Impacts of climate change on Canada's electricity system

Prepared for the Canadian Institute for Climate Choices

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SUBMITTED BY

Navius Research Inc.
Box 48300 Bentall
Vancouver BC V7X 1A1

Brianne@NaviusResearch.com

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About Us

Navius Research Inc. is an independent and non-partisan consultancy based in Vancouver. We operate proprietary energy-economy modeling software designed to quantify the impacts of climate change mitigation policy on greenhouse gas emissions and the economy. We have been active in this field since 2008 and have become one of Canada's leading experts in modeling the impacts of energy and climate policy. Our analytical framework is used by clients across the country to inform energy and greenhouse gas abatement strategy.

We are proud to have worked with:

- Most provincial and territorial governments, as well as the federal government.
- Utilities, industry associations and energy companies.
- Non-profit and research organizations with an interest in energy, climate change and economics.

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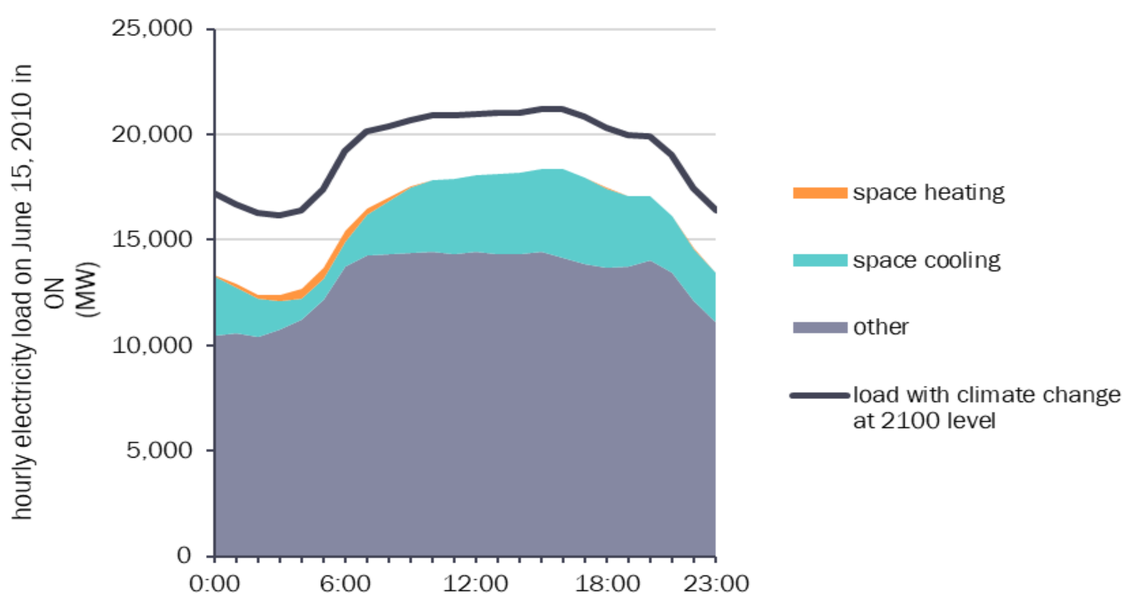
Executive Summary

Canada's electricity system is expected to be impacted as temperatures increase with climate change due to increases in demand for space cooling, decreases in demand for space heating, and a change in the frequency and intensity of peak electricity demand. This study uses seven general circulation models and two representative concentration pathways to project temperature change across Canada under fourteen potential climate change scenarios. Navius' energy-economy model (gTech) and electricity model (IESD) are then used to project heating and cooling demand, peak load, and electricity expenditure by region across Canada under each scenario, compared to a reference case scenario in which no climate change occurs.

Results indicate three key impacts of climate change on Canada's electricity system:

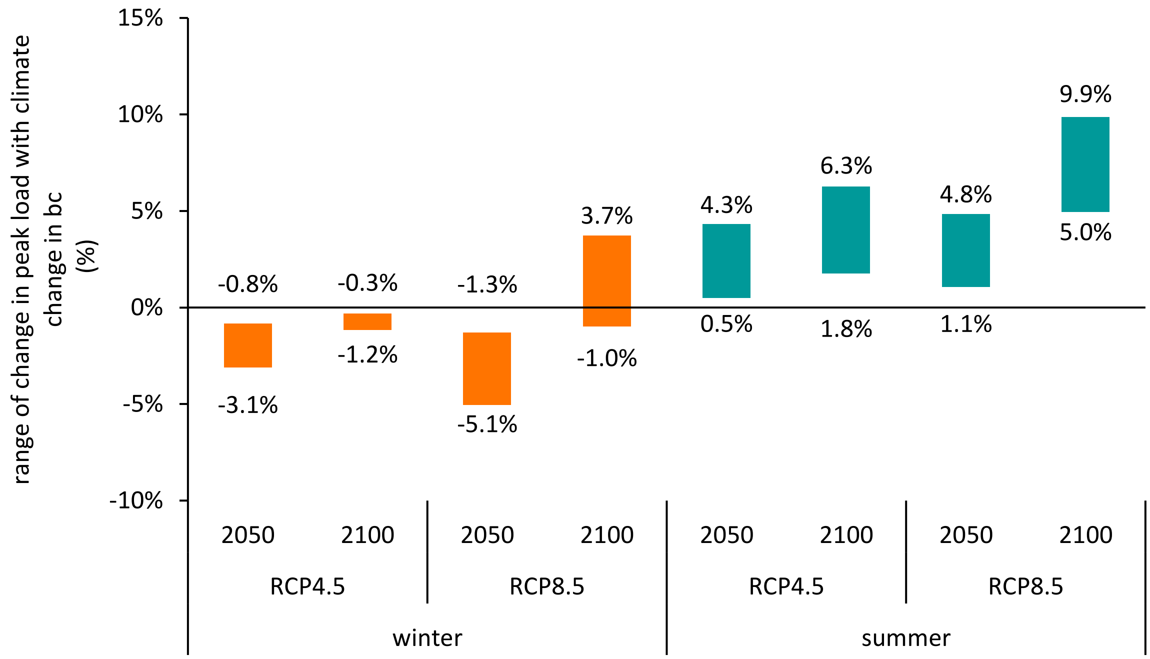
- First, overall electricity demand for space heating and cooling is expected to increase by 0.4 - 4.2% across Canada by 2100 as a result of climate change due to increased demand for space cooling. On average, overall demand for electricity remains higher in winter than summer, although some provinces with more extreme summer temperatures, such as Ontario, may experience a shift in peak electricity demand from the winter (in the absence of climate change) to the summer (with climate change) under some climate change scenarios. This is due to significant increases in electricity demand for cooling in the summer (Figure A).

Figure A. Example summer electricity load in Ontario with and without climate change



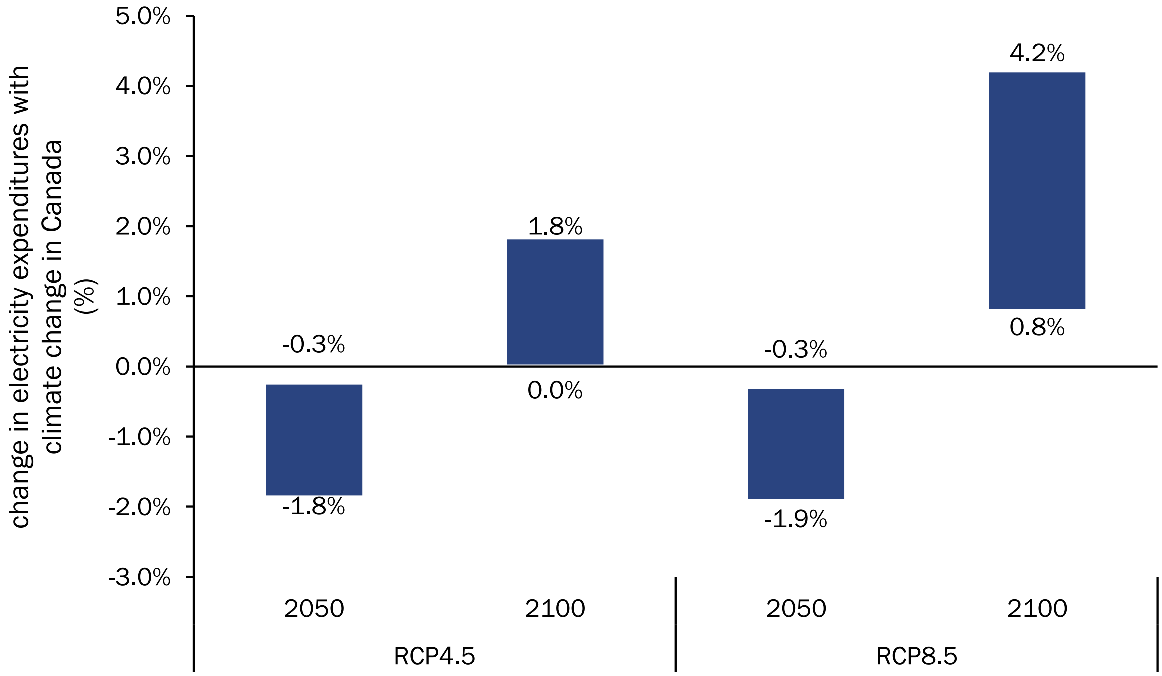
- Second, peak electricity demand is generally expected to increase in the summer as temperatures increase due to increased demand for cooling, while it is expected to decrease in the winter due to reduced demand for heating, compared to a scenario in which no climate change occurs. In some more extreme climate change scenarios, however, peak demand for electricity may increase in the winter due to a change in peak load from a heating peak in the winter to a cooling peak in some warmer winter months occurring in March (Figure B).

Figure B. Change in peak electricity load in British Columbia, relative to a scenario with no climate change



- Third, total expenditure on the electricity system is expected to decrease in the medium term (2050) under climate change due to reductions in demand for electricity for heating, and is expected to increase in the long term (2100) due to increases in demand for cooling (Figure C).

Figure C. Change in total electricity expenditure in Canada, relative to a scenario with no climate change



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1. Introduction

Climate change is expected to impact electricity systems in the future. As average global temperatures increase, there will be an increase in demand for space cooling, a reduction in demand for space heating, and a change in the frequency and intensity of peak electricity demand.[1,2] Climate change is also expected to impact electricity supply, including through changing wind patterns, solar availability, and hydrological patterns.[3] In Canada, these impacts are expected to vary significantly by region.[4,5]

This study examines the potential impacts of climate change on Canada's electricity grid, including impacts on heating and cooling demand, peak loads, and cost.

This report is structured as follows:

- Chapter 2 introduces the approach used to conduct this analysis
- Chapter 3 describes the results of this analysis
- Chapter 4 identifies limitations of this analysis and opportunities for future study

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[1] Damm et al., 2017. Impacts of +2C global warming on electricity demand in Europe. Available at: https://www.sciencedirect.com/science/article/pii/S2405880716300012

[2] Auffhammer et al., 2017. Climate change is projected to have severe impacts on the frequency and intensity of peak electricity demand across the United States. Available at: https://www.pnas.org/content/114/8/1886

[3] Canadian Electricity Association, 2016. Adapting to climate change: State of play and recommendations for the electricity sector in Canada. Available at: https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/energy-resources/Adapting_to_Climate_Change_State_of_Play_and_Recommendations_for_the_Electricity_Sector_in_Canada.pdf

[4] Berardi & Jafarpur, 2020. Assessing the impact of climate change on building heating and cooling energy demand in Canada. Available at: https://www.sciencedirect.com/science/article/abs/pii/S136403211930886X

[5] Concordia University, 2019. How climate change will affect hydropower production in Canada. Available at: https://www.sciencedaily.com/releases/2019/11/191107160013.htm

2. Modeling approach

This chapter provides an overview of the approach used to project the impacts of climate change on Canada's electricity system. It begins with an explanation of how temperature change due to climate change is estimated in Section 2.1, followed by an overview of the models used to undertake this analysis in Section 2.2, and an explanation of how changes in temperature are used to estimate impacts on Canada's electricity system in Section 2.3. Finally, Section 2.4 provides an overview of the key assumptions made in this analysis.

2.1. Estimation of climate change in Canada

The first step to determining the impacts of climate change on Canada's electricity system is to project the potential level of climate change in Canada. This analysis focuses on changes in temperature due to climate change, though climate change is expected to alter other weather patterns as well such as precipitation and wind. Seven general circulation models (GCMs), a type of global climate model used to project climate change, were used to project changes in temperature across Canada under climate change. These include:

- CCAQ2+GFDL-CM3
- BCCAQ2+MRI-CGCM3
- BCCAQ2+HadGEM2-AO
- BCCAQ2+MIROC-ESM-CHEM
- BCCAQ2+CCSM4
- BCCAQ2+GFDL-ESM2M
- BCCAQ2+HadGEM2-ES

Two representative concentration pathways (RCP4.5 and RCP8.5) were run in each GCM to project a total of fourteen potential climate change scenarios out to 2100. RCPs are greenhouse gas concentration trajectories used by the Intergovernmental Panel on Climate Change (IPCC) and are characterized by the radiative forcing produced by emissions of carbon dioxide and other greenhouse gases. RCP4.5 represents an intermediate climate change scenario in which radiative forcing stabilizes at 4.5 W/m^2

in 2100 and global temperature rise is expected to reach 2-3 degrees Celsius by 2100; RCP8.5 represents a worst-case scenario in which radiative forcing continues to rise beyond 8.5 W/m^2 after 2100.

Maximum and minimum monthly temperatures were then extracted from each climate change projection in 10 year increments (from 2040 to 2100) and mapped onto several weather station locations across Canada. These locations include:

- Victoria, BC
- Abbotsford, BC
- Vancouver, BC
- Kamloops, BC
- Fort St. John, BC
- Edmonton, AB
- Calgary, AB
- Peace River, AB
- Cold Lake, AB
- Estevan, SK
- Regina, SK
- Kindersley, SK
- Saskatoon, SK
- Brandon, MB
- Winnipeg, MB
- Thompson, MB
- Thunder Bay, ON
- Sudbury, ON
- Ottawa, ON
- Windsor, ON
- Toronto, ON
- Québec City, QC
- Montreal, QC
- Mont Joli, QC
- Roberval, QC
- Moncton, NB
- Saint John, NB
- Greenwood, NS
- Halifax, NS
- Sydney, NS
- Yarmouth, NS
- Charlottetown, PEI
- Deer Lake, NFLD
- Gander, NFLD
- St. John, NFLD
- Goose Bay, NFLD
- Bathurst, NB

The change in temperature across Canada as a result of climate change was then calculated by comparing the maximum and minimum monthly temperatures under each climate change scenario to reported temperatures in 2010 in these locations. Temperature data was adjusted for each location under each climate change scenario using the following formula:

$$P\_TEMP_{city,h,y} = \left(H\_TEMP_{city,h} - H\_MIN_{city,h}\right) \times \frac{P\_MAX_{city,h,y} - P\_MIN_{city,h,y}}{H\_MAX_{city,h} - H\_MIN_{city,h}} + P\_MIN_{city,h,y}$$

Where P_TEMP = projected temperature under climate change for each city, hour and year (from 2040 to 2100); H_TEMP = historically reported temperature in 2010 by city and hour; H_MIN = historically reported minimum temperature in 2010 by city; H_MAX = historically reported maximum temperature in 2010 by city; P_MAX = projected maximum temperature under climate change for each city, hour and year (from 2040- to 2100), specified by climate change models; P_MIN = projected minimum temperature under climate change for each city, hour and year (from 2040-2100), specified by climate change models. P_MAX and P_MIN are converted from monthly temperature projections from the climate change models (GCM and RCP) to hourly temperature projections by assuming the minimum and maximum values occur on the 15th of the month and weighting hours according to the following equations:

$$P\_MAX_{city,h,y} = \sum_{m} h\_weight_{h,m} \times P\_MAX_{city,m,y}$$

$$P\_MIN_{city,h,y} = \sum_{m} h\_weight_{h,m} \times P\_MIN_{city,m,y}$$

Note that hourly variations in temperature projections were treated differently when analyzing the impacts on electricity consumption or expenditure than when analyzing the impacts on peak electricity demand. In the case of the former, variations in hourly data from each GCM and RCP were fit to an average monthly regression to capture the trend in temperature change from 2040 to 2100. In the case of peak electricity load, however, it is important to capture hourly temperatures at the top and bottom of the temperature fluctuations, rather than dampening these fluctuations with a monthly average, as the highest values are what best inform the capacity that utilities will need to add to meet peak demand. For this reason, temperature projection data was fit to a different regression when analyzing the impacts on peak electricity load, which uses the coldest winter day and hottest summer day in each month and city to capture the high end of the temperature range in each GCM and RCP.

This temperature data was then used with Navius' energy-economy model (gTech) and electricity model (Integrated Electricity Supply and Demand Model, IESD) to determine the impact of climate change on electricity demand across Canada in 10-year increments out to 2100. These models are described in the next section (Section 2.2) and in more detail in Annex 1 and 2, and quantification of the impacts of temperature change on Canada's electricity sector is described in Section 2.3.

2.2. Introduction to IESD and gTech

IESD

The Integrated Electricity Supply and Demand model (IESD) simulates the impact of government policies and economic conditions on electricity demand, supply, and prices. IESD is effectively two separate models: one that simulates the addition to electricity generation capacity and hourly dispatch (generation) decisions in the electricity sector and another that simulates decisions by end-users that affect electricity demand (e.g. technology and fuel choice).

IESD can explore multiple policy and economic scenarios in any region or set of regions[6], and provides detailed insight into their impact on:

- The market for specific generation or supply technologies, in terms of installed capacity and electricity generation by unit, fuel type, technology type etc.
- GHG emissions from the electricity sector
- Electricity trade between regions
- Electricity consumption by sector and end-use
- Wholesale and end-use electricity prices

More detail about IESD and how it is structured is provided in Annex 1. For this analysis, IESD was used to simulate changes in peak electricity load, price and expenditure under each of the fourteen climate change scenarios compared to a scenario with no climate change. This allowed for isolation of the impacts of climate change on Canada's electricity sector out to 2100.

gTech

gTech is unique among energy-economy models because it combines features that are typically only found in separate models:

- A realistic representation of how households and firms select technologies and processes that affect their energy consumption and greenhouse gas emissions;
- An exhaustive accounting of the economy at large, including how provinces and territories interact with each other and the rest of the world; and
- A detailed representation of energy supply, including liquid fuel (crude oil and biofuel), gaseous fuel (natural gas and renewable natural gas) and electricity.

More detail about gTech is provided in Annex 2. For this analysis, gTech was used to simulate annual electricity consumption by region, sector and end-use across Canada out to 2100. This consumption was then input into IESD to quantify the impacts of climate change on Canada's electricity system, as described in the following section.

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[6] The largest coverage to date is disaggregated by each of Canada's 10 provinces as well as the US, which is also disaggregated into 10 regions.

2.3. Estimation of electricity sector impacts

An increase in temperature with climate change is expected to impact heating and cooling demand in two main ways:

- When temperatures are warmer, there is less of a need for heating in the winter and more of a need for cooling in the summer. As a result, people are using their air conditioners more in the summer to achieve the same indoor temperature as they would in the absence of climate change.
- When temperatures are warmer, the amount of floor space that is heated or cooled increases, independent of population or economic growth, as people install air conditioners to cool spaces that would not have needed cooling in the absence of climate change. For example, with warmer temperatures, homes built in Vancouver may include air conditioners that otherwise would not have.

Changes in temperature due to climate change were used to estimate changes in space heating and cooling demand using the PJM method.[7] This method projects electricity load based on weather-related variables,[8] which was then weighted by population at each of the weather station locations listed in Section 2.1. Based on this method, the temperature humidity index (THI) was used for estimating heating load based on the following equation:

$$THI = T - 0.55 \times (1 - H) \times (T - 58), \text{ if } T >= 58$$

$$THI = T, \text{ if } T < 58$$

Where T = Dry bulb temperature and H = Relative Humidity (where 100% = 1)

And the wind adjusted temperate (WWP) was used to estimate cooling load based on the following equation:

$$WWP = T - (0.5 \times (W - 10)), \text{ if } W > 10$$

$$WWP = T, \text{ if } W <= 10$$

Where W = Wind velocity in MPH and T = Dry bulb temperature

Electricity consumption projections in the absence of climate change, output from gTech, were used to adjust hourly electricity load curves (based on 2010 data) out to

[7] PJM, 2016. Load forecasting model white paper. Available at: https://www.pjm.com/~/media/library/reports-notices/load-forecast/2016-load-forecast-whitepaper.ashx

[8] Note that climate change scenario data did not include impacts of climate change on wind speed or humidity, so only the temperature variable in this method was adjusted.

2100, which were disaggregated by sector and end-use to estimate hourly electricity consumption for space heating and cooling for every region in Canada. By using gTech to simulate reference case consumption out to 2100, other impacts on electricity demand were controlled for, including improvements in efficiency for various end uses (for example, space cooling demand decreases over time as the efficiency of air conditioning improves), all current policies that may lead to fuel switching (such as electrification of passenger transport), increases in population and increases in economic growth. By controlling for these factors, the impact of temperature change due to climate change on Canada's electricity system could be isolated.

Electricity consumption for space heating and cooling were then adjusted based on temperature change projections using the PJM equations above, and input into IESD to simulate Canada's electricity system under this demand.

2.4. Important assumptions

A few important assumptions were made in this analysis. These include:

- First, temperature changes projected by each climate change scenario were mapped onto the 37 weather station locations listed in Section 2.1, which were used to estimate temperature change across Canada. Temperature change at these locations was scaled to the regional level (10 provinces and the territories) and resulting changes in heating and cooling demand were weighted based on the population closest to each station.
- Second, heating and cooling demand under climate change were calculated based on a reference case scenario in which all currently implemented and announced federal and provincial climate policies are included. Therefore, any changes in electricity demand due to reference case climate policy has been controlled for, as have changes in electricity demand due to population and economic growth.
- Third, changes in temperature due to climate change are based on a 2010 base year. It is therefore assumed that weather patterns in 2100 are a repeat of weather patterns in 2010, but with temperature adjusted up or down based on climate change models.
- Fourth, the winter season is defined as the days between December 21 and March 21 and the summer is defined as the days between June 20 and September 20. This is important in defining winter and summer peak electricity loads.
- Finally, electricity storage was simulated as a pathway to help mitigate peaks in electricity demand. However, dispatchable load was not included in this analysis.

3. Impacts of climate change on Canada's electricity system

This chapter summarizes the results of this analysis. Section 3.1 and 3.2 quantify the impacts of climate change on electricity demand across Canada, including changes in space heating and cooling demand and peak load. Section 3.3. quantifies the economic impacts of climate change on Canada's electricity system, including impacts on total and capital electricity expenditure.

National impacts as well as regional variability is explored. Ontario and British Columbia are chosen to represent regional variability across the country and are highlighted in more detail as examples of seasonal (hot in the summer, cold in the winter) and moderate (warm in the summer, cool in the winter) temperature profiles.

3.1. Electricity demand for space heating and cooling

In comparison to a scenario without climate change, electricity demand across Canada is expected to decrease in the medium term (2050) in most climate change scenarios, due to a lower demand for space heating. In the long term, however, electricity demand is expected to increase by 0.4 - 4.2% by 2100, as an increase in demand for space cooling outweighs a reduction in demand for heating (Figure 1).

In 2100, electricity demand for space cooling is expected to increase by 32 - 223% in the summer and for space heating to decrease by 14 - 61% in the winter. These ranges in demand reflect the range in potential temperature change due to climate change across Canada, which is based on the fourteen climate change scenarios described in Section 2.1.

Figure 1. Change in electricity demand for heating and cooling in Canada under climate change, relative to a scenario with no climate change.

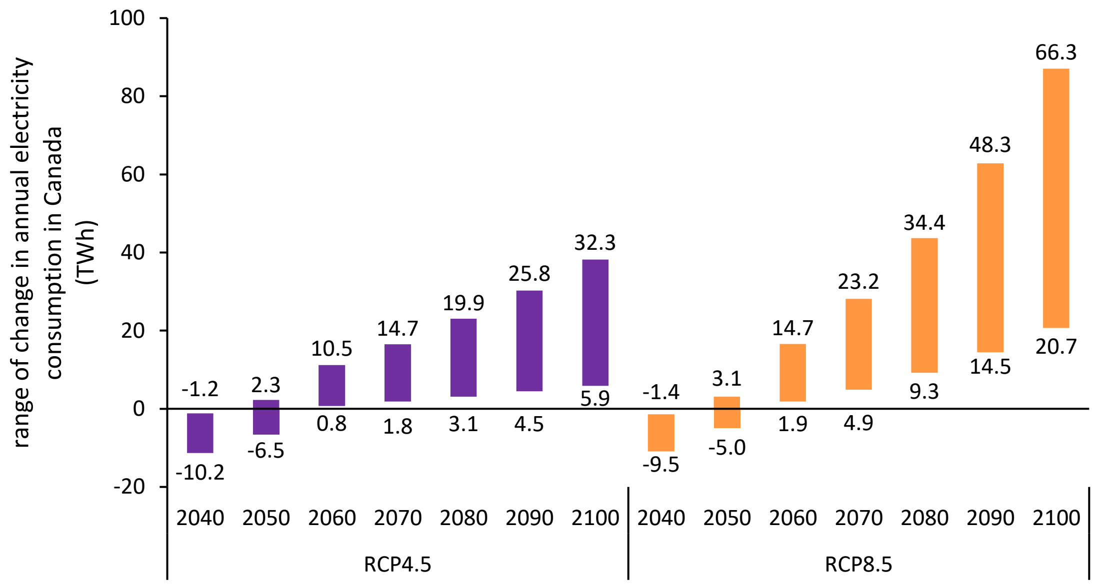


Figure 2 and Figure 3 demonstrate a sample winter and summer day in 2010 in Canada, with temperature adjusted based on the level of climate change in 2100 under one selected climate change scenario (BCCAQ2+HadGEM2-ES, RCP8.5). Figure 2 demonstrates that electricity demand for heating in the winter will decease on average across Canada due to warmer temperatures, while electricity demand for cooling in the summer will increase (Figure 3) compared to the same day with no climate change. Under this climate change scenario, total electricity demand remains slightly higher on this winter day across Canada than on this summer day.

Figure 2. Example of winter electricity load in Canada with and without climate change

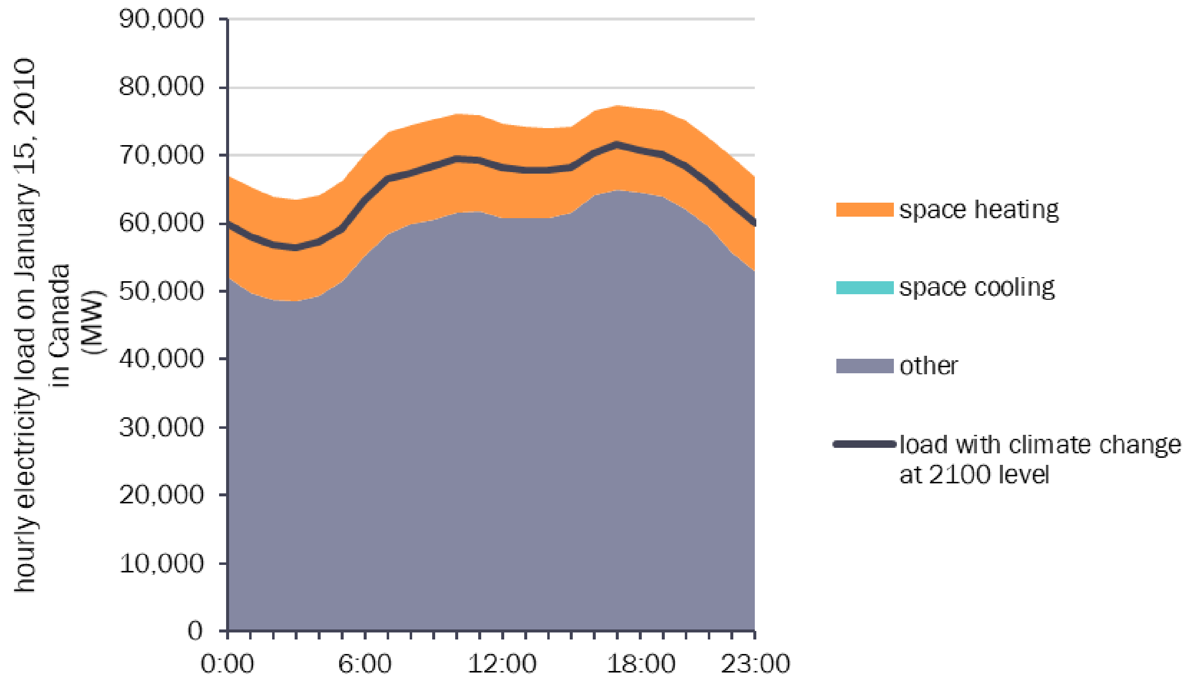
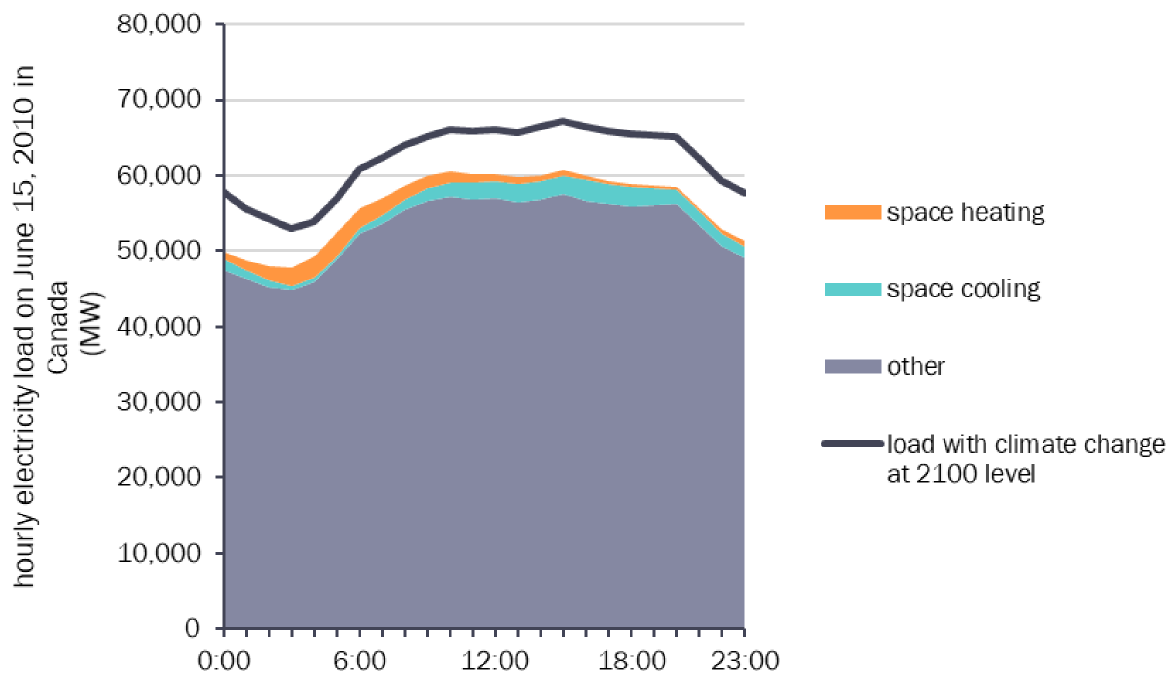


Figure 3. Example of summer electricity load in Canada with and without climate change



Expected changes in electricity demand for space heating and cooling in 2100 are shown by province in Table 1. Ontario and British Columbia are explored in more detail below to demonstrate regional variability. See Annex 3 for a more detailed breakdown of electricity demand for all provinces.

Table 1. Average change in electricity demand for space heating and cooling by province in 2100, relative to a scenario with no climate change

	Space heating		Space cooling	
	RCP4.5	RCP8.5	RCP4.5	RCP8.5
Canada	-28%	-46%	82%	170%
BC	-37%	-57%	147%	313%
AB	-24%	-39%	136%	291%
SK	-23%	-38%	129%	280%
MB	-25%	-41%	106%	209%
ON	-27%	-44%	64%	128%
QC	-28%	-49%	87%	187%
NB	-29%	-50%	123%	300%
PE	-26%	-43%	82%	178%
NS	-28%	-47%	102%	257%
NL	-26%	-46%	103%	262%

Ontario

Ontario, as a province with generally hot summers and cold winters, may experience a shift in peak electricity demand from the winter (in the absence of climate change) to the summer (with climate change). Figure 4 and Figure 5 demonstrate a sample winter and summer day in Ontario in 2010, with temperature adjusted based on the level of climate change in 2100 under one selected climate change scenario (BCCAQ2+HadGEM2-ES, RCP8.5). Figure 4 demonstrates that electricity demand for heating in the winter decreases in Ontario due to warmer temperatures, while electricity demand for cooling in the summer increases significantly (Figure 5) compared to the same day with no climate change.

Overall, electricity demand for space heating and cooling in Ontario is expected to increase by 0.9 - 6.7% in 2100, depending in the climate change scenario, in comparison to a scenario with no climate change. Electricity demand for space cooling is expected to increase by 27 - 170% in the summer and for space heating to decrease by 13 - 59% in the winter.

Figure 4. Example winter electricity load in Ontario with and without climate change

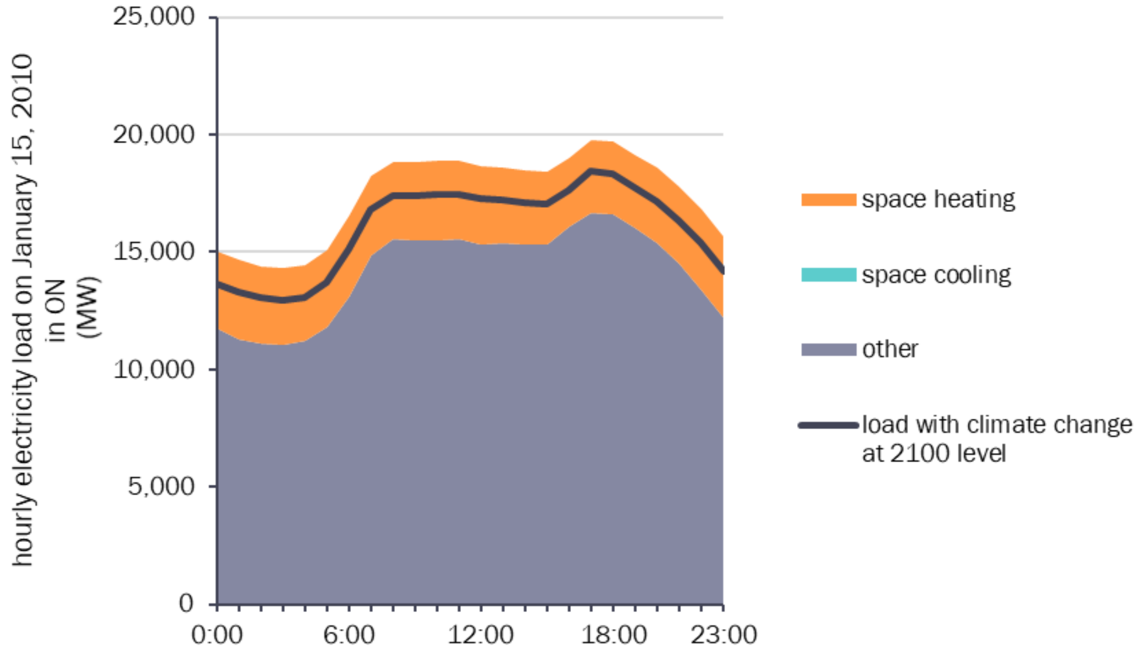
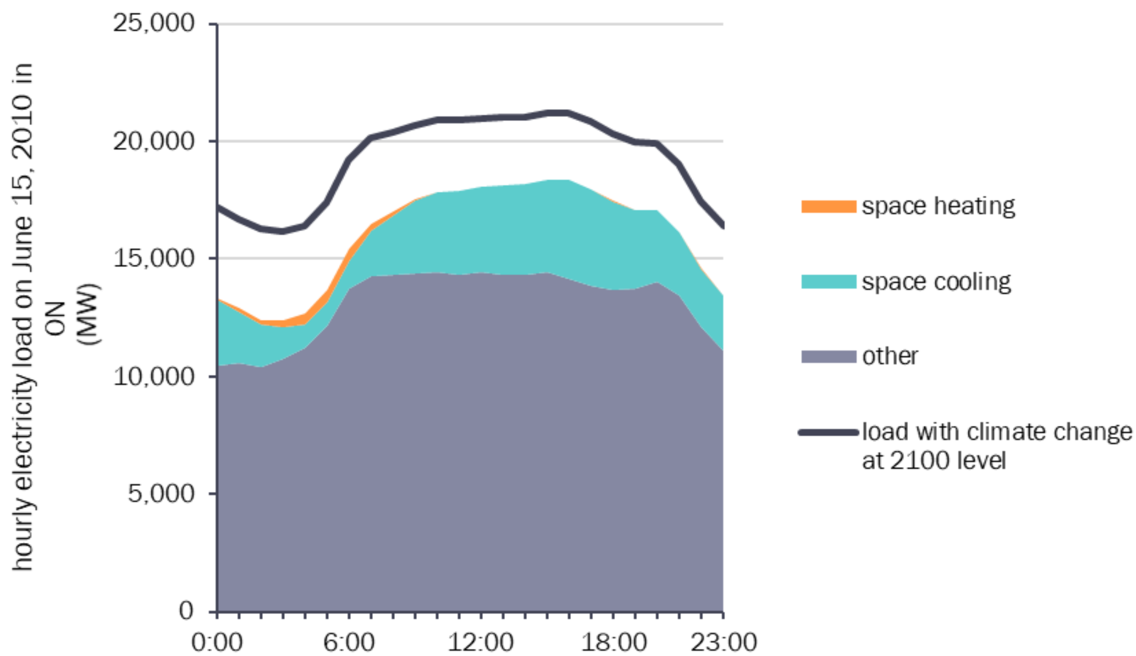


Figure 5. Example summer electricity load in Ontario with and without climate change



British Columbia

British Columbia, as a province with a more moderate seasonal temperature profile, will also experience a decrease in demand for space heating in the winter and an increase in demand for cooling in the summer, though to a less significant extent than Ontario, with demand for electricity remaining higher in the winter than in the summer under climate change. Figure 6 and Figure 7 demonstrate a sample winter and summer day in British Columbia in 2010, with temperature adjusted based on the level of climate change in 2100 under one selected climate change scenario (BCCAQ2+HadGEM2-ES, RCP8.5).

Overall, electricity demand for space heating and cooling in British Columbia is expected to increase by 0.2 - 4.6% in 2100, depending in the climate change scenario, in comparison to a scenario with no climate change. Electricity demand for space cooling is expected to increase by 49 - 470% in the summer and for space heating to decrease by 17 - 73% in the winter.

Figure 6. Example winter electricity load in British Columbia with and without climate change

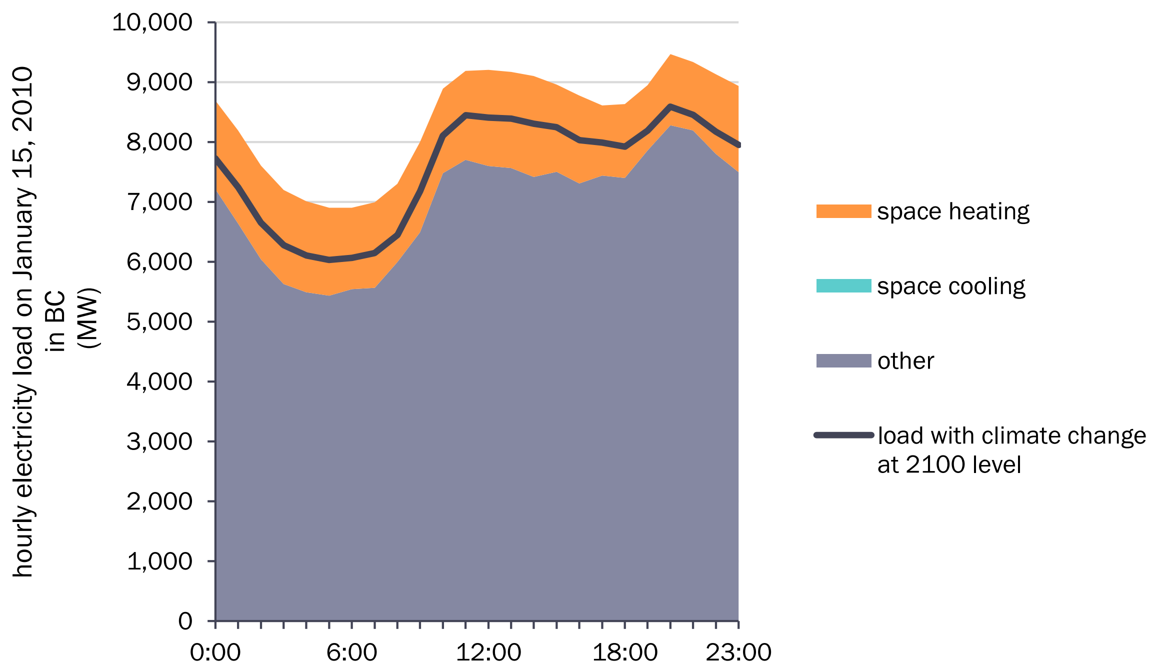
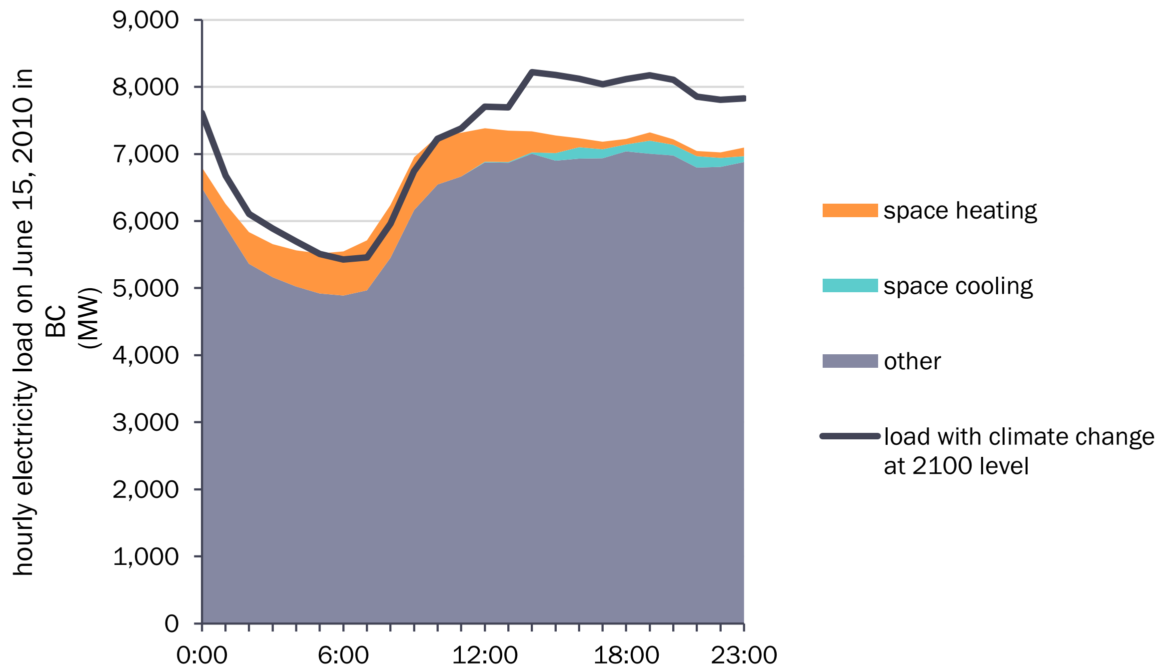


Figure 7. Example summer electricity load in British Columbia with and without climate change



3.2. Peak electricity load

Changes in heating and cooling demand under climate change have an interesting impact on peak electricity load. Annex 3 provides a detailed breakdown of peak electricity load by province, while this section continues to look at Ontario and British Columbia as examples.

Peak electricity load in both provinces increases in the summer as expected, as demand for cooling increases with warmer temperatures. Figure 8 and Figure 9 show an increase in summer peak load in 2100 of 17.3 – 32.7% in Ontario and 0.5 – 9.9% in British Columbia under climate change. This corresponds to an additional 15,243 - 28,782 MW of peak electricity demand in 2100 in Ontario and an additional 84 - 3048 MW of peak electricity demand in 2100 in British Columbia.

In the winter, peak load decreases as expected in 2050 in both provinces in many scenarios due to reduced demand for heating. By 2100, however, peak load increases in both provinces in the winter under more extreme climate change scenarios (RCP8.5 scenarios). Figure 8 and Figure 9 show a change in peak load in the range of –1.7 - 5.7% in Ontario and -1.2 - 3.7% in British Columbia under climate change, compared to a scenario with no climate change. This corresponds to a change of -1340 - 4552 MW of peak electricity demand in 2100 in Ontario and -314 - 1195 MW of peak electricity demand in 2100 in British Columbia. Scenarios in which winter peak load increases in 2050 or 2100 represent a shift in the winter electricity peak from a heating demand peak in the absence of climate change to a cooling demand peak during warmer winter days in March as a result of temperature increases under climate change.

Figure 8. Change in peak electricity load in Ontario, relative to a scenario with no climate change

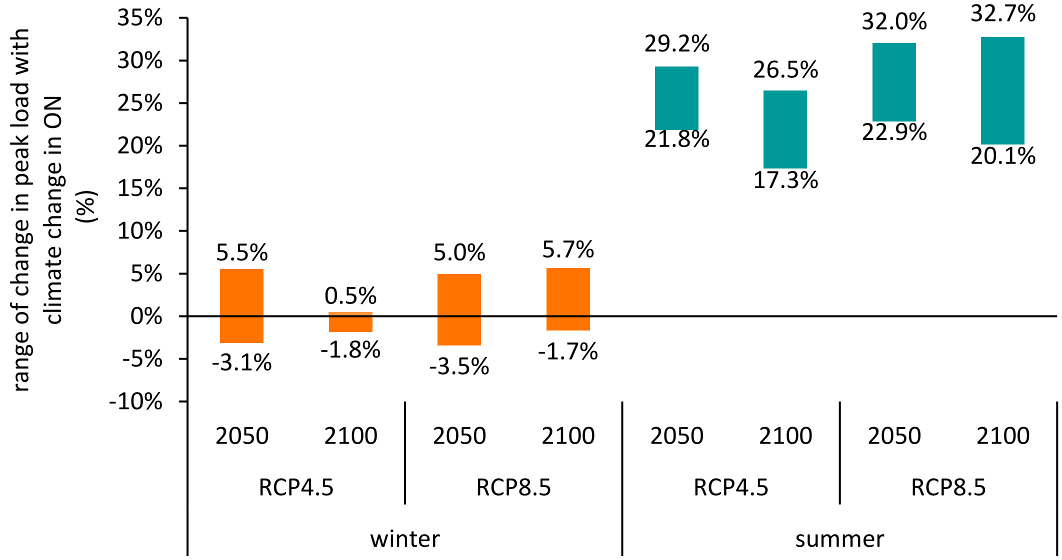
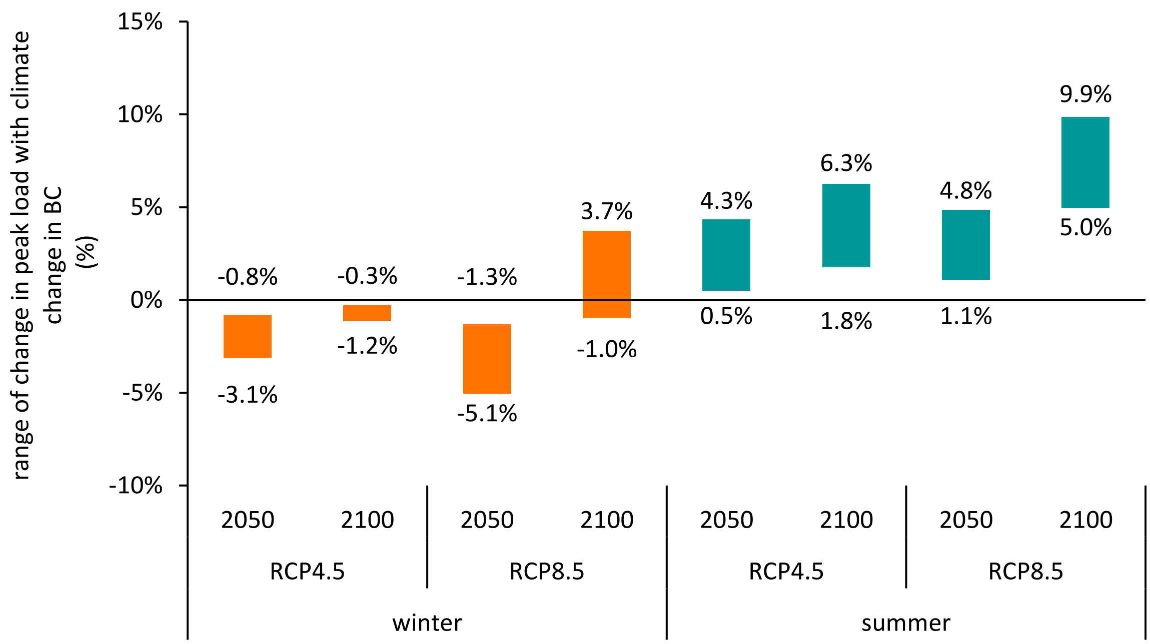


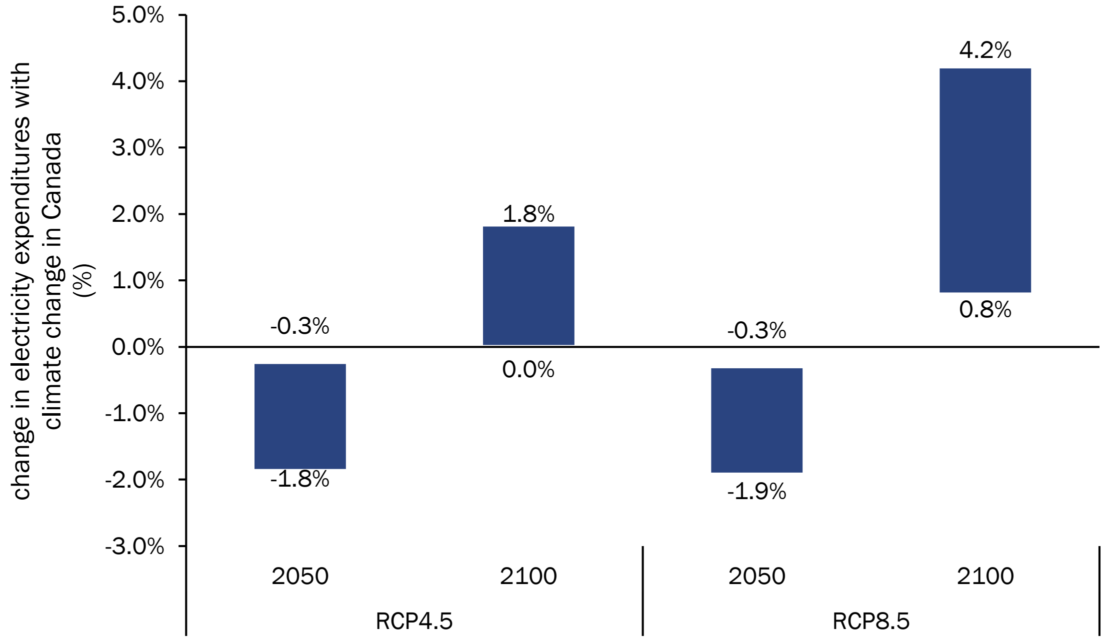
Figure 9. Change in peak electricity load in British Columbia, relative to a scenario with no climate change



3.3. Capital and total electricity expenditure

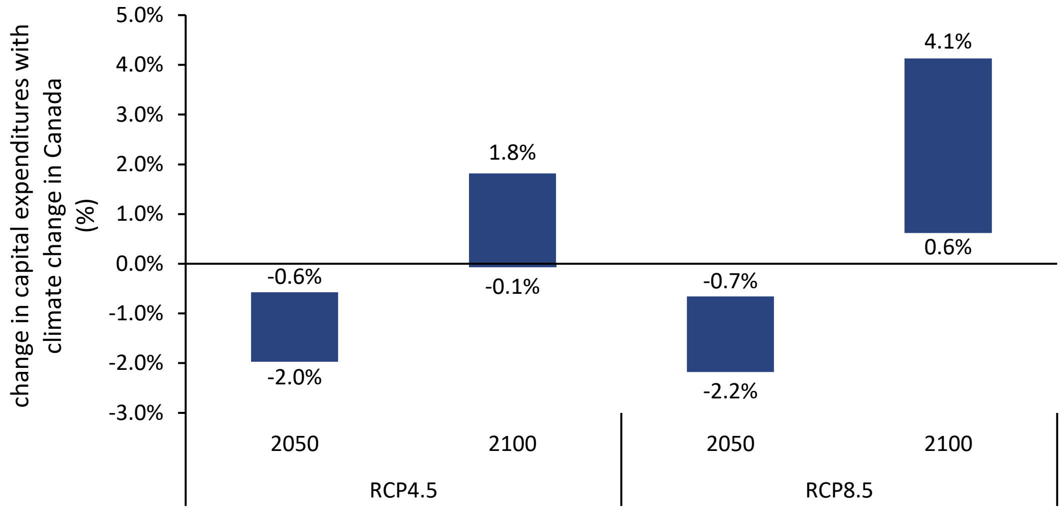
As Canada's electricity demand decreases in the medium term (2050), total electricity system expenditure also decreases by 0.3 - 1.9% depending on the climate change scenario (Figure 10). This corresponds to a reduction in expenditure in 2050 of $141-1029 million (2015 CAD). By 2100, as electricity demand increases and electricity price increases (due to an increase in peak demand), total expenditure on the electricity system also increases by 0 - 4.2% depending on the climate change scenario (Figure 10). This corresponds to an increase in electricity expenditure of $34 - 5351 million (2015 CAD) in 2100 relative to a scenario with no climate change.

Figure 10. Change in total electricity expenditure in Canada, relative to a scenario with no climate change



Total electricity expenditure includes capital expenditure, as well as other operating costs, such as fuel and labour costs. Isolating capital expenditure on electricity shows a similar trend, decreasing by 0.6 - 2.2% ($207 - 791) in 2050 depending on the climate change scenario and increasing by up to 4.1% ($2892 million) in 2100 (Figure 11) (CAD 2015).

Figure 11. Change in capital expenditure on electricity in Canada, relative to a scenario with no climate change



Changes in electricity expenditure by province show regional variability, with most experiencing an increase in expenditure by 2100 due to increased demand for cooling. Figures 12 and 13 show changes in total and capital electricity expenditure in Ontario and British Columbia, and a further breakdown of provincial results can be found in Annex 4. Overall, results indicate that by 2100 the electricity expenditure required to achieve the same desired temperature in buildings across Canada is higher due to temperature increases under climate change than in the absence of climate change.

Figure 12. Change in total electricity expenditure in British Columbia and Ontario, relative to a scenario with no climate change

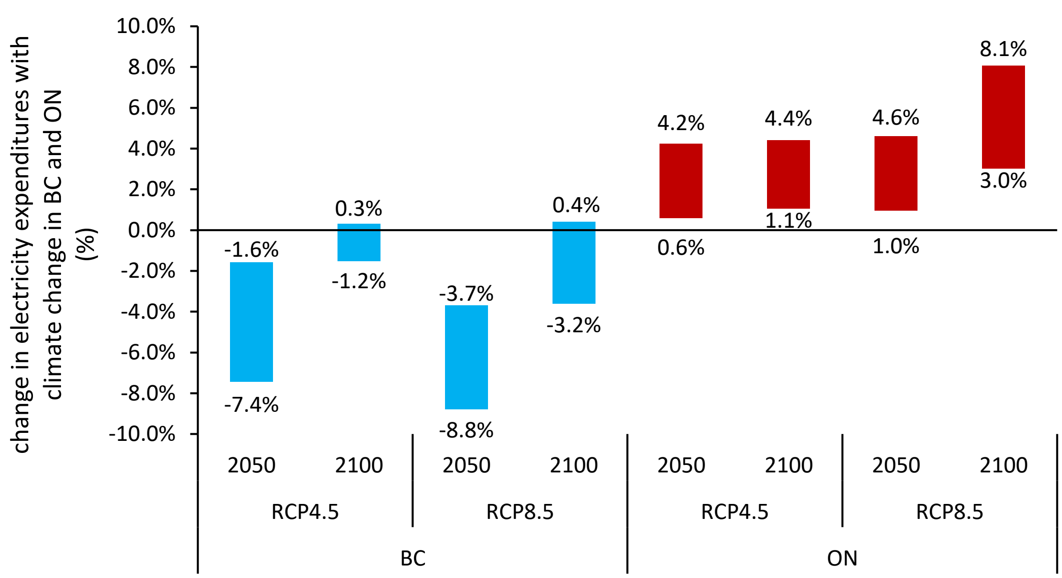
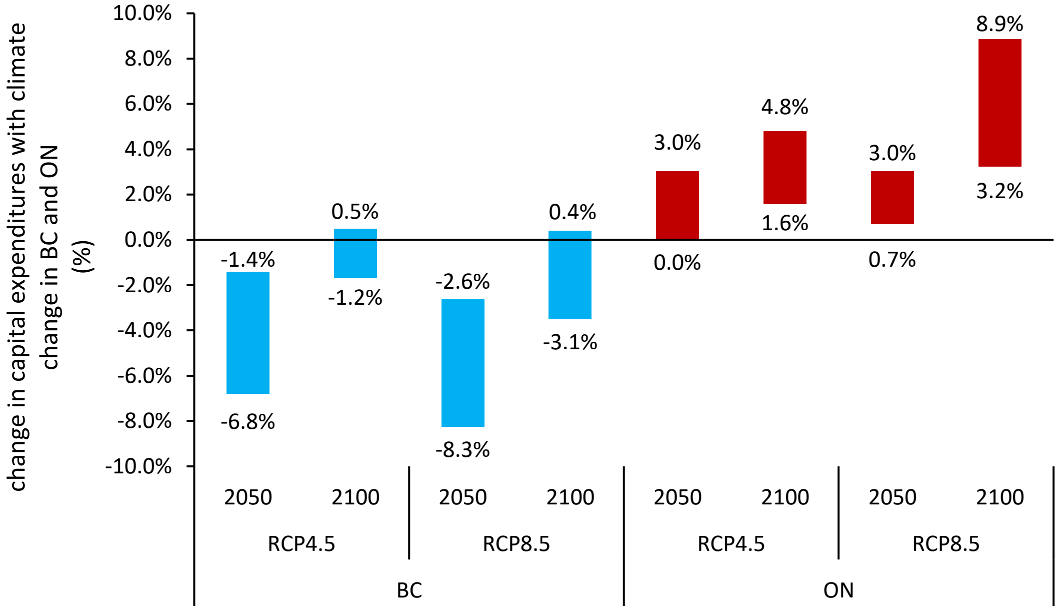


Figure 13. Change in capital expenditure on electricity in British Columbia and Ontario, relative to a scenario with no climate change



4. Limitations

This analysis focused on the impacts of temperature changes due to climate change on the demand for electricity across Canada. There are other important expected impacts of climate change on the electricity system that were not examined in this analysis. These include:

- Impacts of climate change on wind speed and direction. This may affect space heating demand, which is a function of wind speed, as well as capacity for wind electricity generation.
- Impacts of climate change on cloud patterns. This may affect capacity for solar electricity generation.
- Impacts of climate change on hydrological patterns. This may affect capacity for hydroelectricity generation.
- Impacts of temperature on electricity transmission loss, which may increase as temperature increases.

This analysis also did not examine the impacts of climate policy on electricity demand in Canada, but rather isolated changes in demand due to increases in temperature under climate change. Total electricity demand in 2100 can be expected to increase further as additional climate policy is implemented to encourage fuel switching to electricity (such as electric vehicles).

These limitations present potential areas for future research.

Annex 1: Introduction to IESD

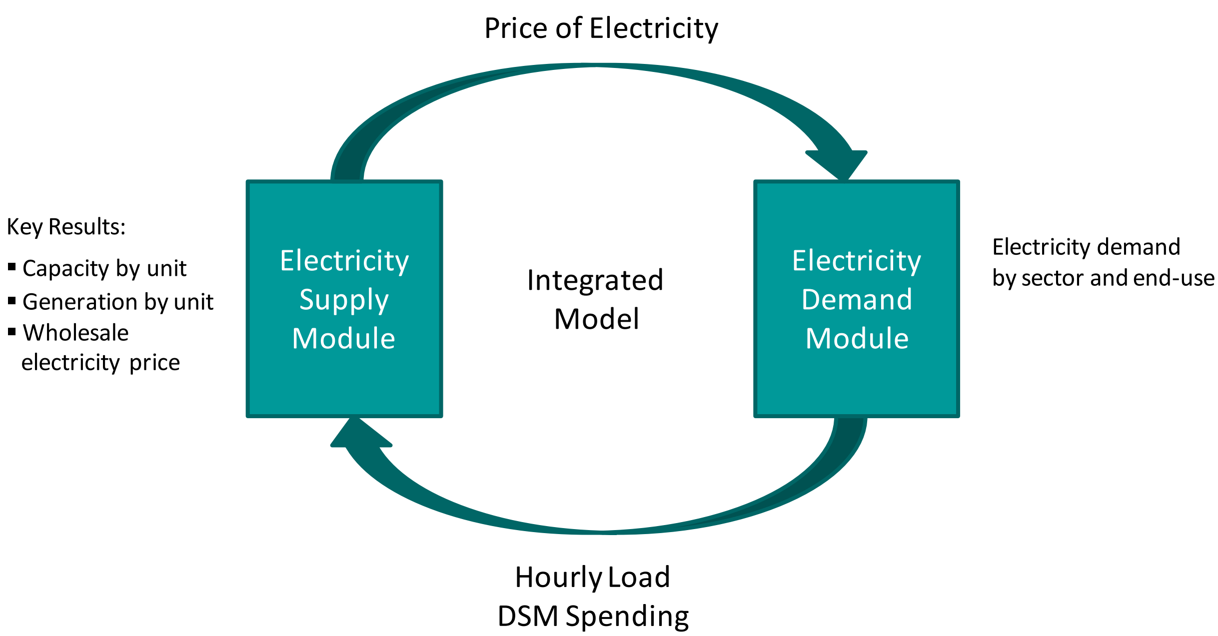
How IESD works

The IESD model simulates:

- How utilities meet electric load by adding new capacity and by dispatching new and existing units on an hourly basis, including electricity storage units, and
- How each sector alters its electricity consumption in response to the price for electricity.

Figure 14 depicts the key components of IESD's simulation process.

Figure 14: Conceptualization of IESD model simulation



IESD's simulation process begins with the Electricity Supply Module, which includes a detailed representation of the different units available to generate or store electricity in each region, including their unique costs and generation constraints. The electricity supply simulation determines new generation and storage capacity additions, hourly dispatch of each unit to meet electric load over the course of the year, GHG emissions from the electricity sector and the wholesale price for electricity.

The price for electricity is then sent to the Electricity Demand Module, which simulates how households and firms change their electricity consumption. The resulting electricity consumption by end-use is used to adjust the magnitude and shape of the hourly load profile. Total load and total demand side management spending are then sent back to the Electricity Supply Module.

Electricity supply module

The electricity supply module of IESD is a linear programming model that simulates how the electricity sector makes capacity and dispatch decisions based on the hourly load profile, energy prices and the cost of installing and operating different units. The electricity supply module endogenously adds and dispatches electricity units such that the total costs of the electricity system are minimized, system revenues are maximized and load in each hour is met. The value provided by storage technologies and their possible revenue streams are reflected by the extent to which they can minimize system costs relative to other generation technologies. The model can be adjusted to represent how specific electricity markets may or may not value the grid services provided by storage.

Representative days versus consecutive days

By default, the national version of IESD represents 43 representative days throughout the year that vary by 1) season, 2) load, and 3) wind capacity utilization (i.e. how much wind power is available in each hour of the day). These 43 representative days were selected to provide an accurate representation of the variation observed in load profiles and wind capacity utilization over all 365 days in a year (2010 data were used to provide the benchmark for electric load). To calculate total annual load, each representative day is assigned a weight such that the load profiles over the 43 days matches the load profile and wind capacity utilization over all 365 days in the year.

To best show the impact of electricity storage technologies, the value of which is a function of their continual release and recharging of energy, we are reconfiguring the national version of IESD to simulate consecutive hours and days through the year. This approach requires greater computing power and we are determining whether a fully national version will solve, or whether we may need to create regional models.

Capacity additions

The electricity supply module endogenously adds electricity generation units to supply energy (i.e. consumption over the year) and capacity (i.e. consumption at a given moment) such that the costs of the electricity system are minimized. Each type of electricity generation resource is characterized by its cost profile (i.e., capital costs, fixed operating costs, variable operating costs), heat rate (i.e. energy efficiency) and maximum capacity utilization. The model can simulate specific policy decisions that may promote or constrain the use of a given technology (e.g. a performance standard that constrains coal power, a portfolio standard that requires renewable energy). This framework also applies to electricity storage technologies.

Dispatch and capacity utilization

Thermal generation (i.e. fossil fuel or biomass combustion) can be dispatched at any time when it will minimize total system costs subject to any existing policy constraints. However, we assume cogenerated electricity is not dispatchable and is produced when heat is required by the thermal host.

Like thermal generation, electricity storage can be dispatched. However, this dispatch is constrained by the installed storage generation capacity, the amount of energy already stored, and any relevant technical constraints represented in the model.

Electricity from intermittent resources must be used when it is available, either consumed, exported or stored. As stated above, the hourly wind energy is based on the installed capacity and the hourly capacity utilization in each hour of the representative day being simulated. Solar capacity availability varies for each month of the year (e.g. lowest in winter, highest in summer) but changes each hour according to the movement of the sun through the sky (e.g. zero at night, low the morning, highest at noon).

Characterizing generation from variable renewable sources

To characterize wind resources by province, we rely on CanWEA data describing the location and hourly capacity factor of 5,000 potential sites across the country[9]. Sites are grouped by generation profile and the cost of transmission access. Each grouping of sites is then included in the model as a potential wind resource that can be developed.

To incorporate variability in solar generation profiles into IESD, we use regression to estimate the impact of different weather patterns (as observed in Environment and Climate Change Canada weather data) on solar insolation (as observed in the closest 1x1 mile square across the border in the US[10]).

[9] CanWEA. 2017. Wind Data from the Pan-Canadian Wind Integration Study. Available from: www.canwea.ca

[10] National Solar Radiation Data Base. https://rredc.nrel.gov/solar/old_data/nsrdb/1991-2010/

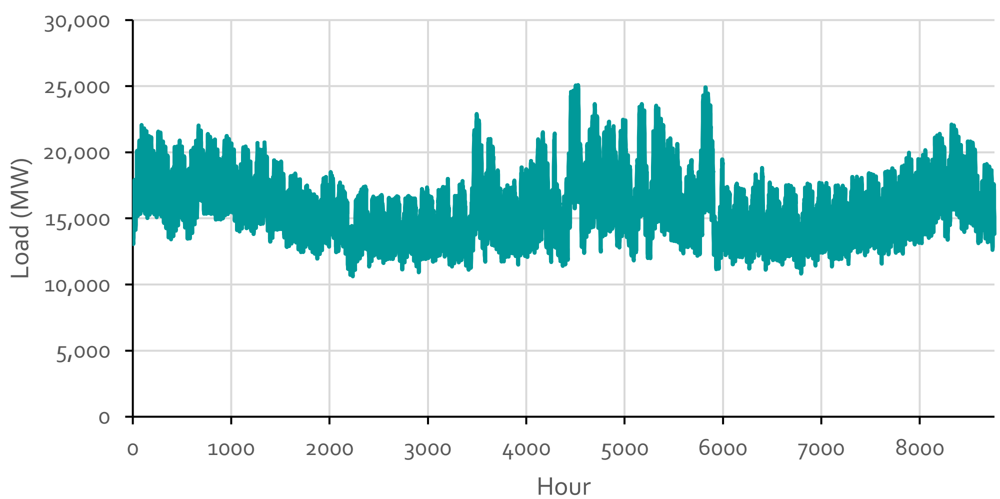
Electricity demand module

Demand for electricity is derived from the Navius' gTech simulation model. The IESD model uses gTech's projections to "shape" the load curve for electricity demand/generation.

Hourly load curves

We obtained hourly load data for all jurisdictions in North America (over 200 utilities). These data provide a starting point for understanding how load varies over the course of 2010, the model's base year. An example of Ontario's hourly load profile in 2010 is shown in Figure 15.

Figure 15. Hourly load profile for Ontario in 2010



Source: Independent Electricity System Operator, 2017, Hourly Ontario and Market Demands, 2002-2016, available from: www.ieso.ca

Sectors and end-uses in the electricity demand module

The electricity demand module disaggregates the hourly load curves into seven end-uses based on data from Natural Resource Canada's Comprehensive Energy End-Use Database. The end-uses for residential and commercial buildings include:

- Space heating
- Air conditioning
- Lighting

- Other multi-fuel end-uses (water heating, cooking, clothes dryers)
- Other electric-only end-uses (refrigerators, freezers, dishwashers, clothes washers, computers, televisions, etc.)

The model also represents industrial electric loads. However, they are represented in less detail. Industrial load is not broken down by end use (e.g. compression, pumping etc.) and we assume it is a base load that is relatively constant over every hour of the year

Electricity load forecast

gTech determines total electricity consumption and the "shape" of electricity consumption in IESD. After a model simulation in gTech is complete, the resulting electricity consumption by end-use is compiled and used to "shape" an electricity consumption load curve. For example, if a policy increases the adoption of electric heat pumps, it will affect electricity consumption at specific times and days of the year.

What is gTech?

gTech provides a comprehensive representation of all economic activity, energy consumption and greenhouse gas emissions in Canada. It is ideally suited for projecting electricity demand because it represents:

- **The competitiveness of electric technologies relative to conventional and low carbon alternatives.** This competitiveness depends not only on the attributes of end-use technologies themselves (such as their capital cost and operating performance), but also on the availability and price of electricity and other energy carriers (which will change based on the amount of electrification, the unique energy resources in each province and energy trade among regions).
- **Firm and consumer preferences.** Electric technologies may be perceived as an imperfect substitute for existing technologies. For example, a given household may prefer a conventional vehicle over an electric vehicle because of its lower upfront cost and greater model variety. In addition, some preferences may change as a technology gains market share. For example, if electric vehicles become widespread and fast charging stations are broadly deployed, concerns about running out of a battery charge would decline.
- **The impact of existing federal and provincial climate policies on technology choice (including how they interact).** Accounting for existing policies is important because electrification is highly affected by their interactive and duplicative effects. For example, electric vehicle adoption is influenced by ZEV mandates, financial

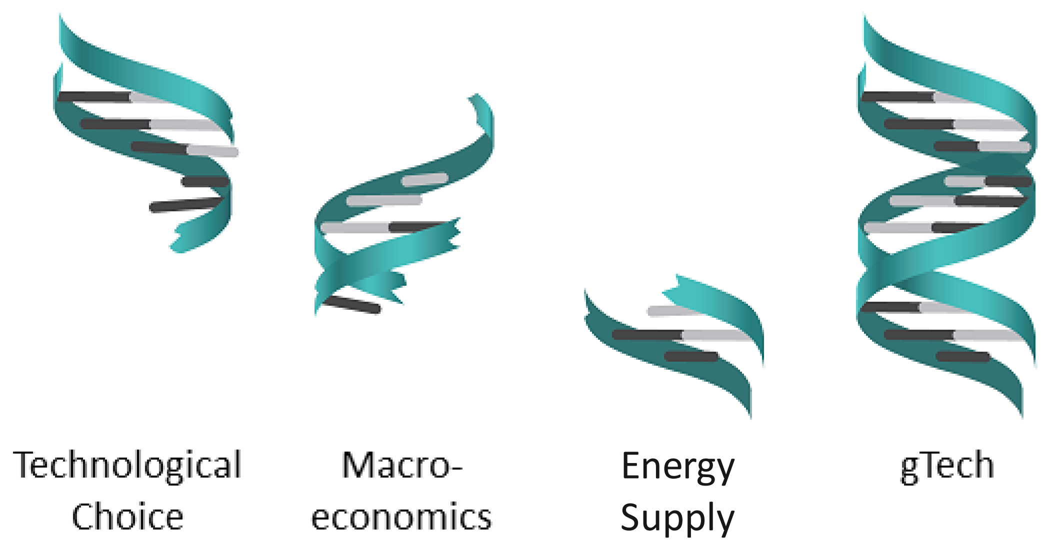
incentives, clean/low carbon fuel standards, fuel economy regulations and carbon pricing.

These various features mean that gTech can provide insight into future load in response to any combination of (1) existing and/or new policies that directly or indirectly affect electricity supply and demand and (2) the cost of electrification technologies relative to alternative options.

Annex 2: Introduction to gTech

gTech is an energy-economy model that combines realistic representation of technology choice, exhaustive accounting of the macroeconomy, and detailed representation of energy supply markets (Figure 16).

Figure 16. The gTech model



gTech builds on three of Navius' previous models (CIMS, GEEM and OILTRANS/IESD), combining their best elements into a comprehensive integrated framework.

Simulating technological choice

Unlike most computable general equilibrium (CGE) models, gTech contains substantial technological detail, such that it can account for the complexities of the energy economy system. Technological detail allows gTech to examine the impact of technology deployment on energy consumption, GHG emissions and the broader economy. gTech is designed to provide a projection of how households and firms adopt technologies, and how technological adoption affects energy and emissions profiles. It simulates how energy prices, technology costs and policies affect which technologies are used to provide energy end-uses (e.g. lighting, process heating, mobility etc.). These choices in turn affect energy consumption, air emissions, capital costs, operating costs and energy costs. The model also accounts for the intangible and interactive technological, behavioural, and economic factors that accompany energy use and GHG emission policies.

Understanding the macroeconomic impacts of policy

As a CGE model, gTech represents key economic transactions within the economy allowing it to project the economic impacts of climate policies. These economic transactions include:

- **Interlinkages between sectors of the economy.** gTech explicitly represents 115 sectors of the economy (e.g., construction, cement manufacturing, petroleum refining). Each sector of the economy is characterized by the goods it produces (e.g., cement), and the inputs required to production (labor, capital, energy, etc.). As an equilibrium mode, gTech simulates how every sector of the economy returns to equilibrium if a policy is introduced or if economic conditions change. For example, if a policy reduces construction activity, demand for construction inputs, such as cement, would also be reduced.
- **Interlinkages between households and sectors of the economy.** Households lend their time and savings to industry in exchange for income. Any change in income generation within a province affects household income.
- **Interlinkages between regions.** gTech represents a total of 12 regions in North America, including each Canadian province, a single region representing the territories, and the United States. gTech accounts for bilateral trade between these regions as well as international trade beyond North America. Policies implemented in a given region can then affect the level of trade that occurs with the rest of the world.

Understanding energy supply markets

gTech accounts for all major energy supply markets, including electricity, refined petroleum products, natural gas and hydrogen. Each market is characterized by resource availability and production costs by province and territory, as well as costs and constraints (e.g. pipeline capacity) of transporting energy between regions.

Low carbon energy sources can be introduced within each fuel stream in response to policy, such as renewable electricity and bioenergy. The model accounts for the availability and cost of bioenergy feedstocks, allowing it to provide insight about the economic effects of emission reduction policy, biofuels policy and the approval of pipelines.

gTech: The benefits of merging macroeconomics with technological detail

By merging the three features described above (technological detail, macroeconomic dynamics, and energy supply dynamics), gTech can provide extensive insight into the effect of climate and energy policy.

First, gTech can provide insights related to technological change by answering questions such as:

- How do policies affect technological adoption (e.g. how many electric vehicles are likely to be on the road in 2030 or 2050)?
- How does technological adoption affect energy consumption and greenhouse gas emissions?

Second, gTech can provide insights related to macroeconomics by answering questions such as:

- How do policies affect gross domestic product?
- How do policies affect individual sectors of the economy?
- Are households affected by the policy?
- Does the policy affect energy prices or any other price in the model (e.g., food prices)?

Third, gTech answers questions related to its energy supply modules:

- Will a policy generate more supply of renewable fuels or greater demand for electricity?
- Does policy affect the cost of transporting refined petroleum products, and therefore the price of gasoline in Canada?

Finally, gTech provides insight into areas where there is overlap between its various features:

- What is the effect of investing carbon revenue into low- and zero-carbon technologies? This question can only be answered with a model such as gTech.
- What are the macroeconomic impacts of technology-focused policies (e.g. how might a zero-emissions vehicle standard impact GDP)?
- Do biofuels focused policies affect (1) technological choice and (2) the macroeconomy?

This modeling toolkit allows for a comprehensive examination of the impacts of energy and climate change policy in Canada.

Annex 3: Electricity demand and peak load results by province

Table 2. Electricity demand (TWh) for space heating and cooling by climate change scenario, province, and year

Climate change scenario	Province	2040	2050	2060	2070	2080	2090	2100
Reference case	AB	119.8	290.7	342.1	400.8	448.3	502.8	593.4
Reference case	BC	98.0	229.5	252.1	283.4	307.5	342.1	380.1
Reference case	MB	30.2	71.4	81.7	96.0	114.2	139.1	169.1
Reference case	NB	14.0	30.5	32.1	34.6	37.4	40.4	43.5
Reference case	NL	6.0	11.9	11.4	11.0	10.7	10.3	10.0
Reference case	NS	10.3	22.3	22.8	24.2	25.7	27.2	29.0
Reference case	ON	195.3	470.9	547.7	649.3	769.0	911.3	1,073.0
Reference case	PE	2.1	4.8	5.2	6.0	6.9	8.0	9.3
Reference case	QC	231.9	494.6	517.6	550.3	587.5	629.6	667.4
Reference case	SK	34.2	83.9	100.3	117.9	131.1	148.2	161.9
BCCAQ2+GFDL-CM3, RCP 4.5	AB	120.2	145.9	171.9	201.6	225.9	253.7	299.4
BCCAQ2+GFDL-CM3, RCP 4.5	BC	96.6	114.0	126.9	142.8	155.2	173.0	192.5
BCCAQ2+GFDL-CM3, RCP 4.5	MB	30.4	36.1	41.5	49.0	58.4	70.9	86.0
BCCAQ2+GFDL-CM3, RCP 4.5	NB	13.7	14.9	15.9	17.2	18.7	20.2	21.8
BCCAQ2+GFDL-CM3, RCP 4.5	NL	5.8	5.8	5.6	5.4	5.3	5.1	4.9
BCCAQ2+GFDL-CM3, RCP 4.5	NS	10.2	11.1	11.4	12.2	13.0	13.8	14.7
BCCAQ2+GFDL-CM3, RCP 4.5	ON	200.1	241.3	282.0	334.8	397.0	471.1	555.4
BCCAQ2+GFDL-CM3, RCP 4.5	PE	2.1	2.4	2.6	3.0	3.5	4.1	4.8
BCCAQ2+GFDL-CM3, RCP 4.5	QC	227.1	243.6	258.3	275.7	295.4	317.7	338.3
BCCAQ2+GFDL-CM3, RCP 4.5	SK	34.5	42.3	50.7	59.6	66.5	75.3	82.3
BCCAQ2+GFDL-CM3, RCP 8.5	AB	120.2	146.1	172.4	202.4	227.2	255.7	302.3
BCCAQ2+GFDL-CM3, RCP 8.5	BC	96.3	113.9	127.3	143.6	156.6	175.1	195.6
BCCAQ2+GFDL-CM3, RCP 8.5	MB	30.2	36.0	41.7	49.6	59.4	72.5	88.3
BCCAQ2+GFDL-CM3, RCP 8.5	NB	13.8	15.0	16.0	17.3	18.8	20.4	22.1
BCCAQ2+GFDL-CM3, RCP 8.5	NL	5.8	5.8	5.6	5.4	5.3	5.1	4.9
BCCAQ2+GFDL-CM3, RCP 8.5	NS	10.2	11.1	11.5	12.4	13.3	14.2	15.2
BCCAQ2+GFDL-CM3, RCP 8.5	ON	199.9	242.2	284.6	339.7	405.0	483.2	572.7
BCCAQ2+GFDL-CM3, RCP 8.5	PE	2.1	2.4	2.6	3.1	3.6	4.2	4.9
BCCAQ2+GFDL-CM3, RCP 8.5	QC	227.6	243.5	258.5	276.5	297.2	321.1	343.8
BCCAQ2+GFDL-CM3, RCP 8.5	SK	34.4	42.4	50.9	60.1	67.2	76.4	84.0
BCCAQ2+MRI-CGCM3, RCP 4.5	AB	119.8	145.4	171.2	200.7	224.6	252.0	297.5
BCCAQ2+MRI-CGCM3, RCP 4.5	BC	96.8	113.8	125.9	141.6	153.9	171.4	190.7
BCCAQ2+MRI-CGCM3, RCP 4.5	MB	30.1	35.7	41.0	48.3	57.5	70.0	85.0
BCCAQ2+MRI-CGCM3, RCP 4.5	NB	13.8	15.0	15.9	17.1	18.5	20.0	21.6

BCCAQ2+MRI-CGCM3, RCP 4.5	NL	5.8	5.8	5.6	5.4	5.3	5.1	4.9
BCCAQ2+MRI-CGCM3, RCP 4.5	NS	10.1	11.0	11.3	12.0	12.7	13.5	14.4
BCCAQ2+MRI-CGCM3, RCP 4.5	ON	196.5	236.9	276.3	327.6	388.1	460.0	541.8
BCCAQ2+MRI-CGCM3, RCP 4.5	PE	2.0	2.3	2.6	3.0	3.5	4.0	4.6
BCCAQ2+MRI-CGCM3, RCP 4.5	QC	228.9	244.7	257.4	274.0	292.8	314.1	333.4
BCCAQ2+MRI-CGCM3, RCP 4.5	SK	34.2	42.0	50.3	59.1	65.8	74.5	81.4
BCCAQ2+MRI-CGCM3, RCP 8.5	AB	119.9	145.6	171.5	201.2	225.5	253.4	299.3
BCCAQ2+MRI-CGCM3, RCP 8.5	BC	97.0	113.8	126.1	142.0	154.5	172.5	192.2
BCCAQ2+MRI-CGCM3, RCP 8.5	MB	30.3	35.9	41.3	48.7	58.1	70.7	85.8
BCCAQ2+MRI-CGCM3, RCP 8.5	NB	13.7	14.9	15.8	17.1	18.4	20.0	21.6
BCCAQ2+MRI-CGCM3, RCP 8.5	NL	5.8	5.8	5.6	5.4	5.2	5.1	4.9
BCCAQ2+MRI-CGCM3, RCP 8.5	NS	10.1	10.9	11.3	12.0	12.8	13.6	14.5
BCCAQ2+MRI-CGCM3, RCP 8.5	ON	196.1	237.0	277.2	329.6	391.4	465.2	549.2
BCCAQ2+MRI-CGCM3, RCP 8.5	PE	2.0	2.3	2.6	3.0	3.5	4.0	4.7
BCCAQ2+MRI-CGCM3, RCP 8.5	QC	228.5	243.6	256.6	273.4	292.7	314.6	334.6
BCCAQ2+MRI-CGCM3, RCP 8.5	SK	34.3	42.1	50.5	59.4	66.3	75.1	82.2
BCCAQ2+HadGEM2-AO, RCP 4.5	AB	120.7	146.6	172.8	202.7	227.2	255.3	301.4
BCCAQ2+HadGEM2-AO, RCP 4.5	BC	96.2	113.7	127.0	143.0	155.7	173.9	193.8
BCCAQ2+HadGEM2-AO, RCP 4.5	MB	30.4	36.1	41.8	49.3	58.8	71.2	86.2
BCCAQ2+HadGEM2-AO, RCP 4.5	NB	13.7	14.9	15.9	17.2	18.6	20.1	21.7
BCCAQ2+HadGEM2-AO, RCP 4.5	NL	5.8	5.8	5.6	5.4	5.2	5.1	4.9
BCCAQ2+HadGEM2-AO, RCP 4.5	NS	10.2	11.0	11.4	12.1	12.9	13.7	14.6
BCCAQ2+HadGEM2-AO, RCP 4.5	ON	199.0	240.2	281.0	333.6	395.7	469.5	553.6
BCCAQ2+HadGEM2-AO, RCP 4.5	PE	2.0	2.4	2.6	3.0	3.5	4.1	4.7
BCCAQ2+HadGEM2-AO, RCP 4.5	QC	226.8	243.3	257.8	275.0	294.5	316.5	336.7
BCCAQ2+HadGEM2-AO, RCP 4.5	SK	34.7	42.6	51.0	60.0	67.0	75.9	83.0
BCCAQ2+HadGEM2-AO, RCP 8.5	AB	120.7	146.9	173.3	203.8	229.1	258.2	305.5
BCCAQ2+HadGEM2-AO, RCP 8.5	BC	95.9	113.8	128.0	144.6	158.2	177.4	198.8
BCCAQ2+HadGEM2-AO, RCP 8.5	MB	30.3	36.1	41.9	49.7	59.5	72.5	88.0
BCCAQ2+HadGEM2-AO, RCP 8.5	NB	13.7	14.9	15.9	17.3	18.7	20.4	22.0
BCCAQ2+HadGEM2-AO, RCP 8.5	NL	5.8	5.8	5.6	5.4	5.2	5.1	4.9
BCCAQ2+HadGEM2-AO, RCP 8.5	NS	10.1	11.0	11.4	12.3	13.2	14.1	15.1
BCCAQ2+HadGEM2-AO, RCP 8.5	ON	197.4	239.6	281.9	336.5	401.3	478.8	567.5
BCCAQ2+HadGEM2-AO, RCP 8.5	PE	2.0	2.4	2.6	3.1	3.6	4.2	4.9
BCCAQ2+HadGEM2-AO, RCP 8.5	QC	227.0	243.0	257.8	275.5	296.0	319.5	341.6
BCCAQ2+HadGEM2-AO, RCP 8.5	SK	34.7	42.7	51.3	60.6	67.9	77.2	84.9
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	AB	120.4	146.2	172.3	201.9	226.2	253.9	299.5
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	BC	95.6	113.1	126.3	142.2	154.6	172.4	191.8
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	MB	30.2	35.9	41.6	49.1	58.5	70.9	85.8
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NB	13.6	14.8	15.8	17.1	18.5	20.1	21.6
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NL	5.8	5.8	5.6	5.4	5.3	5.1	4.9
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NS	10.1	11.0	11.4	12.1	12.9	13.7	14.6
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	ON	196.0	237.1	278.0	330.1	391.6	464.8	548.0
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	PE	2.0	2.3	2.6	3.0	3.5	4.1	4.7
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	QC	223.4	240.0	255.3	272.4	291.8	313.7	333.8

BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	SK	34.6	42.4	50.8	59.8	66.7	75.4	82.5
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	AB	120.3	146.4	172.9	203.2	228.4	257.3	304.5
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	BC	95.5	112.9	126.6	142.7	155.7	174.4	195.0
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	MB	30.2	36.0	42.0	49.9	60.0	73.1	89.1
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NB	13.6	14.8	15.9	17.2	18.7	20.3	22.0
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NL	5.8	5.8	5.6	5.4	5.2	5.1	4.9
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NS	10.1	11.0	11.5	12.3	13.3	14.2	15.3
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	ON	196.4	238.5	281.3	335.9	400.7	478.3	567.3
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	PE	2.0	2.4	2.6	3.1	3.6	4.2	4.9
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	QC	223.8	239.9	255.6	273.5	293.9	317.5	339.9
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	SK	34.5	42.5	51.2	60.5	67.8	77.2	85.1
BCCAQ2+CCSM4, RCP 4.5	AB	120.4	146.1	172.0	201.6	225.7	253.3	298.9
BCCAQ2+CCSM4, RCP 4.5	BC	96.8	114.0	126.4	142.2	154.5	172.2	191.5
BCCAQ2+CCSM4, RCP 4.5	MB	30.2	35.9	41.3	48.7	58.0	70.4	85.4
BCCAQ2+CCSM4, RCP 4.5	NB	13.8	15.0	15.9	17.2	18.6	20.1	21.6
BCCAQ2+CCSM4, RCP 4.5	NL	5.8	5.9	5.6	5.4	5.3	5.1	4.9
BCCAQ2+CCSM4, RCP 4.5	NS	10.2	11.0	11.3	12.0	12.8	13.6	14.4
BCCAQ2+CCSM4, RCP 4.5	ON	197.6	238.4	278.4	330.1	391.0	463.5	545.8
BCCAQ2+CCSM4, RCP 4.5	PE	2.0	2.4	2.6	3.0	3.5	4.0	4.7
BCCAQ2+CCSM4, RCP 4.5	QC	226.9	243.4	257.4	274.4	293.6	315.3	334.9
BCCAQ2+CCSM4, RCP 4.5	SK	34.6	42.4	50.7	59.6	66.4	75.1	82.0
BCCAQ2+CCSM4, RCP 8.5	AB	120.3	146.3	172.6	202.7	227.5	256.1	302.8
BCCAQ2+CCSM4, RCP 8.5	BC	96.8	114.0	127.1	143.2	156.1	174.4	194.6
BCCAQ2+CCSM4, RCP 8.5	MB	30.2	35.9	41.6	49.3	59.0	71.9	87.4
BCCAQ2+CCSM4, RCP 8.5	NB	13.7	14.9	15.9	17.2	18.6	20.2	21.8
BCCAQ2+CCSM4, RCP 8.5	NL	5.8	5.9	5.6	5.4	5.3	5.1	4.9
BCCAQ2+CCSM4, RCP 8.5	NS	10.1	11.0	11.3	12.1	12.9	13.7	14.7
BCCAQ2+CCSM4, RCP 8.5	ON	196.4	238.0	279.4	332.8	396.1	471.6	557.8
BCCAQ2+CCSM4, RCP 8.5	PE	2.0	2.4	2.6	3.0	3.5	4.1	4.8
BCCAQ2+CCSM4, RCP 8.5	QC	226.6	242.7	257.2	274.6	294.6	317.3	338.4
BCCAQ2+CCSM4, RCP 8.5	SK	34.5	42.4	51.0	60.1	67.3	76.4	84.0
BCCAQ2+GFDL-ESM2M, RCP 4.5	AB	119.9	145.5	171.3	200.7	224.7	252.1	297.5
BCCAQ2+GFDL-ESM2M, RCP 4.5	BC	97.2	114.1	126.0	141.7	153.8	171.3	190.4
BCCAQ2+GFDL-ESM2M, RCP 4.5	MB	30.1	35.6	40.8	48.1	57.2	69.6	84.5
BCCAQ2+GFDL-ESM2M, RCP 4.5	NB	13.8	15.0	15.9	17.2	18.6	20.1	21.6
BCCAQ2+GFDL-ESM2M, RCP 4.5	NL	5.9	5.9	5.7	5.5	5.3	5.1	5.0
BCCAQ2+GFDL-ESM2M, RCP 4.5	NS	10.2	11.1	11.3	12.0	12.8	13.6	14.4
BCCAQ2+GFDL-ESM2M, RCP 4.5	ON	196.1	236.6	275.9	327.2	387.6	459.5	541.2
BCCAQ2+GFDL-ESM2M, RCP 4.5	PE	2.1	2.4	2.6	3.0	3.5	4.0	4.6
BCCAQ2+GFDL-ESM2M, RCP 4.5	QC	228.6	244.6	257.6	274.2	293.1	314.4	333.7
BCCAQ2+GFDL-ESM2M, RCP 4.5	SK	34.2	42.0	50.2	59.1	65.8	74.4	81.3
BCCAQ2+GFDL-ESM2M, RCP 8.5	AB	120.1	145.7	171.7	201.3	225.5	253.2	298.9
BCCAQ2+GFDL-ESM2M, RCP 8.5	BC	96.9	113.8	126.2	142.1	154.7	172.6	192.2
BCCAQ2+GFDL-ESM2M, RCP 8.5	MB	30.2	35.7	41.1	48.4	57.7	70.1	85.0
BCCAQ2+GFDL-ESM2M, RCP 8.5	NB	13.8	15.0	15.9	17.1	18.5	20.1	21.6

BCCAQ2+GFDL-ESM2M, RCP 8.5	NL	5.9	5.9	5.6	5.4	5.3	5.1	4.9
BCCAQ2+GFDL-ESM2M, RCP 8.5	NS	10.2	11.0	11.3	12.0	12.8	13.6	14.5
BCCAQ2+GFDL-ESM2M, RCP 8.5	ON	197.3	238.2	278.4	330.8	392.9	466.8	551.1
BCCAQ2+GFDL-ESM2M, RCP 8.5	PE	2.1	2.4	2.6	3.0	3.5	4.0	4.7
BCCAQ2+GFDL-ESM2M, RCP 8.5	QC	228.9	244.3	257.7	274.6	293.8	315.7	335.9
BCCAQ2+GFDL-ESM2M, RCP 8.5	SK	34.3	42.1	50.4	59.3	66.1	74.8	81.8
BCCAQ2+HadGEM2-ES, RCP 4.5	AB	120.6	146.4	172.6	202.4	226.9	254.9	300.9
BCCAQ2+HadGEM2-ES, RCP 4.5	BC	96.7	114.1	127.2	143.0	155.6	173.6	193.3
BCCAQ2+HadGEM2-ES, RCP 4.5	MB	29.9	35.7	41.4	49.0	58.6	71.2	86.4
BCCAQ2+HadGEM2-ES, RCP 4.5	NB	13.7	14.9	15.9	17.1	18.5	20.1	21.7
BCCAQ2+HadGEM2-ES, RCP 4.5	NL	5.8	5.8	5.6	5.4	5.2	5.1	4.9
BCCAQ2+HadGEM2-ES, RCP 4.5	NS	10.1	11.0	11.3	12.1	12.9	13.7	14.6
BCCAQ2+HadGEM2-ES, RCP 4.5	ON	196.7	238.1	279.4	332.2	394.6	468.9	553.5
BCCAQ2+HadGEM2-ES, RCP 4.5	PE	2.0	2.3	2.6	3.0	3.5	4.1	4.7
BCCAQ2+HadGEM2-ES, RCP 4.5	QC	224.6	241.3	256.3	273.7	293.3	315.6	336.0
BCCAQ2+HadGEM2-ES, RCP 4.5	SK	34.5	42.4	50.8	59.9	66.8	75.7	83.0
BCCAQ2+HadGEM2-ES, RCP 8.5	AB	120.2	146.4	172.9	203.4	228.8	258.0	305.6
BCCAQ2+HadGEM2-ES, RCP 8.5	BC	96.3	113.9	127.8	144.3	157.9	177.2	198.7
BCCAQ2+HadGEM2-ES, RCP 8.5	MB	30.0	35.8	41.7	49.6	59.4	72.4	88.0
BCCAQ2+HadGEM2-ES, RCP 8.5	NB	13.7	14.9	15.9	17.3	18.7	20.4	22.0
BCCAQ2+HadGEM2-ES, RCP 8.5	NL	5.8	5.8	5.6	5.4	5.2	5.1	4.9
BCCAQ2+HadGEM2-ES, RCP 8.5	NS	10.1	11.0	11.4	12.3	13.2	14.2	15.2
BCCAQ2+HadGEM2-ES, RCP 8.5	ON	197.7	239.9	282.6	337.3	402.2	479.8	568.6
BCCAQ2+HadGEM2-ES, RCP 8.5	PE	2.0	2.4	2.6	3.1	3.6	4.2	4.9
BCCAQ2+HadGEM2-ES, RCP 8.5	QC	225.7	241.9	257.0	274.9	295.4	319.1	341.5
BCCAQ2+HadGEM2-ES, RCP 8.5	SK	34.4	42.4	51.1	60.4	67.7	77.2	85.2

Table 3. Peak electricity demand (MW) by season, climate change scenario, province, and year

Season	Climate change scenario	Province	2040	2050	2060	2070	2080	2090	2100
summer	Reference case	AB	15,611	19,441	23,227	27,656	31,607	35,833	42,329
summer	Reference case	BC	13,302	16,659	19,352	22,086	24,542	27,593	30,887
summer	Reference case	MB	4,670	5,770	6,893	8,237	9,835	11,778	14,078
summer	Reference case	NB	2,016	2,182	2,362	2,556	2,769	3,006	3,248
summer	Reference case	NL	769	840	855	841	822	803	778
summer	Reference case	NS	1,542	1,698	1,780	1,900	2,017	2,130	2,250
summer	Reference case	ON	32,669	39,419	46,194	54,440	64,091	75,317	87,944
summer	Reference case	PE	318	371	425	494	573	664	769
summer	Reference case	QC	28,198	31,658	35,066	38,024	41,123	44,509	47,706
summer	Reference case	SK	5,677	7,077	8,527	10,039	11,219	12,643	13,717
summer	BCCAQ2+GFDL-CM3, RCP 4.5	AB	16,578	20,748	24,826	29,761	34,352	39,317	46,722
summer	BCCAQ2+GFDL-CM3, RCP 4.5	BC	14,125	17,336	20,128	23,003	25,980	29,261	32,818
summer	BCCAQ2+GFDL-CM3, RCP 4.5	MB	6,363	7,762	9,240	11,067	13,248	15,906	19,047
summer	BCCAQ2+GFDL-CM3, RCP 4.5	NB	2,291	2,549	2,742	2,989	3,240	3,507	3,765
summer	BCCAQ2+GFDL-CM3, RCP 4.5	NL	964	990	914	878	843	817	795
summer	BCCAQ2+GFDL-CM3, RCP 4.5	NS	1,984	2,151	2,229	2,395	2,559	2,722	2,896
summer	BCCAQ2+GFDL-CM3, RCP 4.5	ON	42,505	50,553	58,265	68,381	80,099	93,757	109,183
summer	BCCAQ2+GFDL-CM3, RCP 4.5	PE	467	532	592	692	807	942	1,098
summer	BCCAQ2+GFDL-CM3, RCP 4.5	QC	31,467	33,393	37,073	40,425	43,973	47,869	51,772
summer	BCCAQ2+GFDL-CM3, RCP 4.5	SK	6,466	7,951	9,471	11,174	12,762	14,663	16,437
summer	BCCAQ2+GFDL-CM3, RCP 8.5	AB	16,517	20,796	25,403	30,477	35,291	40,673	48,612
summer	BCCAQ2+GFDL-CM3, RCP 8.5	BC	13,949	17,354	20,280	23,329	26,513	30,059	33,935
summer	BCCAQ2+GFDL-CM3, RCP 8.5	MB	6,298	7,763	9,331	11,278	13,620	16,491	19,912
summer	BCCAQ2+GFDL-CM3, RCP 8.5	NB	2,283	2,588	2,839	3,106	3,357	3,624	3,898
summer	BCCAQ2+GFDL-CM3, RCP 8.5	NL	957	994	923	892	860	842	817
summer	BCCAQ2+GFDL-CM3, RCP 8.5	NS	1,975	2,178	2,293	2,513	2,737	2,924	3,119
summer	BCCAQ2+GFDL-CM3, RCP 8.5	ON	42,267	50,788	59,021	69,807	82,359	97,203	114,227
summer	BCCAQ2+GFDL-CM3, RCP 8.5	PE	465	534	599	707	832	978	1,151

summer	BCCAQ2+GFDL-CM3, RCP 8.5	QC	31,360	35,749	39,874	43,852	48,158	52,962	57,809
summer	BCCAQ2+GFDL-CM3, RCP 8.5	SK	6,380	7,918	9,508	11,303	13,015	15,080	17,066
summer	BCCAQ2+MRI-CGCM3, RCP 4.5	AB	16,255	20,320	24,274	29,018	33,366	38,102	45,233
summer	BCCAQ2+MRI-CGCM3, RCP 4.5	BC	13,412	16,809	19,546	22,347	24,886	28,038	31,454
summer	BCCAQ2+MRI-CGCM3, RCP 4.5	MB	6,066	7,433	8,842	10,576	12,644	15,160	18,131
summer	BCCAQ2+MRI-CGCM3, RCP 4.5	NB	2,153	2,380	2,538	2,742	2,950	3,171	3,390
summer	BCCAQ2+MRI-CGCM3, RCP 4.5	NL	925	948	874	843	824	804	780
summer	BCCAQ2+MRI-CGCM3, RCP 4.5	NS	1,876	2,025	2,089	2,228	2,361	2,493	2,635
summer	BCCAQ2+MRI-CGCM3, RCP 4.5	ON	40,299	48,024	55,411	64,942	75,955	88,649	103,187
summer	BCCAQ2+MRI-CGCM3, RCP 4.5	PE	444	506	564	658	764	888	1,029
summer	BCCAQ2+MRI-CGCM3, RCP 4.5	QC	29,676	34,671	38,481	42,248	46,013	50,135	54,153
summer	BCCAQ2+MRI-CGCM3, RCP 4.5	SK	6,163	7,593	9,050	10,663	12,142	13,908	15,524
summer	BCCAQ2+MRI-CGCM3, RCP 8.5	AB	16,240	20,373	24,428	29,330	33,916	38,984	46,414
summer	BCCAQ2+MRI-CGCM3, RCP 8.5	BC	13,559	16,839	19,653	22,567	25,257	28,967	32,603
summer	BCCAQ2+MRI-CGCM3, RCP 8.5	MB	6,129	7,502	8,951	10,743	12,881	15,495	18,583
summer	BCCAQ2+MRI-CGCM3, RCP 8.5	NB	2,152	2,402	2,587	2,827	3,076	3,343	3,617
summer	BCCAQ2+MRI-CGCM3, RCP 8.5	NL	920	949	878	848	830	811	788
summer	BCCAQ2+MRI-CGCM3, RCP 8.5	NS	1,874	2,042	2,126	2,289	2,454	2,622	2,803
summer	BCCAQ2+MRI-CGCM3, RCP 8.5	ON	40,723	48,434	55,926	65,769	77,200	90,549	105,651
summer	BCCAQ2+MRI-CGCM3, RCP 8.5	PE	445	511	573	672	784	917	1,070
summer	BCCAQ2+MRI-CGCM3, RCP 8.5	QC	31,009	35,150	39,264	43,219	47,395	51,707	55,953
summer	BCCAQ2+MRI-CGCM3, RCP 8.5	SK	6,143	7,613	9,119	10,800	12,368	14,251	16,016
summer	BCCAQ2+HadGEM2-AO, RCP 4.5	AB	17,461	21,768	25,877	30,953	35,747	41,081	48,925
summer	BCCAQ2+HadGEM2-AO, RCP 4.5	BC	14,103	17,380	20,163	23,040	25,668	28,921	32,448
summer	BCCAQ2+HadGEM2-AO, RCP 4.5	MB	6,465	7,846	9,298	11,092	13,225	15,816	18,860
summer	BCCAQ2+HadGEM2-AO, RCP 4.5	NB	2,272	2,520	2,700	2,929	3,161	3,407	3,656
summer	BCCAQ2+HadGEM2-AO, RCP 4.5	NL	954	974	892	854	830	810	786
summer	BCCAQ2+HadGEM2-AO, RCP 4.5	NS	1,966	2,126	2,194	2,344	2,491	2,636	2,788
summer	BCCAQ2+HadGEM2-AO, RCP 4.5	ON	42,521	50,546	58,231	68,314	79,991	92,857	108,120
summer	BCCAQ2+HadGEM2-AO, RCP 4.5	PE	467	529	588	686	798	928	1,080
summer	BCCAQ2+HadGEM2-AO, RCP 4.5	QC	31,182	35,284	40,370	44,081	48,037	52,388	56,668
summer	BCCAQ2+HadGEM2-AO, RCP 4.5	SK	6,563	8,033	9,535	11,215	12,768	14,622	16,332

summer	BCCAQ2+HadGEM2-AO, RCP 8.5	AB	17,425	21,861	26,122	31,421	36,525	42,283	50,695
summer	BCCAQ2+HadGEM2-AO, RCP 8.5	BC	14,288	17,466	20,344	23,360	26,157	29,617	33,392
summer	BCCAQ2+HadGEM2-AO, RCP 8.5	MB	6,448	7,902	9,445	11,366	13,668	16,483	19,814
summer	BCCAQ2+HadGEM2-AO, RCP 8.5	NB	2,254	2,545	2,781	3,067	3,310	3,570	3,835
summer	BCCAQ2+HadGEM2-AO, RCP 8.5	NL	945	979	901	867	843	828	808
summer	BCCAQ2+HadGEM2-AO, RCP 8.5	NS	1,945	2,137	2,243	2,446	2,653	2,844	3,026
summer	BCCAQ2+HadGEM2-AO, RCP 8.5	ON	41,890	51,001	59,373	71,093	83,977	99,485	116,725
summer	BCCAQ2+HadGEM2-AO, RCP 8.5	PE	461	529	592	697	818	960	1,127
summer	BCCAQ2+HadGEM2-AO, RCP 8.5	QC	32,032	35,590	39,734	43,732	48,062	52,897	57,783
summer	BCCAQ2+HadGEM2-AO, RCP 8.5	SK	6,485	8,007	9,575	11,342	13,014	15,024	16,936
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	AB	16,689	20,856	24,922	29,775	34,244	39,121	46,408
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	BC	14,004	17,208	19,962	22,805	25,366	28,533	31,957
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	MB	6,504	7,904	9,380	11,206	13,381	16,026	19,144
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NB	2,237	2,482	2,661	2,889	3,120	3,364	3,611
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NL	972	995	917	879	843	817	794
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NS	1,951	2,115	2,188	2,344	2,497	2,648	2,808
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	ON	41,446	49,419	57,063	67,013	78,536	91,965	107,129
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	PE	460	522	581	679	790	920	1,070
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	QC	30,489	34,536	38,373	41,794	47,213	51,418	55,538
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	SK	6,426	7,889	9,382	11,048	12,589	14,428	16,126
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	AB	16,638	21,006	25,186	30,267	35,637	41,160	49,283
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	BC	13,729	17,120	20,035	23,033	25,811	29,250	33,003
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	MB	6,443	7,934	9,529	11,518	13,910	16,848	20,337
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NB	2,238	2,530	2,770	3,042	3,286	3,545	3,810
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NL	959	1,003	930	898	867	842	818
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NS	1,947	2,146	2,260	2,475	2,685	2,861	3,049
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	ON	41,413	49,867	58,038	68,680	81,294	96,278	113,011
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	PE	458	526	590	696	817	960	1,128
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	QC	32,110	36,555	40,360	42,734	46,840	51,412	55,993
summer	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	SK	6,365	7,904	9,497	11,296	13,012	15,083	17,078
summer	BCCAQ2+CCSM4, RCP 4.5	AB	16,617	20,740	24,747	29,570	34,004	38,834	46,063
summer	BCCAQ2+CCSM4, RCP 4.5	BC	13,954	17,195	19,796	22,595	25,168	28,357	31,816

summer	BCCAQ2+CCSM4, RCP 4.5	MB	6,359	7,708	9,120	10,860	12,925	15,430	18,375
summer	BCCAQ2+CCSM4, RCP 4.5	NB	2,197	2,427	2,584	2,790	2,999	3,219	3,438
summer	BCCAQ2+CCSM4, RCP 4.5	NL	939	964	894	844	825	805	781
summer	BCCAQ2+CCSM4, RCP 4.5	NS	1,894	2,042	2,103	2,240	2,371	2,501	2,639
summer	BCCAQ2+CCSM4, RCP 4.5	ON	42,414	49,577	56,968	66,615	78,052	91,213	106,062
summer	BCCAQ2+CCSM4, RCP 4.5	PE	450	513	571	664	771	896	1,038
summer	BCCAQ2+CCSM4, RCP 4.5	QC	32,005	36,266	40,224	43,927	43,349	47,115	50,716
summer	BCCAQ2+CCSM4, RCP 4.5	SK	6,346	7,781	9,240	10,860	12,341	13,946	15,525
summer	BCCAQ2+CCSM4, RCP 8.5	AB	16,586	20,863	25,029	30,011	34,673	39,818	47,465
summer	BCCAQ2+CCSM4, RCP 8.5	BC	13,900	17,290	20,107	23,100	25,872	29,302	33,045
summer	BCCAQ2+CCSM4, RCP 8.5	MB	6,293	7,716	9,226	11,099	13,341	16,083	19,333
summer	BCCAQ2+CCSM4, RCP 8.5	NB	2,182	2,443	2,641	2,897	3,163	3,451	3,711
summer	BCCAQ2+CCSM4, RCP 8.5	NL	924	954	882	850	832	813	789
summer	BCCAQ2+CCSM4, RCP 8.5	NS	1,884	2,051	2,134	2,297	2,463	2,631	2,716
summer	BCCAQ2+CCSM4, RCP 8.5	ON	40,985	49,236	57,190	67,517	79,512	93,534	109,432
summer	BCCAQ2+CCSM4, RCP 8.5	PE	447	514	575	674	787	920	1,075
summer	BCCAQ2+CCSM4, RCP 8.5	QC	31,479	35,938	40,546	44,443	48,624	53,245	57,845
summer	BCCAQ2+CCSM4, RCP 8.5	SK	6,209	7,691	9,308	11,026	12,638	14,574	16,402
summer	BCCAQ2+GFDL-ESM2M, RCP 4.5	AB	16,405	20,486	24,454	29,231	33,617	38,394	45,570
summer	BCCAQ2+GFDL-ESM2M, RCP 4.5	BC	13,549	16,743	19,464	22,272	24,823	27,992	31,430
summer	BCCAQ2+GFDL-ESM2M, RCP 4.5	MB	6,149	7,515	8,950	10,722	12,837	15,348	18,284
summer	BCCAQ2+GFDL-ESM2M, RCP 4.5	NB	2,192	2,416	2,567	2,766	2,968	3,182	3,393
summer	BCCAQ2+GFDL-ESM2M, RCP 4.5	NL	938	963	893	857	825	805	780
summer	BCCAQ2+GFDL-ESM2M, RCP 4.5	NS	1,909	2,054	2,111	2,246	2,373	2,504	2,639
summer	BCCAQ2+GFDL-ESM2M, RCP 4.5	ON	40,258	48,027	55,463	65,055	76,145	89,050	103,594
summer	BCCAQ2+GFDL-ESM2M, RCP 4.5	PE	455	517	574	668	775	900	1,041
summer	BCCAQ2+GFDL-ESM2M, RCP 4.5	QC	31,432	35,383	39,204	42,765	46,497	50,570	49,381
summer	BCCAQ2+GFDL-ESM2M, RCP 4.5	SK	6,268	7,758	9,226	10,856	12,351	14,135	15,768
summer	BCCAQ2+GFDL-ESM2M, RCP 8.5	AB	16,541	20,687	24,729	29,622	34,163	39,152	46,539
summer	BCCAQ2+GFDL-ESM2M, RCP 8.5	BC	13,603	16,873	19,713	22,662	25,399	28,768	32,422
summer	BCCAQ2+GFDL-ESM2M, RCP 8.5	MB	6,280	7,656	9,105	10,895	13,028	15,626	18,693
summer	BCCAQ2+GFDL-ESM2M, RCP 8.5	NB	2,204	2,452	2,633	2,870	3,113	3,373	3,640

summer	BCCAQ2+GFDL-ESM2M, RCP 8.5	NL	929	961	895	862	830	811	788
summer	BCCAQ2+GFDL-ESM2M, RCP 8.5	NS	1,911	2,073	2,149	2,307	2,468	2,627	2,798
summer	BCCAQ2+GFDL-ESM2M, RCP 8.5	ON	41,270	48,727	56,478	66,514	78,996	92,959	108,488
summer	BCCAQ2+GFDL-ESM2M, RCP 8.5	PE	456	521	583	682	795	928	1,082
summer	BCCAQ2+GFDL-ESM2M, RCP 8.5	QC	31,676	35,897	39,843	43,646	45,987	50,209	54,377
summer	BCCAQ2+GFDL-ESM2M, RCP 8.5	SK	6,404	7,871	9,371	11,046	12,598	14,453	16,173
summer	BCCAQ2+HadGEM2-ES, RCP 4.5	AB	16,955	21,196	25,264	30,182	35,446	40,694	48,433
summer	BCCAQ2+HadGEM2-ES, RCP 4.5	BC	14,191	17,320	20,060	22,883	25,444	28,617	32,048
summer	BCCAQ2+HadGEM2-ES, RCP 4.5	MB	6,332	7,744	9,243	11,100	13,321	16,032	19,242
summer	BCCAQ2+HadGEM2-ES, RCP 4.5	NB	2,220	2,470	2,653	2,887	3,125	3,378	3,635
summer	BCCAQ2+HadGEM2-ES, RCP 4.5	NL	953	976	894	856	831	811	787
summer	BCCAQ2+HadGEM2-ES, RCP 4.5	NS	1,922	2,089	2,167	2,327	2,487	2,647	2,817
summer	BCCAQ2+HadGEM2-ES, RCP 4.5	ON	42,783	50,945	59,287	69,646	81,659	95,410	111,224
summer	BCCAQ2+HadGEM2-ES, RCP 4.5	PE	458	523	582	681	794	927	1,080
summer	BCCAQ2+HadGEM2-ES, RCP 4.5	QC	31,901	36,146	40,160	43,805	47,683	50,251	54,353
summer	BCCAQ2+HadGEM2-ES, RCP 4.5	SK	6,466	7,938	9,443	11,126	12,687	14,553	16,283
summer	BCCAQ2+HadGEM2-ES, RCP 8.5	AB	16,642	21,090	25,894	31,209	36,346	42,161	50,664
summer	BCCAQ2+HadGEM2-ES, RCP 8.5	BC	13,999	17,308	20,228	23,284	26,132	29,655	33,509
summer	BCCAQ2+HadGEM2-ES, RCP 8.5	MB	6,366	7,845	9,427	11,397	13,762	16,667	20,123
summer	BCCAQ2+HadGEM2-ES, RCP 8.5	NB	2,226	2,524	2,772	3,062	3,312	3,578	3,851
summer	BCCAQ2+HadGEM2-ES, RCP 8.5	NL	953	982	902	868	846	830	813
summer	BCCAQ2+HadGEM2-ES, RCP 8.5	NS	1,932	2,133	2,248	2,464	2,685	2,874	3,067
summer	BCCAQ2+HadGEM2-ES, RCP 8.5	ON	42,962	52,043	60,366	71,353	84,145	99,123	116,153
summer	BCCAQ2+HadGEM2-ES, RCP 8.5	PE	459	529	595	703	827	974	1,148
summer	BCCAQ2+HadGEM2-ES, RCP 8.5	QC	30,729	35,401	39,494	43,425	49,239	54,174	59,147
summer	BCCAQ2+HadGEM2-ES, RCP 8.5	SK	6,381	7,939	9,555	11,387	13,145	15,271	17,334
winter	Reference case	AB	16,255	20,219	24,036	28,527	32,381	36,627	43,592
winter	Reference case	BC	16,577	19,392	20,669	23,500	25,864	28,881	32,154
winter	Reference case	MB	5,238	6,091	6,689	7,820	9,323	11,613	14,356
winter	Reference case	NB	2,643	2,827	2,799	2,970	3,159	3,366	3,570
winter	Reference case	NL	1,133	1,112	1,032	976	938	900	860
winter	Reference case	NS	1,919	2,083	2,035	2,128	2,240	2,355	2,474

winter	Reference case	ON	30,656	36,908	41,976	49,590	58,385	68,763	80,481
winter	Reference case	PE	432	497	513	589	675	777	893
winter	Reference case	QC	43,016	44,545	43,151	45,255	47,827	50,705	53,421
winter	Reference case	SK	4,957	6,175	7,368	8,685	9,716	11,017	12,115
winter	BCCAQ2+GFDL-CM3, RCP 4.5	AB	16,234	20,196	24,016	28,496	32,339	36,543	43,413
winter	BCCAQ2+GFDL-CM3, RCP 4.5	BC	15,963	18,844	20,479	23,270	25,619	28,617	31,895
winter	BCCAQ2+GFDL-CM3, RCP 4.5	MB	5,372	6,035	6,632	7,750	9,231	11,452	14,096
winter	BCCAQ2+GFDL-CM3, RCP 4.5	NB	3,030	3,176	3,041	3,201	3,383	3,583	3,780
winter	BCCAQ2+GFDL-CM3, RCP 4.5	NL	1,302	1,236	1,113	1,039	994	944	889
winter	BCCAQ2+GFDL-CM3, RCP 4.5	NS	2,159	2,306	2,186	2,274	2,386	2,502	2,622
winter	BCCAQ2+GFDL-CM3, RCP 4.5	ON	32,230	38,308	41,902	49,255	57,655	67,709	79,274
winter	BCCAQ2+GFDL-CM3, RCP 4.5	PE	478	542	546	624	714	818	937
winter	BCCAQ2+GFDL-CM3, RCP 4.5	QC	44,799	46,071	44,004	45,946	48,394	51,150	53,637
winter	BCCAQ2+GFDL-CM3, RCP 4.5	SK	4,945	6,158	7,355	8,667	9,693	10,976	12,039
winter	BCCAQ2+GFDL-CM3, RCP 8.5	AB	16,230	20,190	24,010	28,486	32,325	36,514	43,347
winter	BCCAQ2+GFDL-CM3, RCP 8.5	BC	15,947	18,798	20,438	23,209	25,598	28,705	32,060
winter	BCCAQ2+GFDL-CM3, RCP 8.5	MB	5,360	6,025	6,603	7,698	9,050	11,123	13,566
winter	BCCAQ2+GFDL-CM3, RCP 8.5	NB	3,022	3,153	3,013	3,162	3,331	3,519	3,703
winter	BCCAQ2+GFDL-CM3, RCP 8.5	NL	1,152	1,235	1,108	1,032	984	932	877
winter	BCCAQ2+GFDL-CM3, RCP 8.5	NS	2,158	2,294	2,172	2,254	2,358	2,467	2,579
winter	BCCAQ2+GFDL-CM3, RCP 8.5	ON	32,313	38,239	41,746	48,970	57,213	68,093	80,558
winter	BCCAQ2+GFDL-CM3, RCP 8.5	PE	477	539	542	618	704	805	919
winter	BCCAQ2+GFDL-CM3, RCP 8.5	QC	44,972	45,850	43,596	45,315	46,519	49,234	51,691
winter	BCCAQ2+GFDL-CM3, RCP 8.5	SK	4,946	6,156	7,352	8,661	9,682	10,955	11,993
winter	BCCAQ2+MRI-CGCM3, RCP 4.5	AB	16,235	20,201	24,022	28,509	32,360	36,589	43,521
winter	BCCAQ2+MRI-CGCM3, RCP 4.5	BC	16,269	19,111	20,563	23,367	25,719	28,721	31,974
winter	BCCAQ2+MRI-CGCM3, RCP 4.5	MB	5,401	6,105	6,691	7,818	9,321	11,607	14,337
winter	BCCAQ2+MRI-CGCM3, RCP 4.5	NB	3,055	3,212	3,076	3,245	3,435	3,644	3,851
winter	BCCAQ2+MRI-CGCM3, RCP 4.5	NL	1,274	1,216	1,100	1,029	984	936	882
winter	BCCAQ2+MRI-CGCM3, RCP 4.5	NS	2,127	2,280	2,180	2,273	2,388	2,509	2,633
winter	BCCAQ2+MRI-CGCM3, RCP 4.5	ON	32,603	38,735	42,257	49,690	58,166	68,334	79,993
winter	BCCAQ2+MRI-CGCM3, RCP 4.5	PE	471	537	543	622	712	818	938

winter	BCCAQ2+MRI-CGCM3, RCP 4.5	QC	46,087	47,416	45,042	47,046	49,578	52,421	54,980
winter	BCCAQ2+MRI-CGCM3, RCP 4.5	SK	4,948	6,163	7,359	8,674	9,703	10,994	12,075
winter	BCCAQ2+MRI-CGCM3, RCP 8.5	AB	16,252	20,208	24,021	28,498	32,336	36,528	43,364
winter	BCCAQ2+MRI-CGCM3, RCP 8.5	BC	16,414	19,109	20,513	23,259	25,558	28,540	31,840
winter	BCCAQ2+MRI-CGCM3, RCP 8.5	MB	5,502	6,129	6,683	7,783	9,247	11,837	14,645
winter	BCCAQ2+MRI-CGCM3, RCP 8.5	NB	3,060	3,181	3,029	3,173	3,339	3,523	3,732
winter	BCCAQ2+MRI-CGCM3, RCP 8.5	NL	1,271	1,196	999	941	910	878	842
winter	BCCAQ2+MRI-CGCM3, RCP 8.5	NS	2,119	2,250	2,146	2,228	2,298	2,404	2,513
winter	BCCAQ2+MRI-CGCM3, RCP 8.5	ON	32,637	38,609	42,043	49,326	57,643	67,783	79,266
winter	BCCAQ2+MRI-CGCM3, RCP 8.5	PE	469	528	533	606	688	785	893
winter	BCCAQ2+MRI-CGCM3, RCP 8.5	QC	46,065	47,004	44,492	46,256	48,547	51,153	53,496
winter	BCCAQ2+MRI-CGCM3, RCP 8.5	SK	4,957	6,166	7,359	8,669	9,692	10,970	12,018
winter	BCCAQ2+HadGEM2-AO, RCP 4.5	AB	16,224	20,185	24,007	28,484	32,323	36,514	43,347
winter	BCCAQ2+HadGEM2-AO, RCP 4.5	BC	15,946	18,806	20,418	23,189	25,561	28,652	32,056
winter	BCCAQ2+HadGEM2-AO, RCP 4.5	MB	5,288	5,946	6,562	7,673	9,135	11,295	13,858
winter	BCCAQ2+HadGEM2-AO, RCP 4.5	NB	3,074	3,214	3,067	3,228	3,411	3,612	3,810
winter	BCCAQ2+HadGEM2-AO, RCP 4.5	NL	1,307	1,237	1,112	1,037	991	940	885
winter	BCCAQ2+HadGEM2-AO, RCP 4.5	NS	2,167	2,312	2,187	2,276	2,389	2,507	2,628
winter	BCCAQ2+HadGEM2-AO, RCP 4.5	ON	32,065	38,174	41,825	49,192	57,608	67,590	79,121
winter	BCCAQ2+HadGEM2-AO, RCP 4.5	PE	479	542	546	624	713	818	936
winter	BCCAQ2+HadGEM2-AO, RCP 4.5	QC	45,499	46,724	44,462	46,412	48,882	51,660	54,163
winter	BCCAQ2+HadGEM2-AO, RCP 4.5	SK	4,941	6,151	7,350	8,659	9,682	10,956	12,000
winter	BCCAQ2+HadGEM2-AO, RCP 8.5	AB	16,219	20,179	24,001	28,474	32,308	36,482	43,274
winter	BCCAQ2+HadGEM2-AO, RCP 8.5	BC	15,805	18,661	20,545	23,532	26,214	29,621	33,349
winter	BCCAQ2+HadGEM2-AO, RCP 8.5	MB	5,381	6,004	6,584	7,675	9,113	11,224	13,703
winter	BCCAQ2+HadGEM2-AO, RCP 8.5	NB	3,104	3,214	3,049	3,191	3,355	3,537	3,716
winter	BCCAQ2+HadGEM2-AO, RCP 8.5	NL	1,309	1,232	1,022	962	921	878	839
winter	BCCAQ2+HadGEM2-AO, RCP 8.5	NS	2,179	2,308	2,173	2,252	2,354	2,460	2,570
winter	BCCAQ2+HadGEM2-AO, RCP 8.5	ON	32,429	38,284	41,730	48,902	57,200	68,238	80,727
winter	BCCAQ2+HadGEM2-AO, RCP 8.5	PE	480	540	542	616	701	800	913
winter	BCCAQ2+HadGEM2-AO, RCP 8.5	QC	46,390	46,991	44,274	45,901	48,050	50,522	51,888
winter	BCCAQ2+HadGEM2-AO, RCP 8.5	SK	4,934	6,147	7,346	8,653	9,673	10,940	11,969

winter	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	AB	16,214	20,177	24,002	28,478	32,317	36,504	43,330
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	BC	15,741	18,643	20,402	23,170	25,505	28,510	31,784
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	MB	5,304	5,979	6,593	7,712	9,189	11,392	14,015
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NB	3,115	3,255	3,100	3,258	3,439	3,638	3,835
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NL	1,342	1,265	1,131	1,053	1,005	954	897
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NS	2,191	2,336	2,204	2,289	2,403	2,522	2,644
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	ON	31,835	35,760	41,417	49,220	58,235	68,800	80,877
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	PE	485	549	552	631	721	827	948
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	QC	44,656	45,895	43,850	45,789	48,231	50,981	53,464
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	SK	4,937	6,149	7,349	8,659	9,683	10,961	12,012
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	AB	16,209	20,166	23,989	28,454	32,280	36,659	43,616
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	BC	15,622	18,412	20,328	23,142	25,593	28,715	32,098
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	MB	5,302	5,953	6,546	7,634	9,062	11,141	13,361
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NB	3,090	3,213	3,058	3,203	3,370	3,556	3,738
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NL	1,350	1,262	1,123	1,042	991	938	880
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NS	2,184	2,315	2,178	2,253	2,356	2,463	2,574
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	ON	29,955	35,633	42,259	50,690	60,498	71,990	85,033
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	PE	483	543	545	620	706	806	920
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	QC	44,426	45,288	43,171	44,873	44,937	47,653	50,496
winter	BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	SK	4,932	6,142	7,343	8,647	9,664	10,925	11,939
winter	BCCAQ2+CCSM4, RCP 4.5	AB	16,243	20,207	24,027	28,514	32,365	36,597	43,532
winter	BCCAQ2+CCSM4, RCP 4.5	BC	16,192	19,032	20,538	23,338	25,688	28,689	31,938
winter	BCCAQ2+CCSM4, RCP 4.5	MB	5,338	6,029	6,637	7,765	9,261	11,361	13,992
winter	BCCAQ2+CCSM4, RCP 4.5	NB	3,085	3,235	3,089	3,254	3,441	3,647	3,851
winter	BCCAQ2+CCSM4, RCP 4.5	NL	1,338	1,263	1,131	1,053	1,006	955	897
winter	BCCAQ2+CCSM4, RCP 4.5	NS	2,192	2,341	2,212	2,303	2,418	2,538	2,662
winter	BCCAQ2+CCSM4, RCP 4.5	ON	32,216	38,377	42,011	49,448	57,931	67,958	79,593
winter	BCCAQ2+CCSM4, RCP 4.5	PE	484	549	553	633	724	831	954
winter	BCCAQ2+CCSM4, RCP 4.5	QC	45,672	47,009	44,741	46,755	49,289	52,129	54,687
winter	BCCAQ2+CCSM4, RCP 4.5	SK	4,943	6,158	7,357	8,671	9,700	10,991	12,071
winter	BCCAQ2+CCSM4, RCP 8.5	AB	16,259	20,213	24,024	28,502	32,339	36,532	43,367
winter	BCCAQ2+CCSM4, RCP 8.5	BC	16,470	19,138	20,528	23,266	25,611	28,716	32,067

winter	BCCAQ2+CCSM4, RCP 8.5	MB	5,367	6,012	6,608	7,718	9,184	11,367	13,954
winter	BCCAQ2+CCSM4, RCP 8.5	NB	3,129	3,253	3,062	3,212	3,384	3,575	3,762
winter	BCCAQ2+CCSM4, RCP 8.5	NL	1,343	1,261	1,126	1,046	997	944	886
winter	BCCAQ2+CCSM4, RCP 8.5	NS	2,192	2,330	2,198	2,283	2,391	2,504	2,620
winter	BCCAQ2+CCSM4, RCP 8.5	ON	32,412	38,401	41,909	49,198	57,524	67,582	79,141
winter	BCCAQ2+CCSM4, RCP 8.5	PE	483	546	549	627	715	818	935
winter	BCCAQ2+CCSM4, RCP 8.5	QC	46,020	46,970	44,476	46,278	48,606	51,247	53,623
winter	BCCAQ2+CCSM4, RCP 8.5	SK	4,953	6,160	7,355	8,665	9,688	10,965	12,012
winter	BCCAQ2+GFDL-ESM2M, RCP 4.5	AB	16,258	20,217	24,031	28,516	32,362	36,583	43,486
winter	BCCAQ2+GFDL-ESM2M, RCP 4.5	BC	16,449	19,229	20,632	23,425	25,755	28,736	31,965
winter	BCCAQ2+GFDL-ESM2M, RCP 4.5	MB	5,464	6,136	6,708	7,830	9,329	11,610	14,328
winter	BCCAQ2+GFDL-ESM2M, RCP 4.5	NB	3,159	3,305	3,144	3,307	3,494	3,700	3,903
winter	BCCAQ2+GFDL-ESM2M, RCP 4.5	NL	1,350	1,273	1,139	1,061	1,013	961	860
winter	BCCAQ2+GFDL-ESM2M, RCP 4.5	NS	2,217	2,365	2,229	2,314	2,428	2,549	2,673
winter	BCCAQ2+GFDL-ESM2M, RCP 4.5	ON	32,840	38,942	42,388	49,814	58,292	68,388	80,049
winter	BCCAQ2+GFDL-ESM2M, RCP 4.5	PE	490	555	557	637	728	836	959
winter	BCCAQ2+GFDL-ESM2M, RCP 4.5	QC	46,604	47,763	45,191	47,125	49,598	52,381	54,882
winter	BCCAQ2+GFDL-ESM2M, RCP 4.5	SK	4,957	6,170	7,363	8,678	9,705	10,997	12,074
winter	BCCAQ2+GFDL-ESM2M, RCP 8.5	AB	16,249	20,208	24,023	28,505	32,348	36,555	43,427
winter	BCCAQ2+GFDL-ESM2M, RCP 8.5	BC	16,320	19,087	20,541	23,310	25,628	28,595	31,918
winter	BCCAQ2+GFDL-ESM2M, RCP 8.5	MB	5,452	6,101	6,675	7,789	9,271	11,506	14,159
winter	BCCAQ2+GFDL-ESM2M, RCP 8.5	NB	3,141	3,275	3,112	3,267	3,444	3,639	3,832
winter	BCCAQ2+GFDL-ESM2M, RCP 8.5	NL	1,187	1,143	1,048	985	943	899	851
winter	BCCAQ2+GFDL-ESM2M, RCP 8.5	NS	2,208	2,347	2,210	2,290	2,399	2,513	2,630
winter	BCCAQ2+GFDL-ESM2M, RCP 8.5	ON	32,738	38,736	42,173	49,509	57,886	67,910	79,433
winter	BCCAQ2+GFDL-ESM2M, RCP 8.5	PE	488	551	552	630	719	823	942
winter	BCCAQ2+GFDL-ESM2M, RCP 8.5	QC	46,144	47,130	44,626	46,458	48,819	51,492	53,897
winter	BCCAQ2+GFDL-ESM2M, RCP 8.5	SK	4,954	6,164	7,359	8,671	9,696	10,980	12,043
winter	BCCAQ2+HadGEM2-ES, RCP 4.5	AB	16,224	20,187	24,010	28,489	32,331	36,531	43,387
winter	BCCAQ2+HadGEM2-ES, RCP 4.5	BC	16,043	18,910	20,481	23,261	25,599	28,585	31,814
winter	BCCAQ2+HadGEM2-ES, RCP 4.5	MB	5,281	5,951	6,580	7,706	9,191	11,408	14,059
winter	BCCAQ2+HadGEM2-ES, RCP 4.5	NB	3,054	3,199	3,058	3,219	3,401	3,603	3,830

winter	BCCAQ2+HadGEM2-ES, RCP 4.5	NL	1,309	1,237	1,112	1,037	931	889	847
winter	BCCAQ2+HadGEM2-ES, RCP 4.5	NS	2,168	2,314	2,190	2,279	2,391	2,508	2,628
winter	BCCAQ2+HadGEM2-ES, RCP 4.5	ON	31,622	37,802	41,599	48,992	57,441	67,461	79,016
winter	BCCAQ2+HadGEM2-ES, RCP 4.5	PE	478	542	546	624	713	818	935
winter	BCCAQ2+HadGEM2-ES, RCP 4.5	QC	44,680	46,023	44,015	46,009	48,507	51,312	53,844
winter	BCCAQ2+HadGEM2-ES, RCP 4.5	SK	4,938	6,151	7,351	8,662	9,687	10,969	12,027
winter	BCCAQ2+HadGEM2-ES, RCP 8.5	AB	16,212	20,172	23,995	28,465	32,297	36,461	43,229
winter	BCCAQ2+HadGEM2-ES, RCP 8.5	BC	15,976	18,750	20,369	23,200	25,904	29,374	33,154
winter	BCCAQ2+HadGEM2-ES, RCP 8.5	MB	5,265	5,927	6,525	7,612	9,034	11,095	13,510
winter	BCCAQ2+HadGEM2-ES, RCP 8.5	NB	3,064	3,177	3,018	3,156	3,342	3,519	3,696
winter	BCCAQ2+HadGEM2-ES, RCP 8.5	NL	1,297	1,221	1,097	1,021	914	871	836
winter	BCCAQ2+HadGEM2-ES, RCP 8.5	NS	2,173	2,297	2,166	2,242	2,339	2,442	2,548
winter	BCCAQ2+HadGEM2-ES, RCP 8.5	ON	32,078	37,915	41,445	48,572	57,058	67,871	80,096
winter	BCCAQ2+HadGEM2-ES, RCP 8.5	PE	479	537	539	613	694	792	901
winter	BCCAQ2+HadGEM2-ES, RCP 8.5	QC	45,377	46,088	43,678	45,308	47,444	49,905	52,120
winter	BCCAQ2+HadGEM2-ES, RCP 8.5	SK	4,928	6,142	7,343	8,647	9,665	10,926	11,941

Annex 4: Electricity expenditure results by province

Table 4. Total electricity expenditure (CAD2015) by climate change scenario, province, and year

Climate change scenario	Province	2040	2050	2060	2070	2080	2090	2100
Reference case	AB	9,494	11,285	13,070	14,901	16,178	17,744	20,083
Reference case	BC	6,460	9,580	11,598	15,676	19,487	24,490	32,096
Reference case	MB	1,550	1,631	1,963	2,593	3,638	7,216	11,042
Reference case	NB	1,291	1,356	1,408	1,507	1,616	1,738	1,877
Reference case	NL	954	946	939	940	941	932	920
Reference case	NS	791	867	886	935	993	1,068	1,152
Reference case	ON	13,111	16,123	18,969	22,512	26,937	31,701	37,475
Reference case	PE	361	404	435	486	550	628	711
Reference case	QC	8,525	9,177	9,768	11,096	12,418	14,144	16,401
Reference case	SK	2,461	2,996	3,601	4,230	4,706	5,311	5,811
BCCAQ2+GFDL-CM3, RCP 4.5	AB	9,532	11,368	13,126	14,964	16,335	17,122	20,390
BCCAQ2+GFDL-CM3, RCP 4.5	ON	13,663	16,805	19,639	23,450	27,900	33,181	39,127
BCCAQ2+GFDL-CM3, RCP 4.5	BC	6,400	9,104	11,576	15,573	19,414	25,998	32,095
BCCAQ2+GFDL-CM3, RCP 4.5	MB	1,578	1,646	2,080	2,722	3,906	6,819	10,851
BCCAQ2+GFDL-CM3, RCP 4.5	NB	1,266	1,331	1,398	1,501	1,581	1,726	1,876
BCCAQ2+GFDL-CM3, RCP 4.5	NL	968	938	942	937	937	923	921
BCCAQ2+GFDL-CM3, RCP 4.5	NS	766	862	879	942	1,008	1,095	1,175
BCCAQ2+GFDL-CM3, RCP 4.5	PE	355	400	435	491	562	628	717
BCCAQ2+GFDL-CM3, RCP 4.5	QC	8,101	8,748	9,602	11,066	12,617	14,695	16,760
BCCAQ2+GFDL-CM3, RCP 4.5	SK	2,498	3,022	3,646	4,307	4,791	5,407	5,933
BCCAQ2+GFDL-CM3, RCP 8.5	NS	773	864	872	971	1,058	1,142	1,235
BCCAQ2+GFDL-CM3, RCP 8.5	AB	9,529	11,381	13,176	15,049	16,335	17,231	20,830
BCCAQ2+GFDL-CM3, RCP 8.5	BC	6,139	9,006	11,522	15,438	20,010	26,500	32,011

BCCAQ2+GFDL-CM3, RCP 8.5	MB	1,566	1,651	2,117	2,806	4,063	7,011	11,068
BCCAQ2+GFDL-CM3, RCP 8.5	NB	1,267	1,332	1,399	1,510	1,594	1,738	1,872
BCCAQ2+GFDL-CM3, RCP 8.5	NL	962	938	958	932	926	925	923
BCCAQ2+GFDL-CM3, RCP 8.5	ON	13,630	16,865	19,865	23,814	28,681	34,064	40,503
BCCAQ2+GFDL-CM3, RCP 8.5	PE	356	401	436	494	571	641	740
BCCAQ2+GFDL-CM3, RCP 8.5	QC	8,004	8,726	9,627	11,088	12,844	15,106	17,687
BCCAQ2+GFDL-CM3, RCP 8.5	SK	2,490	3,027	3,662	4,342	4,820	5,521	6,049
BCCAQ2+MRI-CGCM3, RCP 4.5	AB	9,495	11,302	13,068	14,897	16,262	16,825	20,116
BCCAQ2+MRI-CGCM3, RCP 4.5	BC	6,549	9,244	11,480	15,549	19,263	26,185	32,065
BCCAQ2+MRI-CGCM3, RCP 4.5	MB	1,553	1,631	2,008	2,651	3,714	7,105	11,222
BCCAQ2+MRI-CGCM3, RCP 4.5	NB	1,269	1,332	1,393	1,492	1,589	1,716	1,839
BCCAQ2+MRI-CGCM3, RCP 4.5	NL	963	946	942	940	936	933	920
BCCAQ2+MRI-CGCM3, RCP 4.5	NS	764	846	867	920	984	1,051	1,136
BCCAQ2+MRI-CGCM3, RCP 4.5	ON	13,254	16,237	19,192	22,880	27,106	32,217	37,928
BCCAQ2+MRI-CGCM3, RCP 4.5	PE	353	398	431	483	544	622	708
BCCAQ2+MRI-CGCM3, RCP 4.5	QC	8,311	8,903	9,600	10,960	12,366	14,210	16,096
BCCAQ2+MRI-CGCM3, RCP 4.5	SK	2,467	2,999	3,616	4,255	4,732	5,322	5,857
BCCAQ2+MRI-CGCM3, RCP 8.5	AB	9,498	11,313	13,101	14,944	16,292	17,034	20,358
BCCAQ2+MRI-CGCM3, RCP 8.5	ON	13,261	16,279	19,314	23,061	27,512	32,704	38,664
BCCAQ2+MRI-CGCM3, RCP 8.5	BC	6,571	9,227	11,491	15,430	19,352	26,032	32,022
BCCAQ2+MRI-CGCM3, RCP 8.5	MB	1,563	1,646	2,052	2,689	3,822	6,774	10,827
BCCAQ2+MRI-CGCM3, RCP 8.5	NB	1,269	1,326	1,389	1,487	1,559	1,707	1,831
BCCAQ2+MRI-CGCM3, RCP 8.5	NL	963	947	942	937	937	922	922
BCCAQ2+MRI-CGCM3, RCP 8.5	NS	759	838	862	921	987	1,073	1,153
BCCAQ2+MRI-CGCM3, RCP 8.5	PE	352	395	427	482	552	620	710
BCCAQ2+MRI-CGCM3, RCP 8.5	QC	8,229	8,811	9,544	10,913	12,361	14,232	16,206
BCCAQ2+MRI-CGCM3, RCP 8.5	SK	2,468	3,008	3,636	4,294	4,769	5,404	5,919
BCCAQ2+HadGEM2-AO, RCP 4.5	AB	9,592	11,457	13,204	15,084	16,440	17,351	20,790
BCCAQ2+HadGEM2-AO, RCP 4.5	BC	6,279	8,955	11,477	15,373	19,437	25,920	31,711
BCCAQ2+HadGEM2-AO, RCP 4.5	MB	1,594	1,675	2,121	2,774	3,920	6,765	10,700
BCCAQ2+HadGEM2-AO, RCP 4.5	NB	1,270	1,330	1,397	1,499	1,594	1,732	1,867
BCCAQ2+HadGEM2-AO, RCP 4.5	NL	969	938	942	936	936	922	921

BCCAQ2+HadGEM2-AO, RCP 4.5	NS	763	858	875	935	997	1,079	1,154
BCCAQ2+HadGEM2-AO, RCP 4.5	ON	13,624	16,570	19,636	23,417	27,938	33,234	39,048
BCCAQ2+HadGEM2-AO, RCP 4.5	PE	354	399	433	488	554	624	713
BCCAQ2+HadGEM2-AO, RCP 4.5	QC	8,119	8,704	9,595	11,016	12,502	14,527	16,616
BCCAQ2+HadGEM2-AO, RCP 4.5	SK	2,526	3,037	3,661	4,330	4,837	5,433	5,973
BCCAQ2+HadGEM2-AO, RCP 8.5	AB	9,588	11,476	13,270	15,250	15,938	17,704	21,483
BCCAQ2+HadGEM2-AO, RCP 8.5	BC	6,164	8,795	11,425	15,243	20,770	26,391	31,580
BCCAQ2+HadGEM2-AO, RCP 8.5	MB	1,592	1,681	2,140	2,833	4,109	6,965	10,939
BCCAQ2+HadGEM2-AO, RCP 8.5	NB	1,273	1,331	1,400	1,506	1,607	1,705	1,857
BCCAQ2+HadGEM2-AO, RCP 8.5	NL	968	938	942	904	923	922	922
BCCAQ2+HadGEM2-AO, RCP 8.5	NS	762	857	880	989	1,047	1,133	1,223
BCCAQ2+HadGEM2-AO, RCP 8.5	ON	13,463	16,577	19,751	23,692	28,567	34,000	40,292
BCCAQ2+HadGEM2-AO, RCP 8.5	PE	353	398	434	491	559	648	744
BCCAQ2+HadGEM2-AO, RCP 8.5	QC	8,112	8,689	9,601	11,036	12,686	15,003	17,463
BCCAQ2+HadGEM2-AO, RCP 8.5	SK	2,525	3,049	3,682	4,370	4,870	5,591	6,150
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	AB	9,547	11,397	13,151	14,999	16,345	17,165	20,391
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	BC	6,191	8,868	11,448	15,344	19,247	25,736	31,841
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	MB	1,593	1,685	2,107	2,748	3,883	6,721	10,672
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NB	1,263	1,333	1,372	1,479	1,587	1,721	1,841
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NL	971	938	942	936	937	922	921
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NS	756	853	872	936	1,000	1,084	1,161
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	ON	13,289	16,292	19,324	23,079	27,553	32,684	38,612
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	PE	352	397	442	491	553	624	719
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	QC	8,000	8,577	9,442	10,848	12,295	14,172	16,186
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	SK	2,508	3,025	3,653	4,319	4,807	5,408	5,930
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	AB	9,539	11,420	13,214	15,159	16,111	17,427	21,172
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	BC	6,192	8,740	11,281	15,050	20,156	26,175	31,072
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	MB	1,586	1,691	2,153	2,849	4,139	7,005	11,120
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NB	1,264	1,333	1,374	1,488	1,599	1,706	1,846
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NL	970	938	958	915	924	923	922
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NS	759	856	868	985	1,057	1,141	1,234
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	ON	13,349	16,405	19,597	23,493	28,340	33,737	39,935

BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	PE	354	398	444	496	565	648	744
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	QC	8,015	8,520	9,444	10,897	12,490	14,776	17,072
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	SK	2,499	3,036	3,679	4,357	4,820	5,612	6,188
BCCAQ2+CCSM4, RCP 4.5	AB	9,550	11,381	13,142	14,957	16,412	17,033	20,267
BCCAQ2+CCSM4, RCP 4.5	BC	6,438	9,163	11,526	15,512	19,170	26,007	32,193
BCCAQ2+CCSM4, RCP 4.5	MB	1,583	1,651	2,067	2,695	3,790	6,805	11,217
BCCAQ2+CCSM4, RCP 4.5	NB	1,273	1,333	1,396	1,496	1,592	1,730	1,849
BCCAQ2+CCSM4, RCP 4.5	NL	962	946	942	941	936	933	920
BCCAQ2+CCSM4, RCP 4.5	NS	771	853	875	927	992	1,059	1,143
BCCAQ2+CCSM4, RCP 4.5	ON	13,554	16,437	19,481	23,227	27,630	32,689	38,457
BCCAQ2+CCSM4, RCP 4.5	PE	355	400	432	488	549	624	713
BCCAQ2+CCSM4, RCP 4.5	QC	8,085	8,731	9,560	10,978	12,417	14,399	16,432
BCCAQ2+CCSM4, RCP 4.5	SK	2,503	3,024	3,641	4,296	4,782	5,382	5,912
BCCAQ2+CCSM4, RCP 8.5	AB	9,542	11,392	13,205	15,086	16,540	17,426	21,020
BCCAQ2+CCSM4, RCP 8.5	BC	6,448	9,146	11,493	15,341	19,177	26,035	31,536
BCCAQ2+CCSM4, RCP 8.5	MB	1,572	1,661	2,106	2,784	3,960	6,899	10,920
BCCAQ2+CCSM4, RCP 8.5	NB	1,271	1,330	1,395	1,496	1,577	1,709	1,867
BCCAQ2+CCSM4, RCP 8.5	NL	962	946	943	937	936	922	921
BCCAQ2+CCSM4, RCP 8.5	NS	769	849	873	933	998	1,085	1,167
BCCAQ2+CCSM4, RCP 8.5	ON	13,364	16,410	19,527	23,390	28,006	33,326	39,494
BCCAQ2+CCSM4, RCP 8.5	PE	354	399	432	487	560	631	719
BCCAQ2+CCSM4, RCP 8.5	QC	8,105	8,699	9,554	10,986	12,547	14,728	16,807
BCCAQ2+CCSM4, RCP 8.5	SK	2,496	3,034	3,661	4,339	4,847	5,473	6,033
BCCAQ2+GFDL-ESM2M, RCP 4.5	AB	9,505	11,310	13,046	14,919	16,218	17,866	20,117
BCCAQ2+GFDL-ESM2M, RCP 4.5	BC	6,369	9,430	11,561	15,600	19,474	24,308	32,068
BCCAQ2+GFDL-ESM2M, RCP 4.5	MB	1,557	1,629	1,967	2,620	3,656	7,079	10,937
BCCAQ2+GFDL-ESM2M, RCP 4.5	NB	1,277	1,334	1,399	1,495	1,592	1,717	1,849
BCCAQ2+GFDL-ESM2M, RCP 4.5	NL	957	946	940	941	935	933	920
BCCAQ2+GFDL-ESM2M, RCP 4.5	NS	779	856	878	927	991	1,058	1,141
BCCAQ2+GFDL-ESM2M, RCP 4.5	ON	13,239	16,217	19,154	22,835	27,163	32,123	37,871
BCCAQ2+GFDL-ESM2M, RCP 4.5	PE	357	402	432	486	550	625	710
BCCAQ2+GFDL-ESM2M, RCP 4.5	QC	8,306	8,900	9,609	10,980	12,391	14,249	16,132

BCCAQ2+GFDL-ESM2M, RCP 4.5	SK	2,467	3,000	3,615	4,259	4,729	5,344	5,854
BCCAQ2+GFDL-ESM2M, RCP 8.5	AB	9,523	11,342	13,116	14,951	16,289	17,012	20,263
BCCAQ2+GFDL-ESM2M, RCP 8.5	BC	6,385	9,224	11,534	15,491	19,391	26,102	32,225
BCCAQ2+GFDL-ESM2M, RCP 8.5	MB	1,559	1,640	2,027	2,648	3,743	6,689	11,092
BCCAQ2+GFDL-ESM2M, RCP 8.5	NB	1,275	1,332	1,394	1,494	1,590	1,709	1,857
BCCAQ2+GFDL-ESM2M, RCP 8.5	NL	956	946	942	937	936	931	921
BCCAQ2+GFDL-ESM2M, RCP 8.5	NS	779	853	874	931	993	1,065	1,150
BCCAQ2+GFDL-ESM2M, RCP 8.5	ON	13,367	16,345	19,404	23,125	27,594	32,884	38,609
BCCAQ2+GFDL-ESM2M, RCP 8.5	PE	356	401	434	486	552	628	713
BCCAQ2+GFDL-ESM2M, RCP 8.5	QC	8,309	8,853	9,614	11,002	12,464	14,425	16,509
BCCAQ2+GFDL-ESM2M, RCP 8.5	SK	2,476	3,009	3,648	4,296	4,769	5,386	5,907
BCCAQ2+HadGEM2-ES, RCP 4.5	AB	9,576	11,425	13,185	15,058	16,406	17,323	20,699
BCCAQ2+HadGEM2-ES, RCP 4.5	QC	7,975	8,556	9,435	10,872	12,397	14,428	16,513
BCCAQ2+HadGEM2-ES, RCP 4.5	BC	6,402	9,054	11,503	15,385	19,448	25,909	31,739
BCCAQ2+HadGEM2-ES, RCP 4.5	MB	1,574	1,660	2,087	2,748	3,909	6,779	10,792
BCCAQ2+HadGEM2-ES, RCP 4.5	NB	1,263	1,335	1,395	1,496	1,590	1,729	1,865
BCCAQ2+HadGEM2-ES, RCP 4.5	NL	969	938	942	936	937	922	921
BCCAQ2+HadGEM2-ES, RCP 4.5	NS	758	854	872	934	999	1,084	1,164
BCCAQ2+HadGEM2-ES, RCP 4.5	ON	13,440	16,436	19,500	23,280	27,809	33,130	38,976
BCCAQ2+HadGEM2-ES, RCP 4.5	PE	352	397	431	487	556	626	719
BCCAQ2+HadGEM2-ES, RCP 4.5	SK	2,502	3,029	3,656	4,329	4,832	5,430	5,973
BCCAQ2+HadGEM2-ES, RCP 8.5	AB	9,536	11,413	13,251	15,204	15,842	17,631	21,478
BCCAQ2+HadGEM2-ES, RCP 8.5	BC	6,181	8,937	11,417	15,203	20,817	26,387	31,427
BCCAQ2+HadGEM2-ES, RCP 8.5	MB	1,562	1,671	2,120	2,815	4,075	6,821	10,906
BCCAQ2+HadGEM2-ES, RCP 8.5	NB	1,270	1,338	1,399	1,506	1,594	1,723	1,859
BCCAQ2+HadGEM2-ES, RCP 8.5	NL	969	939	959	904	924	923	922
BCCAQ2+HadGEM2-ES, RCP 8.5	NS	762	856	864	990	1,051	1,135	1,228
BCCAQ2+HadGEM2-ES, RCP 8.5	ON	13,529	16,567	19,785	23,754	28,678	34,141	40,459
BCCAQ2+HadGEM2-ES, RCP 8.5	PE	353	398	433	491	568	647	747
BCCAQ2+HadGEM2-ES, RCP 8.5	QC	8,234	8,613	9,521	10,948	12,662	14,949	17,445
BCCAQ2+HadGEM2-ES, RCP 8.5	SK	2,491	3,032	3,677	4,359	4,864	5,605	6,178

Table 5. Capital expenditure on electricity (CAD2015) by climate change scenario, province, and year

Climate change scenario	Province	2040	2050	2060	2070	2080	2090	2100
Reference case	AB	2,885	3,702	4,516	5,507	6,334	7,337	8,927
Reference case	BC	5,572	8,042	9,654	12,282	14,037	16,734	19,655
Reference case	MB	1,919	1,980	2,055	2,375	3,124	5,048	6,797
Reference case	NB	859	883	903	932	966	996	1,054
Reference case	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
Reference case	NS	316	343	344	368	395	423	456
Reference case	ON	7,251	8,982	9,940	11,063	12,458	13,802	15,496
Reference case	PE	202	221	231	255	285	321	354
Reference case	QC	9,451	9,738	9,781	10,130	11,048	11,905	13,960
Reference case	SK	998	1,214	1,413	1,601	1,811	1,977	2,137
BCCAQ2+GFDL-CM3, RCP 4.5	AB	2,905	3,739	4,551	5,569	6,482	7,450	9,036
BCCAQ2+GFDL-CM3, RCP 4.5	ON	7,477	9,213	10,034	11,440	12,733	14,375	16,240
BCCAQ2+GFDL-CM3, RCP 4.5	BC	5,583	7,701	9,669	12,212	14,085	16,565	19,709
BCCAQ2+GFDL-CM3, RCP 4.5	MB	1,935	1,989	2,116	2,434	3,349	5,046	6,924
BCCAQ2+GFDL-CM3, RCP 4.5	NB	847	870	898	927	941	995	1,048
BCCAQ2+GFDL-CM3, RCP 4.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+GFDL-CM3, RCP 4.5	NS	307	332	335	358	388	419	454
BCCAQ2+GFDL-CM3, RCP 4.5	PE	200	215	230	254	292	318	355
BCCAQ2+GFDL-CM3, RCP 4.5	QC	9,188	9,389	9,516	10,113	11,301	12,700	14,018
BCCAQ2+GFDL-CM3, RCP 4.5	SK	1,017	1,242	1,457	1,688	1,860	2,088	2,324
BCCAQ2+GFDL-CM3, RCP 8.5	NS	307	332	337	367	403	441	481
BCCAQ2+GFDL-CM3, RCP 8.5	AB	2,903	3,747	4,574	5,604	6,562	7,595	9,242
BCCAQ2+GFDL-CM3, RCP 8.5	BC	5,320	7,607	9,606	12,188	14,290	16,759	19,604
BCCAQ2+GFDL-CM3, RCP 8.5	MB	1,930	1,992	2,137	2,475	3,444	5,259	7,177
BCCAQ2+GFDL-CM3, RCP 8.5	NB	845	869	899	929	945	986	1,046
BCCAQ2+GFDL-CM3, RCP 8.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+GFDL-CM3, RCP 8.5	ON	7,464	9,255	10,121	11,540	13,059	14,721	16,792
BCCAQ2+GFDL-CM3, RCP 8.5	PE	200	215	230	255	295	323	366
BCCAQ2+GFDL-CM3, RCP 8.5	QC	9,053	9,374	9,525	10,095	11,448	12,793	14,637
BCCAQ2+GFDL-CM3, RCP 8.5	SK	1,012	1,241	1,458	1,696	1,936	2,180	2,386

BCCAQ2+MRI-CGCM3, RCP 4.5	AB	2,885	3,707	4,506	5,524	6,376	7,354	8,942
BCCAQ2+MRI-CGCM3, RCP 4.5	BC	5,735	7,847	9,637	12,194	14,011	16,623	19,653
BCCAQ2+MRI-CGCM3, RCP 4.5	MB	1,923	1,979	2,056	2,405	3,193	5,041	6,877
BCCAQ2+MRI-CGCM3, RCP 4.5	NB	848	873	898	926	958	986	1,031
BCCAQ2+MRI-CGCM3, RCP 4.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+MRI-CGCM3, RCP 4.5	NS	305	330	332	356	382	410	441
BCCAQ2+MRI-CGCM3, RCP 4.5	ON	7,329	8,981	10,069	11,253	12,416	14,062	15,795
BCCAQ2+MRI-CGCM3, RCP 4.5	PE	199	214	228	250	281	318	355
BCCAQ2+MRI-CGCM3, RCP 4.5	QC	9,331	9,564	9,626	10,045	11,120	12,221	13,582
BCCAQ2+MRI-CGCM3, RCP 4.5	SK	1,000	1,220	1,440	1,629	1,829	2,036	2,205
BCCAQ2+MRI-CGCM3, RCP 8.5	AB	2,886	3,714	4,531	5,552	6,438	7,434	9,030
BCCAQ2+MRI-CGCM3, RCP 8.5	ON	7,352	9,045	10,135	11,326	12,631	14,182	16,113
BCCAQ2+MRI-CGCM3, RCP 8.5	BC	5,755	7,829	9,632	12,149	14,090	16,558	19,609
BCCAQ2+MRI-CGCM3, RCP 8.5	MB	1,923	1,986	2,085	2,420	3,280	5,034	6,902
BCCAQ2+MRI-CGCM3, RCP 8.5	NB	851	870	895	923	936	989	1,022
BCCAQ2+MRI-CGCM3, RCP 8.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+MRI-CGCM3, RCP 8.5	NS	304	325	328	349	377	408	442
BCCAQ2+MRI-CGCM3, RCP 8.5	PE	199	213	225	249	286	314	354
BCCAQ2+MRI-CGCM3, RCP 8.5	QC	9,241	9,494	9,580	10,016	11,118	12,247	13,498
BCCAQ2+MRI-CGCM3, RCP 8.5	SK	999	1,221	1,479	1,687	1,911	2,103	2,299
BCCAQ2+HadGEM2-AO, RCP 4.5	AB	2,938	3,777	4,616	5,612	6,539	7,561	9,183
BCCAQ2+HadGEM2-AO, RCP 4.5	BC	5,457	7,565	9,531	12,173	14,165	16,519	19,444
BCCAQ2+HadGEM2-AO, RCP 4.5	MB	1,944	2,000	2,127	2,447	3,346	5,074	6,923
BCCAQ2+HadGEM2-AO, RCP 4.5	NB	851	870	899	928	959	1,003	1,052
BCCAQ2+HadGEM2-AO, RCP 4.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+HadGEM2-AO, RCP 4.5	NS	306	331	333	355	382	410	443
BCCAQ2+HadGEM2-AO, RCP 4.5	ON	7,492	9,121	10,240	11,456	12,821	14,444	16,231
BCCAQ2+HadGEM2-AO, RCP 4.5	PE	200	216	229	253	284	317	355
BCCAQ2+HadGEM2-AO, RCP 4.5	QC	9,225	9,410	9,523	10,080	11,203	12,633	13,955
BCCAQ2+HadGEM2-AO, RCP 4.5	SK	1,033	1,257	1,460	1,695	1,917	2,103	2,333
BCCAQ2+HadGEM2-AO, RCP 8.5	AB	2,938	3,790	4,655	5,684	6,677	7,737	9,460
BCCAQ2+HadGEM2-AO, RCP 8.5	BC	5,379	7,438	9,448	12,112	14,260	16,599	19,235

BCCAQ2+HadGEM2-AO, RCP 8.5	MB	1,947	2,008	2,136	2,484	3,474	5,309	7,186
BCCAQ2+HadGEM2-AO, RCP 8.5	NB	854	871	899	929	963	980	1,023
BCCAQ2+HadGEM2-AO, RCP 8.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+HadGEM2-AO, RCP 8.5	NS	307	329	334	365	398	437	477
BCCAQ2+HadGEM2-AO, RCP 8.5	ON	7,446	9,095	10,195	11,460	13,022	14,749	16,709
BCCAQ2+HadGEM2-AO, RCP 8.5	PE	200	215	230	254	286	334	377
BCCAQ2+HadGEM2-AO, RCP 8.5	QC	9,182	9,406	9,540	10,061	11,294	12,789	14,543
BCCAQ2+HadGEM2-AO, RCP 8.5	SK	1,034	1,262	1,476	1,723	1,964	2,204	2,426
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	AB	2,910	3,752	4,562	5,583	6,489	7,453	9,023
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	BC	5,421	7,495	9,554	12,118	14,044	16,459	19,542
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	MB	1,948	2,021	2,157	2,461	3,329	5,035	6,879
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NB	850	878	881	916	954	992	1,027
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	NS	305	329	332	355	383	413	447
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	ON	7,374	9,042	10,096	11,310	12,657	14,171	16,089
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	PE	200	214	241	257	286	316	360
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	QC	9,216	9,410	9,522	9,955	11,036	12,201	13,526
BCCAQ2+MIROC-ESM-CHEM, RCP 4.5	SK	1,023	1,247	1,457	1,687	1,896	2,082	2,317
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	AB	2,905	3,760	4,572	5,643	6,600	7,680	9,390
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	BC	5,428	7,378	9,404	11,964	14,140	16,607	19,046
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	MB	1,943	2,015	2,164	2,504	3,504	5,331	7,333
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NB	849	877	881	917	958	984	1,035
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	NS	306	329	336	366	403	440	481
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	ON	7,406	9,115	10,023	11,414	12,940	14,580	16,452
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	PE	200	215	242	260	289	333	375
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	QC	9,215	9,377	9,514	9,949	11,118	12,681	14,275
BCCAQ2+MIROC-ESM-CHEM, RCP 8.5	SK	1,016	1,247	1,453	1,691	1,937	2,209	2,433
BCCAQ2+CCSM4, RCP 4.5	AB	2,914	3,744	4,558	5,563	6,452	7,432	9,023
BCCAQ2+CCSM4, RCP 4.5	BC	5,612	7,761	9,641	12,187	13,955	16,581	19,749
BCCAQ2+CCSM4, RCP 4.5	MB	1,940	1,988	2,094	2,418	3,254	5,017	6,903
BCCAQ2+CCSM4, RCP 4.5	NB	851	873	899	928	959	1,004	1,036

BCCAQ2+CCSM4, RCP 4.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+CCSM4, RCP 4.5	NS	310	335	336	361	387	415	447
BCCAQ2+CCSM4, RCP 4.5	ON	7,515	9,252	10,218	11,431	12,739	14,221	16,140
BCCAQ2+CCSM4, RCP 4.5	PE	200	216	229	254	284	317	358
BCCAQ2+CCSM4, RCP 4.5	QC	9,170	9,426	9,531	10,070	11,157	12,553	13,815
BCCAQ2+CCSM4, RCP 4.5	SK	1,019	1,237	1,444	1,679	1,866	2,065	2,249
BCCAQ2+CCSM4, RCP 8.5	AB	2,909	3,752	4,583	5,617	6,505	7,592	9,253
BCCAQ2+CCSM4, RCP 8.5	BC	5,620	7,735	9,595	12,132	14,098	16,562	19,408
BCCAQ2+CCSM4, RCP 8.5	MB	1,934	1,987	2,123	2,452	3,384	5,149	7,024
BCCAQ2+CCSM4, RCP 8.5	NB	851	870	897	926	939	964	1,020
BCCAQ2+CCSM4, RCP 8.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+CCSM4, RCP 8.5	NS	309	333	335	358	383	415	450
BCCAQ2+CCSM4, RCP 8.5	ON	7,429	9,177	10,215	11,460	12,854	14,484	16,482
BCCAQ2+CCSM4, RCP 8.5	PE	200	215	228	252	290	323	359
BCCAQ2+CCSM4, RCP 8.5	QC	9,178	9,419	9,532	10,060	11,262	12,744	14,028
BCCAQ2+CCSM4, RCP 8.5	SK	1,015	1,237	1,456	1,696	1,926	2,136	2,350
BCCAQ2+GFDL-ESM2M, RCP 4.5	AB	2,891	3,715	4,486	5,525	6,372	7,364	8,948
BCCAQ2+GFDL-ESM2M, RCP 4.5	BC	5,522	7,928	9,616	12,195	13,997	16,654	19,665
BCCAQ2+GFDL-ESM2M, RCP 4.5	MB	1,931	1,983	2,060	2,404	3,151	5,027	6,787
BCCAQ2+GFDL-ESM2M, RCP 4.5	NB	852	872	899	926	958	988	1,031
BCCAQ2+GFDL-ESM2M, RCP 4.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+GFDL-ESM2M, RCP 4.5	NS	311	336	338	361	388	416	448
BCCAQ2+GFDL-ESM2M, RCP 4.5	ON	7,332	8,990	10,055	11,234	12,476	14,002	15,742
BCCAQ2+GFDL-ESM2M, RCP 4.5	PE	201	217	228	252	284	321	357
BCCAQ2+GFDL-ESM2M, RCP 4.5	QC	9,353	9,632	9,678	10,050	11,140	12,246	13,605
BCCAQ2+GFDL-ESM2M, RCP 4.5	SK	1,002	1,223	1,444	1,644	1,837	2,035	2,208
BCCAQ2+GFDL-ESM2M, RCP 8.5	AB	2,901	3,732	4,542	5,561	6,440	7,418	9,015
BCCAQ2+GFDL-ESM2M, RCP 8.5	BC	5,555	7,825	9,662	12,105	13,928	16,634	19,734
BCCAQ2+GFDL-ESM2M, RCP 8.5	MB	1,927	1,985	2,077	2,410	3,216	4,963	6,845
BCCAQ2+GFDL-ESM2M, RCP 8.5	NB	851	872	898	926	957	981	1,039
BCCAQ2+GFDL-ESM2M, RCP 8.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+GFDL-ESM2M, RCP 8.5	NS	310	334	336	359	385	412	443

BCCAQ2+GFDL-ESM2M, RCP 8.5	ON	7,391	9,097	10,164	11,323	12,626	14,223	15,997
BCCAQ2+GFDL-ESM2M, RCP 8.5	PE	201	216	229	252	285	321	354
BCCAQ2+GFDL-ESM2M, RCP 8.5	QC	9,347	9,573	9,638	10,086	11,218	12,612	13,934
BCCAQ2+GFDL-ESM2M, RCP 8.5	SK	1,007	1,231	1,512	1,710	1,930	2,118	2,293
BCCAQ2+HadGEM2-ES, RCP 4.5	AB	2,933	3,772	4,570	5,617	6,534	7,527	9,141
BCCAQ2+HadGEM2-ES, RCP 4.5	QC	9,144	9,348	9,471	9,950	11,124	12,567	13,886
BCCAQ2+HadGEM2-ES, RCP 4.5	BC	5,577	7,645	9,598	12,177	14,171	16,526	19,416
BCCAQ2+HadGEM2-ES, RCP 4.5	MB	1,944	2,013	2,141	2,456	3,348	5,081	6,968
BCCAQ2+HadGEM2-ES, RCP 4.5	NB	848	879	899	927	958	1,001	1,050
BCCAQ2+HadGEM2-ES, RCP 4.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+HadGEM2-ES, RCP 4.5	NS	306	330	332	354	383	413	448
BCCAQ2+HadGEM2-ES, RCP 4.5	ON	7,462	9,064	10,183	11,387	12,747	14,345	16,134
BCCAQ2+HadGEM2-ES, RCP 4.5	PE	199	215	228	253	285	317	357
BCCAQ2+HadGEM2-ES, RCP 4.5	SK	1,021	1,248	1,461	1,694	1,915	2,108	2,348
BCCAQ2+HadGEM2-ES, RCP 8.5	AB	2,908	3,761	4,605	5,661	6,640	7,707	9,444
BCCAQ2+HadGEM2-ES, RCP 8.5	BC	5,357	7,534	9,505	12,098	14,228	16,591	19,125
BCCAQ2+HadGEM2-ES, RCP 8.5	MB	1,930	2,003	2,140	2,474	3,446	5,289	7,206
BCCAQ2+HadGEM2-ES, RCP 8.5	NB	850	880	899	928	943	979	1,025
BCCAQ2+HadGEM2-ES, RCP 8.5	NL	1,213	1,213	1,213	1,213	1,213	1,213	1,213
BCCAQ2+HadGEM2-ES, RCP 8.5	NS	308	330	334	366	400	437	478
BCCAQ2+HadGEM2-ES, RCP 8.5	ON	7,476	9,082	10,192	11,584	13,172	14,885	16,869
BCCAQ2+HadGEM2-ES, RCP 8.5	PE	200	215	229	252	294	334	377
BCCAQ2+HadGEM2-ES, RCP 8.5	QC	9,069	9,385	9,535	9,969	11,283	12,746	14,540
BCCAQ2+HadGEM2-ES, RCP 8.5	SK	1,016	1,249	1,461	1,712	1,961	2,212	2,454

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