

# Building Simulations

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Understanding your building's energy profile. This short e-book describes what a building simulation is, its benefits and available energy incentives in Ontario.

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July 2011



# Introduction

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**B**uildings are among the largest end users of energy. Whether commercial, industrial, or residential, buildings are responsible for approximately 40%<sup>1</sup> of the world's greenhouse gas emissions and according to the World Business Council of Sustainable Development (WBCSD), buildings account for 25-40% of energy demand<sup>2</sup>. With many organizations spanning multiple facilities, lowering energy costs and emissions is of increasing concern.

Many newly-constructed buildings consume more energy than is necessary, and millions of today's inefficient buildings will remain standing far into the future. This over-consumption is attributable to poor design, inadequate technology, and

energy-wastage associated with human behaviours.

With rising pressure from stakeholders to implement sustainable practices, a first step towards better energy management is to evaluate the energy efficiency of a building's operation. Assessing a building's design reveals areas of unnecessary energy consumption and points to ways to improve overall inefficiency.

1. "Financial Times Reports". *Efforts increase to improve sustainability*. Financial Times, 3<sup>rd</sup> November 2009, <http://www.ft.com/cms/s/0/e3273d66-305f-11de-88e3-00144feabdc0.html>

2. "Energy Efficiency in Buildings". *Transforming the market*. World Business Council for Sustainable Development, 5<sup>th</sup> November 2009, [http://www.wbcSD.org/DocRoot/E1erYPqD60xOaOIAdV5V/91719\\_EEBReport\\_WEB.pdf](http://www.wbcSD.org/DocRoot/E1erYPqD60xOaOIAdV5V/91719_EEBReport_WEB.pdf)





# Regulations in the industry

## Ontario Building Code

Since 1976, the Ontario Building Code has set the minimum standard for the design and construction of all new buildings and for additions, alterations and change of use of existing buildings in the Province of Ontario.

The purpose of the Code is to set minimum standards for construction to minimize the risks of the health and safety of occupants of a building, to provide barrier-free accessibility into a building and standards for energy efficiency.

In 2006 the Ontario Building Code added a section regarding energy, making it 25% better than the minimum requirements of the Model National

Energy Code for Buildings<sup>†</sup>. This 2006 code included over 700 technical changes from the previous. Example of some changes included:

- Insulation levels of ceilings increased by 29%.
- Insulation levels of basement walls increased by 50%.
- Window energy efficiency increased by 67%.
- All gas and propane-fired furnaces have to have a high-efficiency rating.

<sup>†</sup> The MNECB, by considering climate, fuel types and costs, and regional construction costs, establishes minimum standards that can be adopted as regulations by the appropriate provincial or territorial authorities or simply used as sound energy conservation practice in construction by both industry and corporations. The Code applies to new construction or additions, but not to alterations or renovations of existing buildings (unless they are so extensive that they amount to new construction).



# Managing challenges

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Today, many organizations face multiple challenges when constructing or retrofitting buildings in Ontario. Example of these challenges are:

- Ensuring buildings are built or retrofitted according to the Ontario Building Code.
- Managing all aspects (architects, mechanical and electrical engineers) of the building's design.

- Developing common goals and objectives for the development or retrofit.
- Reviewing all energy efficiency scenarios prior to capital spending.
- Evaluating all energy incentive opportunities prior to commencement of project.

To overcome these challenges complete an assessment of the building's design. This assessment will identify consumption patterns, compare building metrics to industry code and help manage the design team's objectives.



# Why complete a building simulation?

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Integral to developing optimal building retrofit plans, a building simulation is used to identify and evaluate potential energy-saving opportunities in building operations and technologies, and to provide a precise accounting of associated costs and projected savings.

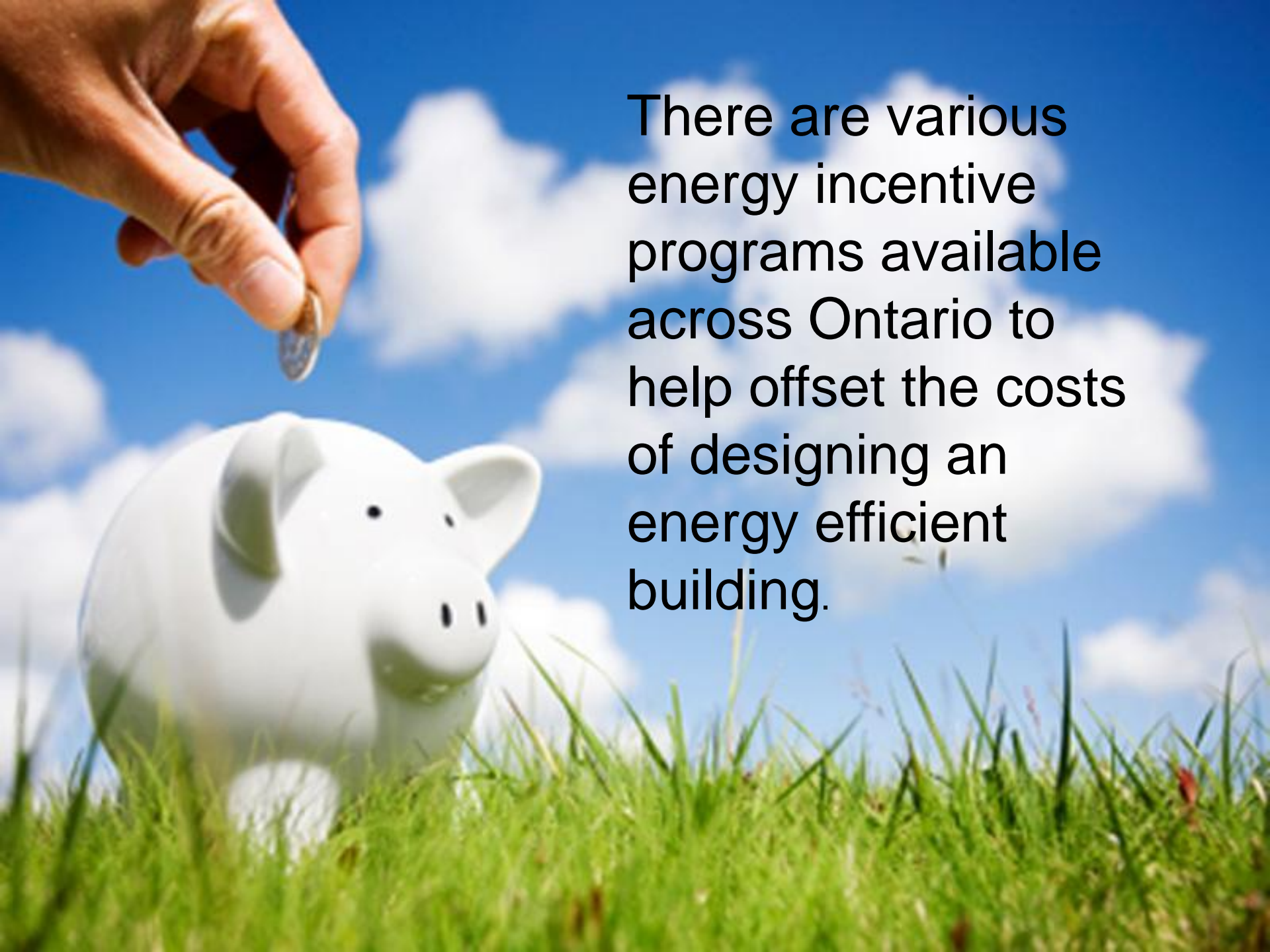
Further benefits of conducting simulations include:

- Effective decision making prior to capital spending.
- Greater precision in budgeting.
- Best possible use of incentive funding.

- Access to simulations for future projects.
- Enhanced reputation within the community.

Improving the energy efficiency of building operations minimizes energy usage, reduces emissions, and establishes organizations as leaders in green business practices and corporate responsibility.



A hand is shown in the upper left corner, holding a coin and about to drop it into a white piggy bank. The piggy bank is sitting on a patch of green grass. The background is a bright blue sky with scattered white clouds. The text is positioned on the right side of the image, overlaid on the sky and grass.

There are various energy incentive programs available across Ontario to help offset the costs of designing an energy efficient building.

# Types of energy incentives in Ontario

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There are three major providers of incentives for building designs. The following pages will describe each program, its requirements, incentive value and benefits.

1. Enbridge
  - Design Advisory Program
  - New Building Construction Program
  - Business Partner Implementation Support
  
3. Ontario Power Authority
  - High Performance New Construction Program

**Note:** City of Toronto - Better Buildings Partnership (BBP) assists building owners and developers access Ontario Power Authority's High Performance New Construction (HPNC) program.



Encourages design activities aimed at improving a building's energy and environmental performance whether it is a new building, an addition to an existing building or a major renovation.

Requirements	Incentive	Benefits
<p>The DAP incentive must be used to develop a building simulation model supporting a variety of activities that can lead to better, more energy efficient buildings:</p> <ul style="list-style-type: none"> <li>• Employing an Enbridge pre-approved DAP adviser to assist in the design process</li> <li>• Developing energy simulation models using EE4, Equest or DOE-2 software</li> <li>• Undertaking an environmental performance assessment using either LEED™ or Green Globes™</li> <li>• Examining and evaluating design alternatives to improve energy and/or environmental performance</li> <li>• Following an integrated design process</li> </ul> <p>To qualify for DAP incentive a project must be:</p> <ul style="list-style-type: none"> <li>• A new structure; OR</li> <li>• A new addition to an existing structure; OR</li> <li>• A renovation that upgrades the structure to meet MNECB Mandatory Provisions</li> <li>• The project must conform to Part 3 of the Ontario Building Code (OBC) 2006 and be intended for commercial, institutional or multi-unit residential occupancy</li> </ul> <p>Project must be located within the Enbridge Gas Distribution franchise territory</p>	<p>Fixed \$3000</p>	<ul style="list-style-type: none"> <li>• Quantify benefits and costs of alternative designs</li> <li>• Find the most cost-effective design solutions.</li> <li>• Understand the relationship between building systems.</li> <li>• Establish correct equipment sizing to reduce capital costs</li> <li>• Achieve ongoing energy savings without sacrificing other performance objectives</li> <li>• Improve building environmental performance and comfort</li> <li>• Enhance your building's marketability</li> </ul>



The NBCP is an two step incentive for energy savings that will result from adding natural gas efficiency measures to a new building design.

Requirements	Incentive	Benefits
<p>To qualify for NBCP incentive a project must be:</p> <ul style="list-style-type: none"> <li>• A new structure; OR</li> <li>• A new addition to an existing structure; OR</li> <li>• A renovation that upgrades the structure to meet MNECB Mandatory Provisions</li> <li>• The project must conform to Part 3 of the Ontario Building Code (OBC) 2006 and be intended for commercial, institutional or multi-unit residential occupancy</li> </ul> <p>Project must be located within the Enbridge Gas Distribution franchise territory.</p> <p>Project savings must come from the design of a more energy efficient building and building systems and cannot be the result of fuel substitution.</p> <p>Applicant must be an owner or developer of a project.</p> <p>All projects must have a simple payback of 1 year or greater and a positive total resource cost (TRC) to qualify for an incentive, unless otherwise approved. Projects with simple paybacks of up to 8 years typically have positive TRC</p>	<p>\$0.10 m3 of projected annual natural gas savings to maximum of \$30,000</p>	<p>Building in energy efficiency ensures ongoing benefits:</p> <ul style="list-style-type: none"> <li>• Energy savings</li> <li>• Environmental performance</li> <li>• Comfort</li> <li>• Improved marketability</li> </ul>



# Enbridge

## Business Partner Implementation Support



This incentive is designed to help support design decision makers in encouraging building owners to implement energy efficient design. It is intended to help offset the administrative cost of assessing and reporting the energy efficient design alternatives included a new building.

Requirements	Incentive	Benefits
<p>Only eligible if your are applying for the New Building Construction Program.</p> <p>Recipient of incentive (business partner) is identified on the NBCP application.</p> <p>Only paid when the NBCP Request for Payment is completed and accepted by Enbridge.</p> <p>Enbridge pre-approval required</p>	<p>Fixed \$2000</p>	<p>Helps offsets the costs of hiring a professional design team</p>



# Ontario Power Authority

## High Performance New Construction Program



The high performance new construction program supports up to 100% of the cost of modelling a building (up to \$10,000) for the building owner.

Requirements	Incentive	Benefits
<p>Eligible construction includes new: Office buildings, industrial buildings, retail spaces, multi-unit residential buildings, affordable housing complexes, colleges, universities, schools, hospitals, long-term care facilities, agricultural buildings, hotels and motels. Agricultural building projects are also encouraged to apply</p> <p>Located in Ontario (excluding 416 area code), conform to Part 3 of the Ontario Building Code (OBC), and be intended for commercial, institutional, industrial or multi-unit residential occupancy.</p> <p>Two types:</p> <ol style="list-style-type: none"> <li><b>Prescriptive:</b> Incentives are based on standard efficiency measures calculated using worksheets for Lighting, Motors, Unitary A/C, Agribusiness, and Alternative measures for Space Cooling and Multi-Residential In-Suite Appliances.</li> <li><b>Custom:</b> Incentives are based on assumed energy and demand savings from modelling software results, used to determine the best energy-efficiency measures to incorporate in a new building or major renovation.</li> </ol>	<p><b>Prescriptive</b></p> <ul style="list-style-type: none"> <li>Up to \$250 for every verified kilowatt saved and up to \$60 per appliance</li> </ul> <p><b>Custom</b></p> <ul style="list-style-type: none"> <li>Up to 25% above code - \$250 for every kilowatt saved</li> <li>25.5-50% above code - \$300 for every kilowatt saved</li> <li>Greater than 50% - \$400 for every kilowatt saved</li> <li>Minimum of \$5000 in incentives</li> </ul> <p><b>Design decision-makers (Architects, Engineers, Consultants, etc.):</b> Greater than 25% above code: \$50 for every verified kilowatt saved. Greater than 50% above Code: \$100 for every verified kilowatt saved.</p>	<ul style="list-style-type: none"> <li>Incentives that offset the cost of energy efficiency measures</li> <li>Lower long-term operating costs</li> <li>Improved marketability</li> <li>Occupant comfort</li> <li>Offsets the cost of hiring a professional design team</li> </ul>



# Summary of incentives

Incentive	Incentive Financials	Details
<b>Enbridge</b>		
Design Advisory Program	Fixed \$3000	Offsets cost of hiring a pre-approved DAP advisor
New Building Construction Program	\$0.10 m3 of projected annual natural gas savings to maximum of \$30,000	Must implement natural gas energy efficiency measures
Business Partner Implementation Support	Fixed \$2000	Paid to business partner to offset administration costs
<b>Ontario Power Authority</b>		
High Performance New Construction Program	<p>Prescriptive - \$250 per verified kW saved</p> <p>Custom - \$250 to \$400 per verified kW saved</p> <p>100% cost of modelling, up to \$10,000</p>	<p>Buildings to be located in Ontario, excluding the 416 area code</p> <p>100% cost of modelling helps offsets the costs of hiring a professional design team</p>



# Excellence in energy management

With over 15 years in the industry, Energy Advantage has completed over 150 building simulations. We have saved over \$3,000,000 in annual combined cost-savings and have secured over \$2,000,000 in incentive funding for our clients. Below are two case studies of our work.

## Hudson's Bay Company

Helped write general building specifications for future Hbc stores, including stores to be 25% better than the MNECB. This specification was implemented before the changes in 2006 to the Ontario Building Code.

Completed simulations of stores across Canada to evaluate the 25% benchmark in different climatic regions.

Completed 15 simulations and proved annual savings of **\$640,000** with an incentive of **\$482,000** from NRCan.

## Sobeys Capital Inc.

Completed 34 simulations and proved annual savings of **\$1,600,000** with an incentive of **\$1,100,000** from NRCan.

Evaluated the design and specifications of Sobeys' buildings by using a design charette and conducting eQUEST simulations to identify and assess potential energy savings opportunities in its building's operations and technologies.

All future new construction for Sobeys' store designs must meet the 25% benchmark (Ontario Building Code).



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