

Toronto Green Sector Scan

Green Buildings

City of Toronto – Economic Development and Culture
www.toronto.ca/invest-in-toronto/green

December 2010

Introduction

This report provides a broad overview of the state of the green building sector in Toronto. It covers the sector's job growth, its major players, relevant education programs, research and innovation as well as highlighting local incentive programs, industry associations and standards. There are case studies of some of Toronto's greenest building projects, coverage of current trends in the sector, concluding with sector forecasts, opportunities for further growth and recommendations.

This report aims to provide a basis for marketing and promotional initiatives at the City's Department of Economic Development & Culture with respect to Toronto's green building sector. References to all sources of information provided herein are detailed in the appendix that follows the final recommendations of this report.

1.0 Sector Overview

1.1 Definition

Green building is the practice of creating structures and using environmentally responsible and resource-efficient processes throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort.¹ This results in the transformation to high-performing healthy buildings and communities.

1.2 Range of Services and Professions

Many services and professions that make up the conventional building and construction sector apply to green buildings. These include:

- Real estate developers
- Design: architects, landscape architects, interior designers, urban planners
- Engineering: environmental, civil, mechanical, electrical, geotechnical
- Builders: general contractors & construction trades

1.3 Toronto Jobs & Growth

Toronto has seen tremendous growth in its green building sector over the past 7 years owing to the Ontario Green Energy Act, Toronto Green Development Standard, Toronto Green Roof Bylaw and increased market awareness of and demand for LEED® buildings. To date there are:

- 43,000+ green building jobs
- 2,000+ employers
- 85% of employers are small to medium enterprises (20 people or less)²

¹ U.S. Environmental Protection Agency. (October 28, 2009). Green Building Basic Information. <http://www.epa.gov/greenbuilding/pubs/about.htm>

² Toronto Workforce innovation group, Greening the Economy: Transitioning to New Careers

2.0 Major Players

2.1 Major firms in the Toronto green building sector

There are several world-leading design, development, engineering and construction firms which feature prominently in Toronto's green building space. The following are lists of those companies that have major operations and resources in Toronto.

Real Estate Developers

Minto Group, Inc.

- Residential and commercial developer in Canada and the USA
- *Minto Green Team* specifies to LEED and ENERGY STAR standard

Tridel

- Largest provider of green high-rise residential buildings in Canada.
- Multiple Builder Of the Year Award winner, built over 65,000 homes.

Design: architects, landscape architects, interior designers, urban planners

Dessau Inc.

- Design, planning, construction and operations.
- Offices in 45 Canadian cities and 6 countries.

HOK Group

- Award Winning global architectural and design firm.
- 1,800 professionals across 25 offices on 3 continents.

Golder Associates Corp.

- Design consulting, and construction services in earth, environment, and energy.
- Global offices and project reach

Trow Global

- Building assessment, design, maintenance and renovation services.

& Green Report FNL2.pdf, <http://www.workforceinnovation.ca/research>

- 125 international offices with global project reach

Engineering: environmental, civil, mechanical, electrical, geotechnical

Enermodal Engineering

- Canada's largest green building consulting firm.
- Offices across Canada with 250 LEED projects completed.

Halcrow-Yolles

- Building Engineering services from design to construction.
- Global presence with projects across the Middle East, Asia & Europe.

MCW Group

- Engineering development, delivery and energy management services.
- Offices across Canada.

MMM Group

- Program management, planning, engineering and geomatics firm.
- Offices across Canada with global project experience.

SNC- Lavalin International Inc.

- One of the largest engineering and construction groups in North America.
- Global offices and project reach.

Stantec Inc.

- Provides full range of building design and construction services.
- International corporation with offices in North America and the Caribbean.

Builders: general contractors & construction trades

Aecon Group Inc.

- Aecon Buildings is a leading North American general contractor.
- Offices across the U.S and Canada.

Graham Group Ltd.

- General contracting, construction management and design/build services.
- Offices across the U.S and Canada.

PCL Construction Enterprises Inc.

- Largest contracting organization in Canada.
- Located in 25 major cities across North America and the Caribbean.

2.2 Global Ranking of Toronto Firms

Top 100 Green Design Firms, 2010³

#4 HOK Group

Top 100 Green Contractors, 2010⁴

#8 PCL Construction Enterprises Inc.

Top 150 Global Design Firms, 2010⁵

#9 SNC-Lavalin International Inc.

#24 Stantec Inc.

#41 Golder Associates Corp.

#76 Trow Global

#58 Dessau Inc.

#119 MMM Group Ltd.

Top 200 Environmental Firms, 2010

#22 Stantec Inc

#27 PCL Construction Enterprises Inc.

#41 Halcrow

#81 Golder Associates Inc.

Top 225 Global Contractors, 2010⁶

#44 PCL Construction Enterprises Inc.

#110 SNC-Lavalin International Inc.

^{3,5} Based on total design revenues, *The Engineering News Record*. See Appendix.

^{4,6} Based on total contracting revenues, *The Engineering News Record*. See Appendix.

#115 Aecon Group Inc.

#120 Graham Group Ltd.

3.0 Education, Research & Innovation

3.1 Post-Secondary Institutions & Academic Programs

University of Toronto

Undergraduate

- Architectural Studies (BA)
- Civil Engineering (BASc)
- Environmental Engineering (BASc)
- Energy Systems Engineering (BASc)
- Sustainable Energy (BASc)

Graduate

- Architecture (MArch)
- Landscape Architecture (MLA)
- Urban Design (MUD)
- Environmental Science (MEnvSc, PhD)
- Planning: Urban, Environmental and Sustainability (MScP, PhD)
- Urban Design Studies (MUDS)
- Civil Engineering: Building, Geoscience, Environmental (MASc, MEng, PhD)
- Forest Conservation (MFC)

Ryerson University

Undergraduate

- Architectural Science (BArchSc)
- Civil Engineering: Civil, Geomatics, Engineering Management (BEng)
- Interior Design (BID)
- Urban and Regional Planning (BURPI)

Graduate

- Architecture (MArch)
- Civil Engineering (PhD, MASc, MEng)
- Urban Development (MPI)

York University

Undergraduate

- Geomatics Engineering (BASc)

- Ecosystem Management (BES)
- Environmental Science (BSc)
- Real Estate (Certificate)
- Urban Ecologies (Certificate)

Graduate

- Real Estate & Infrastructure Graduate (Diploma)

Humber College

Ontario College Diplomas offered in:

- Architectural Technician/ Technology
- Sustainable Energy and Building Technology
- Heating, Refrigeration and Air Conditioning Technician/ Technology
- Electrician: Construction and Maintenance, Apprenticeship
- Facilities Maintenance Mechanic, Apprenticeship
- Plumber, Apprenticeship
- Landscape Technician
- Building Technology and Design
- Civil Engineering Technology
- Interior Decorating
Interior Design (BAA)

Centennial College

Ontario College Diplomas offered in:

- Architectural Technician/ Technology
- Construction Management
- Electrician, Construction Maintenance Apprenticeship
- Energy Systems Engineering Technician/ Technology
- Environmental Protection Technician/ Technology
- Mechanical Engineering Design Technician/ Technology
- Refrigeration & Air Conditioning Apprenticeship

George Brown College

Provides approximately 50% of construction education in Ontario.⁷ College diplomas in:

- Architectural Technician/ Technology
- Building Renovation Technician/Technology
- Construction Engineering Technician/ Technology
- Heating, Refrigeration and Air Conditioning Technician/ Technology
- Civil Engineering Technology

⁷ Toronto Workforce Innovation Group, *Skills for Energy Efficient Construction.pdf*,
<http://www.workforceinnovation.ca/research>

- Construction Science and Management (Bachelor of Applied Technology)
- Construction Trades (Apprenticeship In-School Training)

Seneca College

Ontario College Diplomas offered in:

- Environmental Landscape Management
- Civil Engineering Technician/ Technology
- Environment and Site Investigation
- Environmental Site Remediation Degree
- Environmental Technician/ Technology
- Green Business Management
- Mechanical Engineering Technology - Building Sciences
- Project Management - Environmental
- Real Property Administration (Assessment and Appraisal)

3.2 Examples of Major Innovation and R&D

Self-Compacting Concrete

Ryerson University's Canada Research Chair in Sustainable Construction, Dr. Mohamed Lachemi is spearheading laboratory and field research to evaluate the properties and uses of self-compacting concrete. The goal is to produce a less labour-intensive product that reduces the negative environmental impacts of using traditional forms of concrete.

Solid State Lighting Network

Toronto Atmospheric Fund (TAF) & University of Toronto's Institute of Optical Sciences has created a Solid State Lighting Network (SSLNet) to bring together academic researchers, industries, governmental agencies, graduate students in the field, and end-users to create a shared photometric laboratory facility for industrial and academic use.

Led by University of Toronto's Dr. V Venkataramanan.

The Rooftop Solar Program

Toronto and Region Conservation is seeking to drive greater adoption of rooftop solar on buildings by landowners and facility managers across the greater Toronto area and beyond. The Rooftop Solar Program is a project to understand the issues, barriers and solutions to move the market for rooftop solar in industrial and commercial developments.

High-Efficiency, Low-Cost Solar Cells.

Today's technologies for harnessing the sun's energy are either efficient and costly or inexpensive and inefficient. Dr. Ted Sargent at the university of Toronto aims to change that by creating the world's first low-cost high-efficiency solar cell by using a technology known as "quantum-size-effect tuning" to tap into a broader spectrum of the sun's rays, the key to improving solar efficiency. The project recently received \$3 million in funding.

Bark Bio-Refinery: Green Adhesives & Bio-Based Foams from Bark.

Professors Ning Yan and Mohini Sain from the University of Toronto are leading a multi-disciplinary team that is developing an innovative bark bio-refinery process that will turn bark biomass, a waste residue with unique compositional characteristics, into high-value, eco-friendly adhesives and bio-products with large market potential. The project received \$1,750,000 and has seven private sector partners - FPInnovations, the Woodbridge Group, Huntsman Corporation, Arclin, St. Mary's Paper, Tembec and AbitibiBowater.

High-efficiency, low cost heat exchangers

Heat exchangers recover energy lost as exhaust and must withstand both high temperatures and corrosion. They are made out of refractory materials, which are difficult and expensive to form. University of Toronto's Professor Javad Mostaghimi, and colleagues have developed a novel forming technology for fabricating lightweight, low-cost high-efficiency heat exchangers that could revolutionize heat recovery. The project received \$3,471,879 and includes private sector partners Plasco Energy Group Inc., Pratt and Whitney Canada Inc. and Centreline Ltd.

4.0 Toronto LEEDing the Way

4.1 Green Neighbourhoods: LEED® ND Pilots

Metrogate Solaris

Metrogate Solaris is a landmark green development integrating smart growth, new urbanism, and green building into a new international standard for urban design. Located on a 17-acre infill site at the intersection of Kennedy Road and Highway 401, the development consists of 1,776,000 sq. ft. of residential condos and commercial space with a mix of building types. Comprised of 46 stacked townhouses, two 35-storey residential towers, a 23-storey office tower, two 30-storey residential towers, and two 40-storey residential towers, as well as a 1.65 acre city park and two day care facilities.

Toronto waterfront project

On a world scale, Toronto's waterfront revitalization is almost unequalled in size. It's larger than Lower Manhattan south of Houston Street, and four times the size of Monaco. To get a sense of its proportions on a local scale, the total area being redeveloped is 800 hectares (1,977 acres), which translates into an area roughly the size of Toronto's downtown core. Expected to take 25 years to complete, this LEED ND pilot project will create approximately 40,000 new residences and 40,000 new jobs

4.2 LEED Building Profiles

To date, there are 268 LEED certified buildings in the city of Toronto, representing roughly 10% of all LEED certified buildings in Canada. Five examples of LEED certified buildings are highlighted below, each designed with a different purpose; mixed-use, residential, institutional and commercial. A complete list

of all LEED certified buildings in Toronto can be found at the Canada Green Building Council website, given in the appendix.

60 Richmond Housing Co-Op

- LEED Registered (New Construction, Gold), Mixed-use
- 2007 Canadian Architecture Award of Excellence.
- Urban revitalization and live/work cooperative housing project
- Rainwater capture and distribution to green terraces recreation space
- Green roof and walls produce vegetables and herbs used in restaurant
- Training kitchen/ restaurant on ground floor staffed by residents
- Onsite organic recycling program
- Energy Recovery Ventilation system & high efficiency plumbing fixtures
- Hybrid auto-share program & bicycle storage

Thomas L. Wells Public School

69 Nightstar Road

- LEED-Silver Certified (New Construction), Educational Facility
- First LEED certified elementary school in Canada
- Toronto Urban Design Award - Award of Excellence
- Layout maximizes green space on its compact site
- Classroom design harvests solar energy, maximize daylight
- Exhaust heat recovery system; condensing boilers space heating
- Hollow core concrete part of unique displacement ventilation system
- Use of durable, low VOC interior finishes & furniture
- Green housekeeping program
- 40% of materials sourced locally (exceptional LEED performance)
- 31% energy cost performance over the Model National Energy Code
- Green education program for the public and occupants

Minto Roehampton

150 Roehampton Avenue

- LEED-Gold Certified (New Construction), Residential Condominium
- 38% energy cost performance over the Model National Energy Code,
- Heat recovery wheels, high efficiency boilers & Energy Star appliances
- 39% potable water use reduction with high efficiency plumbing fixtures
- Rainwater harvesting system to eliminate potable water use for
- Reclamation of a Brownfield site;
- Hybrid Car share program for residents
- Education program on building's green features for residents & public

St. Gabriel's Passionist Parish

650 Sheppard Avenue East

- LEED-Gold Certified (New Construction)
- First LEED certified church in Canada; "Greenest Place of Worship"
- Extensive underground parking reduces urban heat island effect
- Extensive green roof garden
- 78% water use reduction using drought-tolerant plants & drip-irrigation
- 47% indoor potable water reduction through high efficiency fixtures
- 100% of purchased electricity in Renewable Energy Certificates
- 50% Energy use reduction through high-efficiency HVAC
- Extensive use of natural ventilation, daylight & passive solar heating
- Smart sensor building controls
- 25% of materials reused from salvage or have high recycled content
- 30% of construction materials locally produced.
- Onsite recycling & green housekeeping programs

RBC Centre

155 Wellington Street West

- LEED-Gold Certified (Existing Buildings), Class A Office
- "Toronto's most environmentally friendly office tower"
- NAIOP Commercial Real Estate Excellence Award for Green Building
- Renovated Building, BOMA Canada National Awards, Toronto, 2009
- Ontario Concrete Award for Sustainable Concrete Construction
- Connected to the pedestrian underground PATH system
- Natural Daylight and views with floor to ceiling glass
- Sensor controlled, variable lighting systems
- Enwave's Deep-Lake water cooling and steam heating systems
- Individual thermal comfort controls & passive ventilation system
- Rainwater collection and reuse; high-efficiency plumbing fixtures
- Recycled 99% of construction waste

5.0 Key Industry Associations & Standards

5.1 Associations

- Canada Green Building Council (CaGBC)
- Sustainable Buildings Canada
- Green Roofs For Healthy Cities
- Royal Architectural Institute of Canada (RAIC)
- Construction Specifications Canada
- Building Owners and Managers Association (BOMA)
- Canadian Energy Efficiency Alliance
- Ontario Home Builders Association
- Natural Resources Canada (NRCan), Office of Energy Efficiency

5.2 Standards

LEED. *Leadership in Energy and Environmental Design* promotes green building with focus on sustainable

site development, water efficiency, energy efficiency, materials selection, and indoor environmental quality. *Canada Green Building Council (CaGBC)*

ENERGY STAR. Designates products conforming to set energy efficient standards.

NRCan, Office of Energy Efficiency

Energuide. Denotes energy efficient appliances, heating and cooling equipment, vehicles, houses and commercial and institutional buildings. *NRCan, Office of Energy Efficiency*

R-2000. An industry-endorsed technical performance standard for energy efficiency, indoor air tightness quality, and environmental responsibility in home construction.

NRCan, Office of Energy Efficiency

BOMA Best. A national environmental recognition and certification program for existing commercial buildings. *Building Owners and Managers Association (BOMA)*

Green Globes. A Building environmental design and management tool. It delivers an interactive online assessment protocol, rating system and guidance for green building design, operation and management. www.greenglobes.com

Toronto Green Standard. Specifies building performance measures for air and water quality, greenhouse gases, energy efficiency, solid waste and the environment.

City of Toronto

Greenhouse Certified Construction. Is an initiative that goes beyond the Ontario building code, resulting in buildings that use less energy, generate less greenhouse gasses, require less materials to build and offer a fresher, healthier living environment.

EnerQuality Program: Canadian Energy Efficiency Alliance & Ontario Home Builders Association.

6.0 Local Programs & Incentives

6.1 City of Toronto Programs

The City of Toronto administers a wide variety of incentive programs designed to spur growth in the green building sector and hasten market transformation toward sustainability. It also partners with a variety of provincial and federal government entities as well as non-governmental organizations in this regard. Below is a list of some of the major incentive programs that the City of Toronto offers.

- **Better Buildings Partnership**

BBP provides resources and financial assistance for energy efficient retrofits and construction to reduce carbon dioxide (CO₂) emissions from Toronto buildings.

- **ChemTRAC Toxics Reduction Grants (Live Green)**

This program is intended to raise awareness, understanding and implementation of toxics reduction opportunities in our businesses and communities.

- **Commercial Façade Improvement Program**

The City offers grants to eligible commercial property owners for improvements to building façades in designated Business Improvement Areas (BIA).

- **Eco-Roof Incentive Program**

Toronto's Eco-Roof Incentive Program promotes the use of green and cool roofs on Toronto's commercial, industrial and institutional buildings.

- **Green Development Standard**

The Toronto Green Standard specifies performance measures for air and water quality, greenhouse gases, energy efficiency, solid waste and the environment.

- **Green Roof Bylaw**

Toronto is the first City in North America to have a bylaw to require and govern the construction of green roofs on new development.

- **Solar Neighbourhoods** (SolarCity)

The goal of this pilot project is to advance the use of solar hot water systems to reduce greenhouse gas emissions and improve local air quality. This pilot project is now complete.

- **Streetscape Improvement Program**

In partnership with a BIA, the City provides 50/50 matching capital funds for eco-friendly streetscape beautification projects.

- **Tower Renewal**

This initiative targets the more than 1,000 high-rise residential concrete frame buildings located throughout Toronto to improve their energy efficiency.

- **Toronto Sustainable Energy funds**

The Toronto Energy Conservation and Green Energy Funds offer 0% interest loans up to a maximum of \$1 Mill not exceeding 49% of the total eligible costs of a project.

- **WaterSaver Programs**

This programs provides rebates and incentives for building strategies that reduce water consumption for industrial, commercial and institutional customers

6.2 Other Local programs

- **Carbon Competitive Cities** (Toronto Regional Conservation Authority)

This program provides a series of tools to reduce carbon emissions in *Getting to Carbon Neutral: A Guide for Canadian Municipalities*

- **EcoSMART Ecocondo for Chongqing, China**

This life-size exhibition suite demonstrates green building products and strategies. It will travel to 11 sites throughout the world's largest municipality in 2011.

- **Mayors' Megawatt Challenge** (Toronto Regional Conservation Authority)

This program provides energy conservation innovation benchmarking, online energy tracking, information sharing and between municipalities to building owners and operators.

- **Partner's in Project Green**

This project works with local businesses to transform the area surrounding Toronto Pearson Airport into an internationally recognized eco-business zone.

- **TowerWise**

This program provides free advice on planning a retrofit and assistance with applying for incentives to condominium resident, building owner or manager.

7. 0 Sector Forecasts, Opportunities & Drivers

Overall Increase in Local Green Building Momentum

- Market response to incentives
- Improved cost-benefit of efficient green tech
- Greening existing buildings-LEED EB is fastest growing rating system
- Expansion into green Neighbourhood development with LEED ND. Toronto has 2 pilots

Overall Increase in Global Green Building Momentum

- Developing countries begin to create their own green building councils
- Passage of new legislation and incentive rollouts in developing regions
- Lifecycle costs and economies of scale have made green tech affordable
- Local innovation in developing countries creating new economic opportunities

Increased Municipal Mandates

- Environmental pressures and desire to reduce carbon emissions
- Government's continued focus on green jobs and green economy
- Infrastructural pressures from increasing urban populations
- Rising energy demand and costs

Clean Water Supply & Sustainable Food Production

- Rising costs of water treatment, delivery and sewage management
- Improved cost benefit of new water conserving technologies
- Rising health care costs & lower food quality from mechanized farming
- Growing social movement toward green roofs and urban agriculture

Buildings as Utility scale power plants

- Buildings consume less energy due to improved envelope tech and energy efficiency
- Government incentives and third-party provision of capital for large rooftop projects
- Lower cost of manufacturing photovoltaic panels with higher efficiencies
- Strong push toward renewable power installations and smart grid tech by utilities

Campus Sustainability plans (higher education) and Greener Retail

- Market demands for corporate social responsibility reporting
- Operational cost savings greener supply chain
- Building automation to manage synergies between campus buildings
- LEED for Neighbourhood development applies to campuses

More Progressive Green Building Standards

- Innovation transfer from Europe where energy is 400% more expensive
- Rising cost of energy and desire to reduce green house gas emissions
- Emergence and growing demand for Zero-net-energy designs
- Growing number of European architects and engineers in Canada

Green Job opportunities

- Large number of construction workers are expected to retire in the next 5 years
- Green building jobs require special training and entry-level positions to emerge last
- Parents & youth are unaware of the trades as a viable career option
- There aren't enough journey persons to take on new apprentices.

Insurance & Finance Sector Involvement Opportunities

- Government incentives may stimulate unsustainable artificial demand
- Financiers need to realize that Green building 'premium' is a myth
- Banks and insurers need to adopt green underwriting standards
- Leveraging green building cost benefits can fuel & sustain sector growth
- Market opportunity for creation of green REITs and financial products

8.0 Green Building Events in Toronto in 2011

High Performance & Sustainable Buildings

- Strategy Institute
- March 1–2, 2011
- Hilton Garden Inn Toronto Airport

Greenbelts Conference: Local Solutions for Global Challenges

- Friends of the Greenbelt Foundation
- Mar 22 – 24
- Radisson Hotel Admiral Toronto-Harbour front

2011 National CaGBC Symposium

- Canada Green Building Council
- April 13–14, 2011
- Allstream Centre

IIDEX/Neocon Canada/Green Building Festival

- Sustainable Buildings Canada
- Exposition September 22 – 23
- Conference September 22 -24
- Direct Energy Center

Greenbuild 2011

- U.S. Green Building Council & Canada Green Building Council
- October 4-7, 2011
- Metro Toronto convention Center

Construct Canada/ National Green Building Conference

- MMPI Canada
- November 30 - December 2, 2011
- Metro Toronto convention Center

9.0 Recommendations

Toronto has a healthy and vibrant green building sector. Going forward there are two immediate opportunities to accelerate its growth.

First is the transfer of ownership for incentives from government to the private sector. The marketplace continues to affirm the value of green buildings in higher rents and greater demand. This fact, combined with the lower operating costs resulting from improved building efficiencies represents lower risks to lenders and insurers. As such, the costs of insuring and borrowing capital for green building projects must be lower compared to conventional buildings. This is not yet common practice and needs to become the norm in order to accelerate the market transformation to sustainability. The mechanisms to quantify the reduced risk resulting from green building practices have now been created in the form of green building underwriting standards, but have not been deployed in Toronto. A green building underwriting awareness and training campaign needs to be developed and deployed if the acceleration of green building is to occur. For further consultation on this matter please contact the Sustainable Asset Group.

Second is the need for improved performance of current green buildings. While green buildings are outperforming their conventional counterparts, they still under-perform their design case performance baselines by 60%. This is due to the fact that most green building usage and management is misaligned with the building's design intent. Furthermore the absence of redundant systems to automatically compensate for improper use makes it difficult for green buildings to achieve their full potential. Building performance can be drastically improved with educated and properly trained tenants and managers in conjunction with building automation systems. In the future a green building will be a smart building with smart tenants. This is already evident, as the upcoming revision of the LEED program in 2012 will, for the first time, have a unique credit section dedicated to building performance.

APPENDIX

1.3 People, Jobs & Growth

Toronto Workforce innovation group, <http://www.workforceinnovation.ca/research>

- *Greening the Economy: Transitioning to New Careers*
- *Green Report FNL2.pdf*

2.1 Major Toronto firms in the green building sector

Halcrow-Yolles, <http://www.halcrow.com/halcrowyolles>

Stantec Inc., <http://www.stantec.com/default.htm>

Enermodal Engineering, <http://www.enermodal.com/>

MMM Group, <http://www.mmm.ca/>

Halsall Associates Ltd., <http://www.halsall.com/>

MCW Group, <http://www.mcw.com/>

HOK Canada Inc., <http://www.hok.com/>

Tridel, <http://www.tridel.com/>

Minto Group, Inc., <http://www.minto.com/>

PCL Construction Enterprises Inc., <http://www.pcl.com/>

SNC- Lavalin International Inc., <http://www.snclavalin.com/index.php?lang=en>

Aecon Group Inc., <http://www.aecon.com/Buildings/>

Graham Group Ltd., <http://grahamgroupLtd.com/aboutus.html>

Golder Associates Corp., http://www.golder.com/location_map.php

Trow Global, <http://www.trow.com/tnw/Default.aspx?langID=EN>

Dessau Inc., <http://www.dessau.com/en/services>

2.2 Global Ranking of Toronto Firms

Top 100 Green Design Firms 2010, *The Engineering News Record*

<http://enr.construction.com/toplists/GreenDesignFirms/001-100.asp>

Top 100 Green Contractors 2010, *The Engineering News Record*

<http://enr.construction.com/toplists/greencontractors/001-100.asp>

Top 200 Environmental Firms 2010, *The Engineering News Record*

<http://enr.construction.com/toplists/EnvironmentalFirms/001-100.asp>

Top 150 Global Design Firms 2010, *The Engineering News Record*

<http://enr.construction.com/toplists/GlobalDesignFirms/001-100.asp>

Top 225 Global Contractors 2010, *The Engineering News Record*

<http://enr.construction.com/toplists/GlobalContractors/001-100.asp>

3.1 Post-Secondary Institutions & Academic Programs

Toronto Workforce Innovation Group, <http://www.workforceinnovation.ca/research>

- *Skills for Energy Efficient Construction.pdf*
University of Toronto, <http://www.utoronto.ca/>

Ryerson University, <http://www.ryerson.ca/home.html>

York University, <http://www.yorku.ca/web/index.htm>

Humber College, <http://www.humber.ca/>

Centennial College, <http://www.centennialcollege.ca/>

George Brown College, <http://www.georgebrown.ca/>

Seneca College, <http://www.senecac.on.ca/>

3.2 Examples of Major Innovation and R&D

Self-Compacting Concrete

http://www.ryerson.ca/ors/research_chairs/canada_lachemi.html

Solid State Lighting Network

<http://www.toronto.ca/taf/lightsavers.htm#grants-loans>

The Rooftop Solar Program

<http://www.trca.on.ca/understand/programs-of-the-living-city/the-renewable-energy-program/rooftop-solar-program.dot>

High-efficiency low-cost solar cells.

<http://www.light.utoronto.ca/>

Bark bio-refinery: green adhesives and bio-based foams from bark

<http://www.forestry.utoronto.ca/people/yan/yan.html>

High-efficiency, low cost heat exchangers

<http://www.mie.utoronto.ca/faculty/mostaghimi/>

4.1 Green Neighborhoods: LEED® ND Pilots

Metrogate @ Tridel, <http://www.tridel.com/metrogate-townhomes/masterplan.php>

Toronto waterfront project, http://www.toronto.ca/waterfront/dev_projects.htm

4.2 LEED® Building Profiles

List of LEED certified projects in Canada

<http://www.cagbc.org/Content/NavigationMenu/Programs/LEED/ProjectProfilesandStats/default.htm>

5.1 Associations

Canada Green Building Council (CaGBC), <http://www.cagbc.org/>

Sustainable Buildings Canada, <http://www.sbcCanada.org/>

Royal Architectural Institute of Canada (RAIC), <http://www.raic.org/>

Construction Specifications Canada, <http://www.csc-dcc.ca/>

Building Owners and Managers Association (BOMA), <http://www.bomacanada.ca/>

Canadian Energy Efficiency Alliance, <http://www.energyefficiency.org/>

Ontario Home Builders Association, <http://www.ohba.ca/>

(NRCAN), Office of Energy Efficiency, <http://oee.nrcan.gc.ca/english/index.cfm?attr=0>

Green Roofs For Healthy Cities, <http://greenroofs.org/>

6.0 Local incentives and programs

Green Dev Std <http://www.toronto.ca/planning/environment/greendevdevelopment.htm>

Green Roof Bylaw, <http://www.toronto.ca/greenroofs/overview.htm>

Eco-Roof http://www.toronto.ca/livegreen/greenbusiness_greenroofs_eco-roof.htm

Solar Neighborhoods, (SolarCity), <http://www.solarnighbourhoods.ca/>

Solar Technology Assessment <http://www.toronto.ca/taf/solarcity.htm#solarcity>

Better Buildings Partnership, <http://bbptoronto.ca/>

ChemTRAC, http://www.toronto.ca/livegreen/greenneighbourhood_rebates_chemtrac.htm

Capital Project Fund http://www.toronto.ca/livegreen/greenneighbourhood_rebates_cpf.htm

WaterSaver http://www.toronto.ca/livegreen/greenbusiness_savewater.htm#toronto

MW ChIng, <http://www.trca.on.ca/understand/programs-of-the-living-city/mayors-megawatt-challenge/>

C Comp Cities, <http://www.trca.on.ca/understand/programs-of-the-living-city/carbon-competitive+cities.dot>

TowerWise, <http://www.toronto.ca/taf/towerwise.htm>

Commercial Façade, http://www.toronto.ca/bia/financial_incentive_programs.htm#1

Streetscape Imp, http://www.toronto.ca/bia/financial_incentive_programs.htm#3

Mayor's Tower Renewal, <http://www.towerrenewal.ca/>

Toronto Sustainable Energy funds, <http://www.toronto.ca/energy/sef.htm>

Partners in Project Green, <http://www.partnersinprojectgreen.com/>

EcoSMART Ecocondo, <http://www.ecosmart.ca/index.cfm?bd=KBDet.cfm&id=78>

7.0 Sector Forecasts & Opportunities

Yudelson Associates <http://www.greenbuildconsult.com/books/>

- *LEEDing Retail to Greener Pastures,*
- *ICSC Report: LEEDing the Retail Sector Green,*
- *New Water Technologies for Mechanical Contractors,*
- *Campus Sustainability Benchmarking,*
- *Green Building Trends in Higher Education,*
- *20 Questions with Jerry Yudelson,*
- *Corporate Sustainability Management: Best Practices*

Toronto Workforce Innovation Group, <http://www.workforceinnovation.ca/research>

- *Greening the Economy: Transitioning to New Careers,*
- *Green Report FNL2.pdf*
- *Skills for Energy Efficient Construction.pdf*
- *Toronto's Opportunities and Priorities.pdf*

Toronto Green Standard <http://www.toronto.ca/planning/environment/greendevlopment.htm>

- *What is Green Development.pdf*
- *Why do we need a Green Development Standard.pdf*
- *What have we learned about Green Development.pdf*

Cost Benefit Study (U of T), <http://www.toronto.ca/planning/environment/consultantsreport.htm>

8.0 Green building Events in Toronto in 2011

High Performance & Sustainable Buildings, www.greenbuildingsummit.ca

Greenbelts Conference, <http://www.globalgreenbeltsconference.ca/>

2011 National CaGBC Symposium, www.cagbc.org/cagbc/conference

IIDEX/Neocon, http://www.iidexneocon.com/2010/index.php/show_dates/

Greenbuild 2011, <http://www.greenbuildexpo.org/Home.aspx>

Construct Canada, http://www.constructcanada.com/post_show/index.php