2014 CARBON NEUTRAL ACTION REPORT

British Columbia Institute of Technology

BCIT 50 YEARS

Declaration Statement

This Carbon Neutral Action Report for the period January 1 to December 31, 2014, summarizes our emissions profile, the amount of offsets purchased to reach net zero emissions, the actions we have taken in 2014 to reduce our greenhouse gas emissions, and our plans to continue reducing emissions in 2015 and beyond.

By June 30, 2015, BCIT's final Carbon Neutral Action Report will be posted to our website at **bcit.ca/facilities/sustainability/energy**.

Emissions and Offsets Summary Table

BCIT GHG Emissions and Offsets for 2014 (tCO_2E)	
GHG emissions created in calendar year 2014	
Total emissions	8,363
Total emissions for offsets	8,360
Adjustments to GHG emissions reported in previous years	
Total emissions	-4
Total emissions for offsets	1
Credit owing from PCT at end of 2014 reporting year	
Credit owing	n/a
Total emissions for offsets for the 2014 reporting year	**8,361**

Executive Summary

At the British Columbia Institute of Technology (BCIT), our commitment to sustainability encompasses everything from advancing the state of practice through education and research, to improving the efficiency of campus operations, to engaging the community across the institute in green initiatives.

BCIT is well-known for transforming innovative ideas into real results. As a strong supporter of the province's mission to reduce energy use and greenhouse gas (GHG) emissions, the institute has applied this results-driven approach to its sustainability practices. Putting sustainability strategy into action, the institute has made its campuses living laboratories, where examples of environmental stewardship are always evolving. The main Burnaby campus is home to a green roof, a solar panel electric car charging station, a greenhouse, and a wind turbine.

This Carbon Neutral Action Report (CNAR) details the many notable activities that BCIT has undertaken in 2014. For example, within the past year, BCIT implemented new heating, air handling, and water optimization processes in the Gateway/SW1 building at the Burnaby campus, which resulted in 279,632 kWh of energy savings. In addition, a new photovoltaic system installed on the Gateway/SW1 building roof has generated 17 MWh of energy since going online just over a year ago.

British Columbia is a dynamic place to live and work – and for over 50 years, BCIT has played an important role in supporting its growth. Our applied research activities help to bring new products to the marketplace and to address industry-specific problems. Together, with our graduates' contributions, our research helps drive the economy forward.

Lorcan O'Melinn
Vice President, Administration and CFO

May 8, 2015
Date

Photovoltaic system on Gateway building roof

2014 Greenhouse Gas Emissions

In 2014, the total GHG emissions for BCIT was 8,363 tCO_2e.

Offsets Applied to Become Carbon Neutral in 2014

BCIT purchased 8,360 tCO_2e of offsets to become carbon neutral. The variance of 3 tCO_2e were from biomass emissions and do not require offsets.

Changes to Greenhouse Gas Emissions and Offsets Reporting from Previous Years

1 tCO_2e was purchased as an adjustment to offsets from 2013. This offset was for December 2013 invoices not yet received prior to the 2013 reporting.

Emissions Reduction Activities in 2014

Key initiatives taken between January 1 and December 31, 2014 to reduce greenhouse gas emissions include:

- The Factor Four 200-kW biomass boiler system project (wood-waste-to-energy) made good progress in 2014 with completion of the schematic design, publication of the RFP, and awarding of the contract for all equipment. Construction will start in 2015.
- BCIT worked with ESC Automation to resolve comfort and reliability issues with the HVAC system in the Gateway building. An energy optimization process was implemented on the geofield, multi-stack heat pumps, and heat exchangers. A new chilled water beam strategy and air handling unit sequences were implemented as well. The building is now operating more efficiently. The changes resulted in an approximate energy savings of 279,632 kWh per year.
- The 75 kWh lithium-ion battery energy storage system in the SE8 building was made fully operational in 2014. It is designed to work with the Steam Turbine Generator in SE8.

Guichon Creek

- The 15 kW photovoltaic system on the Gateway building roof sends energy it generates directly to the building / BCIT grid. The PV system has been online for one year and three months. Data analysis shows that the energy generated by the PV system in the last 12 months is approximately 15 MWh. The total lifetime generation since the system went online is 17 MWh.
- The following OASIS system components have been in commissioning and partially operational since March 2014:
  - 250 kW photovoltaic system in Lot 7.
  - 500 kWh lithium-ion battery energy storage system for the Photovoltaics in Lot 7.
  - Two level 3 (DC fast charge) electric vehicle chargers in Lot 7.
  - Two level 2 electric vehicle chargers in Lot 7.
  - Three ION 7650 smart meters, and a power analyzer for data measurement of the OASIS system and components.

  The process of gathering and analyzing initial data from the OASIS system is underway.
- The old district heating system was leaking a large amount of heated water. We replaced it with new high efficiency boilers in buildings NE1, SE4, SE14, SE16, and SW9. The new boilers are rated at 85% efficiency.
- Half of the 4th floor in NE1 was upgraded with a new rooftop air handling unit with an outdoor air economizer that utilizes a variable speed drive and VAV box controls. The heating coil for the unit is located inside the building to minimize standby losses.
- A new centralized air conditioning system was installed in NW6 to replace the multiple small, less efficient split systems. The new centralized system has the ability to transfer heat from a space that is too hot and move it to a space that needs heat. Items installed on this project include:
  - Variable refrigerant flow AC system with heat recovery and inverter driven compressors.
  - A gas-fired dedicated outdoor air handling unit (DOA) with variable speed drives and controls.
    - The gas-fired portion is condensing.
    - The variable speed drives are integrated into the DOA unit.
    - 2-stage cooling is incorporated as well to enable the DOA unit to reduce the makeup airflow through the unit to 50%.
    - Variable volume dampers are used in conjunction with the DOA unit to save energy when classrooms are not in use.

Rain gardens outside NE1

- A new high-efficiency duct furnace was installed in NE18 to replace an old, less efficient unit.
- A gas assessment was completed by FortisBC at the NE1, NE2, and NE6 buildings.
- A Transsolar energy study was completed at NE1.
- A FortisBC / Factor Four heat recovery custom incentive energy study was performed.
- Work was started at the BCIT Aerospace and Downtown campuses on the Continuous Optimization Program (BC Hydro / FortisBC re-commissioning program).
- A pilot project on occupancy sensors to control baseboard heating has been launched in Student Housing.
- HVAC coil cleaning pilot at Downtown and Marine campuses was completed.
- Discussions took place about replacing older maintenance vans with electric models.
- A detailed energy and feasibility study for daylighting the School of Construction and the Environment (SoCE) Carpentry Canopy has been completed.
- Continued with parking lot lighting safety improvement program by replacing 250-watt HID lights with 142-watt LED lights at the Canada Way and Willingdon Avenue parking lot. Additional lighting upgrades include:
  - Replacement of HID exterior wall packs with LED on buildings NE7, SE16, SE30, SW5, and the Royal Oak buildings.
  - Several pot lights throughout the campus were replaced with LED pot lights.
- Construction of the new 25-kV receiving and distribution centre began, improving electrical distribution for the south campus.
- Survey and condition assessment of all Burnaby campus underground utilities began. Blockages in the storm system were removed.
- An old, undersized air handling unit at the CARI building Phytolab was replaced with a new variable speed unit complete with high efficiency motors.

Bike racks at north-central entrance of NE1

Actions to Reduce Provincial Emissions and Improve Sustainability

- A business case for annual funding to support all Green Team activities has been presented to BCIT VP Finance and VP Education and is awaiting approval.
- Continued communications to encourage participation in Green Team initiatives through BCIT announcements in The Loop.
- The 2014-2015 BCIT Green Team campaign "The Office Doctor" was designed to increase individual workstation energy efficiency. The first 20 doctors were recruited and trained, and the first office visits (with a total objective of 150 visits for the duration of the campaign) began.
- The Green Team cleaned up and maintained their Commute Smart campaign website where tips and reasons to carpool are featured.
- Rain gardens were created at the north-east and north-west entrances of building NE1 as well as building NE8. The rain gardens enable surface water run-off to be absorbed by specially selected local vegetation that filters sediment and reduces water flows into storm drainage systems. The plants provide bio-filtration of water run-off that ultimately enters the Guichon Creek / Still Creek / Burnaby Lake watershed.
- Additional improvements that were part of the NE1 Exterior Renewal project include:
  - 22 new trees, along with shrubs and other plantings.
  - New aluminum bike racks beside the north-central entrance.
- BCIT's Food Waste program was expanded and is now in all Burnaby campus cafeterias, the campus pub, the Rix coffee shop, the SW1 2nd floor deli, the SW1 1st floor common area, and high use meeting rooms Townsquare A, B, and D. The program was adopted at the Annacis Island, Aerospace, and Marine campuses in 2014.
- New signage was created for all recycling and organics bins and posted throughout BCIT campuses as well as on our website at: bcit.ca/facilities/facilitiesserv/waste/bins.shtml.
- Multiple tours of the Factor Four area were provided to various members of the community and a self-guided tour brochure was produced, published, and promoted. The Factor Four educational website was expanded at: commons.bcit.ca/factorfour.
- BCIT 2013-2016 Strategic Energy Management Plan (SEMP) has been updated and re-approved by BCIT's VP Education and VP Finance. A progress report after one year of implementation has been published and presented.

Guichon Alley

- The Sustainability category in the Employee Excellence Awards was maintained and there were multiple submissions for candidates to receive the award.
- The Climate Change 101 free online course for staff and students was offered again in 2014.
- Earth Hour and Sweater Day were promoted to the BCIT community.
- Many energy saving and sustainability tips were shared with the BCIT community in 2014 using various channels such as The Loop, BCIT website, and BCIT Marketing and Communications digital slides.
- Patio planters on the 7th floor of the Downtown campus were cleared so vegetables could be grown as a staff community building project.
- Building teamwork and working closely with the grounds labourers, we eliminated the use of a second cart at the Burnaby campus.
- There was a higher than average amount of windfall this winter in our wooded area on the south aspect of campus. Rather than remove the trees to the landfill, the windfall was cut and re-distributed in the woods. The logs rot and provide shelter for spiders, beetles, ants, worms, etc. which in turn provides a food source for birds and other animals. Ultimately, the breakdown of logs provides nutrients back to the soil.
- Landscaping, in partnership with Afresh Refresh and grant monies from TD Friends of the Environment, began work on a sustainable garden which includes a composter, water catchment barrel to be used for irrigating ornamental plants, mason bee habitat, and a vertical gardening concept design.
- Landscaping, in partnership with the School of Construction and the Environment and Project Services, introduced nine self-watering containers along the new Guichon Alley. This has significantly improved the corridor.
- Vermicompost continues to provide valuable organic soil to planters on campus. Green waste is supplied by the kitchens on campus and the Recycling department manages the vermicompost facilities.
- Work has begun on a program to educate the BCIT purchasing community on existing and recognized green standards for energy, water, fair trade, well managed forest, chemical, organics, etc.

Plans to Continue Reduction of Greenhouse Gas Emissions and Improve Sustainability in 2015 and Beyond

BCIT will be focusing on the following key areas to reduce greenhouse gas emissions and improve sustainability in the coming year:

- Construction will begin in 2015 of the 200-kW biomass boiler system that will convert BCIT woodworking programs' waste into energy used to heat the NE1 building.
- Completion of the survey and condition assessment of all Burnaby campus underground utilities.
- The Food Waste program will be expanded to staff lunch rooms throughout the Burnaby campus. The program will be in place at the Downtown campus in April 2015.
- Additional lighting upgrades for 2015 include:
  - Replacing old HID wall packs with LED lighting on the exterior of buildings NE6, NE9, SE14, and CARI.
  - Continue replacing old pot lights with LED pot lights as funding permits.
- Work began on a project to ensure direct involvement of energy personnel in new construction and major renovation projects in 2014. A checklist will be developed, and when approved, used in the review of new construction and major renovation projects at the planning stage. Target completion date for this work is 2016.
- A project to replace walk-in coolers on campus with energy efficient models is scheduled to begin in 2015 with an energy study. This project is anticipated to save a significant amount of energy and also approximately 250,000 litres of city water every year.
- The Centre for Architectural Ecology is investigating the acoustical and air quality impact of interior living walls. A BCIT MASc graduate student is conducting empirical measurement on the absorption and scattering properties of living wall components and different plant species. A UBC graduate student is investigating the CO2, VOC, endotoxins, and bacteria impact of living walls on rooms. A third graduate student is developing a simulation model to predict the overall IEQ of rooms with living walls.
- A project to develop purchasing guidelines for energy efficiency is in progress and scheduled to be completed in 2016.

Centre for Architectural Ecology study

2014 Carbon Neutral Action Report (CNAR) - Part 2 ACTIONS

Organization Name

British Columbia Institute of Technology

Actions Taken to Reduce Emissions

1) Stationary Fuel Combustion, Electricity (Buildings):Indicate which actions were taken in 2014:

Performed energy retrofits on existing buildings

Yes

Built or are building new LEED Gold or other "Green" buildings.

No

Undertook an evaluation of overall building energy use.

No

Please list any other actions taken to reduce emissions from Buildings:

-BCIT worked with ESC Automation to resolve comfort and reliability issues with the HVAC system in the Gateway building. An energy optimization process was implemented on the geofield, multi-stack heat pumps, and heat exchangers. A new chilled water beam strategy and air handling unit sequences were implemented as well. The building is now operating more efficiently. The changes resulted in an approximate energy savings of 279,632 kWh per year.

-The old district heating system was leaking a large amount of heated water. We replaced it with new high efficiency boilers in buildings NE1, SE4, SE14, SE16, and SW9. The new boilers are rated at 85% efficiency.

-Half of the 4th floor in NE1 was upgraded with a new rooftop air handling unit with an outdoor air economizer that utilizes a variable speed drive and VAV box controls. The heating coil for the unit is located inside the building to minimize standby losses.

-A new centralized air conditioning system was installed in NW6 to replace the multiple small, less efficient split systems. The new centralized system has the ability to transfer heat from a space that is too hot and move it to a space that needs heat. Items installed on this project include:
- Variable refrigerant flow AC system with heat recovery and inverter driven compressors.
- A gas-fired dedicated outdoor air handling unit (DOA) with variable speed drives and controls.
- The gas-fired portion is condensing.
- The variable speed drives are integrated into the DOA unit.
- 2-stage cooling is incorporated as well to enable the DOA unit to reduce the makeup airflow through the unit to 50%.
- Variable volume dampers are used in conjunction with the DOA unit to save energy when classrooms are not in use.

-A new high-efficiency duct furnace was installed in NE18 to replace an old, less efficient unit.

-A gas assessment was completed by FortisBC at the NE1, NE2, and NE6 buildings.

-A FortisBC / Factor Four heat recovery custom incentive energy study was performed.

-Work was started at the BCIT Aerospace and Downtown campuses on the Continuous Optimization Program (BC Hydro / FortisBC re-commissioning program).

-A pilot project on occupancy sensors to control baseboard heating has been launched in Student Housing.

-HVAC coil cleaning pilot at Downtown and Marine campuses was completed.

-A detailed energy and feasibility study for daylighting the School of Construction and the Environment (SoCE) Carpentry Canopy has been completed.

-Continued with parking lot lighting safety improvement program by replacing 250-watt HID lights with 142-watt LED lights at the Canada Way and Willingdon Avenue parking lot. Additional lighting upgrades include:
- Replacement of HID exterior wall packs with LED on buildings NE7, SE16, SE30, SW5, and the Royal Oak buildings.
- Several pot lights throughout the campus were replaced with LED pot lights.

-Construction of the new 25-kV receiving and distribution centre began, improving electrical distribution for the south campus.

-An old, undersized air handling unit at the CARI building Phytolab was replaced with a new variable speed unit complete with high efficiency motors.

2) Mobile Fleet Combustion (Fleet and other vehicles):Indicate which actions were taken in 2014:

Do you have a fleet?

Yes

Replaced existing vehicles with more fuel efficent vehicles (gas/diesel)

No

Replaced existing vehicles with hybrid or electric vehicles

No

Reduced the overall number of fleet vehicles

No

Took steps to drive less than last year

Yes

Please list any other actions taken to reduce emission from fleet:

-Discussions took place about replacing older maintenance vans with electric models.

-Building teamwork and working closely with the grounds labourers, we eliminated the use of a second cart at the Burnaby campus.

-The Green Team cleaned up and maintained their Commute Smart campaign website where tips and reasons to carpool are featured.

3) Supplies (Paper):Indicate which actions were taken in 2014:

Used less paper than previous year

Yes

Used only 100% recycled paper

No

Used some recycled paper

Yes

Used alternate source paper (Bamboo, hemp, etc.)

Yes

Please list any other actions taken to reduce emissions from paper use:

-Tested approximately 20,000 sheets of wheat paper.

-Many energy saving and sustainability tips were shared with the BCIT community in 2014 using various channels such as The Loop, BCIT website, and BCIT Marketing and Communications digital slides.

Actions Taken to Reduce Emissions - continued

Explain how you plan to continue minimizing emissions in 2015 and future years:

-Construction will begin in 2015 of the 200-kW biomass boiler system that will convert BCIT woodworking programs' waste into energy used to heat the NE1 building.

-Completion of the survey and condition assessment of all Burnaby campus underground utilities.

-Additional lighting upgrades for 2015 include:
- Replacing old HID wall packs with LED lighting on the exterior of buildings NE6, NE9, SE14, and CARI.
- Continue replacing old pot lights with LED pot lights as funding permits.

-Work began on a project to ensure direct involvement of energy personnel in new construction and major renovation projects in 2014. A checklist will be developed, and when approved, used in the review of new construction and major renovation projects at the planning stage. Target completion date for this work is 2016.

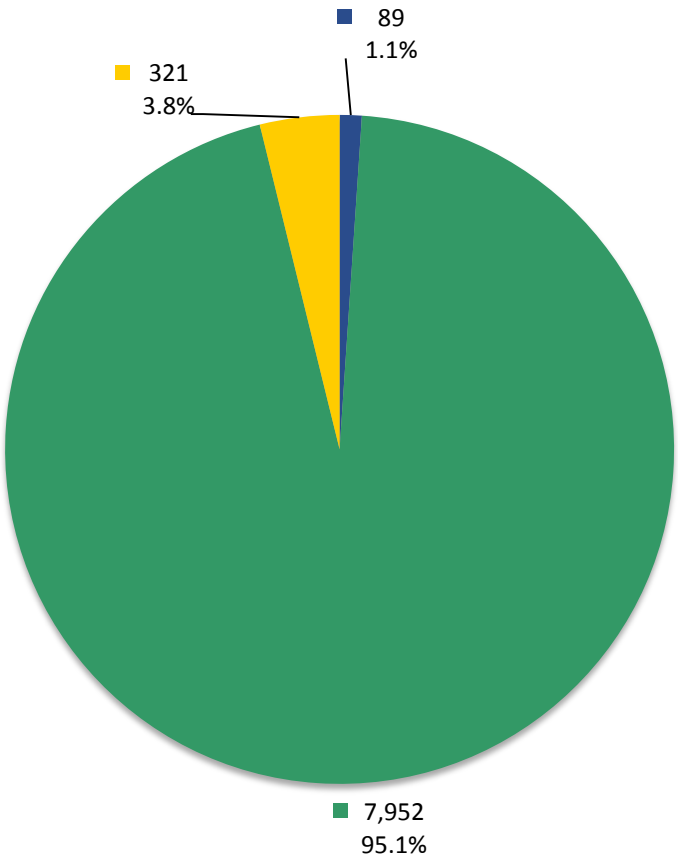
-A project to replace walk-in coolers on campus with energy efficient models is scheduled to begin in 2015 with an energy study. This project is anticipated to save a significant amount of energy and also approximately 250,000 litres of city water every year.

-A project to develop purchasing guidelines for energy efficiency is in progress and scheduled to be completed in 2016.

If you wish to list any other "sustainability actions" outside of buildings, fleet, paper and travel check "yes". This reporting is optional.

No

British Columbia Institute of Technology
Greenhouse Gas Emissions by Source
for the 2014 Calendar Year (tCO_2e*)



Total Emissions: 8,363

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

Offsets Applied to Become Carbon Neutral in 2014 (Generated June 23, 2015 3:55 PM)

Total offsets required: **8,360**. Total offset investment: $**209,000**. Emissions which do not require offsets: **3** **

*Tonnes of carbon dioxide equivalent (tCO_2e) 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.