AN ENERGY STANDARD FOR HOMES IN IQALUIT

A BUSINESS CASE

Prepared by:

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1. INTRODUCTION

This report presents the business case for the city of Iqaluit to adopt an energy standard for low-rise homes.

Iqaluit is the capital and the largest city in Nunavut. With a current population of 6,000, it is one of the fastest growing communities in Canada. There is general agreement that there is a shortage of housing in the city, with a current supply of only 2,243 housing units and significant over-crowding in many dwellings. The medium housing projection in the General Plan for the city calls for 1,668 additional new dwelling units to be constructed by 2022.

The City is currently planning the development of a new subdivision on a parcel of land called Area A (also known as the Plateau). As part of the City's commitment to environmental responsibility and sustainability, they are conducting a study to explore innovative best practices that can be used to develop this subdivision sustainably. Any efforts to develop a sustainable subdivision must include energy efficiency within the homes to be constructed.

All land within the City of Iqaluit is owned by the municipality. Private ownership of land was restricted by a plebiscite held under the Land Claim Agreement. Land on which people and businesses wish to build is leased, usually for thirty-year terms renewable on expiration, with a payment based on development cost. Standard leases provide leaseholders with occupancy rights, while equity leases provide more security of tenure and stronger renewal clauses to the leaseholders. The Land Administration by-law governs development, disposal, and administration of land, including how land can be priced, what types of leases are permitted, and how leases my be terminated. This document is currently being revised.

The City is required to hold a ballot draw for new single family lots and proposal calls for other types of land. Through the ballot process, individuals may win the right to lease a parcel of land. The proposal call process permits the city to review potential development projects. The City has often played a financing role for potential leaseholders. For several recent subdivisions and for at least the initial phases of the Area A development, the City has acted in the role of developer as well.

There has been something of a vacuum in home inspection in Iqaluit in recent years. At one point, Canada Mortgage and Housing Corporation (CMHC) inspected many of the new homes in the city, because they often provided the mortgages for the homes. Several years ago, CMHC dropped that role. Because of the large proportion of Iqaluit homes that are built for different levels of government, there was some ongoing oversight of construction, at least in the rental market. Nonetheless, the City of Iqaluit has identified the introduction of home inspection as a priority. To that end, a building inspector has been hired, and the process of adopting a building code has begun.

Approximately two-thirds of Iqaluit housing units are rental units. Of those, over 30% are government owned, and most of the remaining units, while privately owned, are leased by one of the three levels of government. Thus, government plays a dominant role in the rental housing market, providing both social housing and housing for many government employees. In most cases, tenants are responsible for paying utility costs, but again this usually means one of the three levels of government is paying. In social housing, for example, the user pay program encourages the occupants to pay 6 c/kWh for electricity used in the housing unit, but the current rate is 32 c/kWh: a government subsidy covers the remainder.

Marbek's role on the project team was to provide technical expertise on energy efficiency. The other team members are Steve Burden of SLB Consulting Ltd., FoTenn Urban Planners and Designers, Rowan Williams Davies & Irwin (RWDI), Debbie Nielsen and Chrystal Fuller.

Project Objective

The primary objective of this assignment was to assess the feasibility of introducing an energy performance standard for new low-rise housing in Iqaluit, with the Area A subdivision serving as a possible testing ground.

1.1. Approach

The study approach was designed to address the factors with which a business case could be developed, specifically addressing the following questions:

- What are the potential energy and greenhouse gas emission savings that would be achieved with a new City standard for energy efficiency in new home construction? To address this question, the following tasks were undertaken:
  1. Develop a baseline for energy consumption in standard newly constructed homes in Iqaluit, based on housing types and existing data from previous studies, and implement the resulting baseline in HOT2000.
  2. Interview provincial and municipal code officials in Canada, to identify energy performance standards in current use in Canada.
  3. Estimate the energy consumption in newly constructed homes assuming construction to meet an EnerGuide for New Homes rating of 80 and to meet the R-2000 standard. If another energy performance standard is identified as being in use in Canada, estimate energy consumption under this third standard.
  4. Scale up the energy impact, based on estimated growth in housing stock over a ten-year period.
  5. Estimate the greenhouse gas (GHG) emissions impact, based on standard emission factors for heating fuel and for diesel-generated electricity.
- Is there an economic case to go forward with a new City standard for energy efficiency in new homes? There are two critical dimensions to development of the economic case. First, there is the requirement to show that proposed standard provides a societal value greater than the value of the "do nothing" option, based on discounted cash flow over the life cycle of the housing. Second, there is the requirement to show how adoption of the proposed standard would affect other key market stakeholders, notably the homebuyers and the housing builders. To address this question, the following tasks were undertaken:
  1. Estimate the economic impacts of adopting each of the leading energy performance standards, including energy cost reduction, incremental cost of house construction, start-up code enforcement costs, including training of developers, builders and code officials, and ongoing costs of monitoring and enforcement.
  2. Estimate the life-cycle cost of the baseline (do-nothing) option and each of the leading energy performance standard options, based on societal cost,
  3. For the performance standard option with the lowest societal life-cycle cost, estimate the costs and benefits from the perspective of the owner or occupant of the home,

accounting for both owner-occupied and rented homes (where energy bills may be paid either by owner or renter),

4. Estimate return on investment from the owner or occupant perspective
5. For the performance option with the lowest societal life-cycle cost, estimate the costs and benefits from the perspective of the builder or developer.
6. Recommend which energy performance standard option is the most economically beneficial.

- Is there an acceptable framework for an administratively cost-effective and practical adoption and enforcement of the standard? Related to this, what are the key risks to address for adoption and implementation? To address this question, the following tasks were undertaken:
  1. Interview provincial and municipal code officials in Canada to establish the process used elsewhere to adopt new code requirements.
  2. Interview provincial and municipal code officials in Canada and key stakeholders in Iqaluit, to identify barriers to the adoption of an energy performance standard in Iqaluit.
- What are the next steps required to pilot the concept and address the key risks? To address this question, the following tasks were undertaken:
  1. With code officials in municipalities that have adopted energy standards, probe further to elicit information on how barriers were overcome, and the financial and other resources that were required.
  2. With the Iqaluit stakeholders, probe further to establish what options are feasible in the Iqaluit context.
  3. Outline the steps required to implement a new energy standard and to provide ongoing enforcement, including a pilot phase to test and evaluate the new standard, potentially within the context of the new sustainable subdivision.

1.2. <u>This Report</u>

This report presents the results of the foregoing tasks. Following this introductory section, the remainder of this report is organized and presented as follows:

- Section 2 presents the savings potential for energy performance standards for new low-rise homes in Iqaluit
- Section 3 presents the cost/benefit analysis of the leading choices for an energy performance standard for low-rise homes in Iqaluit
- Section 4 presents the framework for adoption and enforcement of a standard, and the barriers likely to be encountered
- Section 5 identifies the resources and approaches needed to overcome the key barriers, and recommends next steps.

2. THE SAVINGS POTENTIAL FROM ENERGY PERFORMANCE STANDARDS FOR NEW LOW-RISE HOMES IN IQALUIT

2.1. Introduction

This section establishes the savings potential for energy performance standards for new low-rise homes in Iqaluit. Consistent with the structure noted in Section 1, the discussion in this section is organized as follows:

- Baseline energy consumption
- Performance standards currently in use in Canada
- Energy consumption using leading standard options
- Energy impact over a ten-year period
- GHG impact.

2.2. Baseline Energy Consumption

This section profiles the baseline construction characteristics and energy performance of the homes built in Iqaluit to current construction practice. Three typical housing archetypes were developed and modeled using HOT 2000 EGH Advisor Version 9.21.

What is an archetype?

An archetype is a description of the physical and operating characteristics of a home designed to represent the homes in a particular group. It includes size, lay-out, thermal characteristics of walls, floors, roof, windows and doors, information on the mechanical systems such as furnaces and water heaters, appliances present, and data on lighting and other uses. The archetype is not always an average or typical house, but is instead designed so that when its energy consumption for each end use (such as heating, lighting, or dishwashing) is multiplied by the number of houses in the group, the result will be the total energy used by the group of houses for that end use. Archetypes are usually constructed as computer models, so that proposed changes can be tested to determine their effect on energy consumption for the group.

The baseline data for the profile was sourced from a study of homes in Iqaluit conducted for the OEE EnerGuide for Homes program by Don Eaton of the Elora Centre for Environmental Excellence. The results for each house included floor area, energy consumption, detachment type (fully-detached, row house, etc.), and many other characteristics.

Housing descriptions in the study and follow-up discussions with the study author provided the initial baseline housing archetypes for the three types of houses: a fully detached house, a row house end unit, and a row house middle unit. The energy data from the study were used to provide reference points for calibration of the house models. The study author had concluded that new homes in Iqaluit are being built to a standard very close to an EnerGuide rating of 80 (see the next section for an explanation of EnerGuide ratings and other standards). The sample of new homes was small, however, particularly for the detached units (only one fully detached home in the study had been built in the last two years).

Because of the small sample size of new homes, further information on the general level of construction quality was gathered in discussions with a small number of Iqaluit builders. There are approximately ten homebuilders active in the city. The majority of the homes are built by the larger builders, and some of these would achieve the energy performance described by the EnerGuide testers. Builders in Iqaluit indicated, however, that at least half of the homes would fall below the R-2000 level of performance (equivalent to EnerGuide 80). The performance of row houses generally exceeds that of detached homes. It is likely that only two builders, each building perhaps three houses per year, build homes that are well below the R-2000 standard.

Based on the information provided by Iqaluit builders, the initial archetypes were refined. Exhibit 2.1 shows the resulting baseline annual energy consumption.

Exhibit 2.1
Baseline Energy Consumption for Iqaluit New Homes

Segment	EnerGuide for Houses Rating	Fossil Energy (MJ)	Heating Fuel (litres)	Electricity (kWh)	Diesel Fuel (litres)
Fully Detached	76	81,672	2,087	15,793	5,069
Row House - End Unit	77	73,575	1,881	15,719	5,045
Row House - Mid Unit	78	63,704	1,628	15,678	5,032

Further details on the HOT2000 models constructed is provided in Appendix A.

2.3. Energy Performance Standards To Be Used For The Analysis

This section reports on the proposed energy performance standards used for the analysis. The economics of the business case are predicated on the energy performance improvements generated from the new standard. In turn, the projected energy performance improvement is a function of the level set for the standard relative to the current construction practice in Iqaluit.

At the outset, the study's working premise is that there were three existing energy performance standards in Canada to serve as candidates for the Iqaluit standard:

- Model National Energy Code of Canada for Houses (MNECH)
- R-2000
- EnerGuide for Homes rating of 80 (EGH-80)

The study also called for a review to consider whether additional options should be added to the scope of the analysis. The standards above were selected because they were pre-existing, defined standards within the marketplace, and would not require the creation of a new standard specifically for Iqaluit.

Exhibit 2.2
Energy Performance Standards in Canada

MNECH	The MNECH contains cost-effective minimum requirements for energy efficiency in new low-rise housing. It provides minimum insulation levels for building envelope components, varying by heating source and region. It also provides minimum performance levels for windows, references energy efficiency equipment standards, and describes when a heat recovery ventilator is required. The MNECH was first published in 1997, after a collaborative effort involving federal departments, provincial and territorial ministries, and industry associations. It has not been formally adopted into code by a province or territory, although some of its individual provisions are in use.
R-2000	R-2000 is a program of NRCan's Office of Energy Efficiency, including an energy efficiency standard, an education and training program for builders, and a testing and certification program. The R-2000 Standard is based on an energy consumption target for each house and a series of technical requirements for ventilation, air-tightness, insulation, choice of materials, water use, and other factors. A home built to the R-2000 Standard will achieve an EnerGuide rating of 80 (see below).
EnerGuide for Houses	An EnerGuide for Houses rating is a standard measure of a home's energy performance, calculated by a professional EnerGuide for Houses advisor. The rating is based on information on the construction of the home and the results of a blower door test performed once the house has been built. A blower door test measures air leakage when the air pressure within the house is lowered a specified amount below the air pressure outside. EnerGuide ratings for new houses fall within the following ranges: • Typical new houses: 66 to 74 (a house built to code in Ontario would typically receive a rating of 68) • Energy efficient new houses: 75 to 79 • R-2000 houses: 80 • Highly energy-efficient new houses: 80 to 90 • Advanced houses using little or no purchased energy: 91 to 100

EGH-80 and R-2000 are both aimed at the same level of energy performance in a home. An EGH-80 rating is an indication that the house will use a certain amount of energy under specific conditions of weather and occupancy. R-2000 is more of a prescriptive standard – a set of specific construction measures that must be included in the home for it to qualify. Essentially, it is a practical implementation of the level of performance reflected in an Energuide rating of 80. MNECH is also a prescriptive standard, but the level of performance expected from a house built to MNECH would be lower than that of a house built to R-2000 standards.

The results are as follows:

- Interviews with provincial and municipal code officials in five provinces and two territories established that no Canadian jurisdiction has implemented any of the three standards above in their building codes. In a 1998 study to compare the Model National Energy Code of Canada for Houses (1997) with then-current energy-related requirements in provincial building codes, the National Research Council established that most provinces had standards consisting only of minimum thermal resistance values for house components such as walls, ceilings, and windows. Some provinces also required new homes to meet an air-tightness standards and a few required heat recovery. This is still the case.

- Relative to current construction practice in Iqaluit, construction of EnerGuide rating of 80 or R-2000 is considered to be an attainable target for builders in the area. EGH-80 or R-2000 would require some builders to substantially improve their standard construction practices, while others would need to make only modest changes.
- The performance of a house built to the specifications in MNECH is lower than that of an R-2000 or EGH-80 house. Given the baseline assumptions shown in Exhibit 2.1, it is unlikely that MNECH would offer significant savings potential in Iqaluit. MNECH does potentially offer a valuable framework for crafting an enforceable energy standard, because it is designed to be a code, unlike R-2000 or EGH-80.
- No Canadian standards were identified, either by code officials or through other sources that are higher than the R-2000 or EGH-80 level of performance. A higher EnerGuide level could be chosen by the City as a target for builders. Implementing a higher EGH rating level in code would require the creation of a prescriptive set of measures that result in the required level of performance, in much the same way that R-2000 produces the EGH-80 level of performance. The cost of this effort has not been estimated, but would likely be too great for the City to bear on its own. Ideally, the cost of this development should be spread among several municipalities, territories, or provinces.

For the purposes of this study, it was decided that two performance standard options would be evaluated: R-2000/EGH-80 and EGH-83.

2.4. Energy Consumption Using the Leading Standard Options

Using the baseline HOT2000 models, energy consumption was estimated for each of the leading energy performance standard candidates, EGH-80/R-2000 and EGH-83. Appendix A provides a brief summary of the changes made to the inputs and assumptions in the models, to achieve the savings. One key change is the replacement of electric water heaters, which have been commonly installed in Iqaluit. The change to oil-fired unit's results in more fuel burned in the home, but the net effect on Iqaluit energy consumption is positive: a much larger amount of diesel fuel will be saved at the generating plant than will be burned in the home's water heater. Substantial cost savings for the homeowner also result, because electricity is much more expensive than heating oil. The fossil energy and heating fuel savings calculated by the models are negative in most cases, because the fuel needed for the water heaters exceeds the fuel saved by the space heating measures.

Exhibit 2.3 shows the results. All savings in the exhibit are relative to the base case homes shown in Exhibit 2.1 (the consumption figures from Exhibit 2.1 are shown in the grey boxes). The fossil energy and heating fuel figures are equivalent, and are based on oil used in the home. The electricity figures are based on consumption within the home, and the diesel fuel figures are based on the consumption at the generating plant to produce that electricity.

Exhibit 2.3
Estimated Savings per Home for EGH-80 and EGH-83

Segment	Fossil Energy (MJ)	Heating Fuel (litres)	Fossil Savings (%)	Electricity (kWh)	Diesel Fuel (litres)	Electricity Savings (%)
Fully Detached	81,672	2,087	--	15,793	5,069	--
EGH-80 (R-2000)	(10,908)	(278)	-13%	6,479	2,079	41%
EGH-83	4,988	126	6%	6,573	2,110	42%
Row House - End Unit	73,575	1,881	--	15,719	5,045	--
EGH-80 (R-2000)	(16,531)	(422)	-22%	6,406	2,056	41%
EGH-83	(1,217)	(32)	-2%	6,495	2,084	41%
Row House - Mid Unit	63,704	1,628	--	15,678	5,032	--
EGH-80 (R-2000)	(22,903)	(587)	-36%	6,460	2,073	41%
EGH-83	(10,456)	(270)	-17%	6,527	2,095	42%

2.5. Energy Impact over the Study Period

The estimated energy savings per house were scaled up to estimate energy savings over a ten-year period. The assumption is that the market for housing in Iqaluit would evolve sufficiently in that period that the construction standards required would become business as usual. Savings from houses constructed after ten years are not counted however. The energy analysis actually includes a longer period, however, because the energy savings from the first ten years of construction will persist over the life of the homes, assumed to be 30 years.

Exhibit 2.3 shows the resulting long-term energy impact. Fossil energy and heating fuel savings are equivalent, and represent the oil consumed in the home. Electricity figures also represent consumption within the home. The diesel figures represent the generating plant consumption associated with that electricity use.

The EGH-80 (R-2000) standard would result in increased oil consumption within the home, largely due to the switch to oil-fired water heating. The electricity savings would be substantial, however, and the associated diesel fuel savings would greatly exceed the increase in fuel oil consumption.

The EGH-83 standard, with increase space heating savings, would largely eliminate the increase in fuel oil consumption. The electricity savings would be similar to those under the EGH-80 (R-2000) standard.

Exhibit 2.3
Energy Impact of Ten Years of Construction

Segment	Units Built	Fossil Energy (GJ)	Heating Fuel (m3)	Fossil Savings (%)	Electricity (MWh)	Diesel Fuel (m3)	Electricity Savings (%)
Fully Detached	410						
EGH-80 (R-2000)		(134,000)	(3,420)	-13%	79,684	25,587	41%
EGH-83		61,000	1,554	6%	80,845	25,945	42%
Row Houses	420						
EGH-80 (R-2000)		(248,000)	(6,360)	-29%	81,058	26,011	41%
EGH-83		(74,000)	(1,893)	-9%	82,045	26,338	41%
TOTAL	830						
EGH-80 (R-2000)		(382,000)	(9,780)	-21%	160,742	51,598	41%
EGH-83		(13,000)	(339)	-1%	162,890	52,283	42%

2.6. GHG Impact

The impact on GHG emissions, the following factors were used:

- Emission factor for heating oil: 2.836 kg CO_2e/litre
- Efficiency of the diesel-electric generating station: 3.12 kWh per litre
- Emission factor for diesel: 2.836 kg CO_2e/litre

Exhibit 2.5 shows the GHG impact from ten years of construction. Again, the savings for each house are expected to persist over a 30-year lifetime.

Exhibit 2.5
GHG Emissions Impact of Ten Years of Construction

Segment	Units Built	GHG Savings from Heating Fuel (tonnes CO_2e)	GHG Savings from Diesel Generation (tonnes CO_2e)	TOTAL GHG Savings (tonnes CO_2e)	TOTAL GHG Savings (%)
Fully Detached	410				
EGH-80 (R-2000)		(9,699)	72,565	62,866	25%
EGH-83		4,407	73,580	77,987	31%
Row Houses	420				
EGH-80 (R-2000)		(18,037)	73,767	55,730	23%
EGH-83		(5,369)	74,695	69,326	29%
TOTAL	830				
EGH-80 (R-2000)		(27,736)	146,332	118,596	24%
EGH-83		(961)	148,275	147,313	30%

3. COST/BENEFIT ANALYSIS

3.1. Introduction

This section provides a cost/benefit analysis of the two proposed standards for energy performance in low-rise housing in Iqaluit. Consistent with the structure noted in Section 1, the discussion in this section is organized as follows:

- Economic and financial impacts of the two leading standard options, as inputs to the cost/benefit analysis
- Societal life-cycle cost of each option, including the baseline (do nothing) option
- Owner/occupant perspective
- Builder/developer perspective
- Recommendation.

3.2. Economic and Financial Impact

The primary economic criterion for selecting the recommended energy performance standard option is a life cycle cost/benefit analysis at the societal level. This analysis is a slightly modified version of a pure life cycle cost analysis: the value of energy savings are shown as positive, while incremental costs are shown as negative. The discounted value of the resulting stream of cash flows provides the net present value of each option as compared with the "do nothing" alternative. The societal cost/benefit analysis requires a comprehensive set of inputs, including the reduced cost of energy, the incremental cost of house construction, the start-up costs of introducing the standard, and the ongoing cost of enforcement.

Subsequently, financial analysis for the business case is done on the basis of two specific perspectives: the customer (owner and/or occupant) and the builder. The financial analyses from the customer and builder viewpoints each require a subset of the inputs required for the societal analysis. They also require an allocation of the costs among the different participants.

3.2.1. Cost of Energy

The prevailing prices for heating fuel and electricity are as follows:

- Heating fuel = $0.60 per litre
- Electricity = $0.35 per kWh

Exhibit 3.1 shows the reduced energy cost for the average housing units that would be affected by the program.

Exhibit 3.1
Annual Energy Cost Savings

Segment	Heating Fuel (litres)	Fuel Cost	Electricity (KWh)	Electricity Cost	Total Energy Cost Savings	Total Energy Cost Savings (%)
Fully Detached	2,087	$1,252	15,793	$5,528	$6,780	--
EGH-80 (R-2000)	-278	($167)	6,479	$2,268	$2,101	31%
EGH-83	126	$76	6,573	$2,301	$2,376	35%
Row House – End Unit	1,881	$1,129	15,719	$5,502	$6,630	--
EGH-80 (R-2000)	-422	($253)	6,406	$2,242	$1,989	30%
EGH-83	-32	($19)	6,495	$2,273	$2,254	34%
Row House – Mid Unit	1,628	$977	15,678	$5,478	$6,464	--
EGH-80 (R-2000)	-587	($352)	6,460	$2,261	$1,909	30%
EGH-83	-270	($162)	6,527	$2,284	$2,122	33%

3.2.1 Cost of Construction and Compliance

A summary report of the Cost Impact of the New R-2000 Standard[1] indicated that the incremental cost of building to the Standard varies considerably by location and type of house. Incremental costs varied from little more than 2% of the total construction cost of the base house (excluding cost of land, municipal services, and other development overhead) to as much as 6%. In most cases, building envelope requirements are the largest incremental cost, followed by ventilation system requirements (heat recovery ventilators).

In Iqaluit, the majority of new homes are being built at an energy performance level that is closer to the R-2000 Standard than many homes in the South. Incremental costs may therefore be lower for most Iqaluit builders. For a minority of Iqaluit builders, however, the R-2000 Standard would require a substantial improvement in construction standards. A construction cost increase of 4% is a relatively conservative assumption for the incremental cost most builders would face. In addition, the cost to comply with the R-2000 certification in most areas of Canada ranges from $500 to $1000. We estimate that the cost of complying with energy performance provisions within a locally-enforced building code would be towards the higher end of this range for most Iqaluit builders.

The higher standard option, equivalent to EGH-83, will require a further incremental construction cost. In general, each additional EGH point is more expensive to achieve than the previous one. A construction cost increase of a further 6% beyond the cost of building to the R-2000 standard is assumed, for a total of 10% incremental cost above standard construction cost. Compliance costs would remain the same.

The base housing construction costs were based on discussions with a small number of Iqaluit builders. The variation in reported construction costs was relatively wide and may be improved

[1] Anil Parekh, "Cost Impact of the New R-2000 Technical Standard – Summary Report", March 2000, NRCan.

with further discussion. Exhibit 3.2 shows the incremental construction and compliance costs for different types of homes.

Exhibit 3.2
Incremental Construction and Compliance Costs

Segment	Base Cost	Compliance Cost	Incremental Construction Cost (EGH-80)	Incremental Construction Cost (EGH-83)	Total Incremental (EGH-80)	Total Incremental (EGH-83)
Fully Detached	$260,000	$1,000	$10,400	$26,000	$11,400	$27,000
Row House	$230,000	$1,000	$9,200	$23,000	$10,200	$24,000

3.2.2 Cost of Code Introduction and Enforcement

Based on interviews with code officials in other provinces and territories, we estimate the City of Iqaluit would face the following costs:

- Training of one code official on the new energy code: five person-days @ $400/day = $2,000.
- Travel costs for code official training: airfare @ $1700 round trip plus five days per diem @ $200/day = $2,700.
- Training of builders and architects (including logistics and preparation time for a one-day session): ten person-days @$400/day = $4,000.
- Ongoing cost of enforcement: 20% of one full-time equivalent @ $100,000/year = $20,000/year.

In addition to these costs, builders and architects would need to cover the cost their own time to attend the one-day training session. We estimate that approximately 20 people in Iqaluit would attend the session, at an average cost of $500/day = $10,000.

The cost of developing enforceable energy code provisions for addition to Iqaluit's building code may not be borne entirely by the City, but must be included in the implementation cost. A potentially efficient approach would be to use the structure of MNECH as a starting point and incorporate the provisions required by R-2000. The cost would include both writing and reviewing, with administrative support. The total cost is not likely to exceed $20,000.

The cost of developing an enforceable energy code to produce houses that perform at the EGH-83 level has been neglected. For the EGH-80 level, the earlier development of R-2000 reduces this cost to a straightforward writing task. The cost of developing an equivalent prescriptive standard at the EGH-83 level is an unknown. If this option is considered attractive, this development should be pursued on behalf of a larger region, perhaps nationally, and not just for Iqaluit.

3.3. Societal Life-Cycle Cost

Exhibit 3.3 and 3.4 present the life-cycle cost of the two energy performance standard options relative to the do-nothing option. If a positive discounted cash flow results, the energy performance standard option is superior to the do-nothing option. All of the cost components discussed in Section 3.2 are included. The exhibits have been collapsed to show the savings after completion of the ten years of construction on a single line. More detailed tables are provided in Appendix B.

The following additional assumptions were used in the Exhibits 3.3 and 3.4:

- Discount rate: 7%
- Societal cost of GHG emissions: $10/tonne CO_2e[2]
- Savings persist over 30 years
- No net difference in salvage value of home at end of life
- Employment and other social effects neglected.

As can be seen from the two exhibits, both performance standard options show a positive cash flow, and are therefore attractive from a societal point of view. The EGH-80/R-2000 has a larger positive discounted cash flow, and is therefore the more attractive of the two options, from a societal point of view.

Exhibit 3.3
Life-Cycle Benefit/Cost of EGH-80/R-2000 Standard
Relative to Do-Nothing Option

Year	Units Built	Energy Cost Savings (undiscounted)	Incremental Construction Costs (undiscounted)	Total Enforcement Costs (undiscounted)	Value of GHG Savings (undiscounted)	Total Cash Flow (undiscounted)	Total Cash Flow (discounted)
2005	83	$0	-$812,800	-$141,700	$0	-$954,500	-$954,500
2006	83	$167,987	-$812,800	-$103,000	$3,970	-$743,843	-$695,180
2007	83	$355,973	-$812,800	-$103,000	$7,970	-$571,914	-$499,532
2008	83	$503,960	-$812,800	-$103,000	$11,854	-$399,986	-$326,508
2009	83	$671,946	-$812,800	-$103,000	$15,797	-$228,057	-$173,984
2010	83	$839,933	-$812,800	-$103,000	$19,767	-$56,100	-$39,999
2011	83	$1,007,919	-$812,800	-$103,000	$23,737	$115,857	$77,200
2012	83	$1,175,906	-$812,800	-$103,000	$27,679	$287,785	$179,218
2013	83	$1,343,892	-$812,800	-$103,000	$31,621	$459,714	$267,558
2014	83	$1,511,879	-$812,800	-$103,000	$35,535	$631,614	$343,556
2015-2044		$42,836,570	$0	$0	$1,008,085	$43,844,655	$10,935,580
Total	830	$50,395,965	-$8,128,000	-$1,068,700	$1,185,958	$42,385,233	-$9,113,409

[2] Need to footnote this value. It is a commonly used assumption in federal work, but we need to include a specific reference.

Exhibit 3.4
Life-Cycle Benefit/Cost of EGH-83 Standard
Relative to Do-Nothing Option

Year	Units Built	Energy Cost Savings (undiscounted)	Incremental Construction Costs (undiscounted)	Total Enforcement Costs (undiscounted)	Value of GHG Savings (undiscounted)	Total Cash Flow (undiscounted)	Total Cash Flow (discounted)
2005	83	$0	-$2,032,000	-$141,700	$0	-$2,173,700	-$2,173,700
2006	83	$189,329	-$2,032,000	-$103,000	$4,906	-$1,940,765	-$1,813,799
2007	83	$378,657	-$2,032,000	-$103,000	$9,813	-$1,746,530	-$1,525,487
2008	83	$567,986	-$2,032,000	-$103,000	$14,690	-$1,552,324	-$1,267,158
2009	83	$757,315	-$2,032,000	-$103,000	$19,653	-$1,358,032	-$1,036,036
2010	83	$946,643	-$2,032,000	-$103,000	$24,531	-$1,163,825	-$829,791
2011	83	$1,135,972	-$2,032,000	-$103,000	$29,466	-$969,562	-$646,060
2012	83	$1,325,301	-$2,032,000	-$103,000	$34,344	-$775,355	-$482,852
2013	83	$1,514,629	-$2,032,000	-$103,000	$39,250	-$581,121	-$338,217
2014	83	$1,703,958	-$2,032,000	-$103,000	$44,157	-$386,886	-$210,440
2015-2044		$48,278,806	$0	$0	$1,252,321	$49,531,127	$12,353,909
Total	830	$56,798,595	-$20,320,000	-$1,068,700	$1,473,132	$36,883,027	-$2,030,367

3.4. Owner/Occupant Perspective

The EGH-80/R-2000 level energy standard is evaluated from the perspective of owners and occupants using the simple payback method. Exhibit 3.5 presents the effects of the standard from the perspective of an owner-occupant. This analysis neglects the increase in property value that is likely to result from R-2000 level energy performance. This benefit is likely to offset the increased purchase price of the home. In most cases, this additional benefit will not accrue to the homeowner until after the cost increment has already been repaid in energy savings.

Exhibit 3.5
Financial Analysis from Owner-Occupant Perspective

Year	Construction Cost	Mark-up	Incremental Selling Price	Annual Energy Savings	Simple Payback
Fully Detached	$11,400	$2,280	$13,680	$2,101	7
Row House	$10,200	$2,040	$12,240	$1,949	6

The landlord of a property where the landlord pays utilities will experience essentially the same financial scenario as the owner of an owner-occupied home: incremental purchase price of the rental property will be the same, and the landlord will be able to recover the savings in reduced utility costs. The tenant will be unaffected either by the incremental purchase price of the property (because rents would be unchanged) or by the energy cost reduction. [3] In Iqaluit, the landlord rarely pays utility costs, so cost recovery will not be this straightforward for most rental properties.

Energy efficiency efforts in rental units in Iqaluit will face challenges typical of such efforts in other communities: specifically, the landlord would have to pay the upfront costs of most efficiency upgrades, but it is the tenant paying the energy bill who would experience the savings. The situation is made more challenging by the fact that, in most cases, the government is paying all or most of the utility costs, not the occupant. Savings may easily be eroded by occupant behaviour (such as leaving windows open in winter), because there is no financial benefit to the occupants from using energy wisely.

Different levels of government dominate the rental market in Iqaluit: they own a significant fraction of the units, lease most of the rest, and pay most of the utilities. If the proposed energy standard is implemented for construction of new rental accommodations, the builder will pass along the increased construction costs to the landlord. For most units, the government renting the property will experience the savings in utility costs. To ensure that landlords are able to recover the costs of implementing the standard, these utility savings must be passed onto the landlord in the form of increased rent. The three levels of government must be prepared to pay these rent increases.

If the landlord is compensated with increased rent equal to the expected utility savings, the payback scenario will be as shown in Exhibit 3.5. The tenants will, on average, see no net financial change, because the increase in rent will equal the decrease in utility costs. In cases where the occupants are unaffected by utility costs, the governments paying the bills will be responsible for seeking ways to provide incentives for wise energy use.

3.5. Builder/Developer Perspective

The EGH-80/R-2000 energy standard is evaluated from the perspective of builders and developers based on the change in profit per unit built. Exhibit 3.6 presents the effects of the standard on an average builder who would be required to improve his/her standard construction practices to meet the standard. There will be considerable variation in these figures, ranging from some builders whose house construction standards would require almost no improvement to others who would have to make major changes. The exhibit shows average assumed incremental costs. The exhibit also shows training costs, assuming each builder or developer sends one staff person to the training at a cost of $500.

One key change whose cost is difficult to estimate is the cost of improved air tightness. This requires attention to detail on the part of the contractors and their workers. Much of the air leakage in new homes comes from failure to seal well around windows, around pipes and wires that penetrate the walls, and around openings from the house into the attic or crawlspace. Most

[3] This assumes that the landlord would be unable to increase rents compared to other recent properties with less efficient construction. If the landlord could do so, he or she would obtain a rapid payback through the utility savings and the increased rents – in effect, double dipping. The tenants would be harmed by this scenario, because they would be obliged to pay increased rents to cover the upgrade costs, but would not obtain the savings. This scenario is unlikely for two key reasons: there is increasing construction in the Iqaluit marketplace that will gradually reduce scarcity of rental units, increase competition, and prevent landlords from charging unfair rents; and in many cases the tenant is a level of government with enough market power to ensure rents are fair.

of the building envelope may incorporate an adequate air barrier, but if sealing is not effective around construction details, the benefits are greatly diminished. It is also important to ensure a balance between the flows of ventilation air in and exhaust air out, to reduce the difference in air pressure that drives leakage. Attention to these issues does not increase the material cost of the house, but does require some additional initial training for construction labourers. This initial training is unlikely to amount to more than one day per worker. We assumed that an average builder would have to train three new employees per year, at a cost of $500 per employee. Total training cost, including both the builder training on the standard and the training of new labourers, is $2,000 per year. The modest increment in labour required per house is included in the incremental construction cost shown below.

It is also difficult to estimate the increased sale price of a more efficient house in the Iqaluit market. In the South, new R-2000 houses sell at a premium and builders are able to recover their costs, but in general they are sold to buyers who are interested in the option.[4] A market in which R-2000/EGH-80 houses are the norm is an unknown. The price premium may largely disappear if it is no longer based on differentiation. On the other hand, the fact that all homes will include the energy efficiency features may permit all builders to price their homes appropriately for recovery of the incremental costs. Because the Iqaluit market for homes includes significant activity by all three levels of government, the governments involved can play a role in ensuring that builders are able to recover their incremental costs with an appropriate mark-up.

We assumed that a builder would be able to mark up the incremental cost of building the R-2000 home by 20%. The **net** annual impact on the builder's revenue is the mark-up on the incremental cost/unit multiplied by the number of units the builder builds per year. Exhibit 3.6 shows the results.

Exhibit 3.6
Financial Analysis from the Builder/Developer Perspective

Year	Training Cost (1 person)	Incremental Cost per Unit	Incremental Mark-up per Unit	Incremental Selling Price per Unit	Units/Yr	Annual Incremental NET Revenue
Fully Detached	-$2,000	-$11,400	$2,280	$13,680	5	$13,400
Row House	-$2,000	-$10,200	$2,040	$12,240	5	$12,200

As can be seen in the exhibit, the builders and developers are expected to experience a net increase in cash flow as a result of the new standard.

[4] Compas. "R-2000 Home Builders' Survey: Motivations and Marketing Strategies." Natural Resources Canada: Ottawa, March 2002. The Survey confirms that builders do successfully recover their costs.

3.6. Recommendations

On the basis of the foregoing cost/benefit analysis, we recommend pursuing the EG-80/R-2000 level of performance, either in the form of an energy standard or through a program of information and/or incentives. From a societal point of view, this level of performance exhibits the most attractive life-cycle costs. Assuming recovery of the incremental construction costs with an appropriate mark-up, it can be financially attractive to builders and developers. From the perspective of a homeowner, or a landlord who is able to recover the upfront costs through either utility savings or increased rents, the payback is approximately seven years. Because rental units form the majority of housing units in Iqaluit, special care needs to be taken to ensure that landlords facing increased construction costs will be able to recover their costs. The governments that lease most of the units must be prepared to pay increased rents equivalent to the expected savings in utility costs.

4. ENERGY CODE ADOPTION

4.1. Introduction

This section discusses the process of adopting and enforcing energy provisions in a building code, as well as the barriers to adopting such provisions. Consistent with the structure noted in Section 1, the discussion in this section is organized as follows:

- Process of adoption of new energy provisions in code
- Barriers identified by code officials in Canada.

4.2. Code Adoption Framework

Interviews were conducted with code officials in five provinces and two territories. In general the following process for adopting new code provisions is followed:

- A public consultation process occurs, lasting several months and including developers and builders, municipal officials including code officials, architects and engineers, representatives of the trades, and often utility representatives and representatives of the public.
- A public review process is common, once the code has been drafted. This typically lasts two to three months.
- Most jurisdictions do not pilot new codes in a specific area, though the first year may be considered a pilot phase in some cases.
- Training sessions associated with new code introduction usually consist of a single one-day session in any given location. Attendees would include municipal officials including code officials, builders and developers, engineers and designers, and representatives of the trades.

None of our contacts was able to provide an estimate of what this whole process costs their jurisdictions. In the cost estimates used in Section 3, the cost of training and ongoing enforcement staff time was included, but not the cost of consultation or public review. It should also be noted that none of the jurisdictions has adopted an energy code similar to MNECH or R-2000: their experience of energy provisions is limited to minimum insulation requirements and the like.

4.3. Barriers

The following barriers have been identified in discussions with code officials across Canada:

- Incremental cost of new homes relative to current standard
- Cost of enforcement
- Lack of consumer demand based on poor knowledge of the benefits, short-term thinking, etc. This is primarily a barrier in terms of its influence on the thinking of the builders.
- Resistance by builders and developers
- Conflict with other standards and guidelines in the marketplace

Of these, by far the most significant are the resistance by builders and developers and the incremental cost (or perceived incremental cost) of constructing a new home that meets the standard. These two issues are closely related, in that builders are more resistant to a standard if they do not believe they can recover the cost of meeting it in the sale price of the home. Steps to reduce this uncertainty would reduce this barrier.

Cost of enforcement and conflict with other standards were not generally identified as significant issues.

As discussed in Section 3.4, additional barriers may pertain to landlord/tenant situations. Perceived inability to recover costs from their tenants may cause landlords to oppose the new standards. Again, the key difficulty here is uncertainty – steps to reduce the landlords' uncertainty would alleviate this barrier.

5. IMPLEMENTATION APPROACHES AND NEXT STEPS

5.1. Introduction

This section discusses approaches to implementing the new code and outlines the next steps. Consistent with the structure noted in Section 1, the discussion in this section is organized as follows:

- Approaches to overcoming barriers
- Feasibility of these approaches
- Next steps.

5.2. Approaches to Overcoming Barriers

No jurisdiction in Canada has adopted an energy code of the type envisioned in this report. Our contacts were therefore unable to offer specific insights on the approaches and resources needed to overcome the barriers involved in adopting an energy performance standard. Nonetheless, based on interviews with code officials and Iqaluit stakeholders, a number of suggestions can be made:

- Reduction of uncertainty on the part of builders is a key. Builders' and developers' resistance to additional regulation is based partly on uncertainty as to whether they will be able to recover incremental costs from the home buyers.
- An information campaign to inform home buyers of the advantages of R-2000 homes will increase the saleability of these homes.
- Evidence concerning cost recovery can be gathered through a program to encourage the construction and sale of R-2000 homes in Iqaluit. The Area A development is an ideal context in which to undertake this piloting.
- A monitoring program will be needed to collect evidence on the experience with R-2000 homes in the Area A development. This monitoring program does not need to be highly detailed: installation of meters for individual energy end-uses within the homes is likely unnecessary, for example. Monitoring of energy use in the homes should focus primarily on analysis of the fuel and electricity bills, along with qualitative information on the occupancy of the home. At the same time, similar information should be collected on recently built homes that are not R-2000 construction. It is likely that statistically significant differences would be detected with approximately 20 to 25 samples in each group. Another key element of the monitoring program will be collecting information on the builder's experience in recovering their costs. Builders should be asked to document the incremental cost of building to the R-2000 standard, including materials, labour, training, and compliance costs. Documentation on the selling prices of the homes should also be collected. As with the energy information, data should also be collected on several recently built homes that are not R-2000, as a control group.
- Rental accommodations pose special challenges for fair application of an energy code. Landlords who pay utilities will be obliged to spend more initially on energy efficiency measures, but will recover the cost through savings and should not therefore raise rents to recover the initial cost twice. Landlords who do not pay utilities, by far the majority in Iqaluit, need to be able to recover their costs through rent increments that reflect the tenants' utility savings. Iqaluit will need to explore ways to ensure fairness in both these scenarios, through

existing channels of landlord/tenant regulation. Because of the dominance of governments in leasing housing units and paying the utility costs, the three levels of government are in a position to landlords are able to recover costs appropriately.

5.3. Feasibility of These Approaches

In discussion with City of Iqaluit staff and a small group of local builders, we obtained some feedback on the feasibility of specific approaches to implementing an R-2000 standard. The largest concern expressed by builders was the existing high price of housing in Iqaluit. Because of high transportation costs, house construction in Iqaluit can be as much as 75% higher than it is in the South. As a result, an incremental capital cost places an additional burden on a population that is already burdened by very high purchase prices.

The existing high price of Iqaluit homes re-emphasizes the need to gather evidence of the financial performance of R-2000 homes – both from the builder and from the owner/occupant perspectives. To gain support for an energy standard enforced in code, Iqaluit will require locally gathered evidence that an R-2000 builder can recover costs with an appropriate profit margin, and that owners and occupants will realize savings that pay back the incremental purchase price in a reasonable timeframe.

If the R-2000 level of performance is to be mandatory, it is essential to ensure that the implementation is fair to all builders. Builders who have been constructing high performance homes already will be losing some of their market differentiation. They should not be penalized for their conscientiousness in building high quality homes before a standard was in place. It should also be recognized that the builders who are already building well will face much smaller incremental costs than those whose homes currently fall below the standard. The price disadvantage of the high-quality builders will therefore narrow somewhat.

Iqaluit has an extremely short building season, and the homebuilders have developed special techniques for extremely rapid construction. Even high quality homes are constructed much more quickly than comparable homes in the South. Application of the standard (and indeed the rest of the building code), including documentation and inspections, will need to be much more streamlined than it is in southern cities, to avoid disrupting this unusual building process.

Northern homes tend to experience significant temperature stratification. This means that if air movement is not sufficient (for example, where heat is supplied with hot water radiators), warm air will rise towards the top of the house. In a single-storey home, this can be remedied with ceiling fans. In a two-storey home, the second floor can become so much warmer than the lower floor that occupants are forced to open windows. Heat recovery ventilators reduce this problem to some extent, because they require some ductwork to distribute the ventilation air to different parts of the house, resulting in more air movement. This may not be sufficient in all cases, however. An energy code prepared for Iqaluit may need to include a requirement for active recirculation of warm air from second floor rooms down to the main floor of the home. Otherwise, if occupants open windows in the winter to cool off upstairs rooms, most of the benefits of the R-2000 level energy performance standard may be lost.

5.4. Next Steps

The following steps are recommended:

- Iqaluit should take advantage of its planned sustainable subdivision in Area A to pilot the R-2000 concept. This pilot project should be carefully monitored, to document incremental construction costs, ability of the builders to recover these costs and retain a suitable profit margin, subsequent energy savings, and qualitative reports on comfort and other intangible occupant benefits or costs. It is important to monitor a control group of houses not affected by the R-2000 pilot.
- If an enforced energy standard is to be adopted, NRCan and Iqaluit should collaborate to implement the R-2000 prescriptive standard in code language. The structure of the MNECH provides a good starting point for this effort.
- Prior to adoption of an energy standard, Iqaluit should develop an information campaign to share the results of the pilot program and inform the public and the building community of the advantages of R-2000 construction.
- Adoption of the new code should follow the process outlined in Section 4.2.

Appendix 'A'

Modelling Details

```
**************************************
*                                    *
*              HOT2000               *
*           Version 9.21             *
*              CANMET                *
*      Natural Resources CANADA      *
*            Jul  8, 2004            *
*        Reg. # ENERGUIDEVER         *
**************************************
```

File = Iqaluit SDbase.HSE

Application type : EnerGuide for Houses

Weather Data for IQALUIT, NUNAVUT

Builder Code =
Data Entry by: Date of entry 17/08/2004
Company:

Client name: ,
Street address:
City: Region:
Postal code: Telephone:

*** GENERAL HOUSE CHARACTERISTICS ***

```
House type:               Single detached
Number of storeys:        Two storeys
Plan shape:               Rectangular
Front orientation:        South
Year House Built:          2004
Wall colour: Default       0.40               Absorptivity:  .400
Roof colour: Medium brown 0.84                Absorptivity:  .840
```

Soil Condition: Normal conductivity: dry sand, loam, clay

Water Table Level: Normal (7-10 m, 23-33 Ft)

House Thermal Mass Level: (A) Wood frame construction, 12.5 mm (0.5 in.)
gyproc walls and ceiling, wooden floor

Effective mass fraction 1.000

```
Occupants :  2 Adults   for  50.0 % of the time
             2 Children for  50.0 % of the time
             0 Infants  for    .0 % of the time
```

Sensible Internal Heat Gain From Occupants = 2.40 kWh/day

*** HOUSE TEMPERATURES ***

```
Heating Temperatures    Main Floor              = 21.0 C
                        Basement                = 19.0 C
                        Crawl Space             = Unheated
```

TEMP. Rise from 21.0 C = 2.8 C

Indoor design temperatures for equipment sizing
Heating = 22.0 C
Cooling = 24.0 C

*** WINDOW CHARACTERISTICS ***

Label	Location	#	Overhang Width m	Header Height m	Tilt deg	Curtain Factor	Shutter RSI
South							
Ceiling01	MainWall-03	2	.41	.20	90.0	1.00	.00
North0001	MainWall-03	2	.41	2.64	90.0	1.00	.00
North							
North0001	MainWall-03	2	.41	2.64	90.0	1.00	.00
North0001	MainWall-03	2	.41	.20	90.0	1.00	.00

Label	Type	#	Window Width m	Window Height m	Total Area m2	Window RSI	SHGC
South							
Ceiling01	DLowE	2	.91	1.22	2.22	.494	.5384
North0001	DLowE	2	.91	1.22	2.22	.494	.5384
North							
North0001	DLowE	2	.91	1.22	2.22	.494	.5384
North0001	DLowE	2	.91	1.22	2.22	.494	.5384

*** Window Code Schedule ***

Name	Internal Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
DLowE	233214	Double/Double with 1 coat, Low-E .20 (Hard1), 13 mm Argon, Insulating, Hinged, Vinyl, ER* = -12.6, Eff. RSI= .48

* Window Standard Energy Rating estimated for assumed dimensions, and
Air tightness type: CSA - A1; Leakage rate = 2.79 m3/hr/m

*** BUILDING PARAMETER DETAILS ***

CEILING COMPONENTS

Construction Type	Code Type	Roof Slope	Heel Ht. m	Section Area m2	R-Value RSI

Ceiling01	Attic/Gable	2401491000	3.00/12	.13	58.43	6.80

*** Ceiling Code Schedule ***

Name	Internal Code	Description (Structure, typ/size, Spacing, Insul1, 2, Int., Sheathing, Exterior, Studs)
2401491000	2401491000	Truss, 38 x 89 mm (2 x 4 in) Attic truss, 400 mm (16 in), RSI 3.9 (R 22) Batt, Same as Insulation Layer 1, 12 mm (0.5 in) Gypsum board, N/A, N/A, N/A

MAIN WALL COMPONENTS

Label	Lintel Type	Fac. Dir	Number of Corn.	Inter.	Height m	Perim. m	Area m2	R-Value RSI
MainWall-03 Type: 2x6R20	001	N/A	4	4	2.44	30.6	74.61	2.80
MainWall-03 Type: 2x6R20	001	N/A	4	4	2.44	30.6	74.61	2.86
MWhdr-02 Type: 1800300420	000	N/A	4	4	.23	30.6	7.03	3.83

*** Wall Code Schedule ***

Name	Internal Code	Description (Structure, typ/size, Spacing, Insul1, 2, Int., Sheathing, Exterior, Studs)
2x6R20	1211301421	Wood frame, 38 x 140 mm (2 x 6 in), 400 mm (16 in), RSI 3.5 (R 20) Batt, None, 12 mm (0.5 in) Gypsum board, Plywood/Particle board 9.5 mm (3/8 in), Hollow metal/vinyl cladding, 3 studs
1800300420	1800300420	Floor Header, N/A, N/A, RSI 3.5 (R 20) Batt, None, N/A, Plywood/Particle board 9.5 mm (3/8 in), Hollow metal/vinyl cladding, N/A

DOORS

Label	Type	Height m	Width m	Gross Area m2	R-value RSI
Door-01 Loc: MainWall-03	Steel polyurethane core	2.07	.81	1.68	1.14
Door-02 Loc: MainWall-03	Steel polyurethane core	2.07	.81	1.68	1.14

*** FOUNDATIONS ***

Crawlspace - 3

Foundation type	: Crawl Space	Volume	: 116.7 m3
Data Type	: Library	Ventilation type	: Open
		Thermal break R-value	: .00 RSI
		Skirt R-value	: .00 RSI

Total wall height: 2.00 m

Rectangular
Floor length : 7.64 m
Floor width : 7.64 m

Wall type	:	R-value :	.00 RSI
Number of corners	: 1		
Lintel type	: N/A		
Added to slab type	: N/A	R-value :	.00 RSI
Floors above found.	: 4231504760	R-value :	4.95 RSI

Exposed areas for : Crawlspace - 3

Exposed Perimeter = 30.56 m

Configuration: SCN_1
- concrete or soil (for crawl space) floor
- no insulation
- first storey is non-brick veneer or bricks thermally broken from concrete floor

---

Foundation Code Schedule

Floors above Foundation

Name	Internal Code	Description (Structure., typ/size, Spacing, Insul1, 2, Int, Sheathing, Exterior, Drop Floors)
4231504760	4231504760	Wood frame, 38 x 235 mm (2 x 10 in), 400 mm (16 in), RSI 4.9 (R 28) Batt, None, Tile-linoleum, Plywood/Particle board 18.5 mm (3/4 in), Wood, No

Lintel Code Schedule

Name	Code	Description (Type, Material, Insulation)
L001000000000000	001	Single, Wood, Same as wall framing cavity
	000	Single, Wood, None

Roof Cavity Inputs

Gable Ends	Total Area	7.3 m2
Sheathing Material: Plywood/Part. bd	9.5 mm (3/8 in)	.08 RSI

Exterior Material: Hollow metal/vinyl cladding .11 RSI

Sloped Roof   Total Area 60.2 m2
Sheathing Material: Plywood/Part. bd 12.7 mm (1/2 in) .11 RSI
Roofing   Material: Asphalt shingles .08 RSI

Total cavity volume 27.9 m3   Ventilation rate .50 ACH/hr

*** BUILDING ASSEMBLY DETAILS ***

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Ceiling01	2401491000	7.74	7.59	6.80

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
MainWall-03	2x6R20	3.22	2.80	2.80
MainWall-03	2x6R20	3.22	2.86	2.86
MWhdr-02	1800300420	3.50	3.83	3.83

FLOORS ABOVE CRAWL SPACE

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 3	4231504760	4.91	4.95	4.95

DOORS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 3	4231504760	4.91	4.95	4.95

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 3	4231504760	4.91	4.95	4.95

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
MainWall-03	2x6R20	3.22	2.80	2.80
MainWall-03	2x6R20	3.22	2.86	2.86
MWhdr-02	1800300420	3.50	3.83	3.83

FLOORS ABOVE CRAWL SPACE

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 3	4231504760	4.91	4.95	4.95

DOORS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 3	4231504760	4.91	4.95	4.95

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 3	4231504760	4.91	4.95	4.95

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
MainWall-03	2x6R20	3.22	2.80	2.80
MainWall-03	2x6R20	3.22	2.86	2.86
MWhdr-02	1800300420	3.50	3.83	3.83

FLOORS ABOVE CRAWL SPACE

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 3	4231504760	4.91	4.95	4.95

DOORS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 3	4231504760	4.91	4.95	4.95

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 3	4231504760	4.91	4.95	4.95

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI

MainWall-03	2x6R20	3.22	2.80	2.80
MainWall-03	2x6R20	3.22	2.86	2.86
MWhdr-02	1800300420	3.50	3.83	3.83

*** BUILDING PARAMETERS SUMMARY ***

Component	Area (m2) Gross	Net	Effective RSI	Heat Loss MJ	% Annual Heat Loss
ZONE 1 : ABOVE GRADE					
Ceiling	58.43	58.43	6.80	7193.2	6.68
Main Walls	156.24	144.01	2.87	45925.6	42.66
Doors	3.35	3.35	1.14	2791.3	2.59
South windows	4.44	4.44	.49	8527.6	7.92
North windows	4.44	4.44	.49	8527.6	7.92
		ZONE 1 Totals:		72965.4	67.78
ZONE 3 : CRAWL SPACE FOUNDATION					
Foundation	58.37	58.37	-	10166.0	9.44
		ZONE 3 Totals:		10166.0	9.44

Ventilation

House Volume	Air Change	Heat Loss MJ	% Annual Heat Loss
298.50 m3	.228 ACH	24512.6	22.77

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area = 273.0 m2
Air Leakage Test Results at 50 Pa.(0.2 in H2O) = 2.50 ACH
Equivalent Leakage Area @ 10 Pa. = 270.0 cm2

"CGSB" Blower Door C, n 1.34278E-02 .6996

Terrain Description		Height	m
@ Weather Station :	Open flat terrain, grass	Anemometer	10.0
@ Building site :	Suburban, forest	Bldg. Eaves	5.5

Local Shielding- Walls: Heavy
Flue : Light local shielding

Leakage Fractions - Ceiling: .150 Walls: .600 Floors: .250

Normalized Leakage Area @ 10 Pa. = .9888 cm2/m2
Estimated Airflow to cause a 5 Pa Pressure Difference = 43 L/s
Estimated Airflow to cause a 10 Pa Pressure Difference = 67 L/s

*** F326 VENTILATION REQUIREMENTS ***

Kitchen,living,dining:	3 rooms @ 5.0 L/s	=	15.0 L/s
Utility rooms:	1 rooms @ 5.0 L/s	=	5.0 L/s
Bedrooms:	1 rooms @ 10.0 L/s	=	10.0 L/s
Bedrooms:	2 rooms @ 5.0 L/s	=	10.0 L/s
Bathrooms:	2 rooms @ 5.0 L/s	=	10.0 L/s
Other habitable rooms:	2 rooms @ 5.0 L/s	=	10.0 L/s
Basement Rooms:			.0 L/s

*** CENTRAL VENTILATION SYSTEM ***

System Type : Fans without heat recovery
Manufacturer:
Model Number:

Mechanical Ventilator Fan Power = 40. Watts

Operating schedule for Fans without heat recovery

Month	% of Time	Added Vent. Rate (L/s)	Month	% of Time	Added Vent. Rate (L/s)
Jan	53.6	6.1	Jul	.0	.0
Feb	52.7	6.0	Aug	.0	.0
Mar	62.3	7.1	Sep	.0	.0
Apr	80.7	9.2	Oct	100.0	11.4
May	.0	.0	Nov	82.0	9.3
Jun	.0	.0	Dec	62.8	7.2

*** SECONDARY FANS & OTHER EXHAUST APPLIANCES ***

	Control	Supply (L/s)	Exhaust (L/s)
Dryer	Continuous	-	1.20

Dryer is vented outdoors

*** AIR LEAKAGE AND VENTILATION SUMMARY ***

F326 Required continuous ventilation rate = 60.0 L/s (.72 ACH)
Central Ventilation Rate (Balanced) = 11.4 L/s (.14 ACH)
Total house ventilation is Balanced

Gross Air Leakage and Ventilation Energy Load = 25030.9 MJ
Seasonal Heat Recovery Ventilator Efficiency = .0 %
Estimated Ventilation Electrical Load: Heating Hours = 518.3 MJ
Estimated Ventilation Electrical Load: Non-Heating Hours = .0 MJ
Net Air Leakage and Ventilation Energy Load = 24771.7 MJ

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel : Oil
Equipment : Mid-eff. furnace/boiler (no dil. air)

```
Manufacturer                  : SPHMan
Model                         : SPHMod
Calculated* Output Capacity    =       9.0 kW
* Design Heat loss * 1.10 + 0.5 kW

Steady State Efficiency        =  85.0 %

Fan Mode : Auto                 Fan Power     175. watts
```

*** DOMESTIC WATER HEATING SYSTEM ***

```
PRIMARY Water Heating Fuel   : Electricity
Water Heating Equipment      : Conventional tank
Energy Factor                :    .822

Manufacturer                 : DHW man
Model                        : DHW mod
Tank Capacity =  189.3 Litres      Tank Blanket Insulation     .0 RSI
Tank Location : Main floor
```

*** ANNUAL SPACE HEATING SUMMARY ***

```
Design Heat Loss at -40.0 C     =   27.17 Watts/m3     =   8110. Watts

Gross Space Heat Loss                                  = 107644. MJ

Gross Space Heating Load                               = 107644. MJ
Usable Internal Gains                                  =  29189. MJ
Usable Internal Gains Fraction                         =    27.1 %
Usable Solar Gains                                     =  11025. MJ
Usable Solar Gains Fraction                            =    10.2 %
Auxiliary Energy Required                              =  67430. MJ

Space Heating System Load                              =  67430. MJ
Furnace/Boiler Seasonal efficiency                     =    82.6 %
Furnace/Boiler Annual Energy Consumption               =  80389. MJ
```

*** ANNUAL DOMESTIC WATER HEATING SUMMARY ***

```
Daily Hot Water Consumption                            =   225.0 Litres  /day
Hot Water Temperature                                  =    55.0 C
Estimated Domestic Water Heating Load                  =  20371. MJ

PRIMARY Domestic Water Heating Energy Consumption      =  23518. MJ
PRIMARY System Seasonal Efficiency                     =    86.6 %
```

*** BASE LOADS SUMMARY ***

	kwh/day	Annual kWh
Interior Lighting	3.0	1095.0
Appliances	14.0	5110.0
Other	3.0	1095.0
Exterior use	4.0	1460.0

HVAC fans

HRV/Exhaust	.4	144.0
Space Heating	1.0	356.5
Space Cooling	.0	.0
Total Average Electrical Load	25.4	9260.4

*** FAN OPERATION SUMMARY (kWh) ***

Hours	HRV/Exhaust Fans	Space Heating	Space Cooling
Heating	144.0	356.5	.0
Neither	.0	.0	.0
Cooling	.0	.0	.0
Total	144.0	356.5	.0

*** ENERGUIDE FOR HOUSES ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption = 81672. MJ = 22686.7 kWh
Ventilator Electrical Consumption: Heating Hours = 518. MJ = 144.0 kWh
Estimated Annual DHW Heating Energy Consumption = 23518. MJ = 6532.9 kWh

ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION = 105709. MJ = 29363.6 kWh

ENERGUIDE RATING (0 to 100) 76
EnerGuide Required Ventilation Capacity 11.4 L/s

Estimated Greenhouse Gas Emissions 20254. kg/Year

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel		Space Heating	Space Cooling	DHW Heating	Appliances	Total
Oil	(Litres)	2086.7	.0	.0	.0	2086.7
Electricity	(kWh)	500.4	.0	6532.9	8760.0	15793.3

*** MONTHLY ENERGY PROFILE ***

Month	Energy Load MJ	Internal Gains MJ	Solar Gains MJ	Aux. Energy MJ	HRV Eff. %
Jan	14878.6	2503.9	520.3	11854.4	.0
Feb	13422.0	2257.5	1014.8	10149.7	.0
Mar	13828.8	2497.7	1736.6	9594.5	.0
Apr	10493.2	2418.7	1795.6	6278.9	.0
May	6408.5	2503.9	1496.9	2407.7	.0
Jun	4473.6	2411.7	904.3	1157.6	.0
Jul	3374.3	2315.5	724.2	334.6	.0
Aug	3627.1	2376.0	722.4	528.7	.0
Sep	4861.5	2438.2	718.8	1704.4	.0
Oct	8104.6	2520.9	662.3	4921.4	.0
Nov	10428.2	2435.2	439.8	7553.3	.0
Dec	13743.6	2510.1	289.3	10944.2	.0
Annual	107644.0	29189.1	11025.3	67429.5	.0

*** FOUNDATION ENERGY PROFILE ***

Month	Heat Loss (MJ) Crawl Space	Slab	Basement	Walkout	Total
Jan	1331.8	.0	.0	.0	1331.8
Feb	1208.1	.0	.0	.0	1208.1
Mar	1257.1	.0	.0	.0	1257.1
Apr	972.2	.0	.0	.0	972.2
May	688.8	.0	.0	.0	688.8
Jun	494.4	.0	.0	.0	494.4
Jul	387.5	.0	.0	.0	387.5
Aug	407.6	.0	.0	.0	407.6
Sep	519.4	.0	.0	.0	519.4
Oct	734.8	.0	.0	.0	734.8
Nov	936.0	.0	.0	.0	936.0
Dec	1228.4	.0	.0	.0	1228.4
Annual	10166.0	.0	.0	.0	10166.0

*** FOUNDATION TEMPERATURES & VENTILATION PROFILE ***

Month	Temperature (Deg C) Crawl Space	Basement	Walkout	Air Change Rate Natural	Total	Heat Loss (MJ)
Jan	.0	.0	.0	.213	.302	3736.8
Feb	.0	.0	.0	.215	.302	3392.1
Mar	.0	.0	.0	.201	.302	3539.1
Apr	.0	.0	.0	.176	.302	2710.5
May	.0	.0	.0	.144	.158	1028.5
Jun	.0	.0	.0	.115	.129	599.6
Jul	.0	.0	.0	.089	.104	381.1
Aug	.0	.0	.0	.093	.108	408.2
Sep	.0	.0	.0	.118	.132	635.9
Oct	.0	.0	.0	.150	.302	2025.5
Nov	.0	.0	.0	.174	.302	2609.5
Dec	.0	.0	.0	.201	.302	3445.8
Annual	.0	.0	.0	.157	.228	24512.6

*** SPACE HEATING SYSTEM PERFORMANCE ***

Month	Space Heating Load MJ	Furnace Input MJ	Pilot Light MJ	Indoor Fans MJ	Heat Pump Input MJ	Total Input MJ	System Cop
Jan	11854.4	13875.3	.0	225.6	.0	14100.9	.841
Feb	10149.7	11892.4	.0	193.2	.0	12085.5	.840
Mar	9594.5	11280.2	.0	182.6	.0	11462.8	.837
Apr	6278.9	7460.5	.0	119.5	.0	7580.0	.828
May	2407.7	3009.4	.0	45.8	.0	3055.2	.788
Jun	1157.6	1559.2	.0	22.0	.0	1581.2	.732
Jul	334.6	586.1	.0	6.4	.0	592.5	.565

Aug	528.7	851.7	.0	10.1	.0	861.8	.614
Sep	1704.4	2208.9	.0	32.4	.0	2241.4	.760
Oct	4921.4	5907.9	.0	93.7	.0	6001.6	.820
Nov	7553.3	8927.2	.0	143.7	.0	9070.9	.833
Dec	10944.2	12830.1	.0	208.3	.0	13038.4	.839
Ann	67429.5	80389.0	.0	1283.2	.0	81672.2	.826

*** MONTHLY ESTIMATED ENERGY CONSUMPTION BY DEVICE (MJ) ***

	Space Heating		DHW Heating		Lights &	HRV &	Air
	Primary	Secondary	Primary	Secondary	Appliances	FANS	Conditioner
Jan	13875.3	.0	2014.3	.0	2678.4	283.1	.0
Feb	11892.4	.0	1830.5	.0	2419.2	244.1	.0
Mar	11280.2	.0	2031.0	.0	2678.4	249.3	.0
Apr	7460.5	.0	1961.2	.0	2592.0	203.2	.0
May	3009.4	.0	2014.3	.0	2678.4	45.8	.0
Jun	1559.2	.0	1933.2	.0	2592.0	22.0	.0
Jul	586.1	.0	1980.9	.0	2678.4	6.4	.0
Aug	851.7	.0	1968.7	.0	2678.4	10.1	.0
Sep	2208.9	.0	1900.9	.0	2592.0	32.4	.0
Oct	5907.9	.0	1968.7	.0	2678.4	200.8	.0
Nov	8927.2	.0	1917.0	.0	2592.0	228.7	.0
Dec	12830.1	.0	1997.6	.0	2678.4	275.5	.0
Total	80389.0	.0	23518.4	.0	31536.0	1801.5	.0

****

Energy units: MJ = Megajoules (3.6 MJ = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

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                    ****************************************
                    *                                      *
                    *              HOT2000                 *
                    *            Version 9.21              *
                    *              CANMET                  *
                    *       Natural Resources CANADA       *
                    *            Jul  8, 2004              *
                    *         Reg. # ENERGUIDEVER          *
                    ****************************************

File = Iqaluit endRowbase.HSE

Application type : EnerGuide for Houses

Weather Data for IQALUIT, NUNAVUT

Builder Code =
Data Entry by:                                     Date of entry  31/08/2004
Company:

Client name:      ,
Street address:
City:                                   Region:
Postal code:                            Telephone:

                     *** GENERAL HOUSE CHARACTERISTICS ***

House type:               Row house, end unit
Number of storeys:        Two storeys
Plan shape:               Rectangular
Front orientation:        South
Year House Built:          2004
Wall colour: Default       0.40                Absorptivity:  .400
Roof colour: Medium brown 0.84                 Absorptivity:  .840

Soil Condition: Normal conductivity: dry sand, loam, clay

Water Table Level: Normal  (7-10 m, 23-33 Ft)

House Thermal Mass Level: (A) Wood frame construction, 12.5 mm (0.5 in.)
                              gyproc walls and ceiling, wooden floor

Effective mass fraction     1.000

Occupants :  2 Adults   for  50.0 % of the time
             2 Children for  50.0 % of the time
             0 Infants  for    .0 % of the time

Sensible Internal Heat Gain From Occupants             =   2.40 kWh/day


                           *** HOUSE TEMPERATURES ***

Heating Temperatures    Main Floor                 = 21.0 C
                        Basement                   = 19.0 C
                        Crawl Space                = Unheated
```

TEMP. Rise from 21.0 C = 2.8 C

Indoor design temperatures for equipment sizing

Heating	=	22.0 C
Cooling	=	24.0 C

*** WINDOW CHARACTERISTICS ***

Label	Location	#	Overhang Width m	Header Height m	Tilt deg	Curtain Factor	Shutter RSI
South							
South0001	MainWall-01	2	.41	2.64	90.0	1.00	.00
South0002	MainWall-03	2	.41	.20	90.0	1.00	.00
North							
North0001	MainWall-01	2	.41	2.64	90.0	1.00	.00
North0002	MainWall-03	2	.41	.20	90.0	1.00	.00

Label	Type	#	Window Width m	Window Height m	Total Area m2	Window RSI	SHGC
South							
South0001	DLowE	2	.91	1.22	2.22	.494	.5384
South0002	DLowE	2	.91	1.22	2.22	.494	.5384
North							
North0001	DLowE	2	.91	1.22	2.22	.494	.5384
North0002	DLowE	2	.91	1.22	2.22	.494	.5384

*** Window Code Schedule ***

Name	Internal Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
DLowE	233214	Double/Double with 1 coat, Low-E .20 (Hard1), 13 mm Argon, Insulating, Hinged, Vinyl, ER* = -12.6, Eff. RSI= .48

* Window Standard Energy Rating estimated for assumed dimensions, and
  Air tightness type: CSA - A1; Leakage rate = 2.79 m3/hr/m

*** BUILDING PARAMETER DETAILS ***

CEILING COMPONENTS

Construction Type	Code Type	Roof Slope	Heel Ht. m	Section Area m2	R-Value RSI

Ceiling01	Attic/Gable	2401491000	3.00/12	.13	66.32	6.84

*** Ceiling Code Schedule ***

Name	Internal Code	Description (Structure, typ/size, Spacing, Insul1, 2, Int., Sheathing, Exterior, Studs)
2401491000	2401491000	Truss, 38 x 89 mm (2 x 4 in) Attic truss, 400 mm (16 in), RSI 3.9 (R 22) Batt, Same as Insulation Layer 1, 12 mm (0.5 in) Gypsum board, N/A, N/A, N/A

MAIN WALL COMPONENTS

Label	Lintel Type	Fac. Dir	Number of Corn.	Number of Inter.	Height m	Perim. m	Area m2	R-Value RSI
MainWall-01 Type: 2x6R20i	001	N/A	4	4	2.44	23.4	57.01	3.10
MainWall-03 Type: 2x6R20i	001	N/A	4	4	2.44	23.4	57.01	3.17
MWhdr-02 Type: 1800300530	000	N/A	4	4	.23	23.4	5.37	4.06

*** Wall Code Schedule ***

Name	Internal Code	Description (Structure, typ/size, Spacing, Insul1, 2, Int., Sheathing, Exterior, Studs)
2x6R20i	1213301430	Wood frame, 38 x 140 mm (2 x 6 in), 600 mm (24 in), RSI 3.5 (R 20) Batt, None, 12 mm (0.5 in) Gypsum board, Plywood/Particle board 9.5 mm (3/8 in), Insul. metal/vinyl cladding, 2 studs
1800300530	1800300530	Floor Header, N/A, N/A, RSI 3.5 (R 20) Batt, None, N/A, Plywood/Particle board 12.7 mm (1/2 in), Insul. metal/vinyl cladding, N/A

DOORS

Label	Type	Height m	Width m	Gross Area m2	R-value RSI
Door-01 Loc: MainWall-01	Steel polyurethane core	2.07	.81	1.68	1.14
Door-02 Loc: MainWall-01	Steel polyurethane core	2.07	.81	1.68	1.14

*** FOUNDATIONS ***

Crawlspace - 2

Foundation type	: Crawl Space	Volume	: 132.5 m3
Data Type	: Library	Ventilation type	: Open
		Thermal break R-value	: .00 RSI
		Skirt R-value	: .00 RSI
Total wall height:	2.00 m	Rectangular	
		Floor length	: 8.14 m
		Floor width	: 8.14 m
Wall type	:	R-value :	.00 RSI
Number of corners	: 1		
Lintel type:	N/A		
Added to slab type	: N/A	R-value :	.00 RSI
Floors above found.	: 4231504760	R-value :	4.95 RSI

Exposed areas for : Crawlspace - 2

Exposed Perimeter = 24.43 m

Configuration: SCN_1
- concrete or soil (for crawl space) floor
- no insulation
- first storey is non-brick veneer or bricks thermally broken from concrete floor

---

Foundation Code Schedule

Floors above Foundation

Name	Internal Code	Description (Structure., typ/size, Spacing, Insul1, 2, Int, Sheathing, Exterior, Drop Floors)
4231504760	4231504760	Wood frame, 38 x 235 mm (2 x 10 in), 400 mm (16 in), RSI 4.9 (R 28) Batt, None, Tile-linoleum, Plywood/Particle board 18.5 mm (3/4 in), Wood, No

Lintel Code Schedule

Name	Code	Description (Type, Material, Insulation)
L001000000000000	001	Single, Wood, Same as wall framing cavity
	000	Single, Wood, None

Roof Cavity Inputs

Gable Ends		Total Area	8.3 m2
Sheathing Material:	Plywood/Part. bd	9.5 mm (3/8 in)	.08 RSI

Exterior Material: Hollow metal/vinyl cladding .11 RSI

Sloped Roof		Total Area	68.4 m2
Sheathing Material:	Plywood/Part. bd 12.7 mm (1/2 in)		.11 RSI
Roofing Material:	Asphalt shingles		.08 RSI

Total cavity volume 33.8 m3 Ventilation rate .50 ACH/hr

*** BUILDING ASSEMBLY DETAILS ***

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Ceiling01	2401491000	7.74	7.59	6.84

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
MainWall-01	2x6R20i	3.22	3.09	3.10
MainWall-03	2x6R20i	3.22	3.16	3.17
MWhdr-02	1800300530	3.50	4.06	4.06

FLOORS ABOVE CRAWL SPACE

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

DOORS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
MainWall-01	2x6R20i	3.22	3.09	3.10
MainWall-03	2x6R20i	3.22	3.16	3.17
MWhdr-02	1800300530	3.50	4.06	4.06

FLOORS ABOVE CRAWL SPACE

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

DOORS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
MainWall-01	2x6R20i	3.22	3.09	3.10
MainWall-03	2x6R20i	3.22	3.16	3.17
MWhdr-02	1800300530	3.50	4.06	4.06

FLOORS ABOVE CRAWL SPACE

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

DOORS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI

MainWall-01	2x6R20i	3.22	3.09	3.10
MainWall-03	2x6R20i	3.22	3.16	3.17
MWhdr-02	1800300530	3.50	4.06	4.06

*** BUILDING PARAMETERS SUMMARY ***

Component	Area (m2) Gross	Net	Effective RSI	Heat Loss MJ	% Annual Heat Loss
ZONE 1 : ABOVE GRADE					
Ceiling	66.32	66.32	6.84	8115.6	8.21
Main Walls	119.39	107.16	3.17	30955.9	31.33
Doors	3.35	3.35	1.14	2791.3	2.82
South windows	4.44	4.44	.49	8527.6	8.63
North windows	4.44	4.44	.49	8527.6	8.63
		ZONE 1 Totals:		58918.0	59.62
ZONE 3 : CRAWL SPACE FOUNDATION					
Foundation	66.26	66.26	-	11543.3	11.68
		ZONE 3 Totals:		11543.3	11.68

Ventilation

House Volume	Air Change	Heat Loss MJ	% Annual Heat Loss
338.90 m3	.233 ACH	28354.3	28.69

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area = 252.0 m2
Air Leakage Test Results at 50 Pa.(0.2 in H2O) = 2.00 ACH
Equivalent Leakage Area @ 10 Pa. = 245.0 cm2

"CGSB" Blower Door C, n 1.21678E-02 .7002

Terrain Description		Height	m
@ Weather Station :	Open flat terrain, grass	Anemometer	10.0
@ Building site :	Suburban, forest	Bldg. Eaves	5.5

Local Shielding- Walls: Heavy
Flue : Light local shielding

Leakage Fractions - Ceiling: .300 Walls: .500 Floors: .200

Normalized Leakage Area @ 10 Pa. = .9723 cm2/m2
Estimated Airflow to cause a 5 Pa Pressure Difference = 39 L/s
Estimated Airflow to cause a 10 Pa Pressure Difference = 61 L/s

*** F326 VENTILATION REQUIREMENTS ***

Kitchen,living,dining:	3 rooms @	5.0 L/s	= 15.0 L/s
Utility rooms:	1 rooms @	5.0 L/s	= 5.0 L/s
Bedrooms:	1 rooms @	10.0 L/s	= 10.0 L/s
Bedrooms:	2 rooms @	5.0 L/s	= 10.0 L/s
Bathrooms:	2 rooms @	5.0 L/s	= 10.0 L/s
Other habitable rooms:	2 rooms @	5.0 L/s	= 10.0 L/s
Basement Rooms:			.0 L/s

*** CENTRAL VENTILATION SYSTEM ***

System Type : Fans without heat recovery
Manufacturer:
Model Number:

Mechanical Ventilator Fan Power = 40. Watts

Operating schedule for Fans without heat recovery

Month	% of Time	Added Vent. Rate (L/s)	Month	% of Time	Added Vent. Rate (L/s)
Jan	28.8	3.0	Jul	.0	.0
Feb	28.1	3.0	Aug	.0	.0
Mar	44.1	4.7	Sep	.0	.0
Apr	72.8	7.7	Oct	100.0	10.6
May	.0	.0	Nov	72.2	7.7
Jun	.0	.0	Dec	43.0	4.6

*** SECONDARY FANS & OTHER EXHAUST APPLIANCES ***

	Control	Supply (L/s)	Exhaust (L/s)
Dryer	Continuous	-	1.20

Dryer is vented outdoors

*** AIR LEAKAGE AND VENTILATION SUMMARY ***

F326 Required continuous ventilation rate = 60.0 L/s (.64 ACH)
Central Ventilation Rate (Balanced) = 10.6 L/s (.11 ACH)
Total house ventilation is Balanced

Gross Air Leakage and Ventilation Energy Load = 28763.1 MJ
Seasonal Heat Recovery Ventilator Efficiency = .0 %
Estimated Ventilation Electrical Load: Heating Hours = 408.8 MJ
Estimated Ventilation Electrical Load: Non-Heating Hours = .0 MJ
Net Air Leakage and Ventilation Energy Load = 28558.7 MJ

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel : Oil
Equipment : Furnace/Boiler with flame ret. head

Manufacturer : SPHMan
Model : SPHMod
Calculated* Output Capacity = 9.0 kW
* Design Heat loss * 1.10 + 0.5 kW

Steady State Efficiency = 83.0 %

Fan Mode : Auto Fan Power 175. watts
Flue Diameter = 127.0 mm

*** DOMESTIC WATER HEATING SYSTEM ***

PRIMARY Water Heating Fuel : Electricity
Water Heating Equipment : Conventional tank
Energy Factor : .822

Manufacturer : DHW man
Model : DHW mod
Tank Capacity = 189.3 Litres Tank Blanket Insulation .0 RSI
Tank Location : Main floor

*** ANNUAL SPACE HEATING SUMMARY ***

Design Heat Loss at -40.0 C = 23.29 Watts/m3 = 7892. Watts

Gross Space Heat Loss = 98816. MJ

Gross Space Heating Load = 98816. MJ
Usable Internal Gains = 28936. MJ
Usable Internal Gains Fraction = 29.3 %
Usable Solar Gains = 10826. MJ
Usable Solar Gains Fraction = 11.0 %
Auxiliary Energy Required = 59054. MJ

Space Heating System Load = 59054. MJ
Furnace/Boiler Seasonal efficiency = 80.3 %
Furnace/Boiler Annual Energy Consumption = 72452. MJ

*** ANNUAL DOMESTIC WATER HEATING SUMMARY ***

Daily Hot Water Consumption = 225.0 Litres /day
Hot Water Temperature = 55.0 C
Estimated Domestic Water Heating Load = 20371. MJ

PRIMARY Domestic Water Heating Energy Consumption = 23518. MJ
PRIMARY System Seasonal Efficiency = 86.6 %

*** BASE LOADS SUMMARY ***

	kwh/day	Annual kWh
Interior Lighting	3.0	1095.0
Appliances	14.0	5110.0
Other	3.0	1095.0
Exterior use	4.0	1460.0

```
HVAC fans
    HRV/Exhaust                                        .3          113.5
    Space Heating                                      .9          312.2
    Space Cooling                                      .0             .0

Total Average Electrical Load                        25.2         9185.7

                 *** FAN OPERATION SUMMARY (kWh) ***

Hours      HRV/Exhaust Fans         Space Heating     Space Cooling

Heating          113.5                   312.2              .0
Neither             .0                      .0              .0
Cooling             .0                      .0              .0

Total            113.5                   312.2              .0

        *** ENERGUIDE FOR HOUSES ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption   =  73575. MJ = 20437.6 kWh
Ventilator Electrical Consumption: Heating Hours    =    409. MJ =   113.5 kWh
Estimated Annual DHW Heating Energy Consumption     =  23518. MJ =  6532.9 kWh

ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION     =  97503. MJ = 27084.0 kWh

ENERGUIDE RATING (0 to 100)                                77
EnerGuide Required Ventilation Capacity                  10.6 L/s

Estimated Greenhouse Gas Emissions   19604. kg/Year

                *** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel                       Space     Space      DHW    Appliances    Total
                          Heating   Cooling   Heating

Oil         (Litres)      1880.7        .0        .0        .0       1880.7
Electricity (kWh)          425.7        .0    6532.9    8760.0      15718.6


               *** ESTIMATED ANNUAL FUEL CONSUMPTION COSTS ***

Fuel Costs Library = C:\H2KEGH~1\STDLIBS\FuelLib.FLC

        Electricity Natural Gas        Oil      Propane        Wood       Total
RATE     (Ottawa97)  (Ottawa97)  (Ottawa97)  (Ottawa97)  ($70/Cord)

   $        1312.55         .00      882.62         .00         .00     2195.16

                   *** MONTHLY ENERGY PROFILE ***

Month  Energy Load  Internal Gains  Solar Gains  Aux. Energy  HRV Eff.
           MJ            MJ              MJ           MJ         %
----------------------------------------------------------------------

Jan      13689.7         2503.9          520.3      10665.5         .0
Feb      12362.7         2257.5         1014.6       9090.7         .0
Mar      12766.4         2497.7         1729.2       8539.5         .0
```

Apr	9698.1	2418.7	1782.2	5497.3	.0
May	5893.8	2503.9	1463.9	1926.1	.0
Jun	4047.1	2375.7	878.7	792.7	.0
Jul	3018.0	2211.7	653.7	152.6	.0
Aug	3244.9	2283.6	680.7	280.7	.0
Sep	4394.5	2417.1	711.7	1265.7	.0
Oct	7461.0	2520.9	662.2	4277.9	.0
Nov	9592.8	2435.2	439.8	6717.9	.0
Dec	12646.6	2510.1	289.3	9847.1	.0
Annual	98815.6	28935.9	10826.2	59053.5	.0

*** FOUNDATION ENERGY PROFILE ***

Month	Heat Loss (MJ)				
	Crawl Space	Slab	Basement	Walkout	Total
Jan	1512.2	.0	.0	.0	1512.2
Feb	1371.7	.0	.0	.0	1371.7
Mar	1427.4	.0	.0	.0	1427.4
Apr	1103.9	.0	.0	.0	1103.9
May	782.2	.0	.0	.0	782.2
Jun	561.4	.0	.0	.0	561.4
Jul	440.0	.0	.0	.0	440.0
Aug	462.8	.0	.0	.0	462.8
Sep	589.8	.0	.0	.0	589.8
Oct	834.3	.0	.0	.0	834.3
Nov	1062.9	.0	.0	.0	1062.9
Dec	1394.9	.0	.0	.0	1394.9
Annual	11543.3	.0	.0	.0	11543.3

*** FOUNDATION TEMPERATURES & VENTILATION PROFILE ***

Month	Temperature (Deg C)			Air Change Rate		Heat Loss
	Crawl Space	Basement	Walkout	Natural	Total	(MJ)
Jan	.0	.0	.0	.254	.299	4254.6
Feb	.0	.0	.0	.255	.299	3863.1
Mar	.0	.0	.0	.237	.300	4039.1
Apr	.0	.0	.0	.205	.300	3091.4
May	.0	.0	.0	.166	.179	1323.0
Jun	.0	.0	.0	.132	.145	764.8
Jul	.0	.0	.0	.103	.115	481.1
Aug	.0	.0	.0	.107	.120	516.2
Sep	.0	.0	.0	.136	.148	812.1
Oct	.0	.0	.0	.175	.300	2309.3
Nov	.0	.0	.0	.205	.299	2970.9
Dec	.0	.0	.0	.238	.299	3928.5
Annual	.0	.0	.0	.184	.233	28354.3

*** SPACE HEATING SYSTEM PERFORMANCE ***

Month	Space Heating Load MJ	Furnace Input MJ	Pilot Light MJ	Indoor Fans MJ	Heat Pump Input MJ	Total Input MJ	System Cop
Jan	10665.5	12811.5	.0	203.0	.0	13014.5	.820
Feb	9090.7	10933.5	.0	173.0	.0	11106.5	.819
Mar	8539.5	10311.3	.0	162.5	.0	10473.8	.815
Apr	5497.3	6722.6	.0	104.6	.0	6827.2	.805
May	1926.1	2508.3	.0	36.7	.0	2545.0	.757
Jun	792.7	1158.5	.0	15.1	.0	1173.6	.675
Jul	152.6	386.2	.0	2.9	.0	389.1	.392
Aug	280.7	573.3	.0	5.3	.0	578.6	.485
Sep	1265.7	1744.7	.0	24.1	.0	1768.8	.716
Oct	4277.9	5293.5	.0	81.4	.0	5374.9	.796
Nov	6717.9	8159.0	.0	127.8	.0	8286.9	.811
Dec	9847.1	11849.1	.0	187.4	.0	12036.5	.818
Ann	59053.5	72451.5	.0	1123.8	.0	73575.4	.803

*** MONTHLY ESTIMATED ENERGY CONSUMPTION BY DEVICE (MJ) ***

	Space Heating Primary	Space Heating Secondary	DHW Heating Primary	DHW Heating Secondary	Lights & Appliances	HRV & FANS	Air Conditioner
Jan	12811.5	.0	2014.3	.0	2678.4	233.8	.0
Feb	10933.5	.0	1830.5	.0	2419.2	200.2	.0
Mar	10311.3	.0	2031.0	.0	2678.4	209.8	.0
Apr	6722.6	.0	1961.2	.0	2592.0	180.1	.0
May	2508.3	.0	2014.3	.0	2678.4	36.7	.0
Jun	1158.5	.0	1933.2	.0	2592.0	15.1	.0
Jul	386.2	.0	1980.9	.0	2678.4	2.9	.0
Aug	573.3	.0	1968.7	.0	2678.4	5.3	.0
Sep	1744.7	.0	1900.9	.0	2592.0	24.1	.0
Oct	5293.5	.0	1968.7	.0	2678.4	188.5	.0
Nov	8159.0	.0	1917.0	.0	2592.0	202.7	.0
Dec	11849.1	.0	1997.6	.0	2678.4	233.5	.0
Total	72451.5	.0	23518.4	.0	31536.0	1532.6	.0

*** ESTIMATED FUEL COSTS (Dollars) ***

	Electricity	Natural Gas	Oil	Propane	Wood	Total
Jan	113.49	.00	144.85	.00	.00	258.34
Feb	104.20	.00	125.08	.00	.00	229.28
Mar	113.35	.00	118.54	.00	.00	231.89
Apr	109.72	.00	80.76	.00	.00	190.48
May	109.65	.00	36.40	.00	.00	146.05
Jun	105.96	.00	22.19	.00	.00	128.16
Jul	108.34	.00	14.07	.00	.00	122.40
Aug	108.15	.00	16.03	.00	.00	124.18
Sep	105.51	.00	28.36	.00	.00	133.87
Oct	111.72	.00	65.72	.00	.00	177.44
Nov	109.30	.00	95.88	.00	.00	205.19
Dec	113.16	.00	134.72	.00	.00	247.88

Total	1312.55	.00	882.62	.00	.00	2195.16

****

Energy units: MJ = Megajoules (3.6 MJ = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

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***************************************
*                                     *
*              HOT2000                *
*           Version 9.21              *
*              CANMET                 *
*      Natural Resources CANADA       *
*            Jul  8, 2004             *
*        Reg. # ENERGUIDEVER          *
***************************************
```

File = Iqaluit midRowbase.HSE

Application type : EnerGuide for Houses

Weather Data for IQALUIT, NUNAVUT

Builder Code =
Data Entry by: Date of entry 31/08/2004
Company:

Client name: ,
Street address:
City: Region:
Postal code: Telephone:

*** GENERAL HOUSE CHARACTERISTICS ***

House type:	Row house, middle unit		
Number of storeys:	Two storeys		
Plan shape:	Rectangular		
Front orientation:	South		
Year House Built:	2004		
Wall colour: Default	0.40	Absorptivity:	.400
Roof colour: Medium brown	0.84	Absorptivity:	.840

Soil Condition: Normal conductivity: dry sand, loam, clay

Water Table Level: Normal (7-10 m, 23-33 Ft)

House Thermal Mass Level: (A) Wood frame construction, 12.5 mm (0.5 in.) gyproc walls and ceiling, wooden floor

Effective mass fraction 1.000

Occupants :	2 Adults	for	50.0 %	of the time
	2 Children	for	50.0 %	of the time
	0 Infants	for	.0 %	of the time

Sensible Internal Heat Gain From Occupants = 2.40 kWh/day

*** HOUSE TEMPERATURES ***

Heating Temperatures	Main Floor	= 21.0 C
	Basement	= 19.0 C
	Crawl Space	= Unheated

TEMP. Rise from 21.0 C = 2.8 C

Indoor design temperatures for equipment sizing

Heating	=	22.0 C
Cooling	=	24.0 C

*** WINDOW CHARACTERISTICS ***

Label	Location	#	Overhang Width m	Header Height m	Tilt deg	Curtain Factor	Shutter RSI
South							
South0001	MainWall-01	2	.41	2.64	90.0	1.00	.00
South0002	MainWall-03	2	.41	.20	90.0	1.00	.00
North							
North0001	MainWall-01	2	.41	2.64	90.0	1.00	.00
North0002	MainWall-03	2	.41	.20	90.0	1.00	.00

Label	Type	#	Window Width m	Window Height m	Total Area m2	Window RSI	SHGC
South							
South0001	DLowE	2	.91	1.22	2.22	.494	.5384
South0002	DLowE	2	.91	1.22	2.22	.494	.5384
North							
North0001	DLowE	2	.91	1.22	2.22	.494	.5384
North0002	DLowE	2	.91	1.22	2.22	.494	.5384

*** Window Code Schedule ***

Name	Internal Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
DLowE	233214	Double/Double with 1 coat, Low-E .20 (Hard1), 13 mm Argon, Insulating, Hinged, Vinyl, ER* = -12.6, Eff. RSI= .48

* Window Standard Energy Rating estimated for assumed dimensions, and
  Air tightness type: CSA - A1; Leakage rate = 2.79 m3/hr/m

*** BUILDING PARAMETER DETAILS ***

CEILING COMPONENTS

Construction Type	Code Type	Roof Slope	Heel Ht. m	Section Area m2	R-Value RSI

Ceiling01	Attic/Gable	2401491000	3.00/12	.13	66.32	6.84

*** Ceiling Code Schedule ***

Name	Internal Code	Description (Structure, typ/size, Spacing, Insul1, 2, Int., Sheathing, Exterior, Studs)
2401491000	2401491000	Truss, 38 x 89 mm (2 x 4 in) Attic truss, 400 mm (16 in), RSI 3.9 (R 22) Batt, Same as Insulation Layer 1, 12 mm (0.5 in) Gypsum board, N/A, N/A, N/A

MAIN WALL COMPONENTS

Label	Lintel Type	Fac. Dir	Number of Corn.	Number of Inter.	Height m	Perim. m	Area m2	R-Value RSI
MainWall-01 Type: 2x6R20i	001	N/A	4	4	2.44	16.3	39.77	2.98
MainWall-03 Type: 2x6R20i	001	N/A	4	4	2.44	16.3	39.77	3.08
MWhdr-02 Type: 1800300530	000	N/A	4	4	.23	23.4	5.37	4.06

*** Wall Code Schedule ***

Name	Internal Code	Description (Structure, typ/size, Spacing, Insul1, 2, Int., Sheathing, Exterior, Studs)
2x6R20i	1213301430	Wood frame, 38 x 140 mm (2 x 6 in), 600 mm (24 in), RSI 3.5 (R 20) Batt, None, 12 mm (0.5 in) Gypsum board, Plywood/Particle board 9.5 mm (3/8 in), Insul. metal/vinyl cladding, 2 studs
1800300530	1800300530	Floor Header, N/A, N/A, RSI 3.5 (R 20) Batt, None, N/A, Plywood/Particle board 12.7 mm (1/2 in), Insul. metal/vinyl cladding, N/A

DOORS

Label	Type	Height m	Width m	Gross Area m2	R-value RSI
Door-01 Loc: MainWall-01	Steel polyurethane core	2.07	.81	1.68	1.14
Door-02 Loc: MainWall-01	Steel polyurethane core	2.07	.81	1.68	1.14

```
 *** FOUNDATIONS ***

Crawlspace - 2
  Foundation type  : Crawl Space         Volume              :   132.5 m3
  Data Type        : Library             Ventilation type    : Open
                                         Thermal break R-value:     .00 RSI
                                         Skirt R-value       :     .00 RSI

  Total wall height:   2.00 m            Rectangular
                                         Floor length        :   8.14 m
                                         Floor width         :   8.14 m

  Wall type         :                                 R-value :    .00 RSI
  Number of corners :   1
  Lintel  type: N/A

  Added to slab type : N/A                            R-value :    .00 RSI
  Floors above found.: 4231504760                     R-value :   4.95 RSI

Exposed areas for : Crawlspace - 2

Exposed Perimeter =     16.28  m

Configuration: SCN_1
  - concrete or soil (for crawl space) floor
  - no insulation
  - first storey is non-brick veneer or bricks thermally broken from concrete
    floor
```

Foundation Code Schedule

Floors above Foundation

Name	Internal Code	Description (Structure., typ/size, Spacing, Insul1, 2, Int, Sheathing, Exterior, Drop Floors)
4231504760	4231504760	Wood frame, 38 x 235 mm (2 x 10 in), 400 mm (16 in), RSI 4.9 (R 28) Batt, None, Tile-linoleum, Plywood/Particle board 18.5 mm (3/4 in), Wood, No

Lintel Code Schedule

Name	Code	Description (Type, Material, Insulation)
L001000000000000	001	Single, Wood, Same as wall framing cavity
	000	Single, Wood, None

Roof Cavity Inputs

```
Gable Ends                                 Total Area          8.3 m2
Sheathing Material: Plywood/Part. bd  9.5 mm (3/8 in)          .08 RSI
```

Exterior Material: Hollow metal/vinyl cladding .11 RSI

Sloped Roof Total Area 68.4 m2
Sheathing Material: Plywood/Part. bd 12.7 mm (1/2 in) .11 RSI
Roofing Material: Asphalt shingles .08 RSI

Total cavity volume 33.8 m3 Ventilation rate .50 ACH/hr

*** BUILDING ASSEMBLY DETAILS ***

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Ceiling01	2401491000	7.74	7.59	6.84

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
MainWall-01	2x6R20i	3.22	2.97	2.98
MainWall-03	2x6R20i	3.22	3.08	3.08
MWhdr-02	1800300530	3.50	4.06	4.06

FLOORS ABOVE CRAWL SPACE

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

DOORS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
MainWall-01	2x6R20i	3.22	2.97	2.98
MainWall-03	2x6R20i	3.22	3.08	3.08
MWhdr-02	1800300530	3.50	4.06	4.06

FLOORS ABOVE CRAWL SPACE

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

DOORS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
MainWall-01	2x6R20i	3.22	2.97	2.98
MainWall-03	2x6R20i	3.22	3.08	3.08
MWhdr-02	1800300530	3.50	4.06	4.06

FLOORS ABOVE CRAWL SPACE

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

DOORS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

CEILING COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI
Crawlspace - 2	4231504760	4.91	4.95	4.95

MAIN WALL COMPONENTS

Label	Construction Code	Nominal RSI	System RSI	Effective RSI

MainWall-01	2x6R20i	3.22	2.97	2.98
MainWall-03	2x6R20i	3.22	3.08	3.08
MWhdr-02	1800300530	3.50	4.06	4.06

*** BUILDING PARAMETERS SUMMARY ***

Component	Area (m2) Gross	Net	Effective RSI	Heat Loss MJ	% Annual Heat Loss
ZONE 1 : ABOVE GRADE					
Ceiling	66.32	66.32	6.84	8115.6	9.07
Main Walls	84.92	72.68	3.09	21535.4	24.07
Doors	3.35	3.35	1.14	2791.3	3.12
South windows	4.44	4.44	.49	8527.6	9.53
North windows	4.44	4.44	.49	8527.6	9.53
				=========	=======
		ZONE 1 Totals:		49497.5	55.33
ZONE 3 : CRAWL SPACE FOUNDATION					
Foundation	66.26	66.26	-	11543.3	12.90
				=========	=======
		ZONE 3 Totals:		11543.3	12.90

Ventilation

House Volume	Air Change	Heat Loss MJ	% Annual Heat Loss
338.90 m3	.234 ACH	28414.9	31.76

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area = 217.5 m2
Air Leakage Test Results at 50 Pa.(0.2 in H2O) = 2.00 ACH
Equivalent Leakage Area @ 10 Pa. = 245.0 cm2

"CGSB" Blower Door C, n 1.21678E-02 .7002

Terrain Description		Height	m
@ Weather Station :	Open flat terrain, grass	Anemometer	10.0
@ Building site :	Suburban, forest	Bldg. Eaves	5.5

Local Shielding- Walls: Heavy
Flue : Light local shielding

Leakage Fractions - Ceiling: .300 Walls: .500 Floors: .200

Normalized Leakage Area @ 10 Pa. = 1.1264 cm2/m2
Estimated Airflow to cause a 5 Pa Pressure Difference = 39 L/s
Estimated Airflow to cause a 10 Pa Pressure Difference = 61 L/s

*** F326 VENTILATION REQUIREMENTS ***

Kitchen,living,dining:	3 rooms @ 5.0 L/s	=	15.0 L/s
Utility rooms:	1 rooms @ 5.0 L/s	=	5.0 L/s
Bedrooms:	1 rooms @ 10.0 L/s	=	10.0 L/s
Bedrooms:	2 rooms @ 5.0 L/s	=	10.0 L/s
Bathrooms:	2 rooms @ 5.0 L/s	=	10.0 L/s
Other habitable rooms:	2 rooms @ 5.0 L/s	=	10.0 L/s
Basement Rooms:			.0 L/s

*** CENTRAL VENTILATION SYSTEM ***

System Type : Fans without heat recovery
Manufacturer:
Model Number:

Mechanical Ventilator Fan Power = 40. Watts

Operating schedule for Fans without heat recovery

Month	% of Time	Added Vent. Rate (L/s)	Month	% of Time	Added Vent. Rate (L/s)
Jan	29.6	3.2	Jul	.0	.0
Feb	29.0	3.1	Aug	.0	.0
Mar	44.8	4.8	Sep	.0	.0
Apr	73.1	7.8	Oct	100.0	10.7
May	.0	.0	Nov	73.2	7.8
Jun	.0	.0	Dec	43.7	4.7

*** SECONDARY FANS & OTHER EXHAUST APPLIANCES ***

	Control	Supply (L/s)	Exhaust (L/s)
Dryer	Continuous	-	1.20

Dryer is vented outdoors

*** AIR LEAKAGE AND VENTILATION SUMMARY ***

F326 Required continuous ventilation rate = 60.0 L/s (.64 ACH)
Central Ventilation Rate (Balanced) = 10.7 L/s (.11 ACH)
Total house ventilation is Balanced

Gross Air Leakage and Ventilation Energy Load	=	28828.3 MJ
Seasonal Heat Recovery Ventilator Efficiency	=	.0 %
Estimated Ventilation Electrical Load: Heating Hours	=	413.4 MJ
Estimated Ventilation Electrical Load: Non-Heating Hours	=	.0 MJ
Net Air Leakage and Ventilation Energy Load	=	28621.6 MJ

*** SPACE HEATING SYSTEM ***

PRIMARY Heating Fuel : Oil
Equipment : Furnace/Boiler with flame ret. head

```
Manufacturer                   : SPHMan
Model                          : SPHMod
Calculated* Output Capacity    =       8.0 kW
* Design Heat loss * 1.10 + 0.5 kW

Steady State Efficiency        =  83.0 %

Fan Mode : Auto                 Fan Power     155. watts
Flue Diameter                  = 127.0 mm
```

*** DOMESTIC WATER HEATING SYSTEM ***

```
PRIMARY Water Heating Fuel   : Electricity
Water Heating Equipment      : Conventional tank
Energy Factor                :    .822

Manufacturer                 : DHW man
Model                        : DHW mod
Tank Capacity =  189.3 Litres      Tank Blanket Insulation     .0 RSI
Tank Location : Main floor
```

*** ANNUAL SPACE HEATING SUMMARY ***

```
Design Heat Loss at -40.0 C     =   21.40 Watts/m3     =   7253. Watts

Gross Space Heat Loss                                  =  89456. MJ

Gross Space Heating Load                               =  89456. MJ
Usable Internal Gains                                  =  28580. MJ
Usable Internal Gains Fraction                         =    31.9 %
Usable Solar Gains                                     =  10421. MJ
Usable Solar Gains Fraction                            =    11.6 %
Auxiliary Energy Required                              =  50455. MJ

Space Heating System Load                              =  51104. MJ
Furnace/Boiler Seasonal efficiency                     =    80.2 %
Furnace/Boiler Annual Energy Consumption               =  62731. MJ
```

*** ANNUAL DOMESTIC WATER HEATING SUMMARY ***

```
Daily Hot Water Consumption                            =   225.0 Litres  /day
Hot Water Temperature                                  =    55.0 C
Estimated Domestic Water Heating Load                  =  20371. MJ

PRIMARY Domestic Water Heating Energy Consumption      =  23518. MJ
PRIMARY System Seasonal Efficiency                     =    86.6 %
```

*** BASE LOADS SUMMARY ***

	kwh/day	Annual kWh
Interior Lighting	3.0	1095.0
Appliances	14.0	5110.0
Other	3.0	1095.0
Exterior use	4.0	1460.0

HVAC fans		
HRV/Exhaust	.3	114.8
Space Heating	.7	270.2
Space Cooling	.0	.0
Total Average Electrical Load	25.1	9145.0

*** FAN OPERATION SUMMARY (kWh) ***

Hours	HRV/Exhaust Fans	Space Heating	Space Cooling
Heating	114.8	270.2	.0
Neither	.0	.0	.0
Cooling	.0	.0	.0
Total	114.8	270.2	.0

*** ENERGUIDE FOR HOUSES ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption = 63704. MJ = 17695.4 kWh
Ventilator Electrical Consumption: Heating Hours = 413. MJ = 114.8 kWh
Estimated Annual DHW Heating Energy Consumption = 23518. MJ = 6532.9 kWh

ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION = 87635. MJ = 24343.2 kWh

ENERGUIDE RATING (0 to 100) 78
EnerGuide Required Ventilation Capacity 10.7 L/s

Estimated Greenhouse Gas Emissions 18854. kg/Year

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel		Space Heating	Space Cooling	DHW Heating	Appliances	Total
Oil	(Litres)	1628.4	.0	.0	.0	1628.4
Electricity	(kWh)	385.0	.0	6532.9	8760.0	15677.9

*** ESTIMATED ANNUAL FUEL CONSUMPTION COSTS ***

Fuel Costs Library = C:\H2KEGH~1\STDLIBS\FuelLib.FLC

RATE	Electricity (Ottawa97)	Natural Gas (Ottawa97)	Oil (Ottawa97)	Propane (Ottawa97)	Wood ($70/Cord)	Total
$	1309.69	.00	780.30	.00	.00	2089.99

*** MONTHLY ENERGY PROFILE ***

Month	Energy Load MJ	Internal Gains MJ	Solar Gains MJ	Aux. Energy MJ	HRV Eff. %
Jan	12431.6	2503.9	520.3	9407.4	.0
Feb	11233.5	2257.5	1012.4	7963.6	.0
Mar	11611.7	2497.7	1714.1	7399.9	.0

Apr	8826.7	2418.7	1752.7	4655.3	.0
May	5290.2	2503.9	1386.2	1400.1	.0
Jun	3608.8	2311.5	814.2	483.1	.0
Jul	2680.8	2085.6	543.2	52.0	.0
Aug	2881.5	2166.1	594.8	120.6	.0
Sep	3915.3	2368.7	692.3	854.2	.0
Oct	6772.7	2520.9	661.6	3590.2	.0
Nov	8721.9	2435.2	439.8	5846.9	.0
Dec	11481.1	2510.1	289.3	8681.7	.0
Annual	89455.7	28579.8	10420.8	50455.1	.0

*** FOUNDATION ENERGY PROFILE ***

Month	Heat Loss (MJ)				
	Crawl Space	Slab	Basement	Walkout	Total
Jan	1512.2	.0	.0	.0	1512.2
Feb	1371.7	.0	.0	.0	1371.7
Mar	1427.4	.0	.0	.0	1427.4
Apr	1103.9	.0	.0	.0	1103.9
May	782.2	.0	.0	.0	782.2
Jun	561.4	.0	.0	.0	561.4
Jul	440.0	.0	.0	.0	440.0
Aug	462.8	.0	.0	.0	462.8
Sep	589.8	.0	.0	.0	589.8
Oct	834.3	.0	.0	.0	834.3
Nov	1062.9	.0	.0	.0	1062.9
Dec	1394.9	.0	.0	.0	1394.9
Annual	11543.3	.0	.0	.0	11543.3

*** FOUNDATION TEMPERATURES & VENTILATION PROFILE ***

Month	Temperature (Deg C)			Air Change Rate		Heat Loss
	Crawl Space	Basement	Walkout	Natural	Total	(MJ)
Jan	.0	.0	.0	.254	.300	4266.3
Feb	.0	.0	.0	.254	.300	3873.2
Mar	.0	.0	.0	.237	.300	4047.9
Apr	.0	.0	.0	.205	.301	3095.1
May	.0	.0	.0	.166	.179	1320.9
Jun	.0	.0	.0	.132	.145	763.9
Jul	.0	.0	.0	.103	.115	480.9
Aug	.0	.0	.0	.107	.120	515.9
Sep	.0	.0	.0	.136	.148	811.0
Oct	.0	.0	.0	.175	.301	2311.2
Nov	.0	.0	.0	.206	.301	2990.5
Dec	.0	.0	.0	.238	.300	3938.0
Annual	.0	.0	.0	.184	.234	28414.9

*** SPACE HEATING SYSTEM PERFORMANCE ***

Month	Space Heating Load MJ	Furnace Input MJ	Pilot Light MJ	Indoor Fans MJ	Heat Pump Input MJ	Total Input MJ	System Cop
Jan	9407.4	11302.1	.0	179.0	.0	11481.2	.819
Feb	7963.6	9581.1	.0	151.6	.0	9732.6	.818
Mar	7399.9	8941.3	.0	140.8	.0	9082.1	.815
Apr	4655.3	5702.5	.0	88.6	.0	5791.1	.804
May	1400.1	1854.4	.0	26.6	.0	1881.0	.744
Jun	483.1	758.9	.0	9.2	.0	768.1	.629
Jul	52.0	244.9	.0	1.0	.0	245.9	.211
Aug	120.6	349.7	.0	2.3	.0	352.0	.343
Sep	854.2	1224.6	.0	16.3	.0	1240.9	.688
Oct	3590.2	4453.0	.0	68.3	.0	4521.4	.794
Nov	6495.9	7869.9	.0	123.6	.0	7993.5	.813
Dec	8681.7	10448.6	.0	165.2	.0	10613.9	.818
Ann	51104.1	62731.0	.0	972.6	.0	63703.6	.802

*** MONTHLY ESTIMATED ENERGY CONSUMPTION BY DEVICE (MJ) ***

	Space Heating		DHW Heating		Lights &	HRV &	Air
	Primary	Secondary	Primary	Secondary	Appliances	FANS	Conditioner
Jan	11302.1	.0	2014.3	.0	2678.4	210.8	.0
Feb	9581.1	.0	1830.5	.0	2419.2	179.6	.0
Mar	8941.3	.0	2031.0	.0	2678.4	188.8	.0
Apr	5702.5	.0	1961.2	.0	2592.0	164.4	.0
May	1854.4	.0	2014.3	.0	2678.4	26.6	.0
Jun	758.9	.0	1933.2	.0	2592.0	9.2	.0
Jul	244.9	.0	1980.9	.0	2678.4	1.0	.0
Aug	349.7	.0	1968.7	.0	2678.4	2.3	.0
Sep	1224.6	.0	1900.9	.0	2592.0	16.3	.0
Oct	4453.0	.0	1968.7	.0	2678.4	175.5	.0
Nov	7869.9	.0	1917.0	.0	2592.0	199.5	.0
Dec	10448.6	.0	1997.6	.0	2678.4	212.0	.0
Total	62731.0	.0	23518.4	.0	31536.0	1386.0	.0

*** ESTIMATED FUEL COSTS (Dollars) ***

	Electricity	Natural Gas	Oil	Propane	Wood	Total
Jan	113.04	.00	128.97	.00	.00	242.01
Feb	103.80	.00	110.85	.00	.00	214.64
Mar	112.94	.00	104.12	.00	.00	217.06
Apr	109.42	.00	70.02	.00	.00	179.44
May	109.45	.00	29.52	.00	.00	138.97
Jun	105.85	.00	17.99	.00	.00	123.83
Jul	108.30	.00	12.58	.00	.00	120.88
Aug	108.09	.00	13.68	.00	.00	121.77
Sep	105.35	.00	22.89	.00	.00	128.24
Oct	111.46	.00	56.87	.00	.00	168.34
Nov	109.24	.00	92.84	.00	.00	202.08
Dec	112.74	.00	119.98	.00	.00	232.72

Total	1309.69	.00	780.30	.00	.00	2089.99

****

Energy units: MJ = Megajoules (3.6 MJ = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

Appendix 'B'

Life-Cycle Benefit/Cost Details

Energy Savings from Improvement to EGH80/R2000

Year	Units Built		Annual Fossil Energy (MJ)		Heating Fuel (litres)		Electricity (kWh)		Diesel Fuel (litres)	
	Detached	Row	Detached	Row	Detached	Row	Detached	Row	Detached	Row
2005	41	42	-	-	-		-		-	-
2006	41	42	-447,000	-828,000	-11,000	-21,000	266,000	270,000	85,000	87,000
2007	41	42	-894,000	-1,656,000	-23,000	-42,000	531,000	540,000	171,000	173,000
2008	41	42	-1,342,000	-2,484,000	-34,000	-64,000	797,000	811,000	256,000	260,000
2009	41	42	-1,789,000	-3,312,000	-46,000	-85,000	1,063,000	1,081,000	341,000	347,000
2010	41	42	-2,236,000	-4,141,000	-57,000	-106,000	1,328,000	1,351,000	426,000	434,000
2011	41	42	-2,683,000	-4,969,000	-68,000	-127,000	1,594,000	1,621,000	512,000	520,000
2012	41	42	-3,131,000	-5,797,000	-80,000	-148,000	1,859,000	1,891,000	597,000	607,000
2013	41	42	-3,578,000	-6,625,000	-91,000	-170,000	2,125,000	2,161,000	682,000	694,000
2014	41	42	-4,025,000	-7,453,000	-103,000	-191,000	2,391,000	2,432,000	767,000	780,000
2015	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2016	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2017	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2018	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2019	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2020	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2021	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2022	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2023	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2024	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2025	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2026	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2027	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2028	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2029	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2030	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2031	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2032	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2033	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2034	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2035	0	0	-4,472,000	-8,281,000	-114,000	-212,000	2,656,000	2,702,000	853,000	867,000
2036	0	0	-4,025,000	-7,453,000	-103,000	-191,000	2,391,000	2,432,000	767,000	780,000
2037	0	0	-3,578,000	-6,625,000	-91,000	-170,000	2,125,000	2,161,000	682,000	694,000
2038	0	0	-3,131,000	-5,797,000	-80,000	-148,000	1,859,000	1,891,000	597,000	607,000
2039	0	0	-2,683,000	-4,969,000	-68,000	-127,000	1,594,000	1,621,000	512,000	520,000
2040	0	0	-2,236,000	-4,141,000	-57,000	-106,000	1,328,000	1,351,000	426,000	434,000
2041	0	0	-1,789,000	-3,312,000	-46,000	-85,000	1,063,000	1,081,000	341,000	347,000
2042	0	0	-1,342,000	-2,484,000	-34,000	-64,000	797,000	811,000	256,000	260,000
2043	0	0	-894,000	-1,656,000	-23,000	-42,000	531,000	540,000	171,000	173,000
2044	0	0	-447,000	-828,000	-11,000	-21,000	266,000	270,000	85,000	87,000
TOTAL	410	420	-134,162,000	-248,431,000	-3,420,000	-6,360,000	79,684,000	81,058,000	25,587,000	26,011,000

Energy Savings from Improvement to EGH83

Year	Units Built		Annual Fossil Energy (MJ)		Heating Fuel (litres)		Electricity (kWh)		Diesel Fuel (litres)	
	Detached	Row	Detached	Row	Detached	Row	Detached	Row	Detached	Row
2005	41	42	-	-	-		-		-	-
2006	41	42	205,000	-245,000	5,000	-6,000	269,000	273,000	86,000	88,000
2007	41	42	409,000	-490,000	10,000	-13,000	539,000	547,000	173,000	176,000
2008	41	42	614,000	-735,000	15,000	-19,000	808,000	820,000	259,000	263,000
2009	41	42	818,000	-981,000	21,000	-25,000	1,078,000	1,094,000	346,000	351,000
2010	41	42	1,023,000	-1,226,000	26,000	-32,000	1,347,000	1,367,000	432,000	439,000
2011	41	42	1,227,000	-1,471,000	31,000	-38,000	1,617,000	1,641,000	519,000	527,000
2012	41	42	1,432,000	-1,716,000	36,000	-44,000	1,886,000	1,914,000	605,000	614,000
2013	41	42	1,636,000	-1,961,000	41,000	-51,000	2,156,000	2,188,000	692,000	702,000
2014	41	42	1,841,000	-2,206,000	46,000	-57,000	2,425,000	2,461,000	778,000	790,000
2015	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2016	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2017	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2018	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2019	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2020	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2021	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2022	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2023	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2024	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2025	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2026	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2027	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2028	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2029	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2030	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2031	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2032	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2033	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2034	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2035	0	0	2,045,000	-2,451,000	52,000	-63,000	2,695,000	2,735,000	865,000	878,000
2036	0	0	1,841,000	-2,206,000	46,000	-57,000	2,425,000	2,461,000	778,000	790,000
2037	0	0	1,636,000	-1,961,000	41,000	-51,000	2,156,000	2,188,000	692,000	702,000
2038	0	0	1,432,000	-1,716,000	36,000	-44,000	1,886,000	1,914,000	605,000	614,000
2039	0	0	1,227,000	-1,471,000	31,000	-38,000	1,617,000	1,641,000	519,000	527,000
2040	0	0	1,023,000	-1,226,000	26,000	-32,000	1,347,000	1,367,000	432,000	439,000
2041	0	0	818,000	-981,000	21,000	-25,000	1,078,000	1,094,000	346,000	351,000
2042	0	0	614,000	-735,000	15,000	-19,000	808,000	820,000	259,000	263,000
2043	0	0	409,000	-490,000	10,000	-13,000	539,000	547,000	173,000	176,000
2044	0	0	205,000	-245,000	5,000	-6,000	269,000	273,000	86,000	88,000
TOTAL	410	420	61,355,000	-73,533,000	1,554,000	-1,893,000	80,845,000	82,045,000	25,945,000	26,338,000

GHG Savings from Improvement to EGH80/R2000

Year	Heating Fuel (litres)		GHG Savings (kg CO_2e)		Electricity (kWh)		Diesel Fuel (litres)		GHG Savings (kg CO_2e)		GHG Savings (kg CO_2e)
	Detached	Row	Detached	Row	Detached	Row	Detached	Row	Detached	Row	TOTAL
2005	-	-	-	-	-	-	-	-	-	-	
2006	-11,000	-21,000	-31,196	-59,556	266,000	270,000	85,000	87,000	241,060	246,732	397,040
2007	-23,000	-42,000	-65,228	-119,112	531,000	540,000	171,000	173,000	484,956	490,628	791,244
2008	-34,000	-64,000	-96,424	-181,504	797,000	811,000	256,000	260,000	726,016	737,360	1,185,448
2009	-46,000	-85,000	-130,456	-241,060	1,063,000	1,081,000	341,000	347,000	967,076	984,092	1,579,652
2010	-57,000	-106,000	-161,652	-300,616	1,328,000	1,351,000	426,000	434,000	1,208,136	1,230,824	1,976,692
2011	-68,000	-127,000	-192,848	-360,172	1,594,000	1,621,000	512,000	520,000	1,452,032	1,474,720	2,373,732
2012	-80,000	-148,000	-226,880	-419,728	1,859,000	1,891,000	597,000	607,000	1,693,092	1,721,452	2,767,936
2013	-91,000	-170,000	-258,076	-482,120	2,125,000	2,161,000	682,000	694,000	1,934,152	1,968,184	3,162,140
2014	-103,000	-191,000	-292,108	-541,676	2,391,000	2,432,000	767,000	780,000	2,175,212	2,212,080	3,553,508
2015	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2016	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2017	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2018	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2019	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2020	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2021	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2022	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2023	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2024	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2025	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2026	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2027	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2028	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2029	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2030	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2031	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2032	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2033	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2034	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2035	-114,000	-212,000	-323,304	-601,232	2,656,000	2,702,000	853,000	867,000	2,419,108	2,458,812	3,953,384
2036	-103,000	-191,000	-292,108	-541,676	2,391,000	2,432,000	767,000	780,000	2,175,212	2,212,080	3,553,508
2037	-91,000	-170,000	-258,076	-482,120	2,125,000	2,161,000	682,000	694,000	1,934,152	1,968,184	3,162,140
2038	-80,000	-148,000	-226,880	-419,728	1,859,000	1,891,000	597,000	607,000	1,693,092	1,721,452	2,767,936
2039	-68,000	-127,000	-192,848	-360,172	1,594,000	1,621,000	512,000	520,000	1,452,032	1,474,720	2,373,732
2040	-57,000	-106,000	-161,652	-300,616	1,328,000	1,351,000	426,000	434,000	1,208,136	1,230,824	1,976,692
2041	-46,000	-85,000	-130,456	-241,060	1,063,000	1,081,000	341,000	347,000	967,076	984,092	1,579,652
2042	-34,000	-64,000	-96,424	-181,504	797,000	811,000	256,000	260,000	726,016	737,360	1,185,448
2043	-23,000	-42,000	-65,228	-119,112	531,000	540,000	171,000	173,000	484,956	490,628	791,244
2044	-11,000	-21,000	-31,196	-59,556	266,000	270,000	85,000	87,000	241,060	246,732	397,040
TOTAL	-3,420,000	-6,360,000	-9,699,120	-18,036,960	79,684,000	81,058,000	25,587,000	26,011,000	72,564,732	73,767,196	118,595,848

GHG Savings from Improvement to EGH83

Year	Heating Fuel (litres)		GHG Savings (kg CO2e)		Electricity (kWh)		Diesel Fuel (litres)		GHG Savings (kg CO2e)		GHG Savings (kg CO2e)
	Detached	Row	Detached	Row	Detached	Row	Detached	Row	Detached	Row	TOTAL
2005	-	-	-	-	-	-	-	-	-	-	
2006	5,000	-6,000	14,180	-17,016	269,000	273,000	86,000	88,000	243,896	249,568	490,628
2007	10,000	-13,000	28,360	-36,868	539,000	547,000	173,000	176,000	490,628	499,136	981,256
2008	15,000	-19,000	42,540	-53,884	808,000	820,000	259,000	263,000	734,524	745,868	1,469,048
2009	21,000	-25,000	59,556	-70,900	1,078,000	1,094,000	346,000	351,000	981,256	995,436	1,965,348
2010	26,000	-32,000	73,736	-90,752	1,347,000	1,367,000	432,000	439,000	1,225,152	1,245,004	2,453,140
2011	31,000	-38,000	87,916	-107,768	1,617,000	1,641,000	519,000	527,000	1,471,884	1,494,572	2,946,604
2012	36,000	-44,000	102,096	-124,784	1,886,000	1,914,000	605,000	614,000	1,715,780	1,741,304	3,434,396
2013	41,000	-51,000	116,276	-144,636	2,156,000	2,188,000	692,000	702,000	1,962,512	1,990,872	3,925,024
2014	46,000	-57,000	130,456	-161,652	2,425,000	2,461,000	778,000	790,000	2,206,408	2,240,440	4,415,652
2015	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2016	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2017	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2018	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2019	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2020	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2021	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2022	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2023	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2024	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2025	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2026	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2027	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2028	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2029	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2030	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2031	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2032	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2033	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2034	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2035	52,000	-63,000	147,472	-178,668	2,695,000	2,735,000	865,000	878,000	2,453,140	2,490,008	4,911,952
2036	46,000	-57,000	130,456	-161,652	2,425,000	2,461,000	778,000	790,000	2,206,408	2,240,440	4,415,652
2037	41,000	-51,000	116,276	-144,636	2,156,000	2,188,000	692,000	702,000	1,962,512	1,990,872	3,925,024
2038	36,000	-44,000	102,096	-124,784	1,886,000	1,914,000	605,000	614,000	1,715,780	1,741,304	3,434,396
2039	31,000	-38,000	87,916	-107,768	1,617,000	1,641,000	519,000	527,000	1,471,884	1,494,572	2,946,604
2040	26,000	-32,000	73,736	-90,752	1,347,000	1,367,000	432,000	439,000	1,225,152	1,245,004	2,453,140
2041	21,000	-25,000	59,556	-70,900	1,078,000	1,094,000	346,000	351,000	981,256	995,436	1,965,348
2042	15,000	-19,000	42,540	-53,884	808,000	820,000	259,000	263,000	734,524	745,868	1,469,048
2043	10,000	-13,000	28,360	-36,868	539,000	547,000	173,000	176,000	490,628	499,136	981,256
2044	5,000	-6,000	14,180	-17,016	269,000	273,000	86,000	88,000	243,896	249,568	490,628
TOTAL	1,554,000	-1,893,000	4,407,144	-5,368,548	80,845,000	82,045,000	25,945,000	26,338,000	73,580,020	74,694,568	147,313,184

Costs and Benefits of Improvement to EGH83/R2000

Year	Units Built		Units Affected by Program		Energy Cost Savings	Incremental Construction Cost	Training & Enforcement Costs (City)	Training & Compliance Costs (Builders/Arch)	Value of GHG Savings	Cash Flow	Discounted Cash Flow	Discounted Savings	Discounted Costs
	Detached	Row	Detached	Row	Total								
2005	41	42	41	42	$0	-$812,800	-$48,700	-$93,000	$0	-$954,500	-$954,500	$0	-$954,500
2006	41	42	41	42	$167,987	-$812,800	-$20,000	-$83,000	$3,970	-$743,843	-$695,180	$160,707	-$855,888
2007	41	42	41	42	$335,973	-$812,800	-$20,000	-$83,000	$7,912	-$571,914	-$499,532	$300,363	-$799,895
2008	41	42	41	42	$503,960	-$812,800	-$20,000	-$83,000	$11,854	-$399,986	-$326,508	$421,058	-$747,566
2009	41	42	41	42	$671,946	-$812,800	-$20,000	-$83,000	$15,797	-$228,057	-$173,984	$524,676	-$698,659
2010	41	42	41	42	$839,933	-$812,800	-$20,000	-$83,000	$19,767	-$56,100	-$39,999	$612,954	-$652,953
2011	41	42	41	42	$1,007,919	-$812,800	-$20,000	-$83,000	$23,737	$115,857	$77,200	$687,436	-$610,236
2012	41	42	41	42	$1,175,906	-$812,800	-$20,000	-$83,000	$27,679	$287,785	$179,218	$749,532	-$570,314
2013	41	42	41	42	$1,343,892	-$812,800	-$20,000	-$83,000	$31,621	$459,714	$267,558	$800,562	-$533,004
2014	41	42	41	42	$1,511,879	-$812,800	-$20,000	-$83,000	$35,535	$631,614	$343,556	$841,691	-$498,135
2015	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$874,055	$874,055	$0
2016	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$816,874	$816,874	$0
2017	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$763,434	$763,434	$0
2018	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$713,490	$713,490	$0
2019	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$666,813	$666,813	$0
2020	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$623,189	$623,189	$0
2021	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$582,420	$582,420	$0
2022	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$544,318	$544,318	$0
2023	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$508,708	$508,708	$0
2024	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$475,428	$475,428	$0
2025	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$444,325	$444,325	$0
2026	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$415,257	$415,257	$0
2027	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$388,091	$388,091	$0
2028	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$362,702	$362,702	$0
2029	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$338,974	$338,974	$0
2030	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$316,798	$316,798	$0
2031	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$296,073	$296,073	$0
2032	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$276,704	$276,704	$0
2033	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$258,601	$258,601	$0
2034	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$241,684	$241,684	$0
2035	0	0	0	0	$1,679,866	$0	$0	$0	$39,534	$1,719,399	$225,873	$225,873	$0
2036	0	0	0	0	$1,511,879	$0	$0	$0	$35,535	$1,547,414	$189,981	$189,981	$0
2037	0	0	0	0	$1,343,892	$0	$0	$0	$31,621	$1,375,514	$157,828	$157,828	$0
2038	0	0	0	0	$1,175,906	$0	$0	$0	$27,679	$1,203,585	$129,066	$129,066	$0
2039	0	0	0	0	$1,007,919	$0	$0	$0	$23,737	$1,031,657	$103,392	$103,392	$0
2040	0	0	0	0	$839,933	$0	$0	$0	$19,767	$859,700	$80,522	$80,522	$0
2041	0	0	0	0	$671,946	$0	$0	$0	$15,797	$687,743	$60,202	$60,202	$0
2042	0	0	0	0	$503,960	$0	$0	$0	$11,854	$515,814	$42,198	$42,198	$0
2043	0	0	0	0	$335,973	$0	$0	$0	$7,912	$343,886	$26,292	$26,292	$0
2044	0	0	0	0	$167,987	$0	$0	$0	$3,970	$171,957	$12,287	$12,287	$0
TOTAL	410	420	410	420	$50,395,965	-$8,128,000	-$228,700	-$840,000	$1,185,958	$42,385,223	$9,113,409	$16,034,559	-$6,921,150

Costs and Benefits of Improvement to EGH83

Year	Units Built		Units Affected by Program		Energy Cost Savings	Incremental Construction Cost	Enforcement Costs (City)	Enforcement Costs (Builders/Arch)	Value of GHG Savings	Cash Flow	Discounted Cash Flow	Discounted Savings	Discounted Costs
	Detached	Row	Detached	Row	Total								
2005	41	42	41	42	$0	-$2,032,000	-$48,700	-$93,000	$0	-$2,173,700	-$2,173,700	$0	-$2,173,700
2006	41	42	41	42	$189,329	-$2,032,000	-$20,000	-$83,000	$4,906	-$1,940,765	-$1,813,799	$181,528	-$1,995,327
2007	41	42	41	42	$378,657	-$2,032,000	-$20,000	-$83,000	$9,813	-$1,746,530	-$1,525,487	$339,305	-$1,864,792
2008	41	42	41	42	$567,986	-$2,032,000	-$20,000	-$83,000	$14,690	-$1,552,324	-$1,267,158	$475,638	-$1,742,796
2009	41	42	41	42	$757,315	-$2,032,000	-$20,000	-$83,000	$19,653	-$1,358,032	-$1,036,036	$592,745	-$1,628,781
2010	41	42	41	42	$946,643	-$2,032,000	-$20,000	-$83,000	$24,531	-$1,163,825	-$829,791	$692,434	-$1,522,225
2011	41	42	41	42	$1,135,972	-$2,032,000	-$20,000	-$83,000	$29,466	-$969,562	-$646,060	$776,581	-$1,422,641
2012	41	42	41	42	$1,325,301	-$2,032,000	-$20,000	-$83,000	$34,344	-$775,355	-$482,852	$846,718	-$1,329,571
2013	41	42	41	42	$1,514,629	-$2,032,000	-$20,000	-$83,000	$39,250	-$581,121	-$338,217	$904,372	-$1,242,589
2014	41	42	41	42	$1,703,958	-$2,032,000	-$20,000	-$83,000	$44,157	-$386,886	-$210,440	$950,858	-$1,161,299
2015	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$987,421	$987,421	$0
2016	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$922,823	$922,823	$0
2017	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$862,452	$862,452	$0
2018	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$806,029	$806,029	$0
2019	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$753,299	$753,299	$0
2020	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$704,017	$704,017	$0
2021	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$657,960	$657,960	$0
2022	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$614,916	$614,916	$0
2023	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$574,688	$574,688	$0
2024	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$537,091	$537,091	$0
2025	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$501,955	$501,955	$0
2026	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$469,116	$469,116	$0
2027	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$438,427	$438,427	$0
2028	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$409,744	$409,744	$0
2029	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$382,939	$382,939	$0
2030	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$357,887	$357,887	$0
2031	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$334,474	$334,474	$0
2032	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$312,592	$312,592	$0
2033	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$292,142	$292,142	$0
2034	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$273,030	$273,030	$0
2035	0	0	0	0	$1,893,287	$0	$0	$0	$49,120	$1,942,406	$255,168	$255,168	$0
2036	0	0	0	0	$1,703,958	$0	$0	$0	$44,157	$1,748,114	$214,621	$214,621	$0
2037	0	0	0	0	$1,514,629	$0	$0	$0	$39,250	$1,553,879	$178,294	$178,294	$0
2038	0	0	0	0	$1,325,301	$0	$0	$0	$34,344	$1,359,645	$145,801	$145,801	$0
2039	0	0	0	0	$1,135,972	$0	$0	$0	$29,466	$1,165,438	$116,799	$116,799	$0
2040	0	0	0	0	$946,643	$0	$0	$0	$24,531	$971,175	$90,963	$90,963	$0
2041	0	0	0	0	$757,315	$0	$0	$0	$19,653	$776,968	$68,012	$68,012	$0
2042	0	0	0	0	$567,986	$0	$0	$0	$14,690	$582,676	$47,668	$47,668	$0
2043	0	0	0	0	$378,657	$0	$0	$0	$9,813	$388,470	$29,701	$29,701	$0
2044	0	0	0	0	$189,329	$0	$0	$0	$4,906	$194,235	$13,879	$13,879	$0
TOTAL	410	420	410	420	$56,798,595	-$20,320,000	-$228,700	-$840,000	$1,473,132	$36,883,027	$2,030,367	$18,114,088	-$16,083,721