

October 2002

Energy and Emission Management Plan

Facility Department



Services



Kwantlen
UNIVERSITY COLLEGE

**Kwantlen University College
Energy and Emission
Management Plan**

**Oct 31, 2002
March Update**



PRESIDENT'S MESSAGE

Kwantlen University College has become the largest growing university college in Canada as our enrolment has doubled in the past decade. Our challenge is to sustain the vitality of a growing, thriving university college while continuing to create new opportunities for our community and our students. To sustain this growth we must pursue both fiscally and environmentally responsible policies and practises.

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

In 1995 we were one of the first Colleges or Universities to join the federal government's Energy Innovators Initiative and Canada's Climate Change Voluntary Challenge and Registry (VCR). In 1996 we were pleased to set our first energy efficiency goal. In 1999 we assisted the Government of British Columbia to develop its Green Buildings BC – Retrofit Program by becoming the first "Pilot Project" to test the various policies and instruments that underpin its efforts.

In this regard, I am pleased to report that we have reduced our equivalent carbon dioxide per full time equivalent ratio from 0.43 tonnes / FTE in 1994 to 0.39 tonnes/FTE in 2002. Furthermore we have verified that our efforts have reduced electrical consumption at our Richmond and Langley Campuses by 36% and 45% from 1994 levels respectively.

In this regard, I am pleased to confirm that we will not only continue to cooperate with the Office of Energy Efficiency and VCR in the pursuit of our greenhouse gas reduction goals but we will introduce a commitment to further reduce energy consumption by 5% per year, incorporate "green maintenance policies" in our electronic work order system and introduce a water conservation program.

Kwantlen remains committed to being an environmentally responsible citizen and a leader in our community and we look forward to reporting even stronger results to the VCR next year.

Skip Triplett, President

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 both the Energy Innovators Initiative and the Voluntary Challenge and Registry.

Targets

In 1996 we set our first energy efficiency target – a 10% reduction in energy consumption by 1999. In 1997 we initiated a request for proposals for an Energy Performance Contract, which culminated in our becoming a “Pilot Project” for the BC Government’s Green Buildings BC Retrofit Program. In 2000 we were able to sign our Energy Performance Contract, in accordance with the new BC Government Policy.

As part of that project, we engaged an “Energy Management Consultant” to assist us manage the contract, verify the savings and to develop an ongoing “Resource Management Strategy”. Consequently, we incorporated our 1996 target into a new target to reduce our electricity, gas and greenhouse gas consumption and emissions by 16%, 15%, and 15% of 1994 levels respectively.

In 2001–02 we implemented: energy efficiency training programs for our operators and facility managers; energy efficiency and climate change awareness initiatives for our students, and a communication program to inform our community of our efforts and compiled case histories for media packages.

In October 2002, we introduced a new initiative and a further 5% annual reduction target. This raises our target to a reduction of 20% of our 1994 consumption. This is an annual reduction of 560 tonnes of CO₂e. Furthermore we will incorporate climate change policies into our electronic work order system and implement a full resource management system and water conservation program.

Results

We are currently finalizing the commissioning and verification of the electrical measures implemented at the Surrey Campus and the natural gas measures at Richmond, Langley and Surrey campuses. However, we have verified that we have reduced electrical consumption by an amount equal to 45% and 36% of our 1994 base year consumption at the Langley and Richmond Campuses.

We are now tracking greenhouse gas reductions. As of October 2002, we have reduced greenhouse gas intensity from 0.43 tonnes of CO₂e/FTE in 1994 to 0.39 tonnes of CO₂e/FTE.

We anticipate further improvements in our greenhouse gas intensity as the results of our Energy Performance Contract and our new 5% program become evident in our utility bills.

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Section 1 - University College Profile

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.

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.

Over 25,000 students, an FTE equivalent of 8232, 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 1,200 people in staff, faculty and administrative positions, with the majority located on the Surrey campus.

1.1. Key Executive Personnel

President
Skip Triplett
(604) 599-2080

Vice President, Learner Support
Derek Francis
(604) 599-2065

Director of Facilities
Karen Hearn
(604) 599-2442

1.2. Mailing Address

Kwantlen University College
12666 – 72nd Ave,
Surrey BC V3W 2M8

1.3. College Survey

Kwantlen University College consists of three post 1990 owned campuses and one older leased facility constructed in the 1970's. The campuses are located in the Greater Vancouver Region in the British Columbia municipalities of Richmond, Surrey and Langley. Gross area is 78,484 m² and usable area is 72,187 m².

Newton Campus (leased)
13479 – 77th Avenue
Surrey, B.C.

This campus consists of four main warehouse type buildings and five individual smaller buildings. All are of similar age built mostly in the 1980's. The buildings on this campus are leased with the exception of one building. Gross area is 14,865.4 m². There are 14,283.6 square metres of usable space¹. It is anticipated that the majority of offerings from this campus will be integrated into the Surrey and Langley Campuses by 2003.

Langley Campus
20901 Langley Bypass
Langley, B.C.

This campus consists of two interconnected main buildings and one separate “shops” building on one site. Across the street is one large building connected to an attached commercial type green house. At that same site is an adjoining shop and poly type greenhouses, which are also heated. This is a purpose built facility constructed in 1993. Gross area is 18,310.20 m². There are 16,931 square metres of usable space.

Richmond Campus
8771 Lansdowne Road
Richmond, B.C.

This campus consists of one concrete low-rise type building with on-grade parking. This building was purpose built in 1992. Gross area is 19,699.90 m². Usable area is 18,137 m², which includes a Conference Centre (420.7 square meters) that opened in 1997.

Surrey Campus
12666 – 72nd Avenue
Surrey, B.C.

This campus consists primarily of five purpose built buildings constructed in 1990 and one building completed in 1999. The original five buildings have a usable area of 17,324 square metres. The new building (1999) has 5,511 square metres of usable space. Gross area is 25,908.90 m².

1.4. Enrolment and Staffing Levels

Year	Funded FTEs
1993-4	6191.2
1994-5	6452.9
1995/96	6900.1
1996/97	6943.1
1997/98	6991.0
1998/99	7420.8
1999/2000	7593.3
2000/01	8142.5 ²
2001/02	8232.9

Kwantlen has experienced a substantial growth in its Full Time Equivalent (FTEs) over the past ten years. From 1995/96 to 2001/02 the Funded FTE enrolment grew 19.3%. This growth in enrolment has kept conditioned space utilization at capacity over this time period. The Growth in Funded FTEs is outlined in the table to the left.

At the end of the fiscal year 2000/01 a total of 1,285 staff were employed by Kwantlen University College, with 39% located at the Surrey Campus, 29% on the Richmond Campus, and the balance on the Langley/Newton Campuses.

¹ Usable Space consists of those areas used to accommodate a specific function plus the areas used to accommodate mechanical, electrical, building systems, janitor closets, washrooms, corridors, and storage rooms.

² FTEs include foreign and contract FTEs

1.5. Background Description

Kwantlen University College has three modern campuses all with Building Automation System, modern lighting, heating, ventilation and air conditioning equipment. Each campus received "PowerSmart" recognition for energy efficiency design when they were under construction. In addition, when we built our new additional building on the Surrey Campus in 1999 we were awarded "PowerSmart" recognition for energy efficient design. In addition to these three modern campuses there is also a fourth older campus that we hope to be able to replace with newer facilities in future.

However, buildings change to meet the needs of their managers, operators and inhabitants. Consequently, we were able to find energy efficiency opportunities in all of our buildings – in spite of their original design.

Over the evolution of our target setting exercise we have steadily developed a better understanding of our buildings, how they perform and the people charged with operating and maintaining them.

These valuable lessons have enabled us to not only achieve substantial savings and have highlighted the importance of our Preventive Maintenance and Continuous Improvement Programs.


Full description of our various energy and water consuming systems are available upon request.

Section 2 - Energy Management Policy

2.1. Commitment of Kwantlen University College

Kwantlen University College is committed to cost-effective resource management within all of its facilities. We are also committed to being environmental leaders within the various communities that house our campuses. Waste

Figure 1: Waste Reduction



**waste reduction
at kwantlen**

REDUCE consumption. Less is best! For our efforts to truly have an impact, we must reduce all consumable waste products.
REUSE materials whenever possible. Choose re-usable rather than disposable products.
RECYCLE all materials accepted by our programs.
RECOVER all useful materials for reuse before disposal. Think about what you are throwing away! Trade your waste products where possible.
REPLACE environmentally harmful products with more sensitive ones.
RESOURCES and here is an extra "R" for a few interesting links to other sites.

reduction is promoted throughout our Campuses. Our program principles were identified in 1991 and are summarized in Figure 1. We have worked with Natural Resources Canada's Office of Energy Efficiency and the Climate Change Voluntary Challenge and Registry (VCR) for the past seven years. We have progressively increased our targets and investments in energy efficiency. Our commitments are further outlined in Table 1.

Table 1: Commitments

Commitment Date	Committed
June 28 1995	Kwantlen implement policy on Sustainability
September 1 st 1995	Kwantlen joined the Energy Innovators Initiative.
September 14 th 1995	Registered with Canada's Climate Change Voluntary Challenge and Registry (VCR)
June 6 th 1996	Kwantlen committed to reduce energy by 10% by 1999
June 1997	Kwantlen issued an Expression of Interest for an Energy Performance Contract as part of its commitment to reduce energy by 10% by 1999. Kwantlen started negotiations with the BC Government for permission to enter into an Energy Performance Contract.
July 1999	Kwantlen agreed to be a "Pilot Project" to assist the B.C. Government develop the Green Buildings BC – Retrofit Program. Kwantlen received permission from the BC Ministry of Finance and Corporate Relations to finance a \$2 million Multi-Year Energy Services Contract.
July 1999	Kwantlen Developed an Eco-Efficiency Action Plan for its three owned campuses (Langley, Richmond and Surrey) NRCan's Office of Energy Efficiency approved an Energy Innovators ^{PLUS} Incentive to support the project. Kwantlen committed to annual reporting to the VCR, to implement a Community Communications, Employee Awareness and a Facility Manager/Operator Training Program.
September 14, 2000	Kwantlen signed an Energy Services Agreement with Vestar Ltd. to implement the energy efficiency project at the Langley, Richmond and Surrey Campuses (owned facilities). Kwantlen amalgamates the 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 ₂ e by 420 tonnes.
October 22 nd 2002	Kwantlen commits to implement a "Sustainable Resource Management Program" <ul style="list-style-type: none"> □ A program of continuous improvement. □ A further commitment to reduce energy and greenhouse gas emissions by 5% from 1994 levels – a further 139 tonnes of CO₂e. □ Full implementation of energy and greenhouse gases monitoring program and annual reporting to the VCR. □ A commitment to introduce "green procurement" policies that include greenhouse gas management policies, resource management policies and water conservation.

2.2. Energy Management Goals and Targets

Kwantlen first introduced energy efficiency policies and targets in its June 1996 letter to the 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 increase targets as appropriate.

Table 2: Targets

Target	Results
1996 to 1999: Reduce Energy Consumption by 10%	Incorporated into EPC target in Sept 2000
Sept 2000: Energy Performance Contract by 15% of 1994 consumption and 420 tonnes of CO₂e	
□ Richmond Campus Natural Gas Target – 3,800 GJ/ year	Verification Stage
□ Richmond Campus Electricity Target – 1,300,000 kWh/year	Verification Stage (see Figure 5)
□ Surrey and Langley Natural Gas Target – 3,042 GJ	Verification Stage
□ Surrey and Langley Electricity Target – 668,000 kWh	Verification Stage (see Figure 5)
□ Kwantlen Combined Target – Greenhouse Gas Reduction Target - 1,968,441 kWh, 337 kW, and 6,842 GJ of natural gas	Verification Stage (see Figure 5)
2002: 5% Annual Energy Efficiency Target and a further 139 tonnes of CO₂e Greenhouse Gas Reduction Target by 2005.	New

2.3. Energy and Greenhouse Gas Management Objectives

1. To assist the government of Canada to meet its anticipated Kyoto Commitments through a program of continuous improvement in energy efficiency.
2. Continue to increase the awareness of climate change within our student and local communities through an expanded awareness program.
3. To incorporate greenhouse gas reporting into our energy and water monitoring program and to expand our Metrix monitoring back to 1994 for our GHG baseline.
4. Maintain ongoing “green purchasing and management policies” including waste reduction, energy consumption and greenhouse gas emissions into our electronic procurement system.
5. Proceed to the next phase to our energy and emission management program. This will include further measures to further reduce energy, water and solid waste production in all of our campuses. Our new “ratcheted up” energy efficiency target is a further 5% reduction in annual use (based on 1994 levels) by 2005.
6. To create a “Facilities Supervisor” position for our campuses. To provide in depth training for the Facilities Supervisors including energy efficiency and greenhouse gas management.

2.4. Key Personnel Involved (Planning and Management Team)

Name	Title	Role/Responsibility
Karen Hearn	Director, Facilities	Chair of Energy Efficiency & Greenhouse Gas Committee
Dan Brown	Manager, Physical Plant	Energy Efficiency Project Manager
Tom Knox	Energy and Emissions Consultant	Consultant
Barry Mohring	Facility Manager	Richmond Campus
Craig Regan	Facility Manager	Surrey Campus
Iain Hunter	Facility Manager	Langley and Newton Campuses

2.5. Additional Policy Information

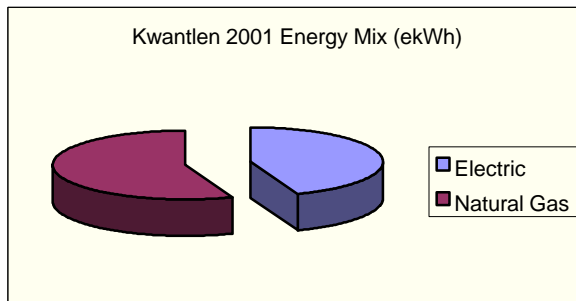
1. In the spring of 1997, Kwantlen University College issued an RFP for an Energy Performance Contract. We were a little ahead of our time and approval by the British Columbia Government was not forthcoming. However, in July 1999 we agreed to be a “Pilot Program” for what eventually became the Green Buildings BC – Retrofit Program. Over the past two years we have worked closely with EnviroVest Energy Ventures Inc. and the BC Government to develop and test the various contracts and procedures necessary for the Program’s success.
2. In 2002 we plan to create three “Facilities Supervisor” positions. These individuals will each be assigned to an educational region. They will be responsible for onsite operation and maintenance activities. This will include the energy efficient management of each campus, and the preventative maintenance program that will ensure that the energy savings are maintained.
3. Many programs at the Newton Campus will be transferred to the more modern facilities at Surrey and Langley Campuses and remaining offerings at Newton will be incorporated into fewer buildings until we are able to construct replacement facilities. This will significantly improve our energy and greenhouse gas consumption per square meter and per student. It is anticipated that overall consumption will be reduced but that consumption at the Surrey Campus will increase.

Section 3 - Energy Use and Costs

3.1. Energy Consumption and Cost

Kwantlen University College purchases its electricity from B.C. Hydro and its Natural Gas from B.C. Gas and Premstar (a Natural Gas commodity broker). The Energy Mix in 2001, in terms of Equivalent kWh is outlined in Figure 2.

Figure 2: 2001 Energy Mix



Figures 3,4 and 5 provide utility bill data for each of Kwantlen's four campuses for the period 1994 to 2001. They are based on the billing data and have not been normalized for weather, billing days or occupancy. Electricity consumption in 2001 is ~5.8% lower than in 1994, primarily due to ongoing efforts to incorporate efficiency measures into capital and operating activities. This is in spite of the addition of the conference centre and the new building at Surrey Campus and an increase in utilization to meet the increased student FTE. It is anticipated that the savings from the natural gas measures will begin to be apparent in 2002-03 heating season.

In developing its Energy Performance Contract, Kwantlen chose to use 1997 as its base year. This was because of the availability of utility billing data and the need to eliminate some of the undocumented physical changes to the buildings and their energy consuming systems that occurred from 1994 to 1997.

For our efforts to track Greenhouse Gas Reductions as part of our commitment to the VCR we will use Calendar Year 1994 as our base year. As part of our Phase 3 energy efficiency program we will complete the normalization of the utility bill data using the Metrix® Utility Management Software.

In 2002, we completed or will complete the commissioning phase of our Energy Performance Contract at the Richmond, Surrey and Langley Campuses. Figure 6 illustrates the impact of the electrical measures with respect to our 1994 base year. At this time we have not adjusted the consumption levels for increased energy consuming equipment, such as computers, weather, enrolment or hours of occupancy.

Figure 7 illustrates our historical emissions of greenhouse gases. It contains both direct and indirect emissions. The breakdown in terms of N₂O, CO₂ (direct and indirect) and CH₄ are included in the Table in Figure 8. Kwantlen is a rapidly growing University College and consequently experiences significant growth in "plug loads" computers, hours of use – Mandarin Language Classes on Saturday, enrolment, and a myriad of other variables, which impact on energy consumption. However, our continuous efficiency improvement efforts, when measured as emissions per Full Time Equivalent demonstrate that today we are below 1994 levels and will be even lower when the full impact of our EPC and new 5% commitment are felt. The historical and forecasted greenhouse gas emission intensity (in terms of tonnes of CO₂ Equivalents/FTE) is contained in Figure 9. We have displayed both "Business as Normal" (No Action) and the Energy Efficiency Scenarios. Our current ratio of 0.39 is 9% lower than our 0.43 ratio in 1994.

Figure 3: Electrical Consumption 1994 to 2001

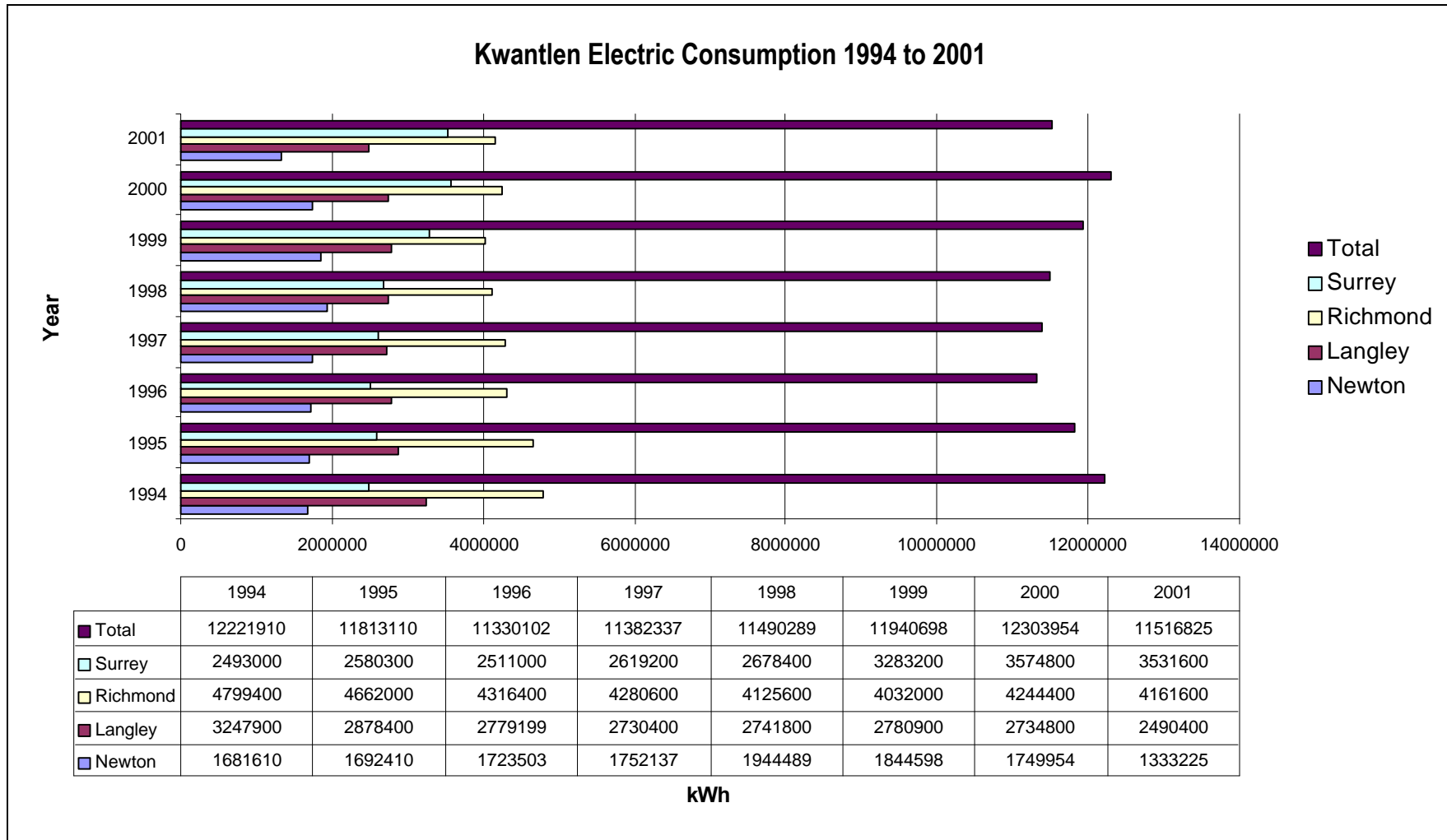


Figure 4: Natural Gas Consumption 1994 - 2001

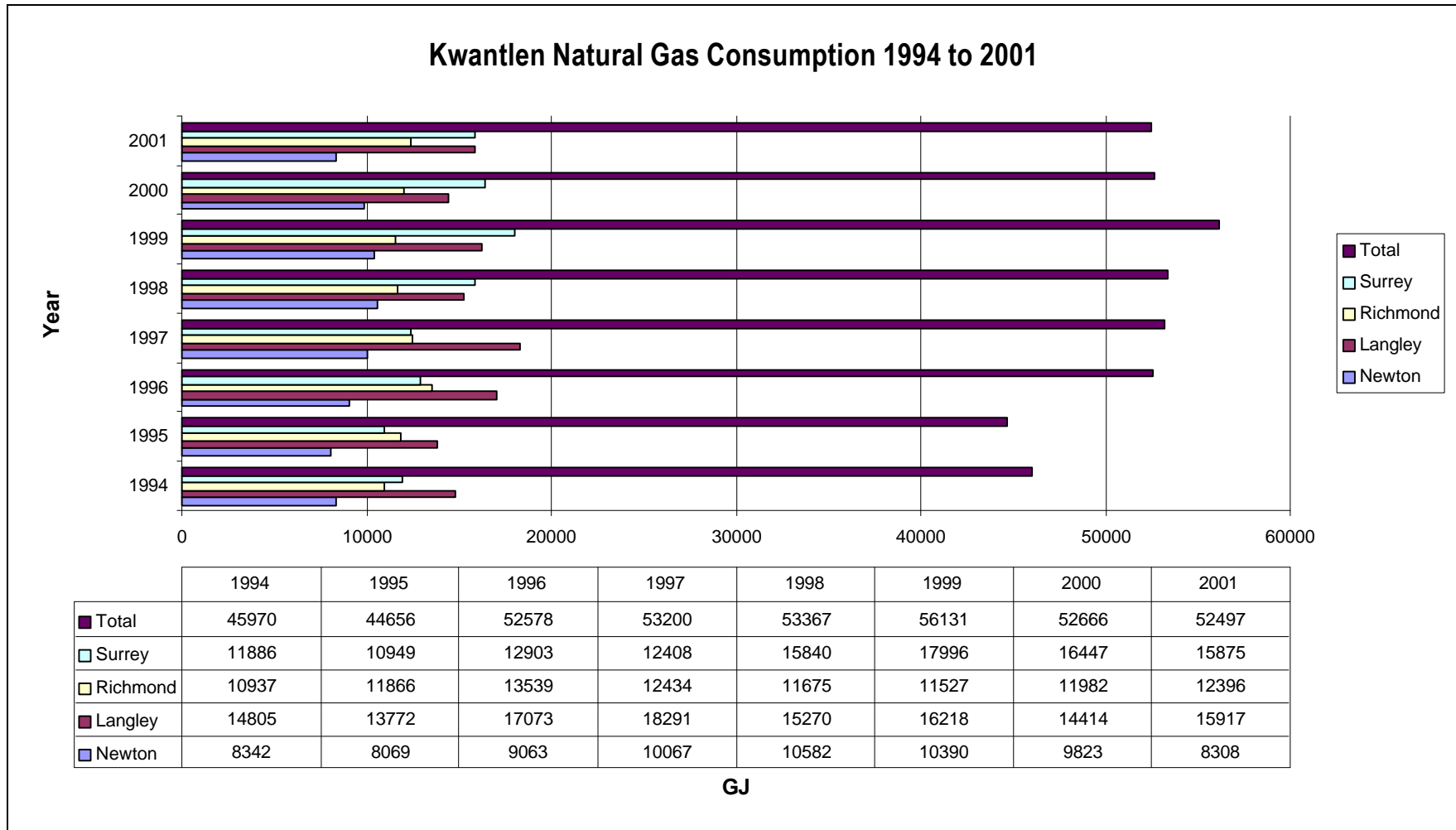


Figure 5: Energy Bills 1994 to 2001

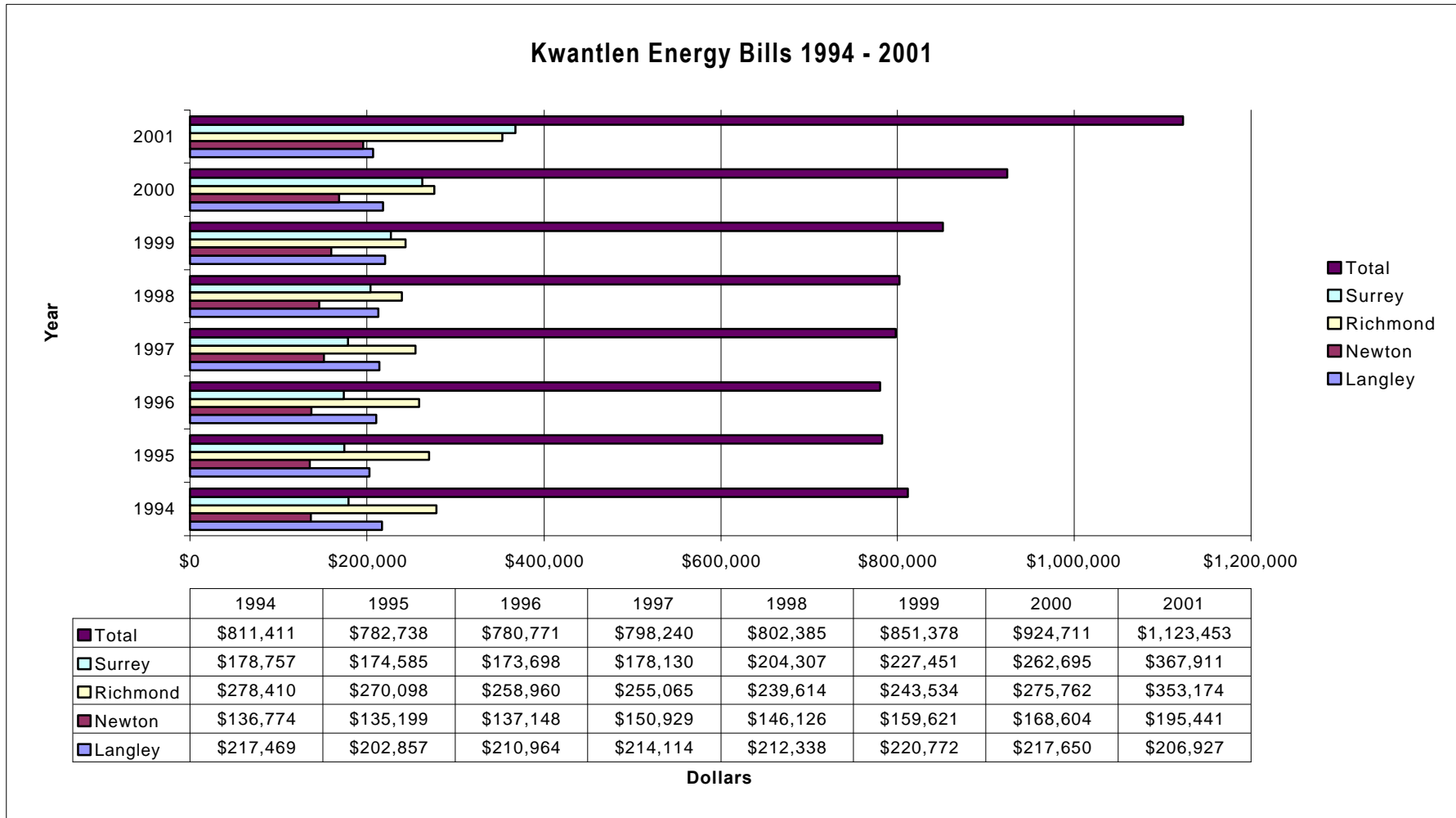
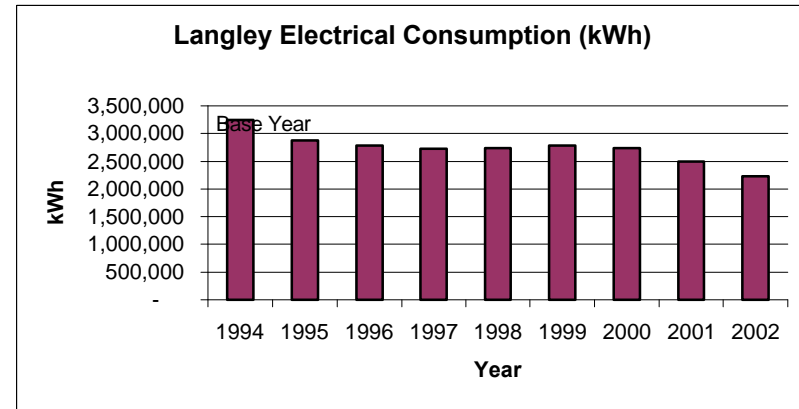
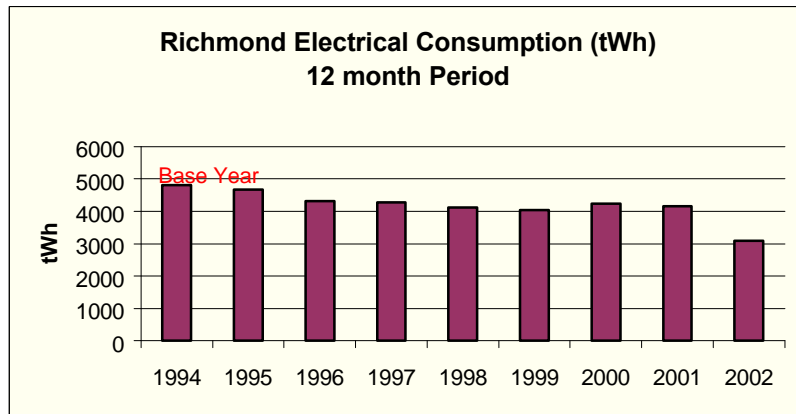


Figure 6: Richmond and Langley Campuses Initial Impact of the EPC Savings



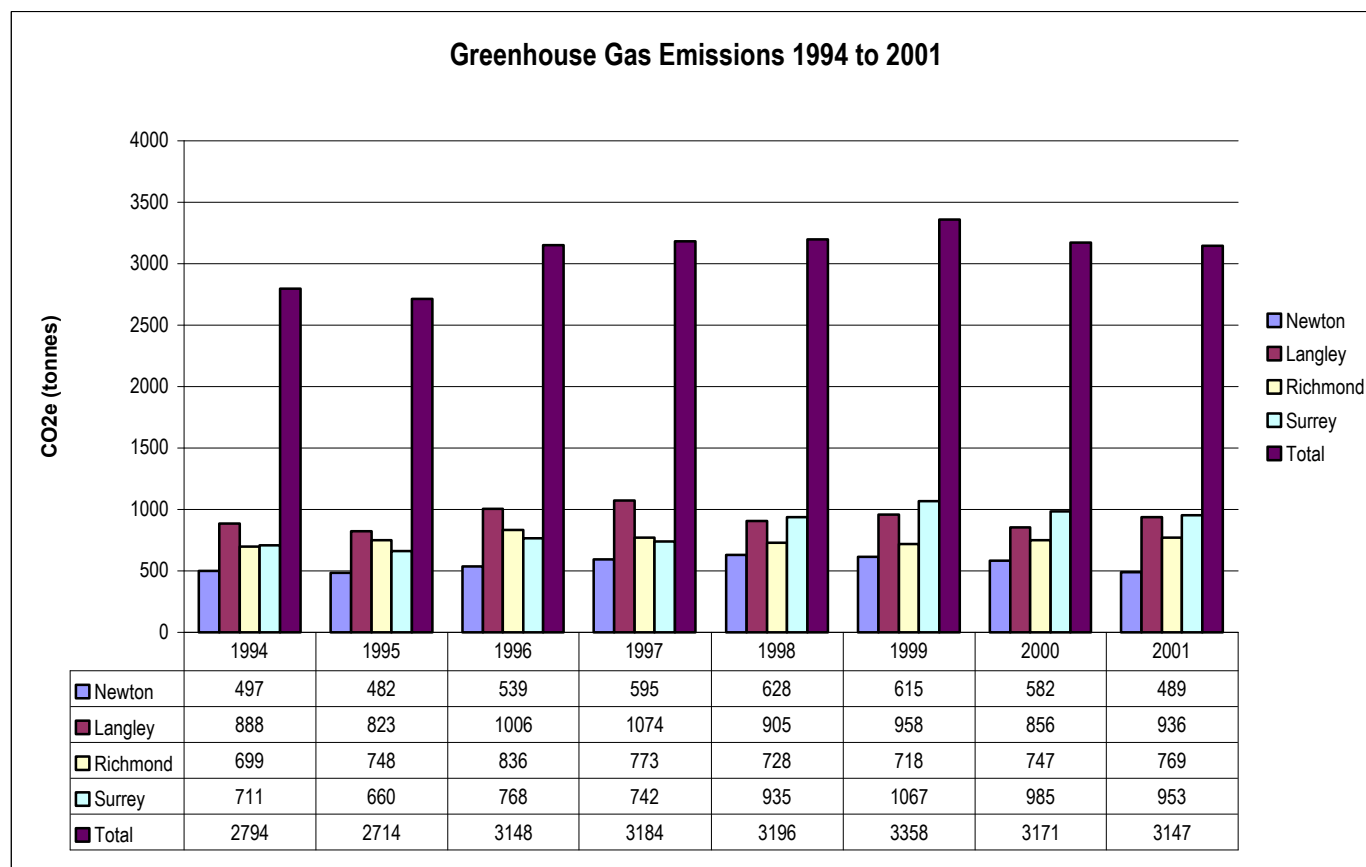
Notes

1. The 2002 period is based on the 12 months from October 2001 to September 2002 to illustrate some of the early results of the Energy Performance Contract.
2. The electricity consumption data is based on actual billing and has not been adjusted for weather, increased enrolment, increased space, increased plug load from new computers or other variables. This will be done as part of the next phase of the project.
3. The early results of the electrical efficiency measures indicate that consumption savings in the order of 45% and 36% from 1994 to 2001-2002 at Langley and Richmond Campuses respectively.
4. It is anticipated that the electrical savings from the Surrey Campus and the natural gas savings from Surrey, Richmond and Langley Campuses will start to show in the 2002 winter utility bills.
5. Kwantlen, is committed as part of the insurance reconciliation process to update the baselines incorporating all variables – weather, enrolment, plug load and changes to the amount of conditioned space.

Confirmed Savings

6. We have now verified the electrical savings at the Richmond Pilot Project.

Figure 7: Greenhouse Gas Emissions – 1994 to 2001



Notes

Based on actual utility bills.

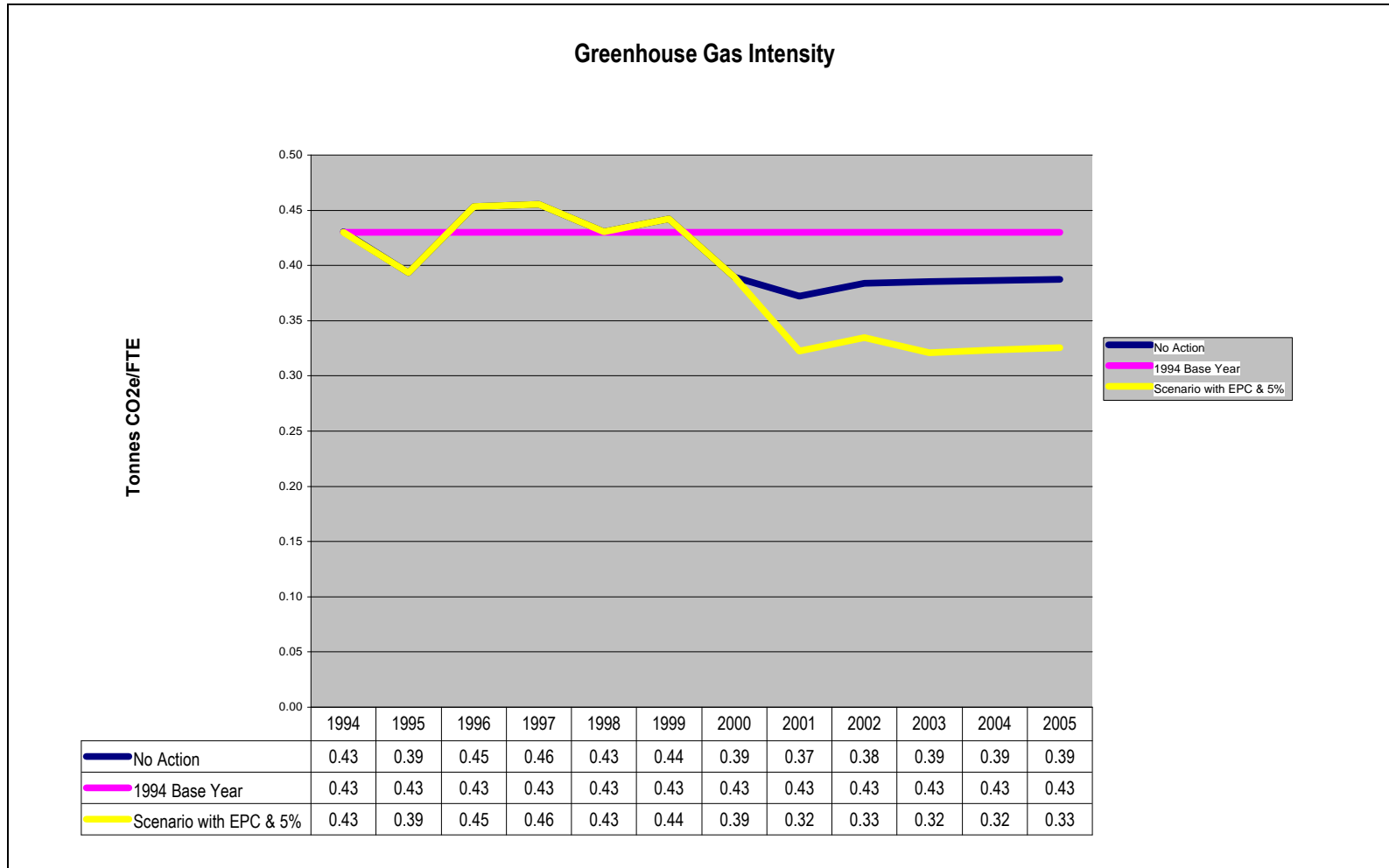
Figure 8: Equivalent CO2 Emissions

	Full Time Equivalent (FTE)	CO ₂ Direct (Equiv. CO ₂ Tonnes)	CO ₂ – Indirect (Equiv. CO ₂ Tonnes)	N ₂ O (Equiv. CO ₂ Tonnes)	CH ₄ (Equiv. CO ₂ Tonnes)	Total (Equiv. CO ₂ Tonnes) No EE	Total (Equiv. CO ₂ Tonnes) EPC+5%	Equiv. CO ₂ tonnes/FTE
Baseline – 1994	6492	2284	204	9.1	281.6	2778		0.43
1995	6900	2219	213	8.9	273.5	2714		0.39
1996	6943	2612	204	10.4	322	3148		0.45
1997	6991	2643	205	10.6	325.9	3184		0.46
1998	7421	2651	207	10.6	326.9	3195		0.43
1999	7593	2789	215	11.1	343.8	3358		0.44
2000	8142	2616	221	10.5	322.6	3171		0.39
2001	8456	2608	207	10.4	321.5	3147		0.37
2002	8587	2759	184	11.02	340.2	3295	FORECAST	0.38
2003	8722	2814	188	11.24	347	3361	2801	0.39
2004	8872	2871	192	11.46	354	3428	2868	0.39
2005	9022	2928	196	11.69	361	3497	2937	0.39

Notes:

1. 2002 Emissions are based on actual January to September plus October to December from the previous year.
2. Forecast assumes constant FTE growth of ~2%/year from 2002 to 2005.
3. Forecast assumes an emission increase of 2% per year over the previous year from 2002 to 2005.

Figure 9: Greenhouse Gas Emission Intensity



Notes

1. When Kwantlen meets its EPC Targets plus 5% its GHG Intensity will be substantially below its 1994 CO₂ Equivalent emission level.
2. No Action is really business as normal but includes the impact of incorporating energy efficiency and climate change into our ongoing operations and capital projects.

3.2. Special Events and Other Variables

The following are variables, which have impacted on energy consumption over the tracking period or will impact on energy consumption in the future.

- ❑ An increase in student enrolment and the expansion of the hours of use of the various campuses to accommodate the increased demand.
- ❑ The addition of the Conference Centre at the Richmond Campus and the new building at the Surrey Campus.
- ❑ The planned closing of the Newton campus and the incorporation of the students in the other Campuses. The potential expansion by building a new Campus at Cloverdale.
- ❑ The increased use of computers and computer instruction. For example more than 300 computers (75,000 kWh) were added during the 2000-2002 period.

3.3. Additional Operational Information

3.4. Baselines

3.4.1 VCR Emission Baseline

Kwantlen has continuous utility bill data from 1994 to present. Therefore we have chosen to use 1994 as our emissions baseline for our VCR Action Plan. The utility data in this document was created using the actual billing data. As part of the Monitoring and Verification Protocol, Kwantlen will normalize the baseline for weather, enrolments and other variables and create a normalized baseline, which can be used to track our emission reduction progress.

3.4.2 EPC and Energy Savings Insurance Baseline

Our Insurer Provider – CGU Insurance Company requires much more stringent definition and tracking of those variables, which impact on the baseline. Consequently, we chose 1997 as our Base Year for our Agreement. We have Metrix Baselines for the period 1997 to 2001.

Section 4 - Energy Management Programs and Actions

4.1. Phase 1

Energy Management was initiated at Kwantlen University College in 1991 by incorporating energy efficiency into the ongoing operating and capital budgets. Kwantlen operates from 4 campuses with a total of 72,187 square meters of usable conditioned space. Energy Management activities included introducing lighting controls and optimizing boiler and chiller plants. At the same time alternate operator strategies were introduced.

In 1995 Kwantlen joined the Natural Resources Canada's Energy Innovators Initiative and set its first energy efficiency goal – to save 10% of Kwantlen's 1996-1999 energy consumption by the year 1999.

In 1997 as part of this initiative Kwantlen University College issued a Request for Proposals for an Energy Performance Contract. A successful bidder was chosen and negotiations began with the B.C. Government to allow Kwantlen University College to sign an Energy Performance Contract with Vestar Ltd. and initiate the project. In 1999, Kwantlen engaged "EnviroVest Energy Ventures Inc. (EnviroVest) to assist in the development of the project.

4.2. Phase 2

On July 14, 1999 Kwantlen received permission to borrow \$2 million to initiate the project as long as the energy savings fully covered the debt servicing and the debt was non-recourse.

In September 2000 Kwantlen entered into an Energy Performance Contract with Vestar Ltd. It was decided at that time that Kwantlen would purchase Energy Savings Insurance from CGU and self-finance the project from its Endowment Fund.

In the fall of 2000, Kwantlen retained a "full time" Energy Manager Consultant on contract to manage the EPC and to initiate a verification program to ensure that the estimated savings outlined in the Feasibility Study materialized. After a careful review of the savings estimates Kwantlen and its Energy Savings Insurer reduced the level of savings, eliminated some of the measures and added a number of new measures.

Technologies installed include new VAV controllers integrated with lighting occupancy sensors that go to minimum settings when the building is unoccupied, isolation dampers isolating portions of a duct system for rooms with a different operating schedule, digital thermostats for precise control and feedback, VFD pumping, boiler controls, motor controls, recommissioning the building management system, occupancy sensors triggered by sound in addition to movement, new BMS algorithms, control of exhaust systems and vending machines, (public and staff) awareness and training programs, and media and promotion programs.

There are 8 measures for the pilot buildings and 24 including the replications. Five measures were found common in each building:

1. Lighting
2. Variable speed drive pumping or fan control
3. Boiler control
4. BMS Recommissioning
5. Vending machine control (total 25 machines)

Monitoring loggers for lighting, were installed for calculation of savings if monitoring points from the BMS were not available. This will ensure objectives are met *and* maintained.

Programs incorporated in the project provided a significant enhancement.

- ❑ Occupant awareness and interaction
- ❑ Fixture / switching program – new renovations
- ❑ Training Program
- ❑ Awareness program – staff, students, others
- ❑ Communications (Media) program

Practices, Schedules and Policies in various stages of development by the Facilities Department will contribute to comprehensiveness of the project:

- ❑ Checking occupancy sensors
- ❑ Cleaning reflectors
- ❑ VFD operation review
- ❑ Various (data) **trend logs** were designed and setup to automatically generate various reports (motor operating hours, outdoor air temperatures, etc.) through the BMS and store reports to computer hard drive.
- ❑ Design and setup of various **alarms** indicate conditions related specifically to a measure.

As an example, one measure reduces operation of atrium exhaust fans unless temperature is over 44 deg. C. Actual data indicates fans now operate only 5 to 10% of original operating hours. Alarm printouts are generated if operating hours go over user-designated hours. This alarm setup is actually a measure in itself since it automatically shows when a measure is not working. It may also show that some part of the building operation has changed and the measure should therefore be reviewed for applicability, safety or potential increased maintenance costs.

4.2.1 Training of Operators and Buildings Managers

As part of our EPC we provided training to those employees who are responsible for ensuring that the savings sustain themselves.

An active and relevant training program is a valuable program component. Operating staff were consulted to ensure questions would be answered, allowing them to operate new equipment both effectively and with generally less labour. The pilot training program took place for 7 staff. Approximately 20 facilities staff will ultimately be trained once replications are complete. Each measure was required to address at least the following topics:

- ❑ Savings potential (\$ and energy and percent of original)
- ❑ Reason for Change
- ❑ Other Benefits (non-monetary)
- ❑ Principles of (measure) operation
- ❑ Rationale of Operation
- ❑ Potential Problems
- ❑ (Staff) Actions on Failure
- ❑ Maintenance Required
- ❑ Warranty Details (warranty end date, phone numbers, contacts)

4.2.2 Awareness Program

An active internal awareness program was a significant feature of this program. Items included:

- ❑ Emails and memos to staff
- ❑ Promote program at student gatherings
- ❑ Product giveaways
- ❑ Delamping stickers and 'posters' (for both maintenance and occupant communication)
- ❑ General project awareness posters
- ❑ Articles in the Kwantlen "Connection" newsletter for staff and students
- ❑ Presentations to administration support personnel

4.2.3 Communications Program

The communications strategy is primarily directed more outside the campus community, although there is an overlap with the awareness program. The strategy is considered an important part of what is typically only a hardwire and hardware project. It includes photographs and ½ to 2 page case histories of each measure for compilation to a Communications / Media manual. Various distribution networks will then be considered:

- ❑ Community newspapers
- ❑ Award Programs
- ❑ Presentations to Kwantlen University College Board
- ❑ Trade magazines
- ❑ Facilities Professional Organizations conference presentations.

4.2.4 Supplier Policy Influence

As part of our greenhouse gas management program we are requesting that all waste management companies that wish to service our four campuses utilize compactors. This will lead to a 95% decrease in truck travel to the dumps and an associated reduction in greenhouse gas emissions. We will quantify the emission reductions and communicate the results and the benefits to other institutions in BC and Canada.

Phase 3

4.3. Phase 3

In 2002-03 we will implement our Phase 3 project, which consists of a number of measures, both water and energy which were identified during our EPC but not implemented. At the same time we will provide training to our Facilities Supervisors so that they can manage the various campuses in an energy and water efficient manner.

4.4. Past and Currently Undergoing Projects and Actions

Project/Action	Objective	Target	Details	Date	Responsible	Investment	Savings		
							CO ₂ e	kWh	(GJ)
Richmond Campus	Save Energy and reduce Emissions and reduce costs	10% by 1999 631,799 kWh 4019 GJ natural gas \$40,000 Rolled into EPC Target in 1998	Variety of measures including lighting, Cooling and heating Plant Optimization, DDC conversion	1993	Manager, Physical Plant	Part of Capital – Operating Budget		40,000	
Langley Campus	Save Energy and reduce Emissions and reduce costs	10% by 1999 Rolled into EPC Target in 1998	Boiler modifications	1999	Manager, Physical Plant	Part of Capital – Operating Budget			
All Campuses	Save Energy and reduce Emissions and reduce costs	10% by 1999 Rolled into EPC Target in 1998	Operational Optimization and Lighting Controls	1996	Manager, Physical Plant	Part of Capital – Operating Budget			
Richmond Campus EPC	Save Energy and reduce Emissions and reduce costs	3,800 GJ/yr 1.3 million kWh 236 tonnes CO ₂ e	Comprehensive controls, lighting, VSDs, Heat Recovery	2000-02	Vestar Ltd	\$880,000	236 tonnes	1.3 million	3,800
Langley and Surrey Campus EPC	Save Energy and reduce Emissions and reduce costs	3,042 GJ/yr 688,000 kWh 184 tonnes CO ₂ e	Comprehensive controls, lighting, VSDs, Heat Recovery	2000-02	Vestar Ltd	\$820,750	184 tonnes	688,000	3,042

Proposed Actions and Projects

Project/Action	Objective	Target	Details	Date	Responsible	Investment	Savings		
							CO ₂ e	kWh	(GJ)
Phase 3: All Campuses (See Annex 2)	Reduce Energy and Emissions	5% reduction in annual energy consumption based on 1994 consumption	<ol style="list-style-type: none"> 1. Reviewing base night time load - never less than 200 kW after the project 2. Replacing incandescent Atrium lighting 3. Computer use at night 4. Compressor operation at night 5. UPS operation 6. Exterior Parking lot lighting at night 7. Exterior Building lighting at night 8. Interior lighting at night (when building closed to public) 9. Cleaning staff use of the building at night 10. Water conservation measures 11. Turning off all non-code required lighting when the building alarm system is engaged 	2002	Tom Knox	\$50,000 initial	139	5%	5%
Expanded Awareness Program	Sustain Savings		Add information on energy savings tips to Web Site	2002	Manager Physical Plant				
Preventative Maintenance	Sustain Savings	N/A	A Comprehensive Preventative Maintenance Program is contracted to ensure that the savings are sustained.	Ongoing	Manager Physical Plant				
Green Purchasing	Sustain Savings		Ongoing work to ensure the procurement system complies with better tracking of energy and water consuming equipment and to ensure that efficiency is a part of all purchase decisions.	Ongoing	Director, Material Management				

Section 5 - Future Reporting

As part of Kwantlen University College's commitment to energy management and to its membership in the Energy Innovators Initiative Kwantlen will submit annual update reports to the Office of Energy Efficiency and the Climate Change Voluntary Registry Challenge. Kwantlen will continue to set targets and report on its efficiency gains and emission reductions. Our Monitoring and Verification Protocol will be completed in 2002-03 and annual reconciliation of the savings will be undertaken with the Insurance Company. We will also incorporate variables into our VCR CO₂ Equivalent Baseline and tracking system.

Our monitoring system will be based on the Metrix® Utility Management System and we will extend our current Metrix files back to 1994.

ANNEX

5.1. Monitoring and Verification

Kwantlen University College uses the Metrix® Utility Accounting System to develop and define our base year and track future energy consumption, demand and greenhouse gas emissions as part of its Energy Performance Contract. We selected 1997 as the base year. The utility bills are adjusted for the key variables such as weather, hours of use and enrolment. Metrix is also used to monitor consumption and demand reductions and track future energy efficiency opportunities and savings. Metrix will also be used to reconcile our energy and water savings annually with CGU Insurance our energy savings insurance company and to report our results to the VCR.

For our efforts to assist the Government of Canada to meet its international climate change commitments, we will establish 1994 as our baseline.

5.1.1 Energy Savings and Emission Reduction Verification

We use a variety of methods to measure and verify the energy savings resulting from our various measures. Our foundation verification strategy is the 'whole building approach' detailed as Option 'C' in the North American Energy Measurement and Verification Protocol (NEMVP) using the Metrix Utility Accounting System. However we supplemented the utility bill analysis with the following strategies:

- ❑ An independent electrical contractor was hired to measure power from a number of circuits that had either lighting or other electrical measures installed (before and after).
- ❑ Demand (kW) loading was recorded through the Building Management System (BMS) and taken at 15 minute intervals
- ❑ Lighting loggers were purchased to measure operating hours for use in monitoring and calculations with operating hours for lighting savings.
- ❑ Temperature and humidity loggers were purchased for monitoring and subsequent calculation of savings (electrical and gas) for various HVAC systems and for ongoing optimization of existing measures.
- ❑ Hourly operation trend logs were installed on motors to determine actual effectiveness of measures intended to minimize use.
- ❑ Use of existing sensors (e.g. Outdoor air) to monitor summer temperatures to enable 'free-cooling'.
- ❑ Use of existing BMS points to record operating times before and after the measures were implemented.

During the Feasibility Study, we established calendar year 1997 as the base year. The establishment and verification of the baseline energy use was done during the feasibility study, and is thereafter monitored and maintained throughout construction and for the duration of the guarantee period.

- ❑ Our Insurance Company's engineers reviewed the feasibility study, the baseline and verified the forecasted savings as part of the insurance approval process, and
- ❑ Engineering staff from the local electric utility reviewed the project on-site after commissioning and verified expected savings.

5.1.2 Independent Verification

During the course of our emission reduction efforts we have utilized a number of methods of independent verification. As noted above the energy services company of record was Vestar Inc. However, we have engaged EnviroVest Energy Ventures Inc. to verify that the measures were generating the estimated energy and emission reductions plus a number of independent contractors to implement specific monitoring and measurement tasks.

We also utilized BC Hydro to verify anticipated electrical savings and indirect emission reductions. Further more we purchased 3rd party insurance for the project from CGU Insurance Company, who have engaged an independent engineering firm Finn Projects Ltd. of Toronto to review and verify the various savings. This will result in an insurance policy that will guarantee that the measures are generating the savings and emission reductions.

Sample Calculations

5.1.3 Greenhouse Gas Emissions

The required conversion factors were taken from the VCR website. The College Sector Handbook provided the conversion factors for natural gas – CO₂, N₂O and CH₄.

5.1.4 Glossary of Terms and Abbreviations

CO ₂ e	Carbon Dioxide Equivalent
ekWh	Equivalent kilowatt hours
FTE	Full Time Equivalent
GHG	Greenhouse Gas
GJ	Gigajoules
GWP	Global Warming Potential
KWh	Kilowatt hours
M ²	Square meters
NRCan	Natural Resources Canada
OEE	Office of Energy Efficiency
TJ	Terajoules
VCR	Voluntary Challenge and Registry

Annex II: Emission and Energy Savings Phase II and III

See next page