



2016 CARBON NEUTRAL ACTION REPORT

MAY 30, 2017

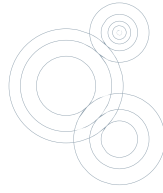


THE UNIVERSITY OF BRITISH COLUMBIA
sustainability



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EXECUTIVE SUMMARY

As a rapidly growing, research-intensive institution, the University of British Columbia (UBC) is working on finding innovative ways to decouple growth from carbon emissions. Driven by the need to manage operational costs and the urgent need to mitigate climate change, UBC's efforts focus on renewable energy supply and demand side energy conservation. Our actions to date have saved the university \$3M in avoided carbon costs since 2007.

In 2016, UBC continued to deliver on our bold climate action commitments, reducing greenhouse gas (GHG) emissions at our Vancouver and Okanagan campuses by **32 per cent** against a 2007 baseline, despite a 23 per cent increase in floor space and a 26 per cent increase in student enrollment. Relative to student enrolment, we have reduced GHG emissions per full-time equivalent (FTE) student by 47 per cent compared to 2007 levels.

As the majority of UBC's GHG emissions arise from the operation of buildings, our achievement has resulted largely through integrating renewables into the district energy fuel supply, increasing the operational energy efficiency of district energy systems, re-commissioning existing buildings, designing and constructing new green buildings and delivering behaviour change programs focused on energy conservation.

From 2007 UBC's Vancouver campus achieved a 34 per cent reduction in absolute carbon emissions. This reduction was attained by the first year of operation of the highly efficient Campus Energy Centre, the near completion of the steam to hot water conversion of the Academic District Energy System (ADES), the fourth full year of operation for the Bioenergy Research and Demonstration Facility (BRDF), and the "Building Tune-up" program to re-commission all major buildings on campus resulting in continued energy conservation. As part of UBC's commitment to advance green buildings on campus, there was continued construction of nine campus buildings targeting Leadership in Energy and Environmental Design (LEED) gold and four neighbourhood buildings targeting Residential Energy Assessment Program (REAP) gold in 2016.

UBC's Okanagan campus achieved an absolute reduction in carbon emissions for a third consecutive year in 2016, reporting a 6 per cent decrease over the prior reporting year. Factors contributing to this achievement include a continued focus on demand-side energy reduction projects, ongoing infrastructure performance improvements, and participation in energy conservation activities. The campus also established an MOU with FortisBC for Partners in Energy and developed a dedicated Energy Team to support the implementation of energy and carbon reduction activities. Foundational to these accomplishments was the establishment of the Whole Systems Infrastructure Plan (WSIP, 2016) - in parallel to and in support of the UBC Okanagan Campus Plan (2015). The WSIP establishes a long-term roadmap, performance goals, and implementation plan to address energy, carbon, water, landscape, ecology, biodiversity and engagement. The objectives of the WSIP are wide reaching – from mitigating future climate change risks by reducing energy and carbon emissions, to reducing operational and maintenance costs and limiting our exposure to future price volatility.

We are pleased to share key highlights of our climate action initiatives implemented in 2016.

MICHAEL WHITE
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Campus and Community Planning

ROB EINARSON
Associate Vice-President
Finance and Operations - Okanagan Campus

EMISSIONS OVERVIEW

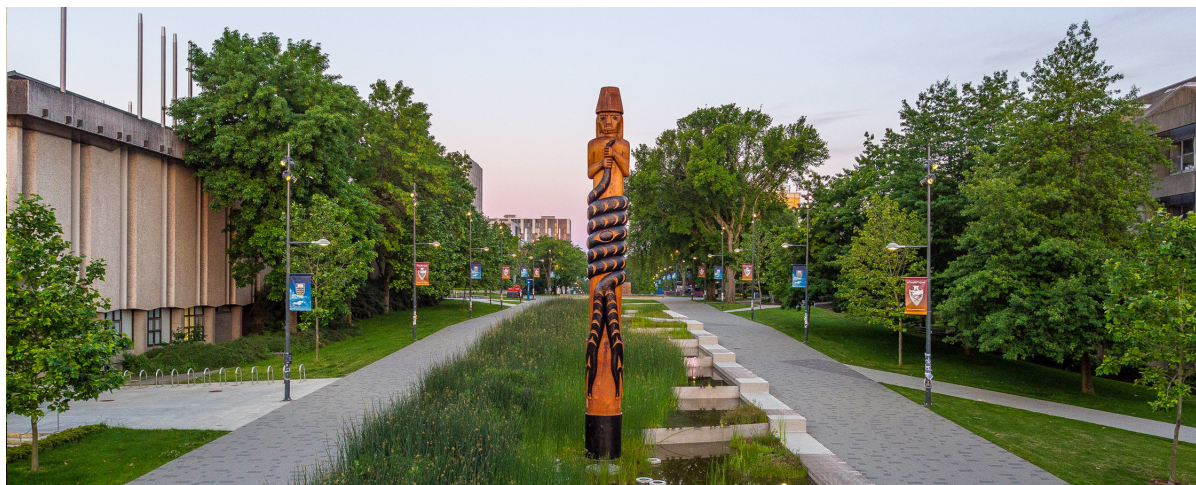


Photo credit: Hover Collective

DECLARATION STATEMENT

The University of British Columbia's 2016 Carbon Neutral Action Report for the period January 1, 2016 to December 31, 2016 summarizes our emissions profile, the total offsets to reach net-zero emissions, and the actions we have taken in 2016 to reduce our greenhouse gas emissions and our plans to continue reducing emissions in 2017 and beyond. By June 30, 2017 a copy of this report will be posted on our website at:

<https://sustain.ubc.ca/our-commitment/strategic-plans-policies-and-reports>. Following the emissions overview section, a detailed implementation report provides additional information on emissions and actions taken to reduce emissions for UBC's Vancouver and Okanagan campuses.

ABOUT UBC

The University of British Columbia is a global centre for research and teaching, consistently ranked among the top 20 public universities in the world. Since 1915, UBC's West Coast spirit has embraced innovation and challenged the status quo. Its entrepreneurial perspective encourages students, staff and faculty to challenge convention, lead discovery and explore new ways of learning. At UBC, bold thinking is given a place to develop into ideas that can change the world. Our two main campuses — the Vancouver campus and the Okanagan campus — attract and educate nearly 63,000 students from 162 countries and employ over 15,600 staff and faculty. UBC's Vancouver campus is home to a vibrant, sustainable residential community where some 25,000 students, faculty, staff and other residents live, work and learn together. UBC's Okanagan campus, which has nearly doubled in size since 2007, is home to 1,700 students.

SUSTAINABILITY PLANS AND PUBLICATIONS

UBC's Vancouver campus sustainability plans and reports, including annual GHG Inventories, Carbon Neutral Action Reports, and Annual Sustainability Reports are available at <http://sustain.ubc.ca/ourcommitment/planspoliciesreports>. UBC's Okanagan campus Carbon Neutral Action Reports and SHIFT Sustainability Reports are available at <http://sustain.ok.ubc.ca/reports.html>.

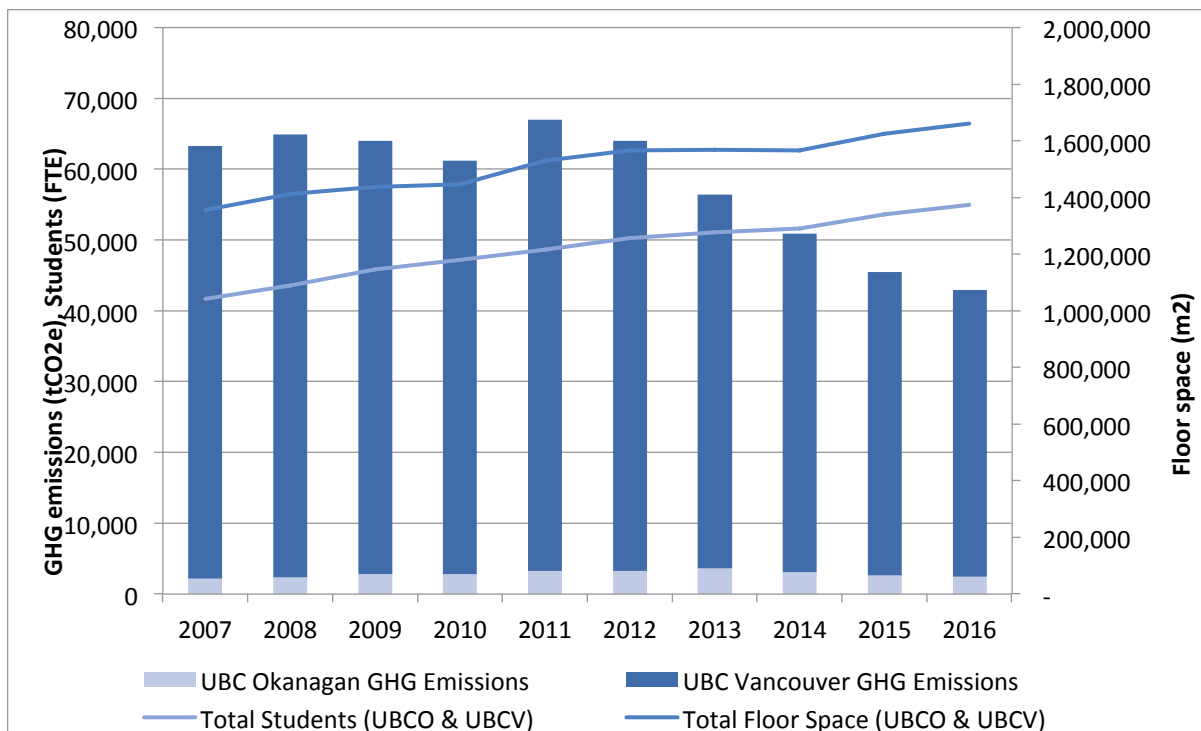


Photo credit: Hover Collective

EMISSIONS AND OFFSETS SUMMARY

UBC tracks and reports the absolute and relative emissions for each campus against a 2007 baseline to measure and demonstrate performance against our Climate Action Plan targets. Despite significant campus growth in floor space and student enrolment, UBC has achieved a substantial decrease in emissions per capita, as shown in Figure 1.

Figure 1: UBC Emissions for Offsets and Growth, Vancouver and Okanagan campus, 2007 to 2016



2016 Emissions and Offsets

Under the [Greenhouse Gas Reductions Target Act](#), UBC has been required to report and offset its emissions since 2010, including emissions from all properties owned and leased by UBC and its subsidiaries. Table 1 shows UBC's total GHG emissions and offsets purchased in addition to any adjustments made to previously reported figures.

Table 1: 2016 Total UBC Emissions and Offsets Summary

	UBC Vancouver ¹	UBC Okanagan	UBC Total ²
GHG Emissions Created in Calendar Year 2016 (tCO ₂ e)			
Total Emissions	61,204	2,436	63,639
Total Emissions for Offsets ³	45,463	2,434	47,897
Adjustments to GHG Emissions Reported in Previous Years (tCO ₂ e)			
Adjustments to 2015 Offsets	+2 ⁴	0	+2
Total Emissions for Offset Purchase in 2016 (tCO ₂ e)			
Total Emissions for Offsets	45,465	2,434	47,899

¹ Including UBC Properties Trust and off-campus properties.

² May not sum to total due to rounding.

³ Biogenic emissions (BioCO₂) from biomass, renewable natural gas and biofuels are not required to be offset due to their renewable source. Methane (CH₄) and Nitrous Oxide (N₂O) emissions from those sources are required to be offset and are included in offset amount.

⁴ Adjustments made to 2015 offsets corrects for an off-campus property in which UBC had reported estimated emissions for which there is now actual data.

A summary of emissions attributed to UBC's campuses and off-campus units is provided in Table 2 and Figure 2. Emissions for offsets for all properties and sites amounted to 47,899 tCO₂e in 2016. Biogenic emissions, which are carbon dioxide emissions from biomass, renewable natural gas and biofuels, amount to 15,742 tCO₂e but are not required to be offset, only reported. Including biogenic emissions, UBC's 2016 total emissions amounted to 63,639 tCO₂e.

Table 2: UBC Total 2016 Emissions by Location

Location	2016 Emissions (tCO ₂ e)
UBC's Vancouver campus	40,536
UBC's Okanagan campus	2,434
Off-campus properties	31,12
UBC Properties Trust	1,815
Total Emissions for Offset purchases	47,897
Emissions not required to be offset ¹	15,742
Total Emissions	63,639

¹ Biogenic emissions (BioCO₂) from biomass, renewable natural gas and biofuels are not required to be offset due to their renewable source. Methane (CH₄) and Nitrous Oxide (N₂O) emissions from those sources are required to be offset and are included in offset amount.

Figure 2: UBC 2016 Emissions for Offsets by Location

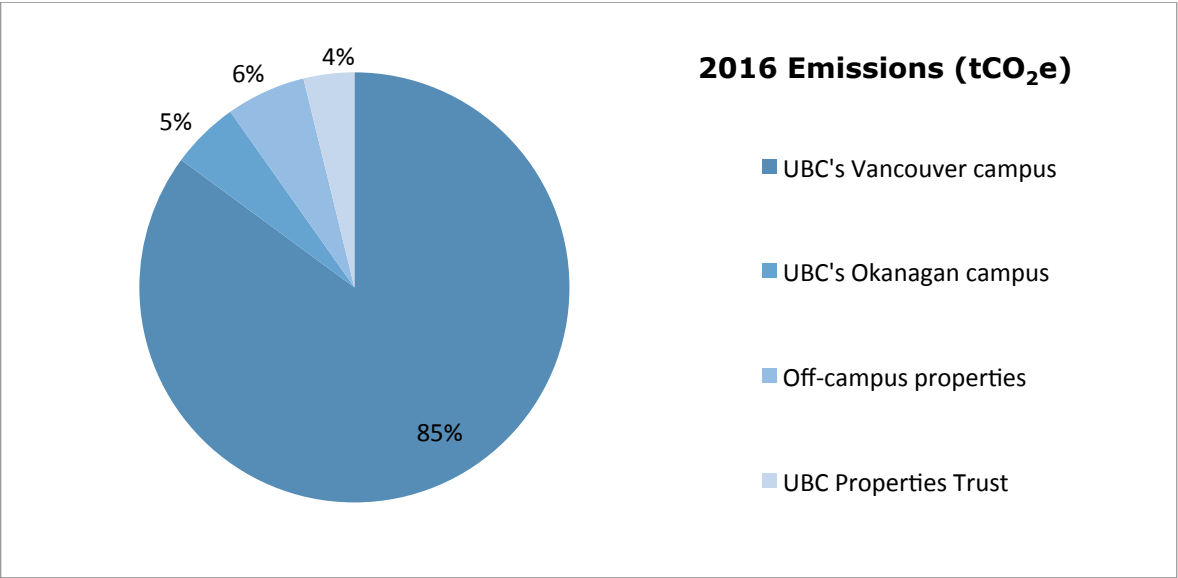


Table 3 shows the 2016 emissions for offsets from UBC’s two main campuses along with key performance indicators.

Table 3: 2016 Emissions for Offsets for UBC’s Vancouver and Okanagan Campuses

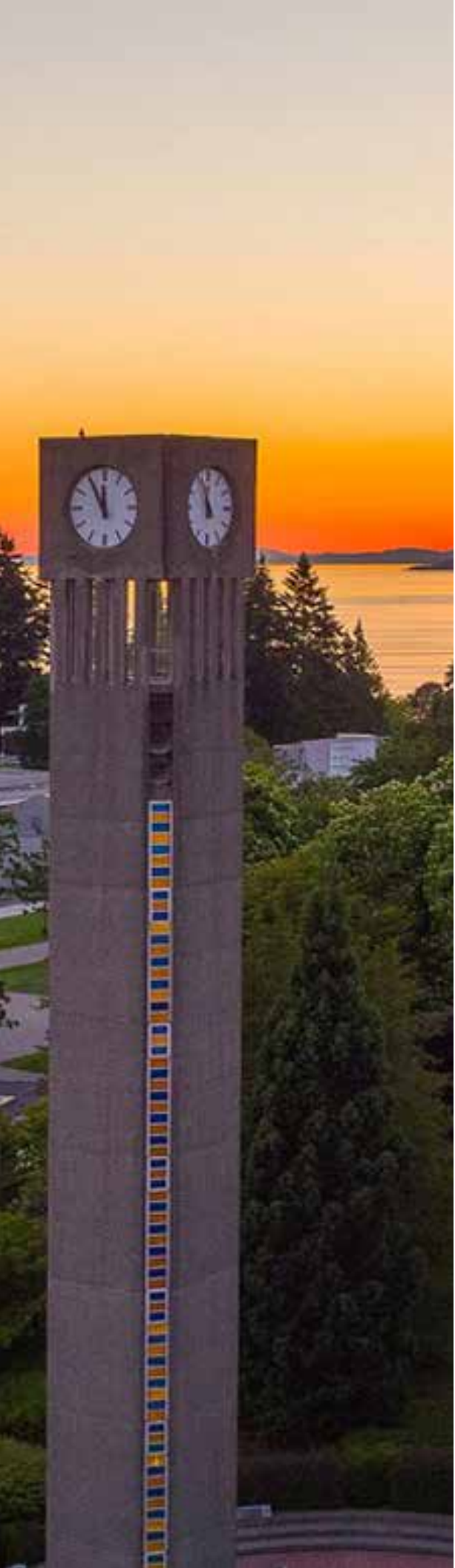
Key Performance Indicator	Vancouver Campus ¹	Okanagan Campus
Floor Space (square meters)	1,522,833	139,505
Staff and Faculty Employees (FTE)	12,287	1,080
Student Enrolment (FTE)	47,373	7,549
GHG Emissions (tonnes CO₂e)	40,536	2,434
GHG Emissions per Student (tonnes CO ₂ e/FTE)	0.86	0.32
GHG Emissions per Square Metre (tonnes CO ₂ e/m ²)	0.027	0.017

¹ Excludes UBC Properties Trust and off-campus properties



PART A

UBC Vancouver Campus Emission Details



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VANCOUVER CAMPUS SUMMARY



Photo credit: Hover Collective

We set a bold goal and we've met it! In 2010, UBC Vancouver's [Climate Action Plan](#) set some of the most aggressive GHG reduction targets among universities worldwide - 33 per cent reduction by 2015, 67 per cent by 2020 and 100 per cent by 2050 from a 2007 baseline.

In 2016, UBC Vancouver's campus surpassed its first target with a **34 per cent** reduction in GHG emissions despite a 19 per cent increase in building floor space and 26 per cent increase in student enrolment. Per capita, that translates to a GHG emission reduction of 47 per cent per student since 2007. Meeting this target also means UBC is achieving operational savings, improving efficiency of buildings, increasing our resiliency, and building a strong reputation as a sustainability leader.

UBC's 2016 success is due to its action over the last 5 years:

- UBC's award winning [Bioenergy Research and Demonstration Facility](#), a pioneering campus as a living lab project which began operation in 2012, generating renewable thermal energy from clean wood waste and electricity from Renewable Natural Gas, significantly reducing natural gas use on campus.
- The multi-year [Academic District Energy System](#) steam to hot water conversion project is nearly complete with the new [Campus Energy Centre](#) having completed its first full year of operation as the primary thermal energy source for UBC's new hot water district energy system. The project replaces the campus' 90 year old steam system and aging steam plant, improving energy efficiency by over 24 per cent. Upon final completion, the \$88 million project will reduce emissions by 22 per cent and save \$5.5 million a year in operational costs.
- UBC continued to implement its ["Building Tune Up" program](#) to conserve energy and reduce waste in over 70 major buildings across campus. Alongside energy conservation projects, such as the Life Sciences heat recovery chiller project, the program has reduced energy in over 50 buildings, saving \$2 million a year in operational costs and eliminating over 9 per cent of campus GHG emissions compared to 2007 levels. UBC is targeting to offset future growth through energy conservation.

In 2016, we developed the next 5 year CAP to help advance toward our 2020 reduction target. The first phase of UBC Vancouver's 2020 Climate Action Plan identified 24 actions to advance toward the 2020 target of 67% reduction below the 2007 baseline. Phase 2 of the Climate Action Plan is currently underway, with the detailed analysis of the expansion of the Bioenergy Research and Demonstration Facility, which would increase the use of renewable wood waste and further reduce UBC's reliance on fossil fuels.

On the new construction side, as part of UBC's commitment to advance green buildings on campus, nine campus buildings are targeting LEED gold or REAP gold, including the construction of Brock Commons, the world's tallest wood building, which is anticipated to be complete and occupied in the fall of 2017.

In addition to large scale infrastructure changes, we continue to engage our campus community to reduce emissions. In 2016, key engagement activities included the fourth annual [Shut the Sash](#) energy conservation competition engaging researchers to save energy in labs, UBC also expanded the [Green Labs Program](#) and the Sustainability Coordinator program to further reduce the environmental impact of our research laboratories.

Although there is much more work to be done in order to achieve our 2020 GHG reductions target, 2016 has been a highly productive year, and we are happy to share the results of our efforts with you.



MICHAEL WHITE
Associate Vice-President
Campus and Community Planning
The University of British Columbia

CLIMATE ACTION AT UBC VANCOUVER

OVERVIEW

In 2010, UBC announced our Vancouver campus Climate Action Plan, committing to aggressive reduction targets for GHG emissions – 33 per cent reduction by 2015, 67 per cent by 2020, and 100 per cent reduction by 2050, compared to 2007 levels. In 2016, we succeeded in achieving our 33% reduction target - the Vancouver campus now emits **34 per cent less** GHG emissions than it did in 2007 despite a 19 per cent growth in building floor space and a 26 per cent increase in student enrolment. Building upon this success, UBC Vancouver has also completed the first phase of the Climate Action Plan for 2020, and identified an additional 24 measures to achieve the 67 per cent reduction target.

Table 1: UBC Vancouver Total 2016 Emissions by Location

Location	2016 Emissions (tCO ₂ e)
UBC Vancouver campus	40,536
Off-campus properties	3,112
UBC Properties Trust	1,815
Biogenic Emissions (not required to be offset)*	15,741
Total 2016 Emissions	61,204
Total 2016 Emissions for Offset	45,463
Adjustments to 2015 Inventory Offsets	2
Total 2016 Emissions for Offset purchased in 2016 to become carbon neutral	45,465

** Biogenic emissions (BioCO₂) from biomass, renewable natural gas and biofuels are not required to be offset due to their renewable source. Methane (CH₄) and Nitrous Oxide (N₂O) emissions from those sources are required to be offset and are included in offset amount.*

For the 2016 calendar year, UBC's Vancouver campus, UBC Properties Trust and off-campus properties emissions for offsets totalled 45,463 tCO₂e (see Table 1). In addition, 15,741 tCO₂e of biogenic (BioCO₂) emissions, which are carbon dioxide emissions from biomass, renewable natural gas (RNG) and biofuels, were emitted but are not required to be offset due to their renewable sources. The total UBC Vancouver emissions amounted to 61,204 tCO₂e in 2016. Under the [Greenhouse Gas Reductions Target Act](#), UBC has been required to report and offset its emissions since 2010, including emissions from all properties owned and leased by UBC and its subsidiaries.



ACTIONS TAKEN TO REDUCE EMISSIONS

The Vancouver campus now emits **34 per cent** less GHG emissions than it did in 2007 despite a 19 per cent growth in floor space. UBC achieved its GHG emission reduction target, among the most aggressive of any large institution, by reducing energy consumption, investing in efficient energy generation and distribution, and innovative integration of renewable energy sources.

INVESTING IN EFFICIENT ENERGY GENERATION AND DISTRIBUTION

In 2016, UBC's new 45 megawatt [Campus Energy Centre](#) completed its first full year of operation as the primary thermal energy source for UBC's new hot water district energy system. The new hot water district energy system replaces the campus' 90-year-old steam system and improves energy efficiency by over 24 per cent through high efficiency boilers, heat recovery, and well-insulated piping. When combined with the new hot water district energy system, the Campus Energy Centre reduces the Vancouver campus' GHG emissions by 22 per cent and reduces operational costs by \$5.5 million a year.



TUNING UP EXISTING BUILDINGS AND REDUCING ENERGY CONSUMPTION



UBC Energy & Water Services continued to implement its [“Building Tune Up”](#) program to conserve energy and reduce energy waste in all buildings across campus. In 2016, actions such as Life Sciences' new heat recovery chiller, supply air optimization, and heat recovery system recommissioning, have reduced over 100,000GJ of natural gas. To date the program has reduced energy and operational costs by \$2.0 million a year in over 50 buildings, eliminating over 9 per cent of campus GHG emissions compared to 2007 levels. A further 25 buildings are set for tune-ups starting in 2017.

ADVANCING LOW-CARBON AND RENEWABLE ENERGY SOURCES

UBC's [Bioenergy Research and Demonstration Facility \(BRDF\)](#) completed its fourth year of operation, generating heat from renewable biomass and electricity from Renewable Natural Gas (RNG). In 2016, despite being out of operation for three months for maintenance, the facility still converted 7,500 tonnes of clean wood waste to produce over 20 per cent of total campus steam and hot water production. This has significantly reduced natural gas use on campus and eliminated 11 per cent of campus GHG emissions compared to 2007 levels.





For additional details on UBC's sustainability plans, initiatives, and other performance reports, please visit the [Plans and Reports](#) section of our website and refer to our full UBC Annual Sustainability Report.

2016 GREENHOUSE GAS EMISSIONS IN DETAIL

The Vancouver campus [GHG Inventory](#), which is comprised of the emissions from core and ancillary buildings, TRIUMF, fleet and paper, has been compiled each year since 2006. In 2016, the Vancouver campus emissions for offsets amounted to 40,536 tCO₂e. A detailed breakdown of the campus emission sources is provided in Table 2.

Table 2: UBC's Vancouver Campus Emissions for Offsets, 2016

Source	2007 Emissions (tCO ₂ e) ¹	2016 Emissions (tCO ₂ e) ¹	Per cent of 2016 campus emissions ¹
UBC Vancouver Campus - Core Buildings ²	46,478	28,723	71%
<i>Steam/DES (natural gas and light fuel oil)</i>	40,106	21,181	52%
<i>Natural gas (direct burn)</i>	3,515	5,653	14%
<i>Electricity</i>	2,856	1,569	4%
<i>Biomass facility³</i>	N/A	301	0.7%
<i>Renewable Natural Gas⁴</i>	N/A	18	0.04%
UBC Vancouver Campus – Ancillary buildings ⁵	11,405	10,238	25%
<i>Steam/DES (natural gas and light fuel oil)</i>	7,311	5,920	15%
<i>Natural gas (direct burn)</i>	3,108	3,707	9%
<i>Electricity</i>	986	593	1.5%
<i>Biomass facility³</i>	N/A	18	0.0%
TRIUMF ⁶	222	104	0.3%
Total Building Emissions	58,105	39,066	96%
Fleet	1,973	1,017	2.5%
Paper	1,003	453	1.1%
Total Vancouver Campus Emissions for Offsets	61,082	40,536	100%

It was estimated that fugitive emissions of refrigerant gases comprise less than one per cent of the Vancouver campus' total emissions and collecting data to estimate these emissions would be disproportionately onerous. For this reason, emissions from this source have been deemed out of scope and have not been included in the Vancouver campus' GHG emissions profile.

¹ May not sum to total due to rounding.

² Core buildings comprise academic and administrative buildings.

³ UBC is required to offset the CH₄ and N₂O portions of biomass combustion. In addition, the Bioenergy Research and Demonstration Facility (BRDF) burns a small amount of natural gas. The BRDF began operating in 2012.

⁴ UBC is required to offset the CH₄ and N₂O portions of renewable natural gas.

⁵ Ancillary buildings include student housing, conference, athletics and parking facilities.

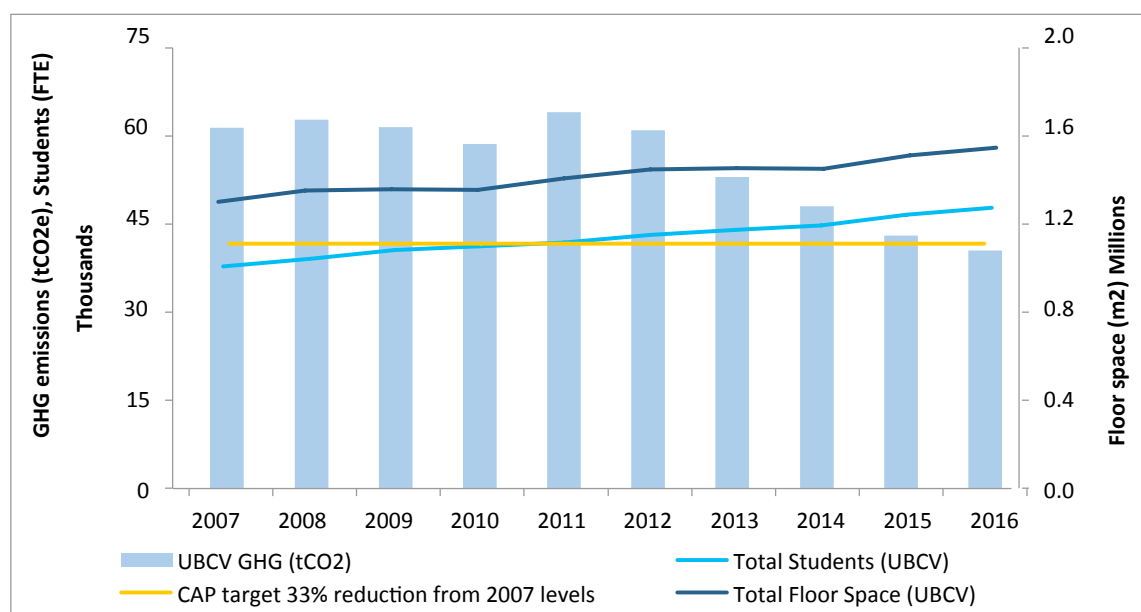
⁶ Although TRIUMF is a joint venture with other universities, it has historically been included in the UBC Vancouver Campus inventory since it is located on campus. UBC accounts for 1/12th of emissions from TRIUMF.



COMPARISON TO BASELINE YEAR

Since the implementation of its Climate Action Plan in 2011, the Vancouver campus has steadily decreased its GHG emissions despite campus growth. From 2007 to 2016, the Vancouver campus' emissions for offsets decreased 34 per cent, despite a 19 per cent increase in building floor space and a 26 per cent increase in student enrolment.

Figure 1: UBC's Vancouver Campus' Historical Emissions and Growth



The emissions from campus buildings along with fleet and paper amounted to 0.86 tCO₂e per student (FTE) in 2016, a 49% decrease in emissions per student (FTE) since 2007. The Vancouver campus' building floor space increased by 19% between 2007 and 2016, with several older buildings demolished to make way for construction of new buildings. Table 3 and Figure 1 outline the change in campus emissions since the 2007 baseline year, along with indicators of Vancouver campus growth.

Table 3: UBC's Vancouver Campus Emissions for Offsets Compared to 2007 Baseline

Key Performance Indicator	2007	2016	Change from 2007 to 2016
Staff and Faculty Employees (FTE)	10,509	12,287	+17%
Student Enrolment (FTE)	37,589	47,373	+26%
Floor Space (square meters)	1,284,462	1,522,833	+19%
GHG Emissions (tonnes CO ₂ e)	61,082	40,536	-34%
GHG Emissions per Student (tonnes CO ₂ e/FTE)	1.62	0.86	-47%
GHG Emissions per square meter (tonnes CO ₂ e/m ²)	0.048	0.027	-45%



SCOPE 3 EMISSIONS

Going beyond the provincial requirements, the annual Vancouver campus [GHG Inventory](#) also quantifies several categories of optional or Scope 3 emissions (Table 4). These emissions are not required to be offset. UBC's [Climate Action Plan](#) includes strategies for reducing Scope 3 emissions related to commuting, business travel, procurement and food.

Table 4: UBC Vancouver Campus' Scope 3 Emissions, 2016

Source	2007 Emissions (tCO ₂ e)	2016 Emissions (tCO ₂ e)	% Change from baseline year
Commuting	36,059 ¹	35,047	-3%
Staff and Faculty Air Travel	13,600 ²	12,020 ³	-12%
Solid Waste ⁴	1,930	1,012	-48%
Building Lifecycle	10,190	12,563	+23%
Scope 3 Emissions	61,779	59,644	-4%

¹ Baseline adjusted in 2015 to correct errors and reflect updated methodology

² Not calculated in 2007; the value from 2006 is provided.

³ Emission factors for air travel changed in 2016.

⁴ Solid waste includes operational waste sent to landfill or incinerated.

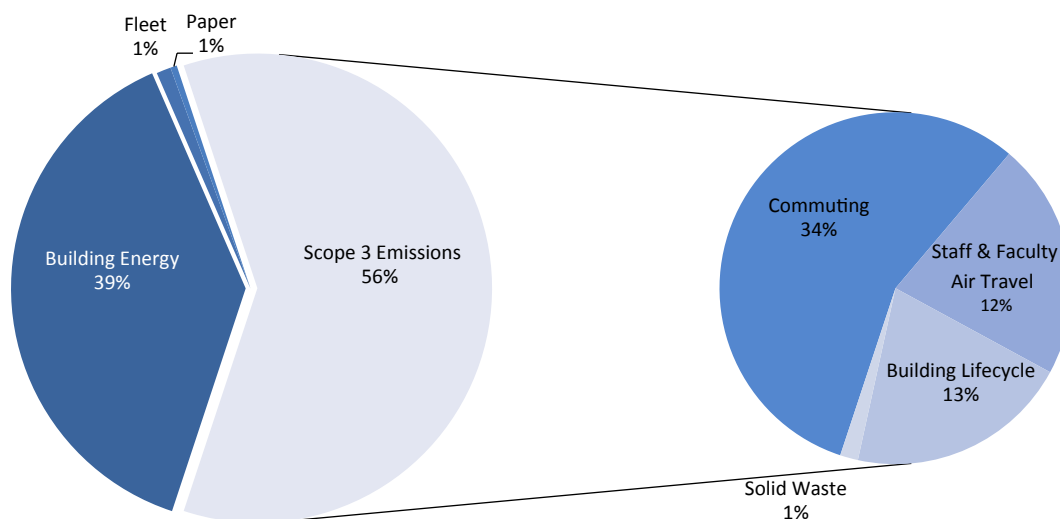
Solid waste emissions decreased significantly from 2007 to 2016 despite the increase in campus population during that time. This is a result of the change in Metro Vancouver's emission factor and the implementation of the Zero Waste Action Plan, with a subsequent decrease in the total amount of operational waste disposed to the landfill or incinerated during that time. Building lifecycle emissions are approximately proportional to campus floor space.



Comparison to Scope 1 & 2 Emissions

In comparison to Scope 1 & 2 emissions, the combined Scope 3 emissions from commuting, business travel, building lifecycle and solid waste (Table 4) were more than the Vancouver campus emissions for offsets (Table 1). Figure 2 shows the comparative proportions of the various emission categories for the Vancouver campus. Even though Scope 3 emissions fall out of scope of the provincial requirements for carbon neutrality, Figure 2 characterizes their relative significance.

Figure 2: UBC's Vancouver Campus Total Emissions by Scope (Scope 1, 2 & 3), 2016





UBC Vancouver Actions Survey

2016 Carbon Neutral
Action Report (CNAR)

UBC ACTIONS SURVEY

2016 Carbon Neutral Action Report (CNAR) - Part 1 UBC Vancouver campus

1) Stationary Sources (Buildings, Power Generators): Fuel Combustion, Electricity use, Fugitive Emissions.

Survey Question	Response
During 2016, did your organization take any of the following actions to support emissions reductions from buildings? Select all that apply - Conducted an energy audit/study of building(s) in the organization's portfolio - Performed energy retrofits of the organization's buildings. - If yes, how many buildings? - Built, or are building new LEED Gold or other "Green" buildings. - If yes, how many buildings?	Yes Yes 23 Yes 9
Other actions? Please describe briefly. Many buildings have undergone energy efficiency upgrades, however only 4 have undergone major capital upgrades, within the 2016 calendar year. Other energy work has included continuous optimization, building tune-ups, air-filter replacements, and other smaller projects.	
Briefly describe your organization's plans to continue reducing emissions from its stationary sources in future years. UBC has set ambitious GHG reduction targets to achieve by 2020 and 2050 – 67% and 100%, respectively. In order to achieve these targets, especially the 2020 target, intensive demand-side management (DSM) activities are planned, in addition to creating a business case for the expansion of the Bioenergy Research Demonstration Facility (BRDF), and creation of a Green Building Plan. DSM activities that are planned over the next few years include a campus-wide lighting retrofit, building recommissioning (residences and core buildings), continuation of the building tune-up and optimization program, energy audits, coil cleaning, and ACH optimization (especially in labs). The BRDF expansion program aims to install an additional boiler to take on a higher proportion of campus baseload energy use. This, in itself, has the capacity to significantly reduce GHG emissions related to power generation and building use by reducing demand for natural gas, replacing it with a renewable energy source. The Green Building Plan has the vision to create a pathway for development of net-positive buildings, both academic and residential, which promote human and ecological wellbeing (in addition to zero emissions). The plan is currently in development, and will define a 20-year framework (2015-2035), along with a 5-year implementation plan, to achieve the net-positive building vision. Once implemented, this will contribute significantly to achieving the 2050 GHG reduction target of 100%.	
During 2016, did your organization participate in utility-sponsored energy demand management program(s) (e.g. BC Hydro's Energy Management (Manager))?	Yes

If yes, please describe briefly: UBC employs: - A BC Hydro-sponsored Energy Manager, operating out of Energy and Water Services (UBC's utility and DSM group) - A BC Hydro-sponsored Community Energy Manager, operating out of Campus and Community Planning; focusing on the residential neighbourhoods on campus. - A FortisBC-sponsored Energy Specialist, operating out of Energy and Water Services Each of these individuals is required to create a BC Hydro- or FortisBC-approved work plan, set targets for GJ and kWh reductions each year, and align projects with utility program offerings.	
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2) Mobile Sources (Fleet, Off-road/Portable Equipment) Fuel Combustion

Survey Question	Response
During 2016, did your organization take any of the following actions to support emission reductions from its mobile sources? Select all that apply • Replaced existing vehicles with more fuel efficient vehicles (gas/diesel). • If yes, how many vehicles? • Replaced existing vehicles with hybrid or electric vehicles. • If yes, how many vehicles? • Took steps to drive less than previous years.	Yes 29 Yes 3 Yes
Other actions? Please describe briefly. In 2015, the compressed natural gas (CNG) fueling stations came online, so 2016 was the first full year of on-campus CNG operation. Two additional CNG refuse trucks were added to the fleet, as well as two diesel/electric hybrid cube vans. Twenty nine vehicles were replaced with more efficient alternatives. Additionally, research is currently underway to identify additional opportunities GHG reducing strategies.	
Briefly describe your organization's plans to continue reducing emissions from its mobile sources in future years. UBC building operations has significantly improved GHG emissions from fleet vehicles over the past few years. However, there are remaining opportunities to continue this trend. In the near future, UBC will assess the viability of CNG station expansion, and the electric charging network around campus. There will be an effort made to expand the electric fleet of vehicles on campus, and replace at least 6 medium to heavy duty vehicles with modern fuel efficient technologies. UBC will continue to monitor the OEM expansion of electric vehicles, and look at expansion into the truck and van categories. We will also assess the viability of replacing vehicles that have low usage rates, with car share access.	

3) Supplies: (Paper)

Survey Question	Response
During 2016, did your organization take any of the following actions to support emissions reductions from paper supplies? Select all that apply • Awareness campaign focused on reducing office paper use. • Policy requiring the purchase of recycled content paper. • If yes, state % of recycled content (eg 30%, 100%) • Policy requiring the purchase of alternate source paper (bamboo, hemp, wheat, etc). • If yes, state source type (eg bamboo, wheat)	No No No
Other actions? Please describe briefly. Although there are no distinct purchasing policies to support the purchase of recycling content/agricultural paper, there have been initiatives to promote the purchase of these lower emissions paper options. One of these is the creation of a Sustainable Purchasing Guide, which was completed in 2016. This was a joint effort among several business units on campus, including Finance and Sustainability & Engineering. The guide furthers our support of substituting virgin paper with a minimum 30% recycled content paper at UBC, use of double-sided printing, avoiding unnecessary printing of emails or draft documents, and use of UBC preferred vendors with developed sustainable delivery schedules. The preferred supplier for paper at UBC continues to offer the 30% paper at the lowest price than other paper grades.	
Briefly describe your organization's plans to continue reducing emissions associated with its office paper use in future years. In future years, we plan to promote the Sustainable Purchasing Guide to the campus community, especially involving and capitalizing from the Sustainability Coordinators network across campus. We also hope to work with vendors to encourage sales of a minimum of recycled content percentage to UBC customers. And monitor paper use in UBC units, so we can target our virgin paper reduction approaches.	

4). Other Sustainability Actions: Business Travel

Survey Question	Response
During 2016, did your organization take any of the following actions to support emissions reductions from business travel? Select all that apply • Created a low-carbon travel policy or travel reduction goal (low-carbon = lowest emission of greenhouse gas per kilometer per passenger) • Encouraged alternative travel for business (e.g. bicycles, public transit, walking) • Encouraged or allowed teleworking or working from home	No Yes Yes
Other, please describe briefly UBC has made a strong effort to provide video conferencing technology in multiple meeting rooms across campus, making it easier for staff and faculty to reduce travel. One of the most common trips is from UBC Vancouver to UBC Okanagan, and vice versa – this strategy is helping to reduce these trips. Through evaluation of scope 3 GHG emissions from business travel, it has been determined that not all trips	

are being recorded. Therefore, the Sustainability and Engineering group is working with the SEEDS program on a research project looking at better ways to quantify and track business travel to/from UBC by air. Once we have a better idea of these trips, we can begin to develop behaviour change approaches to reducing GHG emissions.

One of the major goals of the UBC's Transportation Plan is to reduce Single Occupancy Vehicle (SOV) travel; one way this goal is being targeted is by working with application developers and other technologies, to make it easier for people to carpool rather than take their own vehicles to work/school.

Another major effort to reduce car travel to UBC, is through the development of a rapid transit line from the city of Vancouver. Several staff members are communicating with Translink and other stakeholders to discuss potential options for travel to UBC.

Other Sustainability Actions

Survey Question	Response
During 2016, did your organization have any of the following programs or initiatives to support sustainability? Select all that apply • A water conservation strategy which may include a plan or policy for replacing water fixtures with efficient models • An operations policy or program to facilitate the reduction and diversion of building occupant waste (e.g., composting, collection of plastics, batteries) from landfills or incineration facilities • Green procurement standards for goods (e.g., office furniture, etc.) • Lifecycle costing of new construction or renovations	Yes Yes Yes Yes
Other, please describe briefly UBC's Climate Action Plan was updated and released in 2016, detailing how UBC could meet the GHG reduction target of 67% below 2007 levels, by 2020. Phase 2 of the CAP update, an investigation into energy supply opportunities, resulted in a business case for the expansion of the Bioenergy Research Demonstration Facility; this phase is still underway, with the CAP project team preparing for a request to the Board of Governors for funding, within the 2017 calendar year. We have continued with the implementation of the Zero Waste Action Plan and engagement strategies throughout the year, with plans to continue rollout and continuous improvement through 2017.	

Education and Awareness

Survey Question	Response
During 2016, did your organization have any of the following programs or initiatives to support sustainability education and awareness? Select all that apply • Green, Sustainability or Climate Action Team • Support for professional development on sustainability (e.g. workshops, conferences, training) • Supported or provided education to staff about the science of climate change, conservation of water, energy and/or raw materials	Yes Yes Yes
Other actions, please describe For additional details on UBC's sustainability initiatives please refer to UBC's Annual Sustainability Reports (https://sustain.ubc.ca/our-commitment/strategic-plans-policies-reports/annual-reports) and STARS Reports (https://stars.aashe.org/institutions/university-of-british-columbia-bc/report/2015-08-04/).	



PART B

UBC Okanagan Campus Emission Details

ENVISIONING A SUSTAINABLE FUTURE

UBC is a recognized leader in sustainability and the Okanagan campus has developed goals and initiatives that support and advance UBC's sustainability commitments.

The UBC Okanagan Sustainability Office, Campus Planning and Development was established to help deliver on UBC's sustainability commitments. We aspire to build capacity and foster leadership across the campus to broaden the impact of sustainability.

Provincially mandated greenhouse gas (GHG) and sustainability reporting for the Okanagan campus is the responsibility of the Sustainability Office, Campus Planning and Development. The 2016 Carbon Neutral Action Overview Report contributes to UBC reporting submitted to the Climate Action Secretariat. This report provides an overview of the actions taken by the campus to reduce carbon emissions in 2016 and future planned actions to support British Columbia's commitment to reduce the provincial GHG emissions by 80 per cent below 2007 levels by 2050.



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EXECUTIVE SUMMARY AND DECLARATION

2016 marked a year of noteworthy achievements for UBC's Okanagan Campus relative to advancing our commitment to the BC Provincial Government's Carbon Neutral mandate.

For the third consecutive year, the campus achieved an absolute reduction in carbon emissions, reporting a 6 percent decrease in 2016 over the prior reporting year. Factors contributing to this achievement include a continued focus on the implementation of demand-side energy reduction projects, ongoing infrastructure performance improvements, and participation in energy conservation activities. 2016 also marked the year the campus established an MOU with FortisBC for Partners in Energy Efficiency and developed a dedicated Energy Team to support the implementation of energy and carbon reduction activities.

Foundational to these accomplishments was the establishment of the Whole Systems Infrastructure Plan —(WSIP, 2016) in parallel to and in support of the UBC Okanagan Campus Plan (2015). The WSIP establishes a long-term roadmap and implementation plan to address energy, carbon, water, landscape, ecology, biodiversity and engagement. The objectives of the WSIP are wide reaching—from mitigating future climate change risks by reducing energy and carbon emissions, to reducing operational and

maintenance costs and limiting our exposure to future price volatility.

Going forward, UBC Okanagan will continue to focus on supporting future growth while reducing energy use and operational carbon emissions through the implementation of key recommendations of the WSIP. Over the short-term it's anticipated that activities will focus on demand-side management for existing buildings, changing user behaviours and the expansion of the campus' existing district energy systems to new facilities.



Rob Einarson

Associate Vice-President,
Finance and Operations
University of British
Columbia, Okanagan campus

DECLARATION STATEMENT

This Carbon Neutral Action Report for the period January 1, 2016 to December 31, 2016 summarizes our emissions profile, the total offsets to reach net-zero emissions, the actions we have taken in 2016 to reduce our greenhouse gas emissions and our plans to continue reducing emissions in 2017 and beyond.

By June 30, 2017 UBC Okanagan campus' final Carbon Neutral Action Report will be posted to our website at sustain.ok.ubc.ca/reports/cnar

EMISSIONS AND OFFSET SUMMARY

EMISSIONS AND OFFSET SUMMARY

UBC Okanagan campus GHG Emissions and Offset for 2016 (tCO ₂ e)	
GHG Emissions created in Calendar Year 2016:	
Total Emissions (tCO ₂ e)	2,436
Total Offsets (tCO ₂ e)	2,434
Adjustments to GHG Emissions Reported in Prior Years:	
Total Emissions (tCO ₂ e)	0
Total Offsets (tCO ₂ e)	0
Grand Total Offsets for the 2016 Reporting Year:	
Grand Total Offsets (tCO ₂ e)	2,434

RETIREMENT OF OFFSETS

In accordance with the requirements of the Greenhouse Gas Reduction Targets Act and Carbon Neutral Government Regulation, UBC Okanagan campus (the Organization) is responsible for arranging for the retirement of the offsets obligation reported above for the 2016 calendar year, together with any adjustments reported for past calendar years. The Organization hereby agrees that, in exchange for the Ministry of Environment ensuring that these offsets are retired on the Organization's behalf, the Organization will pay, within 30 days, the associated invoice to be issued by the Ministry in an amount equal to \$25 per tonne of offsets retired on its behalf plus GST.

2016 EMISSIONS OVERVIEW

GREENHOUSE GAS EMISSIONS

The following greenhouse gas (GHG) emissions have been quantified using the BC Provincial Government's SMARTTool Reporting Framework.

Table 1: GHG Comparison by Source between 2015 - 2016

Source	2015 Emissions (tonnes CO ₂ e)	2016 Emissions (tonnes CO ₂ e)	Change from 2015 to 2016
Buildings	2,370	2,227	-6%
Fleet	45	47	+4%
Paper	64	64	+0.3%
Fugitive	122	98	-20%
Total Emissions	2,601	2,436	-6%
Total Offsettable emissions	2,599	2,434	-6%

**Individual amounts may not sum exactly due to rounding.*

Table 1 demonstrates an absolute campus GHG emission reduction of six per cent over the 2015 reporting year, which will result in a \$4,331.25 carbon offset savings to the university. The largest source of in-scope emissions identified within the UBC Okanagan portfolio is derived from buildings, which were reduced by six per cent over the previous year. Factors contributing to this reduction include a focus on demand-side energy reduction through building optimization, routine capital investments, building re-commissioning, maintenance of the District Energy System (DES), and building occupant behaviour change. Detailed information on measures implemented to achieve a reduction in emissions over the previous and baseline years can be found in the 'Actions to Reduce Emissions' section of this report.

Carbon Neutral Offsets in 2016

In accordance with the campus SMARTTool¹ reporting and as required by the Greenhouse Gas Reduction Targets Act (GGRTA), offsets required to achieve carbon neutrality in 2016 total 2,434 tCO₂e. As part of the Okanagan campus' 2016 GHG emissions profile, two tCO₂e do not require offsets.

¹ Protocols established in 2016/2017 BC Best Practices Methodology for Quantifying Greenhouse as Emissions

EMISSIONS REDUCTION ACTIVITIES

ACTIONS TAKEN TO REDUCE GREENHOUSE GAS EMISSIONS IN 2016

The following provides an overview of actions and plans reported in the CNAR Actions Form, Section 1.

A. Stationary Fuel Combustion, Electricity (Buildings)

The largest source of in-scope GHG emissions on campus is derived from buildings, which comprises 91.5 per cent of in-scope emissions in 2016. However, notably, absolute stationary building emissions were reduced by 143 tCO₂e or six per cent, compared to the 2015 reporting year. This demonstrates a continued emissions reduction trend over prior reporting years.

Contributing factors to this reduction include a focus on demand-side energy reduction through building optimization, routine capital investments, building re-commissioning, maintenance of the DES, and behaviour change.

ACTIONS:

Academic and Administration Buildings

- Completed replacement of Arts Building Chiller CH-2.
- Completed recommissioning and balance of air in Arts Building.
- Continued to implement sub-metering and BMS enhancement and adopted LEED® v4, which includes a component requirement to step up metering (increased levels of metering).
- Completed lighting upgrade design documents for Arts, Science, Creative and Critical Studies, and Administration buildings.
- Completed sourcing for additional District Energy System cooling opportunities. Findings support the addition of a third cooling tower, projected for installation in 2017.
- Implemented FortisBC's 'Partner in Energy' program that provides direct lighting rebates at the point-of-sale.
- Continued to implement UBC Okanagan Whole Systems Infrastructure Plan. Completed projects include:
 - I. Secured seed funding to implement Year 1 Energy Conservations Measures identified in the Plan.
 - II. Established an Energy Team and Energy Committee.
 - III. Completed and initiated implementation of 5-Year Strategic Energy Management Plan.
 - IV. Continued to assess routine capital plan to determine energy efficient implementation options that respond to recommendations of the Whole Systems Infrastructure Plan and Strategic Energy Management Plan.
 - V. Continued to develop and obtain endorsement of a campus-wide energy policy. A draft of an energy policy

for the Okanagan Campus has been generated. The initial draft was based on the Point Grey campus energy policy with modifications to account for the Okanagan climate.

VI. Developed a behaviour change plan—UBC Okanagan's Campus-Wide Three-Year Conservation Awareness and Action Strategy.

VII. Initialized update to campus green building guidelines and defined new construction recommendations for efficient buildings.

- Building Optimization Program, a partnership between UBC Okanagan and FortisBC, successfully completed in Administration and Science Buildings. Science achieved savings of six per cent (33,996 kWh) and 87 per cent (1,625 GJ) respectively accounting for a projected emission reduction of 81 tCO₂e annually. These savings exceeded initial BOP targets of one per cent electrical savings and combined gas and Medium Temperature District Energy System (MDES) savings of 22 per cent.
- Administration Building MUA replacement completed. Projected annual savings include lower energy costs of \$14,400 and a reduction in gas consumption by 1,390 GJ. Despite an expected increase in electricity consumption of 33,333 kWh annually, the carbon emission impact is projected to be reduced by 69 tCO₂e per year.
- Continued to implement Wi-Fi HVAC Occupancy Project to monitor building occupancy levels. More information can be found in 'Above and Beyond' section of this document.
- Developed proposal for lighting upgrades in the Administration and Creative and Critical Studies buildings. Initial estimates project that the campus will reduce its energy consumption by approximately 380,000 kWh and 0.98 tCO₂e annually.
- Building optimization projects completed within Reichwald Health Science Centre and Engineering, Management and Education building include having both buildings' hydronic controls adjusted to allow for larger Low Temperature District Energy System (LDES) supply/return water temperatures and reduced flows.
- Adapted to UBC Technical Guidelines for Okanagan Campus.

Residence Buildings

- Completed LED bulb replacement in all resident buildings' common areas and in locations of easy access.

B. Mobile Fuel Combustion (Standard and Non-Standard Fleet)

In 2016, fleet vehicles accounted for 47 tCO₂e, or 1.9 per cent of campus total emissions, up two tCO₂e from 2015. Increased use of the research and departmental operations vehicles are contributing factors to this rise. Although there was a slight increase in fleet emissions, the campus has achieved a 31 per cent absolute reduction in fleet emissions since 2010.

ACTIONS:

- Removed stand-alone gasoline storage unit, reducing fuel loss through evaporation.
- Reduced campus fleet by one Student Housing and Hospitality Services operations vehicle.
- Continued to implement measures to reduce reliance on fleet vehicles and diverted the number of trips taken by encouraging fleet carpooling, walking or cycling, as well as consolidating off-campus trips.
- Continued stewardship of sustainable mobile fuel combustion through adherence to Sustainable Fleet Procedures, replacement of retired fleet vehicles with electric and energy efficient models, and ongoing training and education to support sustainable fleet use.

C. Supplies (Paper)

Emissions from paper accounted for 63 tCO₂e, or 2.6 per cent of total in-scope campus emissions in 2016. This demonstrates an increase of 0.3 per cent over the previous year. Although there was an absolute decrease in paper consumed over 2015 by 55 fewer packages, the type of paper purchased containing

the 30 per cent PCW minimum requirement increased, contributing to the increase of emissions.

ACTIONS:

- Full implementation of PaperCut™ system to students, roll-out of system to faculty and staff at departmental level.
- Completed the full integration of PaperCut™ print tracking software to faculty and departments; providing a platform that delivers reports to clients on printing volumes, generating awareness and promoting alternatives to printing.
- Continued program upgrades, using a phase-in approach, to remove step down transformers and install power sharing.
- Commenced pilot of Skype™ for Business, an alternative web-conferencing software.
- Continued to promote the purchase of 30 per cent at minimum or greater post-consumer recycled content paper.
- Continued to ensure wheat sheet paper is available to order from the custom list as an alternative source to tree-derived paper.
- Continued to increase the use of digital signs and related communications platforms within buildings to share news, activities and events to reduce the reliance on paper-based promotional materials.
- Continued replacement of desktop computers with laptops and more efficient devices as part of IT, Media and Classroom Services' Computer Replacement Program.

D. Fugitive Emissions

In 2016, in-scope HFCs accounted for 4 per cent of total campus emissions, producing 98 tCO₂e. A reduction of 24 tCO₂e over 2015 accounted for 20 per cent fewer emissions.

ACTIONS:

- Continued to conduct preventative maintenance and upgrades to HVAC system and associated appliances.

PLANS TO CONTINUE REDUCING GREENHOUSE GAS EMISSIONS IN FUTURE YEARS

This section describes planned actions across buildings, fleet and procurement in the coming year.

A. Stationary Fuel Combustion, Electricity (Buildings)

Academic and Administration Buildings

- Remove domestic hot water from Engineering, Management and Education building's central boilers to allow boilers to seasonally shut down.
- Implement replacement of the Arts and Gym building chillers and Mountain Weather Office's chiller, boiler and generator.
- Initialize recommissioning and balance air, water and controls in Creative and Critical Studies, University Centre and Engineering, Management and Education buildings.
- Continue to implement sub-metering and BMS enhancements for better measurement of energy consumption and conservation planning, including peak demand. New campus measurement and verification standards have been adopted to be in line with LEED V4.
- Lighting upgrade for Administration building projected to reduce energy consumption by 200,000 kWh and 0.52 tCO₂e annually.
- LDES/MDES System Study to account for new building construction planned for the campus. It is important to consider both the capacity of the existing LDES and MDES systems as well as ensure that all HVAC systems in new



buildings are designed to function optimally with the district systems.

- Building optimization projects scheduled to occur in the Charles E. Fipke Centre for Innovative Research (Fipke), University Centre (UNC) and Arts and Sciences Centre (ASC) during 2017 include:
 - Fipke to receive upgrade of its central plant to a four-pipe system with hot and cold tanks.
 - UNC's existing systems have been reviewed by a consulting firm, who will be proceeding with detailed design work.
 - ASC's VRF system has been identified as being a key limit on the operation of the LDES system. A piping upgrade to this system has been proposed and detailed design work is proceeding.
- Cooling Plant Expansion—the addition of a cooling tower will increase the air-cooled capacity of the LDES system.
- Implement energy study recommendations for the Administration building's mechanical and envelope systems.
- Implement Supply Air Temperature Reset—upgrading the BMS control software to set supply-air temperatures based on average heating/cooling valve positions is expected to save the campus \$4,900 per year in heating and cooling costs and reduce energy consumption by 390 GJ of gas and 24,300 kWh of electricity, which reduces the campus' carbon emissions by 20 tCO₂e annually.
- Implement Supply Air Pressure Reset—adjusting the supply-air pressure set points based on the heating/cooling demand in a building to allow for reduced fan speeds and corresponding reduced electrical consumption.
- Increase Heat pump Utilization—optimizing building supply water temperatures will allow existing heat pumps to operate for a larger fraction of the year. Implementation of this strategy is estimated to result in a reduction of natural gas consumption and an increase in electricity use for a net energy cost savings of approximately \$1,200 and a reduction in carbon emissions by 85 tCO₂e annually.
- Implement CNCP project Lab Air Volume Control and Green Labs Education in Science Building laboratories (funding pending). This project is estimated to reduce the campus' energy consumptions by 2,600 GJ and 170,000 kWh and emissions by 131 tCO₂e annually.

- Peak Load Management—electricity costs for the campus are a mixture of charges for energy consumption (kWh) and peak demand (kW). As such, reducing electrical demand at peak times can have significant impacts on campus energy costs. As the initial step-in managing peak loads, control strategies to reduce fan speeds and adjust supply water temperatures during peak periods will be implemented, which is expected to result in a reduction of peak demand charges by \$13,400 per year.
- Whole Systems Implementation Plan projects:
 - Full implementation of the Strategic Energy Management Plan.
 - Implementation of the behaviour change plan—UBC Okanagan's Campus-Wide Three-Year Conservation Awareness and Action Strategy—called the Power of You.
 - Expansion of the District Energy System.
- Integrate Library data center into geo-exchange system during the construction of the Teaching and Learning Centre.

Residence Buildings

- Continue to complete lighting upgrades on a failure-based requirement.
- Complete a full review of automation in residence buildings.
- Review timing and schedule for Monashee building's hot water tank replacement.

B. Mobile Fuel Combustion (Standard and Non-Standard Fleet)

- Enhancements to bus loop to allow for improved traffic flow of high density modes of transportation, i.e. buses—further encouraging alternative modes of transportation be used by campus constituents.
- Continue to implement measures to reduce reliance on fleet vehicles and divert the number of trips taken by encouraging fleet carpooling, walking or cycling, as well as consolidating off-campus trips.
- Continue stewardship of sustainable mobile-fuel combustion through adherence to Sustainable Fleet Procedures, replacement of retired fleet vehicles with electric and energy-efficient models, and ongoing training and education to support sustainable fleet use.

C. Supplies (Paper)

- Continue program upgrades, using a phase-in approach, to remove step down transformers and install power sharing with splice.
- Complete pilot of Skype™ for Business, an alternative web-conferencing software.
- Complete the full integration of PaperCut™ print-tracking software to faculty and departments, providing a platform that delivers reports to clients on printing volumes, generating awareness and promoting alternatives to printing.
- Review of current printing equipment inventory for improvements—reduce inventory size and replace with new, more efficient machines.
- Continue to promote the purchase of 30 per cent at minimum or greater post-consumer recycled content paper.

- Continue to ensure wheat sheet paper is available to order from the custom list as an alternative source to tree-derived paper.
- Continue to increase the use of digital signs and related communications platforms within buildings to share news, activities and events to reduce the reliance on paper-based promotional materials.
- Continue the replacement of desktop computers with laptops and more efficient devices as part of IT, Media and Classroom Services Computer Replacement Program.

D. Fugitive Emissions

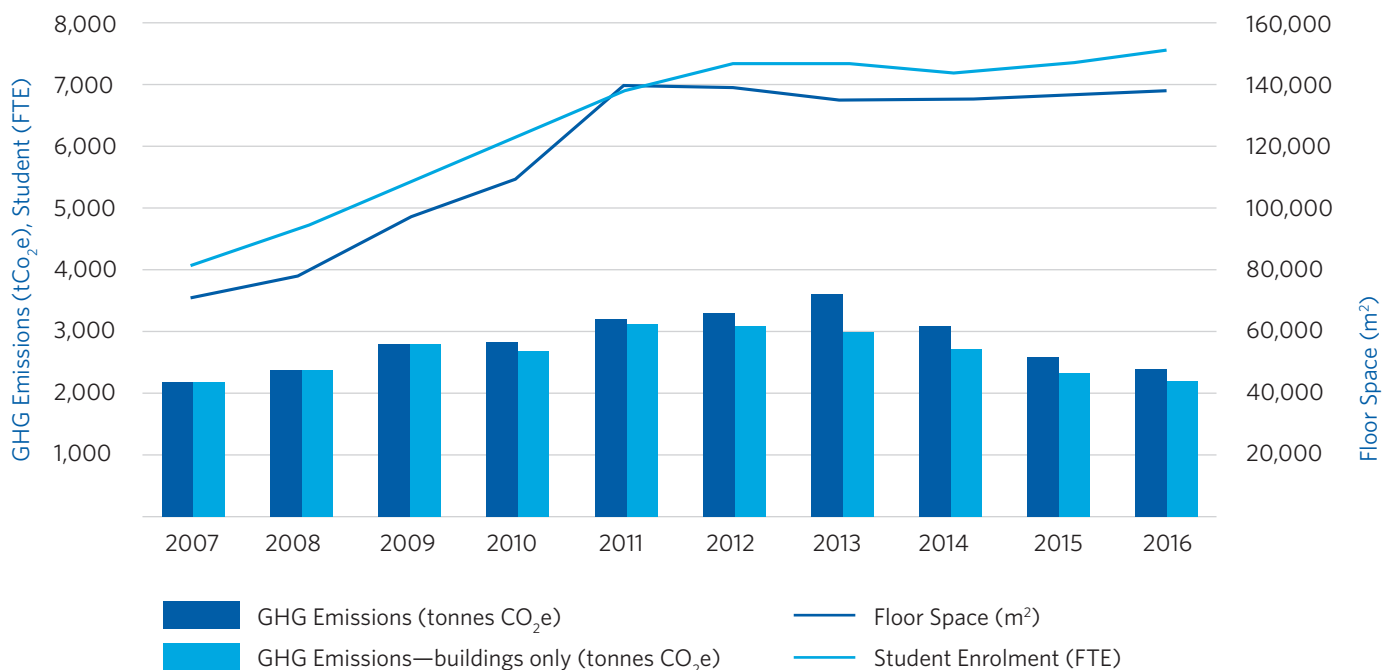
- Continue to conduct preventative maintenance and upgrades to HVAC system and associated appliances.

EMISSIONS IN GREATER DETAIL

COMPARISON TO BASELINES

Figure 1 provides a comparison of absolute campus and building emissions since 2007 relative to growth. From 2007 to 2016, student enrolment increased by 86 per cent while floor space has increased by 94 per cent. Despite growth, absolute emissions have been decreasing over the last three years largely due to the implementation of energy conservation measures initiated through building optimization programs and continual investment into the district energy system's infrastructure and operation, which significantly reduces the campus' reliance on gas-fired heating equipment.

Figure 1 Absolute GHG emissions relative to growth 2007-2016



ABOVE AND BEYOND:

Promoting a Culture of Sustainability

ENERGY CONSERVATION PHILOSOPHY AND PRACTICES

Whole Systems Approach to Sustainability Planning

The UBC Okanagan Whole Systems Infrastructure Plan (Plan), developed in parallel to an in support of the UBC Okanagan Campus Plan (2015), received UBC Okanagan Executive-endorsement in 2016. The Plan identifies key recommendations and processes required to assess and plan for future infrastructure needs that support campus growth and wellbeing. It further establishes a long-term roadmap for improving the overall performance of the campus, performance targets, and a five-year implementation plan to achieve campus sustainability performance across built and natural environments to 2030 and beyond.

The development of policy and strategies integral to successful advancement of the Plan's objectives and achievement of its 2050 Whole Systems goals during 2016 included:

- Formation of a campus Energy Team;
- Development and implementation of the Strategic Energy Management Plan;
- Completion of the behaviour change plan 'Campus-Wide Three-Year Conservation Awareness and Action Strategy' targeting energy conservation and carbon reduction;
- Expansion of district energy to the new Teaching and Learning Centre. This will provide low carbon heating and cooling to the facility and the enabling infrastructure for a future fuel switch to a renewable supply.



Artist rendering of the new Teaching and Learning Centre.

2050 WHOLE SYSTEMS SUSTAINABILITY GOALS

-  1 Achieve a net positive performance in operational energy and carbon
-  2 Implement a framework that supports low embodied carbon in future development
-  3 Optimize water quality, supply and security
-  4 100 per cent diversion of stormwater from municipal systems
-  5 Strive towards full waste recovery/reuse
-  6 Enhance and/or restore the site's ecology

ENERGY AND CARBON REDUCTION PROGRAMS PROVIDING RESULTS

Strategic Building Optimization = Reduction and Conservation

UBC Okanagan supports building optimization programs that are integral to reducing energy consumption and carbon emissions and fundamental to achieve the Whole Systems Infrastructure Plan's long-term goals. Following the successful UBC Okanagan/FortisBC-partnered Building Optimization Program and in response to key framework actions identified within the Whole System Infrastructure Plan, the campus formed an Energy Team and developed the Strategic Energy Management Plan (SEMP). The SEMP was developed to implement existing building energy conservation measures to achieve five-year plan targets, reduce energy consumption of district energy systems, and make capacity available for future growth of the campus.

Conservation measures identified for implementation in the SEMP are anticipated to yield savings of \$229,953 in operational costs and reduce the campus' energy consumption by 13,882 GJ and 2,128,133 kWh. These conservation efforts are expected to reduce UBC Okanagan's carbon emissions by 715 tCO₂e annually.

The building optimization programming will receive paralleled support through the 2017 implementation of the campus' behaviour change program, called the Power of You.

The Power of You Program

UBC Okanagan's Campus-Wide Three-Year Conservation Awareness and Action Strategy (Strategy) was developed in 2016. Responding to a key recommendation of the Whole Systems Infrastructure Plan, the Strategy evolved from the successful foundation established by the inaugural phase of Power of You program. Broadening the scope of the Power of You program to include active initiatives and communication-based campaigns, the Strategy was designed to impact all performance areas—energy, carbon, waste, water and ecology—and intends to build capacity and encourage voluntary actions by all campus constituents, campus-wide.

Actions taken by key operational departments in 2016 in response to the Power of You Lights Out and Power Down campaigns involved a staff-led audit across academic and administration buildings. As a direct result of the nightly audits, over 3,700 lights and 67 projectors were turned off or powered down and almost 1,000 windows were closed at night, contributing to campus energy savings. These figures also represent an improvement of behavioural actions implemented by staff and faculty over 2015's audit when 7,000 lights and 250 projectors and monitors were turned off or powered down and over 1,500 windows were closed at night.

In 2017, campaigns targeting energy, water and waste performance will be introduced to the campus through a variety of focused communication and event activities designed to bring awareness, build capacity and drive action to impact the campus' operational and environmental performance.



Last Up, Lights Out

By turning off lights in residence common areas for the night, you can save enough electricity to recharge 87 laptops for a year.

the **POWER** of you

Wi-Fi Technology Reduces Carbon Emissions

Wi-Fi services have provided UBC Okanagan's community with high-speed access to e-mail, the internet and campus network for the better part of a decade. Through the implementation of the Wi-Fi HVAC Occupancy Project in 2016, the campus effectively broadened the application of this technology to monitor building occupancy levels through the tracking of Wi-Fi frequencies.

Utilizing technology designed by Sensible Building Science. (sensiblebuildingscience.com), a UBC based start-up in Vancouver, a monitoring system fundamentally tracks building occupancy levels through the use of the campus' wireless network. The data collected by the system is transmitted to the campus' building management system (BMS) and, based

on technical programming entered by the Energy Team, the BMS is instructed to adjust building's environmental systems accordingly; accommodating current occupancy requirements by increasing or decreasing the utilization of the heating, cooling and air ventilation (HVAC) systems.

The implementation of this innovative monitoring system was first deployed in the Arts and Engineering, Management and Education buildings and is expected to be rolled out in the remaining academic and administration buildings in 2017. Projected savings estimate an annual decrease of the campus' utility costs by over \$19,000 through a reduction in energy consumption by 620 GJ and 166,700 kWh. These savings will effectively reduce the campus' annual carbon emissions by 31 tCO₂e.

ACTIONS TO SUPPORT CAMPUS SUSTAINABILITY PERFORMANCE

Campus Waste Audit

The UBC Okanagan campus continues to encourage environmental stewardship through behaviour change initiatives that impact a range of environmental performance areas, including waste. Waste reduction programs implemented at UBC Okanagan have been designed to directly reduce the amount of waste generated through encouragement of diversion at the point of disposal, reducing the production of the greenhouse gas methane (CH₄) released when material is left to break-down at the landfill.

In 2016, the campus undertook its fifth Bi-Annual Campus Waste Audit. The audit, which entails reviewing a day's worth of disposed material collected from 13 academic and administrative buildings waste streams, was conducted by Facilities Management personnel and 17 campus volunteers.

An amalgamated total of 6,939 litres of material—3,609 litres of garbage, 3,303 litres of recycling, and 27 litres of organic waste (compost)—was collected, deposited in the campus' main courtyard, and audited. All material was physically sorted into five categories—recycling, returnable, compost, garbage, and other—with 18 sub-categories indicating material type (i.e. paper, refundable and returnable cans and glass, etc.).

Providing overall satisfactory results this year, the outcomes of the compost and waste audits demonstrated improvements in sorting behaviours. The compost audit contained 94 per cent organic material, improving by five per cent over 2014's audit. The garbage audit revealed that 22 per cent of the material found in this waste stream was 'true' garbage, an improvement over the previous audit which reported 15 per cent. The results of the recycle audit showed that 62 per cent was true recycling, 26 per cent was returnable



and compostable material and the remaining 11 per cent was considered waste. This stream's results demonstrated a slight decline in diversion behaviours by four per cent over the previous audit's results.

Responding to the audit's recommendations, projects targeting improvement to UBC Okanagan's diversion rate are scheduled to commence in early 2017, including the launch of a UBC Okanagan specific online waste resource, a recycling event targeting the use and proper disposal of single-use cups on campus, and the initiation of a recycling station signage update.

Waste reduction activities voluntarily undertaken by campus members in 2016 that demonstrate a personal commitment to environmental stewardship included a lunch-hour waste cleanup event. A group of volunteers cleaned an area surrounding the new multi-use pathway entrance located near the flyover and, through their efforts, over 286 pounds of litter from the Bulman Road access was collected and disposed of responsibly.



Student Leadership in Laboratory Sustainability

Lab Armor Beads™, a product of Lab Armor®, are a non-toxic, non-vaporizing material designed to replace water in water bath systems traditionally utilized in laboratories. Benefits identified from the use of this product include an estimated improvement in energy efficiency over standard water baths by approximately 50 per cent (Lab Armor, LLC, n.d.), water conservation, and a reduction in waste production due to contamination—all of which support the campus' 2050 Whole Systems Infrastructure Plan's long-term energy, carbon, water and waste reduction goals.

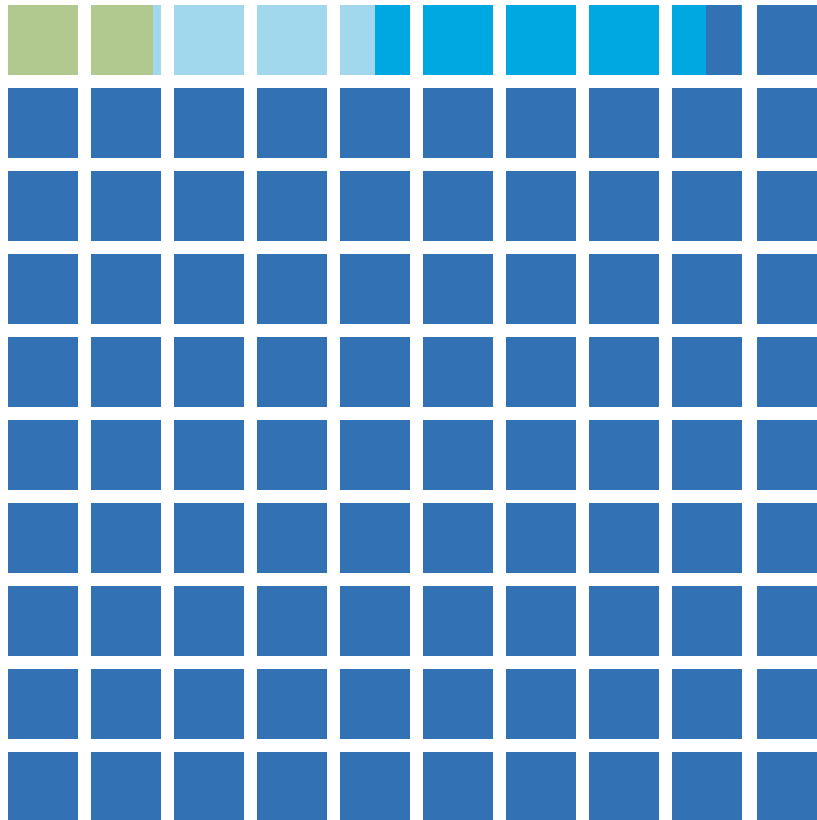
Demonstrating a proactive approach to effectively reduce a UBC Okanagan biology laboratory's environmental impact, a Biology PhD student obtained 2016 UBC Green Labs Funding for the purpose of purchasing Lab Armor Beads™. Based on the projected use of this product, it is estimated that biology laboratory will minimize its hazardous waste production, reduce its water consumption by 1,092 litres, and conserve approximately 138 kWh of electricity annually.

The ongoing integration of sustainable practices and implementation of energy conservation measures into UBC Okanagan research laboratories provides the campus with an invaluable opportunity. An upcoming project, scheduled for implementation in 2017, is the Lab Air Volume Control and Green Labs Education in the Science building's laboratories. Early projections indicate that energy reductions will total 278,900 kWh and 1,050 GJ, saving the campus \$26,600 in operational costs and reducing carbon emissions by 58 tCO₂e annually.



GHG EMISSIONS BY SOURCE

UBC OKANAGAN GREENHOUSE GAS EMISSIONS BY SOURCE FOR THE 2016 CALENDAR YEAR (tCO₂e*)



The following greenhouse gas emissions have been quantified using the BC Provincial Government's SMARTTool Reporting Framework.

1.9%
.....
47

Mobile (fleet and other mobile equipment)

2.6%
.....
63

Supplies (Paper)

4%
.....
98

Fugitive (Refrigerants)

91.5%
.....
2,227

Stationary (Building Heating and Generators) and Electricity

TOTAL EMISSIONS: 2,436

OFFSETS APPLIED TO BECOME CARBON NEUTRAL IN 2016

(Generated March 21, 2016 1:41 p.m.)

Total offsets required: 2,434. Total offset investment: \$60,850.

Emissions which do not require offsets: 2. **

*Tonnes of carbon dioxide equivalent (tCO₂e) is a standard unit of measure in which all types of greenhouse gases are expressed based on their global warming potential relative to carbon dioxide.

** Under the Carbon Neutral Government Regulation of the Greenhouse Gas Reduction Targets Act, all emissions from the sources listed above must be reported. As outlined in the regulation, some emissions do not require offsets.



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UBC Okanagan Actions Survey

2016 Carbon Neutral
Action Report (CNAR)

UBC ACTIONS SURVEY

2016 Carbon Neutral Action Report (CNAR) - Part 1 UBC Okanagan campus

1) Stationary Sources (Buildings, Power Generators): Fuel Combustion, Electricity use, Fugitive Emissions.

Survey Question	Response
During 2016, did your organization take any of the following actions to support emissions reductions from buildings? Select all that apply • Conducted an energy audit/study of building(s) in the organization's portfolio • Performed energy retrofits of the organization's buildings. • If yes, how many buildings? • Built, or are building new LEED Gold or other "Green" buildings. • If yes, how many buildings?	Yes Yes 5 No n/a
Other actions? Please describe briefly. Academic & Administration Buildings • Completed replacement of Arts Building Chiller CH-2. • Completed recommissioning and balance of air in Arts Building. • Continued to implement sub-metering and BMS enhancement and adopted LEED® v4, which includes a component requirement to step up metering (increased levels of metering). • Completed lighting upgrade design documents for Arts, Science, Creative and Critical Studies, and Administration buildings. • Completed sourcing for additional District Energy System cooling opportunities. Findings support the addition of a third cooling tower, projected for installation in 2017. • Implemented FortisBC's 'Partner in Energy' program that provides direct lighting rebates at the point-of-sale. • Continued to implement UBC Okanagan Whole Systems Infrastructure Plan. Completed projects include: I. Secured seed funding to implement Year 1 Energy Conservations Measures identified in the Plan. II. Established an Energy Team and Energy Committee. III. Completed and initiated implementation of 5-Year Strategic Energy Management Plan. IV. Continued to assess routine capital plan to determine energy efficient implementation options that respond to recommendations of the Whole Systems Infrastructure Plan and Strategic Energy Management Plan. V. Continued to develop and obtain endorsement of a campus-wide energy policy. A draft of an energy policy for the Okanagan Campus has been generated. The initial draft was based on the Point Grey campus energy policy with modifications to account for the Okanagan climate. VI. Developed a behaviour change plan—UBC Okanagan's Campus-Wide Three-Year Conservation Awareness and Action Strategy. VII. Initialized update to campus green building guidelines and defined new construction recommendations for efficient buildings. • Building Optimization Program, a partnership between UBC Okanagan and FortisBC, successfully completed in Administration and Science Buildings. Science achieved savings of six per cent (33,996 kWh)	

and 87 per cent (1,625 GJ) respectively accounting for a projected emission reduction of 81 tCO₂e annually. These savings exceeded initial BOP targets of one per cent electrical savings and combined gas and Medium Temperature District Energy System (MDES) savings of 22 per cent.

- Administration Building MUA replacement completed. Projected annual savings include lower energy costs of \$14,400 and a reduction in gas consumption by 1,390 GJ. Despite an expected increase in electricity consumption of 33,333 kWh annually, the carbon emission impact is projected to be reduced by 69 tCO₂e per year.
- Continued to implement Wi-Fi HVAC Occupancy Project to monitor building occupancy levels. More information can be found in *'Above and Beyond'* section of this document.
- Developed proposal for lighting upgrades in the Administration and Creative and Critical Studies buildings. Initial estimates project that the campus will reduce its energy consumption by approximately 380,000 kWh and 0.98 tCO₂e annually.
- Building optimization projects completed within Reichwald Health Science Centre and Engineering, Management and Education building include having both buildings' hydronic controls adjusted to allow for larger Low Temperature District Energy System (LDES) supply/return water temperatures and reduced flows.
- Adapted to UBC Technical Guidelines for Okanagan Campus.

Residence Buildings

- Completed LED bulb replacement in all Resident Buildings' common areas and in locations of easy access.

Briefly describe your organization's plans to continue reducing emissions from its stationary sources in future years.

Academic & Administration Buildings

- Remove domestic hot water from Engineering, Management and Education building's central boilers to allow boilers to seasonally shut down.
- Implement replacement of the Arts and Gym building chillers and Mountain Weather Office's chiller, boiler and generator.
- Initialize recommissioning and balance air, water and controls in Creative and Critical Studies, University Centre and Engineering, Management and Education buildings.
- Continue to implement sub-metering and BMS enhancements for better measurement of energy consumption and conservation planning, including peak demand. New campus measurement and verification standards have been adopted to be in line with LEED V4.
- Lighting upgrade for Administration building projected to reduce energy consumption by 200,000 kWh and 0.52 tCO₂e annually.
- LDES/MDES System Study to account for new building construction planned for the campus. It is important to consider both the capacity of the existing LDES and MDES systems as well as ensure that all HVAC systems in new buildings are designed to function optimally with the district systems.
- Building optimization projects scheduled to occur in the Charles E. Fipke Centre for Innovative Research (Fipke), University Centre (UNC) and Arts and Sciences Centre (ASC) during 2017 include:
 - Fipke to receive upgrade of its central plant to a four-pipe system with hot and cold tanks.
 - UNC's existing systems have been reviewed by a consulting firm who will be proceeding with detailed design work.
 - ASC's VRF system has been identified as being a key limit on the operation of the LDES system. A piping upgrade to this system has been proposed and detailed design work is proceeding.
- Cooling Plant Expansion—the addition of a cooling tower will increase the air-cooled capacity of the LDES system.
- Implement energy study recommendations for the Administration building's mechanical and envelope systems.
- Implement Supply Air Temperature Reset—upgrading the BMS control software to set supply-air temperatures based on average heating/cooling valve positions is expected to save the campus \$4,900 per year in heating and cooling costs and reduce energy consumption by 390 GJ of gas and 24,300 kWh of electricity, which reduces the campus' carbon emissions by 20 tCO₂e annually.

• Implement Supply Air Pressure Reset—adjusting the supply-air pressure set points based on the heating/cooling demand in a building to allow for reduced fan speeds and corresponding reduced electrical consumption. • Increase Heat pump Utilization—optimizing building supply water temperatures will allow existing heat pumps to operate for a larger fraction of the year. Implementation of this strategy is estimated to result in a reduction of natural gas consumption and an increase in electricity use for a net energy cost savings of approximately \$1,200 and a reduction in carbon emissions by 85 tCO₂e annually. • Implement CNCP project Lab Air Volume Control and Green Labs Education in Science Building laboratories (funding pending). This project is estimated to reduce the campus' energy consumptions by 2,600 GJ and 170,000 kWh and emissions by 131 tCO₂e annually. • Peak Load Management—electricity costs for the campus are a mixture of charges for energy consumption (kWh) and peak demand (kW). As such, reducing electrical demand at peak times can have significant impacts on campus energy costs. As the initial step-in managing peak loads, control strategies to reduce fan speeds and adjust supply water temperatures during peak periods will be implemented, which is expected to result in a reduction of peak demand charges by \$13,400 per year. • Whole Systems Implementation Plan projects: - Full implementation of the Strategic Energy Management Plan. - Implementation of the behaviour change plan - UBC Okanagan's Campus-Wide Three-Year Conservation Awareness and Action Strategy - called the Power of You. - Expansion of the District Energy System. • Integrate Library data center into geo-exchange system during the construction of the Teaching and Learning Centre.	
Residence Buildings • Continue to complete lighting upgrades on a failure-based requirement. • To complete a full review of automation in residence buildings. • Review timing and schedule for Monashee building's hot water tank replacement.	
During 2016, did your organization participate in utility-sponsored energy demand management program(s) (e.g. BC Hydro's Energy Management (Manager))?	Yes
If yes, please describe briefly: • Operations: Energy Specialist partnership funding with FortisBC. • Residence: Residence Energy Assessment funded by FortisBC.	

2) Mobile Sources (Fleet, Off-road/Portable Equipment) Fuel Combustion: Indicate which actions your PSO took in 2016:

Survey Question	Response
During 2016, did your organization take any of the following actions to support emission reductions from its mobile sources? Select all that apply • Replaced existing vehicles with more fuel efficient vehicles (gas/diesel). • If yes, how many vehicles? • Replaced existing vehicles with hybrid or electric vehicles. • If yes, how many vehicles? • Took steps to drive less than previous years.	No n/a No n/a Yes
Other actions? Please describe briefly. • Removed stand-alone gasoline storage unit, reducing fuel loss through evaporation. • Reduced campus fleet by one Student Housing and Hospitality Services operations vehicle. • Continued to implement measures to reduce reliance on fleet vehicles and diverted the number of trips	

taken by encouraging fleet carpooling, walking or cycling, as well as consolidating off-campus trips. Continued stewardship of sustainable mobile fuel combustion through adherence to Sustainable Fleet Procedures, replacement of retired fleet vehicles with electric and energy efficient models, and ongoing training and education to support sustainable fleet use.
Briefly describe your organization's plans to continue reducing emissions from its mobile sources in future years. - Enhancements to bus loop to allow for improved traffic flow of high density modes of transportation, i.e. buses - further encouraging alternative modes of transportation be used by campus constituents. - Continue to implement measures to reduce reliance on fleet vehicles and divert the number of trips taken by encouraging fleet carpooling, walking or cycling, as well as consolidating off-campus trips. - Continue stewardship of sustainable mobile-fuel combustion through adherence to Sustainable Fleet Procedures, replacement of retired fleet vehicles with electric and energy-efficient models, and ongoing training and education to support sustainable fleet use.

3) Supplies (Paper):

Survey Question	Response
During 2016, did your organization take any of the following actions to support emissions reductions from paper supplies? Select all that apply - Awareness campaign focused on reducing office paper use. - Policy requiring the purchase of recycled content paper. - If yes, state % of recycled content (eg 30%, 100%) - Policy requiring the purchase of alternate source paper (bamboo, hemp, wheat, etc). - If yes, state source type (eg bamboo, wheat)	No Yes 50% No n/a
Policy requiring the purchase of recycled content paper: Through the UBC Procure to Pay purchasing system, departments are recommended to purchase at minimum paper containing 50 per cent post-consumer recycled (PCR) content, or alternative fiber paper. UBC Okanagan's campus launched the PaperCut™ software program in 2015. The program provides the opportunity to monitor and reduce paper consumption through measures which include print reporting, secure print release and multi-machine printing capabilities. The program's first stage of implementation enabled students to monitor, measure, and receive printing awareness prompts. The following stage introduced preliminary access to faculty and staff in 2016. Full program implementation is intended to be rolled-out in 2017. Other actions? Please describe briefly. - Full implementation of PaperCut™ system to students, roll-out of system to faculty and staff at departmental level. - Completed the full integration of PaperCut™ print tracking software to faculty and departments; providing a platform that delivers reports to clients on printing volumes, generating awareness and promoting alternatives to printing. - Continued program upgrades, using a phase-in approach, to remove step down transformers and install power sharing. - Commenced pilot of Skype™ for Business, an alternative web-conferencing software. - Continued to promote the purchase of 30 per cent at minimum or greater post-consumer recycled content paper. - Continued to ensure wheat sheet paper is available to order from the custom list as an alternative source to tree-derived paper. - Continued to increase the use of digital signs and related communications platforms within buildings to share news, activities and events to reduce the reliance on paper-based promotional materials. - Continued replacement of desktop computers with laptops and more efficient devices as part of IT, Media	

and Classroom Services' Computer Replacement Program.

Briefly describe your organization's plans to continue reducing emissions associated with its office paper use in future years.

- Continue program upgrades, using a phase-in approach, to remove step down transformers and install power sharing with splice.
- Complete pilot of Skype™ for Business, an alternative web-conferencing software.
- Complete the full integration of PaperCut™ print-tracking software to faculty and departments, providing a platform that delivers reports to clients on printing volumes, generating awareness and promoting alternatives to printing.
- Review of current printing equipment inventory for improvements—reduce inventory size and replace with new, more efficient machines.
- Continue to promote the purchase of 30 per cent at minimum or greater post-consumer recycled content paper.
- Continue to ensure wheat sheet paper is available to order from the custom list as an alternative source to tree-derived paper.
- Continue to increase the use of digital signs and related communications platforms within buildings to share news, activities and events to reduce the reliance on paper-based promotional materials.
- Continue the replacement of desktop computers with laptops and more efficient devices as part of IT, Media and Classroom Services Computer Replacement Program.

4). Other Sustainability Actions: Business Travel

Survey Question	Response
During 2016, did your organization take any of the following actions to support emissions reductions from business travel? Select all that apply • Created a low-carbon travel policy or travel reduction goal (low-carbon = lowest emission of greenhouse gas per kilometer per passenger) • Encouraged alternative travel for business (e.g. bicycles, public transit, walking) • Encouraged or allowed teleworking or working from home	No Yes Yes
Other, please describe briefly N/A	

Other Sustainability Actions

Survey Question	Response
During 2016, did your organization have any of the following programs or initiatives to support sustainability? Select all that apply • A water conservation strategy which may include a plan or policy for replacing water fixtures with efficient models • An operations policy or program to facilitate the reduction and diversion of building occupant waste (e.g., composting, collection of plastics, batteries) from landfills or incineration facilities • Green procurement standards for goods (e.g., office furniture, etc.) • Lifecycle costing of new construction or renovations	Yes Yes No Yes
Other, please describe briefly Please refer to the UBC Okanagan's 2016 Carbon Neutral Action Overview Report.	

Education and Awareness

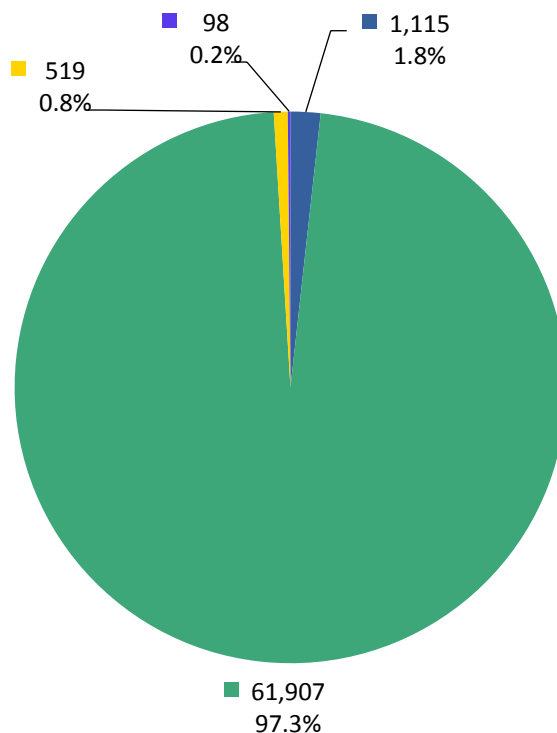
Survey Question	Response
During 2016, did your organization have any of the following programs or initiatives to support sustainability education and awareness? Select all that apply • Green, Sustainability or Climate Action Team • Support for professional development on sustainability (e.g. workshops, conferences, training) • Supported or provided education to staff about the science of climate change, conservation of water, energy and/or raw materials	Yes Yes Yes
Other, please describe briefly Building on the foundation established by the inaugural phase of the UBC Okanagan campus' Power of You behaviour change program and in response to a key recommendation of the Whole Systems Infrastructure Plan (WSIP, 2016), UBC Okanagan developed the 2016 Campus-Wide 3-Year Conservation Awareness and Action Strategy. The new strategy, which retains the Power of You program title, establishes an implementation plan and outline of awareness campaigns and engagement activities designed to build capacity and encourage the voluntary sustainable action by campus constituents, impacting all performance areas - energy, carbon, water, waste, ecosystem and biodiversity.	



PART C

Emissions source report

UNIVERSITY OF BRITISH COLUMBIA GREENHOUSE GAS EMISSIONS BY SOURCE FOR THE 2016 CALENDAR YEAR (tCO₂e*)



Total Emissions: 63,639

- Mobile Fuel Combustion (Fleet and other mobile equipment)
- Stationary Fuel Combustion (Building Heating and Generators) and Electricity
- Supplies (Paper)
- Fugitive Sources

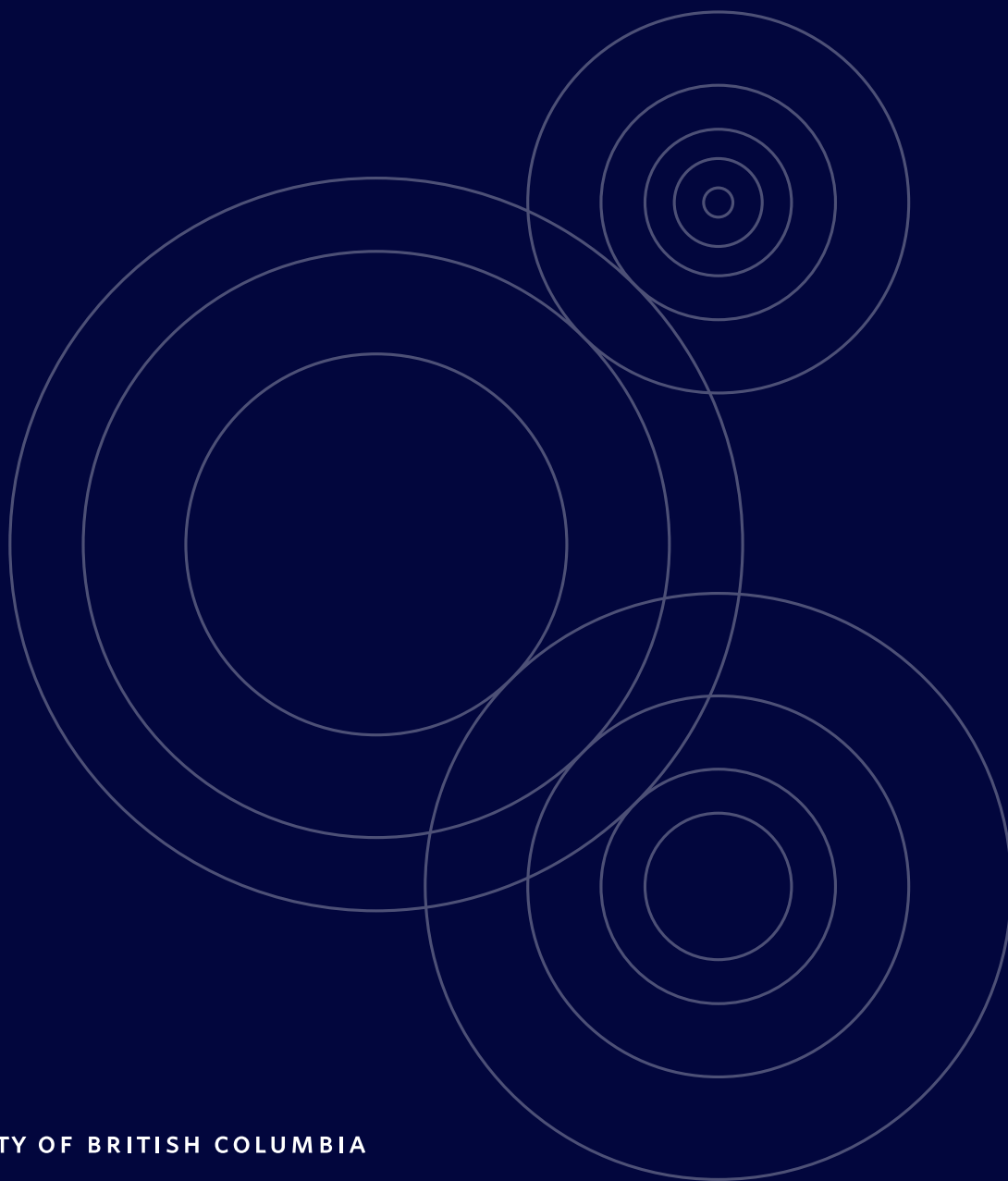
Offsets Applied to Become Carbon Neutral in 2016 (Generated May 30, 2017 1:46 PM)

Total offsets required: **47,897**. Total offset investment: **\$1,197,425**. Emissions which do not require offsets: **15,742** **

*Tonnes of carbon dioxide equivalent (tCO₂e) is a standard unit of measure in which all types of greenhouse gases are expressed based on their global warming potential relative to carbon dioxide.

** Under the *Carbon Neutral Government Regulation of the Greenhouse Gas Reduction Targets Act*, all emissions from the sources listed above must be reported. As outlined in the regulation, some emissions do not require offsets.

2016 CARBON NEUTRAL ACTION REPORT



THE UNIVERSITY OF BRITISH COLUMBIA
sustainability