IMPACT ANALYSIS ON GHG EMISSIONS AND THE ECONOMY

2030 Plan for a Green Economy

2022-2027 IMPLEMENTATION PLAN

Votre gouvernement

Québec

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April 2022

Québec

The Ministère des Finances and the Ministère de l'Environnement et de la Lutte contre les changements climatiques produced this publication.

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Impact Analysis on GHG Emissions and the Economy

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HIGHLIGHTS

Québec has set a greenhouse gas (GHG) emissions reduction target of 37.5% in 2030 compared to 1990 levels, which corresponds to an emission level of 54.2 million tonnes of CO_2 equivalent (Mt).

In the absence of government action to fight climate change, it is estimated that Québec's GHG emissions could be as high as 85.2 Mt in 2030, taking into account the projected economic growth and the evolution of technologies.

— This level corresponds to a potential reduction effort of 31.0 Mt to be achieved if the target is to be reached entirely in Québec (54.2 Mt).

❑ Planned actions make it possible to reach 51% of the target in 2030

All the actions implemented in Québec by 2030 are expected to result in reductions of 15.9 Mt, or 51% of the 31.0 Mt effort to be achieved in 2030.

— This is an increase from the 42% proportion presented in the 2030 Plan for a Green Economy published in the fall of 2020.

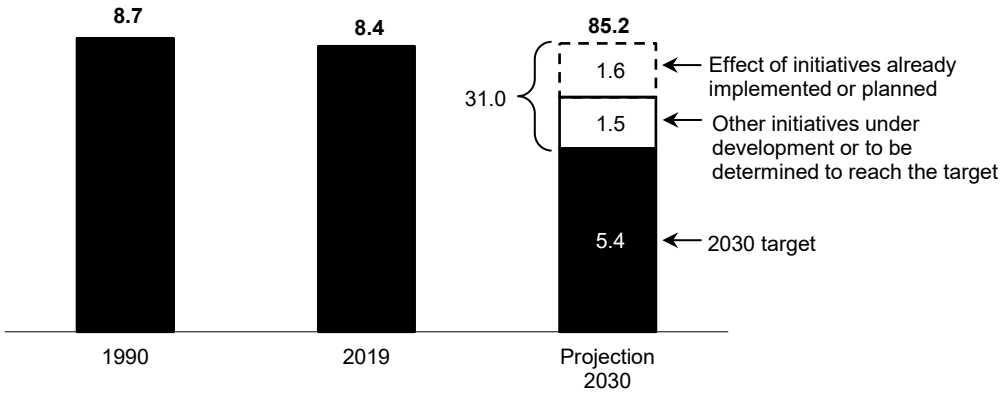
— The projected reductions will be driven primarily by the effect of the price signal from the cap-and-trade system for greenhouse gas emission allowances (CAT system) in Québec, as well as planned measures, regulations and other initiatives, primarily under the 2022-2027 implementation plan of the 2030 Plan for a Green Economy.

Moreover, the 2030 target is estimated to be achievable in Québec by prioritizing the least costly technologies to reduce emissions and by adapting our lifestyles.

In addition, Québec wishes to achieve carbon neutrality by 2050. Steps have already been taken to achieve this goal.

CHART 1

Level of effort required to achieve the 2030 target in Québec
(millions of tonnes of CO_2 equivalent)



Note: These estimates are based on the most recent information available as of March 1, 2022, as well as the 2022-2023 budget economic forecast. It is assumed that climate change investments will continue over the 2027-2030 period within similar parameters to those presented for the 2021-2027 period.
Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

INTRODUCTION

The scientific consensus is unequivocal: climate change will have significant impacts on society, the economy and the environment. All nations must therefore work together to reduce their greenhouse gas (GHG) emissions.

In this regard, Québec has set a GHG emission reduction target of 37.5% in 2030 compared to 1990 levels, which corresponds to an emission level of 54.2 million tonnes of CO_2 equivalent (Mt).[1]

— The government also intends to continue its efforts over the longer term to achieve carbon neutrality (zero net emission) by 2050.

To achieve its climate objectives, Québec has implemented the 2030 Plan for a Green Economy, which is based on:

— the cap-and-trade system for greenhouse gas emission allowances (CAT system), which puts a price on carbon and covers nearly 80% of Québec's GHG emissions;

  — This system guarantees GHG emission reductions over time in the sectors covered by the joint market between Québec and California. The Québec government is committed to maximizing these reductions in Québec.

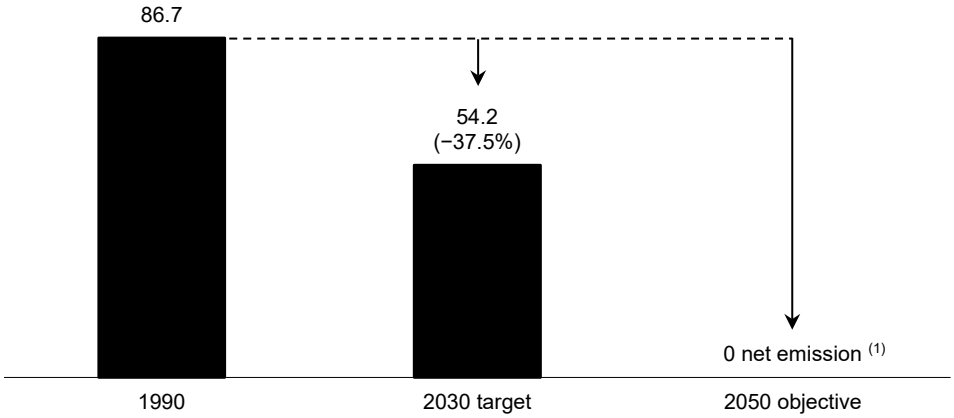
— full reinvestment of revenues from the CAT system into the measures of the implementation plans of the 2030 Plan for a Green Economy, through the Electrification and Climate Change Fund (ECCF);

— other acts, regulations, policies and actions of the Québec government, particularly in the transportation, buildings and industry sectors.

Other actions will contribute to the reduction of GHG emissions in Québec, including those of the federal government, municipalities, and the private sector.

CHART 2

Québec's GHG emissions in 1990 and reduction targets
(millions of tonnes of CO_2 equivalent)



(1) Québec intends to make a longer-term commitment to achieve carbon neutrality by 2050.
Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

[1] In this document, CO_2 equivalent emissions are expressed in metric tonnes.

❑ Québec is doing well in the area of decarbonization

Québec is at the forefront of the fight against climate change, ranking first among Canadian provinces with the lowest per capita GHG emissions.

— In fact, Québec's GHG emissions were 9.9 tonnes per capita in 2019, compared with an average of 19.4 tonnes per capita for Canada as a whole for the same year.

Québec is also doing well among developed economies. This performance is mainly due to the importance of hydroelectricity in its economy.

In the short term, Québec's lead in the decarbonization of its economy may make additional reductions more costly than in other jurisdictions.

— Indeed, a lower level of emissions may require greater investments and the use of more expensive technologies to further reduce emissions.

However, Québec's lead can provide a valuable competitive advantage in a context where financial markets and consumers increasingly value climate-responsible businesses.

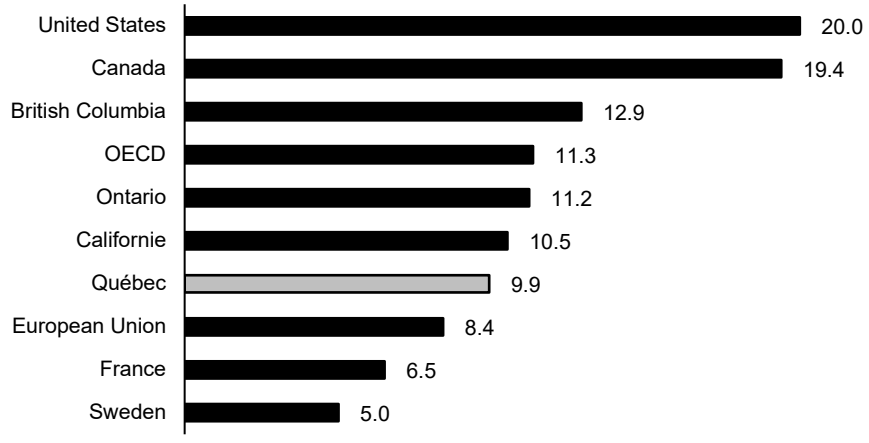
The Québec government will therefore continue to assert its leadership in the fight against climate change and to set an example by reducing its carbon footprint.

— The decarbonization of Québec cannot be fully achieved, however, without the participation of society as a whole.

In order to monitor progress and efforts to achieve its climate objectives, the Québec government has committed to regularly updating its GHG emission projections based on the most recent information available.

CHART 3

GHG emissions in Québec and elsewhere around the world – 2019
(tonnes of CO_2 equivalent per capita)



Sources: United Nations, World Bank, Organisation for Economic Co-operation and Development, Eurostat, California Air Resources Board, Statistics Canada, Environment and Climate Change Canada, Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

GHG emission projections: Models and projection scenarios

The Ministère des Finances du Québec and the Ministère de l'Environnement et de la Lutte contre les changements climatiques have used a combination of two models to estimate GHG emission projections, technical reduction potentials, and the economic impacts of the fight against climate change.

– The general equilibrium model of the Ministère des Finances du Québec for the environment (MEGFQ-E) provides a macroeconomic perspective of the fight against climate change and shows the impacts of the CAT system and investments made on the economy and GHG emissions in Québec.

– The energy system for Québec, the environment, climate and electricity model (SEQUENCE) provides a technical perspective of the various technological and energy choices that can be made to reduce GHG emissions.

These models are used together to study the interrelationships between the economy and the fight against climate change.

The MEGFQ-E

The MEGFQ-E is an elaborate system of equations presenting the main interrelationships in the Québec economy.

– The model details the entire structure of the economy and the CAT system, and therefore takes into account interactions between economic agents (households, businesses and governments) as well as feedback effects between markets.

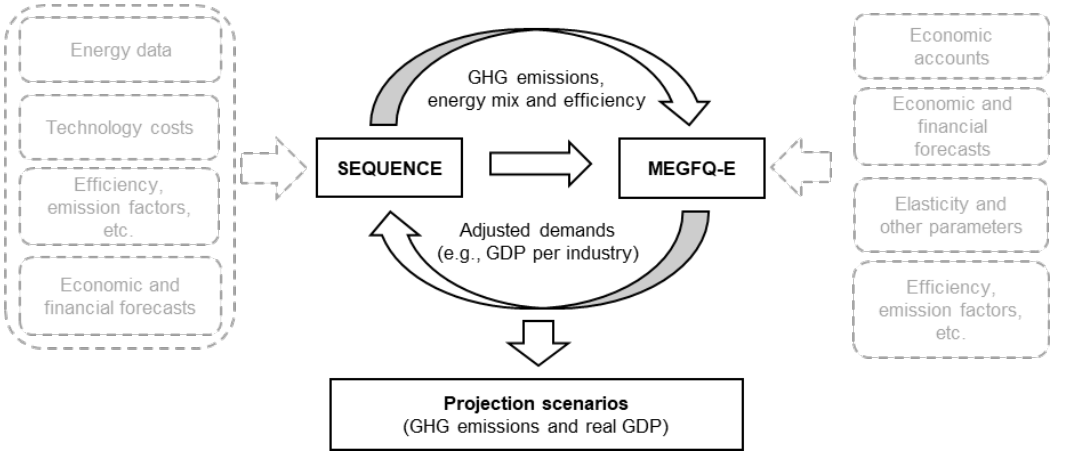
– Prices and quantities adjust to balance all markets simultaneously, in particular the labour and goods and services markets. Households and businesses adjust to changes in the economy.

The SEQUENCE Model

The SEQUENCE model is a very comprehensive energy optimization tool that produces, in particular, a projection of GHG emissions over the long term and measures different reduction potentials to meet the 2030 target.

– It mainly takes into account anticipated technological advances, efficiency in manufacturing processes, the expected level of economic activity in different sectors and the prices of different forms of energy.

Representation of the models used



Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

GHG emission projections: Models and projection scenarios (cont.)

Three separate simulations have been carried out to support the Québec government's decision making in the fight against climate change.[1]

– The **disengagement scenario** illustrates the possible evolution of GHG emissions, taking into account economic growth and improvements in technology, without government interventions from the year 2021.

– The **reference scenario** shows the expected level of GHG emissions, depending on the effect of actions taken in Québec to fight climate change.

– The **technological potential scenario** assumes that the 2030 target will be reached and illustrates, from a technological point of view, the least costly ways to achieve the required reductions (optimization).

The disengagement scenario

The disengagement scenario makes it possible to evaluate the projected level of GHG emissions in the absence of government actions to fight climate change (e.g., CAT system, measures, regulations) as of the year 2021. This is a theoretical scenario that provides a snapshot of the potential effort required to achieve the reduction targets, primarily considering:

– the economic growth forecast by the Ministère des Finances du Québec;

– improvements in technology.

The scenario includes emission reductions that would have occurred without government intervention (e.g., purchase of electric vehicles and new equipment).

The reference scenario

The reference scenario takes into account the initiatives put in place to fight climate change. The projection mainly illustrates the effects in Québec of:

– the CAT system and the measures for which funding is provided under the implementation plans of the 2030 Plan for a Green Economy;[2]

– regulations in force or in the process of being put in place, as well as the actions of the federal government and municipalities.

In particular, the models used take into account the interrelationships between the CAT system and the measures and regulations put in place, avoiding double counting of GHG emission reductions.

The technological potential scenario

The technological potential scenario illustrates, according to current knowledge, the least costly emission reductions that would allow the 2030 target to be reached in Québec. It is a theoretical scenario that gives an idea of the best way to reduce emissions from a technological point of view (optimization).

However, it does not fully take into account some elements that could influence the timeframe for achieving reductions, such as the time required to implement these technologies and to bring about sustainable behavioural changes in households and businesses (e.g., choosing to use public transit).

What are the main sources of data for the models?

The models are based on data from the Québec inventory of greenhouse gas emissions, but also from other sources of information, such as Statistics Canada, Environment and Climate Change Canada, Natural Resources Canada and the Société de l'assurance automobile du Québec.

1 See Appendix 1 for a list of key projection risks.
2 To project emissions to 2030, it is assumed that climate change investments will continue over the 2027-2030 period within similar parameters to those presented for the 2021-2027 period.

GHG emission projections: Models and projection scenarios (cont.)

The federal government's 2030 Emissions Reduction Plan

Throughout the document, estimates are based on the most recent information available as of March 1, 2022.

– Therefore, the projections do not take into account information published since that date, such as Hydro-Québec's Strategic Plan 2022-2026 and the federal government's Emissions Reduction Plan.

On March 29, 2022, the federal government released the *2030 Emissions Reduction Plan – Canada's Next Steps for Clean Air and a Strong Economy*.

This plan outlines the federal government's roadmap for achieving Canada's GHG emission reduction target of 40% to 45% below 2005 levels by 2030.

The Québec government acknowledges the federal government's ambition to reduce GHG emissions and expects the federal government to put in place the means to achieve the objectives of the plan, in collaboration with the Québec government.

1. ECONOMIC GROWTH: AN UPWARD EFFECT ON GHG EMISSIONS BY 2030

Economic and population growth is generally accompanied by increases in household consumption and business output, which can lead to increased GHG emissions.

— However, the effect of this increase on GHG emissions is mitigated by the continuous improvement of energy efficiency and practices in the economy, as well as by equipment replacement.

Therefore, according to the expected economic growth and improvements in technology (disengagement scenario),[2] it is estimated that Québec's GHG emissions could increase by nearly 0.9 Mt between 2019 and 2030, to reach 85.2 Mt. This increase would result from:

— an increase in emissions in the transportation sector (0.7 Mt), while the effect of the increase in the vehicle fleet would be mitigated by a greater use of electric vehicles, which will become more affordable and more accessible;

— an increase in GHG emissions in the industrial sector (1.3 Mt), due to increased production in several sectors;

— a decrease in emissions in the other sectors, mainly in the buildings sector (−1.0 Mt), where the conversion of residential heating systems to electricity is expected to continue.

TABLE 1

GHG emissions projection – Disengagement scenario
(millions of tonnes of CO_2 equivalent)

	Level				Change
	1990	**2019**	**2025**	**2030**	**2019-2030**
Transportation	27.1	36.5	35.4	37.2	0.7
Industry(1)	33.5	25.0	25.8	26.3	1.3
Buildings	11.2	8.4	7.6	7.4	−1.0
Waste	7.9	6.6	6.4	6.4	−0.2
Agriculture	6.9	7.8	7.8	7.8	—
TOTAL	**86.7**	**84.3**	**83.1**	**85.2**	**0.9**

Note: The disengagement scenario illustrates the potential evolution of GHG emissions without government interventions from the year 2021 onward, primarily taking into account economic growth and improvements in technology. These estimates are based on the most recent information available as of March 1, 2022, as well as the 2022-2023 budget economic forecast. Totals may not add due to rounding.
(1) This sector includes emissions from electricity generation and distribution.
Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

[2] A description of the scenarios is presented in the box on page 6. The scenarios were estimated by the Ministère de l'Environnement et de la Lutte contre les changements climatiques and the Ministère des Finances du Québec. Several organizations were consulted in December 2021 as part of this work, including the Ministère de l'Économie et de l'Innovation, the Ministère de l'Énergie et des Ressources naturelles, the Ministère des Forêts, de la Faune et des Parcs, the Société du Plan Nord, and Hydro-Québec.

A 3% reduction in GHG emissions in Québec between 1990 and 2019

According to the Québec inventory of greenhouse gas emissions published in December 2021,[1] GHG emissions in Québec decreased by 3% between 1990 and 2019. This result is mainly due to:

– a 23% reduction in industrial emissions, attributable among other things to the gradual replacement of industrial equipment and manufacturing processes, plant modernization, the increasing use of renewable or less emissive energy, as well as efficiency gains and production adjustments;

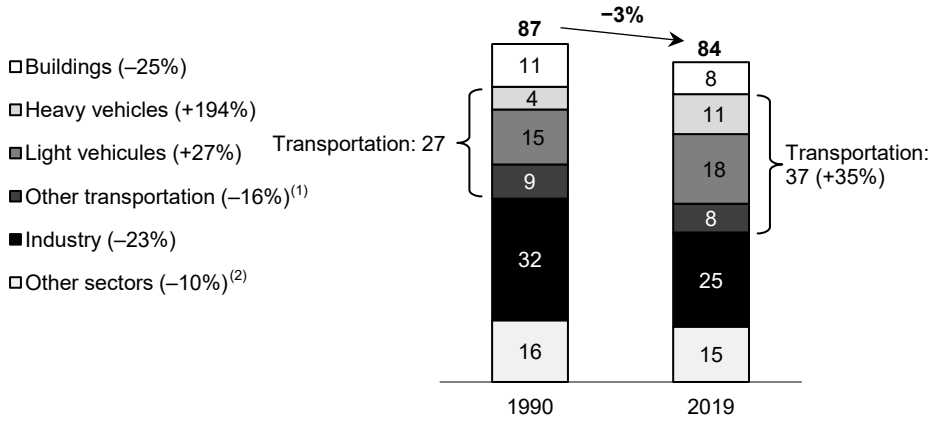
– a 25% decrease in emissions from the residential, commercial and institutional buildings sector, primarily due to the electrification of residential heating and improved energy efficiency;

– a 35% increase in emissions from the transportation sector, which is primarily due to:

  ▪ a 194% growth in emissions related to heavy vehicles, used primarily for the transportation of goods,

  ▪ a 27% increase in emissions related to light vehicles, mainly due to the growing use of sport utility vehicles.

GHG emissions in Québec – 1990 and 2019
(millions of tonnes of CO_2 equivalent, unless otherwise indicated)



Note: Totals may not add due to rounding.
(1) Other transportation includes, in particular, air, rail and sea.
(2) Other sectors include agriculture, waste and electricity.
Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

1 MINISTÈRE DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES, *GES 1990-2019 : inventaire québécois des émissions de gaz à effet de serre en 2019 et leur évolution depuis 1990*, 2021.

Main revisions from the 2020-2021 budget's disengagement scenario

The last projection of Québec's GHG emissions, made public in the 2020-2021 budget, indicated an emissions level of 83.3 Mt in 2030, taking into account economic growth and the evolution of technologies (the disengagement scenario).

However, various adjustments have been made to the projections to take into account updated historical data and changes in the economic context since March 2020.

An upward revision of approximately 5 Mt to the historical level of GHG emissions inventory since the 2020-2021 budget

The level of GHG emissions projected under the disengagement scenario has been increased to 85.2 Mt in 2030. This revision is primarily the result of two factors.

On the one hand, historical data on energy use and emissions in the waste sector have been revised by the organizations that produce these statistics, resulting in upward adjustments to Québec's GHG emissions (+4.7 Mt in 2017).

On the other hand, the energy consumption and production levels of the economy have been revised downwards in the long term (−2.8 Mt in 2030), mainly due to:

– changes in economic conditions and the impact of the COVID-19 pandemic on household and business habits;

– other factors, related in particular to changes in technology costs.

Main revisions to GHG emissions projections in the disengagement scenario since the 2020-2021 budget
(millions of tonnes of CO_2 equivalent)

	1990	2017	2030
Scenario in Budget 2020-2021	**86.1**	**78.6**	**83.3**
Revisions			
Historical data	0.6	4.7	4.7
Economic forecast	—	—	−2.8
Subtotal – Revisions	**0.6**	**4.7**	**1.9**
TOTAL	**86.7**	**83.3**	**85.2**

Note: These estimates are based on the most recent information available as of March 1, 2022, as well as the 2022-2023 budget economic forecast. Totals may not add due to rounding.
Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

2. THE 2030 TARGET: WHERE ARE WE NOW?

2.1 Planned actions make it possible to reach 51% of the target

In the absence of government action to combat climate change, it is estimated that Québec's GHG emissions could reach 85.2 Mt in 2030, given projected economic growth and the trend in technology.

To reach the 2030 reduction target in Québec would require a GHG emission level of 54.2 Mt. This means that a reduction of 31.0 Mt would be required in 2030.

In this regard, it is estimated that all the actions planned in Québec to fight climate change will lead to a reduction of 15.9 Mt of GHG emissions in 2030, which represents 51% of the required effort.

— This is an improvement over the 42% figure presented in the fall of 2020, when the 2030 Plan for a Green Economy was published. This increase is primarily due to new measures announced and implemented since its release.

The expected reductions should result from:

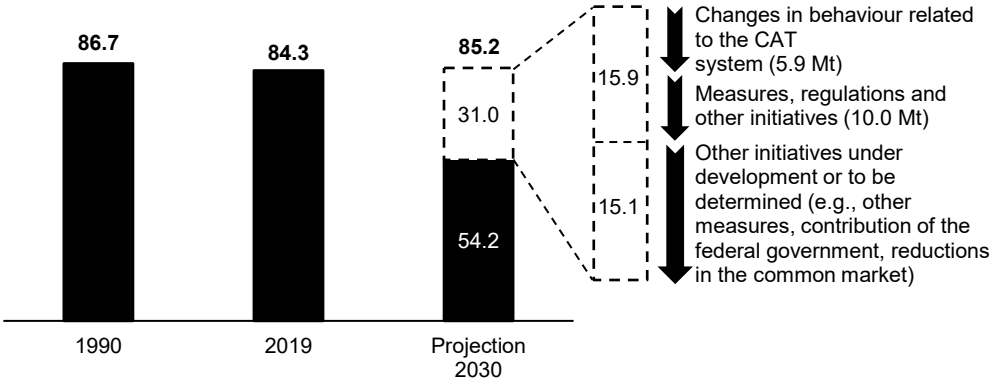
— the effect of the price signal induced by the CAT system on changes in household and business behavior in Québec (5.9 Mt);

— measures, regulations and other initiatives planned, in particular under the 2022-2027 implementation plan of the 2030 Plan for a Green Economy (10.0 Mt).[3]

Remaining reductions could come from, among other things, annual enhancements to the implementation plans of the 2030 Plan for a Green Economy, the expected contribution of the federal government, as well as reductions achieved in the common market of the CAT system.

CHART 4

Changes in GHG emissions and reductions needed to meet the 2030 target
(millions of tonnes of CO_2 equivalent)



Note: These estimates are based on the most recent information available as of March 1, 2022, as well as the 2022-2023 budget economic forecast. It is assumed that climate change investments will continue over the 2027-2030 period within similar parameters to those presented for the 2021-2027 period.
Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

[3] See Appendix 3 for the list of actions included in the reference scenario.

Québec's CAT system: An effective price signal that generates GHG emission reductions

Like other jurisdictions around the world, Québec has made carbon pricing a central component of its climate change strategy.

– Carbon pricing is fundamental to accelerating the decarbonization of the economy, as it generates a price signal that encourages more carbon-efficient behaviour.

Among the possible systems for pricing carbon on its territory, Québec has favored the implementation of a CAT system.

– This economic tool is based on the principle of a market where GHG emission allowances are traded.

– The number of allowances is controlled by government authorities and the system limits the quantity of emissions allowed (emission caps).

– The price evolves according to the interaction between supply (the GHG emission caps set by the government) and demand (GHG emissions).

In Québec, this system came into effect in 2013 and has been linked to the Californian system since 2014. It mainly targets fuel distributors (transportation and buildings sectors) as well as large industrial businesses.

Achieving the desired reductions at the lowest cost

From an economic standpoint, the CAT system is the most efficient way to reduce GHG emissions.

– It allows for reductions in the sectors covered by the system, while letting households and businesses choose the best way to achieve them.

In addition, the system is linked with California's system, allowing the two governments to pool their reduction targets and giving all businesses within the market the opportunity to trade emission allowances.

– Both Québec and California have set significant emission reduction targets for 2030; 37.5% and 40% below their 1990 levels, respectively.

The creation of a joint market will help Québec and California meet their climate objectives at the lowest cost.

– Having a common carbon price means that the least costly reductions are achieved first, regardless of where they originate, thereby reducing the economic impact of addressing climate change.

❑ Transportation: 48% of projected reductions for 2030

Taking into account all of the actions planned in Québec to fight climate change, emissions from the transportation sector are expected to be 29.6 Mt in 2030, a level 7.6 Mt lower than in the disengagement scenario (48% of the 15.9 Mt reductions expected in 2030).

Besides the incentive effect of the CAT system, the projected decrease in GHG emissions in this sector would be primarily due to:

— the increase in the target for electric vehicles on Québec roads to 1.6 million vehicles in 2030;

— the adoption of the regulation respecting the integration of low-carbon-intensity fuel content, which sets a minimum renewable fuel content of 15% for gasoline and 10% for diesel in 2030;

— the Roulez vert program, which provides a rebate for the purchase of electric vehicles;

— the gradual electrification of the Québec government's fleet of vehicles, as well as taxis and school and city buses.

❑ Industry: 35% of projected reductions for 2030

Emissions in the industrial sector are also expected to decrease by 5.6 Mt compared to the disengagement scenario (35% of the 15.9 Mt reductions expected in 2030), to a level of 20.8 Mt in 2030.

These reductions would result mainly from:

— continued action on the industrial sector, including the ÉcoPerformance and Bioénergies programs;

— regulations, in particular the one aimed at increasing the share of renewable natural gas (RNG) in Québec's natural gas consumption[4] and the one on halocarbons;

— the new free allowance rules proposed by the Québec government for the 2024-2030 period under the CAT system, which target large industrial businesses.[5]

[4] Current regulations provide that the share of renewable natural gas in natural gas consumption should reach 5% in 2025. This proportion could be increased to 10% in 2030.

[5] According to the proposed regulatory amendment determining the rules for free allowances for the period 2024-2030.

❑ Nearly 20% of the projected reductions in 2030 will come from other sectors

In the other sectors, the measures implemented are expected to result in emission reductions of 2.8 Mt in 2030 compared to the disengagement scenario.

Measures targeting emissions from buildings (residential, commercial, and institutional sectors) are expected to reduce emissions by 2.0 Mt in 2030. This reduction would result primarily from:

— the continuation of the ÉcoPerformance (commercial and institutional buildings component) and Chauffez vert programs, as well as the support measure for the conversion from natural gas to electricity and dual energy for peak management;

— the regulation respecting oil heaters, which aims to ban the use of oil for residential heating;

— the gradual electrification of the government's building stock.

It is also estimated that the planned measures will result in a decrease in GHG emissions from the waste sector of 0.4 Mt in 2030 compared to the level projected in the disengagement scenario.

— This result is largely due to the measures resulting from the strategy to maximize the valorization of organic matter and the Québec Residual Materials Management Policy.

Finally, reductions of 0.4 Mt should be observed in the agricultural sector, mainly due to better management of nitrogen fertilizers.

TABLE 2

GHG emissions projection – Reference scenario

(millions of tonnes of CO_2 equivalent, unless otherwise indicated)

	Level			Reductions expected in 2030[2]	
	2019[1]	**2025**	**2030**	**(Mt)**	**(%)**
Transportation					
Light vehicules	17.7	14.9	13.0	4.0	25.3
Heavy vehicules	8.4	7.0	6.7	1.5	9.5
Other transportation[3]	10.4	9.9	9.9	2.1	12.9
Subtotal – Transportation	**36.5**	**31.9**	**29.6**	**7.6**	**47.7**
Industry					
Pulp and paper	1.4	1.3	0.9	0.6	3.5
Chemicals and refineries	3.4	3.0	2.5	1.2	7.4
Mining, pelletizing, metallurgy and aluminum	9.0	9.2	8.7	1.0	6.4
Cement and lime	3.9	4.1	3.9	0.6	4.0
Other industries[4]	7.3	5.8	4.8	2.1	13.5
Subtotal – Industry	**25.0**	**23.5**	**20.8**	**5.6**	**34.9**
Buildings	**8.4**	**6.7**	**5.4**	**2.0**	**12.5**
Waste	**6.6**	**6.3**	**6.0**	**0.4**	**2.5**
Agriculture	**7.8**	**7.7**	**7.5**	**0.4**	**2.3**
TOTAL	**84.3**	**75.9**	**69.3**	**15.9**	**100.0**

Note: These estimates are based on the most recent information available as of March 1, 2022, as well as the 2022-2023 budget economic forecast. It is assumed the price of the CAT system allowances will reach $97 in 2030, consistent with private sector estimates, and that climate change investments will continue over the 2027-2030 period within similar parameters to those presented for the 2021-2027 period.

(1) Due to the different sources of data used, there may be discrepancies between the GHG emissions presented and the Québec inventory of greenhouse gas emissions.

(2) Reductions in millions of tonnes compared to the 2030 disengagement scenario and percentage distribution of reductions relative to the total reductions estimated in the reference scenario. Emission reductions that would have occurred without government intervention (the disengagement scenario) are therefore not included in the reductions presented.

(3) Other transportation includes primarily off-road vehicles as well as rail, sea, and air transportation.

(4) Other industries include electricity, construction, forestry, non-ferrous metal (except aluminum) production and processing, and other manufacturing (e.g., electronics manufacturing, glass product manufacturing, plastics, and rubber product manufacturing).

Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

2.2 A positive effect on the Québec economy

In addition to reducing GHG emissions, the actions implemented will have an overall positive effect on the economy. This effect stems from two distinct mechanisms.

- On the one hand, the CAT system induces a price signal on carbon, which reduces real GDP, but also hydrocarbon imports.

- On the other hand, revenues from the CAT system are reinvested in the Québec economy through the measures included in the implementation plans of the 2030 Plan for a Green Economy.

It is estimated that the CAT system and all the actions implemented in Québec to fight climate change would have a beneficial effect of $2.2 billion on Québec's real GDP in 2030. This effect would result from:

- a $2.0-billion increase in investments, mainly due to public investments under the implementation plans of the 2030 Plan for a Green Economy and the purchase of emission reduction technologies by businesses;

- a $1.6-billion increase in consumption, mainly due to an expected increase in household disposable income, driven by the positive impact of investments in Québec in sectors related to the climate transition;

- a $1.4-billion decrease in net exports.

  - This would be mainly due to an increase in imports, as a result of higher consumption and investments, particularly in the context of the implementation plans of the 2030 Plan for a Green Economy.

  - The total increase in imports would be limited, however, by a decline in hydrocarbon imports estimated at $1.2 billion, which would contribute positively to real GDP.

  - Moreover, the effect on net exports is expected to be positive in the long run, as investments related to GHG emission reductions will have been made and hydrocarbon imports will be lower.

TABLE 3

Economic impacts in 2030 of investments made under the implementation plans of the 2030 Plan for a Green Economy
(billions of dollars, in real terms, unless otherwise indicated)

	Measures under the Plan	CAT system price signal	Total
Consumption	2.3	−0.7	1.6
Investment	2.5	−0.5	2.0
Net exports	−1.4	—	−1.4
Government spending	—	—	—
TOTAL – GDP	**3.4**	**−1.3**	**2.2**
Household disposable income	*3.0*	*−1.0*	*2.1*

Note: These estimates are based on the most recent information available as of March 1, 2022, as well as the 2022-2023 budget economic forecast. It is assumed that climate change investments will continue over the 2027-2030 period within similar parameters to those presented for the 2021-2027 period.
Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

Projection models: A decision-making tool

Models represent a simplification of reality and aim to facilitate the understanding of complex phenomena.

They are therefore tools to help the government make decisions. However, other factors must also be taken into account when making a decision, such as social acceptability, the impact on more vulnerable populations, and the economic, legal and political context in Québec and around the world.

Technological potentials: providing insight into the path to take and the obstacles to decarbonization

Technological reduction potentials illustrate, according to current knowledge, the least costly emission reductions that would make it possible to achieve a particular GHG emission reduction target in Québec.

– The potentials are the result of a mathematical approach to optimizing Québec's energy system, taking into account different variables such as economic forecasts, prices of different forms of energy, and the costs and availability of technologies.

– They do not fully take into account certain elements that could influence the timeframe for achieving reductions, such as the time required to bring about sustainable behavioural changes from households and businesses (e.g., choosing to use public transit).

By indicating the most effective technologies for reducing GHG emissions, the technology potentials provide insight into the best pathway to achieve the 2030 target at the lowest cost.

Estimating technology potential also helps in identifying barriers and constraints to decarbonization, thereby guiding government action to address these issues.

3. THE TRAJECTORY TOWARDS THE 2030 TARGET

It is estimated that all the actions planned to date will make it possible to achieve 51% of the reductions required to reach the 2030 target in Québec.

In addition, the 54.2 Mt target could be achieved by prioritizing the least costly technologies to reduce emissions and by adapting our lifestyles.

The optimal trajectory for achieving these reductions can be illustrated using the technological potentials for reduction.

- The technological potentials make it possible to identify, according to current knowledge, the distribution of emission reductions that would allow us to reach the 2030 target at the lowest cost.

- These potentials can vary between sectors and over time, depending, in particular, on the cost of available reduction technologies and the capacity of businesses and households to adopt them.

Based on the modeling performed, it is estimated that in 2030:

- the transportation sector would account for nearly 50% of the 31 Mt of technological potential for reduction in the economy as a whole, primarily through the electrification of transportation and the use of bioenergy;

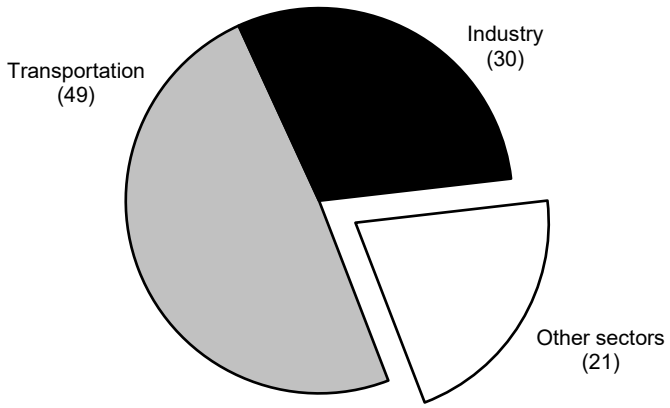
- the industrial sector would account for 30% of the total reductions to meet the target at the lowest cost, for example through greater energy efficiency and the use of various less emissive technologies (e.g., electrification and RNG);

- other sectors (buildings, waste and agriculture) would represent more than 20% of the potential.

    - This proportion would be driven by increased electrification in the buildings sector, but also by increased energy recovery from waste and improved agricultural practices.

CHART 5

Distribution of technological potential for reduction in 2030 by sector
(percentage of the reduction potential in 2030 compared to the disengagement scenario)



Note: These estimates are based on the most recent information available as of March 1, 2022, as well as the 2022-2023 budget economic forecast.
Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

❑ An approach consistent with technological potentials for reduction

When developing the implementation plans of the 2030 Plan for a Green Economy, the Québec government adopted an approach consistent with the assessment of technological potentials.

It is believed that all the actions implemented in Québec to fight climate change will mainly generate reductions in the sectors where the technological potential is greatest, that is:

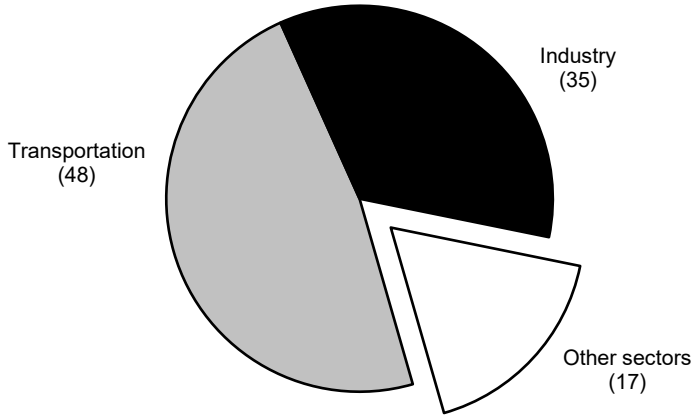
— the transportation sector, with 48% of the 15.9 Mt of reductions projected for 2030;

— the industrial sector, with 35% of the projected reductions.

This approach is in line with the government's desire to maximize the effect of the various measures to fight climate change on the reduction of GHG emissions in Québec.

CHART 6

Distribution of GHG emissions reductions from actions to fight climate change by sector in 2030
(percentage of total reductions in the reference scenario compared to the disengagement scenario in 2030)



Note: These estimates are based on the most recent information available as of March 1, 2022, as well as the 2022-2023 budget economic forecast. It is assumed that climate change investments will continue over the 2027-2030 period within similar parameters to those presented for the 2021-2027 period.
Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

CONCLUSION

Québec wants to reach the target of reducing GHG emissions by 37.5% in 2030 compared to the 1990 level by maximizing the reductions achieved on its territory.

The actions implemented in Québec to fight climate change should make it possible to achieve 51% of the reductions required to reach the 2030 target in Québec.

— These actions represent a step towards achieving the target and will continue to be enhanced as part of the annual update of the implementation plans of the 2030 Plan for a Green Economy.

In addition, Québec wants to be carbon neutral by 2050. Steps have already been taken in this direction. For example, Québec:

— joined the United Nations' Race to Zero campaign in April 2021, the members of which are committed to achieving carbon neutrality by 2050;

— signed the revised version of the Global Climate Leadership Memorandum of Understanding (Under 2 MOU) in November 2021, through which it now commits to achieving carbon neutrality as soon as possible.

The Québec government will continue to assert its leadership in the fight against climate change and to set an example by reducing its carbon footprint.

— However, the full decarbonization of Québec will only be possible with the participation of society as a whole.

— Québec's households, businesses and municipalities, through their individual and collective choices, will make the transformation possible.

APPENDIX 1: MAIN RISKS THAT MAY INFLUENCE THE ACTUAL EVOLUTION OF EMISSIONS

The models used to produce the GHG emission projection scenarios and the economic impact analyses are based on several assumptions. These assumptions are associated with risks that could influence the actual evolution of GHG emissions.

❑ A different evolution of economic growth

The simulations are based on the most recent economic and financial projections of the Québec government for the various sectors of the economy, as of March 1, 2022.

However, a different evolution of economic growth or financial variables over the next few years could have an influence on the economic impacts as well as on Québec's GHG emissions. In particular:

— the extent of the effects of the COVID-19 pandemic on household and business behaviour remains a significant source of uncertainty;

— Russia's invasion of Ukraine could affect economic growth in Québec as well as in the rest of the world.

❑ A different evolution of prices

The simulations are based on a GHG emission allowance price scenario consistent with private sector projections.

However, the evolution of prices will depend on technological innovations, the eventual addition of new partners to the carbon market and the measures taken by the various participating governments.

— Indeed, the pace at which new GHG emission reduction technologies are developed and adopted will greatly influence the cost of achieving the targets.

— Also, the addition of new partners to the carbon market could influence prices, depending on how easily they are able to reduce their GHG emissions to meet their climate targets.

As such, a higher (or lower) price would amplify (or mitigate) the impacts of all climate change measures in Québec.

As with the price of emission allowances in the carbon market, the projections presented in this document are also based on assumptions about the evolution of other prices in the economy by 2030, particularly those of commodities.

— This evolution will depend mainly on the supply and demand relationship in each of the markets.

For example, Russia's invasion of Ukraine could:

— put upward pressure on oil and natural gas prices, which could make electricity prices relatively more attractive and accelerate the electrification of the economy;

— lead to an increase in the price of metals, which could lead to a slower decline in the price of some technologies.

❑ Updating statistical data

Analyses are based on the best statistical data available at the time of the projection scenarios.

The historical data used to estimate GHG emissions are constructed from information provided by statistical agencies and other organizations.

— However, there is a high level of uncertainty regarding this information, despite significant advances in the accuracy of the data published in recent years.

— As a result, these data are revised frequently, which can greatly affect the estimates.

Moreover, data on technologies and their costs come from various information sources, such as specialized agencies and scientific articles.

— Knowledge about future technologies evolves very quickly, which requires regular adjustments to the GHG emission projections and the evaluation of expected reductions.

❑ Technological advances

The GHG emission projections and economic impacts presented are based on assumptions about the improvement of technologies by 2030.

For example, in the reference scenario, the adoption of lower-emitting technologies occurs when it becomes economically advantageous given the decreasing cost of technologies, increasing carbon pricing and government financial support.

However, there can be a great deal of uncertainty associated with them.

— As a result, new technologies may emerge that will result in greater emission reductions by 2030.

— Conversely, delays in the development of certain technologies could result in lower-than-expected emission reductions.

Moreover, in the models, electricity generation is adjusted to optimize the set of technology choices in the economy, particularly with respect to their costs.

— However, a lower level of electricity generated in Québec could also influence the different scenarios.

❑ Public and business support for the fight against climate change

The models used are based on assumptions about the structure of the economy and the behaviour of households and businesses.

However, the fight against climate change requires the contribution of all sectors of the economy and the population.

Therefore, a greater or lesser degree of commitment to the fight against climate change on the part of households and businesses could influence the level of emissions.

❑ The external environment

Changes in the external environment can have a significant impact on GHG emissions and economic benefits in Québec.

For example, the implementation of climate change policies in several regions could lead to:

— an increase in global demand for more carbon-efficient products, which would increase the price of these products on international markets;

— accelerated development of certain technologies, which could increase their availability and uptake.

In addition, higher global carbon pricing or the implementation of border adjustment mechanisms for carbon would affect the economy and the level of GHG emissions.

❑ Full utilization of budgets allocated to fight climate change

The projections presented are based on the assumption that the totality of the budgets allocated to the fight against climate change are used.

— GHG emissions could therefore be higher if some of the programs put in place by different governments are not used to their full potential.

In addition, there is uncertainty at this time about the measures that will be put in place by the federal government and municipalities to fight climate change.

APPENDIX 2: SENSITIVITY ANALYSIS

GHG emission projections are based on various economic, financial and technological assumptions. These must be updated periodically to reflect changes in the economic environment and scientific knowledge.

— Such revisions have a direct influence on the GHG emission projections and the evaluation of the reductions achieved.

Therefore, analyses have been carried out to assess the sensitivity of the results to changes in certain assumptions.

❑ The reference scenario

In this document, it is estimated that all the actions planned in Québec to fight climate change will lead to a reduction in GHG emissions of 15.9 Mt in 2030, which corresponds to a GHG emission level of 69.3 Mt in 2030 (reference scenario).

This estimate is based on a set of assumptions, including:

— the price of the CAT system emission allowances reaching $97 per ton in 2030, which is consistent with private sector forecasts;

— reinvestment of the CAT system revenues in the Québec economy through the measures provided for in the implementation plans of the 2030 Plan for a Green Economy;

— a progressive decrease in the cost of technology;

— economic growth consistent with the economic forecasts in the 2022-2023 budget.

■ GHG emissions could be lower if…

Projected GHG emissions could decline more rapidly to 65.1 Mt in 2030 if, for example:

— the cost of GHG emission reduction technologies was 10% lower on average in 2030 than in the reference scenario;

— the demand for road transportation and agriculture in 2030 was 10% lower than projected;

— energy efficiency of building heating was 10% higher than projected;

— the price of emission allowances on the CAT system increased more rapidly, reaching its ceiling in 2030 ($155 per tonne) and leading to greater changes in consumption and production practices.

■ GHG emissions could be higher if…

Projected GHG emissions could also decline less rapidly to 75.2 Mt in 2030 if, for example:

— the cost of GHG emission reduction technologies was 10% higher on average in 2030 than in the reference scenario;

— the demand for road transportation and agriculture in 2030 was 10% higher than projected;

— energy efficiency of building heating was 10% lower than projected;

— the price of emission allowances on the CAT system increased more slowly, reaching its minimum in 2030 ($42 per tonne) and leading to less significant changes in consumption and production practices.

APPENDIX 3: LIST OF ACTIONS MODELLED IN THE REFERENCE SCENARIO

TABLE 4

Main actions modelled in the reference scenario

Global	Cap-and-trade system for greenhouse gas emission allowances (CAT system)
Transportation	**Programs**
	– Roulez vert – Transportez vert – Écocamionnage – Government assistance program to improve the efficiency of maritime, air and rail transport (PETMAF)
	Regulations
	– Increasing the target for electric vehicles on Québec roads to 1.6 million vehicles by 2030 – Regulation respecting the integration of low-carbon-intensity fuel content into gasoline and diesel fuel
	Other initiatives
	– Electrification of 65% of the school bus fleet and 55% of city buses by 2030 – Electrification of the government fleet – Increasing the availability of public transit services
Industries	**Programs**
	– ÉcoPerformance – ÉcoPerformance for large emitters – Bioénergies – Défi GES – Assistance measure for the decarbonization of Québec's industrial sector (MADI) – Québec green hydrogen and bioenergy strategy – Net Zero Accelerator (federal government initiative)
	Regulations
	– Regulation concerning the minimum volume of renewable natural gas in natural gas supplies in Québec (10% in 2030) – Regulation respecting halocarbons – Free allowance rules 2024-2030 for large industrial businesses under the CAT system, including the consignment of emission allowances
	Other initiatives
	– Renewable energy supply of 70% for Hydro-Québec's off-grid systems in 2025

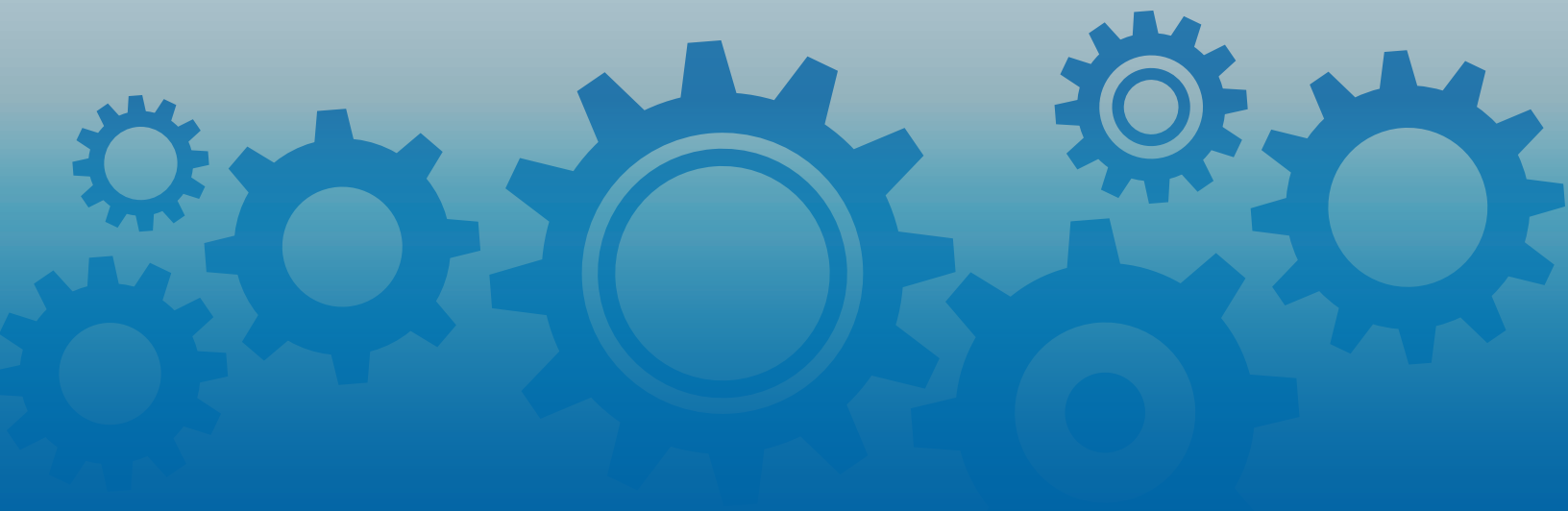
Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.

TABLE 4

Main actions modelled in the reference scenario (cont.)

Buildings	**Programs**
	– Chauffez vert – ÉcoPerformance (commercial and institutional components) – Waste heat recovery
	Regulations
	– Regulation respecting oil heating appliances for the residential market
	Other initiatives
	– Net-zero government buildings in 2040 – Support for conversion from natural gas to electricity and dual fuel for peak management
Other	**Agriculture**
	– Sustainable Agriculture Plan – Developing, operationalizing and expanding the use of practices and technologies that reduce methane emissions from livestock
	Waste
	– Strategy to maximize the valorization of organic matter – Québec Residual Materials Management Policy

Sources: Ministère de l'Environnement et de la Lutte contre les changements climatiques and Ministère des Finances du Québec.



Québec