

Islington United Energy Audit



Energy Audit Update One (2011):

Over the past few months and weeks the Green Team has provided updates on Islington United Church's energy audit and this article will summarize the results. Future articles will provide much more detail on each of the aspects of the audit. We undertook the energy audit because although our solar panels will be producing clean "green" energy for the benefit of all citizens, they aren't going to reduce our energy usage. We are looking for ways to conserve energy through the reduction of what we use. We suspected that Islington United was not particularly energy efficient – look at our leaking doors and windows, excessively hot and cold rooms, and so on. Further, we also know that the cost of electrical power will be rising; it is predicted to go very high and it is highly unlikely that rates will ever decline. The purpose of the energy audit was to identify where we had issues, and recommend potential solutions.

The audit looked at existing lighting (types, wattage, room usage, annual consumption and costs, etc.) and heating and cooling (building envelope, boilers and other heat sources, annual consumption and costs, air flows, etc.). It found that Islington United's total energy usage (both electric and natural gas) translates into the equivalent of the carbon footprint of 26 cars or light trucks per year.

In terms of electricity, Islington United uses about 107 Megawatts per year, at a current annual cost of about \$15,000. A study done of 20 other churches in the Toronto area indicates that there is only one other church with worse electrical consumption than Islington, calculated on a kilowatt hours per metre squared basis.

Islington's usage is broken down as follows:

Energy Usage Type or Location	% Consumption
Lighting – new building (built in 1965)	13%
Inside lighting – old building (built in 1949 & 1955)	8%
Outdoor lighting by old building	19%
Equipment	27%
Boiler room electricals	24%
Air-conditioning in the summer	10%

Opportunities to reduce energy usage include lighting replacement with LEDs (light emitting diodes), where possible; replacement of the electric hot water heater in the Scout Hall kitchen; changes to the electrical pumps in the boiler room, and so on. Islington spends a bit less than \$30,000 per year on heating (natural gas), which is the highest amount compared to the 20 other study churches.

Although our two boilers have a combined efficiency of 88% (i.e., only 12% of the heat produced goes up the chimney), there are significant heat losses elsewhere that are a concern. Tests indicate that the building envelope accounts for about 80% of the heat loss from the building. This is mainly due to low R values of 2 to 3.4 in the walls (the Ontario Building Code requires an R value of 20). The various flat and sloped roofs have R values from 9 to 11.

Some rooms are very cold, Mark Aitchison's office being a case in point. The washroom beside his office has been known to freeze water! Air leakage accounts for about 15% of heat loss of the church – all those gaps in the walls, windows, and doors. The table below shows sections of the church, the number of air changes per hour in each section, and an estimate of the total size of the gaps in the walls/windows in each section:

Building Section	Air Changes per hour (10 is “normal”; > 0.35 is recommended)	Effective Leakage Area (square metres) – sum of the “gaps”
Sanctuary	7.41	1.154
Scout Hall	12.49	0.697
Office wing, upper level	14.13	1.000
Office wing, lower level	7.66	0.998
Stewart East Hall	5.45	0.528

As you can see (look at the **bold** numbers), the Scout Hall is problematic, and the office wing is in poor condition with respect to air changes per hour; the Sanctuary and both floors of the office wing have many gaps. The audit report noted that Islington United Church is “very leaky” compared to other buildings. This costs our congregation about \$3,400 per year in natural gas charges. Most of the gaps can be fixed – they consist, in part, of: cracks around windows, doors, and baseboards; single glazed windows and others that could be replaced with windows with a higher R value; windows that are broken or don’t close properly (e.g., Reception and Youth Rooms); the vent fan in the Choir Room. The list goes on.

Future articles will delve into each of these areas in more detail. In the meantime, if you have any questions about Islington’s energy audit, please contact any member of the Green Team: Carole Bennett, Dennis Bradley, Laura Johnston, Dave Laughton, Michael Perkins, and Steve Tower – Lead.

Energy Audit Update Two:

Over the past few months and weeks the Green Team has provided updates on Islington United Church’s comprehensive energy audit, which occurred over the summer. We now have the draft report from that audit. An article published in last week’s bulletin provided a summary of the overall results. This one will give much more detail on one area of focus of the audit – our electrical energy usage and the opportunities for improvement. We are quite interested in where we have inefficiencies in our use of electricity, given that every source predicts that electrical energy rates will continue to rise to a very high level.

The energy audit did an inventory of all electrical devices in the church, analyzed our electricity usage by type of device, and looked at our hydro bills. Islington United uses about 107 Megawatts of electricity per year, at a current annual cost of about \$15,000. A study done of 20 other churches in the Toronto area reports that there is only one other church with worse electrical consumption than Islington, calculated on a kilowatt hour per square metre basis. This method of calculation ensures that the comparisons (i.e., per square metre) are fair.

Our usage is broken down as follows:

Energy Usage Type or Location	% Consumption
Lighting – new building (built in 1965)	13%
Inside lighting – old building (built in 1949 & 1955)	8%
Outdoor lighting by old building	19%
Equipment	27%
Boiler room electricals	24%
Air-conditioning in the summer	10%

Opportunities to reduce this energy consumption include the following:

- Replacing all remaining standard fixture lamps (screw-in types and fluorescent tubes) with the newest LED (light emitting diode) equivalent. LEDs have a typical life span of 50,000 hours, versus 1,000 hours and 10,000 hours for incandescent lamps and fluorescent lights respectively. For example, the lights in Stewart East Hall (twelve 100 W lamps cost about \$233 per year to operate (given their wattage and replacement costs), whereas it would cost \$40 per year to operate equivalent LEDs. Islington United has about 892 light bulbs of various types. Replacing these is a very compelling business case; government CDM (Clean Development Mechanism) grants to retrofit our lights are also available.
- Mag induction (magnetic induction) lamps could be used for our outside lights; and motion detectors which turn on the lights when triggered would reduce the need to have hallway lights “always on.”
- The electrical power used in the boiler room pumps is high, primarily because the pumps are in operation constantly during the heating season. A more sophisticated control system could turn off some of these when the rooms in the building are at the correct temperature or not in use.
- A vacuum pump is used to drive old-style temperature control devices, which also operates constantly during the heating season (at an annual cost of about \$1,100); this could be replaced with an electronic control system that would also provide better monitoring and control of the heating system.
- The air conditioner in the Stewart East Hall could be operated only when required using a more sophisticated control system which turns it on or off, as appropriate (i.e., according to use of the room).
- The Scout Hall kitchen houses an electric hot water heater. Since this kitchen is not heavily used, we are paying a great deal to keep a ready supply of hot water that is drawn on only rarely. This could be replaced with an on-demand hot water heater, or natural gas.
- Some of the rooms in the church have electric heaters, which would not be required if we didn't have significant problems with heating various parts of the building.

A detailed analysis of replacement costs for any of these items, plus the payback period for each retrofit would need to be completed. The Green Team will be working with the Facilities Committee and others to determine what elements the congregation should consider for remediation in the near- or mid-term. In the meantime, if you have any questions about Islington's energy audit or the information in this article, please contact any member of the Green Team: Carole Bennett, Dennis Bradley, Laura Johnston, Dave Laughton, Michael Perkins, and Steve Tower – Lead.

Energy Audit Update Three:

Over the past few weeks the Green Team has provided updates on Islington United Church's comprehensive energy audit, which occurred over the summer. We now have the draft report from that audit. Articles published in previous bulletins provided a summary of the overall results plus more details on our electricity usage and the opportunities for improvement. This article presents another focus area from the audit – Islington United's natural gas usage and our opportunities for improvement.

The audit found that our building can be divided into two distinct sections based on energy efficiency – the “old” area built in 1949 and 1955 (Sanctuary and Reception Room wings), and the “new” area built in 1965 (office and Stewart East Hall wing). The old area has thicker, better insulated walls (21” thick with an R value of 3.43) compared with those in the new area (16” thick with an R value of 2.13). The flat and sloped roofs range in R value from 9.3 to 11.2. R value is the measure of the resistance of a surface to heat loss, and the higher the R value, the greater the resistance to heat loss (i.e., it is more insulated). The Ontario Building Code requires R values of 20 – so neither area of the church is particularly good! Tests indicate that the building envelope (roof, exterior walls, doors and windows) accounts for about 80 percent of the heat loss from the building. We all know that some areas of the building are quite cold in winter. Mark Aitchison's office is particularly bad and the washroom adjacent to his office has been known to freeze water! If those pipes were to freeze we would be faced with a very unwelcome expense. Adding insulation to the exterior walls and roof would help improve the low R values considerably. How would we do this?

How do we preserve the appearance without destroying the aesthetics of our church? This will require much more analysis than we can provide at this time.

The audit also found that Islington United Church is very leaky – there are a lot of gaps in the walls, windows, around the doors, and in other areas. This air leakage accounts for about 15 percent of the heat loss from the building. Some areas of the church are much worse than others. The table below shows sections of the church, the number of air changes per hour, and an estimate of the totals size of the gaps in each section:

Building Section	Air Changes per hour (10 is “normal”; > 0.35 is recommended)	Effective Leakage Area (square metres) – sum of the “gaps”
Sanctuary	7.41	1.154
Scout Hall	12.49	0.697
Office wing, upper level	14.13	1.000
Office wing, lower level	7.66	0.998
Stewart East Hall	5.45	0.528

As you can see (by the numbers in **bold**), the Scout Hall is very drafty and the church office wing is very poor with respect to air changes per hour. The Sanctuary and both floors of the office wing have many gaps in them. The sum of all these gaps works out to the equivalent of a hole about 4.4 square metres – the size of a wall in a small office. Average air changes per hour throughout the entire building is 9.5 – on average all the air in the building is exchanged with outside air every six minutes! This cold air then has to be heated.

Most of these gaps can be fixed – cracks around windows and baseboards should be caulked; gaps around doors need weather stripping; broken windows and those that don’t close fully require repair; the fireplace chimneys could be sealed. Replacing our single glazed windows with those of a higher R value will not be a trivial expense but some of the other repairs can be done relatively easily at lower cost.

In terms of dollars, Islington United spends a little under \$30,000 per year on heating (with natural gas). This is the highest amount compared with 20 other United Churches studied in the Toronto area. Our natural gas usage translates into about 130,000 kg of carbon dioxide per year – the equivalent of 25 cars on the road. Loss of heat through the building envelope because of low R values costs us about \$10,000 per year. In addition, all of the gaps in the building envelope result in heat losses that cost an extra \$3,400 per year. If we were to spend \$5,100 filling half of these gaps, we would have a three-year payback through reduced natural gas costs. Most of the gaps would not be expensive to fix and are well worth considering. It is premature to think about investing in more energy efficient boilers, a heat recovery ventilator, or alternative heating systems unless we seriously address the building itself first. (In fact, one of our boilers is quite efficient, the other larger one, much less so).

If you have any questions about Islington’s energy audit or the information in this article, please contact any member of the Green Team: Carole Bennett, Dennis Bradley, Laura Johnston, Dave Loughton, Michael Perkins, and Steve Tower – Lead.