



**ENERMODAL  
ENGINEERING**

*Creating energy and resource efficient buildings*



# The Making of Canada's Greenest Office Building

**Enermodal's New Head Office**

**Stephen Carpenter, Enermodal Engineering**  
**February 16, 2011**



# Who We Are and What We Do

- **Canada's leading green building consultant with over 100 employees**
- **Offices in Kitchener, Toronto, Calgary, Edmonton, Winnipeg, Halifax and Thornhill**
- **Responsible for 40% of all LEED Canada certified buildings**



*Creating energy and resource efficient buildings*



## The Need

- **HOT200 list of fastest growing A/E firms in N.A.**
- **outgrew Green on the Grand, the Enermodal-designed building that held title of Canada's most energy-efficient office at 130 kWh/m<sup>2</sup>**





# The Goals

- be the first “triple LEED Platinum” building (NC, CI, and EBOM)
- create the most energy-efficient office in Canada – half the energy use of Green on the Grand
- demonstrate that high-performance green buildings are possible at minimal extra cost using available technology
- provide an attractive, productive, and healthy workplace
- revitalize the urban neighbourhood



# Project Team

## Design Team

**Architect:** Robertson Simmons architects inc.

**Mechanical/Electrical Engineers:** Enermodal

**Structural/Civil Engineers:** MTE Consulting

**LEED Consultant:** Enermodal

**Contractor:** Melloul-Blamey Construction

**Commissioning Agent:** Enermodal

**Energy Performance Monitoring:** Enermodal

**Interior Designer:** Elemental Interior Design Inc.

**Landscape Architect:** Roth Associates





## The Design

- 2150 m<sup>2</sup>, three storeys
- designed for 90 employees



# The Original Site

- derelict gravel lot
- neighbourhood in need of revitalization
- 0.9 ha site overlooking Grand River



# Site Plan



Muloks for recycling and composting

Employee garden plots

Gazebo

Stormwater detention pond

100% native plants no sod

Land donated for Grand River Trail

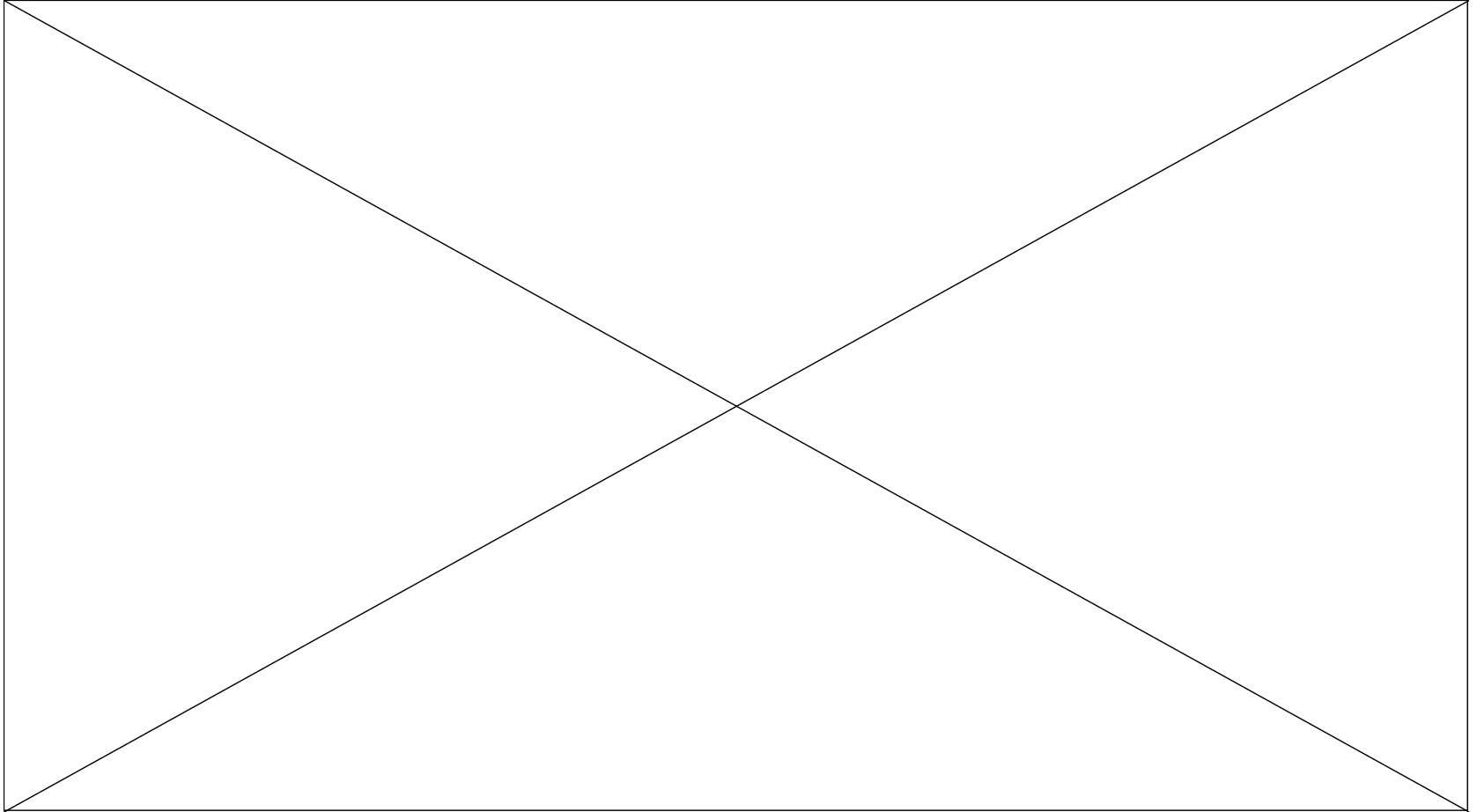




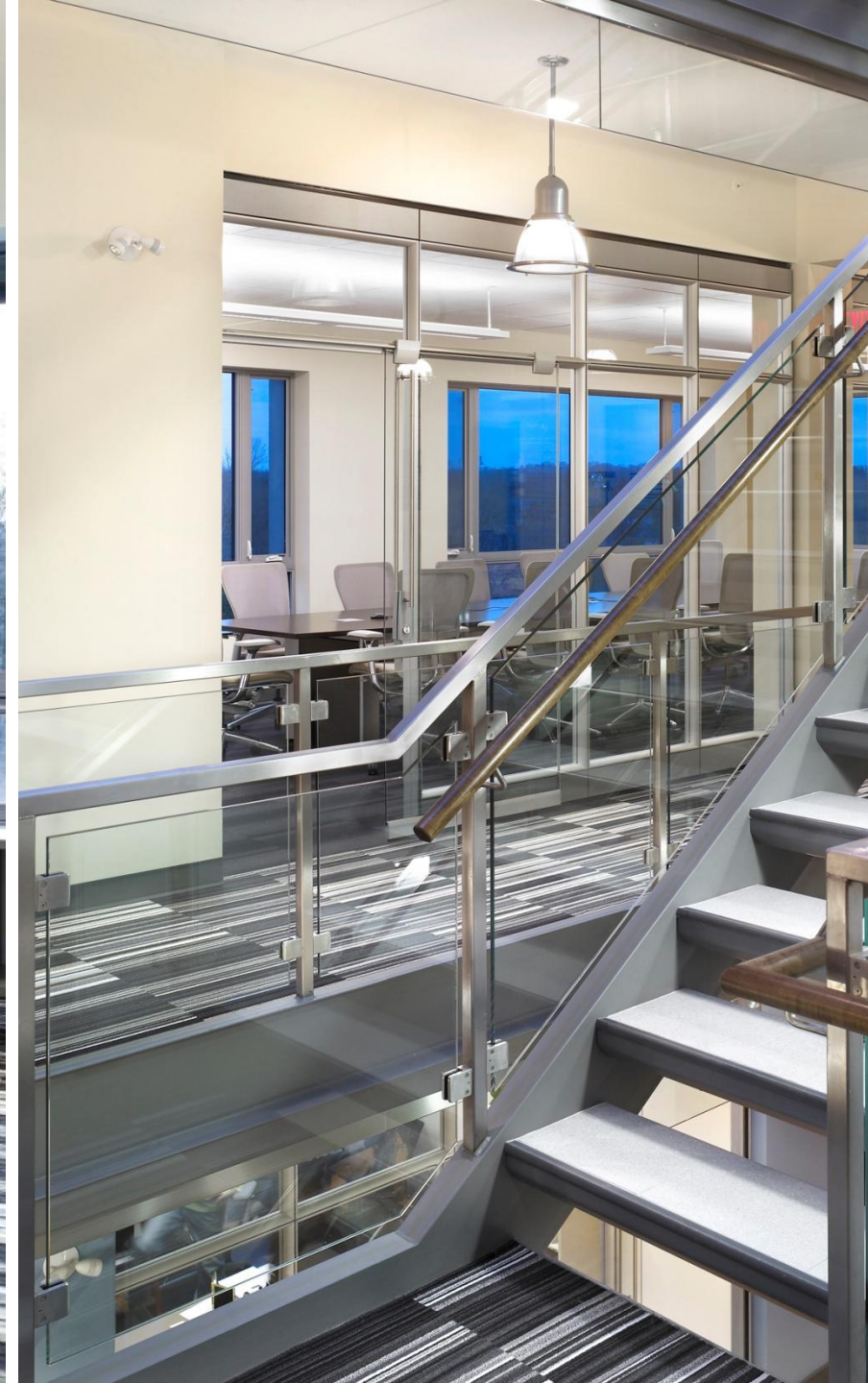
# Landscaping



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# Building Structure

- narrow footprint – only 12 meters wide – everyone has access to natural light
- precast concrete slabs span building: no interior columns







# Building Envelope

- Walls: ICF - R25, 40% w-w ratio
- Windows: triple-glazed, low-e, argon, warm edge, fiberglass
- Curtain wall: 50mm TB alum
- Roof: R24, white Sarnafil membrane







# Innovative Technologies

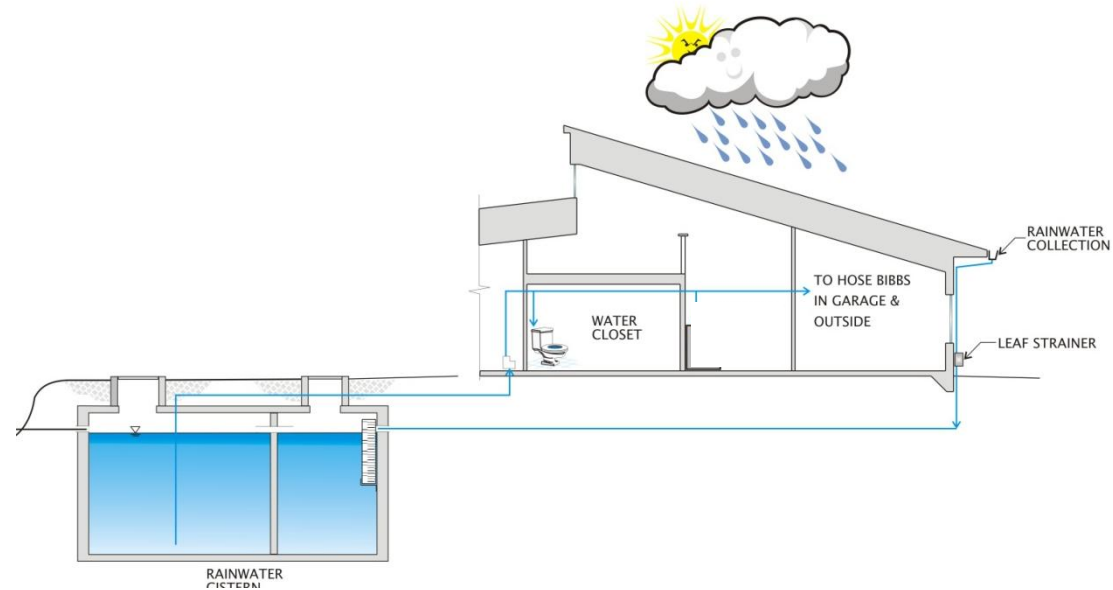
- **automated exterior shading controls solar gains**
- **5.7 kW rooftop PV system**





# Water Saving Features

- 30 m<sup>3</sup> rainwater cistern feeds 4 L flush toilets and 0.5 L/flush urinals





# Water Heating

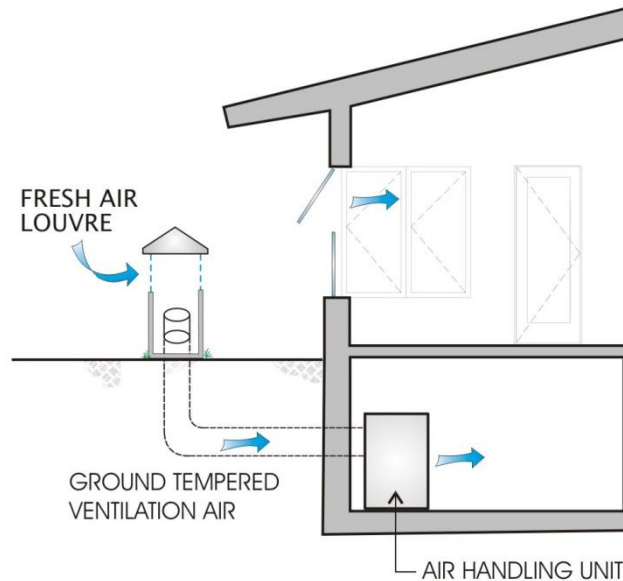
- **Water efficient and automatic lav faucets, low-flow shower heads, Energystar dishwasher**
- **Heat Pump cools server room and preheats water**
- **Small electric tanks provide top up**
- **Shut down in unoccupied hours**
- **No recirculation system**





# Ventilation System

- two earth tubes temper ventilation air
- six ERVs deliver air to many small building zones
- 100% outdoor air supplied at ceiling





# Heating/Cooling System

- zone heating from 34 variable refrigerant flow fan coils
- fan coils are connected by refrigeration piping with heat pumps on the roof
- heat pumps perform better because they are usually lightly loaded





# Fans and Pumps

- **Eliminated HVAC pumps by using VRF**
- **Fans controlled by occupancy sensors**
- **All fans local with minimal head and flow**
- **Variable speed cistern pump**





# HVAC and Lighting Controls

Daylighting sensor



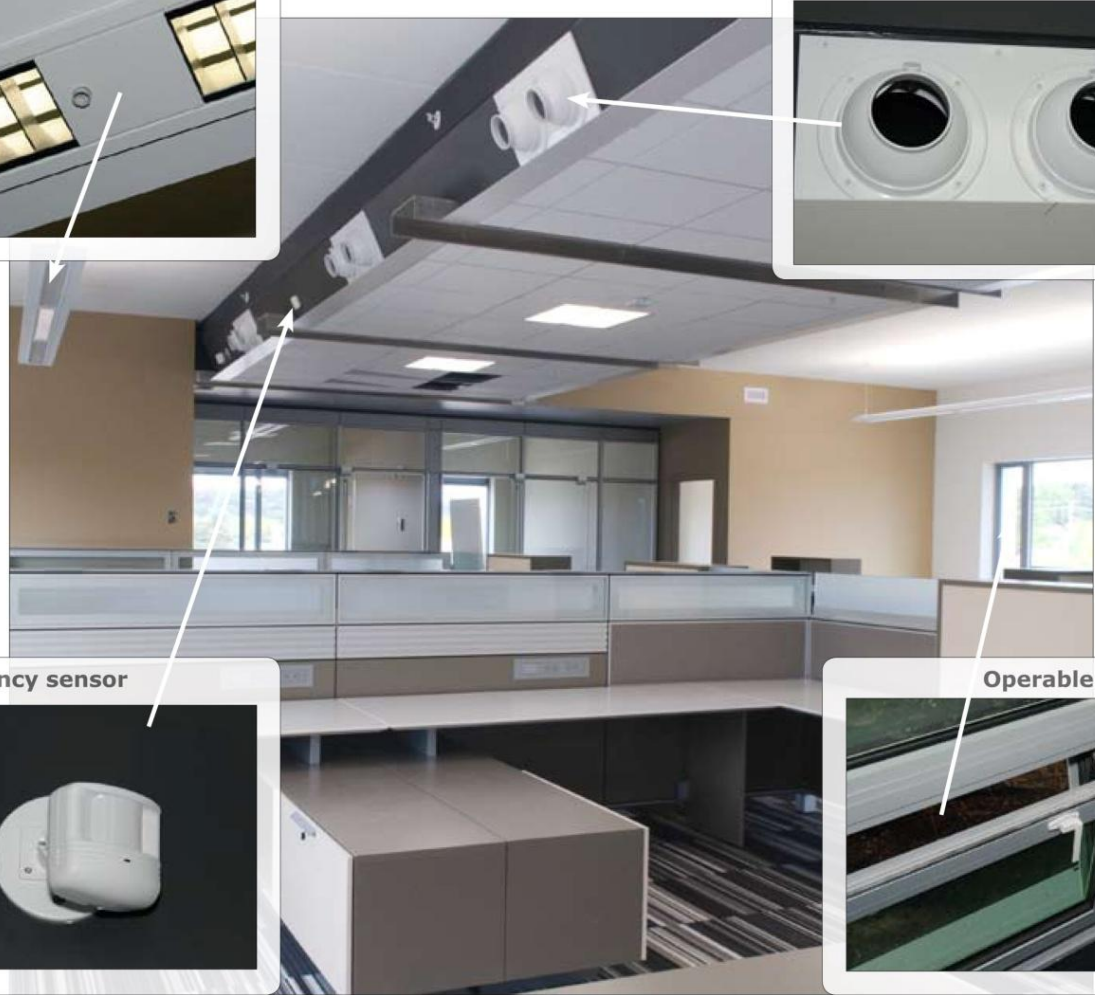
Supply ventilation air and heating and cooling



Occupancy sensor



Operable window





# Salvaged Materials







# Green Materials

- **100% recycled paint**
- **90+% FSC wood**
- **70% recycled carpet and ceiling tiles**
- **GREENGUARD certified furniture**





# Materials

- **100% recycled paper counter tops**
- **bamboo kitchen and bathroom cabinets**
- **100% Energystar appliances**





# Waste Diversion

- **89% construction waste diversion**
- **composting program**
- **in-ground waste storage for less bacteria growth and vertical compression**
- **no-waste printer with resin-based ink, no cartridges**

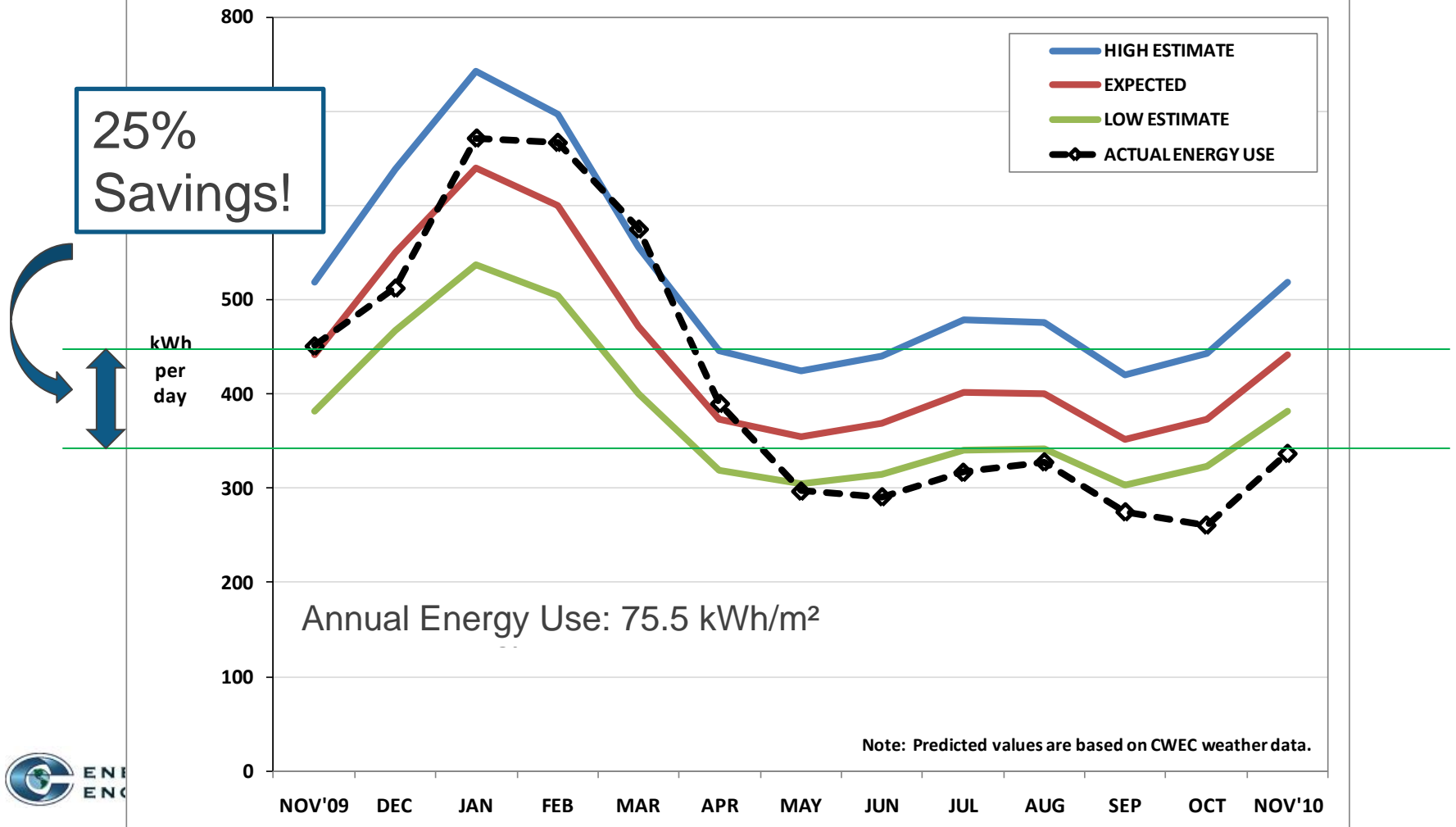






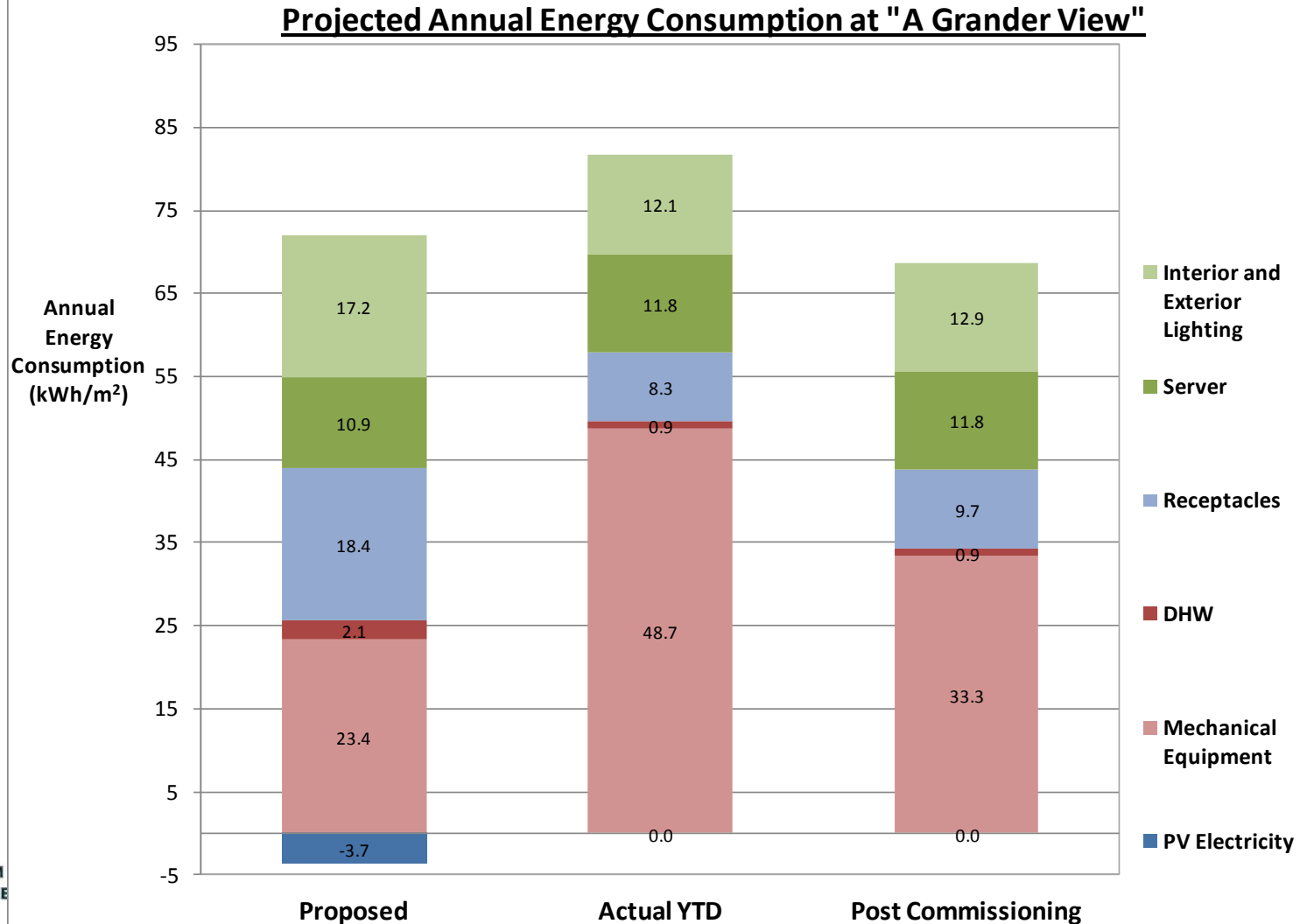
# A Grander View Monitored Energy Use

"A Grander View" - Predicted and Actual Average Daily Energy Use by Month



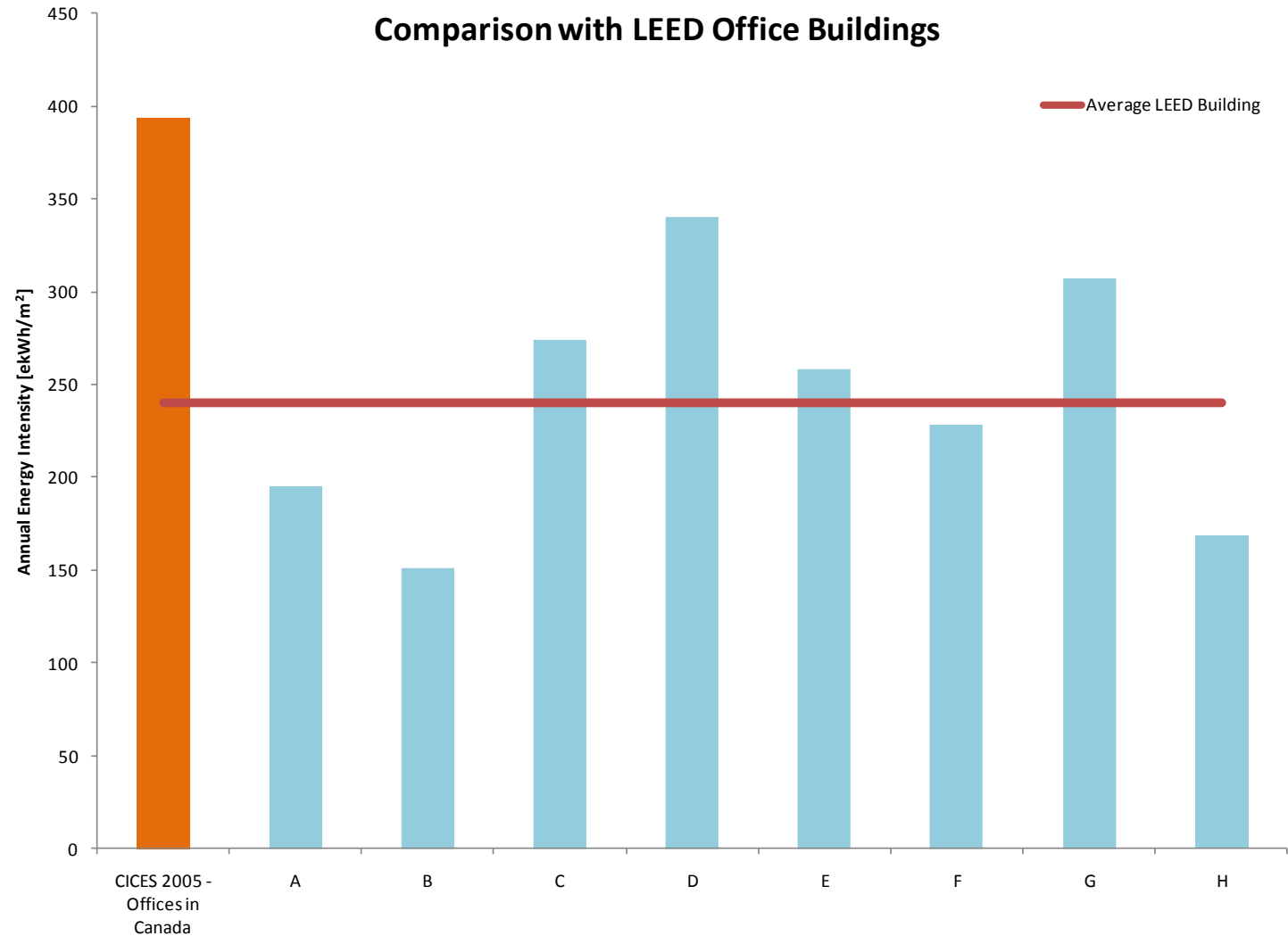


# Monitored Annual Energy Consumption



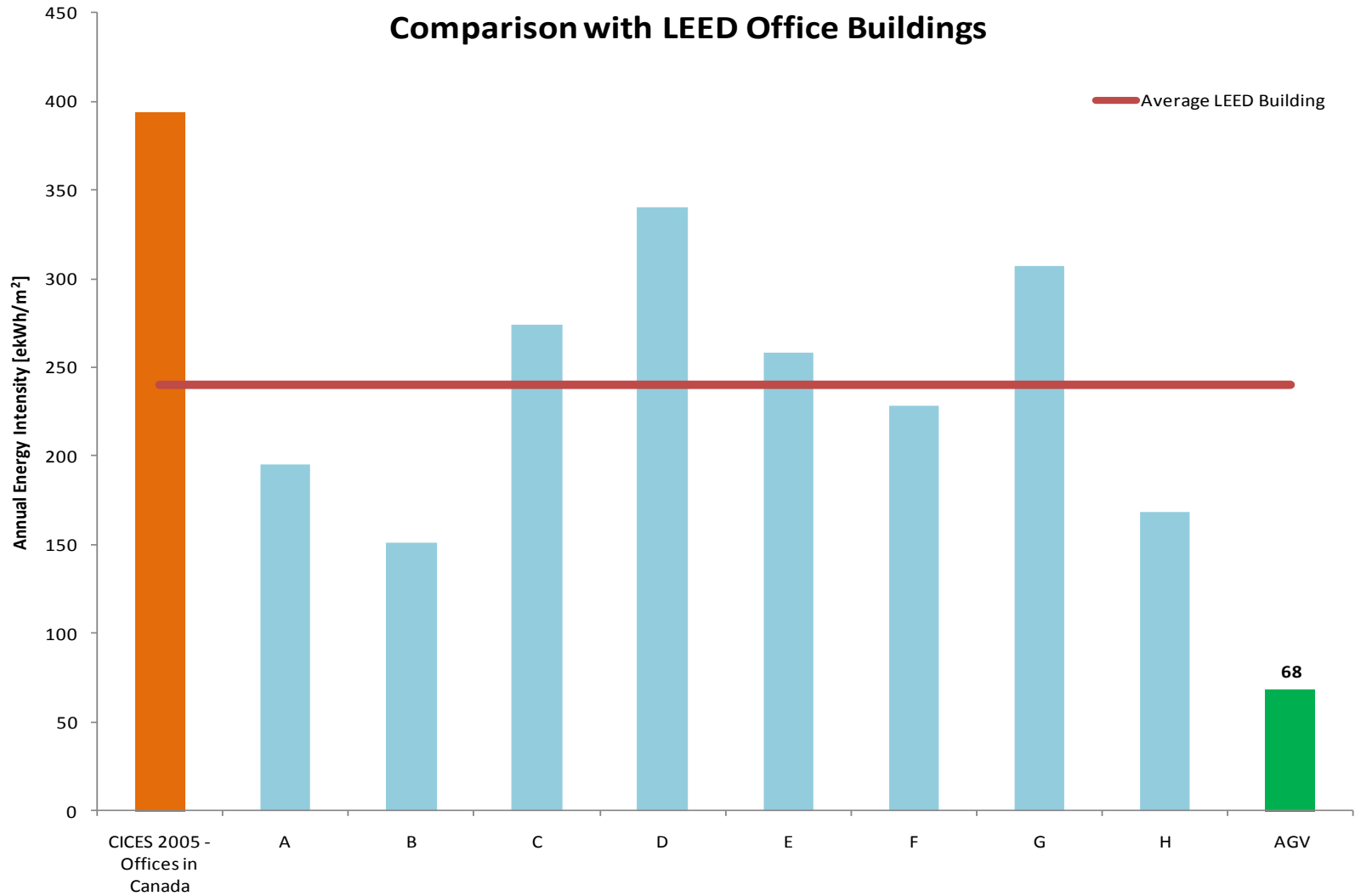


# Performance of LEED Projects





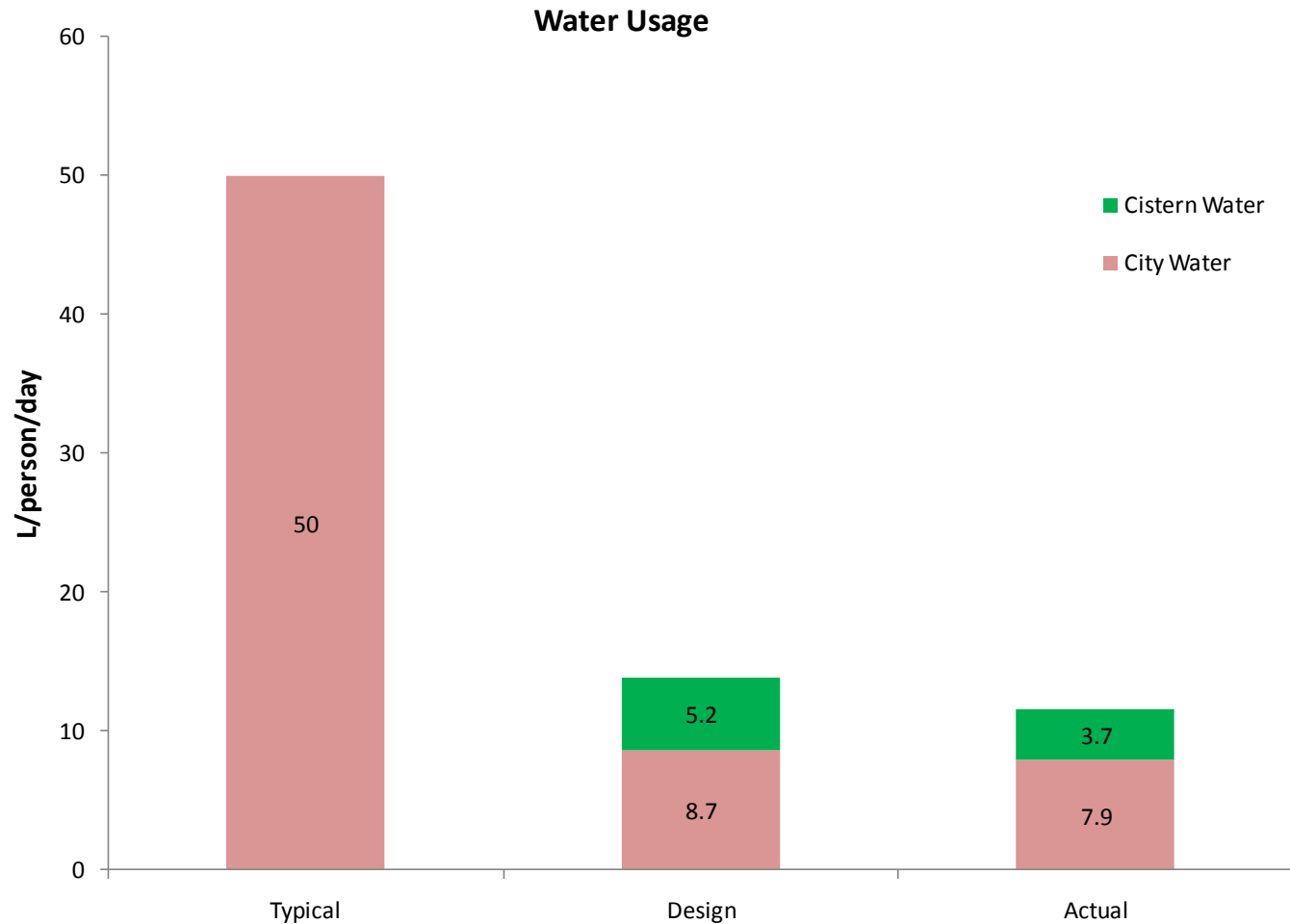
# Performance of LEED Projects





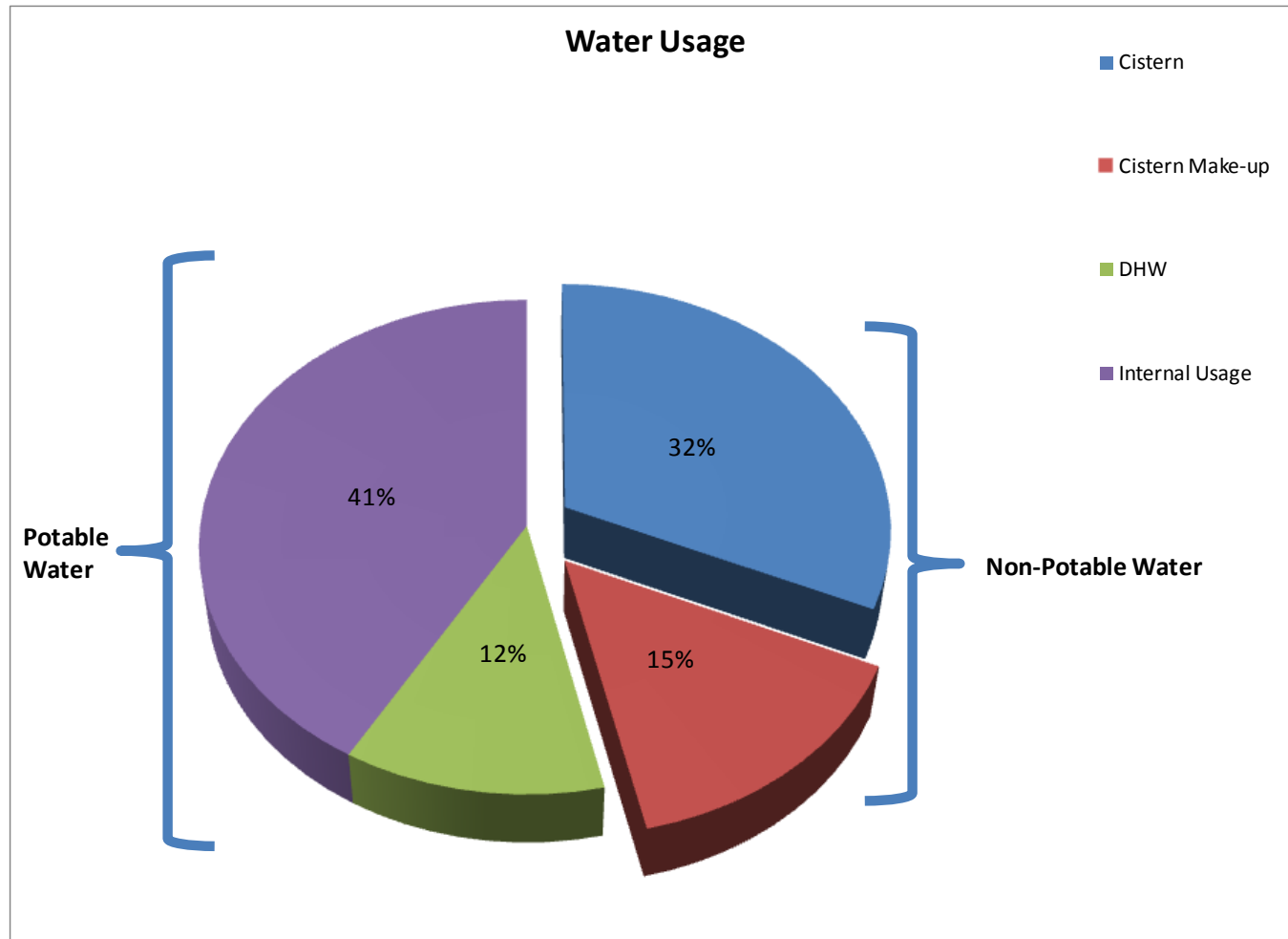


# Annual Water Usage





# First Year Monitored Water Usage





# Occupant Comfort Survey

	<b>% Employees Satisfied</b>	<b>Percentile</b>
General Building Satisfaction	100	100
Lighting	96	99
Cleanliness & Maintenance	95	95
Office Furnishings	95	99
Air Quality	95	99
Office Layout	89	96
Thermal Comfort	81	98
Acoustic Quality	49	70



# First Year Monitored Results

Summary	Unit	YTD	Post Commissioning	Conventional
Total Energy Intensity	kWh/m <sup>2</sup>	81.8	68.6	394
Energy Star Rating		99	99	<50
% Energy Savings	%	79%	83%	
Total Water Demand	L/Person/ Day	11.6	11.6	50
City Water		7.9	7.9	50
% water Savings	%	84%	84%	

## What about the cost?

- **\$180/ft<sup>2</sup> base building, \$70/ft<sup>2</sup> fit-up (all-in except land)**
- **Market rent of \$18.40/ft<sup>2</sup>**





# Going Carbon Neutral

- **Joined Sustainable Waterloo in 2009**
- **Pledging partner to reduce carbon emissions**
- **Committed to being carbon neutral in 5 years**
- **Requires a 50+% reduction in all energy use (operation, commuting, business travel and water)**
- **Remainder can be carbon offsets**



## *Environmental Leadership in Waterloo Region*

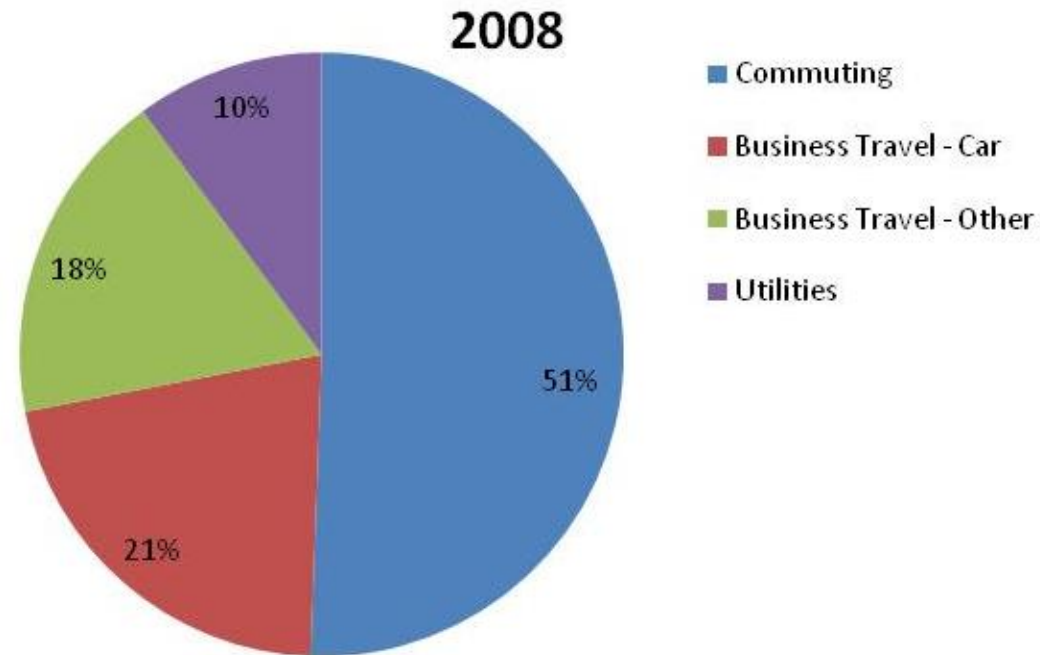
Sustainable Waterloo guides corporations in Waterloo Region towards a more environmentally sustainable future by facilitating collaboration between industry, local government, academia, and NGOs





# First Step: Measure Carbon Emissions

- Carbon emission: 3.6 tonnes per employee
- 90% is due to travel





# Developed Carbon Tracking Tool

- *You manage what you measure*
- Developed on-line tool for employees to track daily commuting and business travel

Enermodal Transportation Tracker - Windows Internet Explorer

http://transporttracker/

File Edit View Favorites Tools Help

Enermodal Transportation Tracker

TRANSPORTATION TRACKER

Scarpenter's Transportation Tracker [Logout](#)

**My Transportation** Home My Commutes My Vehicles

for the week of

← Nov. 2, 2009 - Nov. 8, 2009 →

Monday	Tuesday	Wednesday	Thursday	Friday
am 46 Glasgow	am 46 Glasgow	am Biked	am 46 Glasgow	am car pool
pm 46 Glasgow	pm 46 Glasgow	pm Biked	pm 46 Glasgow	pm car pool

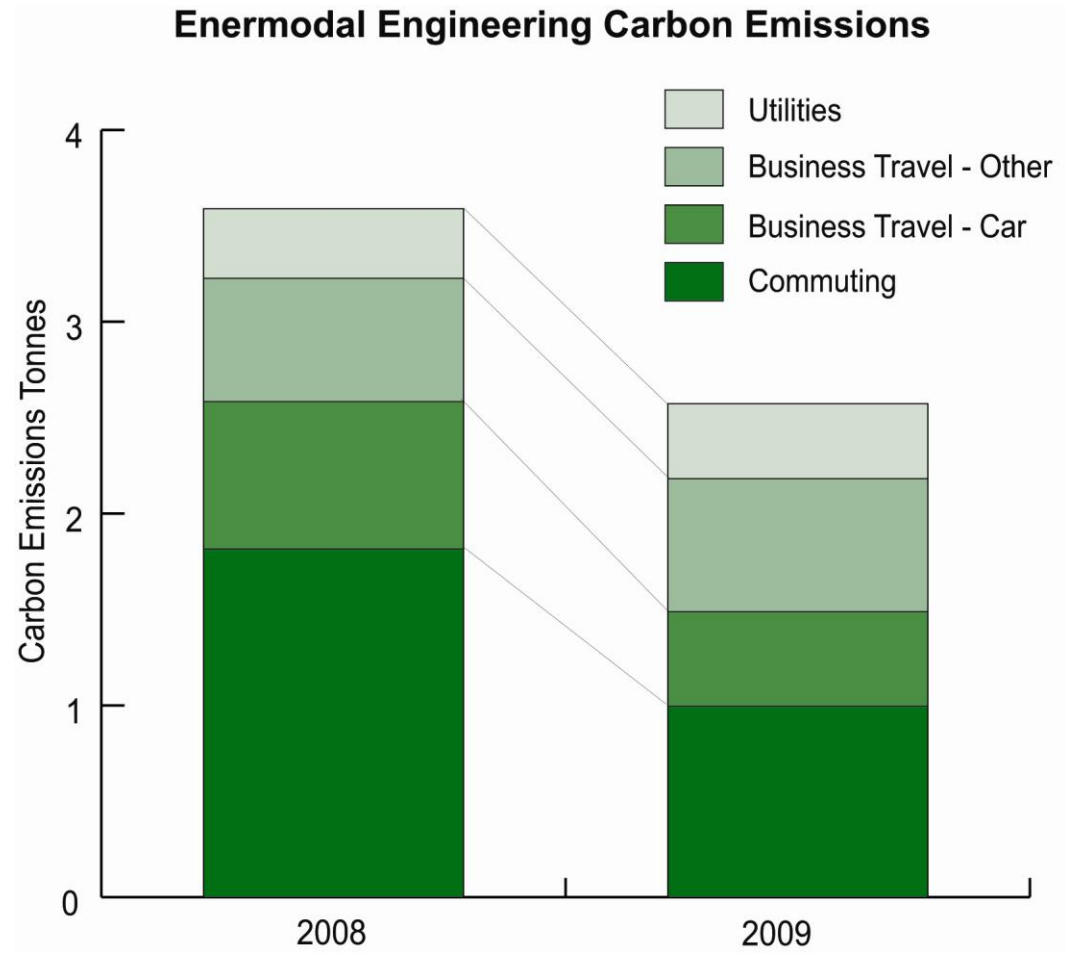
FEEDBACK

FAQ



# 2009 Results

- **57.1 tonnes of CO2 reduced (absolute)**
- **2.6 tonnes per employee, a 28% reduction**
- **11% offset by buying green power for office usage**







## Next Steps

- Strong uptake in hybrid vehicles will show up in 2010
- Implemented a hybrid carshare program at work
- Reward employees that use alternative transportation to work





# On-Going Green Operations

## LEED-EBOM Platinum Candidate:

- Only purchase Energystar equipment and laptops
- Paper is 100% post-consumer recycled
- Organic coffee and food for all corporate functions
- Green cleaning and exterior maintenance
- Green Games for financial support to green charities
- Established an Employee Sustainability Committee with an operating budget



# The Green Life Doesn't End After 5PM

Green incentive	Enermodal rebate provided to employees
<b>Sustainable Transportation</b>	
LEED-compliant, high-efficiency vehicle	\$3,000 or \$1,500 reimbursed for each purchase of a LEED 2004- or LEED 2009-compliant vehicle respectively
Bus pass	Monthly and daily work commute transit pass reimbursed
Walk, bike, carpool-to-work	Awards and recognition will be given to employees who make extra efforts to use alternative methods of transportation to commute
<b>Sustainable Living</b>	
Compost bins	Reimbursed
Rain barrels	Reimbursed
Shower heads	Reimbursed
Windmill/solar panels	\$1,000 incentive for grid-connected renewable energy or permanent solar hot water systems
DHW heating panels	
Home improvements	50% of pre- and post-energy audit paid by Enermodal
	Enermodal will match NRCAN grant awarded up to \$1,000
<b>While @ Work</b>	
Local/organic lunch program	Catered local lunches and local and/or organic purchasing policy for all company events
Bicycles for lunch time use	Company bikes available for employee use along with bike repair kit
Physical fitness	Corporate discount available at select fitness facilities
Health & wellness programs	Regular "lunch and learns"
Garden plots	Employee garden plots are available at <i>A Grandeur View</i>





# Conclusions

- **Huge energy and water reductions can be made in conventional buildings**
- **You need new design practices not new technologies**
- **Monitoring energy use is critical to success**
- **Buildings are easy – now try transportation**
- **Going green takes commitment from the top**





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[www.enermodal.com](http://www.enermodal.com)