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Grant Hogg
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Environmental Protection Branch
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Via email: modeleacvcarburant-fuellcamodel@ec.gc.ca

Re: WaterPower Canada comments regarding Fuel Life Cycle Assessment Model

Dear Mr. Hogg:

This letter provides WaterPower Canada's comments regarding the Fuel Life Cycle Assessment Model ("the LCA Model"). More specifically our comments address the updated carbon intensities for Canadian grid electricity and excess electricity to grid processes, as outlined in the pre-publications posted to the ECCC website.

General comments:

We note that the pre-publication notes that no methodological changes are proposed in the proposed update. WaterPower Canada continues to have concerns related to the methodology applied to Canadian grid electricity and recommends immediate methodological changes.

The treatment of renewable electricity technologies remains inconsistent and does not best meet the decision-making needs of the LCA Model. We outline the specific inconsistencies in the remainder of this letter.

Life Cycle GHG Emissions:

Within the umbrella of life cycle GHG emissions, there are two categories of emissions as they relate to electricity generation technologies[1]:

1. Emissions that vary with electricity production/consumption:

   This includes "combustion emissions from fuel used for electricity generation", "Cradle-to-gate GHG emissions for fossil fuels and uranium used for electricity generation", "electricity losses from electricity transmission and distribution".

   The emissions from all these sources vary with a consumer's use of electricity generated by these alternatives.

2. Emissions that do not vary with electricity production/consumption:

   This includes "SF_6 emissions produced from equipment used in electricity transmission and distribution", "reservoir emissions related to hydroelectricity", and "infrastructure related to electricity generation".

All the emissions in the second category are considered "sunk" – they arose because of a decision to construct a facility and do not change with subsequent changes in consumer consumption or power generation.

These emissions are produced by the construction and installation of wind / solar, storage, hydropower, and transmission and distribution rather than by the ongoing operation of the assets. In the case of reservoir-based hydropower, reservoir emissions may be ongoing after construction, but they arise from the ongoing existence of a reservoir, not from energy production at the generating facility.

These sunk emissions from historic facilities will not change with hydroelectric generation dispatch, and we do not believe they should be included in the LCA Model, particularly when sunk emissions from other renewables have not been included.

Lack of Consistency:

The lack of consistency in the LCA Model arises because emissions that do not vary with electricity production **were** included in the LCA Model for hydroelectric generation, while emissions that do not vary with electricity production **were not** included in the LCA Model for wind and solar generation.

This difference leads one to conclude that life cycle emissions for wind and solar are significantly less than for hydropower, and that GHG emissions would vary with use of hydropower. Both conclusions would be incorrect.

[1] Terms in quotations are referenced from Section 3.3.2 Modelling approach for grid electricity in the Pre-publication.

A further inconsistency arises because the LCA Model uses hydropower modelling results from one province and extrapolates them to other provinces.

The Product Life Cycle Accounting and Reporting Standard[2] from the Greenhouse Gas Protocol requires that users "*choose* methodologies*, data, and assumptions that allow for meaningful comparisons of a GHG inventory over time*". The current LCA Model does not allow for meaningful comparison between hydropower, wind, and solar PV/CSP.

Nearly 100% of life cycle emissions for wind and solar PV/CSP arises from the manufacturing and installation of equipment. These emissions are methodologically excluded in the LCA Model, as they are categorized as arising from "infrastructure related to electricity generation."

The rationale provided for this exclusion is that insufficient data is available.[3] The impact of this exclusion is that wind and solar PV & CSP have assigned life cycle GHG intensities ≈0 g CO_2e/kWh.

While there is a range of estimates related to the lifecycle emissions of renewable technologies, no estimate places the value as low as ≈0 g CO_2e/kWh. A literature review undertaken by IPCC's Working Group Three for the 5th Assessment Report[4] estimates lifecycle emissions from these technologies to be comparable to median lifecycle emissions from reservoir hydroelectricity:

> *"The harmonization has narrowed the ranges down from 5 – 217 gCO2eq / kWh for PV, 7 – 89 gCO2eq / kWh for CSP, and 1 – 220 gCO2eq / kWh for nuclear energy. A new literature review for wind power published since 2002 reports 7 – 56 gCO2eq / kWh, where the upper part of the range is associated with smaller turbines (< 100 kW). (Arvesen and Hertwich, 2012)"*

The exclusion of emissions from "infrastructure related to electricity" eliminates any emissions from wind and solar, yet these emissions are comparable to the emissions from reservoir hydropower in the LCA Model and arise from the decision to construct, just as those arising from a hydropower facility and associated reservoir.

The Methodology Manual also describes a significant limitation regarding the inclusion of reservoir emissions, namely the lack of regional data.

> "*While these values are based on Quebec reservoirs, they are used as proxies for reservoir emissions for all reservoirs in Canada."*

Reservoir emissions related to electricity generation are project specific and proxies should not be used. Since the profiles of all hydroelectric projects in Canada are not the same, this inaccuracy may drive inappropriate policy outcomes and investment decisions.

Inaccuracy in Hydropower Modeling:

While our position is that historic reservoir emissions are irrelevant to the LCA Model, our concerns are compounded by inaccuracies inherent in the model's design.

[2] https://ghgprotocol.org/sites/default/files/standards/Product-Life-Cycle-Accounting-Reporting-Standard_041613.pdf
[3] "lack of data", as noted in Section 2.3.1 of the Methodology Manual.
[4] https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter7.pdf

The LCA Model assumes all "reservoir" hydroelectric generation emits, on a full lifecycle basis, at a rate of 24.76 g CO_2e/kWh and all "run-of-river" hydroelectric generation at a rate of 0.14 g CO_2e/kWh (the "onsite" values). While this might be appropriate for some generation stations over their entire life, in many cases these proxy values are inaccurate.

For example, the recently commissioned 695 MW Keeyask generation station in Manitoba was estimated to have life cycle emissions of 2.5 g CO2e/kWh[5].

All new hydropower projects are subject to detailed GHG analysis and often a comprehensive LCA. These estimates would have much greater accuracy than an extrapolation of one estimate of a province's emissions and consider all the unique circumstances of the facility. We would not object to the inclusion of the reservoir emissions of new hydropower if the emissions associated with infrastructure for new wind and solar was also included.

This approach would result in a much better reflection of the low current emissions associated with the existing grid and the full incremental implications of adding new infrastructure to meet the growing need for electricity.

Research into reservoir emission has been a priority within the Canadian hydropower industry for decades. Recently several of our member companies began working with ECCC, Université du Québec à Montréal, University of Waterloo, and Grand River Conservation Authority to test and calibrate models against actual measurements on reservoirs across Canada. While reasonable LCA estimates are not yet available for all hydroelectric reservoirs in Canada, we anticipate increasing confidence in these models in the coming years.

However, we would reiterate that even if we can better estimate the LCA emissions of existing hydropower these would still not reflect the incremental emissions associated with its dispatch or use of this energy.

Summary:

If the LCA Model is used to assist decision making for new projects, then it must include a comparable full life cycle analysis for all generation used in the model. It is unacceptable to include non-variable emissions from one generation alternative and to exclude those from others when comparable data exists to inform decision making.

While the current LCA Model purports to be a life cycle model, its application does not include a comprehensive estimate of all life cycle emissions for all electricity generation sources in Canada. This is self-evident by wide range of "excluded processes" (sections 2.3.1 and 3.3.1 of the Methodology Manual). If it is "intended to inform and reduce the CI of Canadian fuels" to encourage a reduction of emissions, then it needs to do so on a consistent basis.

[5] https://keeyask.com/wp-content/uploads/2012/07/Climate.pdf

In conclusion, WaterPower Canada and its members are concerned the LCA Model does not properly reflect the GHG emissions associated with hydropower production and grid intensity and provides misleading guidance to energy generation choices. The implications affect not only the assessments and credits under the Clean Fuel Regulation, as they are already being applied to other federal policies. It is reasonable to assume that they will also be referenced by other governments and electricity customers inside and outside of Canada.

Hydropower is the largest source of electricity in Canada and in some provinces, hydropower accounts for more than 95% of the electricity production. Assumptions related to hydropower have a significant effect on the estimated grid intensity of electricity. Overestimating the grid intensity compromises electrification and decarbonization efforts. The emission intensity of hydrogen production is also negatively affected. In fact, under the current estimate of grid intensities some predominantly hydro-based provinces can't get the highest level of investment tax credits.

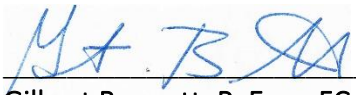
The model provides inaccurate guidance in choosing between renewable resources like hydropower, wind and solar. It will also provide misleading messages to domestic and export customers in choosing their electricity sources. The displacement of hydropower with other electricity sources will not lead to reduced GHG emissions.

Hydropower is a key climate change solution and a Canadian advantage. In addition to supplying the majority of Canada's electricity, it also provides important grid attributes and services that are essential for reliable electricity grid operation.[6] These grid services are essential for integrating variable renewable generation, including wind and PV solar generation into the Canadian electricity grid. We will need more of all these resources to electrify and decarbonize our economy, and it is critical that we provide methodologies that facilitate these activities.

We request that ECCC review and amend the model accordingly. There needs to be more consistency in the inclusion and exclusion of emissions categories between resources like wind solar and hydro. The model should better reflect the incremental implications in the choice of energy sources. For hydropower that should exclude emissions associate with past projects.

We are available to discuss this subject matter at your convenience.

Sincerely,



Gilbert Bennett, P. Eng., FCAE
President

cc. André Bernier, Director General, Electricity Resources Branch, Natural Resources Canada

[6] https://waterpowercanada.ca/wp-content/uploads/2023/08/WPC-Hydropower-Grid-Services_Final_EN.pdf