

# Senate of Canada Net Zero 2030 Project

Phase 1: Benchmarking, Data Collection and Analysis of Scope 1, 2, and 3 GHG emissions  
Greenhouse Gas Emissions Report

AUGUST 2023

**Prepared for:**

ADVISORY WORKING GROUP ON ENVIRONMENT AND SUSTAINABILITY  
STANDING COMMITTEE ON INTERNAL ECONOMY, BUDGETS AND ADMINISTRATION

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# EXECUTIVE SUMMARY

## Context and objectives

The Senate of Canada contracted Lemay and Groupe AGÉCO to develop a plan to benchmark and analyze the Senate's GHG emissions and provide an implementation strategy to guide its goal for achieving a net zero GHG emissions by 2030. The current **Phase 1: Benchmarking, Data Collection and Analysis of Scope 1, 2, and 3 GHG emissions** presents results for the reporting year 2022-2023 (April 2022 – March 2023).

## Results

The Senate's overall GHG emissions are estimated to be **3,577 tonnes CO<sub>2</sub>e** for 2022-2023. They mainly come from **natural gas combustion and steam consumption for heating the buildings the Senate occupies**, as well as from **travels between the senators' provinces/territories and the National Capital Region**.

## Scope of the study

Scope 1 GHG emissions covered by this study are direct emissions from buildings occupied by the Senate and its fleet of vehicles. Scope 2 emissions are indirect and include electricity and steam production, also for buildings. Scope 3 covers other indirect emissions from sources controlled by third parties such as the production of purchased goods and services, waste management, Senate-related travels, employee commuting and other energy-related activities.

## Methodology

GHG calculations are based on the GHG Protocol using activity and financial data from the Senate and Public Services and Procurement Canada (PSPC). A rigorous methodology based on a recognized standard, alongside the excellent communication between the Senate and the consultants ensured that the quality of the present work and the reliability of the obtained data is high.

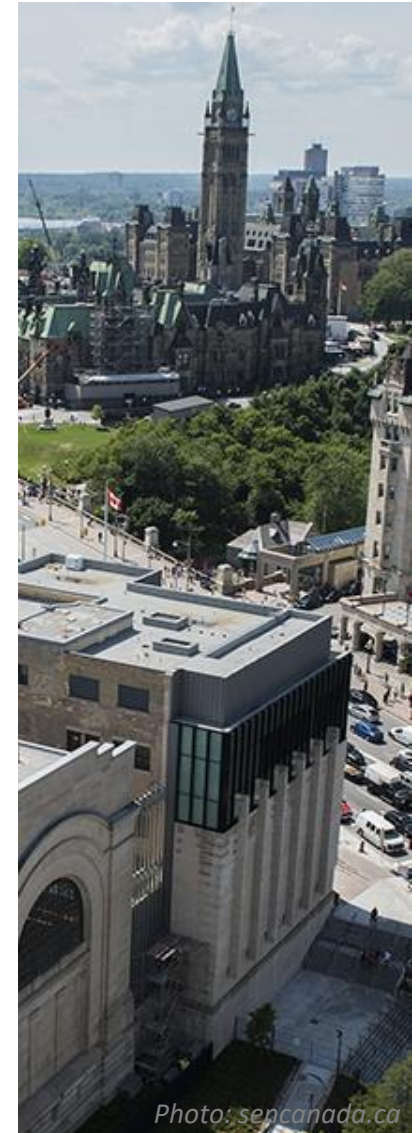


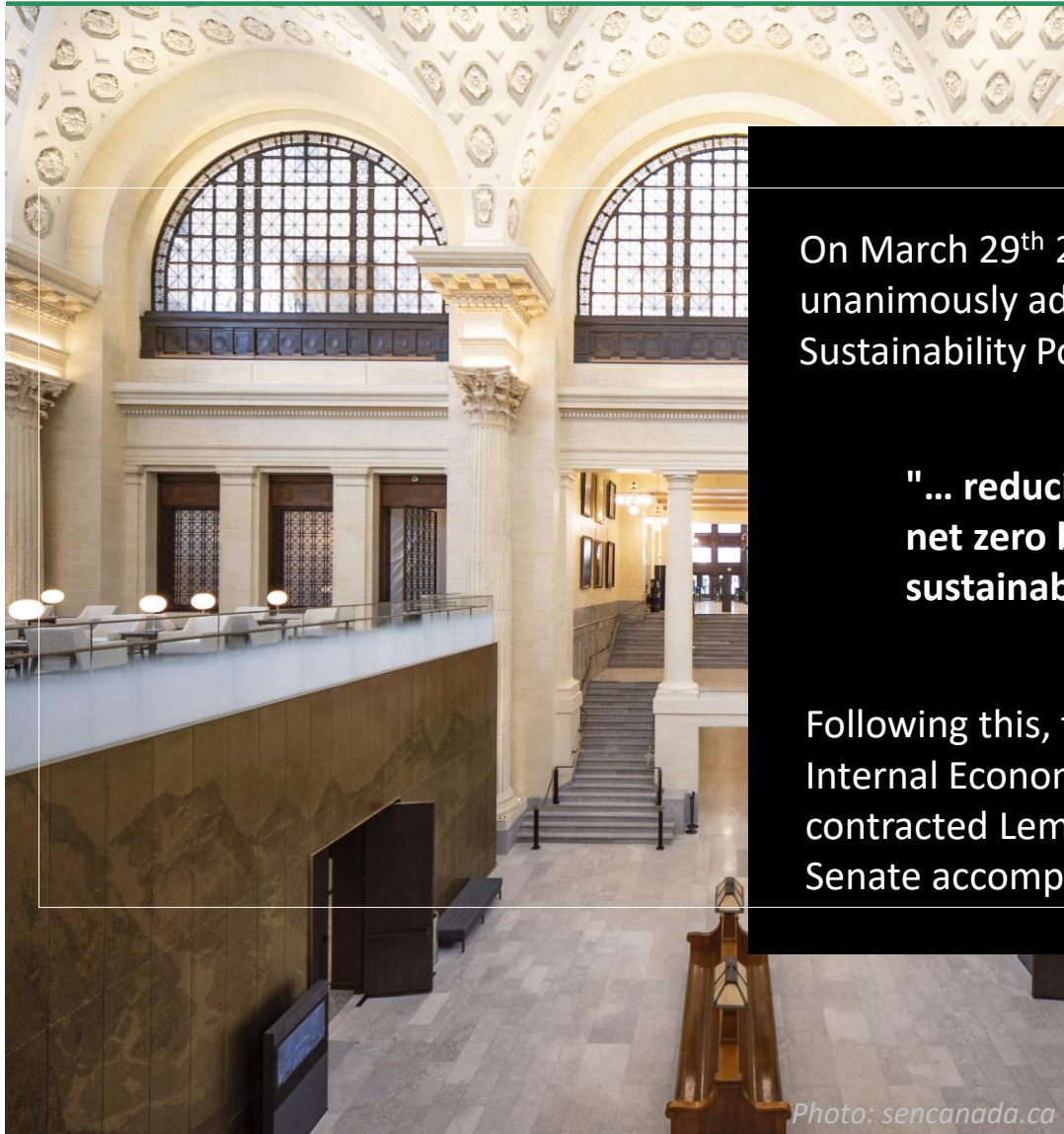
Photo: sencanada.ca



# INTRODUCTION

# 1. INTRODUCTION

## CONTEXT OF THE PROJECT



On March 29<sup>th</sup> 2022, the Senate of Canada unanimously adopted the Environmental and Sustainability Policy Statement, with the objective of

**"... reducing the Senate's carbon footprint to net zero by 2030 and to implement sustainable practices in its operations."**

Following this, the Senate's Standing Committee on Internal Economy, Budgets and Administration (CIBA) contracted Lemay and Groupe AGÉCO to help the Senate accomplish its goal.

*Photo: sencanada.ca*

# 1. INTRODUCTION

## A PROJECT IN 3 PHASES

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The first step of the project consists of establishing the complete GHG inventory of the Senate of Canada's activities, found in this phase 1 report. It also contains 2030 projections of the Senate's GHG emissions as well as a preliminary net zero plan.

Following that, the second phase will establish a carbon neutrality target and propose different strategies and scenarios in order to achieve it, along with an implementation plan.

The third phase is about proposing a methodological framework allowing the Senate of Canada to independently monitor its emissions based on the best practices in order to achieve net zero GHG emissions by 2030.



**GHG emission  
quantification of Scopes  
1 to 3 and data analysis  
in THIS REPORT**



**Establishment of a  
carbon neutrality target  
and implementation  
plan**



**Monitoring and  
continuing progress  
towards carbon  
neutrality**

# 1. INTRODUCTION

## PHASE 1

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### GHG emission quantification of Scopes 1 to 3 and data analysis

This report presents the first step on the road to net zero GHG emissions, which is to assess the current situation and evaluate the **Senate's GHG emission inventory**. During this crucial step, the external experts identify the different **GHG emission sources** and evaluate the extent of the **reduction measures** necessary to achieve the objective.

Throughout this report, the GHG emissions of each Scope will be presented with comments from the external experts on the data itself, and on the data quality and how the results obtained were calculated. A **business-as-usual projection** of emissions up to 2030, including current planned reduction measures, is presented as well as a **preliminary net zero plan** to highlight GHG emission reduction opportunities in order to achieve a net zero carbon target for 2030.



# 1. INTRODUCTION

## PHASE 1

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### Data collection

- Data collected from the Senate and Public Services and Procurement Canada (PSPC)

### GHG quantification

- Scope 1, 2 and 3 GHG emission calculation with activity data and emission factors

### 2030 GHG projection

- Projections based on historical data and planned GHG reduction measures

### Preliminary net zero plan

- Definition of GHG reduction target parameters



# METHODOLOGY OVERVIEW FOR QUANTIFYING GHG EMISSIONS

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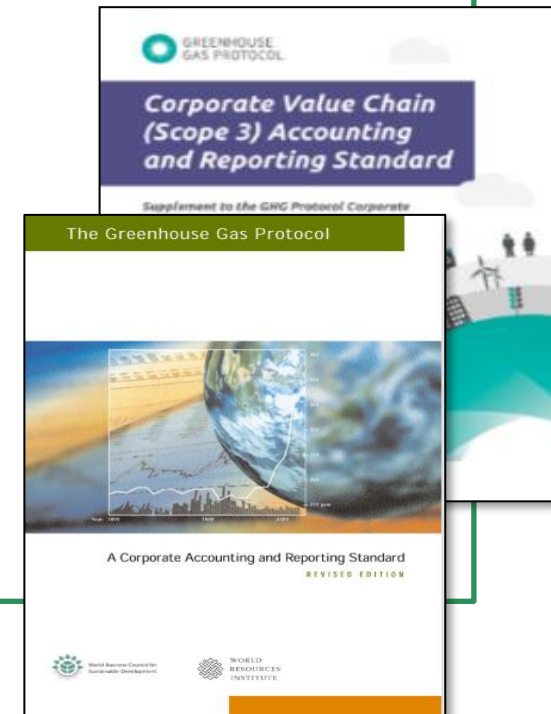
# 2. METHODOLOGY OVERVIEW FOR QUANTIFYING GHG EMISSIONS

## 2.1 – NORMATIVE REFERENCES

### The Greenhouse Gas Protocol

- The Greenhouse Gas Protocol (GHG Protocol) is the main normative reference for this study. It emerged from a partnership between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). Among other things, it establishes standards and guides for measuring and managing greenhouse gas (GHG) emissions.
- More precisely, the **Corporate Accounting and Reporting Standard** was used to calculate the inventory of direct GHG emissions at Scope 1 level and indirect emissions at Scope 2 level (electricity and steam production).
- The calculation of other indirect emissions was based on the **Corporate Value Chain (Scope 3) Accounting and Reporting Standard**.
- In addition to these standards, the GHG Protocol has also published guidance documents for the calculation of Scope 2 and Scope 3 emissions, which have been used to quantify the Senate's GHG emissions.
- Other references are relevant for the elaboration of the Senate's net zero plan. They are presented in section 5.

The GHG Protocol documents have been followed by the authors of this report. However, they have sometimes deliberately adapted the presentation of the results to better represent the specificities of the Senate and improve the clarity of the report.

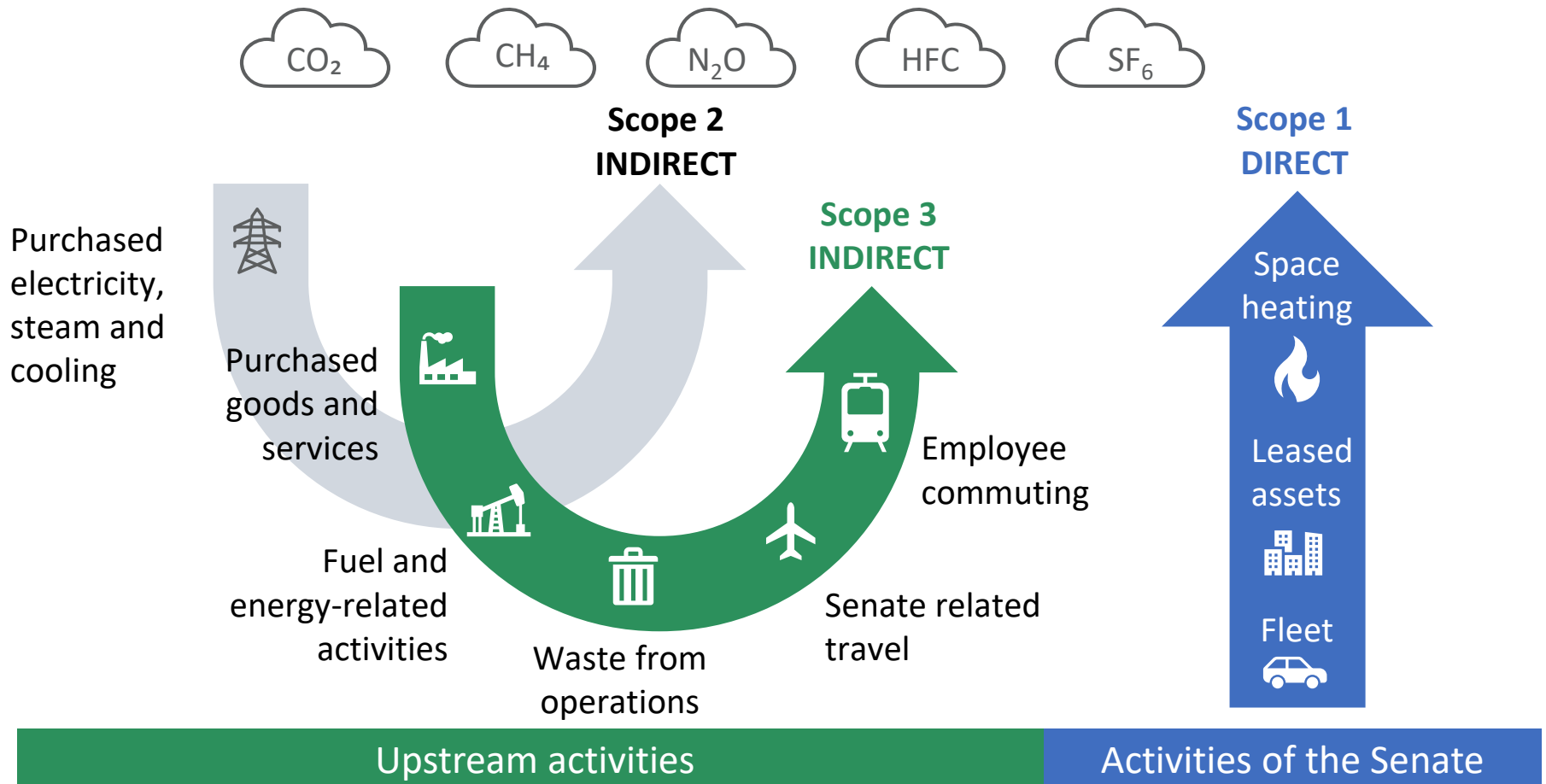


Source: <https://ghgprotocol.org/>

# 2. METHODOLOGY OVERVIEW FOR QUANTIFYING GHG EMISSIONS

## 2.2 – SCOPE OF THE GHG INVENTORY

Based on the GHG Protocol, this inventory covers the GHGs and emission sources shown below. Only the ones relevant to the Senate are presented. For example, downstream activities relevant for manufacturers, such as the use of a product, are not shown.



Source: Adapted from [WRI/WBCSD Corporate Value Chain \(Scope 3\) Accounting and Reporting Standard \(pdf\)](#)

## 2. METHODOLOGY OVERVIEW FOR QUANTIFYING GHG EMISSIONS

### 2.2 – SCOPE OF THE INVENTORY

Several parameters must be defined when quantifying a GHG inventory. They are presented in the following table along with their definition and the rationale behind them.

Parameter	Decision
<b>GHG inventory scope</b> <i>The boundaries of the inventory</i>	<p>The GHG inventory covers direct emissions (Scope 1) from occupied buildings and indirect emissions related to purchased electricity, steam and cooling production (Scope 2).</p> <p>Other indirect emissions (Scope 3) related to upstream activities are included, namely:</p> <ul style="list-style-type: none"><li>• Purchased goods and services</li><li>• Senate related travels</li><li>• Fuel and energy related activities</li><li>• Employee commuting</li><li>• Waste management</li></ul> <p>The following Scope 3 categories of the GHG Protocol have been merged with purchased goods and services due to their low contribution: capital goods and upstream transportation and distribution (delivery of purchased goods). Emissions related to leased assets are accounted for in Scopes 1 and 2. The rest of Scope 3 categories are downstream activities which are not relevant for the Senate of Canada. E.g., processing, use and end-of-life of sold products.</p>

## 2. METHODOLOGY OVERVIEW FOR QUANTIFYING GHG EMISSIONS

### 2.2 – SCOPE OF THE INVENTORY

Several parameters must be defined when quantifying a GHG inventory. They are presented in the following table along with their definition and the rationale behind them. (continued)

Parameter	Decision
<b>Organizational boundaries</b> <i>What defines the Senate's direct emissions (Scope 1)</i>	<p>The boundaries of the organization are determined by the control it has on its operations, i.e., ownership of the emission source is not required to include it in the Scope 1 of the organization. This approach is called the <b>operational control</b>.</p> <p>The main implication of this approach is the inclusion of the GHG emissions from leased building spaces in the Senate's Scope 1.</p>
<b>Base year</b> <i>Year of the GHG inventory that will be used to elaborate scenarios of the Senate's net zero plan</i>	<p>Fiscal year (FY) 2022-2023: starting April 1<sup>st</sup>, 2022, and ending March 31<sup>st</sup>, 2023.</p> <p>Rationale: It represents the most recent fiscal year. Also, the effects of the COVID-19 pandemic during that period were much less severe in terms of in-person sittings, travel bans and office presence.</p> <p>Data covering that period were used to calculate the GHG inventory of the Senate. However, due to a lack of availability at the time of writing, data from the 2021-2022 FY were used for the energy consumption (Scopes 1 and 2) of Crown-owned and leased buildings where the Senate occupied office spaces. Crown-owned buildings energy consumption of 2022-2023 was provided during the writing of this report and are accounted for in <i>Section 4. 2030 emission projections</i>.</p>

# 2. METHODOLOGY OVERVIEW FOR QUANTIFYING GHG EMISSIONS

## 2.2 – SCOPE OF THE INVENTORY

### What GHG emission sources go in what Scope?

GHG emissions related to the Senate take place in different areas. The main emission sources are the Senate occupied buildings (Crown-owned and leased), transport (fleet, travel and commuting) and goods and services purchased by the Senate. The distribution of the emissions in the 3 Scopes is shown to the right.



#### Buildings occupied by the Senate



#### Transport of senators and staff



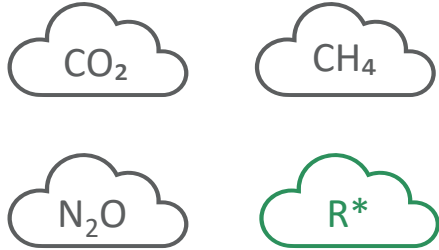

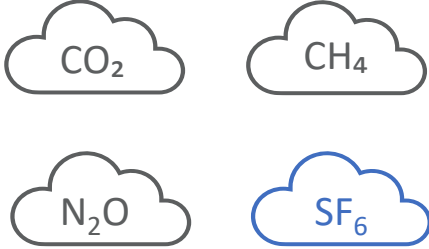
#### Goods and services purchased by the Senate

Scope 1 GHG emissions	Scope 1 GHG emissions	Scope 1 GHG emissions
<ul style="list-style-type: none"> <li>- Natural gas combustion</li> <li>- Refrigerant leaks</li> </ul>	<ul style="list-style-type: none"> <li>- Fuel combustion (fleet)</li> </ul>	
Scope 2 GHG emissions	Scope 2 GHG emissions	Scope 2 GHG emissions
<ul style="list-style-type: none"> <li>- Generation of purchased electricity, steam and cooling</li> </ul>		
Scope 3 GHG emissions	Scope 3 GHG emissions	Scope 3 GHG emissions
<ul style="list-style-type: none"> <li>- Extraction and refining of fossil fuels ("Energy and fuel related activities")</li> <li>- Production of construction/renovation materials</li> <li>- Waste transport and treatment</li> </ul>	<ul style="list-style-type: none"> <li>- Extraction and refining of fossil fuels ("Energy and fuel related activities") used by fleet</li> <li>- Travel and commuting (airplane, train, bus, car, public transport related emissions)</li> </ul>	<ul style="list-style-type: none"> <li>- Production of goods and services</li> </ul>

## 2. METHODOLOGY FOR QUANTIFYING GHG EMISSIONS

### 2.3 – GREENHOUSE GASES CONSIDERED

The Senate's GHG inventory includes carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), refrigerants (R; mixed of different gases such as hydrofluorocarbons also known as HFCs) and sulfur hexafluoride (SF<sub>6</sub>).



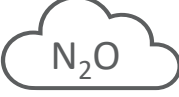


Scope	GHGs	Main sources
<b>1</b>		CO <sub>2</sub> and, to much lower levels, CH <sub>4</sub> and N <sub>2</sub> O are emitted during the <b>combustion of fossil fuels (natural gas for leased spaces heating, fleet operation)</b> . *Although refrigerant leaks (R) were part of the data collection, no leak was detected in Senate-occupied buildings.
<b>2</b>		CO <sub>2</sub> and, to much lower levels, CH <sub>4</sub> and N <sub>2</sub> O are emitted during the <b>combustion of fossil fuels (natural gas for steam production)</b> .
<b>3</b>		CO <sub>2</sub> and, to much lower levels, CH <sub>4</sub> and N <sub>2</sub> O are emitted during the <b>combustion of fossil fuels (transport) and the production of fuels used in Scopes 1 and 2</b> . Production of goods and services: multiple sources. Waste management: CH <sub>4</sub> from the decomposition of biomass such as food waste in landfills. SF <sub>6</sub> is emitted during electricity distribution.



## 2. METHODOLOGY FOR QUANTIFYING GHG EMISSIONS

### 2.3 – GREENHOUSE GASES CONSIDERED

In a GHG inventory, the quantities of gases emitted to the atmosphere are converted to a common unit: tonnes (metric tons) of carbon dioxide equivalent (t CO<sub>2</sub>e). To do it, the Global Warming Potential (GWP) is used. The Intergovernmental Panel on Climate Change (IPCC) of the United Nations publishes in its assessment reports the values for each GHG, which evolve as the physical science of the climate advances. The GWP values used in this study are shown in the table below and are from the fifth assessment report (AR5, 2014) of the IPCC, as in the [Canadian Environmental Protection Act](#).

GHG		GWP
	Carbon dioxide	1
	Methane	28
	Nitrous oxide	265
	Sulfur hexafluoride	23,500*
	Refrigerants (multiple gases)	Variable between gases, often in the thousands*

Example:

**1 tonne**



is equivalent to

**28 tonnes**



*\* Although SF<sub>6</sub> and refrigerants have very high GWP values, they are emitted in very small quantities. In 2021, the contribution of these gases and other less common GHGs, like perfluorocarbons (PFCs), accounted for 1.9% of the total Canadian emissions, according to the 2023 National Inventory Report (part 1, page 5).*

## 2. METHODOLOGY FOR QUANTIFYING GHG EMISSIONS

### 2.4 – DATA SOURCES AND QUANTIFICATION OF EMISSIONS

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- The data source for the energy consumption of the buildings has been provided by Public Services and Procurement Canada (PSPC) for every Crown-owned and leased building occupied by the Senate.
- When available, yearly consumption of the past 4 years was provided for every space in which the Senate of Canada operates.
- The Senate provided a table of the average mileage per year of every vehicle of the Senate's fleet.
- A list of refrigerant leaks (or lack thereof) was provided for Senate-occupied spaces.
- For Scope 3, the [Financial Reports](#) on the Senate public website provided much of the data that we analyzed for this report, such as expenses and travels.
- The emission factors used for quantification of emissions can be found in *Appendix V – Emissions factors*.



## 2. METHODOLOGY FOR QUANTIFYING GHG EMISSIONS

### 2.5 – DATA QUALITY

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The quality of the inventory is assessed against the principles of the GHG Protocol, which aims to ensure the credibility and robustness of the results presented. The assessment focuses on the following aspects:

- **Relevance:** are the data compiled representative of the Senate of Canada’s activities in an average year?
- **Completeness:** are all activities within the established scope of the inventory considered?
- **Consistency:** does the methodology used to compile the data and perform the calculations provide a useful approach to tracking (and comparing) emissions over time?
- **Transparency:** are data sources, assumptions and calculation methods disclosed in a clear, factual, neutral and comprehensible manner?
- **Accuracy:** are the data compiled precise enough to generate a GHG balance from which decisions can be made with a reasonable level of assurance?

In the light of this assessment, the quality of the activity data is judged to be **good**.

The people responsible for data collection within the organization have made efforts to obtain the most complete data for the reference year (April 2022 to March 2023). Historical data was also provided for some important emission sources. Where necessary, assumptions validated by the organization's team were used for data gaps. For example, where data was not available for certain leased buildings, data from other similar nearby buildings were extrapolated.

A rigorous methodology based on established standards such as the GHG Protocol, alongside the excellent communication between the Senate and the group of experts ensured that the quality of the work presented, and the reliability of the data obtained is high.



RESULTS

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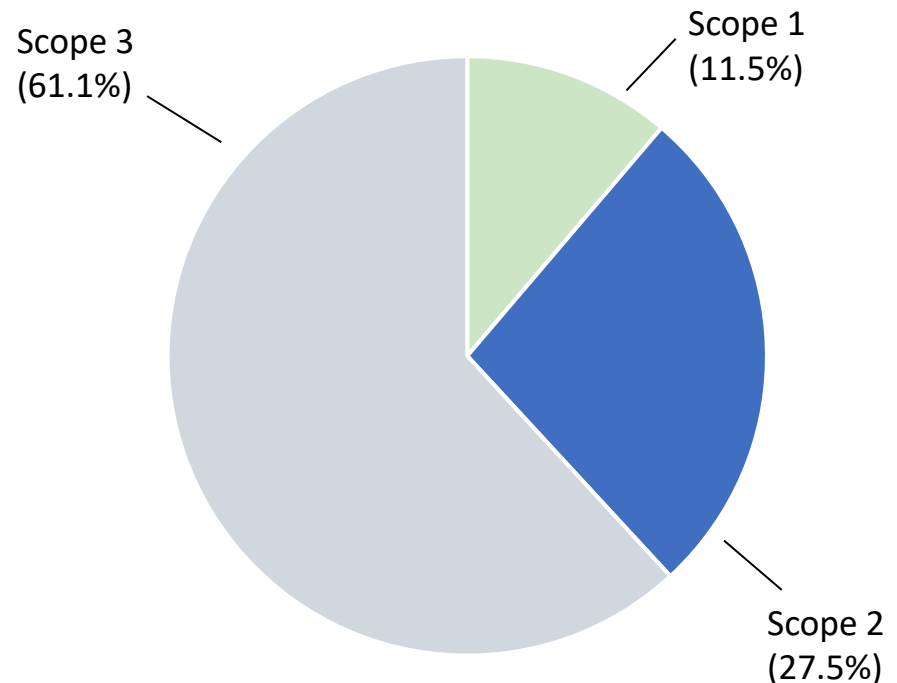
# 3. RESULTS

## 3.0 – TOTAL EMISSIONS (SCOPES 1, 2 AND 3)

Emissions from **Scope 3** account for 61% of the total emissions, mostly from **senators travels and stays** in the National Capital Region, **purchased goods and services** and **energy-related activities** (see next pages).

**Scopes 1 and 2** accounts for 39% of the Senate of Canada’s total emissions. Most of these emissions come from the **heating of spaces**. Whether it be from the steam bought from the Cliff Street Central Heating and Cooling Plant for the Crown-owned buildings, or the natural gas combustion for leased spaces, over a third (34%) of the Senate’s emissions are attributable to space heating.

Scope	GHG emissions (t CO <sub>2</sub> e)	Proportion
Scope 1	410	11.5%
Scope 2	982	27.5%
Scope 3	2,185	61.1%
<b>TOTAL</b>	<b>3,577</b>	<b>100.0%*</b>



# 3. RESULTS

## 3.1.1 – SUMMARY OF SCOPE 1 EMISSIONS

### Key findings



The Senate of Canada occupies spaces in a total of 11 buildings, 5 Crown-owned and 6 leased, many in which they share space with other parliamentary or government organizations.

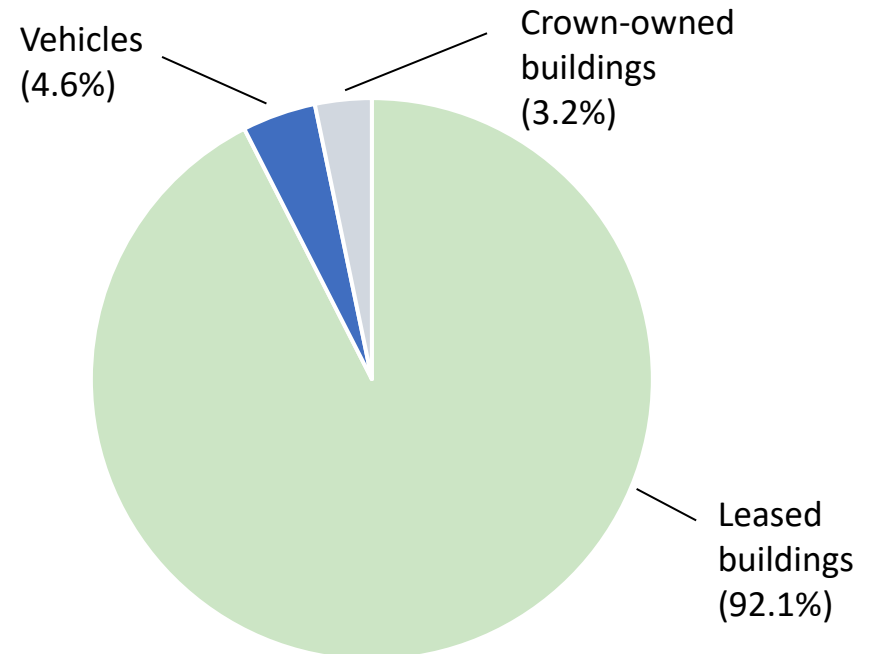
A vast majority of the Senate’s direct emissions (92.1%) occur in leased spaces from the **combustion of natural gas for space heating**.

One of the Crown-owned buildings uses natural gas for heating domestic water, accounting for 3.2% of the Scope 1 emissions.

The Senate-owned vehicle emissions account for 4.6% of the total emissions.

By category:

Category	t CO <sub>2</sub> e	Proportion
Leased buildings	377.59	92.1%
Vehicles	18.99	4.6%
Crown-owned buildings	13.31	3.2%
<b>TOTAL</b>	<b>409.88</b>	<b>100.0%*</b>



# 3. RESULTS

## 3.1.2 – ANALYSIS OF EMISSION SOURCES AND MAIN CONTRIBUTORS FOR SCOPE 1

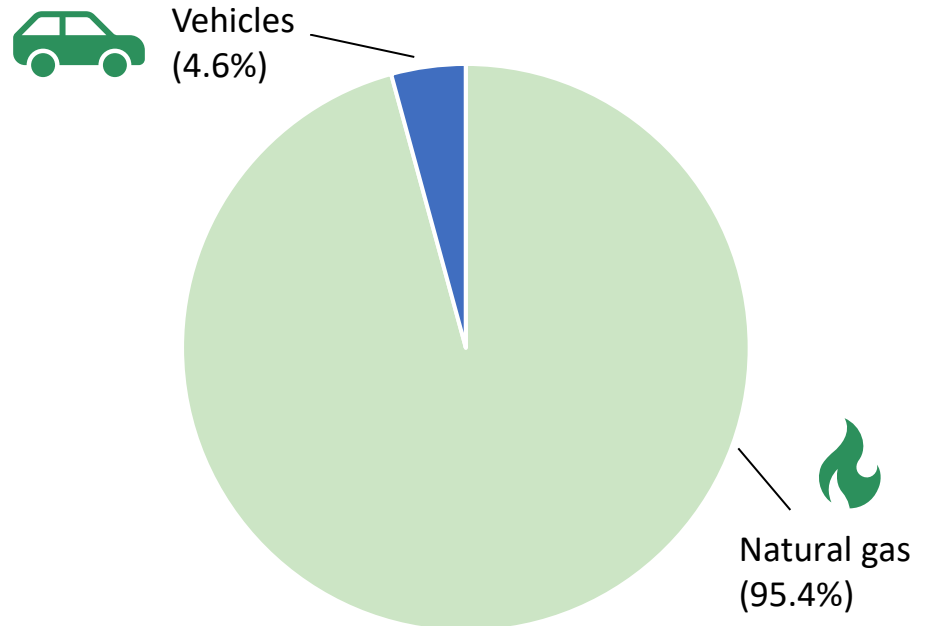
As mentioned previously, the heating of leased spaces is what accounts for most of the direct emissions related to the Senate’s activities.

The burning of **natural gas** emits over **390 tonnes** of carbon dioxide equivalent every year, whereas the burning of fuel for the vehicles is around 19 tonnes of carbon dioxide equivalent.

No equipment was recharged with refrigerant due to leaks in Senate-occupied spaces during the fiscal year 2021-2022.

By source:

Source	t CO <sub>2</sub> e	Proportion
Natural gas	390.90	95.4%
Vehicles	18.99	4.6%
Refrigerant leaks	0.00	0.0%
<b>TOTAL</b>	<b>409.88</b>	<b>100.0%</b>



## 3. RESULTS

### 3.1.3 – DATA QUALITY OF SCOPE 1

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Some assumptions have been made in order to obtain the results shown previously:

#### **Vehicles:**

- For the Senate-owned vehicles fuel consumption emissions, the average yearly mileage of each vehicle was used, along with their respective models specified fuel consumption.

#### **Energy consumption:**

- The energy consumption related to Scope 1 of one of the office spaces leased by the Senate was extrapolated based on another nearby office space due to lack of available data.
- A small parking space leased by the Senate was not considered in the calculations due to the negligible space occupied by the Senate and the lack of available data.
- See section *Appendix V – Emission factors*, for the emission factors used in the calculations.

An assessment on data quality and completeness is made in *Appendix IV*. See next pages for future improvements to be made regarding data gathering and reliability.



# 3. RESULTS

## 3.1.3 – DATA QUALITY OF SCOPE 1

The tables in Appendix IV summarize the data provided by the Senate of Canada to establish the GHG inventory. In order to deepen the analysis and enable the Senate to target the emissions items on which it is most important to take action, the following recommendations would improve the quality of the data used to calculate the GHG balance:

Data to be improved	Recommendations and <i>justifications</i>	Potential contribution to GHG inventory
<b>Energy</b>		
Monthly buildings energy consumptions*  <small>*This recommendation applies for both Scope 1 and 2 energy consumption data.</small>	<b>Collect data of energy consumptions on a monthly basis.</b>  <i>The data for energy consumption used was on a yearly basis. However, in order to identify potential targets of reduction, and to better analyse progress following reduction implementations, it is recommended to use the energy consumptions data on a monthly basis.</i>	Low
<b>Transport</b>		
Vehicles mileage	<b>Collect the exact yearly mileage of every vehicles (rather than the yearly average per vehicle), or the exact amount of fuel bought.</b>  <i>This will provide a more accurate quantity of GHG emissions based on exact data.</i>	Low

# 3. RESULTS

## 3.2.1 – SUMMARY OF SCOPE 2 EMISSIONS

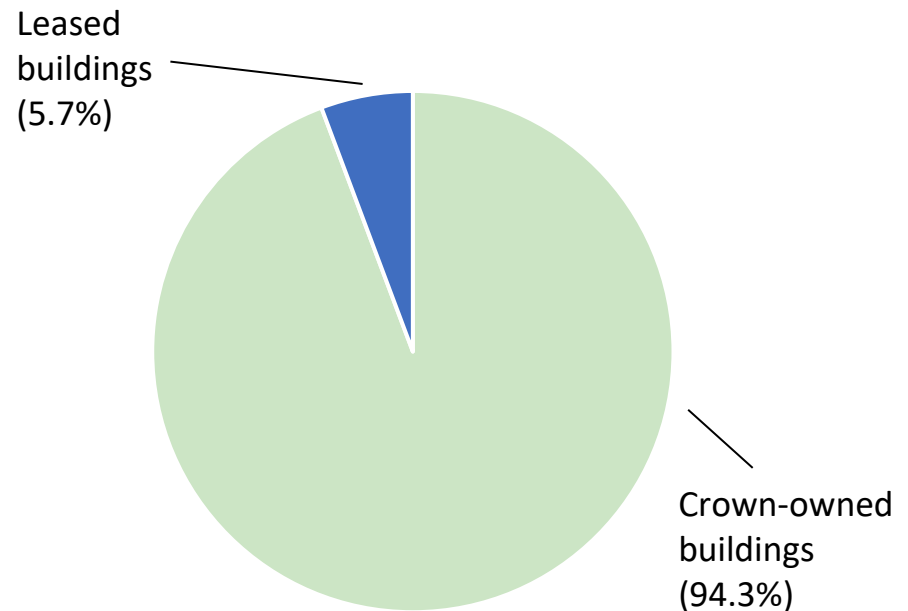
### Key findings

Even though the area occupied by the Senate is similar in both the Crown-owned buildings and leased spaces, Crown-owned buildings' operational indirect emissions are significantly higher. This is due to the fact that most if not all the heating done for these spaces come from **steam bought** from the Cliff Street plant, as shown next.

The small leased spaces' Scope 2 emissions is explained by the fact that those spaces are heated with natural gas, whose emissions count as direct emissions (Scope 1).

By category:

Category	t CO <sub>2</sub> e	Proportion
Crown-owned buildings	926.34	94.3%
Leased buildings	56.09	5.7%
<b>TOTAL</b>	<b>982.43</b>	<b>100.0%</b>



# 3. RESULTS

## 3.2.2 – ANALYSIS OF EMISSION SOURCES AND MAIN CONTRIBUTORS FOR SCOPE 2

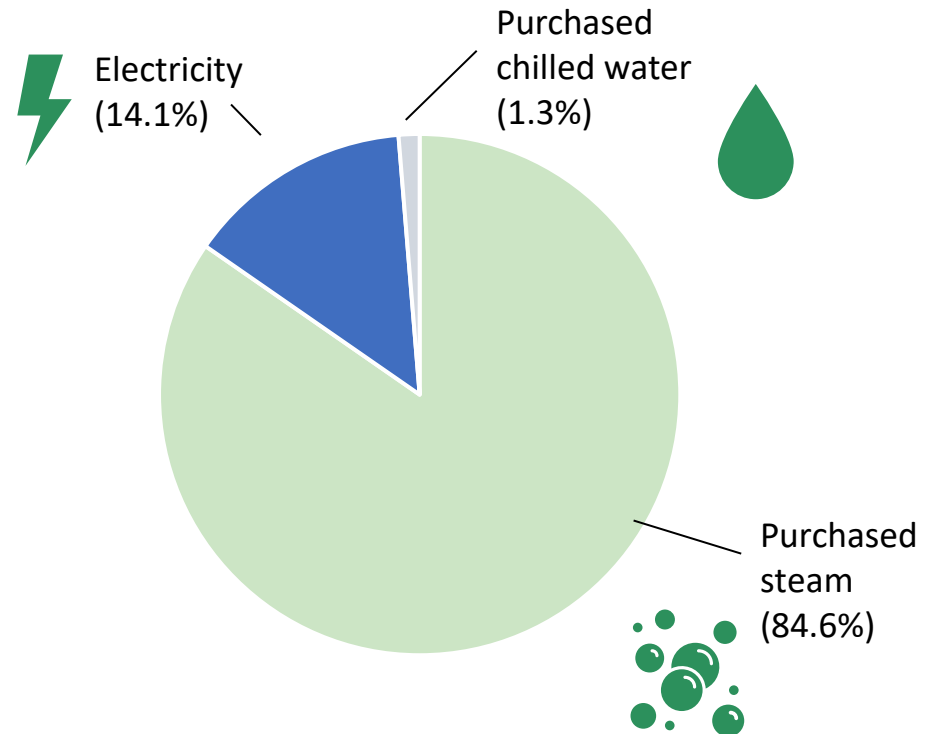
The majority of indirect greenhouse gas emissions from building operations is attributable to the consumption of **purchased steam**, which is only done in Crown-owned building and explains the results shown previously. It is responsible for the releasing of more than **830 tonnes** of carbon dioxide equivalent.

Electricity and chilled water consumption represents just over 15% of the total buildings' operation indirect emissions.

Similarly, to Scope 1 results, the heating of spaces is what accounts for a very large portion of the Scope 2 emissions.

By source:

Source	t CO <sub>2</sub> e	Proportion
Purchased steam	831.62	84.6%
Electricity	138.06	14.1%
Purchased chilled water	12.75	1.3%
<b>TOTAL</b>	<b>982.43</b>	<b>100.0%</b>



## 3. RESULTS

### 3.2.2 – ANALYSIS OF EMISSION SOURCES AND MAIN CONTRIBUTORS FOR SCOPE 2

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#### Focus on space heating and cooling: PSPC district energy system – The Cliff plant

The Cliff plant, built in 1918, supplies heat in the form of steam to nearby buildings. Steam is generated from natural gas boilers. The plant also contains chillers which provides cooling in the form of chilled water. The 5 Crown-owned buildings in which the Senate of Canada occupies spaces are served by the Cliff plant for both heating and cooling.

Despite multiple changes occurring during its service life, the plant's energy technology is outdated. It is less efficient than current industry standard and is responsible for its fair share of GHG emissions, as highlighted in the Senate's Scope 2 emissions.

The Energy Services Acquisition Program (ESAP) is a PSPC's initiative which will, in 2026, modernize and decarbonize the district energy system. Connecting the Cliff plant as part of a network of 5 central plants, some newly built, will significantly reduce the resulting emission factors for the heating and cooling of Senate-occupied spaces. This initiative is accounted for in the 2030 emission projections (Section 4).

Source:

<https://www.tpsgc-pwgsc.gc.ca/biens-property/gestion-management/ecologisation-greener/esap-pase-eng.html>



# 3. RESULTS

## 3.2.3 – DATA QUALITY OF SCOPE 2

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Some assumptions have been made in order to obtain the results shown previously:



### **Energy consumption:**

- The energy consumption related to Scope 2 of two of the office spaces leased by the Senate was extrapolated based on another nearby office space due to lack of available data.
- A small parking space leased by the Senate was not considered in the calculations due to the negligible space occupied by the Senate and the lack of available data.
- See section *Appendix V – Emission factors*, for the emission factors used in the calculations.

An assessment on data quality and completeness is made in *Appendix IV*. See next page for future improvements to be made regarding data gathering and reliability.

## 3. RESULTS

### 3.2.3 - DATA QUALITY OF SCOPE 2

The tables in Appendix IV summarize the data provided by the Senate of Canada to establish the GHG inventory. In order to deepen the analysis and enable the Senate to target the emissions items on which it is most important to take action, the following recommendations would improve the quality of the data used to calculate the GHG balance:





Data to be improved	Recommendations and <i>justifications</i>	Potential contribution to GHG inventory
<b>Energy</b>		
Monthly electricity, steam and chilled water consumption*          <small>*This recommendation applies for both Scope 1 and 2 energy consumption data.</small>	<b>Collect data of energy consumptions on a monthly basis.</b>    <i>The data for energy consumption used was on a yearly basis. However, in order to identify potential targets of reduction, and to better analyse progress following reduction implementations, it is recommended to use the energy consumptions data on a monthly basis.</i>	Low

# 3. RESULTS

## 3.3.1 – SUMMARY OF SCOPE 3 EMISSIONS

### Scope 3 emissions

- Scope 3 emissions are other indirect emissions that occur from the activities of the Senate of Canada but from sources outside of the organizational boundaries (Scope 1).
- According to the GHG Protocol, Scope 3 emissions are divided into 15 categories. For the purpose of this report, 7 categories have been analysed, rearranged into 4: Purchased Goods and Services, Fuel-and energy-related activities, Travel and Commuting and Waste generated in operations.
- The table on the right summarizes the categories from the GHG Protocol grouped under the categories of this report. What they include is described in the next pages.

Senate of Canada report category		GHG Protocol category
	Purchased Goods and Services	Purchased Goods and Services (Cat.1)
		Capital Goods (Cat.2)
		Upstream transportation and distribution (Cat.4)
	Fuel- and energy-related activities	Fuel- and energy-related activities (Cat.3)
	Travel and Commuting	Business travel (Cat.6)
		Employee Commuting (Cat.7)
	Waste generated in operations	Waste generated in operations (Cat. 5)

# 3. RESULTS

## 3.3.1 – SUMMARY OF SCOPE 3 EMISSIONS

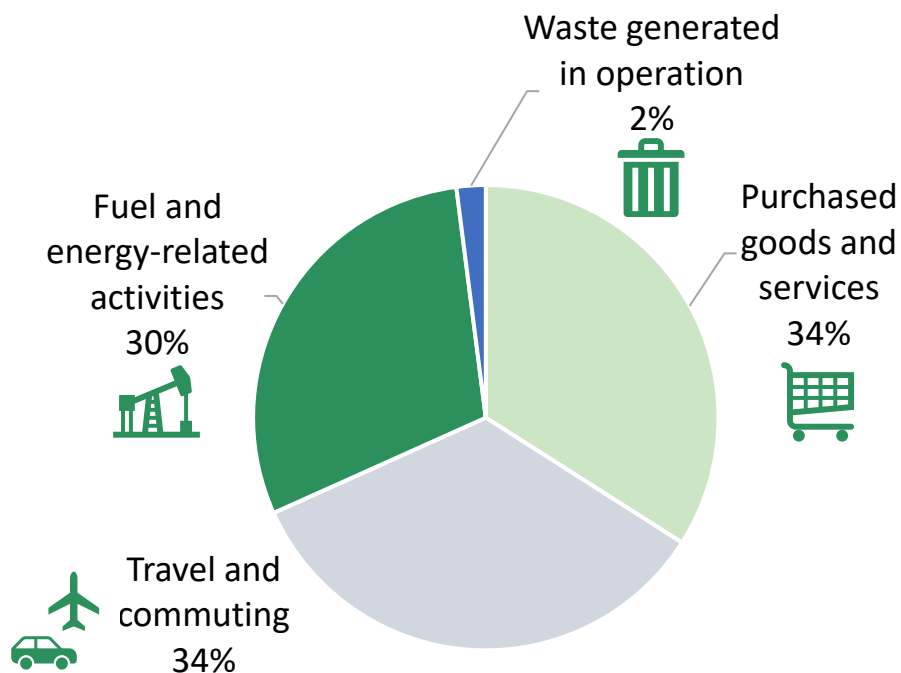
### Key findings

- Most of the indirect GHG emissions come from **goods and services purchased by the Senate, travel and commuting, as well as fuel and energy-related activities** (extraction and refining of fossil fuels used in Scopes 1 and 2).
- Together, these 3 categories account for **98%** of the Senate’s Scope 3 GHG emissions.
- Treatment of waste from operations emits few GHGs with only 2% of the Scope 3.
- Senator travels to the NCR are a source of GHG emissions not only in the Travel and commuting category, but also in the Purchased goods and services category, due to their stay (e.g., accommodation, meals, etc.).

*The next pages will introduce the details of each of the Scope 3 categories and their contributions to the total Scope 3 emissions.*

By category:

Scope 3 Category	t CO <sub>2</sub> e	Proportion
Purchased goods and services	743	34%
Travel and commuting	749	34%
Fuel and energy-related activities	649	30%
Waste generated in operation	44	2%
<b>TOTAL</b>	<b>2,185</b>	<b>100%</b>





# 3. RESULTS

## 3.3.2 – ANALYSIS OF EMISSION SOURCES AND MAIN CONTRIBUTORS



### Purchased goods and services

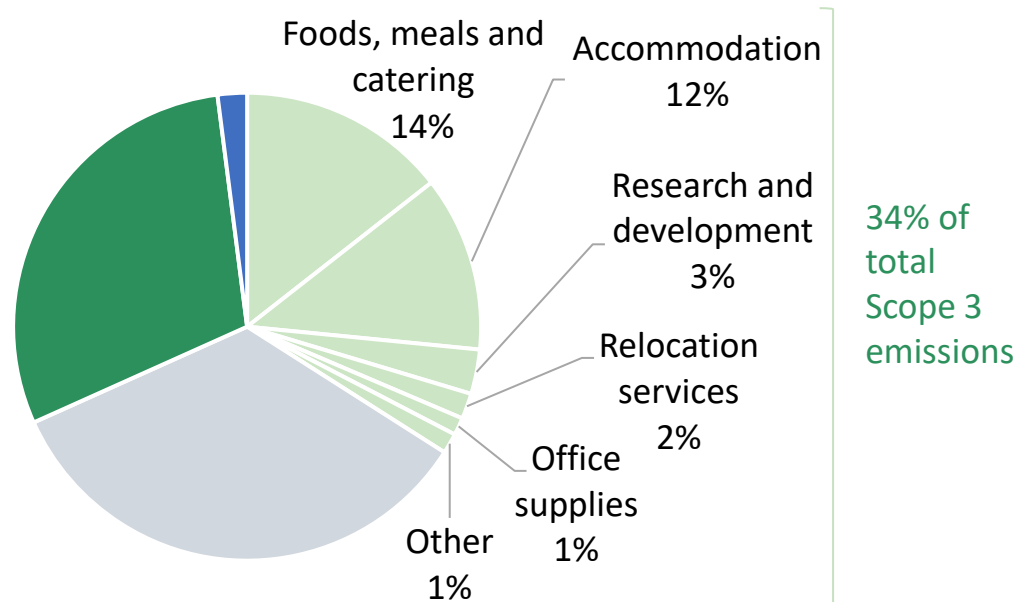
- **Accommodation, food and meals** are the main sources of indirect GHG emissions related to the Senate’s expenses.
- Together, they represent **27%\*** of the Scope 3 GHG emissions.

*Included in this category:*

- *GHG emissions related to the **production of goods and the delivery of services** purchased by the Senate during the reference period*
- ***Accommodation and Food and meals** include mainly expenses of **senators while in the NCR**, but also during committee travels and other travels*

By sub-category:

Purchased goods and services	t CO <sub>2</sub> e	Proportion vs. <u>Scope 3</u>
Food, meals and catering	315	14%
Accommodation	265	12%
Research and development	67	3%
Relocation services	39	2%
Office supplies	26	1%
Other	31	1%
<b>TOTAL</b>	<b>743</b>	<b>34%*</b>



# 3. RESULTS

## 3.3.2 – ANALYSIS OF EMISSION SOURCES AND MAIN CONTRIBUTORS



### Travel and commuting

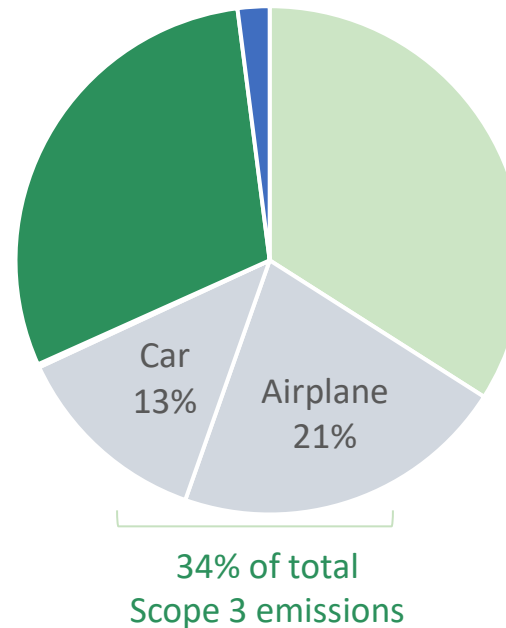
Travel and commuting contribute to **34% of the total Scope 3 GHG emissions**, mostly from senators travelling to the NCR for Senate sittings by airplane and by car, and from staff commuting to the Senate precinct by car.

*Included in this category:*

- *Transport of senators to and from the NCR by airplane and by car*
- *Transport of senators and staff during committee travels, International and Interparliamentary Affairs (IIA) travels and administration travels by airplane and by car*
- *Transport of senators and employees to and from work (precinct of the Senate) by car and public transit*

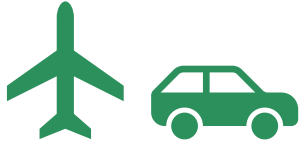
By category:

Travel and commuting	t CO <sub>2</sub> e	Proportion vs. <u>Scope 3</u>
Airplane (short, medium and long distance)	467	21%
Car (rental, taxis, personal)	277	13%
Public transportation (not visible on graph)	4	0.2%
<b>TOTAL</b>	<b>749*</b>	<b>34%</b>



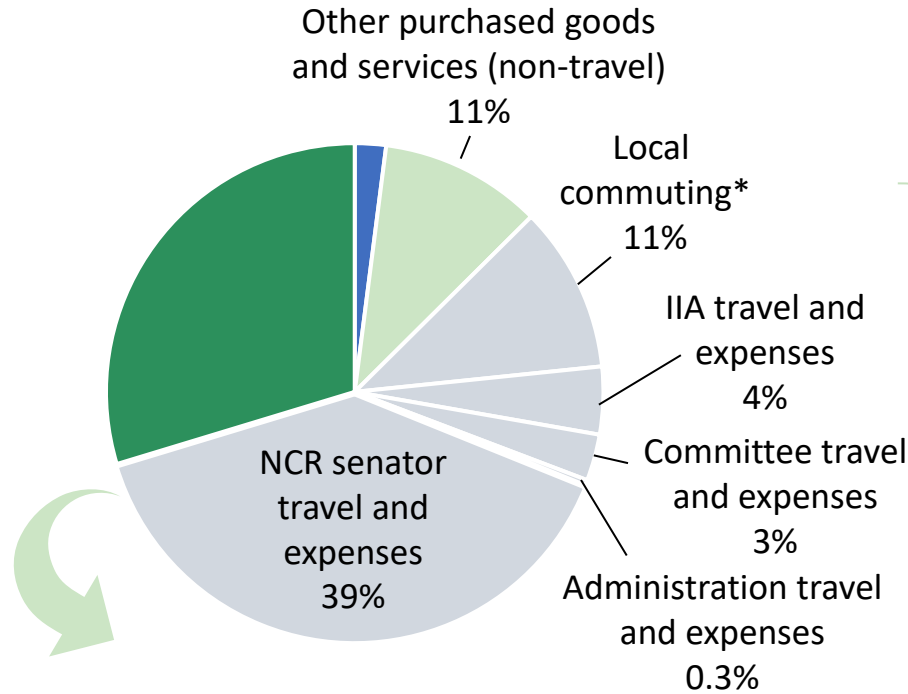
# 3. RESULTS

## 3.3.2 – ANALYSIS OF EMISSION SOURCES AND MAIN CONTRIBUTORS



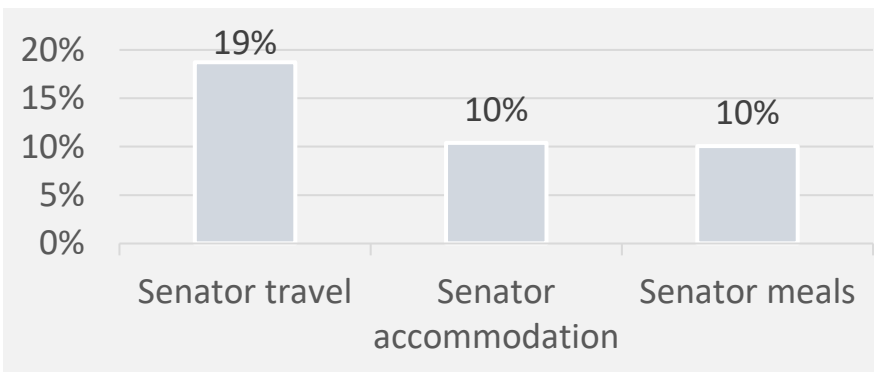
### Key findings on travel

- 39% (856 t CO<sub>2</sub>e) of the Scope 3 GHG emissions come from **senators travelling to and from the National Capital Region (NCR) when including travel and living expenses.**
- Most of those emissions come from **travelling (19%, mostly by airplane)** and expenses related to **accommodation (10%) and meals (10%).**
- Overall, travel and commuting, **including the expenses from travel and commuting (in grey), contribute to 35% (1261 t CO<sub>2</sub>e) of the Senate’s total emissions**, estimated at 3,577 t CO<sub>2</sub>e for 2022-2023.



The categories in grey represent the breakdown of emissions related to transportation and the expenses from travel and commuting.

NCR senator travel and expenses



\* Commuting while in the NCR.

# 3. RESULTS

## 3.3.2 – ANALYSIS OF EMISSION SOURCES AND MAIN CONTRIBUTORS



### Fuel- and energy-related activities

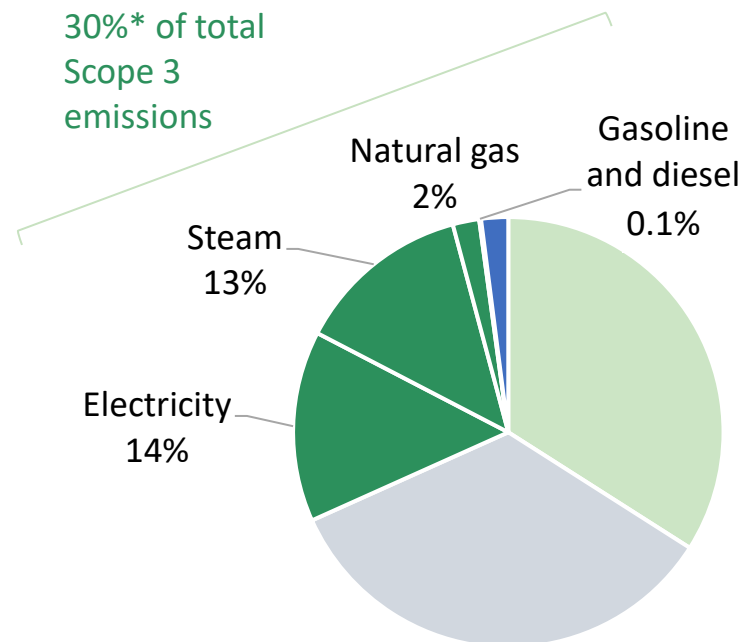
Fuel- and energy-related activities contribute to **30%** of the total Scope 3 GHG emissions, mostly from **the extraction and refining of fossil fuels consumed in Scopes 1 and 2 for electricity and steam generation.**

*Included in this category:*

- *Extraction, production and transportation of resources for the production of electricity, diesel, fuel oil, natural gas and propane consumed in facilities owned or leased by the Senate during the reference period and not included in Scope 1 or Scope 2*

By sub-category:

Fuel- and energy-related activities	t CO <sub>2</sub> e	Proportion vs. <u>Scope 3</u>
Electricity	313	14%
Steam	289	13%
Natural gas	43	2%
Gasoline and diesel	3	0.1%
<b>TOTAL</b>	<b>649*</b>	<b>30%*</b>



# 3. RESULTS

## 3.3.2 – ANALYSIS OF EMISSION SOURCES AND MAIN CONTRIBUTORS



### Waste generated in operations

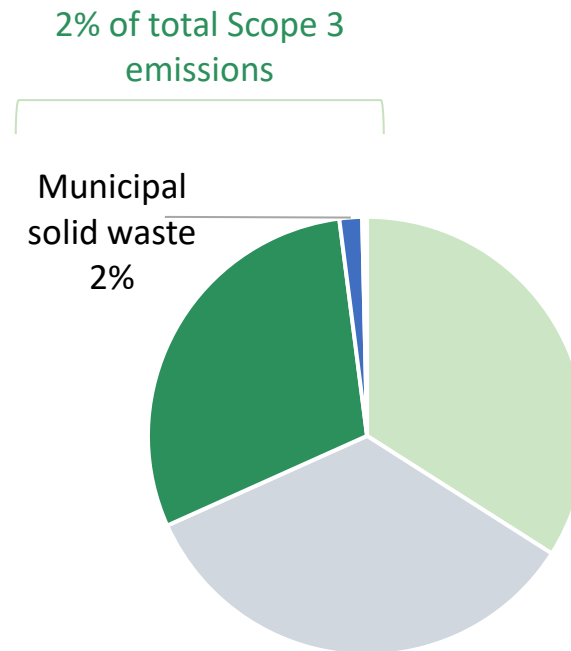
Waste generated in operations contribute to **2%** of the total Scope 3 GHG emissions, mostly from the **treatment of municipal solid waste**.

*Included in this category:*

- *Treatment of residual materials generated by the organization (including solid waste) in facilities owned or controlled by third parties (e.g. recycling or landfill sites)*
- *For recycling, only the emissions from transportation to treatment sites included*

By sub-category:

Waste generated in operations	t CO <sub>2</sub> e	Proportion vs. <u>Scope 3</u>
Municipal solid waste (landfilling)	36	2%
Municipal waste collection service (not visible on graph)	5	0.3%
Compost waste (not visible on graph)	2	0.1%
<b>TOTAL</b>	<b>44*</b>	<b>2%</b>



# 3. RESULTS

## 3.3.2 – ANALYSIS OF EMISSION SOURCES AND MAIN CONTRIBUTORS



### Key findings on buildings

- The vast majority of the Senate’s direct emissions (92.1%) occur in leased spaces from the **combustion of natural gas for space heating** (Scope 1).
- The consumption of **purchased steam to heat Crown-owned buildings** is responsible for 84.6% of indirect emissions (Scope 2), accounting for over 831 t CO<sub>2</sub>e.
- **Fuel- and energy-related activities** contribute to 30% of the total Scope 3 GHG emissions, mostly for electricity (313 t CO<sub>2</sub>e) and steam (289 t CO<sub>2</sub>e) generation.
- Building-related emissions account for **56.4% of the Senate’s overall carbon footprint**, estimated at 3,577 t CO<sub>2</sub>e for 2022-2023.

Total building-related emissions:

Source	t CO <sub>2</sub> e	Proportion
Combustion of natural gas for space heating and domestic hot water (Scope 1)	390.9	19.4%
Purchased steam, electricity and chilled water for buildings (Scope 2)	982.4	48.7%
Fuel- and energy-related activities, i.e. extraction, refining and distribution of fossil fuels used in Scopes 1 and 2 (Scope 3)	645.5	32.0%
<b>TOTAL</b>	<b>2,018.8</b>	<b>100,0%*</b>

56.4% of  
total emissions  
(3,577 t CO<sub>2</sub>e)

## 3. RESULTS

### 3.3.3 – DATA QUALITY OF SCOPE 3

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Some assumptions have been made in order to obtain the results shown previously.

#### **Senator commuting, Employee commuting and Committee and Administration travel**

- Distances travelled per mode of transportation were retrieved from publicly available online tools, and additionally for employee commuting, percentages of modes of transportation used to commute to the NCR.

#### **Fuel and energy-related activities**

- The energy consumption of two of the office spaces leased by the Senate was extrapolated based on another nearby office space due to lack of available data.
- A small parking space leased by the Senate was not considered in the calculations due to the negligible space occupied by the Senate and the lack of available data.

#### **Waste generated in operations**

- Quantities of waste for leased buildings were extrapolated from waste quantities per surface area from Crown-owned buildings.

An assessment on data quality and completeness is made in *Appendix IV*. See next pages for future improvements to be made regarding data gathering and reliability.

## 3. RESULTS

### 3.3.3 – DATA QUALITY OF SCOPE 3

The tables in Appendix IV summarize the data provided by the Senate of Canada to establish the GHG inventory. In order to deepen the analysis and enable to target the emissions sources on which it is most important to take action, the following recommendations would improve the quality of the data used to calculate the GHG balance.

Data to be improved	Recommendations and <i>justifications</i>	Potential contribution to GHG inventory
<b>Senator commuting</b>		
Distances traveled per mode of transportation	<p><b>Collect data on distance travelled (ex. kilometres per mode of transportation) and modes of transport (incl. train travel) for senators commuting from their province/territory to the National Capital Region.</b></p> <p><i>At present, average distances traveled for sittings and hybrid weeks have been estimated with senators per province/territory and a ratio of on-site presence during hybrid weeks from the PBO report (2021) and modes of transport have been used to estimate emissions generated by individuals commuting to the occupied buildings. Emissions generated from train travel are not accounted for in this inventory, as rail transportation services are granted to senators by VIA Rail without any cost to Senate budgets.</i></p>	High



## 3. RESULTS

### 3.3.3 – DATA QUALITY OF SCOPE 3

The tables in Appendix IV summarize the data provided by the Senate of Canada to establish the GHG inventory. In order to deepen the analysis and enable to target the emissions sources on which it is most important to take action, the following recommendations would improve the quality of the data used to calculate the GHG balance.

Data to be improved	Recommendations and <i>justifications</i>	Potential contribution to GHG inventory
<b>Employee commuting</b>		
Commuting distances and mode of transportation for individuals present	<p><b>Collect more precise data on distance and modes of transport for individuals commuting to the Senate buildings. Validate the average number of individuals per day at precinct.</b></p> <p><i>At present, statistics on distances and modes of transport have been used to estimate emissions generated individuals commuting to the occupied buildings. Average number of individuals per day at precinct do not provide a complete picture as several senators and staff access the buildings through the main doors with the help of security and they do not necessarily have to badge / swipe.</i></p>	Medium
<b>Waste generated in operations</b>		
Quantities of waste generated	<p><b>Low priority for more precise data collection for leased buildings as waste management does not contribute significantly to the balance sheet (2% of total emissions).</b></p> <p><i>Quantities of waste for leased buildings were extrapolated from waste quantities per surface area from Crown-owned buildings.</i></p>	Low

## 3. RESULTS

### 3.3.3 – DATA QUALITY OF SCOPE 3

The tables in Appendix IV summarize the data provided by the Senate of Canada to establish the GHG inventory. In order to deepen the analysis and enable to target the emissions sources on which it is most important to take action, the following recommendations would improve the quality of the data used to calculate the GHG balance.

Data to be improved	Recommendations and <i>justifications</i>	Potential contribution to GHG inventory
<b>Committee and Administration travel</b>		
Distances traveled per mode of transportation	<p><b>Collect more detailed data on distance travelled (ex. kilometers per mode of transportation) and modes of transport (incl. train travel) for Committee and Administration travel.</b></p> <p><i>The mode of transportation was determined based on the itinerary travelled and amounts reimbursed. Breakdowns for modes of transportation in the "air-bus-train" travel category are not currently available (while "other ground transportation" is already reported separately). As confirmed by the Senate of Canada, the majority of the reimbursement relate to air travel and for ground transportation car travel. Distances were estimated using the website "airmilescalculator.com" and Google Maps. Train travel within Canada is not accounted for.</i></p>	Low



# 2030 EMISSION PROJECTIONS

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## 4. 2030 EMISSION PROJECTIONS

### 4.1 STATUS QUO PROJECTION WITH PLANNED REDUCTION PROJECTS

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The following pages present the estimated "business as usual" (BAU) GHG emission trajectory of the Senate of Canada, which serves as the reference scenario for determining the 2030 reduction target within the coming net zero plan.



The BAU trajectory takes into account the implementation of in-progress measures that will lead to GHG reductions by 2030. Those measures include the PSPC Energy Services Acquisition Program (ESAP) to decarbonize building heating in the NCR. The sources of planned emission reductions and other factors projected to affect the Senate-related GHG emissions are described in the next pages. The purchase of carbon offsets and renewable energy certificates (RECs), the establishment of Power Purchasing Agreements (PPAs) or nature-based carbon sequestration projects such as tree planting are excluded from the projections. They will be taken into account in phase 2 of the project.

The projections start with the 2022-2023 fiscal year as the base year, and end in 2029-2030.

## 4. 2030 EMISSION PROJECTIONS

### 4.1 STATUS QUO PROJECTION WITH PLANNED REDUCTION PROJECTS

The following table describes the GHG reduction project that will influence the Senate GHG inventory by 2030:

Organi- zation	Project	Affected GHG emissions and Scopes	Region	Period	Short description
PSPC	ESAP district energy system	Steam production (Scope 2) Natural gas production for steam production (Scope 3)	NCR	2026- 2030	Current heating and cooling is provided by the Cliff plant with natural gas fire boilers and electricity for cooling. By the end of FY 2025-2026, instead of steam, the district energy system will use hot water to heat the connected buildings (Crown-owned and private buildings) provided by the retrofitted National printing site in Gatineau. It will use the low-carbon electricity from the Quebec grid. The Cliff plant will provide heat at peak hours during cold days. Therefore, a new emission factor will take effect. In average, the value is estimated to <b>40 kg CO2e/MWh</b> (incl. baseline heating and peaks).

Not taken into account in the projections at this stage:

- Decarbonation of the Ontario grid mix
- Decarbonation of leased buildings
- Acquisition of leased buildings by PSPC and transition to their net zero operations

## 4. 2030 EMISSION PROJECTIONS

### 4.1 STATUS QUO PROJECTION WITH PLANNED REDUCTION PROJECTS

The following table describes the **events** projected to influence the Senate GHG inventory by 2030:

Organization	Event	Affected GHG emissions and Scopes	Region	Period	Short description
Senate	End of COVID restrictions	Senator travels (Scope 3) Commuting (Scope 3)	Canada-wide, NCR and abroad	2026-2030	8 sitting weeks out of 26 were hybrid in 2022-2023 with an average 50% senators present on-site (45 out of 90). The following years are therefore scaled up to full in-person sittings. 25 sitting weeks per year are considered (average of non-election years since 2015, excl. the pandemic). For committee travels, 11 trips on average between 2015 and 2020, vs. 7 in 2022-2023.
Senate	Election years	Senator travels (Scope 3) Commuting (Scope 3)	Canada-wide and NCR	2025 & 2029	6 fewer sitting weeks during election years (2025 and 2029).

Not taken into account in the projections at this stage:

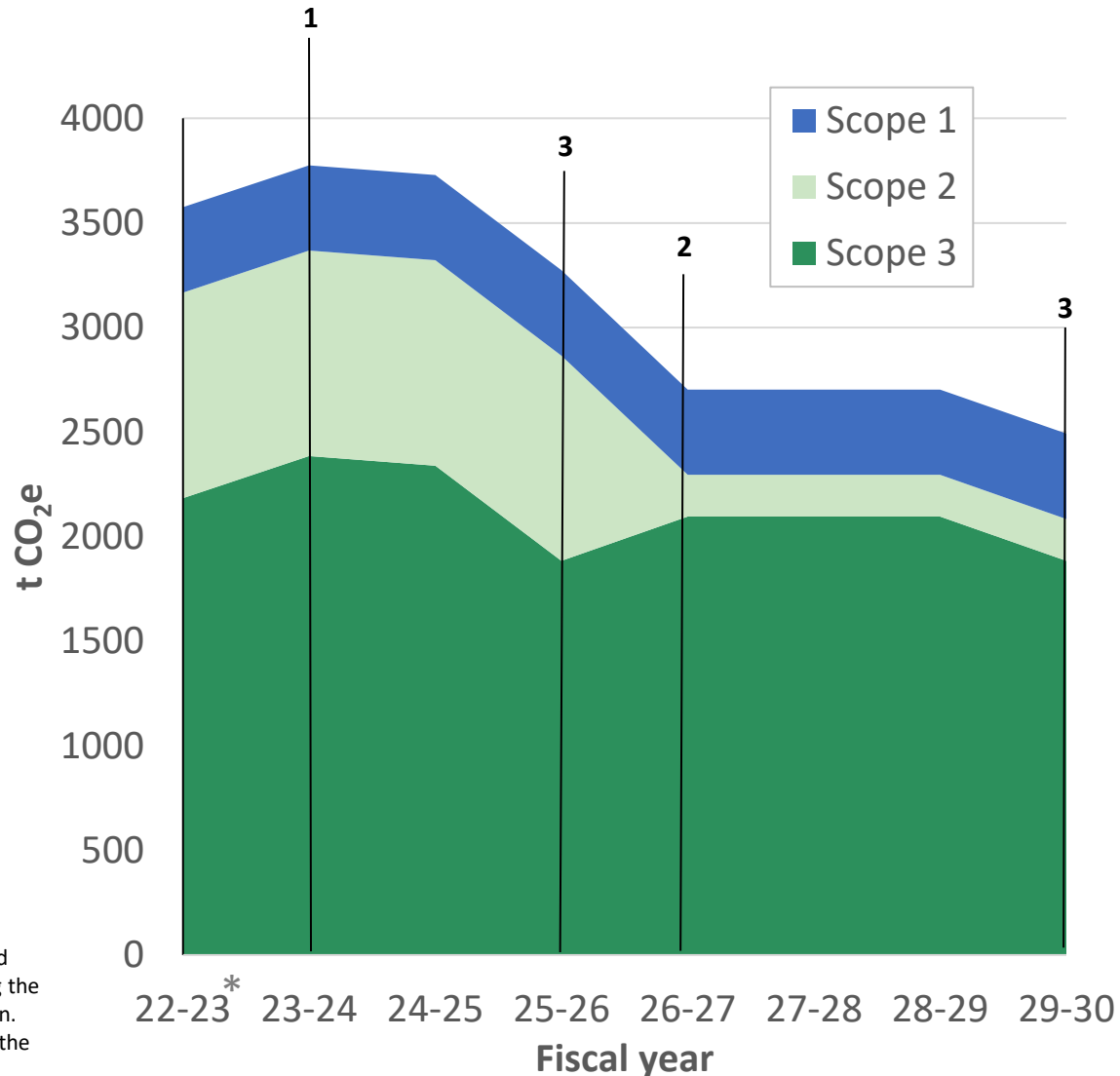
- Variation of the number of senators (90 out of 105 seats in FY 2022-2023)

## 4. 2030 EMISSION PROJECTIONS

### 4.1 STATUS QUO PROJECTION WITH PLANNED REDUCTION PROJECTS

#### Key findings

- Between FY 2022-2023 and 2029-2030, the Senate's GHG emissions are projected to **decrease by 30%**.
- This is mainly due to the new **ESAP energy district** coming online in the NCR in FY 2026-2027. Also, FY 2029-2030 will possibly be an election, boosting the GHG reductions over the covered period.
- Based on planned reduction projects and the end of the COVID-19 restrictions, the following graph illustrates the projected GHG emissions until the 2029-2030 fiscal year, **with three highlights**:
  1. End of COVID-19 restrictions
  2. ESAP district energy system change
  3. Canada's federal election years



\*For the 2022-2023 fiscal year, Scope 1 emissions are 408 t CO<sub>2</sub>e, and Scope 2 emissions are 855 t CO<sub>2</sub>e, totalling 1,263 t CO<sub>2</sub>e. This is using the Crown-owned buildings' energy latest dataset of energy consumption. Corresponding data for the leased spaces is not yet available, hence the use of 2021-2022 energy consumption as a reference year.



PRELIMINARY NET ZERO PLAN

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## 5. PRELIMINARY NET ZERO PLAN

### 5.1. DEFINITION OF A PLAN

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#### **Establishment of carbon neutrality target and implementation plan**

The GHG inventory and projections established in this first report provide the foundation to **setting a GHG reduction target** and a **carbon neutral or net zero plan**. The next step is to define a GHG reduction target using a rigorous approach and consider the Senate's capacity to reach them.

This section will introduce the steps and definitions needed to establish the Senate of Canada's net zero plan in phase 2 of the project, more specifically :

- The meaning of net zero for the Senate of Canada
- The steps needed to set a reduction target
- The parameters to be discussed and defined in phase 2 to set the net zero plan

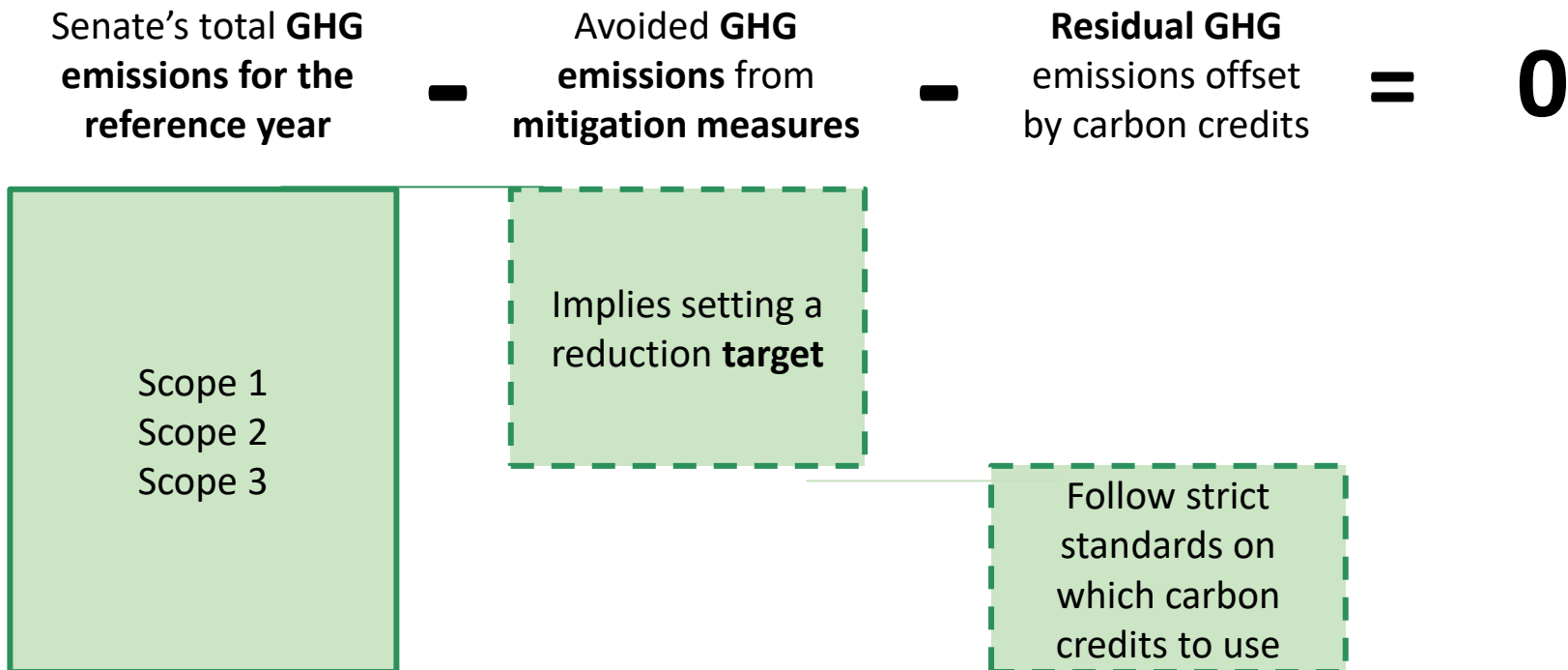
# 5. PRELIMINARY NET ZERO PLAN

## 5.1. DEFINITION OF A PLAN

### What does net zero mean for the Senate of Canada?

The general definition of a net zero organization is one that has reduced **as much as possible** its direct and indirect GHG emissions of a reference year. Its residual GHG emissions at a future target year are offset with the purchase of carbon credits (offsets). The balance is therefore zero GHG emissions.

Source: PAS 2060



# 5. PRELIMINARY NET ZERO PLAN

## 5.1. DEFINITION OF A PLAN

### What different targets exist?

In order to establish a net zero plan to reduce emissions, a GHG target must be set.

Several possibilities exist to establish a target. Incremental targets and science-based targets are the most common used to establish reduction plans. These targets are defined as follows:

#### Incremental target :

Considers the **reality** of the Senate of Canada through the **analysis of current and planned** GHG reduction **initiatives**

Emissions reductions are calculated **at the scale of the organization** only.



#### Science-based target :

**Aligned with international GHG reduction targets** (i.e. Paris Agreement) and compatible with the scenarios defined by the IPCC<sup>1</sup> to limit the global temperature increase **1.5 °C** compared to pre-industrial levels.

The science-based target is ambitious as it considers what an organization must contribute to do its part to limit global warming to **1.5°C**.



<sup>1</sup> IPCC : Intergovernmental Panel on Climate Change

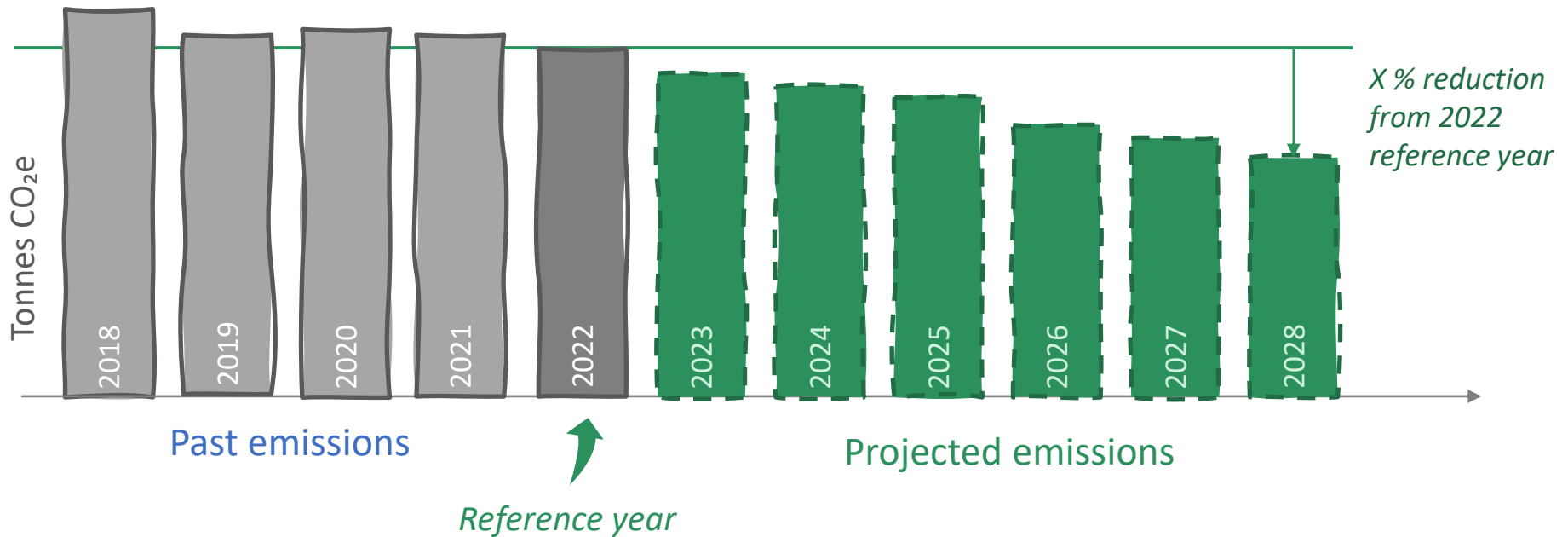
# 5. PRELIMINARY NET ZERO PLAN

## 5.1. DEFINITION OF A PLAN



### Incremental target based on the Senate of Canada's current and planned initiatives

- Considers the **reality** of the organization through the analysis of **current and planned GHG reduction initiatives**
- Emissions reductions are calculated **at the scale of the organization** only.

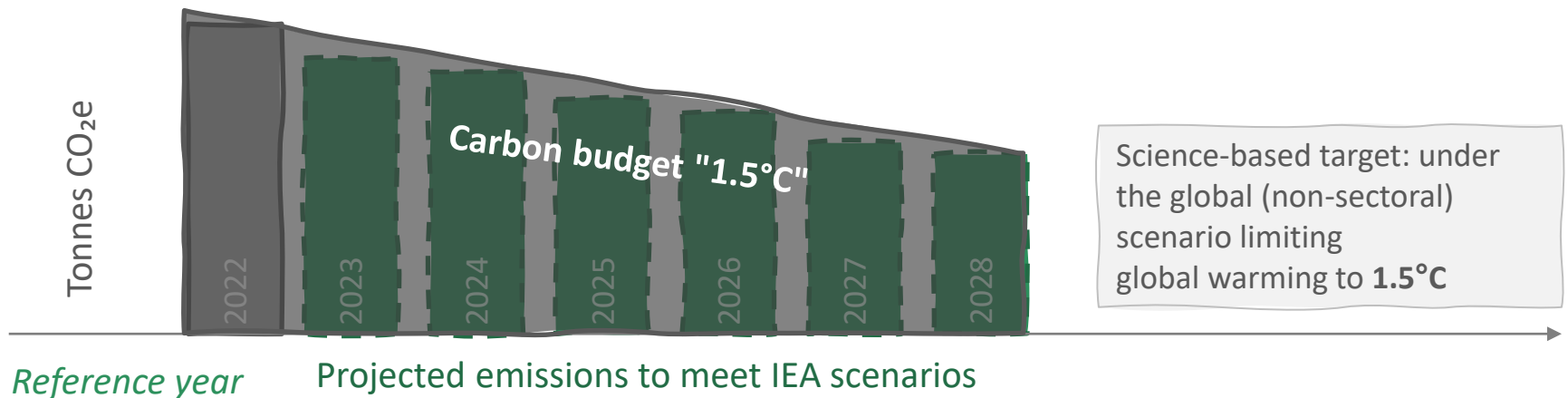


# 5. PRELIMINARY NET ZERO PLAN

## 5.1. DEFINITION OF A PLAN

### A science-based target considers the efforts that organizations must make to limit global warming to 1.5°C as written in the Paris Agreement

- Target compatible with the scenarios defined by the Intergovernmental Panel on Climate Change (IPCC) to limit the global temperature increase to **1.5°C** compared to pre-industrial levels.
- **Based on IEA (International Energy Agency) projections**, which are calculated based on an estimate of the "carbon budget" (amount of GHGs that can be emitted while respecting scenarios below 1.5°C) by sector of activity. They take into account the intensity of emissions and the specificities of different sectors.
- Emissions reductions are calculated **at the scale of the organization** to align with **international GHG reduction efforts**
- A science-based target under the global (non-sectoral) scenario limiting global warming to 1.5°C is **ambitious** and **the only one recognized by the SBTi**, as they consider what an organization must contribute to do its part
- **According to ISO Net zero guidelines and the UN Net zero commitments by businesses, financial institutions, cities and regions, net zero plan should be compatible with the 1.5C ambition.**



## 5. PRELIMINARY NET ZERO PLAN

### 5.1. DEFINITION OF A PLAN

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#### Which models are to be used for the Senate of Canada's net zero plan?

Several international standards and guidelines define best practices for net zero commitments. In line with the IPCC scenarios to limit global warming to 1.5°C, reduction projections will be followed from the Science-based target initiative (SBTi) and International Energy Agency (IEA) :



The targets set within the Science based targets initiative (SBTi) framework are based on the Intergovernmental Panel on Climate Change's objectives and are in alignment with international GHG reduction targets to **limit the global temperature increase of 1.5°C compared to pre-industrial levels.**



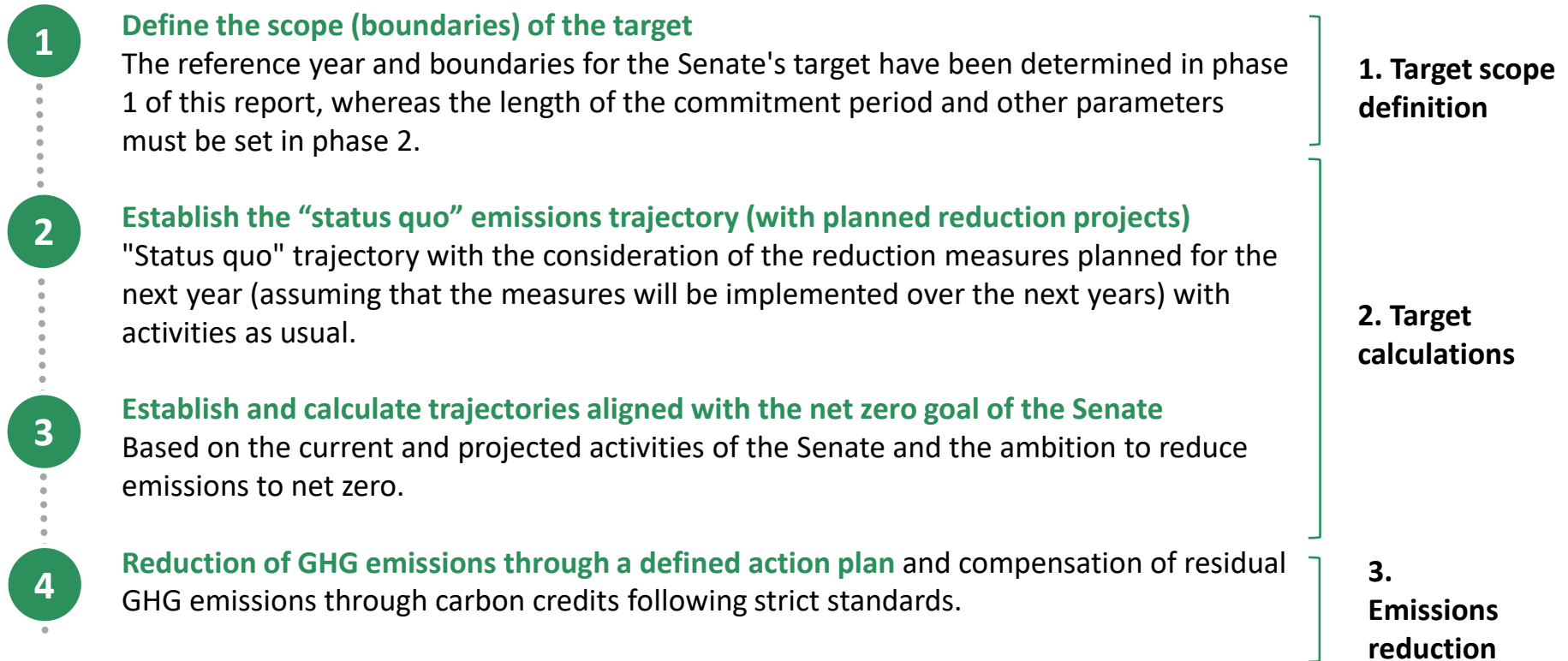
The International Energy Agency (IEA) makes energy projections for different countries and sectors. In 2021, the IEA has developed a comprehensive study of **how to transition to an energy system at net zero CO<sub>2</sub> emissions by 2050.** In 2022, the IEA generated detailed scenarios for sectors and regions.

# 5. PRELIMINARY NET ZERO PLAN

## 5.2. SETTING A REDUCTION TARGET

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The **main steps (methodology)** in setting up the target for the Senate of Canada are as follows:



## 5. PRELIMINARY NET ZERO PLAN

### 5.3. PARAMETERS TO SET A TARGET

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Several parameters are essential in setting a GHG reduction target. For the target type and year of reference, the parameters along with a rationale for the proposed choices are :

Parameter	Decision
<b>Target type</b> (absolute or intensity)	An organization can choose between an absolute (tonnes of CO <sub>2</sub> e) or intensity targets (e.g., kg CO <sub>2</sub> eq./\$). Based on the SBTi recommendations, the recommendation for the Senate is to follow an absolute target. Intensity targets are sometimes appropriate for organisations with growth projections and production activities.
<b>Year of reference</b> (target base year)	2022-2023 is the reference year that has been chosen to establish the GHG inventory in this report and target base year. This year represents the most recent and complete data representing the Senate of Canada's typical GHG inventory after returning activities of COVID-19.



## 5. PRELIMINARY NET ZERO PLAN

### 5.3. PARAMETERS TO SET A TARGET

Parameter	Decision
<b>Target scope (boundaries)</b>	<p>The target boundaries define the Scopes to be included in the target. According to the Senate's objectives, the target could cover direct emissions and indirect emissions from Scopes 1, 2 and 3. To set a science-based target, the SBTi recommends to include Scope 3 emissions, especially when they represent a significant percentage of an organization's GHG inventory.</p> <p>Based on the results from the first phase of the project, the following categories should be included under the target:</p>

Categories to be included under the target	Impact on emissions	Reason for integration
Natural Gas and steam consumption for heating (Scope 1 and Scope 2)	High	33.8% of <u>total</u> emissions comes from Scopes 1 and 2 portion attributable to space heating.
NCR senators travelling incl. accommodation and meals (Scope 3)	Medium	24% of <u>total</u> emissions (11% from NCR senators travelling, 6% from accommodation and 6% from meals when staying in the NCR).
Fuel and energy-related activities (Scope 3)	Medium	18% of <u>total</u> emissions comes from upstream emissions of the consumption of fuels and energy in Scopes 1 and 2.

## 5. PRELIMINARY NET ZERO PLAN

### 5.3. PARAMETERS TO SET A TARGET

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Parameter	Decision
<b>Length of the target commitment period</b>	The SBTi recommends a minimum period of 5 years to reach the target. For the Senate's net zero plan, the target would cover the commitment period of <b>7 years: from 2022-2023 to 2029-2030</b>
<b>Target completion date</b>	<p>Calculating 7 years from 2022-2023, the year in which the target will be put in place, the Senate will have to reach its reduction target for the reporting period <b>2029-2030</b>.</p> <p>The SBTi also recommends developing long-term targets and establishing milestones at 5-year intervals. The Senate could choose a reduced milestone interval within its 7-year timeline.</p>
<b>Target ambition level</b>	<p>The Senate's target could be <b>a science-based target under the global (non-sectoral) scenario limiting global warming to 1.5°C</b>.</p> <p>Science-based targets are considered the most ambitious and are the only ones recognized by the SBTi.</p>

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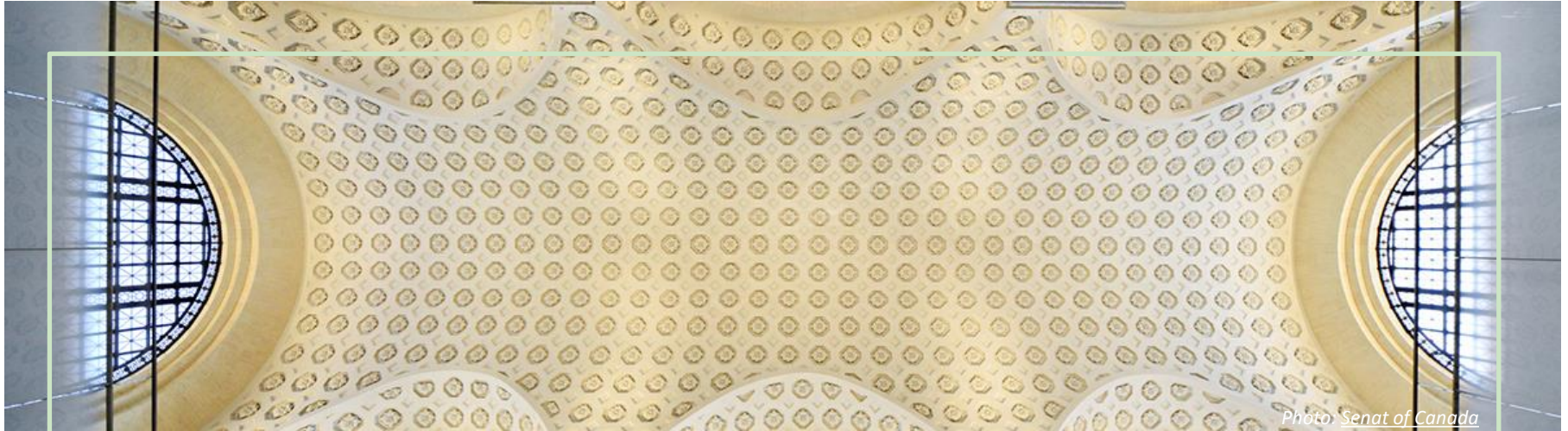


**CONCLUSION**

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## 6. CONCLUSION

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- The Senate's overall carbon footprint, estimated at **3,577 tonnes CO<sub>2</sub>e** for 2022-2023, mainly from **natural gas and steam consumption for heating the buildings and senator travel to the National Capital Region.**
- This report represents the result of the first phase of the project, building the foundation of the Senate's net zero plan.
- This foundation is essential in setting the stage for the next steps of the project to establish a GHG target, calculate projections and set up the action plan for the Senate's path to net zero GHG emissions.

# APPENDICES

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Appendix I: List of acronyms

Appendix II: Glossary

Appendix III: Bibliography

Appendix IV: Data sources and data quality assessment

Appendix V: Emission factors

## 7. APPENDICES

### APPENDIX I: LIST OF ACRONYMS

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CH <sub>4</sub>	Methane
CO <sub>2</sub>	Carbon dioxide
CO <sub>2</sub> e	Carbon dioxide equivalent
EPA	United States Environmental Protection Agency
FY	Fiscal year
GHG	Greenhouse gas (limited to CH <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O and fugitive gases in this inventory)
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
kg	Kilograms
km	Kilometers
kWh	Kilowatt-hour
N <sub>2</sub> O	Dinitrogen oxide or dinitrogen monoxide
NCR	National Capital Region
tCO <sub>2</sub> e	Metric tons of carbon dioxide equivalent
pkm	Person kilometers traveled (unit of measurement of passenger transport over a given distance corresponding to one person transported over one kilometre)
SF <sub>6</sub>	Sulfur hexafluoride

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### APPENDIX II: GLOSSARY

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Carbon offset	Permit or certificate traded on a carbon market corresponding to the avoidance or removal of one tonne of carbon dioxide equivalent (t CO <sub>2</sub> eq.) from the atmosphere through a CO <sub>2</sub> reduction or removal project. Through the purchase of a carbon credit, an organization invests in a project that prevents emissions or removes GHGs from the atmosphere. (adapted from IPCC, 2018)
Emission factor	<i>"A factor that converts activity data into GHG emissions data (e.g., kg CO<sub>2</sub> e emitted per liter of fuel consumed, kg CO<sub>2</sub> e emitted per kilometer traveled, etc.)."</i> (WRI et WBSCD, 2011)
Greenhouse gases (GHG)	<i>"For the purpose of [the GHG Protocol], GHGs are the six gases covered by the UNFCCC: carbon dioxide (CO<sub>2</sub>); methane (CH<sub>4</sub>); nitrous oxide (N<sub>2</sub>O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF<sub>6</sub>)."</i> (WRI et WBSCD, 2011)
Greenhouse gas inventory	<i>"A quantified list of an organization's GHG emissions and sources"</i> (WRI et WBSCD, 2011)
Net zero GHG emissions	Unavoidable or residual GHG emissions are balanced by removals (through offsetting or insetting projects) and local consequences of human activities have no net effect on the local climate system. (adapted from IPCC, 2018)
Scope 1 emissions	<i>"Emissions from operations that are owned or controlled by the reporting company"</i> (WRI et WBSCD, 2011)
Scope 2 emissions	<i>"Emissions from the generation of purchased or acquired electricity, steam, heating or cooling consumed by the reporting company."</i> (WRI et WBSCD, 2011)
Scope 3 emissions	<i>"All indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions."</i> (WRI et WBSCD, 2011)

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### APPENDIX III: BIBLIOGRAPHY

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### APPENDIX IV: DATA SOURCES AND DATA QUALITY ASSESSMENT

Senate of Canada report category	GHG Protocol category	Completeness	Year	Data description	Hypothesis, secondary data source
Natural gas	Scope 1	90%	2021-2022	<ul style="list-style-type: none"> <li>Yearly consumption of natural gas for all the buildings in which the Senate operates.</li> <li>Extrapolation of the consumption based on space area and typology for 1 address.</li> </ul>	n.a
Fuel	Scope 1	80%	2022-2023	<ul style="list-style-type: none"> <li>Average yearly mileage of every vehicle owned by the Senate.</li> </ul>	Vehicles' specified average fuel consumptions
Refrigerant leaks	Scope 1	100%	2021-2022	<ul style="list-style-type: none"> <li>Refrigerant leaks (or lack thereof) which occurred during the 2021-2022 period in Senate-occupied spaces.</li> </ul>	n.a.

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### APPENDIX IV: DATA SOURCES AND DATA QUALITY ASSESSMENT

Senate of Canada report category	GHG Protocol category	Completeness	Year	Data description	Hypothesis, secondary data source
Electricity	Scope 2	80%	2021-2022	<ul style="list-style-type: none"> <li>Yearly consumption of electricity for all the buildings in which the Senate operates.</li> <li>Extrapolation of the consumption based on space area and typology for 2 addresses.</li> </ul>	n.a.
Steam/Chilled water	Scope 2	100%	2021-2022	<ul style="list-style-type: none"> <li>Yearly consumption of steam and chilled water for all the buildings in which the Senate operates.</li> </ul>	n.a.
Fuel- and energy-related activities	Fuel- and energy-related activities (Cat.3)	80%	2021-2022	<ul style="list-style-type: none"> <li>Same data as in Scopes 1 and 2 (natural gas, fuel, electricity and steam)</li> </ul>	n.a. except for fuel

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### APPENDIX IV: DATA SOURCES AND DATA QUALITY ASSESSMENT

Senate of Canada report category	GHG Protocol category	Completeness	Year	Data description	Hypothesis, secondary data source
Purchased Goods and Services*	Purchased Goods and Services (Cat.1)	100%	Apr. 2022 – Mar. 2023	<ul style="list-style-type: none"> <li>Senators and House officer expenses</li> <li>Senator Living expenses in the National Capital Region</li> <li>Senator travel expenses</li> <li>Committees/International and Interparliamentary Affaires (IIA) travel expenses</li> <li>Office expenses</li> </ul>	n.a.
	Capital Goods (Cat.2)	100%	Apr. 2022 – Mar. 2023	<ul style="list-style-type: none"> <li>Expenses for machinery and equipment, furniture and furnishings</li> <li>List of vehicles procured</li> </ul>	n.a.
	Upstream transportation and distribution (Cat.4)	100%	Apr. 2022 – Mar. 2023	<ul style="list-style-type: none"> <li>Expenses for couriers and messengers</li> </ul>	n.a.

\*The [Financial Reports](#) on the Senate public website provided much of the data that we analyzed for this report.

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### APPENDIX IV: DATA SOURCES AND DATA QUALITY ASSESSMENT

Senate of Canada report category	GHG Protocol category	Completeness	Year	Data description	Hypothesis, secondary data source
Travel and Commuting	Business travel (Cat.6)	80%	Apr. 2022 – Mar. 2023	<b>Senator commuting to NCR</b> <ul style="list-style-type: none"> <li>Average distances from province/territory to Ottawa and mode of transportation provided</li> <li>Number of senators per province and territory as of June 2023 (average total number of senators was 90 in 2022-23)</li> <li>Number of in-person sitting weeks (18 weeks) and hybrid sitting weeks (8 weeks)</li> <li>Ratio of Senator presence during hybrid weeks from PBO report (2021)</li> </ul>	Parliamentary Budget Officer (2021)
		80%	2019 – 2023	<b>Administration and Committee travel</b> <ul style="list-style-type: none"> <li>Itinerary travelled and amount reimbursed provided</li> <li>Distances and modes of transportation (air or car) estimated based on destinations travelled</li> </ul>	Airmilescalculator.com (distances, air travel), Google Maps (distances, car travel)

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### APPENDIX IV: DATA SOURCES AND DATA QUALITY ASSESSMENT

Senate of Canada report category	GHG Protocol category	Completeness	Year	Data description	Hypothesis, secondary data source
Travel and commuting	Employee Commuting (Cat.7)	80%	Apr. 2022 – Mar. 2023	<ul style="list-style-type: none"> <li>Average number of individuals for all Senate-occupied buildings ("Precinct") has been calculated from the data of on-site presence from the access reports representing the presence in all Senate-occupied buildings</li> <li>Employee commuting distances and modes of transportation from public statistics (not based on a survey)</li> </ul>	<p>Statistics Canada (2017)</p> <p>Statistics Canada (2023)</p>

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### APPENDIX IV: DATA SOURCES AND DATA QUALITY ASSESSMENT

Senate of Canada report category	GHG Protocol category	Completeness	Year	Data description	Hypothesis, secondary data source
Waste generated in operations	Waste generated in operations (Cat. 5)	50%	2018-2019 & 2022-2023	<ul style="list-style-type: none"> <li>Total Senate-occupied gross floor per building (Crown-owned and leased buildings) (m<sup>2</sup>)</li> <li>Quantities per type of waste (kg)</li> <li>Extrapolation of waste quantities for leased buildings based on average quantities per surface area from Crown-owned buildings</li> </ul>	Quantities of waste for leased buildings

# 7. APPENDICES

## APPENDIX V: EMISSION FACTORS

Emission factor	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> eq.	Unit	Source
<b>Fuel and energy related activities</b>						
Natural gas	1.921 1.944	0.037 0.037	0.035 0.035	<b>Ontario: 1.931</b> <b>Quebec: 1.954</b>	kg CO <sub>2</sub> eq./m <sup>3</sup>	Government of Canada's Greenhouse Emissions Inventory (June 2023)
Diesel				<b>2.79</b>	kg CO <sub>2</sub> eq./l	
Gasoline				<b>2.361</b>	kg CO <sub>2</sub> eq./l	
Steam				<b>0.0767</b>	kg CO <sub>2</sub> eq./MJ	
Chilled water				<b>0.00145</b>	kg CO <sub>2</sub> eq./MJ	
Electricity				<b>Ontario: 26</b> <b>Quebec: 1.2</b>	g CO <sub>2</sub> eq./kWh	
<b>Waste generated in operations</b>						
Municipal solid waste				<b>Not public</b>	kg CO <sub>2</sub> eq./kg	Ecoinvent v3.8
Municipal waste collection service				<b>Not public</b>	kg CO <sub>2</sub> eq./tkm	
Compost waste	-	0.0015	0.0002	<b>0.09</b>	kg CO <sub>2</sub> eq./kg wet waste	ECCC (2020bc)



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## APPENDIX V: EMISSION FACTORS

Emission factor	CO <sub>2</sub> eq.	Unit	Source
<b>Purchased Goods and Services</b>			
Food, Meals and catering	0.3	kg CO <sub>2</sub> eq./\$ CAD	Economic Input Output LCA database (eiolca.net)
Relocation services	1.07	kg CO <sub>2</sub> eq./\$ CAD	
Accommodation	0.22	kg CO <sub>2</sub> eq./\$ CAD	
Stationary	0.43	kg CO <sub>2</sub> eq./\$ CAD	
Software	0.05	kg CO <sub>2</sub> eq./\$ CAD	
Advertising and Public Relations	0.11	kg CO <sub>2</sub> eq./\$ CAD	
Management Consulting	0.08	kg CO <sub>2</sub> eq./\$ CAD	
Data Processing and Hosting	0.12	kg CO <sub>2</sub> eq./\$ CAD	
Clothing	0.19	kg CO <sub>2</sub> eq./\$ CAD	
Housing	0.02	kg CO <sub>2</sub> eq./\$ CAD	
Consumer Goods and General Rental Centers	0.10	kg CO <sub>2</sub> eq./\$ CAD	
Electronic Equipment Repair and Maintenance	0.08	kg CO <sub>2</sub> eq./\$ CAD	
Scientific Research and Development	0.12	kg CO <sub>2</sub> eq./\$ CAD	
<b>Capital Goods</b>			
Machinery and equipment	0.16	kg CO <sub>2</sub> eq./\$ CAD	Economic Input Output LCA database (eiolca.net)
Furniture and Furnishings	0.30	kg CO <sub>2</sub> eq./\$ CAD	
<b>Upstream transportation and distribution</b>			
Couriers and messengers	0.15	kg CO <sub>2</sub> eq./\$ CAD	Economic Input Output LCA database (eiolca.net)

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## APPENDIX V: EMISSION FACTORS

Emission factor	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub> eq.	Unit	Source
<b>Senator Commuting</b>						
Long-haul aircraft (>= 3700 km)	0.101	0.0000004	0.0000032	<b>0.102</b>	kg/pkm	Table 10. Scope 3 Category 6: Business Travel and Category 7: Employee Commuting US EPA. (2023). Emission Factors for Greenhouse Gas Inventories.
Mid-haul aircraft (between >= 482 km, < 3700 km)	0.080	0.0000004	0.0000025	<b>0.081</b>	kg/pkm	
Short-haul/domestic (< 482 km)	0.129	0.0000040	0.0000041	<b>0.130</b>	kg/pkm	
Car, gasoline engine	0.194	0.0000050	0.0000043	<b>0.196</b>	kg/km	
<b>Employee Commuting</b>						
Car, gasoline engine	0.194	0.0000050	0.0000043	<b>0.196</b>	kg/km	Table 10. Scope 3 Category 6: Business Travel and Category 7: Employee Commuting US EPA. (2023). Emission Factors for Greenhouse Gas Inventories.
Average for public transport (metro, bus) (excl. train)	0.047	0.000004	0.000001	<b>0.047</b>	kg/pkm	