

**Memo**

To	Barbara Taylor
From	ERM Consultants Canada Ltd.
Date	28 January 2022
Reference	Ontario Pumped Storage Project
Subject	2020 Preliminary Construction Greenhouse Gas Emission Estimate

1. INTRODUCTION

ERM Consultants Canada Ltd. (ERM) has been contracted by TransCanada Energy Ltd. (TCE) to provide environmental services and regulatory support for the Ontario Pumped Storage Project (the Project), a proposed 1,000-megawatt pumped storage facility located on the Department of National Defence (DND) Canadian Forces 4th Canadian Division Training Centre (4 CDTC) in the Municipality of Meaford, Ontario. The Project is designed to provide the Ontario electricity system with 1,000 megawatts (MW) of flexible on-demand capacity for up to 8 hours (8,000 MWh) featuring fast ramping energy and capacity, regulation services, operating reserve, black start capability and reactive voltage control.

During conceptual Project design in 2020, ERM was requested by TCE to provide a high-level estimate of construction greenhouse gas (GHG)¹ emissions based on other proposed projects of similar scale in Canada. The intent of the estimate was to understand the potential magnitude of construction GHG emissions and was limited to an assessment of data available relative to the conceptual design of a surface powerhouse and conventional water conveyance, as well as preliminary construction assumptions. This memorandum does not represent a Project-specific analysis suitable for regulatory review. It is an initial estimate only. A full analysis utilizing current and applicable regulatory guidance will be conducted as part of the future environmental/impact assessment for the Project.

Construction GHG emissions are included in the evaluation of potential effects of the Project. As Project design continues, a detailed construction inventory and analysis of these emissions will be required for future regulatory processes.

Following is a summary of the high-level estimate provided to TCE in 2020 based on information available at that time. This memo also includes a brief overview of the anticipated regulatory process associated with calculation and assessment of GHG emissions. As Project design progresses, additional project-specific construction data will be available to refine the estimate.

¹ Greenhouse gas is a gas that contributes to the greenhouse effect, which traps heat in the atmosphere causing warming. Greenhouse gases include carbon dioxide, methane, and nitrous oxide (Government of Canada 2019a).

2. 2020 PRELIMINARY CONSTRUCTION GHG EMISSIONS ESTIMATE

To provide an estimate of anticipated GHG emissions during construction, ERM reviewed construction GHG emissions calculated as part of the environmental assessments for two large infrastructure projects that received regulatory approval and are under construction. The projects are Site C Dam in British Columbia (Stantec 2012), and East-West Tie transmission line in Ontario (NextBridge Infrastructure 2017).

Site C was selected for review as it is a large power project, British Columbia's environmental assessment process is similar to the federal process, and the application includes extensive analysis and reporting for GHG emissions. East-West Tie was selected for review because of its geography, the requirement for Individual Environmental Assessment approval in Ontario, and is under construction, planned to be complete in 2022. These projects have characteristics that can be used as a basis to understand the potential magnitude of construction GHG emissions for the proposed Project.

There are two components of construction GHG emissions:

1. GHG emissions from burning fuel from construction equipment, electricity used during construction, and construction materials.
2. GHG emissions released as a result of land clearing where vegetation is cut down/removed and either burned, chipped or piled as brush.

GHG emissions are calculated and reported as CO₂ equivalent (CO₂e)².

The approach to calculate the preliminary estimate was:

- Review the construction GHG emissions for both comparable projects as calculated in their respective environmental assessments;
- Collect relevant conceptual design and construction information for the Project; and
- Calculate a preliminary emission factor (tonnes CO₂e /year).

For this high-level assessment, ERM used the 2012 British Columbia (BC) deforestation emission factor (BC MOE 2012), as BC has publically available calculations and emission factors for land use change. This was used as an additional method to demonstrate the range of potential GHG emissions from land use change.

The 2020 preliminary Project construction GHG estimate was calculated according to the following:

- For construction fuel, electricity, and construction material emissions:

² Government of Canada. 2019b. Global Warming Potentials. <https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/quantification-guidance/global-warming-potentials.html> (accessed January 2022).

- Site C estimated 185,463 tonnes of CO₂e/year during 8 years of construction with an average 1,625 workers/year
- East-West Tie estimated 56,000 tonnes of CO₂e/year during 2 years of construction and an average of 500 workers/year (East-West Tie only includes emissions from fuel usage not electricity or construction materials)
- TCE provided an estimate of 800 construction workers/year and 4 years of construction for the Project³

■ For land use change emissions:

- Site C total carbon biomass / hectare (ha) value for forests/shrubs and calculated CO₂e/ha emissions assumed all carbon is converted to CO₂e emissions. This included above ground and below ground carbon.
 - Site C forest/shrub estimate was 732.6 tonnes of CO₂e/ha
- East-West Tie used total land clearing and biomass burning emissions to calculate CO₂e emissions. The GHG calculations were very minimal and do not present a detailed methodology or detailed quantitative results. There was no description of vegetation types and the emission factor used was much lower than the forestry specific emission factors used for Site C and the BC provincial inventory for forestry (BC MOE 2012).
 - East-West Tie estimate was 97.83 tonnes of CO₂e/ha
- TCE provided a conceptual construction design estimate of 500 acres, equivalent to approximately 202 ha.
 - ERM used a conservative approach, and assumed the 202 ha is all forest land, and that all forest land will be burned or chipped and left to decay. The actual Project footprint is not entirely forested, making the GHG estimates conservative. A more accurate assessment based on the specific ecozone around the Project site will need to be conducted as part of the future environmental assessment. Also, if cleared forest is salvaged and turned into wood product, as is standard practice for timber which is suitable, the carbon emissions would be lower.
- ERM also reviewed the 2012 BC deforestation GHG emission factor (CO₂e/ha) reported in the 2012 inventory (BC MOE 2012). Inventories that are more recent have not substantially changed the emission factor values.
 - The 2012 BC deforestation GHG emission factor was included in this analysis as BC has more publically available guidance and emission factors for land clearing than other jurisdictions in Canada
 - The 2012 BC deforestation GHG emission factor is 255 tonnes of CO₂e/ha

³ Workforce and construction duration based on 2019 conceptual design, prior to the preparation of the Regional Economic Study and design advancements of 2020.

Table 2-1 provides the 2020 preliminary construction GHG emissions estimate for the Project based on conceptual design. The preliminary total construction fuel emissions estimate was calculated by prorating the Site C and East-West Tie project emissions for construction and materials by the number of workers and construction duration of the Ontario Pumped Storage Project (e.g. Site C 185,463 tonnes of CO₂e/year / 1,625 workers x 800 workers x 4 years = 365,220 tonnes CO₂e).

The land use change emission estimate was calculated based on three references Site C Dam (forest specific), East-West Tie (multiple vegetation types) and 2012 BC deforestation GHG emission factors (forest specific) and the land area for the Ontario Pumped Storage Project (e.g., Site C 732.6 tonnes of CO₂e/ha x 202.348 hectares =148,236 tonnes CO₂e).

This includes estimated annual and total construction GHG emissions for each combination of construction emissions and land use change emissions.

Table 2-1: Preliminary Ontario Pumped Storage Project Construction GHG Emissions Estimate

Applied Construction Fuel Emission Method	Applied Land Use Change Method	Preliminary Annual Average Construction Emissions (tonnes CO ₂ e/year)			Preliminary Total Construction Emissions (tonnes CO ₂ e) (assumed total over 4 years of construction)		
		Fuel	Land Use Change	Total	Fuel	Land Use Change	Total
Site C	Site C, forest specific	91,305	37,059	128,364	365,220	148,236	513,457
Site C	East-West, multiple vegetation types	91,305	4,949	96,254	365,220	19,794	385,015
Site C	BC 2012 inventory, forest specific	91,305	12,899	104,204	365,220	51,597	416,818
East-West Tie	Site C, forest specific	89,600	37,059	126,659	358,400	148,236	506,636
East-West Tie	East-West, multiple vegetation types	89,600	4,949	94,549	358,400	19,794	378,194
East-West Tie	BC 2012 inventory, forest specific	89,600	12,899	102,499	358,400	51,597	409,997
Average Ontario Pumped Storage Construction GHG Emissions		108,755			435,020		

The following are key assumptions for the preliminary calculations in Table 2-1:

- The emissions due to land cover changes are predicated on the assumption that the construction and the land cover (trees/shrubs) are similar between Site C, East-West Tie and the Project.
- The emission estimate does not include Project-specific estimates of construction and materials.

As development of the Project progresses, including detailed information on construction design, materials and methods, the GHG inventory for the project will be updated and a new calculation prepared. The revised analysis will be included in the regulatory applications during the impact assessment/environmental assessment. A description of anticipated federal and provincial regulatory requirements is provided in the following section. TCE will follow these requirements, or any updated requirements, when the Project moves to this phase.

3. REGULATORY REQUIREMENTS

Due to the type of project and location on the 4 CDTC, and proposed transmission connection to the provincial grid, the Project will require environmental assessment approvals under the federal *Impact Assessment Act* and the Ontario *Environmental Assessment Act*.

3.1 Federal Impact Assessment

Under the *Impact Assessment Act* proponents are required to provide an estimate of GHG emissions associated with the Project. To fulfill this requirement, an estimate of the maximum annual net GHG emissions for each phase (e.g., construction, operations, decommissioning) of the project will be made. Guidance on GHG emissions calculations required for each submission under the *Impact Assessment Act* is provided in the *Strategic Assessment of Climate Change Regulations* (Government of Canada 2020).

Once the Project has reached the impact statement phase, information is required on the GHG emissions, impact of the project on carbon sinks, impact of the project on federal emission reduction efforts and on global GHG emissions, mitigation measures and climate change resilience. The impact statement components examine the impact of the project on other areas.

The federal assessment process will consider if the Project will contribute to or hinder the Government's ability to meet the Paris 2030 agreements and the net zero 2050 agreements. For projects with a lifetime past 2050, proponents are required to describe a plan to achieve net-zero emissions. The plan will demonstrate how the net GHG emission equation will equal the zero emissions by the year 2050 and continue during the remainder of the project lifetime. The net-zero plan will describe emissions reductions where applicable, at specified intervals up to 2050 and seek to maximize absolute emissions reductions in the earlier years of a project's lifespan.

3.2 Provincial Environmental Assessment

The provincial environmental assessment process begins with the approval of the Terms of Reference by the Minister of the Environment Conservation and Parks under the *Environmental*

Assessment Act. The guide, *Considering Climate Change In The Environmental Assessment Process* (MOECC 2017) sets out the ministry's expectations for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. Through the development of the Terms of Reference and the Environmental Assessment, proponents are expected to take into account:

- the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation);
- resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation); and
- future changes in the climate and the impacts that may have on the project considered in the project planning process.

4. REFERENCES

BC Ministry of Environment (BC MOE). 2012. British Columbia Greenhouse Gas Inventory Report 2012. <https://www2.gov.bc.ca/assets/gov/environment/climate-change/data/provincial-inventory/2012/pir-2012-full-report.pdf> (accessed January 2022).

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