



MOUNT ROYAL UNIVERSITY 2017 GREENHOUSE GAS EMISSIONS INVENTORY

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"Building Towards a Sustainable Future"

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1 Introduction

Mount Royal University is committed to acting sustainably, ensuring key activities are ecologically sound, socially just and environmentally viable. Fundamental to this is a commitment to reducing the university’s environmental footprint, which includes implementing a corporate energy management plan to reduce energy consumption across the campus, adopting LEED certification as the standard for all new university buildings and using the Sustainability Tracking Assessment and Rating System (STARS) framework developed by the Association for the Advancement of Sustainability in Higher Education (AASHE) to measure and track sustainability initiatives.

This report outlines the Greenhouse Gas (GHG) Emissions inventory for Mount Royal University for the 2016/17 fiscal year, as compared with a baseline of the 2014/15 fiscal year.

2 Mount Royal emissions summary

The total emissions for Mount Royal University in the performance year of fiscal 2016/17 were 36,917.34 tonnes of CO₂e as compared with 31,560.09 tonnes of CO₂e in the baseline year of fiscal 2014/15. In the performance year, emissions increased by 17 percent as compared with the 2014/15 year with an increase of 5357.5 tCO₂e. Emissions for both years are shown below in tonnes of carbon dioxide equivalent (tCO₂e).

Figure 1 Mount Royal GHG emissions summary

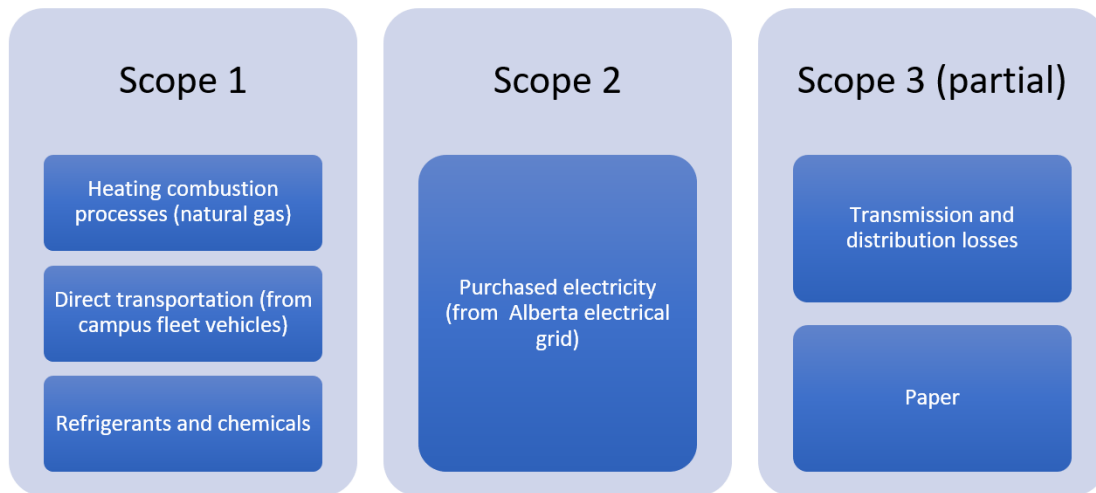
	2014/15	2016/17	% increase from base year to performance year
Scope 1	8,732.60	10,630.06	22%
Scope 2	20,588.67	23,763.25	15%
Scope 3	2,238.82	2,524.03	13%
Total tonnes of CO₂e	31,560.09	36,917.34	17%

Although the exact cause of the GHG emissions increase is not known, during this time the University grew in both size and population and constructed two new buildings on the campus. With the increase in population and new campus facilities, the carbon footprint of the university only increased slightly from 13 kg CO₂/ft² to 14 kg CO₂/ft².

3 Emissions inventory scope

Following the GHG protocol, emissions are grouped in scopes based on the degree of responsibility the university has for producing GHGs. Scope 1 refers to direct GHG emissions. Scope 2 includes indirect GHG emissions from purchased electricity and steam, and Scope 3 covers other indirect emissions. The following are the university’s inventory of Scope 1 and 2 emissions, as well as two sources of Scope 3 emissions that are included.

Figure 2 Operational boundaries of the Mount Royal GHG inventory



Complete Scope 1 and Scope 2 emissions are included in the inventory, as well as two sources of Scope 3 emissions. These are transportation and distribution losses from Scope 2 electricity and paper. Scope 2 emissions from student and staff transportation, air travel, solid waste and waste water will be considered in the future but data was unavailable at the time of this inventory.

Omissions and exclusions are outlined in Appendix A.

4 Methodology

4.1 Assessment method

This report is guided by the *World Resources Institute’s (WRI) Greenhouse Gas Protocol: Corporate Accounting and Reporting Standard (2015)* to calculate emissions through the *Sustainability Indicator Management & Analysis Program (SIMAP)*, the tool recommended by AASHE STARS. SIMAP is a comprehensive footprint reporting tool designed for campuses, replaces the Campus Carbon Calculator and the online CarbonMAP. Activity data specific to Mount Royal University was collected and entered into SIMAP to quantify the university’s GHG emissions using published emissions factors.

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4.2 Organizational boundaries

Mount Royal has followed the Operational Control approach to defining the boundaries of the organization. Operational Control is defined as having has the full authority to introduce and implement its operating policies. This report includes emissions over which the university has operational control.

The organizational boundaries include the following university-operated facilities:

- Lincoln Park Site
- Centre South
- Centre North
- West Wing
- East Wing
- Springbank Hangar
- Springbank Site
- Kerby Hall
- Arts Wing (T Wing)
- Central Plant
- Community & Health Wing
- Student Residences (East Court)
- Science & Technology Wing
- West Wing Expansion
- Faculty of Arts Building
- Bissett School of Business
- Grounds Building
- Student Residences (West Court)
- Roderick Mah Centre For Continuous Learning
- Wyckham House Student Centre & Link
- Science & Technology Wing Expansion
- Taylor Centre for the Performing Arts (2016/17 only)

Omissions and exclusions are outlined in Appendix A.

4.3 Performance year and base year

The base year for this inventory is the 2014/15 fiscal year and the performance year is the 2016/17 fiscal year, which aligns the inventory with university-wide sustainability reporting for AASHE STARS. All calculations are based on the Mount Royal fiscal year (from July 1 to June 30).

4.4 Policy for base year emissions recalculations

Base year emissions recalculations will be made if the university acquires facilities or other operations that existed and were in operation prior to the base year (2014/15). Base year emissions will not be recalculated if new buildings are constructed after the base year.

4.5 Data collection

Collection and compilation of activity data for this report was a collaborative effort between Facilities Management and the Research, Scholarship and Community Engagement departments for the fiscal years 2014/15, 2015/16 and 2016/17. The reporting year for this inventory is the 2016/17, the most recent year for which all necessary data was available.

4.6 Emission Factors

Greenhouse gas emissions for Mount Royal University were determined by applying GHG emission factors to the data collected in the SIMAP tool. Emission factors used are summarized in a table in Appendix B.

5 Emissions Details

5.1.1 Emissions by scope

The following is the breakdown of the emissions by scope for both the base year 2014/15 the and performance year 2016/17. Scope 1 emissions increased by 1.12% in 2016/17 while Scope 2 and 3 emissions decreased slightly.

Figure 3 Percentage emissions by scope 2016/17

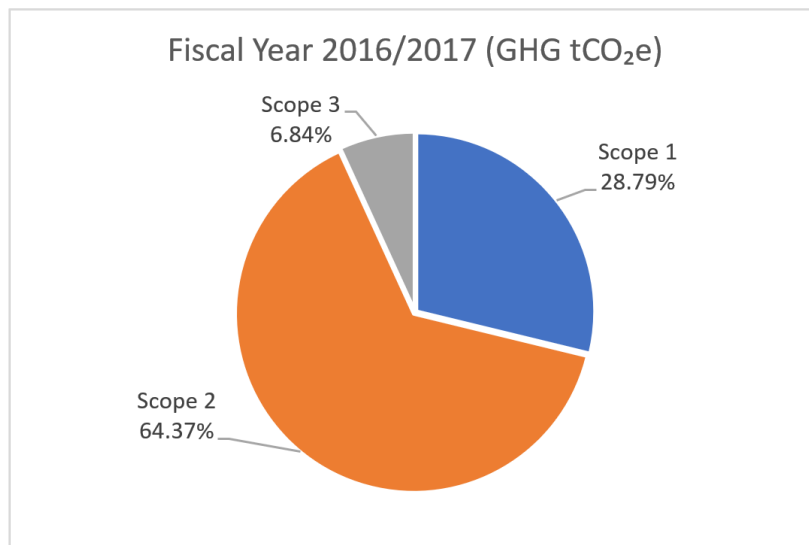
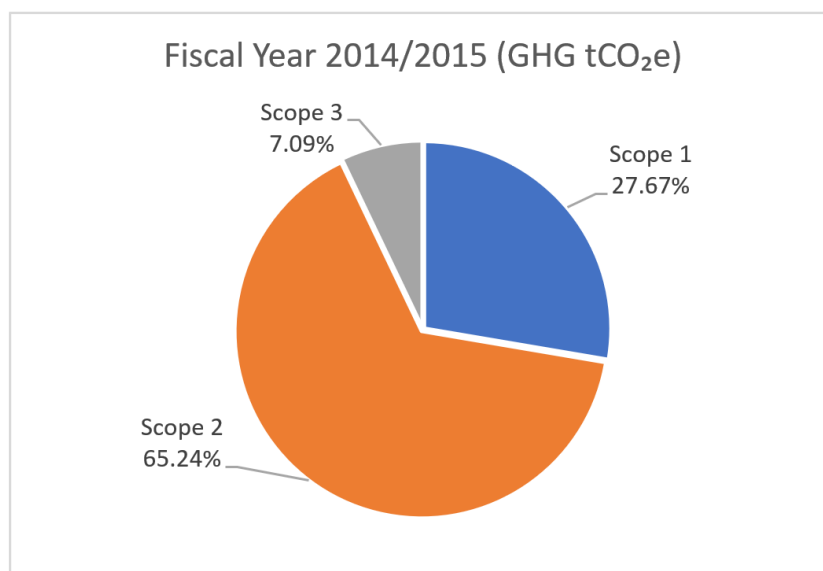


Figure 4 Percentage emissions by scope 2014/15



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5.2 Breakdown by scope

5.2.1 2016/17 scope

For the performance year, the following is the breakdown between the scopes of emissions and the emission data for GHGs separately.

Figure 5 2016/17 Emissions data by scope and GHGs in kilograms

Scope	Source	CH ₄ (kg)	CO ₂ (kg)	N ₂ O (kg)
Scope 1	Other On-Campus Stationary	1,043.0	10,482,641.0	21.0
Scope 1	Direct Transportation	6.0	47,541.0	2.0
Scope 1	Refrigerants & Chemicals	0.0	0.0	0.0
Scope 2	Purchased Electricity	1,193.0	23,555,718.0	596.0
Scope 3	Paper Purchasing	0.0	0.0	0.0
Scope 3	T&D Losses	118.0	2,329,686.0	59.0
	TOTAL	2,360.0	36,415,586.0	678.0

Figure 6 2016/17 Emissions data by scope and GHGs in tonnes of CO₂ equivalent

Scope	Source	CH ₄ (tCO ₂ e)	CO ₂ (tCO ₂ e)	N ₂ O (tCO ₂ e)	Total GHG tCO ₂ e
Scope 1	Other On-Campus Stationary	26.1	10,482.6	6.2	10,514.9
Scope 1	Direct Transportation	0.2	47.5	0.6	48.3
Scope 1	Refrigerants & Chemicals	0.0	0.0	0.0	66.8
Scope 2	Purchased Electricity	29.8	23,555.7	177.7	23,763.3
Scope 3	Paper Purchasing	0.0	0.0	0.0	173.8
Scope 3	T&D Losses	3.0	2,329.7	17.6	2,350.2
	TOTAL	59.0	36,415.6	202.2	36,917.3

5.2.2 2014/15 scope

For the base year, the following is the breakdown between the scopes of emissions and the emission data for GHGs separately.

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Figure 7 2014/15 Emissions data by scope and GHGs in kilograms

Scope	Source	CH ₄ (kg)	CO ₂ (kg)	N ₂ O (kg)
Scope 1	Other On-Campus Stationary	861.0	8,658,431.0	17.0
Scope 1	Direct Transportation	6.0	46,657.0	2.0
Scope 1	Refrigerants & Chemicals	0.0	0.0	0.0
Scope 2	Purchased Electricity	5,346.0	20,361,132.0	315.0
Scope 3	Paper Purchasing	0.0	0.0	0.0
Scope 3	T&D Losses	529.0	2,013,738.0	31.0
	TOTAL	6,742.0	31,079,958.0	365.0

Figure 8 2014/15 Emissions data by scope and GHGs in tonnes of CO₂ equivalent

Scope	Source	CH ₄ (tCO ₂ e)	CO ₂ (tCO ₂ e)	N ₂ O (tCO ₂ e)	Total GHG tCO ₂ e
Scope 1	Other On-Campus Stationary	21.5	8,658.4	5.1	8,685.1
Scope 1	Direct Transportation	0.2	46.7	0.6	47.4
Scope 1	Refrigerants & Chemicals	0.0	0.0	0.0	0.1
Scope 2	Purchased Electricity	133.7	20,361.1	93.9	20,588.7
Scope 3	Paper Purchasing	0.0	0.0	0.0	202.6
Scope 3	T&D Losses	13.2	2,013.7	9.3	2,036.2
	TOTAL	168.6	31,080.0	108.9	31,560.1

5.3 Emissions by source

Below is a comparison of the breakdown of the source of emissions between 2016/17 and the base year of 2014/15. The greatest increase in emissions came from increases in energy use, primarily from the On-Campus Stationary source (heating boilers and other natural gas use) as natural gas use increased by 21% from 2014/15 to 2016/17. Electricity use increased by 3% during the same period.

Figure 9 2016/17 Emissions by source (%)

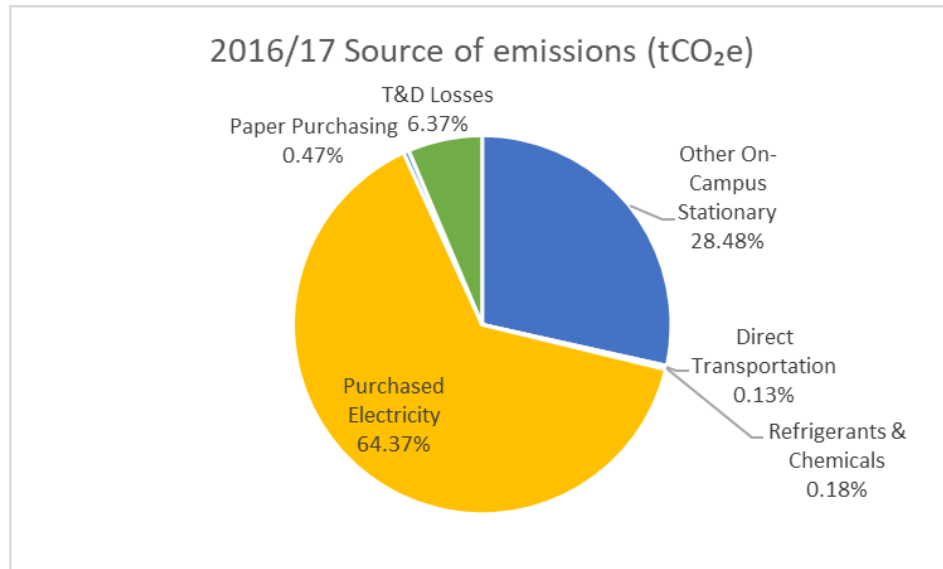
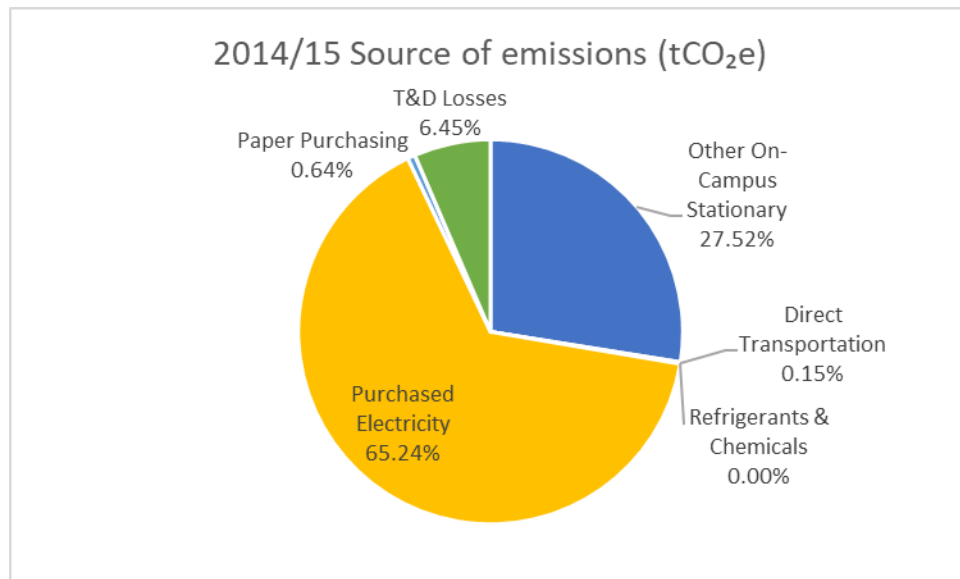


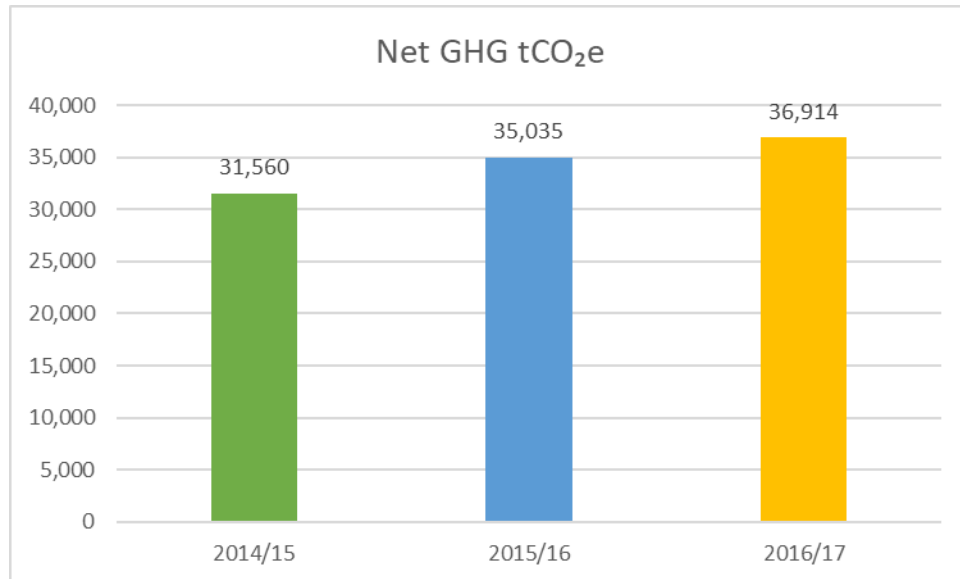
Figure 10 2014/15 Emissions by source (%)



5.4 GHG emission trends

Mount Royal’s total emissions increased by 17% from 2014/15 (31,560.09 tCO₂) to 2016/17 (36,914.26 tCO₂). During this same time the student enrollment increased by 4% and the total square footage of the university facilities increased by 10%. When measured by square footage, the carbon footprint of the campus increased only slightly from 13 kg CO₂/ft² to 14 kg CO₂/ft².

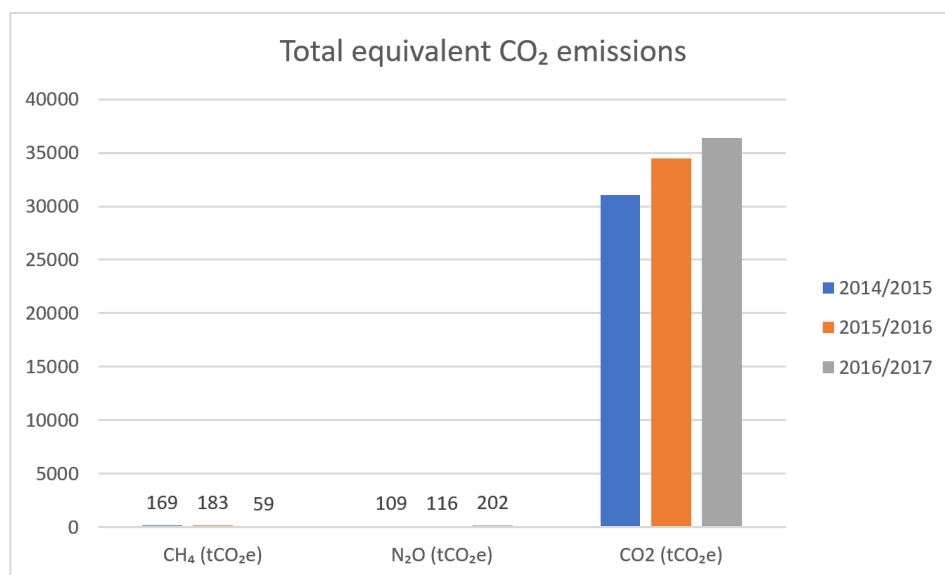
Figure 11 Net emissions trends from 2014/15 to 2016/17



5.5 Emissions by type of greenhouse gas

The following six greenhouse gases are identified by the Kyoto Protocol including carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₈). No sources of HFCs, PFCs or SF₈ were identified at Mount Royal university and so are not included in this inventory. The equivalent CO₂ emissions of CO₂, CH₄, and N₂O for fiscal years 2014/15, 2015/16 and 2016/17 are reported below, as totaled in Figure 6 and Figure 8.

Figure 12 Total equivalent CO₂ emissions by type of GHG



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From 2014/15 to 2016/17 carbon dioxide increased by 17%, nitrous oxide increased by 85% but methane decreased by 65%.

6 Conclusion

Mount Royal University is actively committed to reducing its impact on the environment and measuring and managing the greenhouse gas emissions associated with university operations. This inventory will be updated and maintained to measure overall emissions as well as progress made in reducing GHG emissions.

Appendix A Omissions and Estimates

Omissions

The following sources of GHG emissions were not included in the GHG inventory because data was not available.

1. Buildings under construction
 - a. Riddell Library and Learning Centre (2016/17 and 2014/15)
 - b. Taylor Centre for the Performing Arts (2014/15 only)
2. Fugitive emissions – Fugitive emissions are currently not measured at Mount Royal and were documented by reporting the amounts of refrigerants that were replenished over the reporting period.

Estimates

1. For the base year (2014/15) and the subsequent year (2015/16), direct fuel consumption from fleet vehicles was not available, so estimates based on the actual fuel consumption in 2016/17 were used.

Appendix B Emission factors and notable data

The following emission factors were used to calculate CO₂ equivalent emissions in this report.

Fuel sources

For the fuel sources of GHGs at Mount Royal, these are the emissions factors used by SIMAP to determine GHG emissions for the period.

		FISCAL YEAR			Units	
		2014/15	2015/16	2016/17		
Direct Transportation Sources	University Fleet	Diesel Fleet	10.166	10.166	10.257	kg CO ₂ / US gallon
		Gasoline Fleet	8.5913	8.5913	8.8665	kg CO ₂ / US gallon
On-Campus Stationary Sources		Natural Gas	53.02	53.02	53.02	kg CO ₂ / MMBtu
Electricity, Steam, and Chilled Water		Electricity	0.7038	0.6983	0.559	kg CO ₂ / kWh

Purchased Electricity

The calculation of emissions for purchased electricity was determined using the annual fuel mix for Alberta electrical energy generation as published by the Alberta Utilities Commission¹. At the time of the inventory, generation by resource was only available for 2014 – 2016 so the 2016 breakdown was used for 2017 data.

Resource Type	Coal	Natural Gas	Hydro	Wind	Biogas & Biomass	*Others	Total
Total	42,226.9	33,159.3	1,773.0	4,407.5	2,201.2	339.7	84,107.7
Breakdown by Percentage	50.21%	39.42%	2.11%	5.24%	2.62%	0.40%	
<small>1 Only plants that have to report to the AUC are included (i.e. all electric generating facilities with an installed capacity of 0.5 MW or greater are included). Excludes Isolated Plants.</small>							
<small>* Others include fuel oil, waste heat</small>							

¹ <http://www.auc.ab.ca/Pages/annual-electricity-data.aspx>

ALBERTA ELECTRIC ENERGY GENERATION (GWh) BY RESOURCE, 2015 ¹							
Resource Type	Coal	Natural Gas	Hydro	Wind	Biogas & Biomass	*Others	Total
Total	41,378.1	32,215.4	1,745.0	3,815.6	2,148.5	318.1	81,620.8
Breakdown by Percentage	50.70%	39.47%	2.14%	4.67%	2.63%	0.39%	
¹ Only plants that have to report to the AUC are included (i.e. all electric generating facilities with an installed capacity of 0.5 MW or greater are included). Excludes Isolated Plants. * Others include fuel oil, waste heat							

ALBERTA ELECTRIC ENERGY GENERATION (GWh) BY RESOURCE, 2014 ¹							
Resource Type	Coal	Natural Gas	Hydro	Wind	Biogas & Biomass	*Others	Total
Total	44,442.0	28,136.2	1,861.1	3,471.3	2,065.2	372.6	80,348.4
Breakdown by Percentage	55.31%	35.02%	2.32%	4.32%	2.57%	0.46%	
¹ Only plants that have to report to the AUC are included (i.e. all electric generating facilities with an installed capacity of 0.5 MW or greater are included). Excludes Isolated Plants. * Others include fuel oil, waste heat							

Paper Purchasing

Paper purchasing was determined through paper purchasing reports from Mount Royal's suppliers for all three fiscal years. It indicated paper weight by purchase. Some recycled paper content was indicated, but if it was not, research was conducted to determine the nature and recycled content of the paper. Recycled content and weight was entered for each type of paper for each fiscal year into the SIMAP calculator to determine GHG emissions in tCO₂e

Paper emission factors in the SIMAP calculator are as follows:

Paper type	kg eCO₂ /lb
Coated Freesheet	0.001379148
Corrugated Bleached	0.001424734
Corrugated Semibleached	0.001309748
Corrugated Unbleached	0.001287975
Paperboard Coated Recycled	0.000632761
Paperboard Uncoated Bleached Kraft	0.001411806
Paperboard Uncoated Unbleached Kraft	0.001294326
Uncoated Freesheet	0.001365993

Mount Royal population statistics

The following population statistics were used to determine full time student enrollment and other calculations requiring university population.

	2014-2015	2015-2016	2016-2017
Number of academic divisions	8	8	7
Number of academic departments	37	32	30
Number of students enrolled for credit	13,805	13,593	13,771
Total number of employees (Faculty, Staff, Management, Credit Free)	2,287	2,281	2,306
Full-time equivalent student enrollment	9,165.69	9,265.86	9,533.81
Full-time equivalent of employees (Faculty, Staff, Management, Credit Free)	1,626	1,871	1,835
Full-time equivalent of students enrolled exclusively in distance education	66	77	90
Student Resident on-site	858	915	876
Employees Resident on-site	5	5	5
Other individuals resident on-site (e.g. family members of employees, individual lodging on-site (by average occupancy rate), and/or in-patient hospital beds (if applicable))	120	93	97