British Columbia Institute of Technology

3700 Willingdon Avenue, Burnaby, British Columbia

ENERGY MANAGEMENT ACTION PLAN

For the Natural Resources Canada's Energy Innovators Initiative
and
Canada's Climate Change Voluntary Challenge and Registry Inc.

Date August 24, 2001

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Section 1

INSTITUTE PROFILE

Section 1 – Institute Profile

Institute Name: British Columbia Institute of Technology

Address: 3700 Willingdon Avenue
Burnaby, British Columbia, V5G 3H2

Energy Innovators Registration Date: 9/6/1995 **VCR INC. Registration Date:** 9/19/1995

1.1 Key Personnel

President:	Dr. Tony Knowles		
Telephone:	604-432-8200	Fax:	604-434-6243
Key Contact:	Gil Moore	Title:	Manager, Support Services, Facilities Management, Campus Planning & Development
Telephone:	604-432-8783	Fax:	604-436-3255

1.2 Institute Survey

Date Institute Formed:	1962	Institute Fiscal Year Dates:	April to March
Total Area (m²):	193,796	% Total Area Heated:	100%
Number of Campuses:	4	Number of Buildings:	64
Names of Campuses (# of Bldgs):	Burnaby (57)	Number of Buildings < 10 years old:	3
	Downtown (DTC) (1)	Number of Buildings 10 - 25 years old:	24
	Aerospace & Technology (ATC) (5)	Number of Buildings over 25 years old:	37

	Pacific Marine Training (PMTC) (1)		
Number of Full Time Employees:	1300	Number of Full Time Students:	15,000
Number of Part Time Employees:	700	Number of Part Time Students:	33,000
		Full Time Equivalents (FTE):	11,221

1.3 Background Description

The British Columbia Institute Technology (BCIT) opened in 1962 as the first Institute of Technology in the province, providing primarily engineering technology programmes. Initially the campus, which is nestled in the heart of Burnaby, B.C., just south of Highway 401, consisted of one main academic and administrative building (part of the current SW1). Soon after, other buildings were constructed including further academic complexes, the Library and the Athletic Complex. In the late 1970's, success of the technology programmes offered, necessitated the construction of on-campus student residences, which were expanded in the early 1980's. The nature of the programmes also expanded to include Health, Computer Sciences and Business related studies. In addition, a modest Downtown Vancouver operation was opened, in leased facilities, to provide much needed Part-Time studies to the downtown core. In the mid-1980's a government initiative amalgamated the adjacent Pacific Vocational Institute into the BCIT framework. Adding considerable size and programming diversity to the overall BCIT mandate, including a campus for Aerospace & Technology Training at the Vancouver International Airport. With this addition, BCIT became the premier post secondary school in the B.C. for a wide range of Technology and Trades Training opportunities.

During the 1990's, another government initiative further broadened the range of programmes provided by BCIT. By incorporating the Pacific Marine Training operation, which added a campus located on the North Vancouver waterfront. In addition, with the completion of a Campus Master Plan, along with further programme expansion and specialization, some significant building construction, renovation and retrofitting was completed at the main Burnaby Campus. During this expansion period the Campus Centre was opened in 1995, which provided a focal point for the campus community at the heart of the Campus. All phases of this expansion utilized the opportunities provided by Power Smart to improve the energy efficiency of the facilities included.

In another bold venture, which was primarily self funded, the construction of a new Downtown Vancouver Campus for business & high-tech training, was successfully completed in 1996, consisting of an eight level high rise and a four level underground parking facility. Using high technical standards for occupant comfort and energy efficiency, the new Downtown Campus received the Power Smart Award for Energy Efficiency, as well as the BOMA Toby award for buildings in a similar category.

BCIT now operates on the four campus sites, and continues to expand via various property acquisitions immediately adjacent to the Burnaby Campus. The most recent being the addition of the Royal Oak College property, which will house the BCIT International operations, Interior Design programmes, and other part-time studies activities.

The primary technology training operations at the Burnaby Campus span the months of September through May, with increasing expansion of related programmes into the summer months. Burnaby Campus Trades training related operations span all months of the year, with very minimal breaks during the summer months. The Aerospace & Technology Campus operates year round with the exception of three summer weeks, and the Pacific Marine Training & Downtown Campuses now utilized all twelve months of the year for training. Over the years, the Part-time studies operations have continued to expand (between 5 and 10% annually), increasing the operating hours of facilities, which range from 7 am to 10:30 pm on all campuses, with ever increasing demand for

programmes offered on Saturdays and Sundays. It is expected that this trend towards increased facility usage will continue to match the demand for unique methods of training delivery, as well as the need for BCIT to forge specialized and flexible relationships and partnerships with business and industry.

The utilities for the Institution are the responsibility of, and are coordinated by the Facilities Management, Campus Planning & Development Department. The utilities provided are:

?? Electrical: Electricity is purchased from BC Hydro and metered as follows; two primary meters at the Burnaby Campus, one each for the north & south sectors, one meter for the Student Residence, and one meter for the newly acquired property (formerly Royal Oak College). One primary meter for the Downtown Vancouver Campus, one for the Pacific Marine Training Campus in North Vancouver, and two for the Aerospace & Technology Campus at the Vancouver International Airport. Rates have remained constant at approx. $0.05/kwh, since 1993.

?? Natural Gas: BCIT purchases most of its natural gas commodity direct via Premstar Pacific, and BC Gas provides transportation of all gas to BCIT. Interruptible supply is used for the main heating plant boilers, which serve the south sector of the Burnaby Campus. Firm supply is required for the remainder of the satellite boiler systems in the north sector of the Burnaby Campus, the Aerospace & Technology Campus and the Pacific Marine Training Campus.

?? Fuel Oil Heating Oil is utilized as an alternate fuel in the main heating plant hot water heating boilers, for use when transportation curtailment is implemented by BC Gas for interruptible natural gas.

?? Diesel: Diesel is supplied as a back up energy source for emergency generators.

?? Steam: Steam is purchased from Central Steam in Vancouver for heating at the Downtown Campus.

?? Propane: Very small quantities of Propane are used to fuel a small furnace and a hot water tank for the Daycare building at Burnaby, and small furnaces for three portable buildings at the Aerospace & Technology Campus.

?? Domestic Water: Water and sewer is billed by the City of Burnaby at a total rate (2000/2001) of $0.331 and $0.501 per cubic meter ($m^3$) respectively.

A monitoring and tracking system is in place in spreadsheet form with reports utilized for annual utility budget planning.

BCIT Building Listing:

BUILDING	DESCRIPTION	AREA (SQ.M.)	AGE
Burnaby Campus			
NE 1	JW INGLIS – Classroom/Lab/Trades Shop/AdminOffices/Cafeteria	18,792.50	***1973***
NE 2	BENCHWORK SHOP	1,972.90	***1959***
NE 3	TECHNOLOGY CENTRE	484.30	***1971***
NE 4	CARPENTRY SHOP	1,853.10	***1959***
NE 6	PLUMBING SHOP/CLASSROOM	2,443.30	***1960***
NE7	FACILITIES MANAGEMENT SHOPS	412.52	***1964***
NE 8	WELDING SHOP	1,961.30	***1982***
NE 9	FACILITIES MANAGEMENT ADMIN./TENANT	2,436.95	***1964***
NE10	AUTO COLLISION SHOP/CLASSROOMS	1,670.20	***1964***
NE12	SHEET METAL SHOP/CLASSROOMS	2,680.20	***1971***
NE16	HEAVY DUTY SHOP	2,227.70	***1957***
NE18	AUTOMOTIVE SHOP	1,897.20	***1957***
NE20	SMALL ENGINES SHOP	3,261.20	***1957***
NE21	LEARNING RESOURCES	565.70	***1959***
NE22	SMALL ENGINES RESOURCE	580.70	***1959***
NE23	CARPENTRY CLASSROOM	615.10	***1959***
NE24	AUTOMOTIVE CLASSROOM	615.30	***1959***
NE25	APPLIED TRAINING & TECNOLOGY CENTRE	2,606.90	***1982***
NE26	AUTOMOTIVE RESOURCE CENTRE	591.40	***1959***
NE27	INDUSTRIAL INSTRUMENTATION – Demo. Plant	706.40	***1960***
NE28	HEAVY DUTY CLASSROOM	615.30	***1959***
NW 1	MARKETING/BCIT INTERNATIONAL	1,426.30	***1962***
NW 3	PAINTING	2,702.30	***1961***
NW5	R2000 DEMONSTRATION BUILDING	461.02	***1987***
NW 6	MACHINE SHOP	2,958.00	***1964***
SE 1	ELECTRICAL TRAINING CENTRE	6,612.80	***1979***
5A	FORESTRY FIELD HOUSE	60.40	***1968***
SE 2	FOOD PAVILLION – Main Cafeteria/Conference Rooms/Cafe	2,701.10	***1961***
SE 2	STUDENT ASSOCIATION CAMPUS CENTRE	4,646.00	***1995***
SE 4	CLASSROOM	705.90	***1968***
SE 6	IBM TECHNOLOGY - Classroom/Computer Labs/Faculty Offices	4,681.20	***1991***
SE 8	CENTRAL HEATING PLANT/AUTOMOTIVE SHOP	2,882.80	***1964***
SE 8.1	PORTABLE 1N – OFFICES	35.10	***1981***
SE 8.2	PORTABLE 1M - OFFICES	81.40	***1981***
SE 8.3	PORTABLE 1L - OFFICES	88.70	***1981***
SE10	BROADCAST – RADIO/TV TRAINING	1,766.70	***1982***
SE12	1976 BUILDING CLASSROOM OFFICE	8,889.70	***1976***
SE9	TELEPHONE EXCHANGE/Central Meeting	148.10	***1968***
SE14	LIBRARY	6,004.40	***1969***

BUILDING	DESCRIPTION	AREA (SQ.M.)	AGE

SE16	STUDENT ACTIVITY CENTRE - Gymnasium	5,009.90	***1970***
SE30	WAREHOUSE	669.60	***1980***
SW 1	1962 BUILDING MAIN CLASSROOM BLOCK	15,483.10	***1962***
SW 2	CONNECTOR - Faculty Offices	2,142.00	***1994***
SW 3	1967 BUILDING CLASSROOM BLOCK	16,803.20	***1967***
SW 5	THEATRE BUILDING	896.60	***1967***
SW 7	DAYCARE	626.60	***1989***
SW 9	MECHANICAL/INDUSTRIAL ED.	6,530.30	***1969***
SW10	MAQUINNA RESIDENCE - NOOTKA	1,041.90	***1978***
SW11	MAQUINNA RESIDENCE - SALISH	1,143.90	***1978***
SW12	MAQUINNA RESIDENCE - CHILCOTIN	989.40	***1978***
SW13	MAQUINNA RESIDENCE - CARRIER	991.10	***1978***
SW14	MAQUINNA RESIDENCE - KOOTENAY	991.10	***1978***
SW15	MAQUINNA RESIDENCE - NISHKA	1,071.10	***1983***
SW16	MAQUINNA RESIDENCE - HAIDA	951.00	***1983***
	TOTAL AREA BURNABY	***151,182.89***	
	TOTAL BUILDINGS BURNABY	***54***	
SE40	ex-Royal Oak - aquired 2001		***1989***
SE41	ex-Royal Oak - aquired 2001		***1989***
SE42	ex-Royal Oak - aquired 2001		***1989***
		57	

Aerospace & Technology Campus

SI02	HANGAR	6,505.67	***1955***
SI03	ADMIN/CLASSROOM	3,062.44	***1955***
A	Portable Classroom	150.00	***1980***
B	Portable Classroom	150.00	***1980***
E	Portable Classroom/shop	150.00	***1980***
	TOTAL AREA SEA ISLAND	***10,018.11***	
	TOTAL BUILDINGS SEA ISLAND	***5***	

Pacific Marine Training Campus

PM01001	Marine Training	6,465.80	***1978***
	TOTAL AREA PMTC	***6,465.80***	
	TOTAL BUILDINGS PMTC	***1***	

BUILDING DESCRIPTION		**AREA (SQ.M.)**	**AGE**

Downtown Campus

1	ADMIN/CLASSROOM/TENANT/PARKING	***26,129.60***	***1996***

TOTAL AREA DTC	*26,129.60*
TOTAL BUILDINGS DTC	*1*
TOTAL BCIT BUILDING AREA	*193,796.40*

Section 2

ENERGY MANAGEMENT POLICY

Section 2 - Energy Management Policy

2.1 Commitment by Institute

In an attempt to reduce operating costs, while assisting Canadian governments in meeting Canada's international commitment to stabilize greenhouse gas emissions, the ***BCIT President, Dr. Tony Knowles, and the BCIT Board of Governors***, is pleased to acknowledge that our Institute is committed to continuing the undertaking of economic measures to increase our organization's energy efficiency as a means of limiting the production of greenhouse gas emissions. BCIT has been registered with the Voluntary Challenge and Registry (VCR) and the Energy Innovators since 1995.

2.2 Energy Management Goals and Targets

BCIT has actively pursued and implemented measures to curtail the increase in energy consumption and related greenhouse gas emissions since 1990, during a period in which there has been a significant increase in student population, operating hours, and campus expansion. BCIT now plans to focus it's efforts on implementing all remaining economically viable energy efficiency opportunities, with the following targets established:

- It is projected that by 2005/2006 cost savings or cost avoidances of 20% can be achieved for the combined campus operations, by implementing cost-effective measures in all areas.
- It is projected that by 2005/2006 a reduction in energy consumption of 20% over the 2000/01 levels can be achieved.
- BCIT is a participant in the Voluntary Challenge & Registry and the Energy Innovators Initiative, hence it is projected that the measures implemented will reduce greenhouse gas emissions by 20% over a five year period from 2000/01 to 2005/2006.

Appropriate adjustments to the above targets will be made in consideration of changes to the various campus areas.

2.3 Energy Management Objectives

BCIT 's commitment to effective energy and environmental management is guided by the following objectives:

- To improve the efficiency of energy use through low-cost opportunities by implementing:

- sound operating and maintenance practices;
- employee training, along with occupant, staff and student awareness;
- utilizing existing, and improving upon "green" purchasing policies; and
- utilizing an effective monitoring and tracking system.

- To promote awareness of climate change and greenhouse gas emissions reductions, within the BCIT staff & student population.

- To reduce energy operating costs through the initiation of an energy retrofit program, which in turn, will help reduce greenhouse gas emissions.

- To improve the efficiency of energy use through specific capital upgrades or in conjunction with capital renovation or construction projects.

- To consider the option of energy performance contracting as a potential method of implementing energy efficiency strategies, where capital or other funding may not be available.

2.4 Key Personnel Involved (Planning Team)

To achieve the goals and objectives, BCIT has formed the following planning team:

Name	Title	Roles/Responsibility
John Wong	Director, Facilities Management, Campus Planning & Development	Energy Champion
Gil Moore	Manager, Support Services, Facilities Management, Campus Planning & Development	Project Manager
Graham Beckett	Mechanic Foreman, Facilities Management, Campus Planning & Development	Mechanical system data collection, verification & operations.
Michael Taylor	Electrical Foreman, Facilities Management, Campus Planning & Development	Electrical system data collection, verification & operations.
Janice Baldry	Educational Operations Manager Representative	Educational Planning/Operations data, project information and awareness source for staff.
TBA	Technology Programme Representative (Faculty)	Teaching staff issues/input.
TBA	Trades Programme	Teaching staff issues/input.

	Representative (Faculty)	
Steve Erdman	Student Association Representative	Student feedback, project promotion and awareness.
Ian McLeod	Computer Resources Representative	IT Network & Computer Work Station and lab. data and planning.

2.5 Additional Policy Information

1. **BCIT Environmental Philosophy**

The British Columbia Institute of Technology believes that a healthy environment is essential and we will strive to be exemplary in our environmental performance. We will integrate economic and environmental decision- making in all aspects of our operations.

2. **BCIT Policy**

It is the policy of BCIT to plan and manage our operations to promote environmental protection in ways which meet the needs of the present without compromising the ability of future generations to meet their own needs. Our commitment is to:

- ?? responsibly manage all aspects of our operation to ensure that recognized environmental standards and legal requirements are met and exceeded.
- ?? manage our operations to promote environmental protection in all feasible ways.
- ?? work with industry, government and public groups to help determine environmental priorities.
- ?? communicate with relevant stakeholder groups, in a timely and candid fashion, on the environmental aspects of our policies and operations.
- ?? encourage all employees, to be conscious of environmental considerations and be protective of the environment.
- ?? establish an Environment Committee which develops, implements and monitors the Institute's environmental policy and initiatives.

3. **BCIT Guidelines**

Following are examples of how the policy will be applied at BCIT:

- ?? minimize the use or application of chemicals that are toxic or otherwise harmful to people or the environment.
- ?? minimize and strive to eliminate the release of any pollutants that may cause environmental damage to the air, water, or earth or its inhabitants.
- ?? minimize waste by practicing the three "R"s, reduce, reuse, and recycle.
- ?? assess the environmental impacts of any new project or activity that BCIT undertakes.
- ?? participate in Powersmart and other recognized public environmental programs.
- ?? purchase recycled products such as paper, envelopes, file folders, plastic binders etc., whenever possible.
- ?? purchase on a preferential basis, those goods certified by the Environmental Choice Board.
- ?? evaluate all purchases based on life cycle costs including final disposal.
- ?? promote the adoption of these principles to BCIT's contractors and suppliers.
- ?? incorporate environmental concerns in educational promotion development.

Section 3

ENERGY USE AND COSTS

Section 3 - Energy Use and Costs

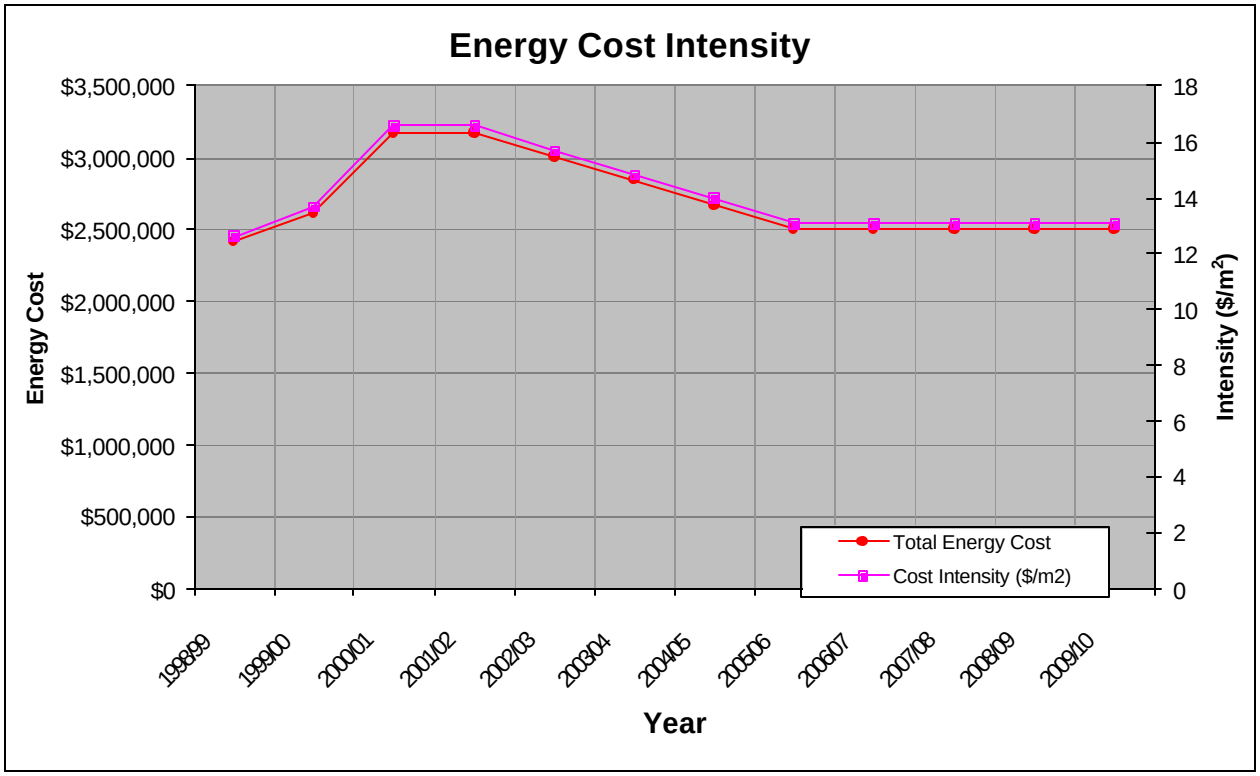
3.1 Energy Consumption and Costs

		Type of Energy Use			
	Total	Electricity	Gas	Oil	Steam
Baseline					
Year	**1998/99**				
Area (m^2)	191,254				
FLE/FTE	10.392				
Cost ($)	$ 2,414,682	$ 1,714,892	$ 652,842	$ -	$ 46,948
Consumption (GJ)	278,010	125,940	148,113	-	3,957
Consumption (ekWh)	77,224,904	34,983,320	41,142,500	-	1,099,084
Cost ($/$m^2$)	$ 12.63	$ 8.97	$ 3.41	$ -	$ 0.25
Consumption (GJ/m^2)	1.45	0.66	0.77	-	0.02
Consumption (ekWh/m^2)	404	183	215	-	6
Cost ($/FTE)	$ 232	$ 165	$ 63	$ -	$ 5
Consumption (GJ/FTE)	26.75	12.12	14.25	-	0.38
Consumption (ekWh/FTE)	7,431	3,366	3,959	-	106
Current					
Year	**2000/01**				
Area (m^2)	191,404				
FLE/FTE	11.221				
Cost ($)	$ 3,169,453	$ 1,765,216	$ 1,332,837	$ -	$ 71,400
Consumption (GJ)	291,462	131,981	152,804	2,962	3,715
Consumption (ekWh)	80,961,643	36,661,320	42,445,556	822,831	1,031,937
Cost ($/$m^2$)	$ 16.57	$ 9.23	$ 6.97	$ -	$ 0.37
Consumption (GJ/m^2)	1.52	0.69	0.80	0.02	0.02
Consumption (ekWh/m^2)	423	192	222	4	5
Cost ($/FTE)	$ 304.99	$ 169.86	$ 128.26	$ -	$ 6.87
Consumption (GJ/FTE)	28.05	12.70	14.70	0.29	0.36
Consumption (ekWh/FTE)	7,791	3,528	4,084	79	99
Forecasted					
Year	**2005/06**				
Area (m^2)	191,404				
FLE/FTE	11.221				
Cost ($)	$ 2,505,048	$ 1,388,792	$ 1,046,285	$ -	$ 69,972
Consumption (GJ)	228,987	103,503	121,844	-	3,641
Consumption (ekWh)	63,607,589	28,750,780	33,845,511	-	1,011,298
Cost ($/$m^2$)	$ 13.10	$ 7.26	$ 5.47	$ -	$ 0.37
Consumption (GJ/m^2)	1.20	0.54	0.64	-	0.02
Consumption (ekWh/m^2)	333	150	177	-	5
Cost ($/FTE)	$ 241.06	$ 133.64	$ 100.68	$ -	$ 6.73
Consumption (GJ/FTE)	22.03	9.96	11.72	-	0.35
Consumption (ekWh/FTE)	6,121	2,767	3,257	-	97

Energy Consumption and Cost Intensity

This table provides more detailed information for past and future years.

Year	Area (m^2)	FTE	Electricity Consumption (KWh)	Electricity Consumption (GJ)	Gas Consumption (GJ)	Oil Consumption (GJ)	Steam Consumption (GJ)	Total Consumption (GJ)	Total Energy Cost ($)	Energy Intensity (GJ/m^2)	Cost Intensity ($/m^2$)	Energy Intensity (GJ/FTE)	Cost Intensity ($/FTE)
1998/99	191,254	10,392	34,983,320	125,940	148,113	0	3,957	278,010	2,414,682	1.45	12.63	26.8	232.36
1999/00	191,404	10,981	36,291,736	130,650	167,796	0	4,404	302,851	2,615,616	1.58	13.67	27.6	238.19
2000/01	191,404	11,221	36,661,320	131,981	152,804	2,962	3,715	291,462	3,169,453	1.52	16.56	26.0	282.46
2001/02	191,404	11,221	36,661,320	131,981	155,304	0	3,715	291,000	3,169,453	1.52	16.56	25.9	282.46
2002/03	191,404	11,221	34,683,685	124,861	146,939	0	3,696	275,497	3,003,352	1.44	15.69	24.6	267.65
2003/04	191,404	11,221	32,706,050	117,742	138,574	0	3,678	259,994	2,837,251	1.36	14.82	23.2	252.85
2004/05	191,404	11,221	30,728,415	110,622	130,209	0	3,659	244,490	2,671,150	1.28	13.96	21.8	238.05
2005/06	191,404	11,221	28,750,780	103,503	121,844	0	3,641	228,987	2,505,048	1.20	13.09	20.4	223.25
2006/07	191,404	11,221	28,750,780	103,503	121,844	0	3,641	228,987	2,505,048	1.20	13.09	20.4	223.25
2007/08	191,404	11,221	28,750,780	103,503	121,844	0	3,641	228,987	2,505,048	1.20	13.09	20.4	223.25
2008/09	191,404	11,221	28,750,780	103,503	121,844	0	3,641	228,987	2,505,048	1.20	13.09	20.4	223.25
2009/10	191,404	11,221	28,750,780	103,503	121,844	0	3,641	228,987	2,505,048	1.20	13.09	20.4	223.25


Energy Cost Intensity
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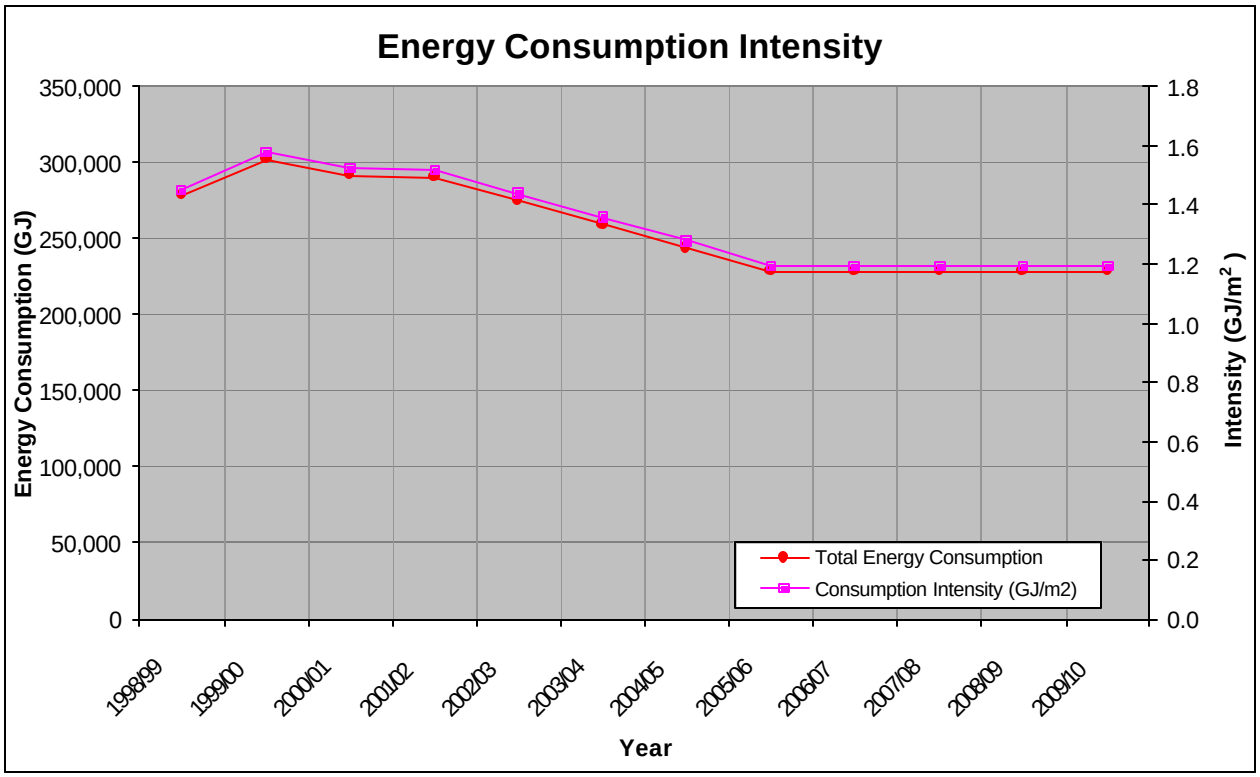
$3,000,000
$2,500,000
$2,000,000
$1,500,000
$1,000,000
$500,000
$0
Energy Cost
18
16
14
12
10
8
6
4
2
0
Intensity ($/m2)
Total Energy Cost
Cost Intensity ($/m2)
1998/99
1999/00
2000/01
2001/02
2002/03
2003/04
2004/05
2005/06
2006/07
2007/08
2008/09
2009/10
Year


Energy Consumption Intensity
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Energy Consumption (GJ)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Intensity (GJ/m2)
Total Energy Consumption
Consumption Intensity (GJ/m2)
1998/99
1999/00
2000/01
2001/02
2002/03
2003/04
2004/05
2005/06
2006/07
2007/08
2008/09
2009/10
Year

3.1.1 Determination of Baseline Consumption and Cost Data

The following is a description of how the baseline was selecting, including why the baseline year was selected any other assumptions that were made. Sample calculations are also provided in the Annex.

1998/99 was chosen as the base year due to it being the most current year for comparison purposes that is relevant to the current operating conditions, including the downtown campus.

1998/99 was the last available year with complete energy records available

3.1.2 Determination of Forecasted Consumption and Cost

The following are assumptions made in determining forecasted consumption intensity, CO_2 productions and savings. Sample calculations are provided in the Appendix.

- Year 2005/2006 was selected as the Target Year. The management goal is to reduce electricity and gas use by the following percentages in its campuses.

  1-DTC: 2% for electricity and gas

  2-ATC: 20% for electricity and gas

  3-PMTC: 16% for electricity and gas

  4-Burnaby Campus: 24% for electricity and 22% for gas

A five-year reduction period was selected to correspond with BCIT's long range planning cycle.

3.2 Special Events and Other Variables

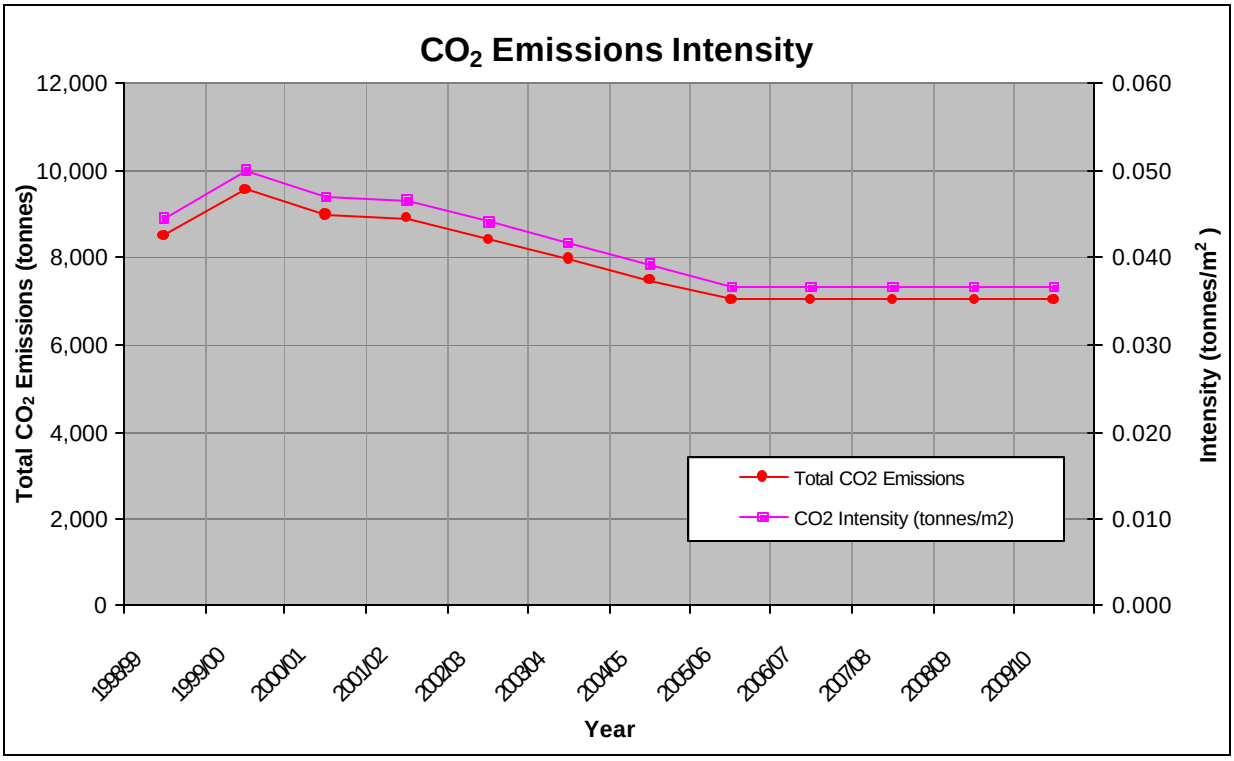
The following are variables, which have influenced energy consumption and costs over the past few years:

- Increase in building areas, via new construction or property acquisitions.
- Increase in operating hours due to FTE increases, particularly Part-time studies.
- Changes in building uses involving more energy driven teaching equipment, including computers and trades machinery.
- Significant increases in the cost for the supply of Natural Gas.

3.3 Greenhouse Gas Information

Production of Greenhouse Gas Emissions

	Energy Consumption		*Type of Gas Emission*			
	Energy Use	**Equivalent Energy Use (GJ)**	**CO_2 (tonnes)**	**N_2O Equivalent CO_2 (tonnes)**	**CH4 Equivalent CO_2 (tonnes)**	**Total Equivalent CO_2 (tonnes)**
Baseline (Year: 1998/1999)						
Electricity	34,983,320 (kWh)	125,940	932.0	4.03	0.07	936.1
Natural Gas	148,113 (GJ)	148,113	7,358.3	23.88	3.42	7385.6
Oil	-	-	-	-	-	-
Steam	3,750,430 (lb)	3,957	196.6	0.64	0.09	197.3
Total		278,010				8,519
Current (Year: 2000/2001)						
Electricity	36,661,320 (kWh)	131,981	976.7	4.22	0.08	981.0
Natural Gas	152,804 (GJ)	152,804	7,591.3	24.63	3.53	7,619.5
Oil	76,582 (liters)	2,962	216.73	0.31	0.04	217.1
Steam	3,521,300 (lb)	3,715	184.6	0.60	0.09	185.2
Total		291,462				9,003
Forecasted (Year: 2005/2006)						
Electricity	28,750,780 (kWh)	103,503	765.9	3.31	0.06	769.3
Natural Gas	121,844 (GJ)	121,844	6,053.2	19.64	2.81	6,075.7
Oil	-	-	-	-	-	-
Steam	3,450,874 (lb)	3,641	180.9	0.59	0.08	181.5
Total		228,987				7,026


CO2 Emissions Intensity
Total CO2 Emissions (tonnes)
Intensity (tonnes/m2)
12,000
10,000
8,000
6,000
4,000
2,000
0
0.060
0.050
0.040
0.030
0.020
0.010
0.000
Total CO2 Emissions
CO2 Intensity (tonnes/m2)
1998/99
1999/00
2000/01
2001/02
2002/03
2003/04
2004/05
2005/06
2006/07
2007/08
2008/09
2009/10
Year

Section 4

ENERGY MANAGEMENT PROJECTS AND ACTIONS

Section 4 - Energy Management Projects and Actions

4.1 Past and Currently Undergoing Projects and Actions

Project/ Action	Power smart program	Details of Project	Date Completed	Project Team (ESCO, in-house)	Capital Invested	Cost Savings	Energy Consumption Savings (kWh)**	CO_2 Savings (tonnes)	Cost Avoidance, benefits, offsets
Energy Lighting Phase I	BIP	NE1, NW1	1991/92		$143,000	$30,000	600,000	16.1	
Food Pavilion Phase I	NBD	SE2 - RIX & Conf A/B	1991/92		N/A	$4,350	87,000	2.3	
Food Pavilion Phase II	NBD	SE2 - Cafe & Conf C/D	1993/94		N/A	$3,850	77,000	2.1	
IBM Technology Building	NBD	SE6	1993/94		N/A	$10,800	216,000	5.8	
SW1 Seismic Upgrading	BIP	SW1 - Main Block	1993/94		$110,300	$22,150	443,000	11.9	
Connector Building	NBD	SW2	1994/95		N/A	$4,100	82,000	2.2	
Exit Lamp Retrofit	BIP	SW1	1994/95		$31,750	$2,470	49,406	1.3	
Maquinna Lighting Upgrade	BIP	SW10-SW16	1994/95		$13,500	$4,293	85,860	2.3	
Trade Shop Lighting I	BIP	NE2	1995/96		$34,450	$4,935	98,700	2.6	
Trade Shop Lighting II	BIP	NE4	1995/96		$16,700	$4,490	89,800	2.4	
Trade Shop Lighting III	BIP	NE16	1995/96		$27,140	$6,120	122,400	3.3	
SA Campus Center	NBD	SE2 - SA Campus Center	1995/96		$100,000	$6,115	122,300	3.3	
New Downtown Campus	NBD	555 Seymour, Vancouver	1996/97		N/A	$11,445	228,900	6.1	
Total						**$115,118**	**2,302,366 (kWh)**	**61.6**	

BIP - Building Improvement Program
NBD - New Building Design

N/A - Costs for measures imbedded in overall construction project.
** Estimated annual kWh savings, via BC Hydro Power Smart

4.2 Proposed Actions and Projects

Proposed Action/ Project	Expected Start and End Dates	Project Team (ESCO, in-house)	Potential Capital Cost	Potential Annual Cost Savings	Potential Consumption Savings	Simple Payback (years)	Potential CO_2 Savings (tonnes)
Burnaby Campus							
Lighting Retrofit	2001-05	In-house	$1,157,000	$144,000	3,044,000 (kWh) 700 (kW)	8.0	81
PC Controls	2001-05	TBA	$98,000	$13,000	412,000 (kWh)	7.5	11
Vending Machines	2001-05	TBA	$16,000	$2,000	72,000(kWh)	8.0	2
Education and Awareness	2001-05	TBA	$35,000	$86,000	1,470,000(kWh) 4,100(GJ)	0.4	244
HVAC Modification, Controls and Scheduling	2001-05	TBA	$788,000	$173,000	1,596,000(kWh) 12,400(GJ)	4.6	661
Central Plant Boiler Upgrade	2001-05	TBA	$188,000	$47,000	4,700(GJ)	3.9	229
Decentralized Boiler Plant Upgrade	2001-05	TBA	$171,000	$26,000	2,600(GJ)	6.6	135
Improved Control of Infrared Heaters	2001-05	TBA	$133,000	$23,000	2,300(GJ)	5.8	115
Compressed Air Improvements	2001-05	TBA	$60,000	$10,000	310,000(kWh)	6.0	8
Refrigeration/Cooling/HP/Pumps Improvements	2001-05	TBA	$114,000	$19,000	620,000(kWh)	6.0	17
Implement Central Plant Summer Shutdown	2001-05	TBA	$300,000	$40,000	4,000(GJ)	7.5	199
Implementation Costs (Engineering & Admin.)			$500,000				
Burnaby Campus Total			**$3,560,000**	**$583,000**	**700 (kW) 7,524,000 (kWh) 30,100 (GJ)**	**6.1**	**1,702**
PMTC							
Install DDC controls on the boiler, chiller and main air handling unit (#6)	2001-05	TBA	$50,000	$10,000	86,988(kWh) 850(GJ)	5.0	
Improve control and operation of the Multi-purpose and Seamanship rooms	2001-05	TBA	$15,000	$1,500	13,084(kWh) 127(GJ)	10.0	
Water Safety Tank – Install Air Handling Unit controls, install a pool cover	2001-05	TBA	$35,000	$4,000	34,808(kWh) 340(GJ)	8.8	

Proposed Action/ Project	Expected Start and End Dates	Project Team (ESCO, in-house)	Potential Capital Cost	Potential Annual Cost Savings	Potential Consumption Savings	Simple Payback (years)	Potential CO_2 Savings (tonnes)
PMTC Total			**$100,000**	**$15,500**	**134,880 (kWh) 1,318 (GJ)**	**6.5**	**69**
ATC							
Lighting Upgrade Hanger SIO2	2001-05	TBA					
Hot Water Heating Line Insulation	2001-05	TBA					
Improved HVAC Controls	2001-05	TBA					
Occupancy Control of Lighting	2001-05	TBA					
Upgrade Cooling system in Admin Bldg. SIO3 (efficiency improvement and control)	2001-05	TBA					
ATC Total			**$260,000**	**$35,750**	**262,264 (kWh) 2,124 (GJ)**	**7.3**	**113**
DTC							
Education and Awareness	2001-05	TBA	**$2,000**	**$5,140**	**69,850(kWh) 74 (GJ)**	**0.4**	**6**
Total Institute			**$3,922,000**	**$640,000**	**7,991,000 (kWh) 700 (kW) 33,616 (GJ)**	**6.1**	**1,890**

4.3 Training, Communication and Awareness Programs

The following is a description of **staff training** on energy management, climate change, or environmental protection:

At BCIT, we are continually upgrading the technical knowledge of our staff on energy management issues.
Our staff will be encouraged to attend other workshops through NRCan and other organizations.
BCIT also will implement a process where staff will receive ongoing feedback on progress with energy management and savings.

The following is a description of the **Institute's response** to climate change or greenhouse emissions issues:

BCIT has committed to improve energy performance and greenhouse gas reduction by registering with NRCan as an Energy Innovator.

The following is a description of the planned staff and student **communication and awareness** program:

Creating an Energy Management team.
Use of lighting occupancy sensors.
Stickers on light switches reminding to turn OFF.
Stickers on light switches informing that the lighting is controlled by occupancy sensor.
Web site section and Institute newsletter section with energy savings tips.
BCIT is planning to increase the staff and student exposure to the regional environmental initiatives through various means such as internal newsletters, its web page and various meetings.

BRITISH COLUMBIA
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Section 5

REPORTING and Evaluation

Section 5 – Reporting and Evaluation

As part of BCIT's commitment to energy management and to its membership to the Energy Innovators Initiative, the Institute will submit a progress report annually to the Office of Energy Efficiency (OEE), Natural Resources Canada (NRCan) and to the Canada's Climate Change Voluntary Challenge and Registry (VCR Inc.). The report will include at minimum:

- Updated Institute Profile
- Updated Energy Management Policy
- Updated Energy Use and Costs
- Energy Management Projects Completed, Undergoing, and Proposed

In addition, BCIT will assist the Association of Canadian Community Colleges (ACCC) and Office of Energy Efficiency (OEE) meet their objectives by committing to the contents of the Institute's energy management action plan and by providing the above information.

5.1 Reporting, Verifying and Updating the Action Plan and Targets

As part of the reporting, BCIT will review and verify the targets, including total CO_2 produced. If discrepancies arise, modifications to the data will be made and initiatives will be recommended to resolve the issues.

The review team will include the personnel listed in Section 2.4.

BRITISH COLUMBIA
INSTITUTE OF TECHNOLOGY

Section 6

Appendix

Methodology for Calculations and Sample Calculations

Calculations

The followings are some sample calculations used to determine the baseline and forecasted costs, consumption, and CO2 emissions:

Consumption Conversion Calculations:

Total consumption for electricity was in kWh. It was converted to equivalent GJ by multiplying it by 0.0036 .

Cost & Consumption Calculations for forecasted years:

The following formulae was used to calculate cost and consumption for forecasted years:

(Current year cost or consumption) x [1-difference between forecasted and current year x (total potential saving factor/ years to implement cost and consumption reduction)]=(forecasted year cost or consumption)

Example:
An organization's electric bill for year 1999 is $100,000. The organization has a plan to implement cost saving management equally over the next 5 years. The potential for this saving is 15% for the whole period. Calculate the electric bill for year 2001 and 2003.

($100,000) x [1-2 x (0.15/ 5)]= $94,000 (for 2 years after current year)(2001)

and

($100,000) x [1-4 x (0.15/ 5)]= $88,000 (for 4 years after current year)(2003)

Direct CO_2 Emissions - Greenhouse Gas Emissions from Gas

The required conversion factors can be found at the NRCan CO2 Spreadsheet, which was used to calculate CO2 emissions. The numbers for natural gas are 49.68 (tonnes CO2/TJ), 0.52 (kg N2O/TJ) and 1.1 (kg CH4/TJ). Also required is the Global Warming Potential (GWP) index for N2O and CH4 , which is 310 and 21 respectively.

Indirect CO_2 Emissions - Greenhouse Gas Emissions from Electricity

The same procedure as above is used for electricity with the following numbers (from the same source):

7.4 (tonnes CO2/TJ);
0.1032 (kg N2O/TJ); and
0.0273 (kg CH4/TJ)