August, 2005

Action Plan for Reducing Greenhouse Gas Emissions

Services

Kwantlen
UNIVERSITY COLLEGE

DEFINITIVELY UNDERGRADUATE

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August 2005

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Executive Summary

Kwantlen University College implemented a program of continuous improvement in energy efficiency in 1995 by incorporating energy efficiency and management practises into its operations and capital projects. In the same year we joined the Energy Innovators Initiative and the Voluntary Challenge and Registry (CSA Climate Change).

Targets

In 1996, we set our first energy efficiency target – a 10% reduction in energy consumption by 1999. While we knew this would also reduce greenhouse gas emissions (GHG) there was no specific target for those emissions.

In 2000, we started a $1,400,000 energy conservation project to save energy and reduce greenhouse gas emissions. We incorporated our 1996 (10% savings) goals into a new target and included greenhouse gas emissions by a total of 15% of 1994 levels, this goal now included GHG's (Carbon Dioxide or Equivalent Carbon Dioxide - CO_2e).

In 2002, we set a further 5% reduction target (GHG's) giving a total reduction of 20% from our 1994 levels. Due to our steady growth and other variables (such as weather), we committed to using adjusted values that would more accurately reflect our avoided emissions, costs, or resource use.

In 2005 we have quality checked, verified and adjusted all electrical and natural gas measures and billing data to the end of 2003 and reviewed our progress in achieving our goals. From this we have determined that our greenhouse gas emissions have been reduced by 43% for CO2e (all adjusted values) which is more than double the original goal of 20% we set in 2002.

Measures

The greenhouse gas reduction measures we have undertaken have been achieved largely by increased energy efficiency and ongoing energy efficiency projects. The projects have included improvements to heating systems, lighting systems and building control systems.

Table – target, actual and savings consumption data

	TARGETS & ACTUALS - All Adjusted					
	Consumption			SAVINGS		
Resource	Base year Consumption - adjusted	Annual **Target**	Annual **Actual**	Cumulative Savings from Base **Target**	Cumulative Savings from Base **Acutal**	**%** Savings from Base **Acutal**
kWh	16,636,512	13,276,885	*7,861,038*	3,359,627	8,775,474	*53%*
GJ	66,585	53,742	*45,790*	12,843	20,795	*31%*
ekWh	35,133,784	28,206,436	*20,581,500*	6,927,389	14,552,284	*41%*
CO_2 e	7,040	5,685	*4,046*	1,355	2,994	*43%*

Organization Profile

Primary Function

Founded in 1981 Kwantlen is the largest university college in Canada. Enrolment has doubled in the past decade. Kwantlen offers more than 90 programs, the largest being in university studies. Kwantlen became a University College with degree granting status in 1995.

Physical location

Located on British Columbia's Lower Mainland, south of the Fraser River, Kwantlen University College serves the communities of Richmond, Delta, White Rock, Surrey, and Langley.

Size

Kwantlen University College consists of three post 1990 owned campuses and one built in the 1970's. The campuses are located in the British Columbia municipalities of Richmond, Surrey and Langley**.** Gross area is 78,229 m^2 and usable area is 71,952 m^2.

Over 25,000 students, an FTE equivalent of 8,461, attend classes on our four campuses, located in Richmond, Langley, Surrey and Newton, where full-time career, vocational and academic programs, continuing education courses and customized training is offered. Kwantlen employs over 1,400 people in staff, faculty and administrative positions, with the majority located on the Surrey campus.

Statement of Endorsement

Kwantlen is proud of our community leadership position and of significant reduction in greenhouse gas our efforts have generated. Our mission statement highlights "the importance of participation in and service to society" and we believe our energy efficiency and greenhouse gas management programs serve local and world communities

Commitment to annual reporting

Kwantlen University College intends to provide updated reports on emission reductions as we make progress on achieving our goals.

Internal Practices on climate change implemented by Kwantlen

Kwantlen first introduced energy efficiency policies and targets in its June 1996 letter to Natural Resources Canada and the VCR. We also introduced a program of "continuous improvement", whereby we committed to review our progress on a regular basis and set targets as appropriate.

Our internal practices have been intended to:

1. Assist the government of Canada to meet it's anticipated Kyoto Commitments through a program of continuous improvement in energy efficiency.
2. Continue to increase awareness of climate change within our student and local communities through an expanded awareness program.
3. Maintain ongoing "green purchasing and management policies"
4. Proceed with further measures to reduce utility consumption at all of our campuses.

Management System in place to monitor progress

Our emissions are based on electrical and natural gas usage as we are an educational facility. To monitor our progress we use a customized spreadsheet to track increases or decreases in energy consumption and related greenhouse gas emissions.

Base Year Quantification

Methodology for calculation of base year (and subsequent) quantification

The following section describes how base year quantification was determined. Examples of how adjustments are made for the following years, and variables used, is also discussed in this section

Variable selection criteria and rationale

Occupants - This has been selected due to the overall impact on buildings, generally in terms of operating hours significance, but also due to increased peripheral loads (DHW, Cafeteria)

Degree Days (Heating) - Heating degree days are considered due to their significant impact on the overall resource consumption (natural gas) and significant variablitly (a review of previous 10 year minimum/maximum range showed a 20% variability).

Building Area - Not considered (or required to be) in the adjusted figures (post base year) to date, generally as a result of the selection of the Base Year as year 2000. There were no area changes from the base year selected (2000) and the following years (to 2003). When there are changes this will be incorporated in adjusted figures.

Building and System Modifications - Not significantly considered in adjusted figures to date, generally as a result of the selection of the Base Year as year 2000 (this year minimized or already included many parameters considered in this category). 'Modification' figures will be incorporated in future reports as a lump sum and single line entry. While the following list is not exclusive, it shows examples of items constituting the modifications total, and entered as positive or negative values.

Electrical Calculations

Electrical Adjustment - Portion Sensitive to Heating Load

Surrey has 92.5 kW of electric heating confirmed, with 100 kW assumed. Therefore 100 kW X 8hr/day X 5.5 day/wk X 28 wk =123,200 kWh X 4 sites = 492,800 kWh / 12,500,000 => 3.9% is sensitive to DD. This value is used in the following formula:

- ((Unadjusted base year kWh X per-cent sensitive to DD) X (1 - (Base yr DD / Present yr DD)). Eg. Ie. ((AC45*$R$102)*(1-($O$17/$O$18))

Electrical Adjustments for Occupant Load

- ((Unadjusted base year kWh X (1 - (Base year Occupants / Present year Occupants)). Eg. (AC45*(1-($O$44/$O$45))

Electrical Adjustments – Non-Cumulative

Adjustments for electrical consumption are made individually with the result of that amount being subtracted from the total remaining prior to adjustments being made for the a further variable. Eg. 10,000 kWh with an increase from 5,000 to 7,500 students, and a new addition changing the total area from 50,000 Sq.M to 75,000 Sq.M.

1. The adjustment is made for the **number of students** first, with a value credit assigned of ((7,500-5,000)/5,000 X 10,000) = 5,000 kWh.

2. Area **adjustment** value is ((75,000 – 50,000) / 50,000) X (10,000 – 5,000) = 2,500 kWh

Applying both adjustments to the original total would give the 5,000 kWh in #1, but the formula for #2 would see no subtraction of the first value from the original total, resulting in ((75,000 – 50,000) / 50,000) X 10,000 = 5,000 kWh, causing an overestimation of savings (10,000 kWh) vs. the preferred adjustment method giving 7,500 kWh savings.

Electrical Adjustment - Portion Sensitive to Cooling Deg Days - Not evaluated.

Natural Gas

Gas Portion Sensitive to Cooling Deg Days

The assumption is that 2,400 GJ per year (50 GJ/month X 4 sites X 12 months) or 4.8% of natural gas consumption (@ 50,000GJ) is not sensitive to Heating Degree Days. Therefore 95.2% is sensitive to DD.

=> ((Unadjusted base year GJ X per-cent sensitive to DD) X (1 - (Base yr DD / Present yr DD)). Eg. ((AC55*$R$103)*(1-($O$17/$O$18))

Gas Adjustments for Occupant Load

=> ((Unadjusted base year GJ X (1 - (Base year Occupants / Present year Occupants))
Eg. (AC55*(1-($O$44/$O$45))

Resource Cost and Savings Calculation - Present Avoided Costs

Savings for adjusted values derive from calculating the average cost per unit of the resource for the latest period of the comparison (ie. If the base year 2000 is being compared to 2003, average cost used will be from 2003). Savings are then calculated by multiplying savings in consumption (from adjusted consumption tables) by this derived average cost from the latest period. This method should provide reasonable certainty and confidence, with present cost-avoided values.

(Unadjusted present cost / Unadjusted present kWh) X (Base year kWh – adjusted kWh present year) = {($300,000 / 6,000,000) * (6,500,000 – 5,500,000} = **$50,000**

Base year calculation methods

Kwantlen follows general principles of monitoring and verification standards: PMVP – Whole building. We evaluate our energy use using a standard spreadsheet program and calculate our greenhouse gas emissions based on energy use.

Base year selection

While Kwantlen has most utility billing data from 1994 to present the data is not available for about 25% of the building area. This is part of the reason we have chosen 2000 as our emissions baseline for our CSA Climate Change Action Plan. In addition, in that year there was relatively little going that would cause irregular resource consumption. There was no energy conservation work being done, and no construction.

Utility data in this document was created using actual billing data from 2000. For the 25% not available for 1994, we used the earliest period for which there was data and assumed that to be 1994 data, adjusting only for weather. 1999 data is continuously available and is used as a secondary check or verification.

For our efforts to assist the Government of Canada to meet its international climate change commitments, we have established 1994 as our baseline, adjusted to the year 2000.

Methodology for calculation of base year quantification by gas type

Figures for calculations of quantification by gas type for base year and subsequent years are derived from the tables available from the CSA Climate Change information and/or U.S. EPA 1.4 – AP 45.

Table – emission conversion factors

Misc. Conversion Factors

		U.S. EPA 1.4 - AP-45				VCR - MVR.CA		VCR - MVR.CA		
					Emission	Emission Quantities	Emission Quantities			
				T	Quantities	Converted to	Converted to			
		Criteria Pollutant		Y	Converted to	Tonnes/	Tonnes/	GLOBAL WARMING POTENTIAL		
		or	Common	P	Tonnes/	KwH *	KwH *	CO2 equivalent factors for Tonnes		
FUEL		Greenhouse Gas	Name	E	GJ	BC	Cdn	CO2 e	N2O	CH4
Natural Gas	-	NO x	Nitric Oxide	Criteria	0.000042			-	-	-
Natural Gas	-	CO	Carbon Monoxide	Criteria	0.000035			-	-	-
Natural Gas	-	CO2	Carbon Dioxide	Green	0.049920			1	-	-
Natural Gas	-	Lead	Lead	Criteria	0.000000			-	-	-
Natural Gas	(Uncontolled)	N2O	Nitrous Oxide	Green	0.000001			-	310	-
Natural Gas	(Contolled- low-Nox burner)	N2O	Nitrous Oxide	Green	0.000000			-	310	-
Natural Gas	(Total)	PM	Particulate Matter	Criteria	0.000003			-	-	-
Natural Gas	(Condensable)	PM	Particulate Matter	Criteria	0.000002			-	-	-
Natural Gas	(Filterable)	PM	Particulate Matter	Criteria	0.000001			-	-	-
Natural Gas	-	SO2	-	Criteria	0.000000			-	-	-
Natural Gas	-	TOC	-	Criteria	0.000005			-	-	-
Natural Gas	-	CH4	Methane	Green	0.000001			-	-	21
Natural Gas	-	VOC	Volatile Organic Compounds	Criteria	0.000002			-	-	-
Spare	-	-	-	-	-			-	-	-
Spare	-	-	-	-	-			-	-	-
Spare	-	-	-	-	-			-	-	-
Elec	-	CO2	Carbon Dioxide	Green		0.00002663998	0.00022067982			
Elec	(Uncontolled)	N2O	Nitrous Oxide	Green		0.00000000037	0.00000000531			
Elec	(Contolled- low-Nox burner)	N2O	Nitrous Oxide	Green		-	-			
Elec	-	CH4	Methane	Green		0.00000000010	0.00000000158			
Spare	-	-	-	-	-					
Water	-	-	-	-	-					

CH4 = methane; H2S = hydrogen sulfide; NH3= ammonia; NO = nitric oxide; N2O = nitrous oxide; PM = particulate matter; VOC = volatile organic compounds

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Indirect emissions

Indirect emissions considered for this review are those from non-owner electrical production. Student or staff travel to site may be considered in future.

Deriving Emissions Standards – Local vs. National and Incremental vs. average

While figures are available for emissions on a provincial level, a National level was chosen as more closely reflecting a reduction in actual incremental emissions. Emissions reductions (particularly in BC) are assumed to be reduced from incremental electrical production methods (oil or natural gas within a 40 km radius), much like savings from conservation measures are not assumed at average costs, but on avoided incremental costs. If electricity is conserved the utility response will be to reduce production from more expensive methods (non-hydro), and/or to avoid purchase from third party producers who tend to be coal, oil or natural gas.

Kwantlen's electricity supplier is a presently a net importer of electricity (15% in 2004; estimated up to 25% in 2005). If our consumption is reduced, emissions caused by the production of imported electricity and associated emissions will be reduced, albeit not necessarily in the vicinity of Kwantlen.

A large thermal electric plant plant that will impact on local airshed is under consideration in neighbouring Washington State. Reducing our consumption should mean less production at this site.

Grid interconnectedness means avoided emissions associated with electricity savings could ultimately be from generation in nearby States or Provinces (most notably Alberta).

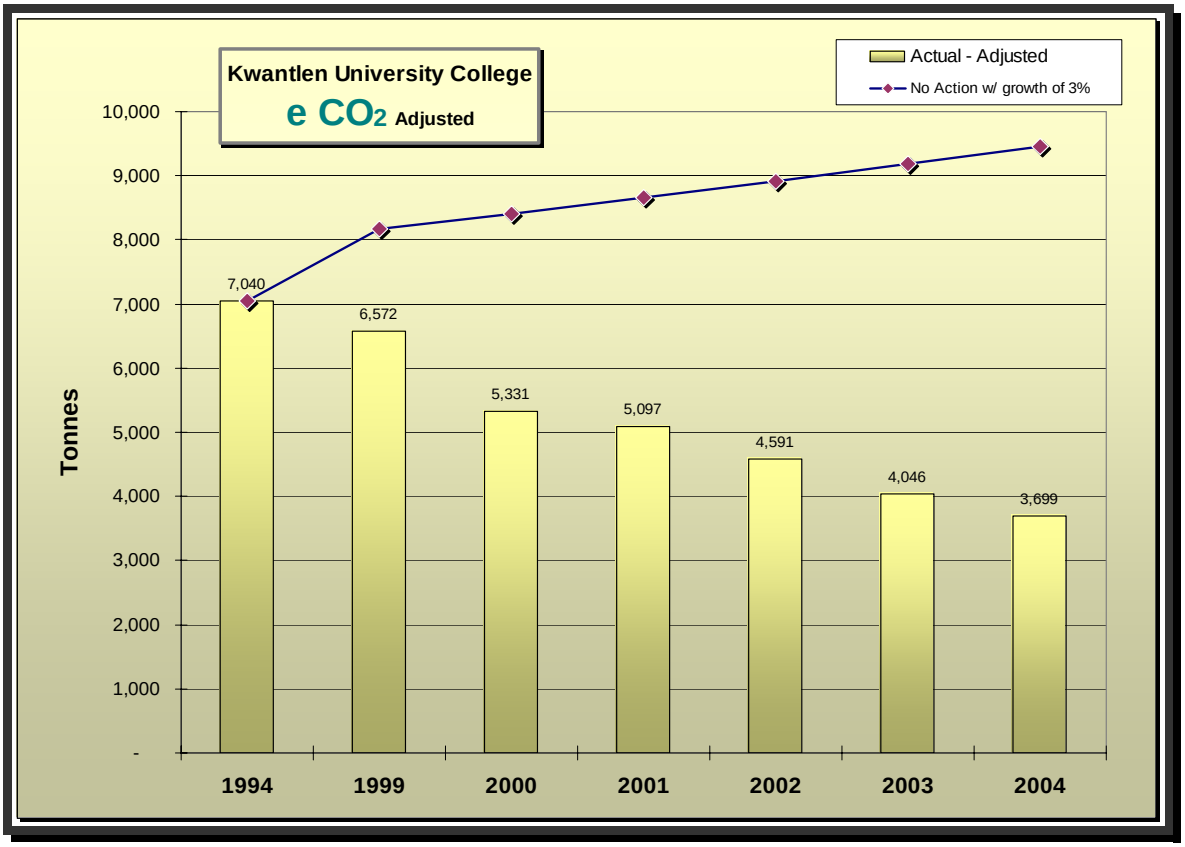
Results Achieved

Results within one year of commitment

By the end of 2003, we have reduced greenhouse gas intensity from 1.11 tonnes CO_2e/FTE in 1994 to 0.47 tonnes CO_2e/FTE in 2003. As noted these values assume Canadian National average emission values for electrical production.

We made excellent progress and more than achieved our 20% targets (established target to the end of 2003), with our greenhouse gas emissions for reporting level of confidence were 43% lower than our 1994 levels (data from 2004 has not undergone the detailed review required).

Table - Emission Levels (adjusted) from 1994 base year with 'No Action' scenario assuming 3% annual growth.



Verifiable Results
Because Kwantlen is a government-funded educational institution, the data is verifiable from a number of sources. Our area/building changes, and our student numbers are publicly available. Our resource usage data is from utility provider billing, our plug load data is from internal sources, but is also ultimately publicly available and the weather data is publicly available.

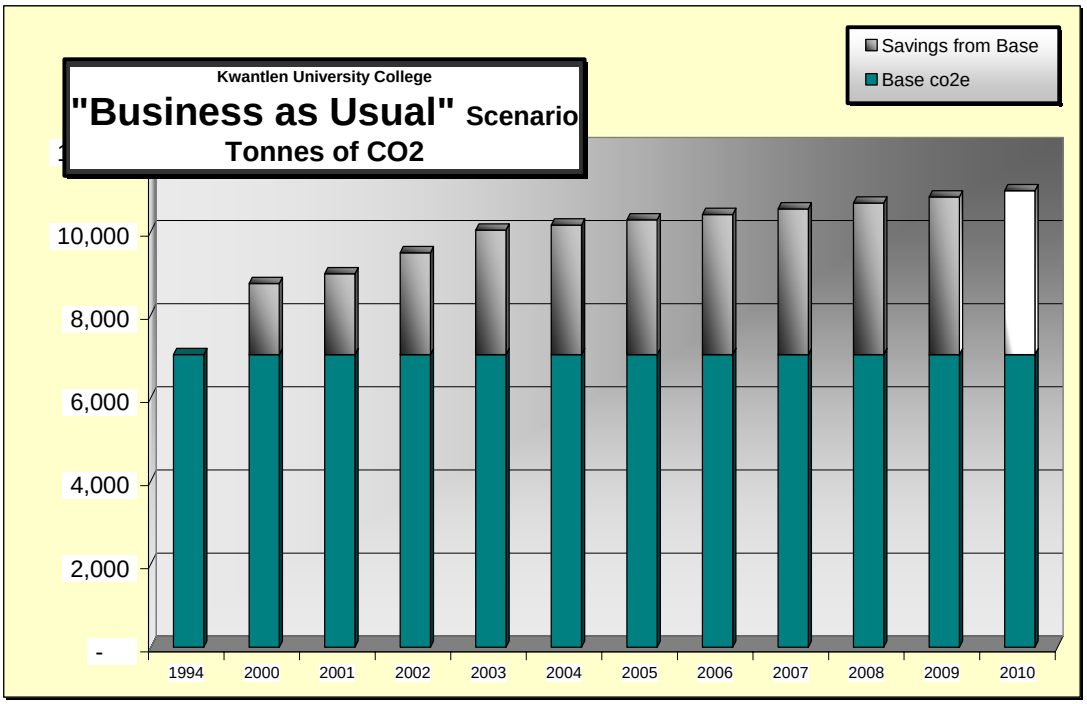
External verification of results
Calculations have not been verified by an independent third party, but calculations are presented in this document in detail and are therefore verifiable, understandable and comprised of standard IPMVP parameters. Calculations have been reviewed internally by staff experienced in energy reviews and studies.

Emission Reduction Offsets
While there are offsets derived from our actions, particularly in the waste reduction and water conservation areas, at this time there will be no offsets taken for emission reductions.

Business-as-Usual Projections

Business-as Usual projection without emissions reduction actions
Our business as usual projection is best illustrated with the graph below that shows the effect if we had taken no actions to reduce our greenhouse gas emissions.

Table - "Business-as-Usual" - Emission Levels (adjusted) from 1994 base



Emission Breakdown by Type
The breakdown of present emission types (GHG, not criteria) are listed in the Appendix at the end of this report. Our major source of GHG emissions (direct and indirect) are by combustion of natural gas (direct), and through our consumption of electricity (indirect).

Business-as-Usual methodology
Business – As – Usual calculations were made assuming 1994 base year adjusted from 2000 data, savings achieved in following years, were added to this base year.

Business – As – Usual projections beyond 2004 was made using a simple inflation of 4% (growth).

Target Setting

Commitment to target setting
Our past actions best demonstrate our commitment to target setting and continual improvements.

List of past actions – Administrative
1995

- Implement policy on Sustainability
- Joined the Energy Innovators Initiative
- Registered with Canada's Climate Change Voluntary Challenge and Registry (VCR)

1996

- Committed to reduce energy consumption by 10% by 1999

1997

- Issued an Expression of Interest for an Energy Conservation Project as part of its commitment to reduce energy by 10% by 1999.
- Started negotiations with the BC Government for permission to enter into an Energy Conservation Project

1999

- Agreed to be a "Pilot Project" to assist the B.C. Government develop the Green Buildings BC – Retrofit Program.
- Received permission from the BC Ministry of Finance and Corporate Relations to finance a $2 million Multi-Year Energy Services Contract.
- Developed an Eco-Efficiency Action Plan for its three owned campuses (Langley, Richmond and Surrey)
- NRCan's Office of Energy Efficiency approved Energy Innovators ^{PLUS} Incentive for project.
- Committed to reporting to VCR, to implement a Community Communications, Employee Awareness and Facility Manager/Operator Training Program

2000

- Amalgamates 1996 targets into a new target to reduce electricity at its 3 owned campuses by 1.85 million kWh, natural gas by 6,842 GJ and CO_2e by 420 tonnes.
- Kwantlen signed Energy Services Agreement with Vestar Ltd. to implement the energy efficiency project at the Langley, Richmond and Surrey Campuses (owned facilities)

2002

- Commits to implement a "Sustainable Resource Management Program"
- Commits to a program of continuous improvement.
- Makes a a further commitment to reduce energy and greenhouse gas emissions by 5% from 1994 levels – a further 139 tonnes of CO_2e.
- Full implementation of energy and greenhouse gases monitoring program and annual reporting to CSA.
- Commits to introduce "green procurement" policies that include greenhouse gas management policies, resource management policies and water conservation.

2003

- Green Power Certificates purchased for 5% electrical energy
- Epoint project adoption (local Electric Utility Conservation Program)
- Committed to additional metering (as part of M&V)
- Adopted Nat'l GHG Emission Parameters
- Gold Champion Level Reporter with VCR
- Facilities Analyst support position providing expert technical support for energy and resource conservation and other projects added.

2004

- Green Power certificates purchased for 5% electrical energy
- Two Facility Managers and One Facilities Analyst become LEED 2.1 certified.
- "Power Smart Certification: Recognition of Energy Efficiency Excellence" award presented by BCHydro. Only the 7th organization in BC to receive this award and the only one for 2004.
- Funding from previous energy savings projects received from BCHydro EPoints program which is utilized in projects to further reduce electrical energy use and improve energy efficiency further.

2005

- Anticipate Green Power certificates to be purchased for 5% electrical energy
- Commitment to construct new Cloverdale Campus as a LEED building
- Results of past efforts and commitment become evident in the significant reductions in our utilities cost expenditures.
- Additional funding from previous energy savings projects again received from BCHydro EPoints program which is utilized in projects to further reduce electrical energy use and improve energy efficiency further.

Identify target/process to select target

We monitor our energy consumption closely and evaluate opportunities to increase energy efficiency which reduces our greenhouse gas emissions. We receive numerous suggestions from contractors and employees which are evaluated for potential savings. We also review external trade magazines and new products for opportunities relevant to our operations and targets.

Table - illustrates our targets and anticipated savings to 2007

BASE YEAR	1994	=	***7,040***	***Tonnes***					
TARGETS & SAVINGS					CO_2 **e**				
	TARGETS								
YEAR	Annual Per-Cent	% of Initial Consumption	**Annual Savings**	**Cumulative Savings**	**Target - Annual Consump. NOT TO EXCEED**	Consumption: Annual (Adjusted)		Actual Savings from Base	Variance from Target (Negative is short of target)
1995		**100.0%**	-	-	7,040				
1996		**100.0%**	-	-	7,040				
1997		**100.0%**	-	-	7,040				
1998		**100.0%**	-	-	7,040				
1999	***15.0%***	**85.0%**	1,056	1,056	5,984				
2000		**85.0%**	-	1,056	5,984				
2001		**85.0%**	-	1,056	5,984				
2002		**85.0%**	-	1,056	5,984				
2003	***5.0%***	**80.8%**	299	1,355	5,685	*4,046*		*43%*	1,639
2004	***5.0%***	**76.7%**	284	1,639	5,401				
2005	***5.0%***	**72.9%**	270	1,909	5,131				
2006	***5.0%***	**69.2%**	257	2,166	4,874				
2007	***5.0%***	**65.8%**	244	2,410	4,630				

Past Actions – Physical Action Measures

	Past Actions	kWh Saving	G J Saving	GHG Reduction (tonnes CO2e)
	2000 - target 15% from 1994 levels	2,660,844	10,014	1,056
All	Training (Staff) => 1 1/2% reduction in lighting operating hours			
Langley	Sewage rebate on irrigation water			
Langley	Power factor correction			
Langley	Boiler Controls - Horticulture - Variable firing rate controller			
Langley	Boiler Controls - Main Campus - Variable firing rate controller			
Langley	Gas fired (FA & IR) heaters - HC			
Langley	Vending machine control			
Langley	BMS Recommissioning			
Langley	Auditorium variable speed fan control			
Langley	Lighting Main + Seed Table (Retrofit; Delamp; Occupancy sensors; etc.)			
Richmond	Exit sign calc error [Orig Watts] @90%-50W;10%30W. Not100%@20W			
Richmond	RTU 12 tied to Conf. Centre Occ Sensor			
Richmond	Boiler control - Variable firing rate controller			
Richmond	Inclusion of occupancy sensor for MP room			
Richmond	Heat Tape control (Improved sensitivity and accuracy)			
Richmond	Exit sign (quantity) error - 17 additional			
Richmond	Inclusion - occupany sensors for parkade - Not in orig. commissioning			
Richmond	Free Cooling (process and procedures)			
Richmond	Inclusion of all night lighting in parkade off			
Richmond	Vending machine control			
Richmond	Duct Static Pressure Reduction RTU3/6			
Richmond	BMS Recommissioning - Includes new (digital) VAV box control			
Richmond	Variable flow heating loop - VFD			
Richmond	Lighting (Retrofitting fixtures; delamping; occupancy sensors; etc.)			
Surrey	Boiler draft pressure control			
Surrey	Vending machine control			
Surrey	Variable speed drive pumping			
Surrey	BMS recommissioning			
Surrey	Lighting (Retrofitting fixtures; delamping; occupancy sensors; etc.)			

Past Actions	kWh Saving	G J Saving	GHG Reduction (tonnes CO2e)
2003 - target 5% from Previous Year	698,783	2,829	299
Training: LEED - Craig/Tom /Dan			
Incandescents to CF - Interior			
Incandescent & mh to Linear Fluor Auditorium - Langley			
Install CO sensor for EF-1 & EF-2 (Parkade Exhaust)			
Replace atrium lighting - adjustable fluorescents			
Replace rotunda lighting			
Install CO 2 sensor in MP room			
Thermostats - Adjustable for control of heat tapes in parkade			
Time off video machines			
Photocontrol for Building G SE Hall			
Install switching for Mech rm 245			
Relays for 175 W building accent lighting - off after 11 pm + all day Sunday			
Convert 250w MH forest floodlights to 50W CF			
Install CO 2 sensor in Conference Centre - 1205 A and 1205 B			
Install CO 2 sensor in gym - hvac			
Disconnect 32 incandescent lights in gym - install 4 - 2L w/reflector 4' fluoresc.			
Install Static Pressure Sensor in Gym			
Photocontrol for Building G North Conference Hall			
Richmond - Install DHW boiler - turn off main boilers in summer			
Install reflectors & T8's in cafeteria fixtures - remove lamps			

Past Actions	kWh Saving	G J Saving	GHG Reduction (tonnes CO2e)
2004 - target 5% from Previous Year	663,844	2,687	284
Post-Pilot: Vending Miser			
Pilot: Washrooms - Hand Drying Methods and Resource Impact			
Exterior Lighting - Parking lot - Reduce wattage			
Time off video machines			
Pilot - 25 Watt T8 tubes in night (24 hour) lighting			
Water meter installation - New - Kwantlen			
Photocontrol - Atrium fixtures			
Incandescents to CF - Exterior			
Exterior Lighting - Turn off some walkway exterior lights after campus closing			
Replace exit fixtures w/LED - Completion			
Elec Sys Distribution Optimization - Transformer Adjustments			
Photocontrol for SE (upper and lower) hall lighting			
Water meter installation / recommission			
Improvement in BMS operation of schedule - graphic for exterior lite			
Install local hot water tank in shop by HC			
Nat Gas - Boiler Hort Centre - Misc. Improvements			
Install electric heat; or gas line and forced air; or gas and small boiler & use existing piping, fc's etc.			
Photocontrol for Building B - Upper Lobby. Connect kitchen lights to other circuit			

Future Actions (Potential) - to Achieve Targets

Estimated impact of potential activities / projects

Future Actions	kWh Saving	G J Saving	GHG Reduction (tonnes CO2e)
2005 - target 5% from Previous Year	630,652	2,553	270
Convert HID fixtures (exterior - [illegible])			
Turn off AHU-26 in Langley HC on weekends in warmer weather			
Turn off some walkway exterior lights			
Kwantlen retires GHG Emissions			
Stickers for de-lamped fixtures			
Install low-flow aerators			
Water - Lo-flow basin adapters			
Turn off Exterior Lighting after 2330 - Building mounted			
Turn off Exterior Lighting after 2330 - [illegible]			
Turn off Exterior Lighting after 2330 - Stand-Alone Post - walkway			
Review status of open duct in conference room			
Install photo-timer control for North entrance lights			
Install low-flow aerators			
Photocontrol for lighting - Bldg. B - 2nd floor landing - not Cafeteria Wall			
Install low-flow aerators			
Control header pumps in HC off when boiler off			
Move switch for exterior lighting (header house - North side by storage			
Elec Sys Distribution Optimization - Transformer Adjustments			
Review Battery Charger in rm 8085 (AHU 7) mechanical room			
Review - Pre-cooling algorithms - Langley			
Review - Free cooling algorithms - Langley			
Photocontrol / keys for 2nd Floor Lights			
Water Cooled Condensor in Comm Room by Ship/Receive - Review			
Fan cut-off switches for loading doors			
Boilers off - shoulder period			
Reduce amount of night lighting - Interior			
Exterior Lighting - Parking lot - Reduce wattage			
Elec Sys Distribution Optimization - Transformer Adjustments			
Review - Free cooling algorithms - Richmond			
Trend logs re boiler use to verify circ pump shutdown in shoulder months			
Fan cut-off switches for loading doors			
Boilers off - shoulder period			
Control off 'information' sign when bldg unoccupied - interior			
Reduce amount of night lighting - Interior			
Photocontrol for lighting - Bldg. C - 2nd Floor Skylight Area			
Photocontrol for lighting - Bldg. D - 3rd Floor Skylight Area			
Mitsubishi unit in boiler room			
Nat Gas - Fume Hoods - Surrey - Misc. Improvements			
Crankcase heaters in RTU's (500 W X 4?)			
Fan cut-off switches for loading doors			
Boilers off - shoulder period			
Install improved switching for Conference room (Bldg G)			
Reduce amount of night lighting - Interior			

Future Actions

	kWh Saving	G J Saving	GHG Reduction (tonnes CO2e)
2006 - target 5% from Previous Year	599,119	2,425	257
Turn off Exterior Lighting after 2330 - Building mounted			
Water - Lo-flow basin adapters			
Water - Leak detection program - All Campuses			
Pumpdowns - could run 10 or 15 seconds X once per night			
Ductless split a/c: 1 1/2 to 2 ton units			
Sensor use and optimization for HC boiler return loop/cycling problem			
Heat loss calcs for Langley HC curtain use			
Install control for exterior water pumps			
LED Safety lighting replacement for mechanical/boiler rooms etc. (replace T8)			
Turn off Exterior Lighting after 2330 - Parking lot			
Turn off Exterior Lighting after 2330 - Stand-Alone Post - walkway			
Review boiler gas supply pressures - Langley			
Control Recirc pumps on irrigation systems			
Review boiler gas supply pressures - Richmond			
LED Safety lighting replacement for mechanical/boiler rooms etc. (replace T8)			
Turn off Exterior Lighting after 2330 - Building mounted			
Turn off Exterior Lighting after 2330 - Parking lot			
Turn off Exterior Lighting after 2330 - Stand-Alone Post - walkway			
Exterior Lighting - Parking lot - Reduce wattage			
Turn off 'Kwantlen Univ.' 72nd ave. sign @ midnight			
Turn off Forest floodlights after 11 pm + all day Sunday			
LED Safety lighting replacement for mechanical/boiler rooms etc. (replace T8)			
Elec - Exterior lighting - Daytime Use and Demand Savings - Surrey			
Replace Bldg G courtyard security lighting with ovrhead fixt.			
Water - Lo-flow toilets			
Review - humidifier use in summer (2)			
Review - 4 submersible pumps (operation)			
Install CO 2 sensor in Library			
Review boiler gas supply pressures - Surrey			

The following items are considered 'Ongoing Actions' that should be a continuous process in an active and operating Resource Management Program.

Ongoing Actions

Web Page development
Additional BMS training for FSG's
Replacement Program: Electric Heater
Energy consumption summary sheets reviewed with FSG's to raise awareness
Kwantlen recycles Mercury in Fluorescent lamps
Success Stories - additional
Computer monitors off at night
BMS Optimization Settings
Computer monitors off at night
Entrance ceiling and wall lights remove - replace with 2 wall mount
Computer monitors off at night
Improve awareness of issues for HVAC Contractor
Review AHU operation at night
Improvement in BMS operation of schedule
Replace weatherstripping
Review AHU operation at night
Improvement in BMS operation of schedule
Replace weatherstripping
Review AHU operation at night
Review - Free cooling algorithms - Surrey
Review - Pre-cooling algorithms - Surrey
Review custodian cleaning times various buildings
Review occ sensor operation at night with custodians in hall
Replace weatherstripping

Education, Training and Awareness

Climate change issues explained to employees

Our energy savings projects allow us to address climate change issues. To achieve our targets we focus on communicating energy efficiency related information where user interaction can reduce consumption. Indirectly, this method allows us to affect climate change issues.

- Occupant awareness and interaction
- Training Programs
- Communications (Media) program

How employees are encouraged to take action to reduce GHG emissions in the workplace

Training

As the majority of our greenhouse gas reductions are from energy consumption efficiencies we have geared our training to building operators and cover the following topics:

- Savings potential ($ and energy and percent of original)
- Reason for changes to reduce energy use
- Principles of operation
- Potential problems and actions for employees to take on failure
- Maintenance requirements

Awareness

An active internal awareness program is a significant feature of our program and the following activities were performed:

- Emails and memos to staff
- Promote program at student gatherings
- Product giveaways
- General project awareness posters
- Articles in the Kwantlen “Connection” newsletter for staff and students
- Presentations to administration support personnel
- Articles of Conservation Successes for the web or other general distribution

Create incentives for emission reductions through supply side management

We have revised our cleaning contact to use environmentally friendly and low VOC products. When we replace flooring we specify and use low VOC products where possible.

Participate in life cycle analysis to influence external contacts

We are in the construction phase of a new 32 million dollar trades campus which will be a LEED building. Throughout the design phase consultants were requested to perform life cycle analysis to determine suitable products to meet our objectives which included elements to:

- Improve energy efficiency which reduces greenhouse gas emissions
- Use low VOC products

Undertake public education

The following communications strategy is directed outside the campus community when there are opportunities to do so.

- Community newspapers
- Trade magazines
- Facilities Professional Organizations conference presentations
- Success Story Articles posted on our web site

Appendix #1 – Table of Business-as-Usual Projections, Base Year, Targets and Results

ACTUALS

		Base					Current	Projections		
Description	**Units**	**1994**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Electricity (CO2E + CH4 + N2O)	Total [tonnes CO_2e]	3,695	2,692	2,517	2,066	1,746	1,691			
Direct Emissions: FUEL	CO2 [tonnes]	3,324	2,622	2,564	2,509	2,286	1,996			
	CH_4 [tonnes CO_2e]	1.34	1.06	1.03	1.01	0.92	0.86			
	N_2O [tonnes CO_2e]	19.92	15.00	15.01	14.90	13.84	12.13			
	Subtotal [tonnes CO_2e]	3,345	2,638	2,580	2,525	2,301	2,009			
Offsets	[tonnes CO_2e]	-	-	-	-	-	-			
NET TOTAL Emissions	Total [tonnes CO_2e]	**7,040**	**5,331**	**5,097**	**4,591**	**4,046**	**3,699**			
GHG Emission Intensity	[tonnes CO_2e/unit of production]	1.11	0.65	0.60	0.54	0.47	0.42			

Business - As - Usual Projections

		Base					Current	Projections		
Description	**Units**	**1994**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Electricity (CO2E + CH4 + N2O)	Total [tonnes CO_2e]	3,695	4,697	4,872	5,323	5,644	5,699	5,927	6,164	6,410
Direct Emissions: FUEL	CO2 [tonnes]	3,324	4,025	4,084	4,139	4,362	4,652	4,838	5,032	5,233
	CH_4 [tonnes CO_2e]	1.34	1.62	1.64	1.67	1.76	1.81	1.89	1.96	2.04
	N_2O [tonnes CO_2e]	19.92	24.84	24.83	24.94	25.99	27.70	28.81	29.97	31.16
	Subtotal [tonnes CO_2e]	3,345	4,052	4,111	4,166	4,390	4,682	4,869	5,064	5,266
Offsets	[tonnes CO_2e]	-	-	-	-	-	-	-	-	-
NET TOTAL Emissions	Total [tonnes CO_2e]	**7,040**	**8,749**	**8,983**	**9,489**	**10,033**	**10,380**	**10,796**	**11,227**	**11,677**
GHG Emission Intensity	[tonnes CO_2e/unit of production]	1.11	1.56	1.62	1.67	1.75	1.79	1.86	1.94	2.01

TARGETS

		Base					Current	Projections		
Description	**Units**	**1994**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Electricity (CO2E + CH4 + N2O)	Total [tonnes CO_2e]	.	3,103	3,103	3,103	2,948	2,800	2,534	2,294	2,076
Direct Emissions: FUEL	CO2 [tonnes]	-	2,825	2,825	2,825	2,682	2,549	2,307	2,088	1,890
	CH_4 [tonnes CO_2e]	-	1.14	1.14	1.14	1.08	1.03	0.93	0.84	0.76
	N_2O [tonnes CO_2e]	-	16.93	16.93	16.93	16.07	15.28	13.83	12.51	11.32
	Subtotal [tonnes CO_2e]	-	2,843	2,843	2,843	2,700	2,566	2,322	2,101	1,902
Offsets	[tonnes CO_2e]	-	-	-	-	-	-	-	-	-
NET TOTAL Emissions	Total [tonnes CO_2e]	-	**5,947**	**5,947**	**5,947**	**5,648**	**5,366**	**4,856**	**4,395**	**3,978**
GHG Emission Intensity	[tonnes CO_2e/unit of production]	-	0.93	0.93	0.93	0.89	0.84	0.76	0.69	0.63