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Bureau

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# THE POWER OF BUILDING BETTER: Increasing the Energy Efficiency Requirements of the Ontario Building Code to Create a Culture of Conservation

Submission of the Chief Energy Conservation Officer  
of the Conservation Bureau

in response to the Ministry of Municipal Affairs and Housing's  
Consultation Document, "Proposed Changes to Ontario's  
Building Code to Increase the Energy Efficiency of Buildings"

**Submitted March 27, 2006**  
**Revised on April 3, 2006**

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## **Introduction**<sup>1</sup>

As the Chief Energy Conservation Officer of Ontario, I call upon the Government of Ontario to substantially increase the minimum energy efficiency standards in the Ontario Building Code (the “Code”) and make Ontario a North American leader of energy efficient building.

We are very pleased that the government has begun a process to increase the energy efficiency requirements in the Code, and that this has been done in an expeditious manner. This was one of the recommendations in the first Annual Report of the Chief Energy Conservation Officer, Our Conservation Challenge (the “Annual Report”)<sup>2</sup>. The Annual Report identified the great potential for energy conservation that lies in improvements to the Code, and made a number of recommendations, including:

- Incorporating higher minimum energy efficiency standards for buildings;
- Increasing the minimum energy efficiency standards for electrically-heated houses; and
- Making “Energy Star” windows the minimum standard for windows.

Ontario faces a growing gap in electricity supply over the next 20 years. This gap flows from increasing electricity demand and decreasing supply due to aging plants and infrastructure, and well recognized concerns regarding greenhouse gas emissions. The province also faces challenges regarding peak demand, i.e. the amount of electricity required at any given moment in time. Ontario has historically been a winter-peaking jurisdiction. However, with the increase in air-conditioning use in all sectors of the economy and other factors, Ontario has become a summer-peaking jurisdiction.

Conservation and demand management are needed to ensure that the Province’s electricity system will continue to meet Ontarians’ needs in a reliable, cost-effective and environmentally sustainable manner today and in the future. In recognition of the need for conservation, the

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<sup>1</sup> This submission was drafted with the assistance of Christian Cianfrone, M.A.Sc. candidate, and Professor K.D. Pressnail of the Department of Civil Engineering, University of Toronto. Background information was also obtained from Natural Resources Canada.

<sup>2</sup> 2005 Annual Report of the Chief Energy Conservation Officer, p. 40-44.

provincial government has called for the creation of a “Culture of Conservation”, and established the Conservation Bureau to champion conservation and demand management.

Improving the energy efficiency requirements of codes and standards so that we ‘build better’-- in an energy efficient way – is a cost-effective and proven way to address our energy challenges and to create a Culture of Conservation. The technology exists and the market is ready to ‘build better’. Investing in energy efficient buildings makes economic sense. As the price of electricity increases, the economics of building better will only improve. The power of building better was recognised by the Conservation Action Team (the “CAT”), a committee of Parliamentary Assistants from eight ministries. In its 2005 Report<sup>3</sup>, the CAT recommended improving the energy efficiency requirements of the Code as one important way of conserving electricity.

The government needs to lead the way on energy efficiency; if we all work together, Ontario’s residents, businesses and institutions will all benefit.

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<sup>3</sup> Building a Conservation Culture in Ontario: A Report of the Conservation Action Team to the Honourable Dwight Duncan , Minister of Energy, May 19, 2005.

## **Summary of Recommendations**

The Ministry of Municipal Affairs and Housing (the “MMAH”) has issued a consultation paper to explore increasing the energy efficiency of the Code. In response to this call for submissions, we make the following recommendations:

- ***All new homes (Part 9) built under the Ontario Building Code shall meet or exceed 80 on the EnerGuide for Houses scale for energy efficiency.***
  - *All new homes shall be built with high efficiency heating and cooling systems, and programmable thermostats.*
  - *All new windows shall have an energy rating of at least -10 ER.*
  - *All cooling systems shall at least meet the EER 11.5 standard.*
- ***All other non-residential new buildings (Part 2) not covered by Part 9 shall be built to a standard of 25% better than the Model National Energy Code for Buildings.***
  - *Ontario should work with the Federal Government to update the Model National Energy Code for Buildings in an expeditious manner.*
- ***A labelling system for all buildings that is based on existing Natural Resources Canada systems should be adopted in the Energy Conservation Responsibility Act, 2006 , and phased-in over time.***
- ***The green technologies listed in the consultation document should be included in the Ontario Building Code.***
  - *A process should be established to ensure that the Code facilitates the adoption of viable green technologies.*
- ***Energy efficiency should be actively encouraged through amendments to the Code and education of the market.***

## **Background**

### **The Conservation Bureau**

The Conservation Bureau is a division of the Ontario Power Authority (the “OPA”) and is under the direction of the Chief Energy Conservation Officer. The OPA is a not-for-profit corporation that was created in 2004 through amendments to the Electricity Act. The OPA has a broad mandate related to the planning of the electricity system in Ontario. To carry out its statutory objectives, the OPA has been organized under four key functions: Power System Planning, Generation Development, Conservation Bureau, and Electricity Sector Development, with a Corporate Affairs service group to provide cross-cutting administrative support.

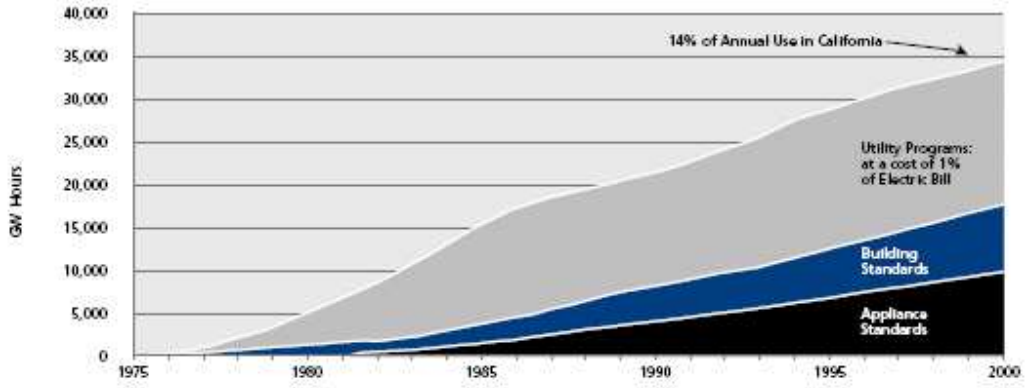
The mandate of the Conservation Bureau, as defined in the Electricity Act, is “to provide leadership in planning and coordination of measures for electricity conservation and load management in Ontario and to engage in such activities as may be prescribed in the regulations.” The Bureau’s programs fall under Conservation – reducing the amount of energy used – and Demand Management – impacting both the amount and timing of electricity demand. The role of the Conservation Bureau is to develop, coordinate and stimulate commitment to electricity conservation and demand management programs. The Conservation Bureau is also required to identify legislative and policy barriers to conservation.

### **The Power of Codes and Standards**

Increasing the energy efficiency requirements of codes and standards is a powerful and proven way to achieve energy conservation. It is also a powerful way to lead! The State of California has already shown the impact such leadership can bring. California has one of the longest and most accomplished energy efficiency track records on the continent, spending annually from \$100 million to over \$300 million on energy efficiency initiatives. Since 1976, total electricity sales have been reduced by 14%, relative to what they would otherwise have been. Just under half of the savings were due to the implementation of appliance and equipment standards, as well as changes made to building codes.

Figure 1: Energy Savings from Building Code and Appliance Standards in California.

**GWh Impacts from Programs Begun Prior to 2001**



## **Area 1 - Building Better Homes: Part 9 of the Ontario Building Code**

### ***Recommendations:***

- ***All new homes built under the Ontario Building Code shall meet or exceed 80 on the EnerGuide for Houses scale for energy efficiency.***
  - ***All new homes shall be built with high efficiency heating and cooling systems, and programmable thermostats.***
  - ***All new windows shall have an energy rating of at least -10 ER.***
  - ***All cooling systems shall at least meet the EER 11.5 standard.***

### **Building to EnerGuide for Houses 80**

Building to EnerGuide for Houses 80 is a proven, cost-effective and long lasting way to reduce electricity consumption and demand. The market and consumers are ready to move to EnerGuide 80. The time is right for the government to show leadership. Failure to embrace this opportunity would represent a significant lost opportunity for conservation.

The MMAH has put forward four options for increasing the energy efficiency requirements of the Code. While these options are a step forward from the current energy efficiency levels in the Code, they fall short of the EnerGuide 80 standard. The energy efficiency ratings of the four options range from 73 – 76 (see Table 1 below).

Table 1: EnerGuide for Houses Ratings of the Options<sup>4</sup>

	Gas Heated House	Electrically Heated House
Base	71	73
MMAH Option 1	73	74
MMAH Option 2	74	75
MMAH Option 3	74	76
MMAH Option 4	76	76
Conservation Bureau Option 5	80	80

<sup>4</sup> This analysis was performed by Natural Resources Canada using the Hot 2000 model. NRCAN assumed a 2000sq/ft house with 2 stories, with minimum acceptable air tightness, north facing, Ottawa home.

As none of the MMAH's options meet the recommended standard of EnerGuide 80, we have set out an Option 5 as an illustration of how Ontario can build better. We recognise that there are many ways to build an EnerGuide 80 home, and simply offer Option 5 to demonstrate that building to EnerGuide 80 is now feasible based on current building techniques.

The details of Option 5 are outlined below and summarized in Table 2. Presented in Table 2 for comparison purposes is a list of the prescriptive measures for the other options proposed by MMAH.

- R31 in walls: achieved by changing 2x4, 16" OC framing to 2x6, 24" OC framing, replacing R13 batt with R20 batt and by adding 2" R11 insulated sheathing.
- Ceiling attic spaces to be increased with more batt insulation where space is not an issue.
- Cathedral ceiling insulation to be increased outboard of the cavity where necessary.
- Basement insulation to be R12 batt inside to 380 mm above basement floor slab plus 2" polystyrene insulation on the exterior or equivalent glass fibre insulation. This arrangement addresses potential moisture problems.<sup>5</sup>
- Exterior basement insulation to be terminated at grade, thereby avoiding above-grade finishing issues.
- Change window ER from -13 to -10.

We recommend that Option 5 values be the same for all homes regardless of the energy source used for heating or cooling. Better-built, energy-efficient homes are good for all Ontarians. We see no compelling reason to have lower standards for some segments of the market. Moreover, having one set of measures provides clarity for builders, consumers and inspectors.

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<sup>5</sup> With half of the insulation value on the exterior, the basement will be drier and warmer. As a result, it may be possible to extend the interior insulation to full depth.

Table 2: Comparison of Prescriptive Measures for all Options

	1992	Current	Option 1 <sup>6</sup>	Option 2	Option 3	Option 4	Option 5
<b>Ceilings</b>	R31	R31	R40	R40	R40	R40	R55
<b>Cathedral</b>	R20	R20	R20	R20	R20	R20	R28
<b>Wall</b>	R19	R17	R17	R19.5	R19.5	R19.5	R31
<b>Foundation</b>	Full height R12	Frost line R8	R12 to Frost line	R12 to Frost line	Full height R12	Full height R12	R12 to 380mm above slab + R11 exterior below grade
<b>Floor</b>	R25	R25	R25	R25	R25	R25	R25
<b>Slab with pipe</b>	R10	R10	R10	R10	R10	R10	R10
<b>Slab without pipe</b>	R8	R8	R8	R8	R8	R8	R10
<b>windows</b>			-10 ER	-10 ER		-13ER	-10 ER

### Building Better Reduces Electricity Consumption and Demand

Building to an EnerGuide 80 standard reduces a home’s energy consumption. The annual space heating savings of building to Option 4 and 5 are set out below. The real electrical savings will be higher as the costs of cooling are not included in the analysis below. In an electrically heated home built to Option 5, the energy consumption is reduced by 3,435 kWh or 26% from the current average standard in electrically-heated homes, i.e. Option 2 ( see Table 3). This is energy conservation that endures across the life of the home.

<sup>6</sup> We are looking at the electrically-heated houses option for Options 1 – 4.

Table 3: Annual Space Heating Savings

	Annual Energy Savings	Annual Cost Savings
<b>Electrically heated</b>		Electricity Price @ \$0.058/kWh Loss Adjustment @ 1.05
Base (OBC) to Option 4	1979 kWh	\$245
Base to Option 5	4026 kWh	\$121
Option 2 to 4	1388 kWh	\$85
Option 2 to 5	3435 kWh	\$209
<b>Gas Heated</b>		Natural Gas Price @ \$0.431/m <sup>3</sup>
Base to Option 4	578 m <sup>3</sup> Natural Gas	\$403
Base to Option 5	934 m <sup>3</sup> Natural Gas	\$249
Option 3 to 4	132 m <sup>3</sup> Natural Gas	\$57
Option 3 to 5	488 m <sup>3</sup> Natural Gas	\$211

Better-built homes will have a positive impact on both summer and winter demand. A better-built home keeps us warmer in winter, reducing the demand for electricity for heat. Better-built, energy-efficient building also keeps our homes cooler in the summer, reducing the demand for electricity for air-conditioning. As we are now a summer-peaking province, in part due to increased air-conditioning loads, a reduction of summer demand through better-built homes is of great significance and benefit to us all.

### **The Market is Ready for Building Better**

The market is ready for EnerGuide 80 as the minimum standard of energy efficiency. Natural Resources Canada statistics indicate that newly-built houses that are not electrically-heated are, on average, already achieving EnerGuide 74, i.e. matching MMAH's Option 3 for non-electrically-heated houses, while new electrically-heated houses are meeting MMAH's Option 2.

Experience shows us that the technology and skills to build better already exist in the market. Ontario builders have been building R-2000 houses for over 25 years, and the EnerGuide 80 standard has been in existence for a number of years. Builders are familiar with energy efficiency issues; according to Natural Resources Canada, over 100 builders in Ontario are already involved with the EnerGuide for Houses program in some way.

Consumers want better buildings. The purchase of a new home is a long-term investment, and consumers benefit from a high quality, energy-efficient product that reduces operating costs over the long term. In a January 2006 poll by Oracle Poll Research, 93% of respondents indicated that energy conservation was important to them. In the same poll, 80% of respondents supported increasing energy efficiency standards in the Code.

**Building Better is Affordable and Cost-Effective**

Building better, energy-efficient homes is affordable and cost-effective for consumers. The cost difference between building to EnerGuide 80 (Option 5) versus EnerGuide 75 (Option 2) for electrically-heated homes is only \$1,265 (see Table 4). The cost difference between building to EnerGuide 80 (Option 5) and EnerGuide 73 (Base Case) for electrically-heated homes is only slightly higher at \$1,996.00. Assuming an investment of \$200,000, the difference between building to EnerGuide 80 and lesser standards is less than 1% of the total investment. A 1% differential is not likely to be a major barrier for the majority of consumers making a \$200,000 investment.

Table 4: Initial Capital Cost Differentials between Options<sup>7</sup>

<b>Electrically-heated</b>	Option 4	Option 5
From Base Case (OBC)	\$1,039	\$1,996
From Option 2 (current real base)	\$348	\$1,265
<b>Gas-Heated</b>		
From Base Case	\$3,279	\$4,331
From Option 3 (current real base)	\$886	\$1,938

When amortised over 25 years, the up-front cost increase of achieving an EnerGuide 80 (Option 5) rating is outweighed by the reduction in operating costs. In the case of a move from Base Case to Option 5, for example, the Base Case monthly mortgage payments are \$11.71 less than Option 5 (Base Case monthly mortgage payments of \$1173.40 versus Option 5 monthly mortgage payments of \$1185.11). However, in the Option 5 house the operating costs would be

<sup>7</sup> Based on calculations carried out by researchers at the Department of Civil Engineering, University of Toronto.

reduced by \$245 per year<sup>8</sup> or \$20.43 per month. As such, the Option 5 house would be \$8.72 per month less expensive to run than the Base Case house based on a 25-year amortization (see Table 5 below). If current electricity prices increase over time with respect to inflation, the net savings would be even greater.

Table 5: Amortisation Table Over a 25-year Period<sup>9</sup>

<b>Electrically heated</b>	Base Monthly Payments	New Monthly Payments	After Savings Monthly Payments	Net Monthly Savings	Down Payment Extra Cost
Base (OBC) to Option 4	\$1,173.40	\$1,179.73	\$1,169.69	\$3.71	\$107.90
Base to Option 5	\$1,173.40	\$1,185.11	\$1,164.68	\$8.72	\$199.63
Option 2 to 4	\$1,173.40	\$1,175.44	\$1,168.40	\$5.00	\$34.50
Option 2 to 5	\$1,173.40	\$1,180.82	\$1,163.39	\$10.01	\$126.53
<b>Gas Heated</b>					
Base to Option 4	\$1,173.40	\$1,192.64	\$1,171.89	\$1.51	\$327.90
Base to Option 5	\$1,173.40	\$1,198.80	\$1,165.27	\$8.13	\$433.13
Option 3 to 4	\$1,173.40	\$1,178.60	\$1,173.86	(\$0.46)	\$88.60
Option 3 to 5	\$1,173.40	\$1,184.77	\$1,167.24	\$6.16	\$193.83

### **Energy-Efficient Cooling and Heating Systems, and Programmable Thermostats**

In addition to getting the building envelope right, it is important to ensure that all homes have high efficiency heating and cooling systems. Heating, cooling and water heating represent a significant portion of every home’s energy use. As such, the Code should mandate that these systems be high efficiency. In particular, the code should mandate that all air-conditioners be at least an EER 11.5 rating.

<sup>8</sup> 4016kwh per year reduction from Table 6 x 1.05 for line loss x 0.058 the price of electricity.

<sup>9</sup> The above table has been calculated with the following parameters:

- Base cost of home \$200,000 (i.e. cost of Base Case or Option 2) with the “new”, more energy-efficient home (Option 4 or 5), including the extra price in going from the first to second description.
- Down payment based on 10% of the price of the home.
- 6% annual interest rate over a 25-year period.
- New monthly payments include the energy cost savings that the homeowner would incur by choosing the more energy-efficient option.

The Code should also mandate that all new homes be built with programmable thermostats. Programmable thermostats are an inexpensive and easy way to enable consumers to better manage their energy consumption and demand.

## **Area 2 - Commercial and Institutional Analysis: Part 2 of the Code**

### ***Recommendations:***

- ***All new building should be built to a standard of 25% better than the Model National Energy Code for Buildings.***
  - ***Ontario should work with the Federal government to update the Model National Energy Code for Buildings.***

Commercial and institutional buildings offer deep potential opportunities for energy conservation. In order for the government to meet its conservation goals, it is imperative that the MMAH take this opportunity to significantly improve the energy efficiency requirements of the Code for buildings.

All new buildings, excluding those built under Part 9, should be built to the Commercial Building Incentive Program (CBIP) standard offered by Natural Resources Canada. This program is designed to increase energy efficiency in new commercial, institutional and multi-unit residential buildings. Generally, there are higher upfront capital costs for construction<sup>10</sup>, but operational savings are ongoing. The CBIP helps offset the extra cost of designing energy efficient buildings. To qualify for an incentive, a building must be at least 25% more energy efficient than if it were constructed to meet the requirements of the Model National Energy Code for Buildings (MNECB).

The Commercial Building Incentive Program has been achieved by over 300 buildings in Ontario since the program's inception in 1998. The experience of CBIP to date includes the following successes:

- The average CBIP building in Ontario building is achieving a standard of 35.5% above MNECB;
- A CBIP building, on average, uses 0.8 gigajoules per M2 per year of energy, while a building built to Code uses 1.2 gigajoules per M2 per year of energy;

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<sup>10</sup> However, NRCan reports that some CBIP buildings have been built for less than buildings built to Code due to the improved up-front design.

- Many CBIP buildings, especially in the institutional sector, are proving to be cheaper to build than lower standard buildings.

The MMAH proposals for improvements to the Code fall short of our call for 25% over the MNECB. An analysis of the options undertaken by Natural Resources Canada indicate that the most aggressive option only achieves a 15 – 18% improvement over the current standard. This leaves currently achievable conservation potential unrealized.

The government should continue to work with the federal government on improving the MNECB, and take all reasonable steps to accelerate the process.

### **Area 3 - Labelling**

***Recommendation: A labelling system for all buildings that is based on existing Natural Resources Canada systems should be adopted in the Energy Conservation Responsibility Act, 2006, and phased in over time.***

We support energy efficiency labelling of all homes and buildings. We are pleased that the provincial government has recognized the importance of labelling by including a labelling provision in the Energy Conservation Responsibility Act, 2006, as well as by setting out proposals for a labelling system. Labelling is a powerful tool for conservation. Energy efficiency labelling of houses and buildings allows consumers to better evaluate the operating costs of their homes, office spaces and industrial facilities, enabling them to make responsible energy choices. It also increases the value of energy efficiency and conservation in the marketplace. In a January 2006 poll by Oracle Poll Research, 89% of respondents supported an energy efficiency label for new homes.

The MMAH has proposed a new labelling system for houses that is based in the Code. In our opinion, this is not the optimum approach to adopt. Instead, we recommend the adoption of the labelling system for all homes and buildings. For homes, we recommend the adoption of the EnerGuide for Houses system. The EnerGuide system is a mature system, and is already recognised in the marketplace. Creating a new system of labelling will likely create unnecessary confusion in the marketplace.

According to staff at Natural Resources Canada, there is significant capacity already in place to begin implementing an EnerGuide-based labelling system, and additional capacity could be developed in a reasonable period of time to cover all homes. Given the need to develop capacity for labelling, we recommend that the labelling system be phased in over time, starting with new houses.

The labelling system should reflect the energy consumption of the entire house, and not just the matters addressed in the Code. As such, we propose that the labelling system be included in the

Energy Conservation Responsibility Act, 2006 and referenced in the Code and in the Energy Efficiency Act.

## **Area 4 - Green Technology**

### ***Recommendation:***

- ***The green technologies listed in the consultation document should be included in the Ontario Building Code.***
  - ***A process should be established to ensure that the Code facilitates the adoption of viable green technologies.***

We applaud the government's move to address green technologies, and we support the inclusion of all technologies set out in the consultation document, including motion sensors and green roofs.

We also recommend that the government adopt processes to continually evaluate green technologies for inclusion in the Code. Technology is moving quickly and the potential for conservation from green technologies should not be hampered by outdated policy constraints.

## **Home Renovation: Part 11 of the Code**

*Recommendation: Energy efficiency should be actively incorporated into renovations through the Code and education of the market.*

Renovations are a lost opportunity for energy efficiency. Currently the Code requires renovations to only match the existing standards of efficiency in the home. Respondents to the Oracle Poll felt that renovations should also meet the highest energy efficiency standards (93%).

We recommend that the Code require renovations to meet a standard higher than the existing level in the home. Given that renovations of existing homes are unique, and difficult to monitor, we recommend that more focus be put on encouraging and educating contractors, architects, designers and consumers to incorporate energy efficiency in all renovation projects. We also encourage the government to continue to evaluate potential policy solutions to ensure that renovations meet higher energy efficiency standards.

## **Other Potential Electricity Savings**

Complementary to updating the Ontario Building Code, there are several other opportunities for electricity savings that should be considered by the government. These include mandating:

- Pool timers;
- Standards regarding light intensity;
- Motion sensors for garage and porch lighting, as well as emergency lighting;
- Bathroom fans that are energy efficient and have timers;
- Block heater timers;
- Visible metering of electricity consumption;
- High efficiency ventilation recovery systems;
- Electronically-commutated motors; and
- Installation of natural gas lines, along with 220-volt outlets, for residential ranges and clothes dryers, for houses serviced by natural gas.