



British Columbia Institute of Technology Campus Master Plan: A Living Laboratory for Sustainability

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1.0 Introduction

The British Columbia Institute of Technology (BCIT) is Canada's premier polytechnic institution. The Institute operates out of five campus locations in the Greater Vancouver area and thirteen satellite locations across British Columbia. The Institute is oriented towards supporting the provincial economy through meeting the needs of industry.

BCIT has six schools that undertake both practical training and applied research:

- 1) School of Business
- 2) School of Computing and Academic Studies
- 3) School of Health Sciences
- 4) School of Manufacturing, Electronics and Industrial Processes
- 5) School of Transportation
- 6) School of Construction and the Environment

A Technology Centre also meets industry demand for multi-disciplinary research and development in the design, proto-type development, testing, commercialization and licensing of new technologies and products (www.bcit.ca/appliedresearch/tc/).

2.0 Sustainability Focus for Education

The School of Construction and the Environment (SOCE) is the largest of BCIT's schools. SOCE aims to become a leader in education and applied research concerned with the natural environment, the built environment and the relationship between them. To help guide faculty and staff in adapting curricula and research as well as delivery of education according to principles of sustainability, a Sustainability Framework and six Sustainability Themes were introduced. The Sustainability Framework is modeled on the way that natural resources flow from global ecosystems and are converted through economic activity into commodities that are used to create the built environment in order

to meet societal needs. Engineered systems facilitate the delivery of natural resources and the removal of wastes through utility services. Ultimately these wastes are returned to ecosystems (See Figure 1).

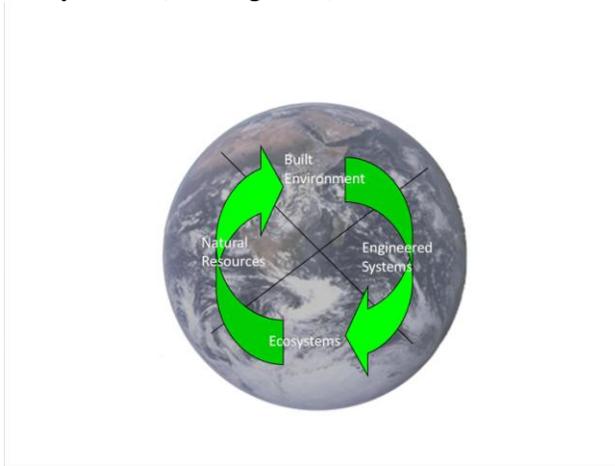


Figure 1: Sustainability Framework based on resource flow cycle

Sustainability Themes are used to inform actions that support this cycle and include:

- Strengthening and protecting assets
- Balancing use and renewal of resources
- Accounting for all costs and benefits
- Reducing wastes and eliminating toxics
- Ensuring safety and access to services
- Supporting opportunities for improvement and enjoyment

Underpinning the Sustainability Framework and Sustainability Themes are the following three foundational concepts of: ecological carrying capacity, global equity, and full-cost accounting. The approach covers ecological, social and economic considerations, and the goal is to embed sustainability content within all of the SOCE education programs and applied research activities. Implementation is proceeding through assessments and modification of curricula, development of new curricula, scoping and refocusing of applied research, and development of projects on-campus that provide students with hands-on learning. This latter initiative is done in cooperation with the Department of Administrative Services that is responsible for BCIT campus operations and planning.

3.0 Sustainability Focus for Campuses

BCIT serves a student body of approximately 48,000 learners across five campuses, one of which is shared with three other academic institutes. The campuses include:

- Burnaby Campus
- Marine Training Campus
- Aerospace Technology Campus
- Downtown Campus
- Great Northern Way Campus (shared)

3.1 Ecological Restoration

Incorporating sustainability into BCIT campuses can be traced from the work started over twenty-five years ago with the restoration of part of Guichon Creek that runs through the south-east portion of the Burnaby Campus. As a result of channelization and vegetation clearing in the 1960s, Guichon Creek had been severely damaged. Through the restoration activities undertaken in cooperation with BCIT faculty and students, Guichon is once again a fish bearing stream (see Figure 2).



Figure 2: Guichon Creek restoration: from drainage ditch to fish-bearing stream

3.2 Green Buildings

The BCIT Downtown Campus was constructed in 1996 using green building technologies and an integrated design process. This commitment to state of the art practice precedes industry and government adoption of Leadership in Energy and Environmental Design (LEED) BC guidelines. Features include: architectural, mechanical and electrical elements that work in concert with one another; flexible design to allow adaptation of use; light shelves and high/low blinds to maximize light penetration and passive solar gain; zone control variable air volume boxes linked to lighting control occupancy sensors through the Building Management System; and photocell dimmed lights, to name a few.



Figure 3: BCIT Downtown Campus: demonstrating leadership in green buildings

3.3 Renewable Energy

In 2007, BCIT opened its new Aerospace Campus that features a geothermal heat pump strategy that serves as the primary heating and chilled water system for the entire campus. The system uses the hangar's massive slab as a radiant heat source with air-to-air heat recovery that provides warmth to adjacent shops and classrooms.

4.0 Campus Master Plan: Creating a Living Laboratory

The Burnaby *Campus Master Plan* represents what could be the most exciting opportunity to incorporate sustainability in BCIT's campuses. Sustainability is an important principle that informs both the plan's objectives and strategies.

4.1 Plan Objectives

Plan objectives include: renewal of existing buildings; integration of training, academic, and applied research activities; investing in learner-support infrastructure; developing landmark buildings that foster the BCIT identity; and developing a new campus gateway.

An important aspect of the Campus Master Plan is orientation to the surrounding community and fostering community and industry relations as part of the planning process. Improving the connection between the Institute and its host communities can be achieved through a variety of measures that include: sharing BCIT's services and providing more accessible services to neighbours. For example, the BCIT Burnaby campus is surrounded by residential, commercial office and light industry activities, but lacks accessible retail and health services. These could be made available through development of a commercial precinct on campus that interfaces with the surrounding community.

Promoting alternative, or preferred, transportation choices such as cycling and transit is another way that BCIT can add benefit to its host communities while simultaneously achieving improved access for students and faculty. The Campus Master Plan calls for the creation of a pedestrian friendly campus where all buildings are clustered within a ten

minute walk (Figure 4). The long term strategy is to migrate buildings toward the pedestrian oriented centre of campus. This will allow for a compact built environment that retains a minimum 25 per cent allocation of greenspace and the long-term day-lighting and ecological restoration of the remaining portion of Guichon Creek that runs through the north-east part of the campus. The Burnaby campus already features pedestrian infrastructure such as covered walkways that provide sheltered passage to nearly all buildings on campus. It also features a colour coded way finding system that maps to a directional quadrant layout of the campus. Additional improvements to bicycle infrastructure and transit oriented development options are part of the strategy to create a commuter campus focused on the needs of people for fast, safe and effective access.

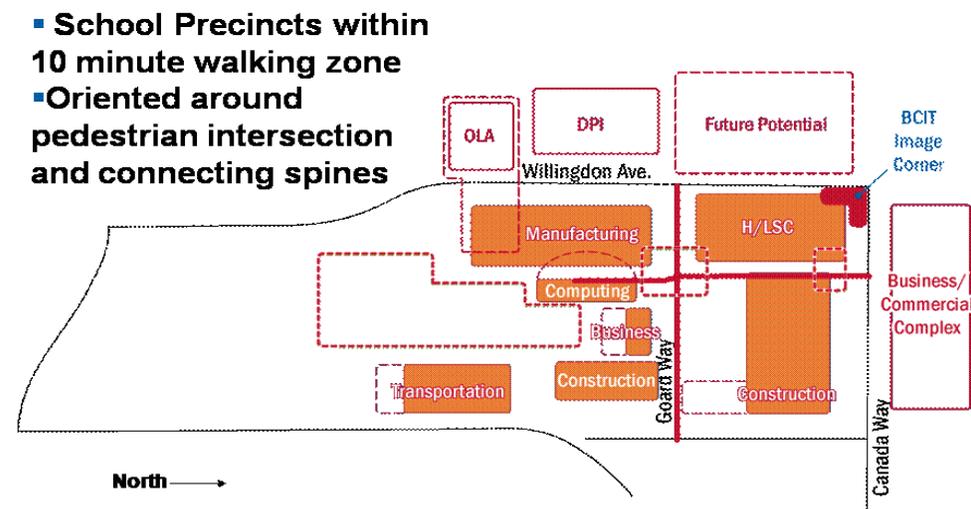


Figure 4: Migrating Buildings to the Pedestrian Oriented Centre of Campus

4.2 Plan Strategies

The Living Laboratory is a key strategic initiative of the Institute’s research arm that is consistent with the objectives of the Campus Master Plan’s commitment to adopt a “learn by doing” approach. Such an approach enables faculty and students to provide leadership in demonstrating emerging and innovative technologies. Emphasis is on supporting instructional delivery methods that entail a greater use of technology, a shift from a passive to an active learning environment, providing more space to facilitate student collaboration and enabling access to technology anywhere and anytime.

In 2007, the School of Construction and the Environment signed a memorandum of understanding with the Department of Administrative Services regarding environmental stewardship and sustainability practices. The intent is to work cooperatively toward the shared goal of transforming the Burnaby campus into a living laboratory of sustainability. Ten action areas are identified including:

- Involving faculty and students in creating examples of new technologies, methods, and approaches and demonstrating and documenting those as part of the educational and research interests of the Institute.

- Making provisions to involve faculty and students in the day-to-day operations of facilities and related construction projects.
- Providing input to master planning of the Burnaby campus and to specific development activities related to the plan's implementation.
- Promoting BCIT's activities in environmental stewardship and sustainability practices within the Institute and to external audiences.
- Assisting to advance each other's interests in delivery of respective mandates.
- Developing a "green" plan for the campuses belonging to the Institute and those managed in partnership with other institutions.
- Disseminating information throughout BCIT campuses to inform, educate, promote and encourage best practices in sustainability and environmental stewardship by staff, faculty and students.
- Assessing the ecological footprint of the Institute and developing the means and methods to minimize and/or repair that impact while achieving economies and adding value to the Institute and industry clients.

4.2 Greening Campuses Strategic Plan

A *Greening Campuses Strategic Plan*, called for by the memorandum of understanding described above, complements the Campus Master Plan and articulates further the principle of sustainability for BCIT campuses. It incorporates the Sustainability Framework and Sustainability Themes developed by the School of Construction and the Environment (see above) and articulates goals and objectives for reducing the ecological footprint of the campuses. A unique feature of this strategy that ties to the concept of the Living Laboratory of Sustainability is an overarching aspiration to model sustainability by achieving a four-fold decrease in the amount of energy and materials throughput on campus (i.e. achieve Factor Four Economy) while simultaneously maintaining the enjoyment and use of campus facilities by all students and faculty. This means not only improving the efficiency of energy and materials consumption per unit of throughput, but actually reducing the overall load of existing energy and materials use by a factor of four. The reduction of existing load, rather than efficiency gains in new load, is the original intended application of the ecological footprint. This important distinction is often overlooked by those who claim to be achieving ecological footprint reductions.

In order to achieve the overarching goal, the *Greening Campus Strategic Plan* identifies the following sub-goals to guide campus greening initiatives:

- i) Greenhouse Gas Neutral
- ii) Net Energy Producer
- iii) Zero Waste
- iv) Water Balanced
- v) Ecologically Restored
- vi) Equitable and Socially Responsible
- vii) Accessible to All Students and Faculty

The strategy builds on existing initiatives such as BCIT's Zero Waste Policy that has been in effect since 2003 and includes one of Canada's largest composting programs, operating since 1997. An extensive recycling program for paper, cardboard and plastics is complemented by a dry cell battery recycling program that is accessible to all students and faculty. BCIT's Energy Management Program has been in effect since 2001; it encompasses 55 buildings on the Burnaby campus and has achieved a 24 per cent decrease in energy use since the program's inception. Alternative energy features such as the installation of sun shades, new technologies and design features that optimize natural light penetration, use of photovoltaic and geothermal energy systems complement the program. Finally, BCIT's water conservation program has achieved a 60 per cent decrease in water use. The Burnaby campus features several permeability treatments in various locations, and in 2007 an initiative was commenced to preserve five London Plane trees by removing concrete from the concourse surrounding the trees. Permeable pavers have been installed as an interim measure in places where the trees roots were pushing the concrete up and thereby creating a tripping hazard. The long term objective is to ecologically restore the area using indigenous plant species.

4.3 Linking Education and Demonstration on Campus

Perhaps the most important feature of the Campus Master Plan is its concerted effort to integrate sustainability education within the campus development and operations. BCIT is uniquely situated to conceive, design, implement, operate and monitor sustainability projects on campus that utilize both the talent and skills of faculty and students as well as the leading edge capabilities of the industries it serves. The Living Laboratory provides the School of Construction and the Environment students, who are the next generation of construction management professionals, opportunities to demonstrate leading edge technologies on campus through provision of value-added projects. It also helps translate findings from BCIT research centres into on-the ground applications while strengthening the connection between students and staff and the campus environment. Examples include the photovoltaic Power Tower, designed and constructed by students, faculty and staff and used in electrical trades training and photovoltaics courses. A geexchange system, part of a revitalization project at BCIT's AFRESH Home was initiated in 2007 through the donated drilling efforts and installation expertise of industry contractors GeoTility and GeoXergy Systems Inc. The acronym AFRESH stands for: affordable, flexible, renewable, environmentally sustainable, home. Staff and students of the Piping Department also participated and plumbing students were involved in fusing and insulating part of the systems pipe (Figure 5).



Figure 5: Research projects link education and demonstration on campus

An important challenge is managing risks that come with pioneering the application of new technologies and working within regulatory requirements that may not recognize appropriate equivalencies for standard applications. However, this challenge further exemplifies the value of the Institute's focus on being a Living Laboratory and the important contribution this approach can bring to Industry's ability to accelerate take-up of new technologies once they have been proven through BCIT field trials. A second challenge is coordinating the timing of construction projects with the delivery of curriculum. Most project work on campus takes place during the summer months, when school is out of session. Incorporating faculty and staff in BCIT campus development projects may require increased flexibility both on the part of the academic delivery program and on the part of the campus operations and management schedule.

5.0 Conclusion:

BCIT is uniquely situated to conceive, design, implement, operate and monitor sustainability projects on campus that utilize both the talent and skills of faculty and students as well as the leading edge capabilities of the industries it serves. The Burnaby Campus Master Plan represents the latest and most exciting opportunity to incorporate sustainability on BCIT's campuses through a concerted effort to integrate sustainability education within the practice of campus development and operations. Through active participation in the Campus Master Planning Initiative by both the Administrative Services Department and the School of Construction and the Environment, BCIT is able to demonstrate leadership in its commitment to applied research through the concept of being a Living Laboratory of sustainability. This integration of operations and academics demonstrates concern for the natural environment, the built environment, and the relationship between them.