A Successful Energy Savings Program at Two Aberfoyle

Our successful Energy Savings Program at Two Aberfoyle has achieved an average of 32% savings in gas consumption and 18% in electricity consumption over the first two years. Savings and incentive payments have repaid the $165,000 investment in equipment early in the third year.

We feel good about our program. The energy savings are a reduction of 482 Tonnes of CO2 per year and equivalent to taking 135 cars off the road. For estimating data see:
www.seen.org/pages/db/method.shtml
www.ecobusinesslinks.com/carbon_offset_wind_credits_carbon_reduction.htm

Ours is a multi-storey, residential, condominium building with 116 suites on twelve floors, two underground parking levels, and with HVAC equipment on the roof. The common area on the first floor includes a party room, billiard room, exercise room, washrooms, change rooms and an indoor pool. The building was first occupied in 2001.

Following is the story of the successful program. Hopefully this story may lead others who have not yet done so to pursue a similar program. Some technical, estimating and financing details have been included that may be of interest. Some helpful suggestions are made based on our experience.

Developing the Recommendation of Projects

In 2004 our Board of Directors decided to pursue energy savings and an Energy Savings Committee was formed. One source of energy-saving ideas is found at the CHMC website (www.cmhc.ca/en/inpr/bude/himu/waensati/index.cfm).

The City of Toronto Better Buildings Partnership (www.toronto.ca/bbp/index.htm) lists prequalified energy management firms. The committee approached three of these, provided them with a list of energy-saving possibilities, and requested proposals. Representatives of the three firms toured the building, provided written proposals, and then presented those proposals to the committee in evening meetings.

One of the proposals included an estimate from Enbridge of the gas-savings incentive payment to be earned. A copy of their calculations allowed us to estimate gas savings for the individual projects.

In reviewing the estimates, we learned the airflows appropriate for the Make Up Air (MUA) unit which delivers air to the corridors. The calculations estimated the gas savings to be expected by reducing the airflow and by decreasing the temperature setting in the heating season. A lower air flow during the cooling season, and at a higher temperature would also result in.air conditioning electricity savings, although none were estimated. The supplier of the Variable Frequency Drive required to reduce the airflow estimated electricity savings for the fan motor speed reduction for both seasons. Enbridge advises that they can now provide electric savings for the fan motor and Chiller for those buildings that have one.

We also learned that 90% of the gas consumption for boilers is taken care of by 50% of the capacity. This allows one high efficiency boiler, with half the capacity of the system, to capture nearly all the savings that would be available by replacing all of the system's capacity. This is described as a lead/lag system, with the high efficiency boiler as lead boiler and the remaining boiler or boilers as lag or backup boilers.

Projects Recommended By the Committee:

1) Variable Frequency Drive (VFD) on the Make Up Air (MUA) Unit ($10,395)
2) T8 Lighting and Electronic Ballasts to Replace T12 Lighting in the Parking Garage ($11,100)
3) Carbon Monoxide (CO) Sensors to Control Exhaust Fans in the Parking Garage ($10,050)
4) High Efficiency Condensing Boiler and Savastat Control to Replace One of Two Atmospheric Domestic Hot Water (DHW) Boilers ($43,740)
5) High Efficiency Boiler and Savastat Control to Replace One of Four Atmospheric Fan Coil Boilers and Repiping to Provide a **Primary/Secondary** Loop ($51,675)
6) High Efficiency Boiler and Savastat Control to Replace One of Two Atmospheric Prime (Common Area/Pool/Slab) Boilers and Repiping to Provide a **Primary/Secondary** Loop $(36,775)

Total Cost $163,735

Response of the Board

The Board was concerned about the reliability of the savings estimates. For payback time calculations, it is better to be conservative in order to not to over-promise and under-deliver. For this reason the savings estimates were reduced by 10% to 25% to be conservative. The electricity savings for the T-8 Lighting and CO Sensors projects, expected to be reasonably accurate, were reduced by 10%. For the MUA VFD both gas and electricity savings were reduced by 15% and the gas savings for the Boiler projects were reduced by 25%.

At the time our gas contract was about to run out, and we were facing a gas price increase. Gas contract price information can be found at www.energyshop.com/ . We expected inflation in the electricity price as well. Expected increases were included in the payback time calculations. The result was payback times of 0.2 years for the MUA VFD, 1.5 years for the T8 Lighting, and approximately 5 years for the CO Sensors and Boiler projects. The overall combined estimated payback time was about two years.

The first three projects were additions of equipment. The three boiler projects required replacement of three four-year old boilers which was cause for concern. However, references provided by a quoting firm indicated that savings of 25% and more were achievable. We tried unsuccessfully to sell the boilers that were replaced. We eventually retained their heat exchangers as spare parts for the remaining atmospheric boilers.

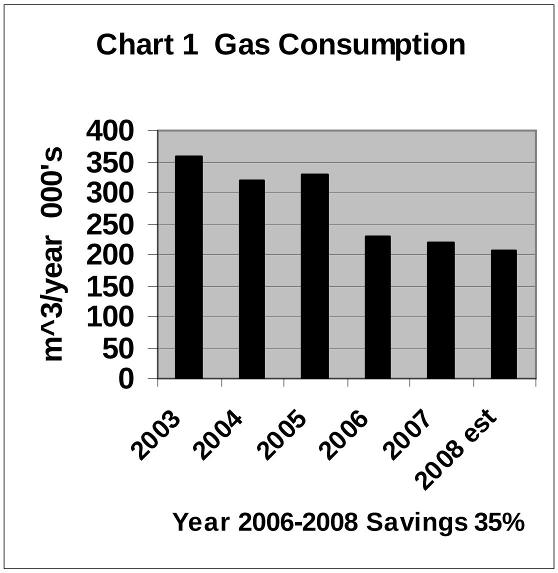
Financing and Implementing the Projects

The Board took a cautious approach and first proposed to pursue the first three projects which were less expensive than boilers and had faster payback. This is sometimes described as “picking the low-hanging fruit”. There is a danger that the more costly and slower payback projects, i.e. the “higher-hanging fruit”, will not get picked. The expression “Show me the money!” also was heard, supporting the cautious approach in order to demonstrate savings, gain credibility, and supply cash for financing further projects.

The Board decided not to borrow money but to finance the projects from the surplus or operating fund. Fortunately the latter was healthy as a result of a significant increase in fees in the early years to provide cash for projects and improve the health of the Reserve Fund. Also, interest on borrowed money would increase the payback time. At this time the building was only 4 ½ years old, so the Reserve Fund for future major maintenance and replacement could not be used. It would be helpful to financing if the Condominium Act would permit borrowing from the Reserve Fund for energy-savings projects under the guidance of the engineer responsible for the Reserve Fund Study. Other government incentives would have been welcomed as well.

The next step was a town-hall meeting with suite owners to acquaint them with the program. Support for the program was good, so good that the fourth project, the DHW Boiler Project was added to the list. The surplus was able to finance it. The plan was to finance the remaining two boiler projects from savings from the first four projects. The end result was a three-year program. The spending in each of the three years was less than 10% of our annual budget. According to Section 97 of the Ontario Condominium Act, the changes were not “substantial” requiring a 66 2/3% vote in favour by owners, but requiring notification of owners.

The first four projects were carried out in the fall of 2005, the fifth in the fall of 2006 and the sixth in the fall of 2007. Charts 1 and 2 show the gas and electricity consumptions for 2003 to 2007, and a projection for 2008.



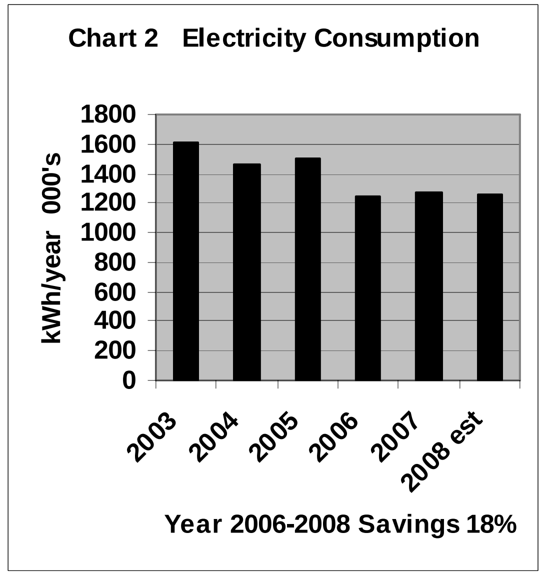


Chart 3 shows the costs of the projects, the expected cost savings in each year, and the actual savings versus the average costs before the program. 2008 is again projected. Note that gas savings incentive payments are included.

Chart 3		Savings versus Costs		
Year	Equipment Costs $000's	Estimated Savings + Incentive Payment $000's	Actual Savings + Incentive Payment $000's	Savings + Incentive Less Costs $000's
2006	$75	$64	$81	$6
2007	$52	$63	$77	$24
2008 Est	$38	$80	$86	$48
Totals	$165	$206	$243	$78

There were several reasons for exceeding expectations in 2006, the first year. It was a milder winter, possibility 10% milder, saving gas (weather data can be found at www.weatherdatadepot.com/dd.asp). The indoor pool was shut down for a significant time, saving both gas and some electricity. There were electricity savings from decreased airflow and increased MUA temperature during the air conditioning seasons which were not estimated beforehand. There were also probably some electricity savings from replacing incandescent light bulbs with compact fluorescent bulbs. Note also that there was an Enbridge gas incentive payment of $12,000, which had been included in the estimates. The achieved savings provided credibility for the program. As a result the Fan Coil Boiler System Project was approved for installation in the fall of 2006.

Savings exceeded expectations again in 2007, the second year. The winter was similar to those before the program, but again there was a significant pool shutdown for repair. Also again there were unestimated MUA air conditioning and other lighting electrical savings. No incentive payment was received or estimated for that year. The savings provided cash for the expected gas price increase and for the third boiler project, installed in the fall of 2007.

In the third year, with the addition of the Prime Boiler Project, a further reduction of MUA airflow overnight, and a further Enbridge incentive, we expect savings to exceed those of the second year, providing the weather is similar to the pre-program levels and there is no significant pool shutdown. For the first three years of the program we expect to reach 96% of the gas savings estimates used in the payback calculations and exceed the electricity savings estimate by 75%. The costs of the program have been repaid by savings and incentive payments early in 2008, the third year.

Some Information Based on Our Experience

1) Variable Frequency Drive (VFD) on the Make Up Air (MUA)

Before the Program our MUA airflow was 143 cubic feet per minute (cfm) per suite. Airflow of 100 to 120 cfm per suite is considered adequate to control cooking odours and provide ventilation to the suites. During non-peak times, e.g.; overnight, even lower airflows are suitable. These measures result in gas savings, fan motor electricity savings and air conditioning electricity savings. Reducing the temperature setting during the heating season, e.g. to 18C (64F), and increasing it during the cooling season, e.g. to say 24C (75F), result in further gas and electricity savings. All of these combined can result in savings of 25% or more and a payback time of a fraction of a year for the Variable Frequency Drive.

The manufacturer of the MUA system should be consulted to determine if the fan motor is suitable for the VFD and what fan speed reductions can be tolerated by the controls of the system and without damage to the heat exchanger. It is possible that the controls may need to be modified.

MUA gas consumption is deducted from total consumption to get consumption by boilers. In our case the MUA gas consumption was overestimated, resulting in the boilers consumption being underestimated. Reduced MUA savings were only partly offset by increased boiler savings. In order to improve the accuracy of the estimates it is recommended to have the preprogram airflow measured, rather than relying on the system fan rating,

Annual gas and electricity consumptions can be quite variable depending on variable heating and cooling loads. We recommend using an average of three years before the program as a basis for estimation of savings and monitoring of performance after installations.

2) T8 Lighting and Electronic Ballasts to Replace T12 Lighting in Parking Garage

Savings estimates based on the number of T12 bulbs replaced by T8 bulbs and the Watts saved per bulb should provide an accurate estimate and a payback time less than two years.

3) Carbon Monoxide (CO) Sensors to Control Exhaust Fans in the Parking Garage

Cost will depend on the number of sensors. One rule of thumb is one sensor per 10,000 square feet, but layout will be a factor as well. Savings will depend on the exhaust fan Horsepower. Allowing for 90% efficiency, one HP consumes 0.83 kilowatts. A supplier reports that in installations where the on/off time has been automatically monitored, the on time is one or two hours per day. Our observations seem to confirm this, so that 90%

savings are achievable. The system has a one-year warranty. The sensors require annual calibration, which is a significant cost. They have a five-year life but failure can occur earlier which can be a further maintenance cost. During the first 2 1/2 years we have had no failures.

4) High Efficiency Condensing Boiler and Savastat Control to Replace One of Two Atmospheric Domestic Hot Water (DHW) Boilers

Our atmospheric boilers were rated at 75% efficiency by Enbridge. The high efficiency condensing boiler is rated at 95%. The atmospheric boiler relies on a natural draft which may not supply enough air for combustion during start up and more than necessary airflow afterward, resulting in additional heat loss up the stack. The high efficiency boiler has a blower which supplies the correct airflow for the gas flow resulting in efficient combustion with less heat wasted. The condensing feature is a second heat exchanger which uses incoming cold water to extract further heat by condensing the water vapour in the gases after combustion.

The Savastat load compensation control monitors the load on the boiler and provides savings.

In our case the atmospheric boilers had the hot water running through the heat exchangers at all times and there were no dampers in the stacks which permitted significant standby heat losses.

Now, on the high efficiency boiler the blower and a filter restrict airflow when the boiler is off and the pump on the lag boiler runs only part of the time. Thereby, standby losses are reduced.

The Enbridge calculations include estimates for the above savings and additional annual savings for the whole system.

5) High Efficiency Boiler and Savastat Control to Replace One of Four Atmospheric Fan Coil Boilers and Repiping to Provide a Primary/Secondary Loop

6) High Efficiency Boiler and Savastat Control to Replace One of Two Atmospheric Prime (Common Area, Pool, Slab) Boilers and Repiping to Provide a Primary/Secondary Loop

The same comments as in 4) above apply except that the high efficiency boiler is rated at 85% as there is no cold water supply and therefore no condensing feature. Circulating pumps were installed on all the heating boilers and are turned off when the boilers are idle, reducing standby losses.

Total Gas Savings

We suggest that gas savings of 25% or more from the installation of high efficiency lead-boilers in existing atmospheric boiler systems, combined with similar savings from the installation of a variable speed drive and lower temperature settings on the makeup air unit can result in savings of 25% or more of the total annual gas consumption.

We strongly recommend that Enbridge tour the building and submit estimates of the gas savings and incentive payments for use in determining payback times.