BCIT™

2018
STRATEGIC ENERGY MANAGEMENT PLAN

BRITISH COLUMBIA
INSTITUTE OF TECHNOLOGY

INTRO

Our commitment to sustainability encompasses advancing the state of practice through education and research, campus operations and planning, and employee and student stewardship programs.

With a strong history of projects to build on, the newly formed BCIT Energy Team has bold plans to reduce the Institute's greenhouse gas (GHG) emissions by one third over the next four years.

To reach that goal, our Energy Team partners with departments across the Institute to:

- improve efficiency through retrofit projects and upgrades of aging equipment
- move to decarbonized energy sources where possible
- provide real-time monitoring of energy use
- support electric fleet vehicles and charging infrastructure

Our work also facilitates the pursuit of two BCIT core sustainability goals, as listed in the Institute's Economic, Social, and Environmental Sustainability Policy 1010:

- Become greenhouse gas neutral
- Become a net energy producer

The BCIT Strategic Energy Management Plan (SEMP) is a roadmap to guide the Energy Team towards reaching these sustainability goals.

WHERE ARE WE NOW?

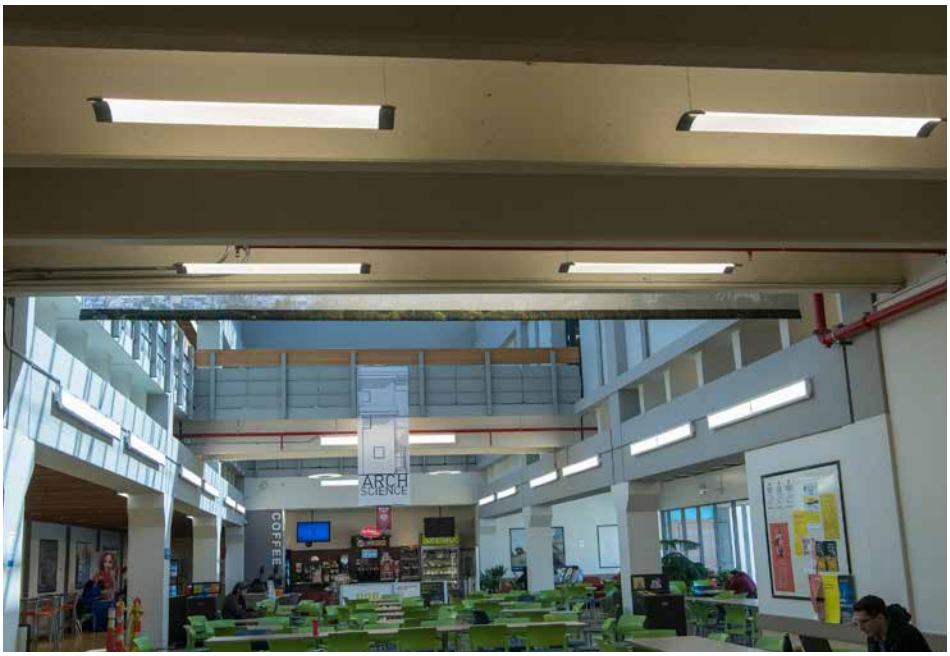
As an Institute, we used approximately 84 million kWh of energy in 2017, and spent $5 million in energy and emission costs. In relative terms, that is comparable to the energy used by 3,000 BC households.

Past Energy Projects

Between 2013 and 2016, BCIT completed 13 energy studies that included the majority of our most energy-intensive buildings across our campuses. These studies helped us understand our energy and GHG emissions reduction potential and the feasibility of reaching a reduction target.

By the end of 2016, 22 energy conservation measures (ECMs) were completed in collaboration with departments across the Institute. Cumulatively, they resulted in the following savings:

ESTIMATED ELECTRICITY SAVINGS	ESTIMATED NATURAL GAS SAVINGS	ESTIMATED GHG REDUCTION	ESTIMATED COST SAVINGS
kWh/year	GJ/year	Tonnes CO_{2eq}/year	$/year
2,395,737	12,469	686	$366,212



Left: A Burnaby Campus cafeteria retrofitted with LED light upgrades.

Right: The BCIT Marine Campus heats its training pool's water with a solar hot water system.

Implemented ECMs include:

- The most energy-intensive building at BCIT, the NE8 welding shop, was retrofitted with an on-demand ventilation system that saves over $130,000 a year in energy costs.
- Phase 1 of the Waste-to-Energy project was completed, which will eventually produce renewable energy by converting wood waste from our carpentry shops to building heat.
- 250 kW of solar canopy—with 500 kWh of Lithium Ion battery storage and a series of electric vehicle charging stations—was installed at the Burnaby Campus.
- Thousands of LED light upgrades were completed across BCIT campuses.
- A solar hot water system was installed at the BCIT Marine Campus to heat water for the training pool.

Despite the implementation of these measures, overall energy consumption increased by 16 percent in 2017 over 2013 levels. Many factors we can and can't control contribute to our energy use, including:

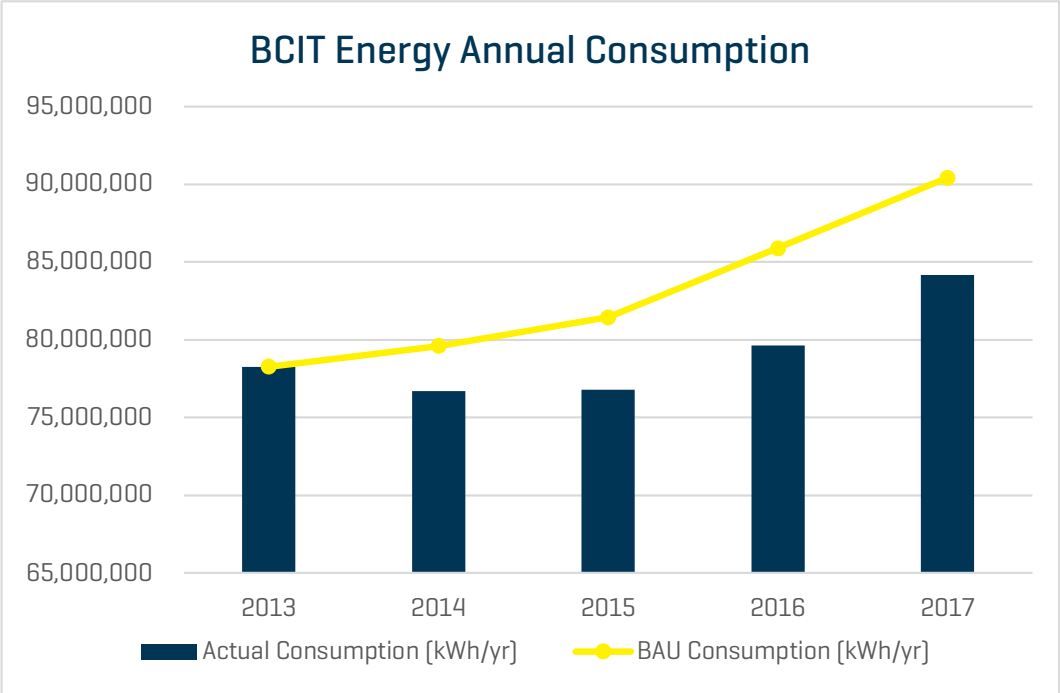
- Weather (4 percent more heating degree days in 2017 than in 2013)
- More full-time equivalent students (4 percent increase)
- The new Annacis Island Campus (4 percent increase to overall energy use)
- Aging infrastructure
- Increased tenancy at the Aerospace Technology Campus

The graph below illustrates that pursuing absolute year-to-year energy savings requires consideration of evolving operational factors.

What are Heating Degree Days (HDD)?

HDD is a way of measuring the energy needed to heat buildings. Cooler years will have more HDDs than warmer years, and total annual HDD is generally proportional to the energy used to heat our campuses.

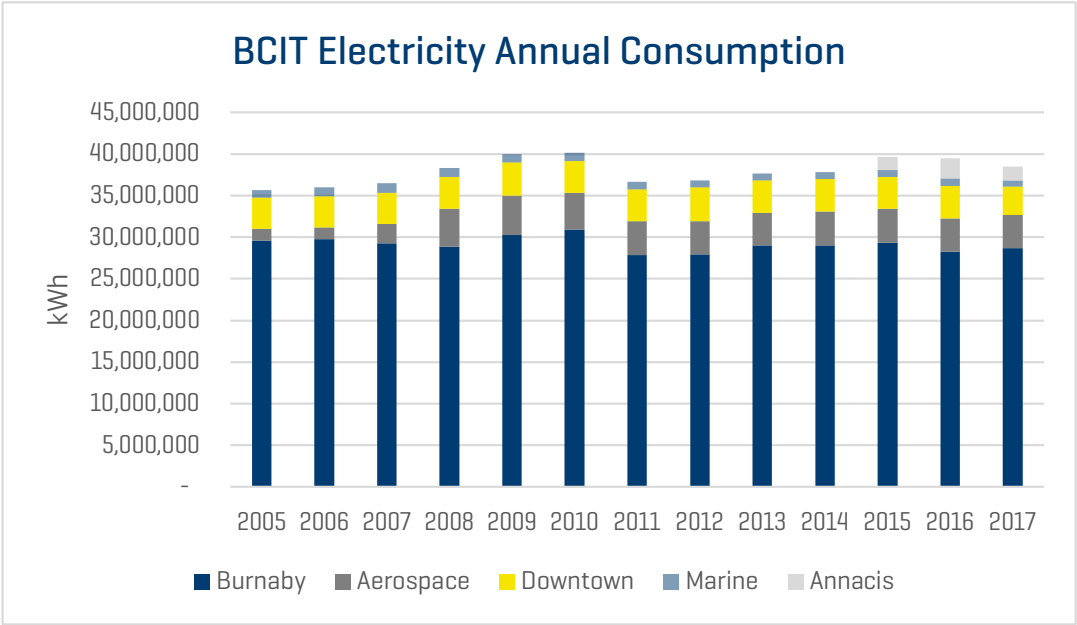
It is important to note that if the ECMs mentioned above were not implemented (business as usual (BAU)), the increase of energy consumption would have been even greater (as represented by the yellow line in the Energy Annual Consumption chart).



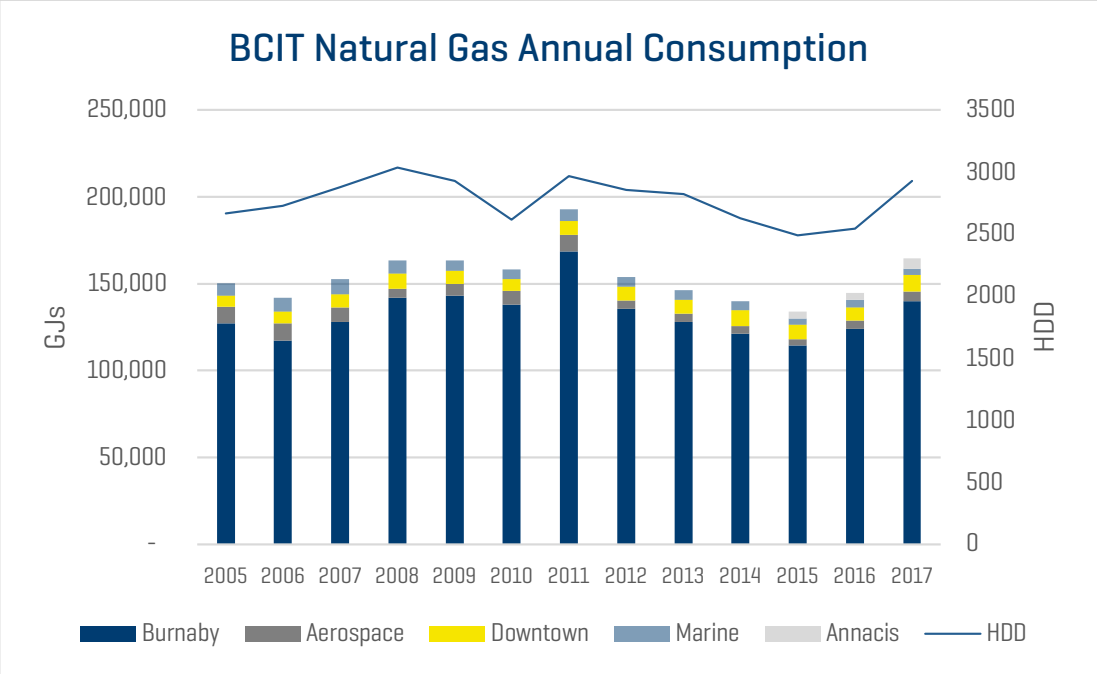
The BCIT Burnaby Campus SW1 building uses a geoexchange system to provide heating and cooling.

Historical Energy Use

Below is the historical electricity consumption chart that shows relatively constant consumption for each campus after 2011, and a small increase in 2015 due to the inclusion of the Annacis Island Campus. Electricity is used to keep our lights on, power our computers and phones, and cool our buildings in the summer.



There is a greater variability of natural gas than electricity consumption, mainly due to its relation to cold weather. As seen in the figure below, the consumption follows the annual heating degree days (HDD) trend. Natural gas is used to heat our buildings, cook food, and provide hot water. 2011 had a spike in natural gas use due to an underground heating water pipe leak from our district heating system.



WHERE ARE WE GOING?

2023 GHG Emissions Reduction Goal

In 2017, BCIT committed to a goal of reducing Institute GHG emissions by 33 percent by 2023. This goal is based on total BCIT emissions in 2007 as a baseline, or 8,700 tonnes CO_2e. A 33 percent reduction would mean an annual GHG emission inventory of approximately 5,800 tonnes CO_2e.

Additionally, BCIT has several long-term goals related to energy and GHG emissions that guide policy and master plan development:

What is CO_2e?

Carbon dioxide equivalent, or CO2e, is a way of measuring total GHG emissions. There are many different types of gases in addition to CO_2 that impact climate change (e.g., methane, nitrous oxides), each with its own global warming potential. CO_2e normalizes all these different GHG emissions into a common measurement unit.

BCIT Electrical Foundation students install solar panels connected to the campus microgrid system.

Economic, Social, and Environmental Sustainability Policy 1010

Policy 1010 serves as an umbrella policy at BCIT to guide development and implementation of new policies and programs that will advance sustainability at BCIT. Within the policy, seven sustainability goals are defined. The policy states that all members of the BCIT community have responsibilities toward advancing the Institute's sustainability aspirations to become:

1. **Greenhouse gas neutral (i.e., avoid, reduce, absorb, offset emissions)**
2. **A net energy producer (i.e., generate more energy on campus than we use)**
3. A zero waste organization (i.e., rethink, reduce, reuse, recycle, and eliminate toxics)
4. Water balanced (i.e., staying within the capacity of natural hydrological flows)
5. Ecologically restored (i.e., restoration of campus ecosystems and native species)
6. Equitable and socially responsible
7. Accessible and safe to all students, faculty, employees, alumni, contractors, and visitors.

While the first and second goals in the list are most relevant to strategic energy management at BCIT, our Energy Team's work is also guided by the complete list of goals.

Provincial Government Targets

In 2018, the Greenhouse Gas Reduction Targets Act was amended with the following target levels (relative to 2007 baseline):

1. 40 percent reduction by 2030
2. 60 percent reduction by 2040
3. 80 percent reduction by 2050

Accordingly, BCIT will continue to pursue GHG emission reductions beyond 2023 to ensure compliance with the Act as well as moving towards the aspirations of Policy 1010.

HOW WILL WE GET THERE?

Energy and GHG emissions go hand in hand, particularly at BCIT. Nearly all of the Institute's GHG emissions come from energy used for heating campus buildings, providing hot water, and cooking. As a result, our primary focus to reduce GHG emissions is in delivering these services more efficiently.

BCIT is fortunate to benefit from low-carbon electricity delivered by BC Hydro. Hence, on the electricity side, the Institute's strategy is twofold: improve the efficiency of electricity used on campus while also de-carbonizing services such as heating and hot water through targeted electrification projects.

As much of BCIT building stock and mechanical equipment is aging, opportunities to improve efficiency are plentiful. Prioritization of energy efficiency projects takes into account several factors, including:

- Finding win-win projects that save energy, while also improving stakeholder experience (e.g. occupant comfort, equipment reliability)
- Evaluating cost-effectiveness and magnitude of GHG emission reductions
- Addressing the least-efficient buildings where applicable
- Aligning with Campus Development plans

As shown in the treemap below, most of our GHG emission reductions toward our goal will come from HVAC optimization, followed closely by projects in the SE8 Central Heating Plant and the SE2 Biomass District Energy System. There is also still a significant portion (gray TBD box) that requires future identification of opportunities through studies and ideas generation. Note that our 33 percent reduction target is an absolute reduction number compared to 2007 levels. Accordingly, the Energy Team is aiming to surpass the 33 percent reduction target, not only to provide buffer for particularly cold HDD years, but also to account for emissions increases produced by new buildings and programs created on campus.

2023 Greenhouse Gas Reduction Goal—How will we get there?

Left: A campus fleet electric vehicle passes by one of the new building-level energy meters.

Right: Each meter displays real-time natural gas use at a building-by-building level.

Current project highlights:

- Energy meters: installing and setting up live electricity and gas meters across all campuses, with a public-facing dashboard
- LED upgrades: DTC, NE6, NE12, NE20, and SE30
- SE12 and DTC heating, ventilation and air conditioning (HVAC): replacing old control systems and strategies to improve efficiency and comfort
- HVAC scheduling: optimization of HVAC schedules across BCIT to align with building occupancy hours
- Geoexchange capacity study: determining excess heat capacity from Gateway (SW1) geofield to use for new Health Sciences Centre
- Feasibility study: heat recovery cooling for data centres at the BCIT Downtown Campus and SE12

Future project highlights:

- Biomass district energy system: connecting and commissioning wood-waste-fired boiler next to NE2
- Retiring and retrofitting old HVAC systems across campus
- SE1 electrification: converting SE1 to a net-zero emissions building through electrification
- SE8 central heating plant: upgrading existing boilers in the central heating plant
- Identifying opportunities for renewable energy expansion on campus
- Advising on energy-efficiency for new campus buildings
- Electric vehicle charging stations: as fleet and staff vehicles become electric, providing more charging resources on campuses

Three new models of BCIT Facilities Services electric fleet vehicles.