and adoption of hydrogen technologies in Canada.**

### **Inadequate Approximations Used to Model Hydrogen’s Potential**

ECCC used an inadequate approximation (or “proxy”) in modelling the potential demand for hydrogen in A Healthy Environment and a Healthy Economy, and then used this estimate to comment on the Hydrogen Strategy for Canada. The proxy (a hydrogen–natural gas blending obligation) was not based on any existing federal or provincial policy and was also uneconomical based on the current trend of carbon pricing. These weaknesses in the proxy thus called into question whether the emission reduction pathway was achievable or realistic.<sup>35</sup>

In this type of energy modelling, hydrogen production is brought into the energy mix via two primary mechanisms:

- A competitive approach based on market dynamics—when the lowest cost production technology meets the demand for hydrogen or when direct subsidies to hydrogen are sufficient to render the hydrogen technology efficient. This approach, however, requires assumptions on production cost and rate of subsidies and how they could affect hydrogen supply and demand.
- A regulatory approach—when a blending mandate of hydrogen in natural gas assumes that hydrogen will be used, at least partially, in place of natural gas; modelling helps determine the lowest cost technologies to produce the hydrogen needed to fulfil the mandate.<sup>36</sup>

In its pathway modelling, ECCC assumed that all existing buyers of natural gas must switch to a 7.3% hydrogen–natural gas blend. The Commissioner found that this mandatory unique uptake for hydrogen misrepresented the share of other blending options (e.g., a

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35 CESD, [Hydrogen’s Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, para. 3.36.

36 *Ibid.*, para. 3.39.



blend of renewable natural gas and natural gas). This imposes a de facto substitution towards a hydrogen–natural gas blend even though other types of blending and energy could be more economical.<sup>37</sup>

Furthermore, CESD found that A Healthy Environment and a Healthy Economy attributed only limited hydrogen demand to the transportation sector given that it used little natural gas. This approach “did not align with the Hydrogen Strategy for Canada, which noted that hydrogen can be used in transportation. As a result, modelling hydrogen with a proxy of a 7.3% hydrogen–natural gas blend could distort the projected choices of businesses and consumers between existing fuels, hydrogen and other low-carbon fuels, and the respective share of each fuel in the energy system.”<sup>38</sup>

Although a 7.3% blending of hydrogen in natural gas might be technically feasible for some gas networks, it was not found to be economical. For example, according to analysis provided to NRCan, a more stringent carbon price of at least \$500 per tonne would be needed to encourage businesses to adopt blending at this level. Moreover, natural gas (as a gaseous fuel) was excluded from ECCC’s recently proposed Clean Fuel Standard. Therefore, it “was contradictory to assume that utility providers would adopt blending given that it was currently uneconomical for them to do so, and would be so even when the carbon price reached \$170 per tonne of carbon dioxide equivalent in 2030.”<sup>39</sup>

Lastly, ECCC’s 7.3% blending assumption required much more additional carbon capture utilization and storage capacity given that the natural gas blending would be made up primarily of blue hydrogen. Yet, “in A Healthy Environment and a Healthy Economy, the department projected the total annual Canada carbon capture utilization and storage capacity in 2030 to be 57 megatonnes, compared with the current capacity of 4 megatonnes. Meeting this projection would require a significant increase in the adoption and use of carbon capture utilization and storage within the decade.”<sup>40</sup>

In light of these considerations, CESD recommended that, in order to “improve consistency across departments, Environment and Climate Change Canada and other federal departments should adopt a standard framework to estimate emission impacts of proposed policies, clean technologies, and fuels.”<sup>41</sup>

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37 Ibid., para. 3.44.

38 Ibid.

39 Ibid., para. 3.49.

40 Ibid., para. 3.48.

41 Ibid., para. 3.50.



In its Detailed Management Action Plan, the department stated its agreement with the recommendation and explained that the “recently established Integrated Climate Lens Centre of Expertise, located at ECCC, has a mandate to ensure that major government decisions, namely through budget and Cabinet processes, consider climate mitigation and adaptation in a rigorous, consistent and, where possible, measurable manner.”<sup>42</sup> It also committed to establishing an inventory of federal approaches to emissions modelling and the development of guidance for evaluating emission impacts of relevant policies and programs.<sup>43</sup>

At the hearing, Derek Hermanutz, Director General, ECCC, explained that “the whole of government is responsible for developing the policy analysis and projections that go into the climate plans. ECCC is the coordinator of that process,” as well as the following:

The projections are done to represent the government's existing policies. That's done in coordination with other federal departments, as the deputy said, including Agriculture, Natural Resources Canada and Transport. The end result is that Environment and Climate Change Canada models the whole package and estimates what the global impacts will be on emissions reductions for Canada.<sup>44</sup>

Therefore, the Committee recommends:

### **Recommendation 2—A Standard Framework**

**That, by 31 May 2024, to improve consistency across departments, Environment and Climate Change Canada (in consultation with other federal departments) provide the House of Commons Standing Committee on Public Accounts with a detailed progress report about adopting a standard framework to estimate emission impacts of proposed policies, clean technologies, and fuels.**

### **Unannounced Policies Used to Justify Plans**

CESD found that ECCC modelled A Healthy Environment and a Healthy Economy based on measures that have not been implemented, and relied on policies that did not have the necessary legislative and financial support as if they were already implemented, for example:

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42 Environment and Climate Change Canada (ECCC), [Detailed Management Action Plan](#), p. 1.

43 Ibid.

44 House of Commons Standing Committee on Public Accounts, *Evidence*, 1st Session, 44th Parliament, 2 December 2022, [Meeting No. 42](#), 1340 and 1345.

- A tax incentive similar to [45Q in the United States for carbon capture, utilization, and storage](#)—such an incentive was not announced at the time of A Healthy Environment and a Healthy Economy and was still not finalized at the time of the audit.
- A proxy of 7.3% blending of hydrogen in the natural gas to represent demand for hydrogen—this was not supported by any blending regulation at the federal or provincial level.
- Clean Fuel Standard regulations—forthcoming and not yet finalized; the standard has evolved over the past years and at the time of the audit recognized only liquid fuels.<sup>45</sup>

CESD also found that “A Healthy Environment and a Healthy Economy presented a list of government policies, programs, and strategies that aimed to support the achievement of its emission reduction target. However, it did not distinguish existing policies and measures from those not yet announced or implemented.”<sup>46</sup> In this regard, ECCC lacked transparency in the reporting of its modelling. And, despite the fact that A Healthy Environment and a Healthy Economy presented a reference case and an updated case with announced initiatives, it provided no clear and comprehensive public list of assumptions for each case. Rather, it presented only high-level and vague assumptions. This prevented an informed public debate about policy choices.<sup>47</sup>

And although ECCC provided the Commissioner with a comprehensive list of assumptions for both cases, it found that the department relied on some inflated and overly confident assumptions when modelling measures to reach the 30% emission reduction target for 2030.<sup>48</sup>

Lastly, CESD found that ECCC used targeted funds to support specific policies or sectors without making public its estimate of expected emission reductions; e.g., “the department had not yet performed modelling of the impact on emissions of the \$5 billion for the Strategic Innovation Fund’s [Net Zero Accelerator initiative](#) announced in Budget 2021.”<sup>49</sup>

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45 CESD, [Hydrogen’s Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, para. 3.58.

46 Ibid., para. 3.59.

47 Ibid.

48 Ibid., para. 3.60.

49 Ibid., para. 3.63.



Consequently, CESD recommended that in order to increase transparency of its emission projections, ECCC should develop and publish results for scenarios

- that include a detailed list of measures and assumptions considered; and
- that show a clear distinction between (1) scenarios based on existing policies and measures and (2) exploratory scenarios that include proposed or aspirational policies and measures.<sup>50</sup>

Although ECCC agreed with the recommendation in its Detailed Management Action Plan, it also stated that this recommendation “aligns with current [ECCC] practice. [ECCC’s] emission projections are published in accordance with international standards that require a clear distinction between existing and planned initiatives. ECCC models and publishes two GHG cases: the ‘Reference’ case, which includes federal, provincial and territorial policies and measures that are funded, legislated and implemented; and the ‘With Additional Measures’ case, which builds on the Reference case by including planned policies. International guidelines for reporting from the United Nations Framework Convention on Climate Change (UNFCCC) are available online:

- Guidelines for the preparation of national communications by Parties included in [Annex I](#) to the Convention, Part II: UNFCCC reporting guidelines on national communications (Annex starts on Page 29, Section VI: Projections on Page 35, para 26)
- UNFCCC biennial reporting guidelines for developed country Parties (Annex I, starts on page 31, Section V Projections on page 33)<sup>51</sup>

The department also stated that it will “continue to follow the UNFCCC reporting guidelines in clearly delineating the policies and measures that have been implemented and received legislative and financial support from the ones that have not yet been implemented, legislated or funded.” (Dates will vary based on UNFCCC or other legislated timelines. Next report will be Canada’s 8<sup>th</sup> National Communication and 5<sup>th</sup> Biennial Report to the UNFCCC expected in late 2022.)<sup>52</sup>

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50 Ibid., para. 3.64.

51 ECCC, [Detailed Management Action Plan](#), pp. 1–2.

52 Ibid.

At the hearing, when asked to explain the difference between these assumptions and the facts (as presented in the audit), Christine Hogan, Deputy Minister, ECCC, provided the following:

In the emission modelling of Canada's climate plans, and when assessing progress towards the country's emission reduction targets, ECCC follows international guidelines that are established for reporting on progress to targets. What we do in these instances, as we did with the strengthened climate plan and again in the emissions reduction plan that was released in March, is that Environment Canada models a package of measures together to estimate the GHG reductions associated with all of the measures contained in the plans. This is consistent with the existing UNFCCC reporting guidelines, the UN Framework Convention on Climate Change.<sup>53</sup>

Derek Hermanutz added the following:

The UNFCCC accounting framework and guidelines allow for two different scenarios, and this is how Canada approaches the modelling. One is the reference case scenario, and that includes policies that are legislated, implemented or funded. That's the baseline analysis that we do ... as defined by the UNFCCC. That's, yes, funded, legislated and implemented.

Then the UNFCCC also allows for an additional measures case. That is where countries can estimate the impacts of policies that have been announced but are not yet fully funded or implemented.<sup>54</sup>

Notwithstanding the above, to ensure that modelling in the hydrogen framework addresses the concerns raised in the audit, the Committee thus recommends:

### **Recommendation 3—Improved Scenarios for Analysis**

**That, by 31 May 2024, Environment and Climate Change Canada provide the House of Commons Standing Committee on Public Accounts with a detailed progress report about publishing results for scenarios that:**

- A) includes a detailed list of measures and assumptions considered;**
- B) shows a clear distinction between**
  - (1) scenarios based on existing policies and measures and;**

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53 House of Commons Standing Committee on Public Accounts, *Evidence*, 1st Session, 44th Parliament, 2 December 2022, [Meeting No. 42](#), 1335.

54 *Ibid.*, 1340.



**(2) exploratory scenarios that include proposed or aspirational policies and measures; and;**

**C) includes the source of the data used for these scenarios.**

CESD also recommended that in “order to better inform decision making, Environment and Climate Change Canada, in coordination with Natural Resources Canada, should improve its pathway modelling by using reasonable, cost-effective, and technically feasible assumptions.”<sup>55</sup>

In its Detailed Management Action Plan, the department stated its agreement with the recommendation and committed to implement “a process with Natural Resources Canada and other departments as required to create an evergreen list of rapidly-evolving or emergent technologies (e.g., carbon capture, utilisation and storage, hydrogen, methane abatement technologies, oil sands solvents, etc.) that could have consequential impacts on results from models used in national-level projections of GHG emissions, with associated cost and technical parameters.” (Winter 2023 and thereafter)<sup>56</sup>

At the hearing, in response to a question about the responsibilities for developing such pathways, Christine Hogan provided the following:

The strengthened climate plan and the emissions reduction plan that followed suit in March are extremely comprehensive. They cover a multitude of sectors of the economy and, therefore, are products of a lot of detailed work done internally within departments and then worked up collectively in a whole-of-government way across.

Obviously, we at [ECCC] work very closely with our partner departments, whether that be Transport Canada in the transportation sector, Natural Resources Canada on energy and natural resources issues, or the like. There are a lot of detailed efforts that go into, then, compiling those plans and telling a whole-of-government story.<sup>57</sup>

Therefore, the Committee recommends:

**Recommendation 4—Improved Pathway Modelling**

**That, by 31 May 2024, in order to better inform decision making, Environment and Climate Change Canada (in coordination with Natural Resources Canada) provide the**

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55 CESD, [Hydrogen’s Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, para. 3.65.

56 ECCC, [Detailed Management Action Plan](#), p. 3.

57 House of Commons Standing Committee on Public Accounts, *Evidence*, 1st Session, 44th Parliament, 2 December 2022, [Meeting No. 42](#), 1340.

**House of Commons Standing Committee on Public Accounts with a detailed progress report about improving its pathway modelling by using reasonable, cost-effective, and technically feasible assumptions.**

## Limited Quality Control and Review

CESD found that ECCC had a limited framework through which its most important models supporting decisions on decarbonization policies were subject to review from peers and stakeholders and quality assurance control.<sup>58</sup>

### Additional Finding

In 2014, the Office of the Auditor General of Canada conducted an audit on the methods for estimating and reporting Canada's future greenhouse gas emissions. It recommended to Environment Canada that, in order to strengthen quality controls and increase transparency, the department should take steps to enhance external review of its climate change modelling framework. In the view of CESD, although there was progress made in a number of areas, this 2014 recommendation is still relevant.

Source: Commissioner of the Environment and Sustainable Development, [Hydrogen's Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, para. 3.67.

ECCC "annually consulted on projections with provinces, territories, and other federal departments. In this way, it shared data, information, assumptions, and modelling results to explain the results of the projections and to better understand and reflect all the provincial policies."<sup>59</sup>

Additionally, the department reported that Canada's Emissions Trends reports and the academic papers written by departmental officials involving the models were reviewed by external peers. However, CESD found that of the four models the department used to estimate emissions, only one underwent a peer review in 2018. The Commissioner also found that the consultants reviewed a set of predetermined questions.<sup>60</sup>

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58 CESD, [Hydrogen's Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, para. 3.66.

59 Ibid., para. 3.68.

60 Ibid., para. 3.69.





Although ECCC believed that these were sufficient to claim acceptable modelling, CESD found that “these reviews were insufficient in terms of rigour and transparency compared with practices of other jurisdictions. Those practices included asking another organization to choose the peer reviewers, having a framework to avoid conflicts of interests, and publishing the peer reviews of their modelling framework on the internet.”<sup>61</sup>

Consequently, CESD recommended that to “improve quality, transparency, and trust in climate change modelling, Environment and Climate Change Canada should develop a formal review framework where its modelling would be subject to

- enhanced peer review
- formal consultations with stakeholders
- formal periodic quality assurance control
- public scrutiny.”<sup>62</sup>

In its Detailed Management Action Plan, the department stated its agreement with the recommendation and that in addition “to the existing consultation, review and transparency measures, ECCC will consider what additional measures may be necessary to ensure that the modelling process remains suitable and reliable by reviewing international best practices and consulting with modelling experts. The details of the approach will be determined based on these consultations.”<sup>63</sup> It also committed to the following milestones:

- Emissions projections published annually, following extensive consultation process with stakeholders.
- Convene expert-led process to provide independent advice to enhance current modelling regime to inform the basis of future Emission Reduction Plans and progress reports.
- Detailed data underlying the projections are published on the Government of Canada Open Data Portal.

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61 Ibid., para. 3.70.

62 Ibid., para. 3.73.

63 ECCC, [Detailed Management Action Plan](#), pp. 3–4.

- International Review Processes of Canada's National Communications and Biennial Reports by UNFCCC Expert Review Teams are supported.
- (by Fall 2023 for the expert-led process to provide independent advice; ongoing for other actions)<sup>64</sup>

At the hearing, Christine Hogan provided the following:

I would like to highlight that in the emissions reduction plan, which came out in March, there is an extremely comprehensive annex in that document to the approach to modelling. It can be a very complex and complicated space. We are doing our best to unpack how the modelling works against our climate plans.

[...]

we acknowledge the recommendations of the commissioner. In fact, one of the other initiatives that are highlighted in the emissions reduction plan is a commitment—and it's referenced in our management action plan as well—to an expert-led process that will allow us to take stock and continue to enhance our modelling efforts going forward.<sup>65</sup>

Therefore, the Committee recommends:

### **Recommendation 5—Improved Climate Change Modelling**

**That, by 31 May 2024, to improve quality, transparency, and trust in climate change modelling, Environment and Climate Change Canada provide the House of Commons Standing Committee on Public Accounts with a detailed progress report about developing a formal review framework where its modelling would be subject to enhanced peer review; formal consultations with stakeholders; formal periodic quality assurance control; and public scrutiny.**

## **CONCLUSION**

The Committee concludes that Environment and Climate Change Canada and Natural Resources Canada modelled the role that hydrogen could play as a pathway to reach Canada's climate commitments. However, NRCan overestimated hydrogen's decarbonization potential, and ECCC used an inadequate proxy to model it. Furthermore,

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64 Ibid.

65 House of Commons Standing Committee on Public Accounts, *Evidence*, 1st Session, 44th Parliament, 2 December 2022, [Meeting No. 42](#), 1405.



ECCE's modelling of A Healthy Environment and a Healthy Economy used policies that had not yet been implemented.

Additionally, the Commissioner noted that "Environment and Climate Change Canada and Natural Resources Canada had different approaches to assessing the role hydrogen should play in reducing greenhouse gas emissions. Environment and Climate Change Canada expected to achieve 15 megatonnes of carbon dioxide equivalent emission reduction in 2030, whereas the Hydrogen Strategy for Canada, published by Natural Resources Canada, projected up to 45 megatonnes."<sup>66</sup>

Finally, the plan was based on some overly confident assumptions that called into question its credibility and its ability to achieve Canada's 2030 emission reduction target.

In this report the Committee has made five recommendations to help the Government of Canada better manage its hydrogen strategy and plans.

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66 CESD, [Hydrogen's Potential to Reduce Greenhouse Gas Emissions](#), Report 3 of the 2022 Reports of the Commissioner of the Environment and Sustainable Development, para. 3.15.

# APPENDIX A: FOLLOW-UP RESPONSES TO COMMITTEE QUESTIONS

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## QUESTION 1

In response to a question about the level of spending in decarbonizing Canada's electricity system, Natural Resources Canada provided the following response in a letter to the Committee:

When considering measures included in the 2030 Emissions Reduction Plan, released on March 29, 2022, and the additional measures presented since, the Government of Canada has announced investments of \$998M over seven years, and \$0.5 million ongoing, to support Canada's efforts to achieve a net zero electricity system by 2035. Those measures are:

- \$600 million in additional funding to the Smart Renewables and Electrification Pathways Program to support additional renewable electricity and grid modernization projects;
- \$250 million to support predevelopment work for large clean electricity projects, in collaboration with provinces, through the Electricity Predevelopment Program;
- \$2.4 million for the creation of the Pan-Canadian Grid Council to provide external advice to the Government of Canada to promote clean electricity infrastructure investments;
- \$69.9 million to undertake research to minimize waste generated from small modular reactors; support the creation of a fuel supply chain; strengthen international nuclear cooperation agreements; and enhance domestic safety and security policies and practices;
- \$50.7 million, and \$0.5 million ongoing, for the Canadian Nuclear Safety Commission to build the capacity to regulate small modular reactors and work with international partners on global regulatory harmonization; and,

- \$25 million to establish Regional Energy and Resource Tables to work with provinces, territories, and relevant stakeholders to develop net-zero energy plans.

Additionally,

- The Canada Infrastructure Bank invested \$970 million in Ontario Power Generation towards Canada's first grid-scale small modular reactor; and,
- The Strategic Innovation Fund invested nearly \$100 million in small modular reactors.

The 2022 Fall Economic Statement also proposes a refundable tax credit equal to 30 per cent of the capital cost of investments in:

- Electricity Generation Systems, including solar photovoltaic, small modular nuclear reactors, concentrated solar, wind, and water (small hydro, run-of-river, wave, and tidal); and,
- Stationary Electricity Storage Systems that do not use fossil fuels in their operation, including but not limited to batteries, flywheels, supercapacitors, magnetic energy storage, compressed air storage, pumped hydro storage, gravity energy storage, and thermal energy storage.

The credit would be available as of the day of Budget 2023 and no longer in effect at the start of 2035, subject to a phaseout starting in 2032.

## QUESTION 2

In response to a question about the carbon content in pipelines that have been retrofitted to blend hydrogen, Natural Resources Canada provided the following response in a letter to the Committee:

There are currently two hydrogen blending projects active in Canada. The projects have different carbon intensities for the hydrogen being used, resulting from different production pathways.

Enbridge Gas is carrying out a blending pilot project for 3,600 customers in Markham, Ontario. According to Enbridge, the hydrogen used in this

pilot project is produced through electrolysis, using a mix of renewable electricity and electricity from the grid. It has a carbon intensity 94% lower than conventional hydrogen produced from natural gas with no carbon abatement.

ATCO Gas in Alberta is blending hydrogen into the natural gas distribution system for 2,100 customers in Fort Saskatchewan, Alberta. According to ATCO, the hydrogen being used currently is conventional hydrogen, produced from natural gas without carbon abatement. It has a carbon intensity of just over 110g CO<sub>2</sub>/MJ hydrogen. In early 2023, this hydrogen is expected to be replaced by hydrogen produced from renewable electricity, thereby lowering the carbon intensity by over 90%.





## APPENDIX B: LIST OF WITNESSES

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The following table lists the witnesses who appeared before the committee at its meetings related to this report. Transcripts of all public meetings related to this report are available on the committee’s [webpage for this study](#).

Organizations and Individuals	Date	Meeting
<b>Department of Natural Resources</b> John Hannaford, Deputy Minister Sébastien Labelle, Director General, Clean Fuels Branch	2022/12/02	42
<b>Department of the Environment</b> Derek Hermanutz, Director General, Economic Analysis Directorate, Strategic Policy Branch Christine Hogan, Deputy Minister Douglas Nevison, Assistant Deputy Minister, Climate Change Branch	2022/12/02	42
<b>Office of the Auditor General</b> Martin Dompierre, Assistant Auditor General Philippe Le Goff, Principal	2022/12/02	42



# REQUEST FOR GOVERNMENT RESPONSE

Pursuant to Standing Order 109, the committee requests that the government table a comprehensive response to this Report.

A copy of the relevant *Minutes of Proceedings* ([Meetings Nos. 42, 90, 94 and 95](#)) is tabled.

Respectfully submitted,

John Williamson, M.P.  
Chair



## **The Conservative Party of Canada's Dissenting Report: Hydrogen's Potential to Reduce Greenhouse Gas Emission**

Conservative members of the Standing Committee on Public Accounts (PACP) demand action be taken due to the incompetence of Government Ministers when it comes to building a hydrogen industry in Canada.

Conservative members of the Committee recommend:

### **Recommendations:**

**Recommendation #1:** The government needs to immediately axe the carbon tax for farmers, First Nations, and families. Conservatives believe that we should protect our environment and reduce emissions using non-fictional technology, unlike the non-existent technology stated by the Environment Commissioner that is currently being used by this government.

**Recommendation #2:** We call for the appearance, without delay, of the Minister of Energy and Natural Resources and the Minister of Environment and Climate Change before the Public Accounts Committee to account for their unmitigated failure to develop a viable strategy for hydrogen and for their department's failure to model correctly.

**Recommendation #3:** Natural Resources Canada and Environment Canada must immediately establish a standard framework to estimate emission impacts of proposed policies, clean technologies, and fuels. There should be zero discrepancies between departments.

**Recommendation #4:** The Government of Canada must mandate Environment and Climate Change Canada and Natural Resources Canada to provide accurate costs to Canadian taxpayers on how much the government's carbon-neutral by 2050 plan will truly cost.

**Recommendation #5:** The Government of Canada must urgently prioritize a real long-term plan for 2050 net zero based upon on existing technology, not the non-existent technology that the Environment Commissioner noted the Government of Canada is using.

## **Background:**

The Auditor General's report, titled "Hydrogen's Potential to Reduce Greenhouse Gas Emissions," highlights a frightening lack of accountability and fabrication between Natural Resources Canada and Environment Climate Change Canada regarding their outright dishonesty with green hydrogen in Canada. This report underscores the failure of both departments, as well as the entire Government of Canada to develop concrete and factual policies on the effective utilization of hydrogen in the country and the long-term financial implications for taxpayers.

We are particularly concerned that Natural Resources Canada and Environment Climate Change Canada “used unrealistic assumptions for modelling”<sup>[1]</sup> greenhouse gas emissions in Canada. In addition, The Environment Commissioner of Canada warned that the Government of Canada “is not fully transparent because it includes assumptions that are not clear and relies on some policies that are not announced or in effect.”<sup>[2]</sup> The report also highlighted that departmental official’s policy makers did not use the hydrogen strategy to inform policy decisions. Conservatives believe the lack of transparency, unrealistic, and fictional modeling from Natural Resources Canada and Environment Climate Change Canada makes the credibility of the Government of Canada’s hydrogen policy, and frankly, their entire climate policy compromised, and non-existent.

Conservatives submitted Order Paper Question 1993, requesting the Minister of Energy and Natural Resources to provide a response outlining the financial plan for the government's net-zero by 2050 carbon policy proposal <sup>[3]</sup>. The Order Paper Question from the minister concluded that the government of Canada does not have a clear cost projection for there net-zero by 2050 climate proposal<sup>[4]</sup>. The Government of Canada's failure to have a stated cost projection for a 25-year plan is not only irresponsible and downright deceptive, particularly when taxpayer money is being used to incentives these projects.

Conservatives Submitted Order Paper Question 1988 which demanded the Minister of Environment to inform Parliament on how emissions are directly reduced from the carbon tax. The minister responded to the Order Paper Question by saying the Government of Canada doesn’t measure the relationship between emissions and carbon pricing.<sup>5</sup> During a cost-of-living crisis - which can be attributed to the carbon tax - the minister's glaring confession that the government doesn't measure the relationship between emissions and carbon pricing proves Liberal hypocrisy. It is in reality a tax plan.

The Government of Canada must prioritize the implementation of clear cost projections and cost analyses for its initiatives. It is unacceptable for departments to use fictional policies and non-existent technology. Canadians and their tax dollars deserve better.

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[1] [https://www.oag-bvg.gc.ca/internet/docs/parl\\_cesd\\_202204\\_03\\_e.pdf](https://www.oag-bvg.gc.ca/internet/docs/parl_cesd_202204_03_e.pdf), Pg8

[2] Ibid, Pg 8

[3] [https://www.oag-bvg.gc.ca/internet/docs/parl\\_cesd\\_202204\\_03\\_e.pdf](https://www.oag-bvg.gc.ca/internet/docs/parl_cesd_202204_03_e.pdf), Pg 5,6

[4] <https://www.ourcommons.ca/documentviewer/en/44-1/house/sitting-270/order-notice/page-9>

[5] Ibid, pg9