Environmental Indicator:
Economics and the Environment in British Columbia

Primary Indicator: ***Intensity of conventional energy use in economic activity in British Columbia.***

Selection of Indicator: Economic activity uses energy and energy use has environmental impacts. Calculating the intensity of energy from conventional sources that is used in economic activity is a *pressure* indicator. That means that it is an indicator of the impact of human activity on the environment. This indicator shows how much energy from conventional sources is consumed per unit of the province's gross domestic product (GDP). The GDP is a measure of the total value of goods and services produced by the province's economy. Conventional energy sources include fossil fuels and large hydroelectric facilities. The production, transportation, transmission and use of energy from such sources has impacts on the environment. For example:

- burning fossil fuels causes air pollution and emits greenhouse gases into the atmosphere.
- development of large scale hydroelectric projects requires flooding of large areas of land.

Improvements in energy efficiency and a move towards greater use of 'alternative' energy sources, such as solar or wind energy, would cause the intensity of conventional energy use to decline. Such changes would enable economic growth with less environmental impact from the associated energy use.

Data and Sources:

Table 1. Consumption of Energy in BC from Conventional[1] Sources and Intensity of Use from Conventional Sources.

Year	Energy Consumption (Petajoules) from Each Source						Gross Domestic Product (GDP) at Market Prices (millions of 1992 constant dollars)	Intensity of Conventional Energy Use[2] (Index = 1.00 in 1981)
	Petroleum	Natural Gas	Coal and Coke	Hydro-electricity	Nuclear	Total[3]		
1981	421.4	170.2	5.1	149.7	0	736.9	68,194	1.00
1982	385.7	181.1	2.9	150.6	0	720.2	64,238	1.04
1983	342.1	179.4	2.9	152.1	0	676.4	65,059	0.96
1984	334.4	191.3	4.1	156.6	0	686.5	65,743	0.97
1985	336.5	211.7	5.3	169.5	0	723.0	70,812	0.94
1986	342.6	186.1	9.1	171.2	0	708.9	71,849	0.91
1987	353.9	202	7	177.2	0	740.2	76,275	0.90
1988	364.6	225.9	8.7	186.3	0	785.5	80,800	0.90
1989	385.2	272.7	8.3	176.6	0	842.6	83,785	0.93
1990	473.9	229.5	7.9	193.7	0	905.0	85,020	0.99
1991	448.4	240.8	9.7	196.3	0	895.2	85,289	0.97
1992	427.4	245.4	10.1	193.9	0	876.7	87,066	0.93
1993	399.9	287.1	11.2	191.3	0	889.5	90,543	0.91
1994	407.3	290.8	11.2	190.2	0	899.6	93,355	0.89
1995	431.6	319.4	13.7	189.3	0	954.0	95,370	0.93
1996	433.7	321.2	12.4	217.6	0	984.8	98,052	0.93
1997	434.1	302.5	10.6	199.8	0	947.1	101,277	0.87
1998	439.8	284.6	8.2	198.7	0	931.3	102,217	0.84
1999	414.7	302.1	11	201.1	0	929.0	104,323	0.82

Sources: Ministry of Water, Land and Air Protection, 2001; Statistics Canada (CANSIM - Canadian Socio-economic Information Database), 2001; and BC Stats (BC Economic Accounts), 2001.

[1] Conventional energy sources include fossil fuels and hydroelectric sources.

[2] Conventional energy intensity is calculated as the ratio of total conventional energy consumption to GDP.

[3] Discrepancies between row totals and total shown in this column are due to rounding.

Methodology and Reliability:

This energy intensity indicator is derived from the ratio of economy-wide conventional energy consumption to GDP relative to the base year of 1981. The indicator is presented as an index to make the percentage change in energy intensity for each year readily apparent. The index for each year was calculated by dividing the energy consumption to GDP ratio for that year by the energy consumption to GDP ratio for 1981.

There has been no attempt in this analysis to identify or account for the many factors that can affect estimates of economy-wide energy intensity. A concern regarding the reliability of this indicator is that some factors have the potential to change energy intensity estimates even when there has been no change in the amount of energy consumed to produce goods and services. This can result in energy intensity estimates

that do not accurately indicate energy used for production of goods and services. For example, energy consumption is affected by weather conditions, therefore, with all other factors constant, changes in weather conditions alone could affect economy-wide energy intensity estimates even though there has been no change in he production of goods and services. Another factor would be the production of goods and services that are not included in the GDP estimate. The energy consumed to produce them would be included in the energy consumption estimate, which would cause the energy intensity estimate to be overestimated to some extent.

Due to factors such as those above, energy intensity calculations are more reliable when they are done at a sectoral level, rather than at the economy-wide level because it is easier to account for factors that affect energy intensity estimates. This results in a more accurate link between the estimates of sectoral energy consumption and the value of goods and services produced using that energy, which makes it possible to draw more meaningful conclusions regarding the use of energy in the sector. Using the transportation sector as an example, energy intensity would change due to factors such as variations in the proportions of vehicle types in use, energy efficiency of the vehicles and energy sources.

Estimates of aggregate energy intensity must be interpreted carefully because there are no universally agreed upon definitions of terms such as "conventional" and "alternative" energy. For the purposes of this indicator, conventional energy consumption includes the consumption of petroleum, natural gas, coal and coke, and hydroelectricity. It includes energy used by final consumers for residential, agricultural, commercial, industrial and transportation purposes as well as intermediate uses of energy, energy used in transforming one energy form to another (e.g., coal to electricity), and energy used by suppliers in providing energy to the market (e.g., pipeline fuel) (OEE, 2001).

Although energy from micro and small hydroelectricity sources is generally considered to be alternative energy, the data source did not enable hydroelectricity consumption to be disaggregated into conventional (large scale) and alternative sources. Since some energy consumed in BC is produced by micro- and small hydroelectric sources, the conventional energy consumption from hydroelectricity would be slightly lower than the amount given in Table 1. As a result, conventional energy intensity would be slightly overestimated.

The link between energy intensity and the associated environmental impacts must be interpreted carefully because energy from different sources (both conventional and alternative) has different environmental impacts. While alternative energy sources, such as wind and solar, are considered to have a lower environmental impact than conventional sources, most alternative sources do have some type of environmental impact. Use of alternative energy sources and technologies may also result in a shift in environmental impacts. For example, while electric vehicles do not produce air polluting emissions at the point of use, emissions may occur where the energy is produced, with the amount of emissions depending on the energy source used to generate the electricity.

Intensity of conventional energy used in economic activity is only one of the indicators needed to understand the link between the environment and the economy. A more

thorough understanding of this link would also require analysis of related issues. For example, reducing the intensity of total material use (rather than intensity of energy use) is another route to reducing impacts on the environment and conserving resources. Material intensity is often measured as tonnes of material required per unit of GDP. This is difficult to measure, but international efforts are underway to improve understanding in this area.

References:

Nyboer, J., and A. Laurin. 2001. *Development of Energy Intensity Indicators for Canadian Industry 1990 to 1999*. Canadian Industry Program for Energy Conservation and Natural Resources Canada.

Office of Energy Efficiency. 2001. *Energy Efficiency Trends in Canada 1990 to 1999: An Update.* Natural Resources Canada, Office of Energy Efficiency.

United Nations Commission on Sustainable Development. Indicators of Sustainable Development: Guidelines and Methodologies. http://www.un.org/esa/sustdev/indisd/isd-ms2001.htm

Secondary Measure: ***Number of certified organic producers and processors.***

Selection of Indicator: The number of certified organic producers and processors in the province is a *response* indicator. It reflects the growing desire by consumers in British Columbia to purchase food produced without the use of synthetic pesticides, fertilizers, genetically altered organisms and synthetic feed additives. Organic producers aim to avoid the negative impacts that use of synthetic fertilizers and pesticides in conventional farming can have on the surrounding environment including:

- Erosion and degradation of soil fertility,
- Pollution of soil, ground and surface water with pesticides, nitrates and other chemicals,
- Contamination of food with pesticide residues,
- Development of pest populations resistant to pesticides and bacteria resistant to antibiotics.

In British Columbia under the Food Choice and Disclosure Act, the Certified Organic Associations of British Columbia (COABC), and the Ministry of Agriculture, Fisheries and Food, have developed certification standards for organic processors and producers. Organic producers and processors in British Columbia must adhere to these standards if they wish to sell their goods as "BC Certified Organic", which is the label adopted by the organic certification accreditation program. They are also subject to both scheduled and random on-site inspections.

Prior to obtaining full certification, producers must undergo a three-year transitional period during which they must adhere to certification standards. This transitional period is intended to allow residues of synthetic chemicals that may be in the soil to degrade.

Data and Sources:

Table 2. Number of Certified Organic Producers and Processors in British Columbia.

Year	# of certified producers	# of certified processors	Total
1992	154	0	154
1993	182	0	182
1994	211	0	211
1995	241	0	241
1996	281	10	291
1997	288	24	312
1998	324	26	350
1999	358	40	398
2001	387	43	430

Source: Canadian Organic Growers Association 2001.
Notes: A producer is an individual or organization that produces fruits, vegetables, grains, mushrooms, dairy, meat or any other agricultural product. A processor is an individual or organization that processes certified organic produce into a another product, such as salsa or cheese.

Methodology and Reliability: The Canadian Organic Growers Association has conducted annual surveys of the number of organic producers and processors in Canada since 1992. In each province, volunteers sent out questionnaires to every organic certification accreditation agency. The questionnaires requested information on the number of certified producers, the number of certified processors, the number in transition, types of enterprise certified and the acreage under organic production. If agencies did not respond they were telephoned until they eventually provided the information. Categories such as types of enterprise certified and the acreage under organic production, were optional to product confidentiality.

References:

Canadian Organic Growers Association: http://www.cog.ca.

Secondary Measure: *Economic benefits of British Columbia's provincial parks.*

Selection of Indicator: This indicator measures the extent to which British Columbia's provincial park system contributes to provincial economic activity, both directly and through secondary impacts. Public and private sector expenditures associated with parks represent the direct impacts. Ripple effects upon the provincial economy represent the secondary effects.

An economic indicator of this type does not seek to capture every detail about the functioning of an economy or the value of an activity; rather, it provides useful information for judging the acceleration or deceleration of the economy as a result of a particular type of economic activity – in this case, parks.

These non-market economic benefits are potentially larger than market-based valuations, but are not included in this indicator. For example, park visitors derive significant benefits from their recreational activities beyond the value of market-based transactions. In addition, the economic value of the ecological services (such as preserving biodiversity) provided by parks is also significant.

Data and Sources:

Table 3. GDP Generated by Provincial Parks in British Columbia.

Year	GDP ($millions)
1993	402
1994	419
1999	521

Source: BC Ministry of Water, Land and Air Protection. 2001. *Economic Benefits of British Columbia's Provincial Parks*.

Methodology and Reliability: Estimates of economic benefits from provincial parks were derived from an input/output model based on expenditures by BC Parks, visitation levels and survey information about visitor expenditure patterns. The model calculates both direct and secondary effects. It also allows for estimates of employment impacts and tax revenues.

When estimating dollar values, conservative assumptions and approaches were selected, resulting in a conservative estimate of economic benefits. Estimates of economic impacts were made for each region and park district, then aggregated on a province-wide basis.

Both direct and secondary benefits were calculated on a provincial Gross Domestic Product (GDP) basis to avoid double counting. For example, the value of goods and services imported from outside BC was subtracted from expenditures, and goods that pass through several stages before final purchase by consumers were counted only once.

The 2001 study was carried out by PricewaterhouseCoopers for the BC Ministry of Water, Land and Air Protection. It updates previous studies conducted by the ministry and Coopers & Lybrand in 1995 and 1996.

References:

British Columbia Ministry of Water, Land and Air Protection. 2001. *Economic Benefits of British Columbia's Provincial Parks.*

Secondary Measure: ***Environment industry employment in British Columbia and other provinces.***

Selection of Indicator: Employment in the environment industry sector in British Columbia is a secondary measure of the value of environmental services to the economy. The size and growth of this industry (of which employment is one measure) can be attributed to the demand by the public and businesses for sustainable solutions to environmental problems.

Data and Sources:

Table 4. Number of Employment Positions in the Environment Industry in Canada by Province.

	Total Environment Industry Employment			
Total Environment Industry Employment	**1995**	**1996**	**1997**	**1998**
Newfoundland	1,640	1,719	1,835	2,354
Prince Edward Island	341	281	316	781
Nova Scotia	3,120	3,189	3,989	4,744
New Brunswick	2,428	3,446	3,957	3,719
Quebec	30,197	30,549	32,748	35,463
Ontario	70,382	57,596	62,620	63,961
Manitoba	4,679	4,434	4,924	3,255
Saskatchewan	2,339	2,724	3,176	3,606
Alberta	16,783	16,954	22,499	25,076
BC	**17,806**	**17,555**	**23,524**	**20,910**
Yukon and NWT	242	221	345	472
Total for Canada	149,957	138,668	159,933	164,341

Sources: Statistics Canada, Environment Industry: Business Sector, 1995, 1996, 1997, 1998.

Methodology and Reliability: The data for this indicator came from the environment industry survey conducted every two years by Statistics Canada. For the purposes of this survey, the environment industry is defined as "…all companies operating in Canada that are involved in whole or in part in the production of environmental goods, the provision of environmental services and the undertaking of environment-related construction activities." The environment industry includes establishments operating in a variety of industries that produce environmental goods and services. Thus, this industry is not classified as a single industry under Statistics Canada's classification system for industries. Before 1998, the statistical tables on the different industry groups that comprise the environment industry were based on the Canadian Standard Industrial Classification System (1980). Starting in 1998, however, the North American Industry Classification System was used. This new industry classification system was designed to provide codes for new and emerging industries and to make business coding compatible across North America. Although codes for certain businesses changed, the categories reported remain the same and statistical reporting continues as before.

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The Statistics Canada *Environment Industry Survey 1998* collected data on the environmental goods and services revenues, total expenses for wages and salaries and total employment for establishments in the environmental industry. In addition to data from the Environment Industry survey questionnaire, data from other Statistics Canada surveys that collected information on environment-related revenues and activities were also used. The survey was developed in consultation with key public and private sector groups with an in-depth knowledge of the environment industry. Industry directories and research conducted on specific companies was used in updating and improving the survey. Only total employment of those businesses producing environmental goods and services are presented in the reports.

The response rate based on total employment, for the 1995 survey was 74% (936 out of 1,262), the 1996 survey was 80% (1,389 out of 1,726), the 1997 survey was 80% (1,436 out of 1,785) and the 1998 survey was 77% (2,059 out of 2,674). In all surveys, respondents had difficulty in estimating the number of workers directly involved in environment-related activities, therefore only the total employment figures for those businesses producing environmental goods and services are presented.

Results from the 1998 survey also showed that total revenue derived from the sale of environmental goods and services in British Columbia was $1.8 billion dollars.

References:

Globe Foundation of Canada. *The State of British Columbia's Environment Industry: Positioning for Growth in the 21st Century.*

Statistics Canada. *Environment Industry: Business Sector, 1995, 1996, 1997, 1998.*

Secondary Indicator: ***Employment in the environmental industry compared to other sectors in British Columbia.***

Not included in Environmental Trends 2002

Selection of Indicator: This indicator used employment figures to shows the relative importance of the environmental industry to the British Columbia economy as compared with other major economic sectors.

Data and Sources: In British Columbia, the environmental industry ranks fifth in number of employment positions, behind tourism, forestry, high technology and agriculture, and ahead of the mining and oil and gas extraction sector and utility sector. In the period between 1995 and 1998, the number of positions in the environmental industry increased by over 17%.

Table 5. Number of Employment Positions in BC in Key Economic Sectors (x 1000)

Total Sector Employment in BC	1995	1996	1997	1998	Percentage Increase/Decrease (1995-1998)
Tourism[1]	107.1	109.8	112.6	112.3	4.9%
Forest Industry[2]	103.5	98.8	100.3	95.9	-7.3%
High Technology[3]	39.2	41.2	45.2	47.0	19.9%
Agriculture[4]	25.6	30.1	33.2	33.1	29.3%
Environment Industry[5]	17.8	17.6	23.5	20.9	17.4%
Mining and Oil and Gas Extraction[6]	14.2	17.5	16.5	17.3	21.8%
Utilities[7]	11.0	10.8	10.3	11.4	3.6%

Sources: Statistics Canada 2001. *Labour Force Survey, Employment by Industry for BC* (Data for agriculture, utilities, forestry, mining, oil and gas extraction sectors)

[1] From: BCSTATS. *Tourism Industry Monitor, BC Direct Tourism Employment, 1984-2000.*

[2] Includes forestry and logging with support activities, also wood product manufacturing and paper manufacturing.

[3] From: BCSTATS 2001. *Profile of the British Columbia High Technology Secto.r*

[4] Includes crop and animal production.

[5] From: Statistics Canada. *Environment Industry: Business Sector, 1995,1996,1997 and 1998.*

[6] Includes support activities.

[7] Includes electrical power generation, transmission and distribution, natural gas distribution, water, sewage and other systems.

Methodology and Reliability: The Statistics Canada *Labour Force Survey*, which was the source of employment information for agriculture, utilities, forestry, mining and oil and gas extraction sectors, is a monthly household survey. It is a survey of individuals who are representative of the civilian, non-institutionalized population, 15 years of age or older, in Canada's ten provinces. The annual sample size is approximately 53,000 households and the non-response rate averages about 5% of eligible households.

See previous indicator for description of how environmental industry employment figures were derived.

References:

Statistics Canada. 2001. *Guide to the Labour Force Survey.*

Statistics Canada. *Environment Industry Survey: Business Sector, 1995,* 1996, 1997 and 1998.

Statistics Canada. 2001. *Labour Force Survey.*

BCSTATS. 2001. *Profile of the British Columbia High Technology Sector.*

BCSTATS. 2000. *Tourism Industry Monitor.*