



*Sustainability and  
Building Assessments*

David C. Stewart MS P. Eng.  
David C. Stewart & Associates Inc.  
902 266-3663
























A word cloud featuring various green building certification and sustainability programs. The words are arranged in a dense, overlapping cluster. The colors of the text include shades of red, orange, blue, green, and brown. The font sizes vary, with some words being significantly larger than others. The background is plain white.

Green Globes  
INVEST  
Energy Star  
Greenroads  
GreenLITES  
Envision  
Living Building Challenge  
China 3 Star  
Estidama-Pearl  
HK-BEAM  
LEED  
CASBEE  
DGNB  
STAR Communities  
CEEQUAL  
BE<sup>2</sup>ST-In-Highways  
CalGreen  
GreenStar  
BREEAM  
Sustainable Sites

# Need for a time and cost effective assessment and asset management tool

## Rating system worldwide

Many countries have developed their own standards for green building or energy efficiency for buildings. Above some examples of buildings currently in use:

-  Australia: Nabers[5] [↗](#) / Green Star[6] [↗](#)
-  Brazil: AQUA [7] [↗](#) / LEED Brasil [8] [↗](#)
-  Canada: LEED Canada [9] [↗](#) / Green Globes[10] [↗](#)
-  China: GBAS [11] [↗](#)
-  Finland: PromisE[12] [↗](#)
-  France: HQE[13] [↗](#)
-  Germany: DGNB[14] [↗](#) / CEPHEUS[15] [↗](#)
-  Hong Kong: HKBEAM[16] [↗](#)
-  India: GRIHA [↗](#) National Rating System developed by TERI / LEED India
-  Italy: Protocollo Itaca[17] [↗](#)
-  Malaysia: GBI Malaysia[18] [↗](#)
-  Mexico: LEED Mexico[19] [↗](#)
-  Netherlands: BREEAM Netherlands[20] [↗](#)
-  New Zealand: Green Star NZ[21] [↗](#)
-  Portugal: Lider A [22] [↗](#)
-  Singapore: Green Mark[23] [↗](#)
-  South Africa: Green Star SA[24] [↗](#)
-  Spain: VERDE
-  Switzerland: Minergie[25] [↗](#)
-  United States: LEED[26] [↗](#) / Living Building Challenge[27] [↗](#) / Green Globes[28] [↗](#) / Build it Green[29] [↗](#) / NAHB NGBS[30] [↗](#)
-  United Kingdom: BREEAM[31] [↗](#)



# Assessment Emphasis

Benchmarking

Rigorous Science vs.  
User Friendliness

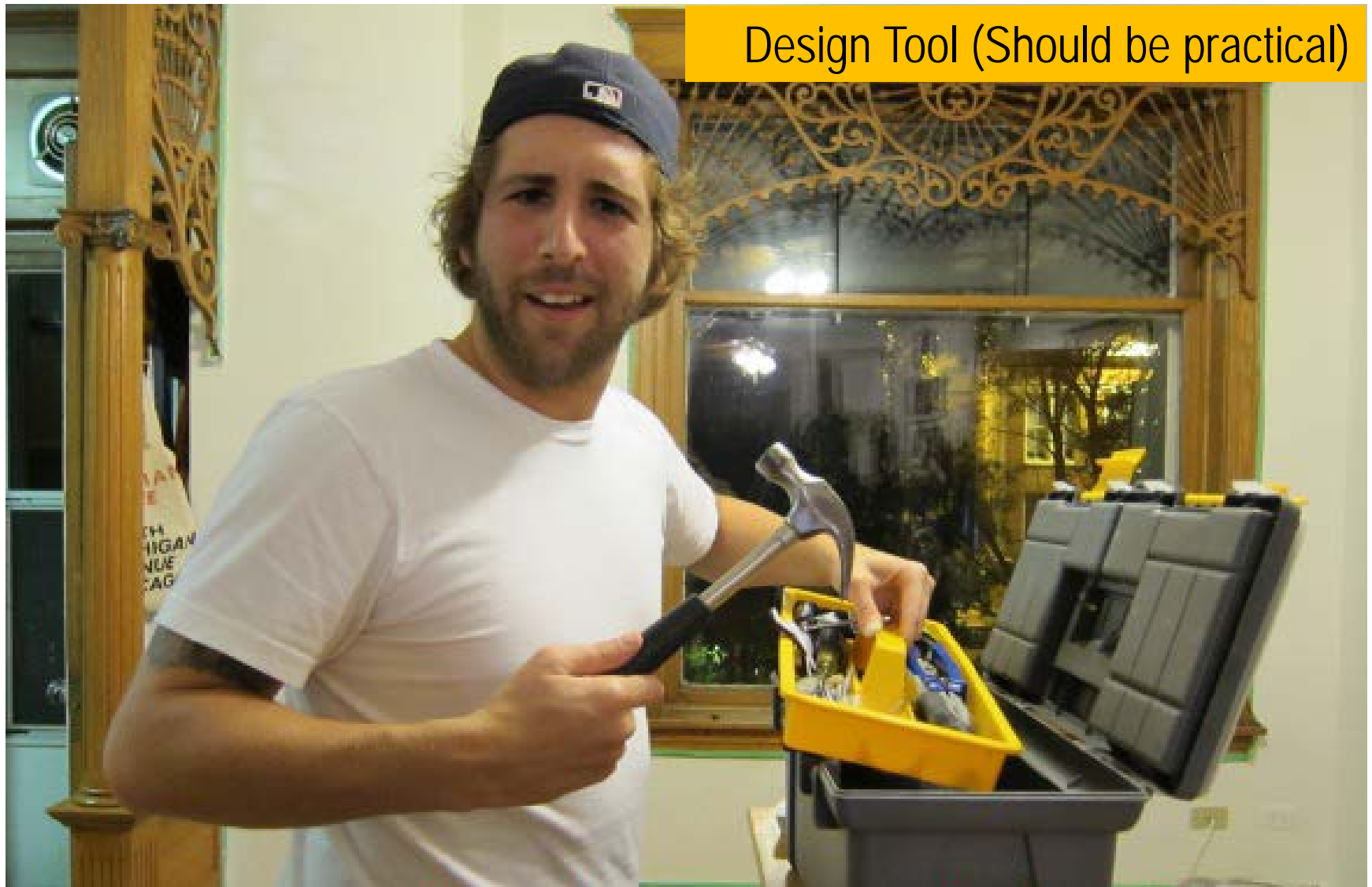


# Assessment Emphasis

Marketing



# Assessment Emphasis

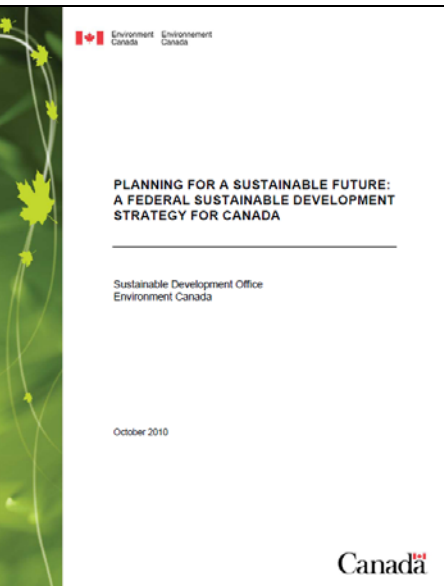


Design Tool (Should be practical)



# Federal Sustainable Strategy for Canada

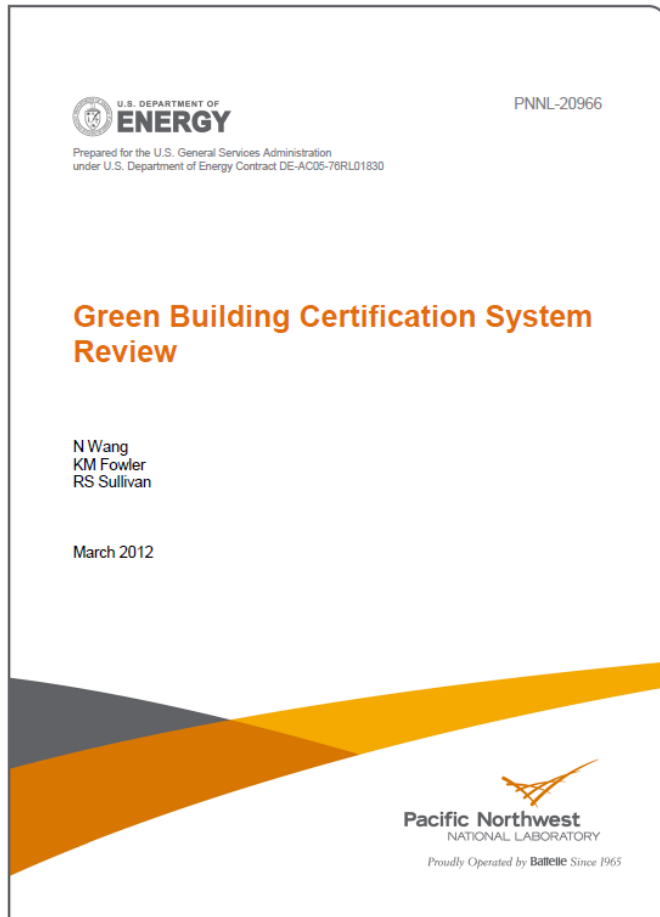
As of **April 1, 2012** and pursuant to departmental strategic frameworks



- 8.1 Target ... **new construction and build-to-lease projects and major renovation projects** will achieve an industry-recognized level of high environmental performance. **Green Globes Design -3 Globes, LEED NC Silver**
- 8.2 Target: ... **existing crown buildings over 1000 m<sup>2</sup>** will be assessed for environmental performance using an industry-recognized assessment tool. **Green Globes , BOMA BEST**
- 8.3 Target: ... **new lease or lease renewal projects over 1000 m<sup>2</sup>**, where the Crown is the major lessee, will be assess for environmental performance using an industry-recognized assessment tool. **BOMA BEST, or eq.**
- 8.4 Target: ... **fit-up and refit projects** will achieve an industry-recognized level of high environmental performance. **Green Globes Fit-up -3 Globes, LEED CI Silver**

# North America

## GSA Report on Green Building Certification Systems



GSA screened 180 certification systems.

### Three identified systems

1. Green Globes
2. LEED
3. International Living Building Challenge

Source: <http://www.gsa.gov/portal/content/131983>



# GSA Report on Green Building Certification Systems

## Energy

Review Questions	Green Globes (CIEB)	LEED (EB)	Living Building Challenge (Renovation)
<b>Energy Efficiency</b>			
Does the metro help a building meet a current Federal requirement?	The Energy Performance Criteria in Green Globes is performance based. Credit is directly derived from ENERGY STAR benchmarking protocol and uses the credit earning threshold of 75 percentile, the same threshold that ENERGY STAR uses to award an ENERGY STAR label.  1.1 Energy Performance 1.2 Lighting 1.3 Boilers 1.4 Controls 1.5 Hot Water 1.6 Other Energy Efficiency Features	LEED requires a minimum ENERGY STAR score of 69, which is less stringent than GP. LEED gives more points for better performance.  EA Prerequisite 2: Minimum Energy Efficiency Performance EA Credit 1: Optimize Energy Efficiency Performance	LBC requires Net Zero but does not have specific energy use requirement. Living Building Challenge frames energy efficiency in the context of the carrying capacity of the site, and as such, requires that the project performs within this parameter. When the Scale Jumping overlay is used by project teams to achieve Net Zero Energy, they are required to demonstrate that a project's demand does not exceed the proportional amount of energy available. The Institute emphasizes the primary strategy of optimizing energy efficiencies prior to installing renewable energy systems.  07 Net Zero Energy
What is the baseline or point of comparison?	ENERGY STAR	ENERGY STAR	n/a
What is the range of requirements to achieve the metro?	80 points spread over ENERGY STAR scores of 75 – 100 percentile	69-95%	n/a
What standards or tools are required for the metro?	ENERGY STAR Portfolio Manager	EnergyStar Portfolio Manager	n/a
<b>On-Site Renewable Energy</b>			
Does the metro help a building meet a current Federal requirement?	If the GG CIEB points are achieved the GP will be met.  1.7 Green Energy	If the LEED EB points are achieved the GP will be met.  EA Credit 4: On-site and Off-site Renewable Energy	To achieve Net Zero, onsite renewable is necessary.  07 Net Zero Energy
What is the baseline or point of comparison?	Building total energy use	Buildings total energy use	n/a
What is the range of requirements to achieve the metro?	>0% to >10%	3%-12% renewables 25%-100% certificates	n/a
Is on-site generation and purchases of green power treated differently?	No - equal points are awarded for offsite generated electricity.	Yes	Yes - purchase of green power not allowed to meet the LBC.
<b>Measurement and Verification</b>			
Does the metro help a building meet a current Federal requirement?	Although energy monitoring is included in Green Globes EB it does not specifically address actual metering, nor does it include all utilities.  1.1 Energy Performance 1.11 Energy Management, Monitoring, and Targeting 1.14 Sub-metering  Energy Use cannot be monitored without metering. Therefore, metering is necessarily implied in section 1.11 Energy Management, Monitoring and Targeting. There is also sub-metering in section 1.14 Sub-metering.	LEED EB meets the GP for energy meters.  EA Prerequisite 2: Minimum Energy Efficiency Performance EA Credit 1: Optimize Energy Efficiency Performance	Measurement and verification is fundamental to the documentation for the Energy and Water Petal requirements in the Living Building Challenge.
What standards or tools are required for the metro?	n/a	n/a	n/a
<b>Benchmarking</b>			

# Similar issues

## “Green Globes Tops LEED in Federal Review, but barely”



**Table ES.3: Summary of Robustness Criteria for New Building Construction**

Certification System	Federal Requirement Met	Federal Requirement Met if Point Achieved	Federal Requirement Could be Met	Not Specifically Mentioned
Green Globes	0	10	15	2
LEED	4	7	9	7
Living Building Challenge	12	0	3	12

GSA

*For new construction, the ability of Green Globes and LEED projects to meet federal standards without extra effort is fairly well matched.*

Source: <http://www.buildinggreen.com/auth/article.cfm/2012/5/9/Green-Globes-Tops-LEED-in-Federal-Review-But-Barely>

October 25, 2013, GSA recommended that the US government agencies use one of two green building certification systems that best suit agency missions and portfolio needs:

the Green Building Initiative's Green Globes® (2010) and the U.S. Green Building Council's Leadership in Energy and Environmental Design® (2009).

Source: <http://www.gsa.gov/portal/content/131983>

# Green Globes is....

...an on-line guidance and assessment tool which promotes sustainability through:

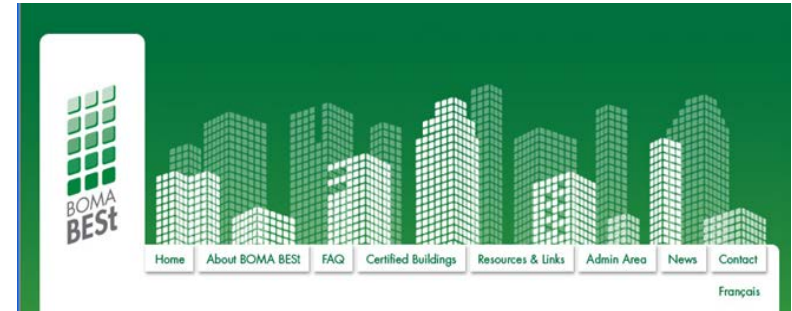
- Integrated design for new construction
- Continuous improvement of existing buildings.

Green Globes  
Design Checklist



# Green Globes

- In Canada, BOMA BEST (for Existing Buildings) is licensed and operated by BOMA Canada (since 2005).
- In the United States Green Globes is licensed and operated by the Green Building Initiative (since 2005)
- now ANSI standard (2010).
- University Campus Assessment licensed to APPA (2013).
- Other Green Globes products in Canada are operated by ECD Energy and Environment Canada Ltd.



ANSI/GBI 01-2010

Green Building Assessment Protocol  
for Commercial Buildings

An American National Standard

April 1, 2010

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www.thegbi.org • CORPORATE OFFICE: 2104 S.E. Morrison, Portland, OR 97214  
Phone: 877-GBI-GBI-1 (877-426-4241) • Fax: 503.961.8991 • Email: info@thegbi.org



# Green Globes Assessment Toolbox

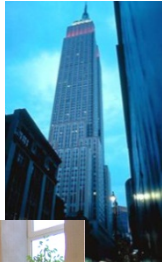
## GG New construction



Guides design and construction of new buildings (ANSI Standard)



## GG Existing buildings



Assess and improve existing base buildings

## Fit-up (CI)



Guides design of interior spaces.

## Green Home



Guides design of green homes

## Building Emergency Management



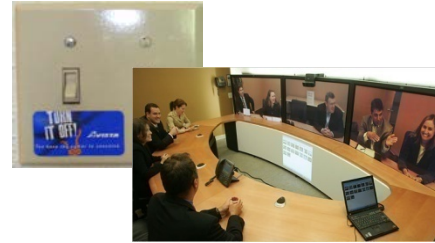
Assess Emergency Preparedness

## Building Intelligence Quotient



Evaluate how “smart” buildings are

## Green +Productive Workplace



Assess and improve occupant behaviors

## U Campus Energy and Sustainability Assessment



Assess energy and environmental performance of university campuses

## Safe and Sustainable Communities



Guides the creation of resilient and sustainable community





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# Attributes

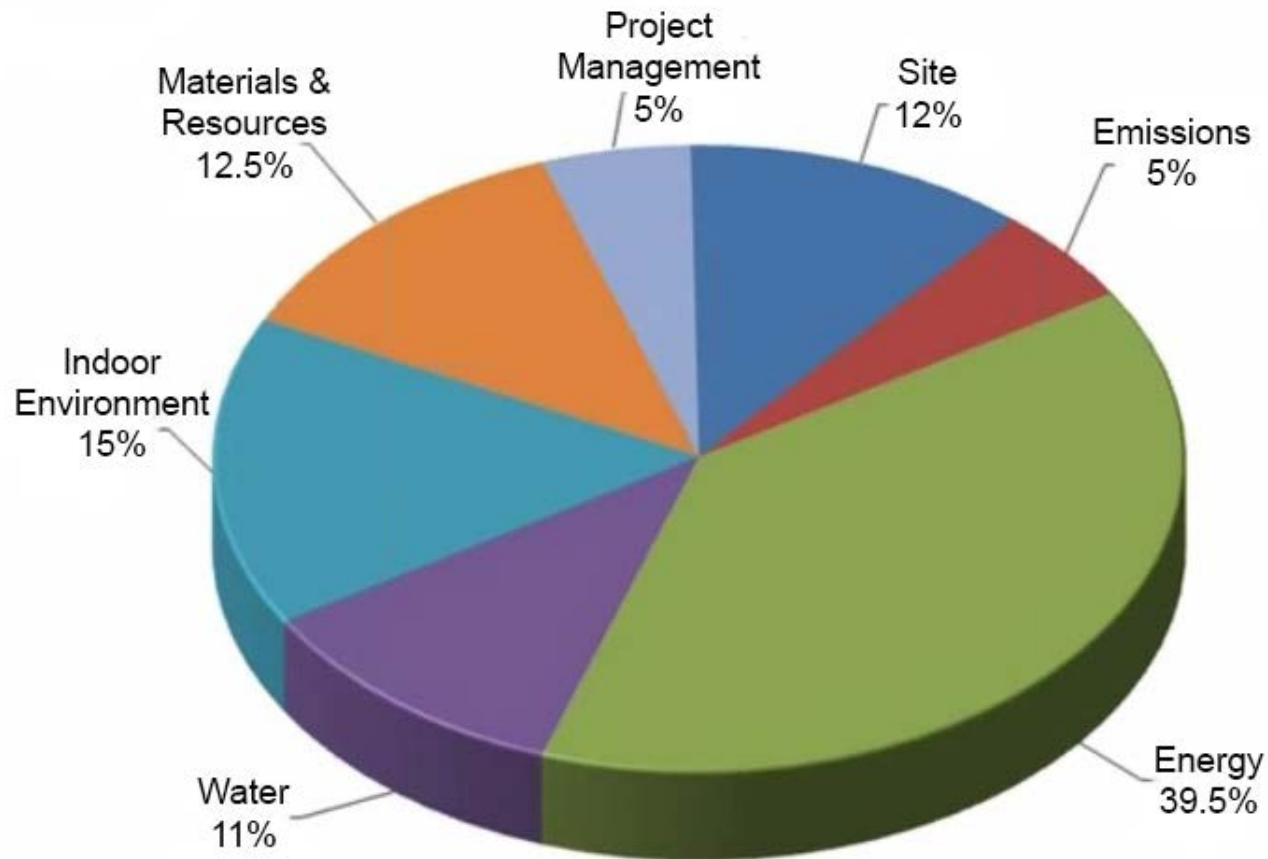
# 7 Areas of Assessment

## New Construction

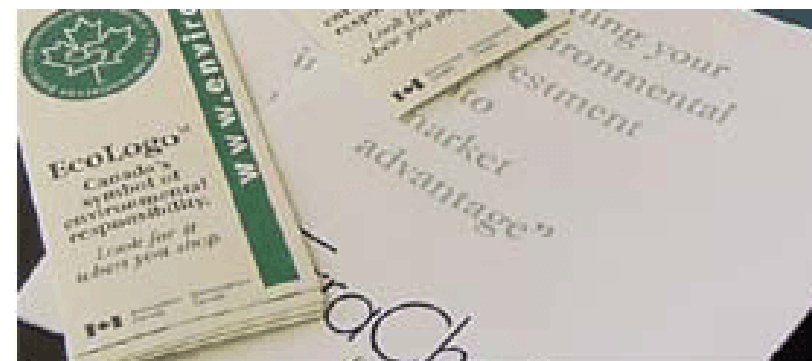
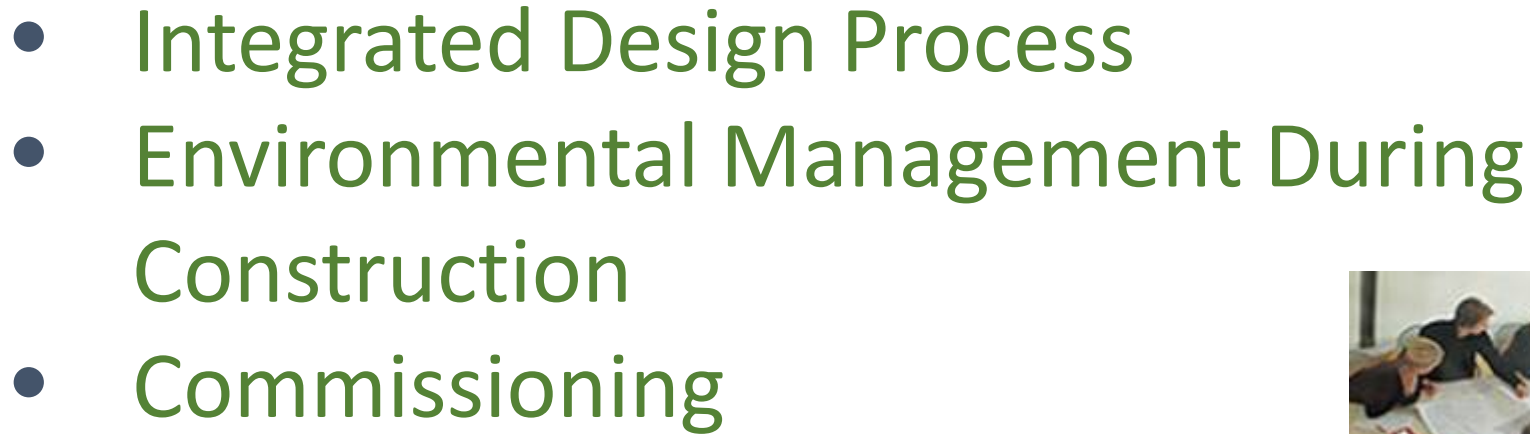
1. Project/Environmental Management
2. Site
3. Energy
4. Water
5. Resources
6. Emissions and effluents
7. Indoor Environment

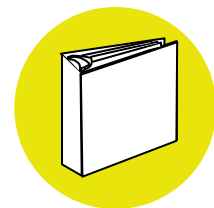




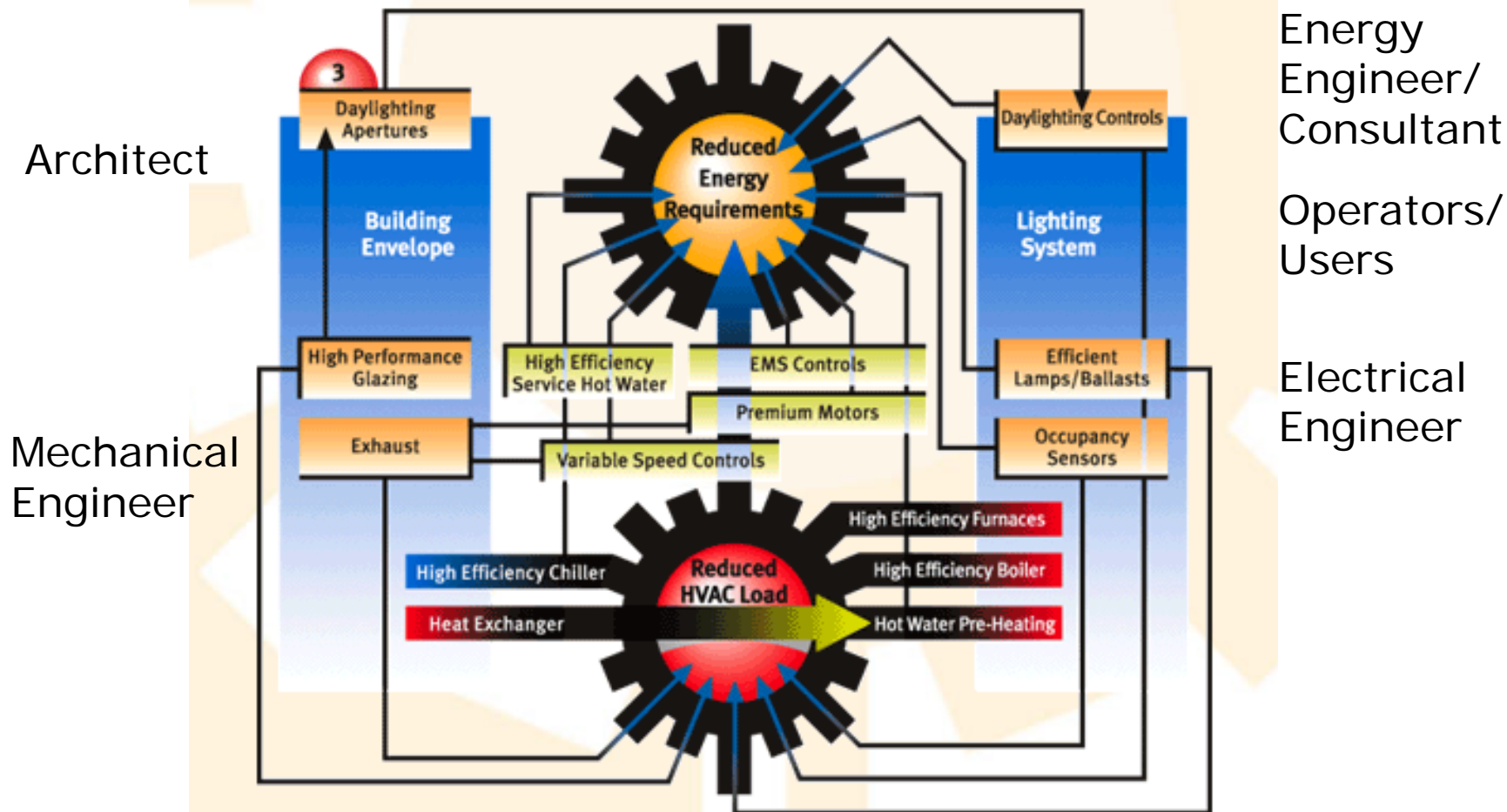


1000-points= 100%





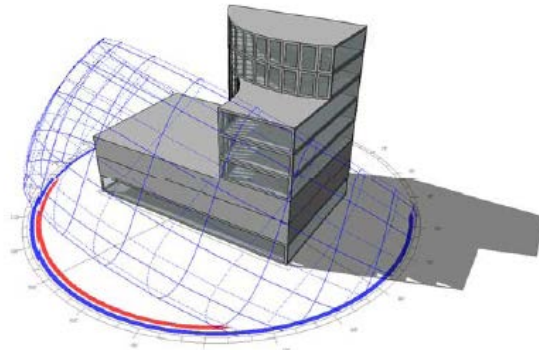
# Integrated Design Process



....key to high performance, sustainable buildings



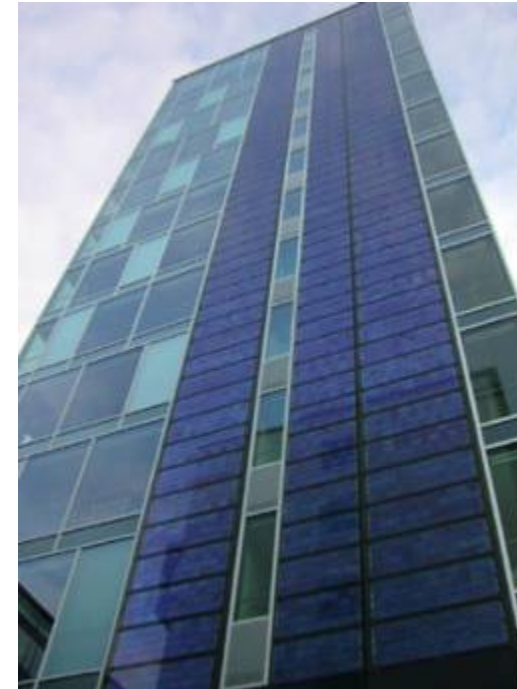
- Development Area
- Ecological Impacts
- Storm Water Management
- Landscaping
- Exterior Light Pollution
- Site Innovation







- Energy Performance
- Energy Demand
- Measurement & Verification
- Building Opaque Envelope
- Lighting
- HVAC Systems & Controls
- Other Equipment and Measures
- Renewable Energy
- Energy Efficient Transportation
- Energy Innovation



# Energy- Performance

## *“Putting the Building on Carbon Diet”*

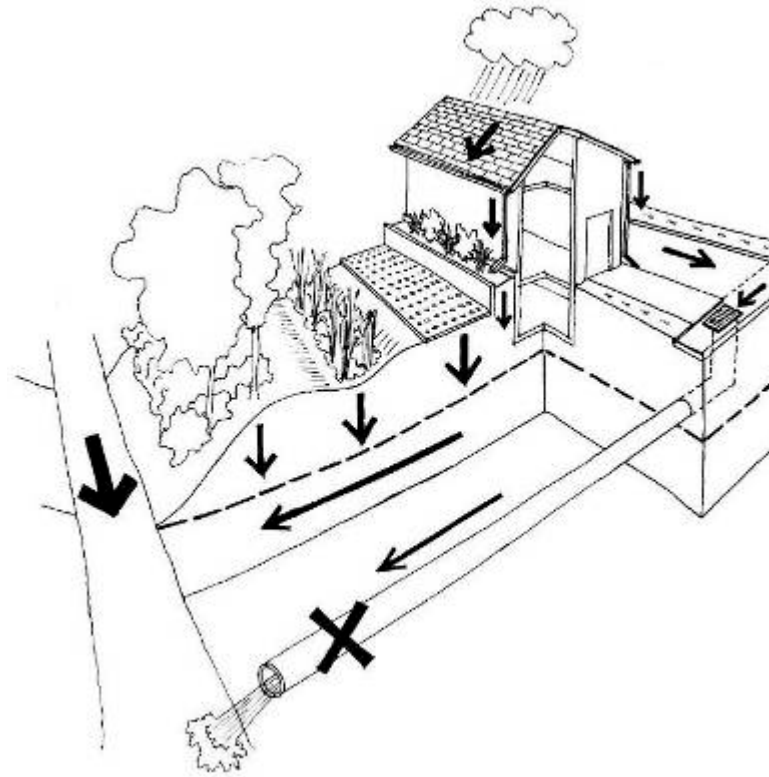
### ASHRAE Climate Zones Canada



Offices TOTAL CARBON DIOXIDE EMISSIONS (kg/sqft/yr)					
Zone 5	Zone 6	Zone 7	Zone 8	POINTS	
16.85	16.17	15.37	14.44	8	
15.17	14.57	13.86	13.02	16	
13.48	12.96	12.34	11.61	24	
11.80	11.35	10.82	10.19	32	
10.11	9.75	9.30	8.78	40	
8.43	8.14	7.79	7.36	48	
6.74	6.53	6.27	5.95	56	
5.06	4.93	4.75	4.53	64	
3.37	3.32	3.24	3.11	72	
1.69	1.71	1.72	1.70	80	



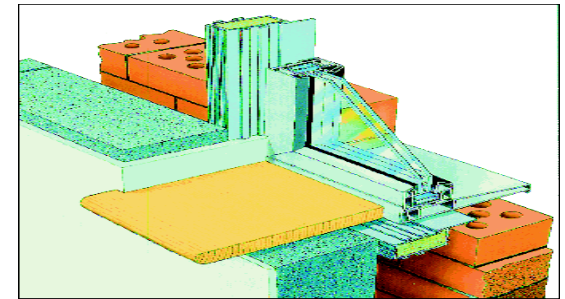
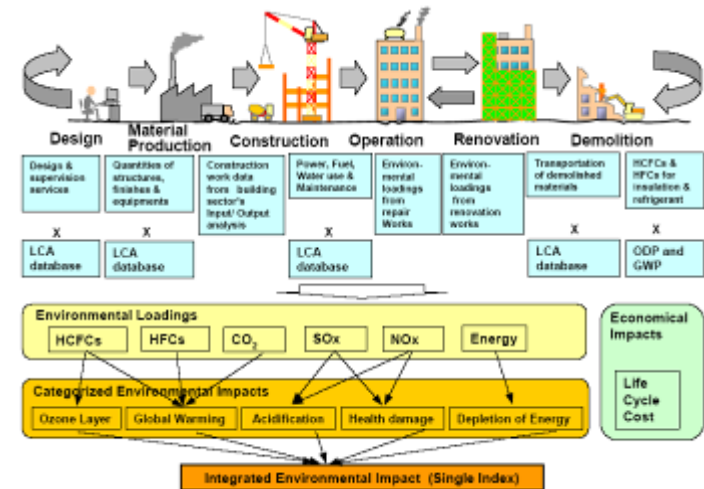
- Water Consumption
- Cooling Towers
- Boilers and Water Heaters
- Water Intensive Applications
- Water Treatment
- Alternate Sources of Water
- Metering
- Irrigation



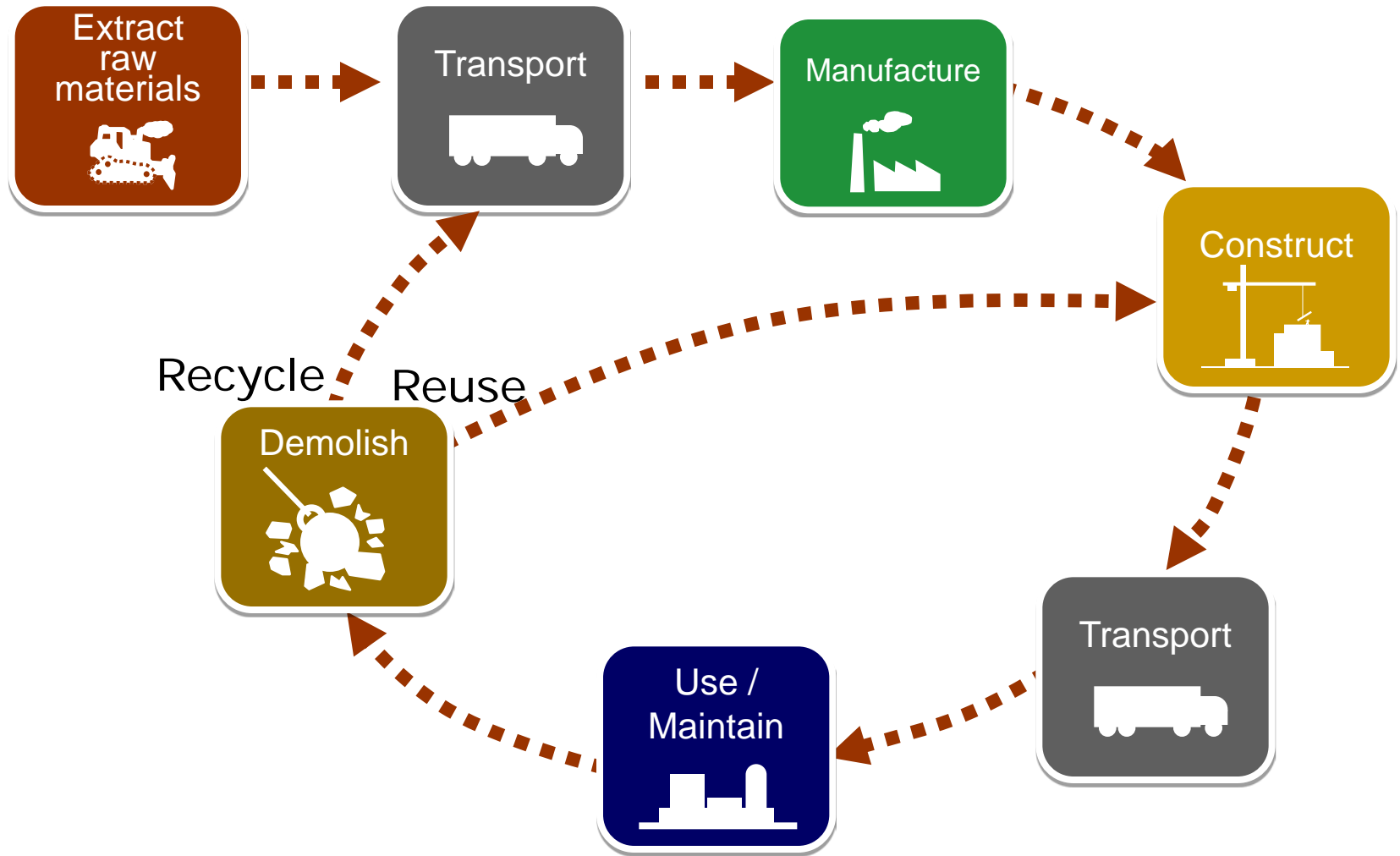




- Building Assembly (LCA)
- Interior Fit-Outs (LCA)
- Re-Use of Existing Structures
- Waste
- Building Service Life Plan
- Resource Conservation
- Envelope – Roofing/Opening
- Envelope – Foundation/Waterproofing
- Envelope – Cladding
- Envelope – Barriers
- Resource Innovation



# Building materials – cradle to cradle



# Key environmental impacts



## Smog



## Global Warming Potential



## Air Pollution

### Health Respiratory Effect

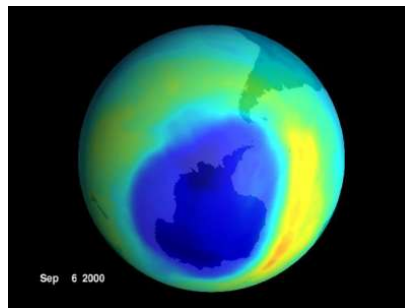


## Acidification

### Primary Energy Consumption



## Resource Depletion (Resource Use)



## Ozone Depletion



## Water Pollution- Eutrophication



# Materials & Resources

## Life Cycle Assessment (LCA)



### KOMOKA COMMUNITY WELLNESS AND RECREATION CENTRE

ECOCALCULATOR RESULTS		PRIMARY ENERGY	GLOBAL WARMING POTENTIAL	RESOURCE DEPLETION	AIR POLLUTION	WATER POLLUTION
BASE DESIGN	QTY UNITS	41718 GJ	2341 tCO2e	6223 tonnes	469941 litres	88695 litres
BLOCK FOUNDATIONS	QTY +/- %	41321 -0.95%	2309 -1.37%	5687 -8.61%	464536 -1.15%	88698 0.00%
MOD BIT FLAT ROOFING	QTY +/- %	40893 -1.98%	2306 -1.50%	6186 -0.59%	448064 -4.66%	88694 0.00%
4-PLY FLAT ROOFING	QTY +/- %	64048 53.53%	3044 30.03%	7116 14.35%	662429 40.96%	88755 0.07%
TPO ALL ROOFING	QTY +/- %	42427 1.70%	2350 1.78%	6138 7.93%	501472 7.95%	88368 -0.37%
MOD BIT ALL ROOFING	QTY +/- %	40157 -3.74%	2253 -3.76%	6035 -3.02%	441338 -6.09%	88365 -0.37%
BLOCK for STEEL CLADDING	QTY +/- %	39838 -4.51%	2136 -8.76%	6421 3.18%	432754 -7.91%	4465 -94.97%
FLOORS ALL PRECAST	QTY +/- %	41374 1.18%	2336 1.30%	6341 2.51%	472710 5.50%	88491 -0.23%
INT. WALLS ALL BLOCK	QTY +/- %	43044 -32.79%	2443 -19.74%	6364 -10.57%	485072 -26.77%	88580 -0.20%

# Materials & Resources








## Environmental Impact Declaration (EPD)

### Softwood Lumber –Canadian Wood Council



#### LIFECYCLE IMPACT CATEGORIES

The environmental impacts listed below were assessed throughout the product's lifecycle – including raw material extraction, transportation, manufacturing, packaging, use, and disposal at end of life.

ATMOSPHERE			WATER		EARTH		
							
<p><b>Global Warming Potential</b> refers to long-term changes in global weather patterns – including temperature and precipitation – that are caused by increased concentrations of greenhouse gases in the atmosphere.</p>	<p><b>Ozone Depletion Potential</b> is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that’s harmful to life, caused by human-made air pollution.</p>	<p><b>Photochemical Ozone Creation Potential</b> happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce a type of air pollution known as smog.</p>	<p><b>Acidification Potential</b> is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – a phenomenon that pollutes groundwater and harms aquatic life.</p>	<p><b>Eutrophication Potential</b> occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.</p>	<p><b>Depletion of Abiotic Resources (Elements)</b> refers to the reduction of available non-renewable resources, such as metals and gases, that are found on the periodic table of elements, due to human activity.</p>	<p><b>Depletion of Abiotic Resources (Fossil Fuels)</b> refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.</p>	
TRACI	72.64 kg CO2 eq.	0 kg CFC-11 eq.	14.51 kg O3 eq.	42.25 H+ moles eq.	0.0326 kg N eq.	0.11 kg	1113.01 MJ






# Materials & Resources

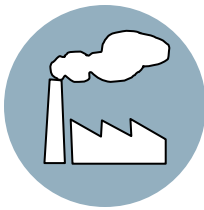
## Environmental Impact Declaration (EPD)

### Work Chair- Steelcase

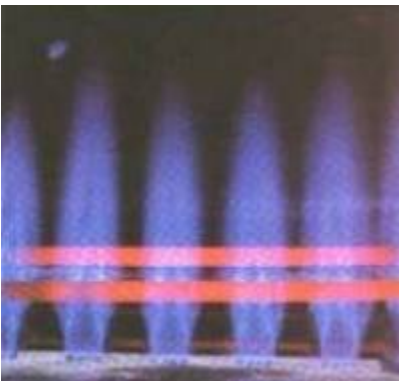


#### Distribution of the environmental impacts for the relevant life cycle stages

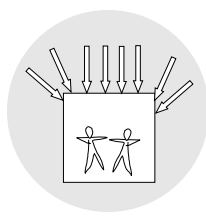
Category		Unit	Total	Materials	Production	Transport	End of Life
							
	Global warming	[g CO <sub>2</sub> -eq.]	102 610.0	67 800.0	27 700.0	3 720.0	3 390.0
	Acidification	[g SO <sub>2</sub> -eq.]	836.6	535.0	266.0	35.3	0.3
	Eutrophication	[g NO <sub>3</sub> -eq.]	712.2	471.0	179.0	59.2	3.0
	Photochemical smog	[g C <sub>2</sub> H <sub>4</sub> -eq.]	24.2	18.0	0.8	4.6	0.7



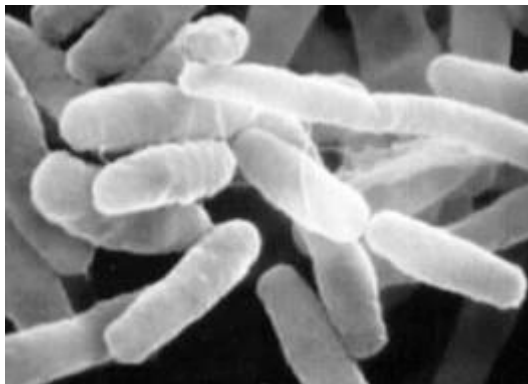
- Heating (NO<sub>x</sub>)
- Cooling (Green House Gasses)
- Janitorial Equipment







- Ventilation
- Indoor Pollutants
- Lighting Design and Systems
- Thermal Comfort
- Acoustic Comfort

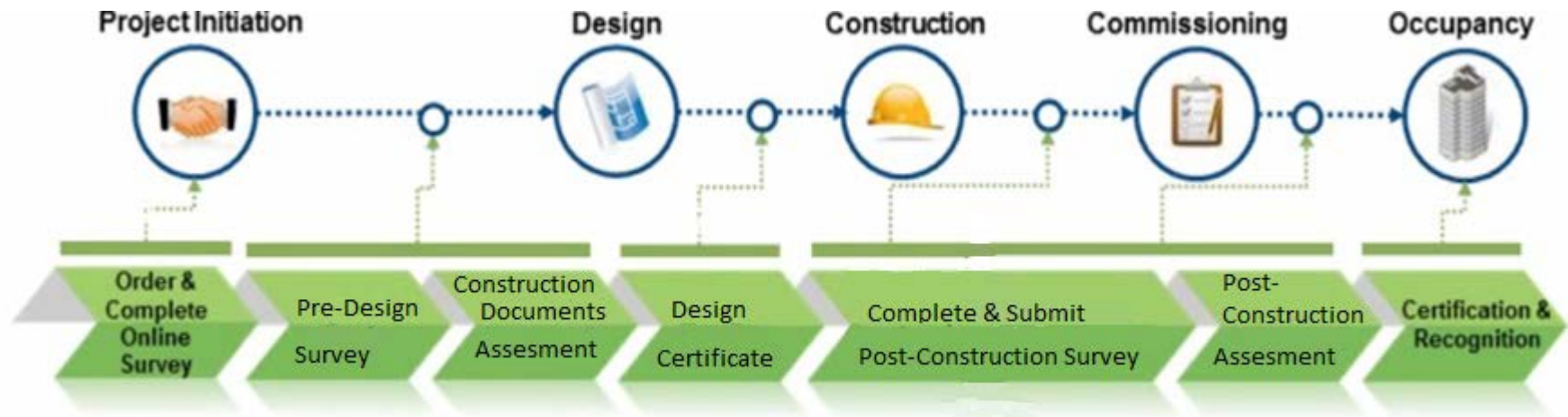




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# Assessment Process

# Green Globes Canada for New Construction: Rating and Certification Process

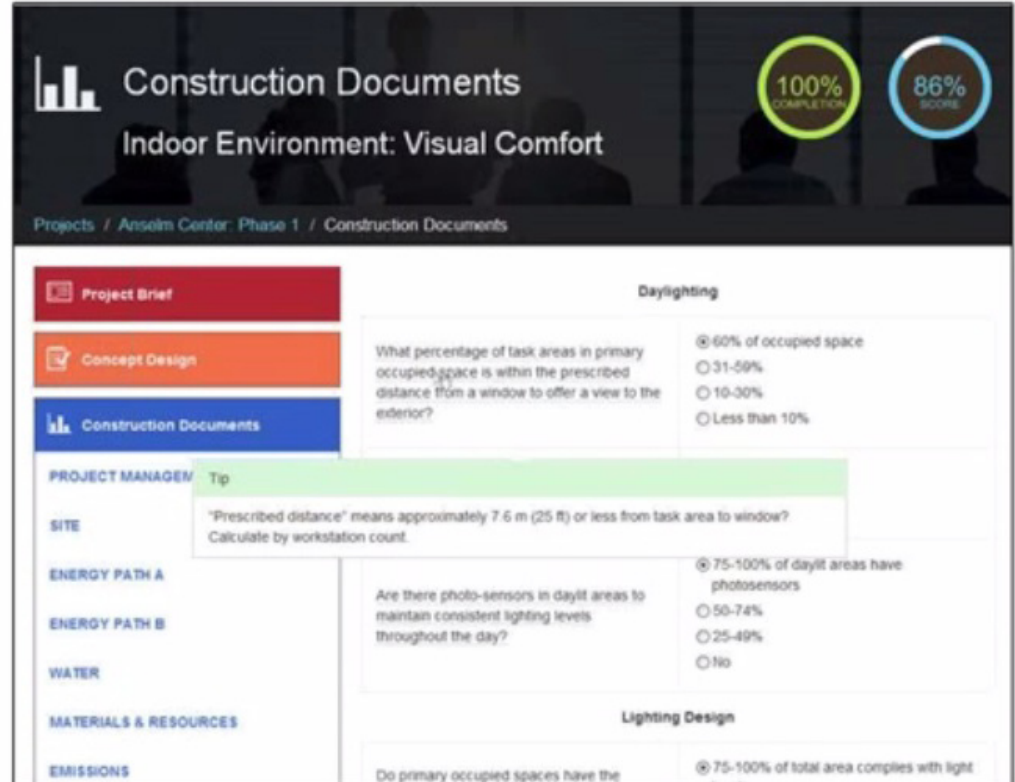


1. Order and start completing online survey
2. Complete Pre-Design Survey –provides Environmental Intent
3. Design Assessment (Construction Documents) – design review includes written report, recommendations and design certification
4. Post-Construction survey- updates the online questionnaire to reflect design changes, if needed
5. Post-Construction Assessment – review of implementation and changes during the construction
6. Certification and public recognition of achievement

## Online Evaluation Features

- Web-based
- Includes all Green Globes NC and criteria, which are clearly identified
- Access to different “Phase” surveys:
  - I. Pre-Design
  - II. Schematic Design
  - III. Construction Documents
  - IV. Post-Construction (upon completion of Construction Documents)
- The user interface is easier to navigate between surveys, sections (e.g. Energy, Water, etc.), and sub-sections (e.g. Renewable Energy, Energy Demand, etc.)
- Hover over questions for ToolTip guidance and references
- Create a printer-friendly version of the evaluation with your completed answers
- Phase III and IV surveys workflow creates less repetitive data entry

*Screenshot mock up of new GG NC survey in development*








The screenshot shows a web-based survey interface for 'Construction Documents' under the 'Indoor Environment: Visual Comfort' section. The header includes a progress bar showing '100% COMPLETION' and a score of '86%'. The main content area is divided into a left sidebar with navigation links (Project Brief, Concept Design, Construction Documents, PROJECT MANAGER, SITE, ENERGY PATH A, ENERGY PATH B, WATER, MATERIALS & RESOURCES, EMISSIONS) and a main panel. The main panel displays a 'Daylighting' question: 'What percentage of task areas in primary occupied space is within the prescribed distance from a window to offer a view to the exterior?'. The question has four radio button options: 60% of occupied space (selected), 31-59%, 10-30%, and Less than 10%. A 'Tip' box provides guidance: '“Prescribed distance” means approximately 7.6 m (25 ft) or less from task area to window? Calculate by workstation count.' Below the question is another question: 'Are there photo-sensors in daylight areas to maintain consistent lighting levels throughout the day?'. This question has four radio button options: 75-100% of daylight areas have photosensors (selected), 50-74%, 25-49%, and No. At the bottom, a 'Lighting Design' section is partially visible with a question: 'Do primary occupied spaces have the...'. The selected option is '75-100% of total area complies with light...'. The interface is clean and modern, with a dark header and a light main content area.



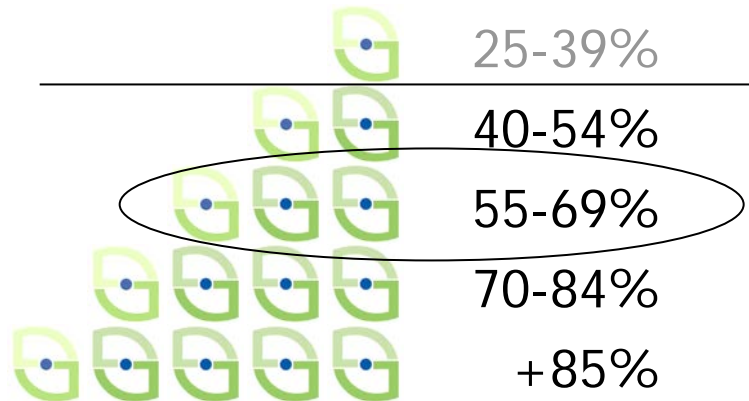


# Green Globes for New Construction: Green Globes Rating Scale

Once an assessment is verified by a third party, buildings achieving a score of 25% or greater receive a Green Globes rating based on the percentage of total points earned

<b>25-39%</b>		<b>1 Green Globe</b> To participate in the Green Globes Eco-Rating Program, a building design must have identified and initiated some measures to improve the energy and environmental performance such as energy use reduction strategies, water conservation steps, waste reduction, etc. A key component should be a commitment to a set of guiding environmental principles.
<b>40-54%</b>		<b>2 Green Globes</b> This designation indicates that the design has moved beyond awareness and commitment to sound energy and environmental design practices, and has demonstrated good progress in reducing environmental impacts.
<b>55-69%</b>		<b>3 Green Globes</b> This designation indicates excellent progress in achieving eco-efficiency results through current best energy and environmental design practices.
<b>70-84%</b>		<b>4 Green Globes</b> This designation indicates leadership in terms of energy and environmental design practices and commitment to continuous improvement and industry leadership.
<b>more than 85%</b>		<b>5 Green Globes</b> This designation is reserved for select building designs, which are serving as national or world leaders in energy and environmental performance, and are introducing design practices that can be adopted and implemented by others.

## Green Globes



## LEED

Certified	50-60%
Silver	61-70%
Gold	71-80%
Platinum	81+ %

Canada - 5 Globes

USA - 4 Globes



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# Case Studies



# Case Study

Scotiabank Laval East, Quebec



## Design Highlights

- Energy-efficient lighting fixtures and lightshelves
- Energy-efficient HVAC equipment
- TRANE Building control systems
- Natural ventilation system through trickle vents

John Surridge, Architect

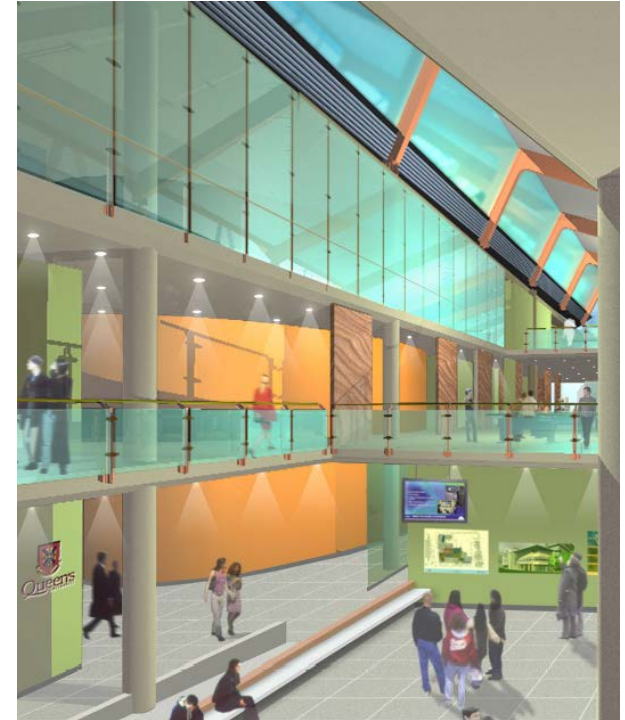


Green Globes

Energy & Environmental Performance Assessment and Benchmarking

ECD Energy & Environment Canada Ltd.

# Case Study Queen's University, Kingston



B+H Architects

## Design Highlights

- Good use of daylighting
- Hands-on experience of environmental systems & “breathing wall”



Green Globes

Energy & Environmental Performance Assessment and Benchmarking

ECD Energy & Environment Canada Ltd.



# Case Study

## O Fipke Multi Purpose Academic & Research Facility UBC, Kelowna



Kasian Architecture

### Design Highlights

- 46% more energy efficient than MNECB (In slab radiant heating and cooling - Aquifer geothermal energy system)
- Passive ventilation system and passive cooling



Green Globes

Energy & Environmental Performance Assessment and Benchmarking

ECD Energy & Environment Canada Ltd.

# Case Study

## Academic Building (Canal) Carleton University, Ottawa



Griffiths Rankin Cook Architects  
Moriyama and Teshima Architects

### Design Highlights

- 34% more energy efficient than MNECB, state-of-the-art automation system and occupancy controlled lighting
- West-facing wall with "fins" shade windows, 10-kilowatt solar array and a green roof



Green Globes

Energy & Environmental Performance Assessment and Benchmarking

ECD Energy & Environment Canada Ltd.

# Case Study

## DNR District Office, Richibucto, New Brunswick



### Design Highlights

- 56% more energy efficient than MNECB (Ground source vertical closed loop heat pump system)
- Conventional, cost efficient sustainability measures



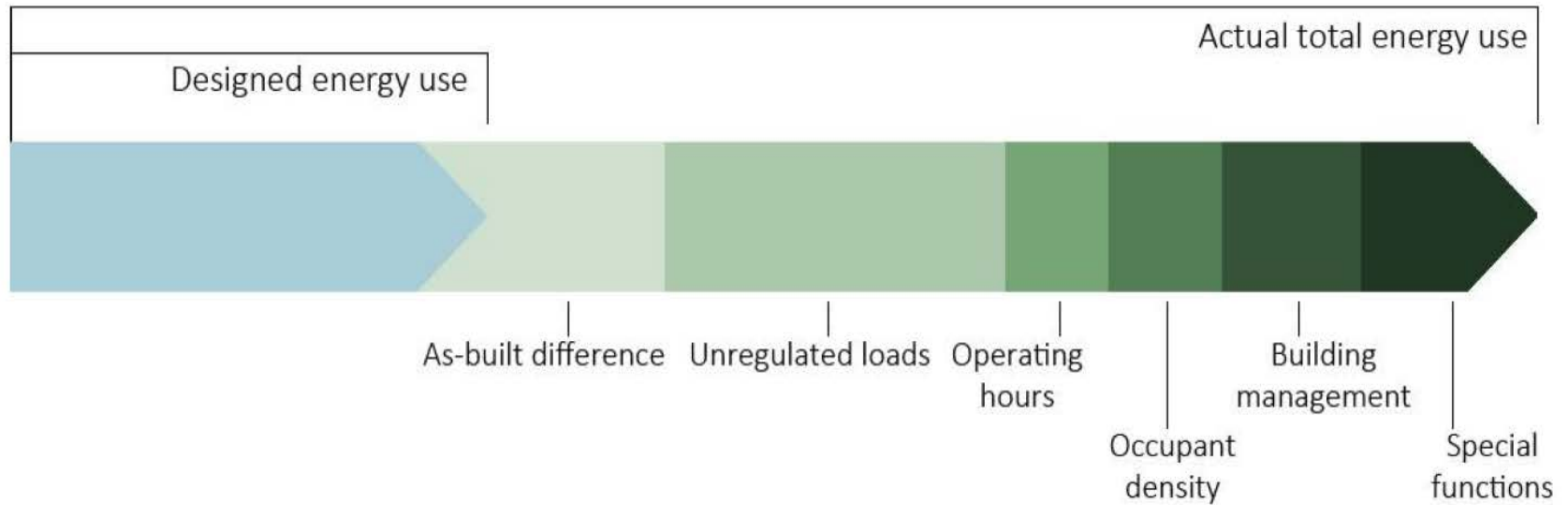




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# How the Building Perform?

# Design v. Operational Energy

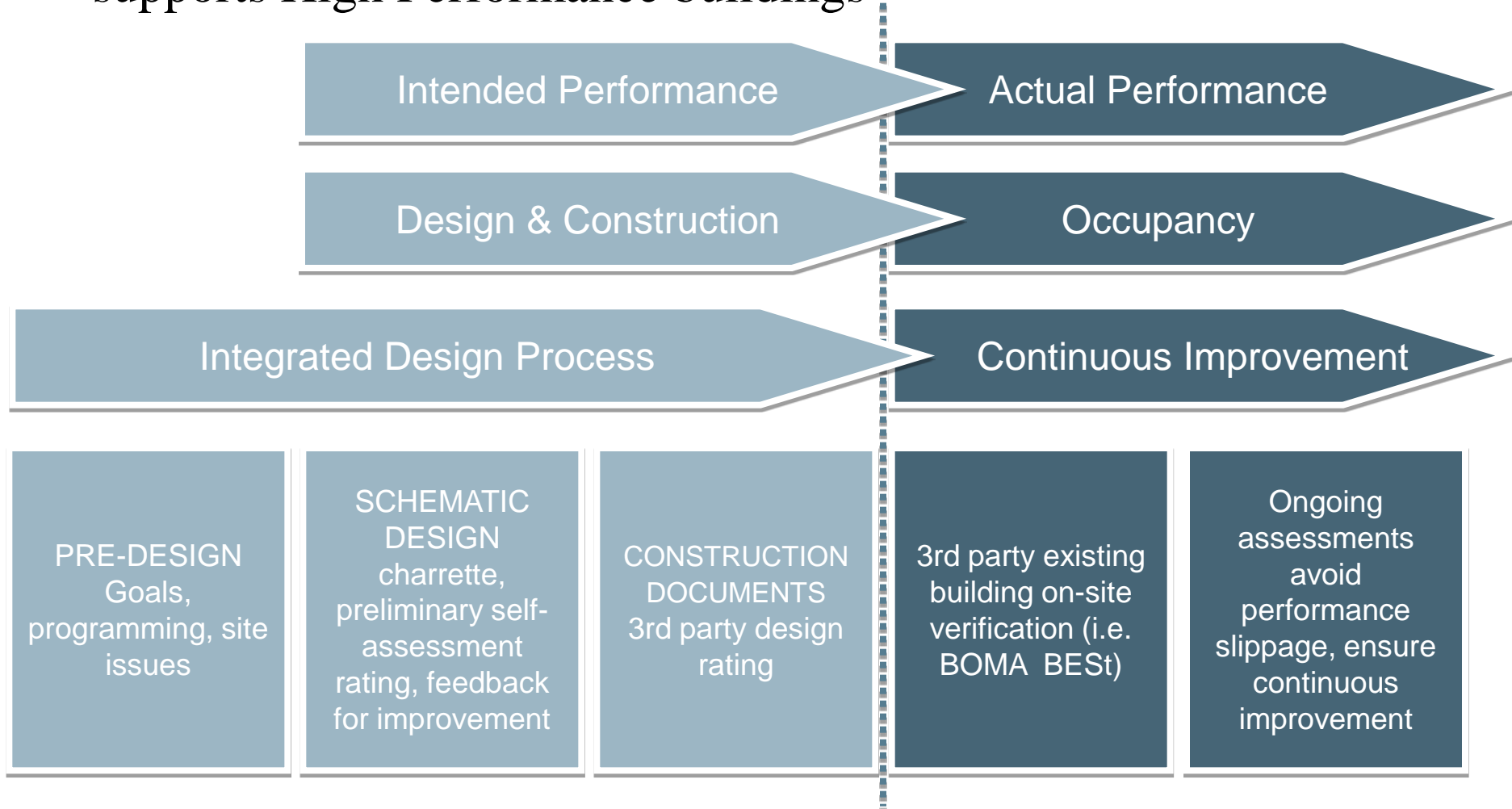


Comparison of the designed and the actual total energy use of a building

[Adapted from (CarbonBuzz, 2013), ratio of bars adapted from (Carbon Trust, 2011)].

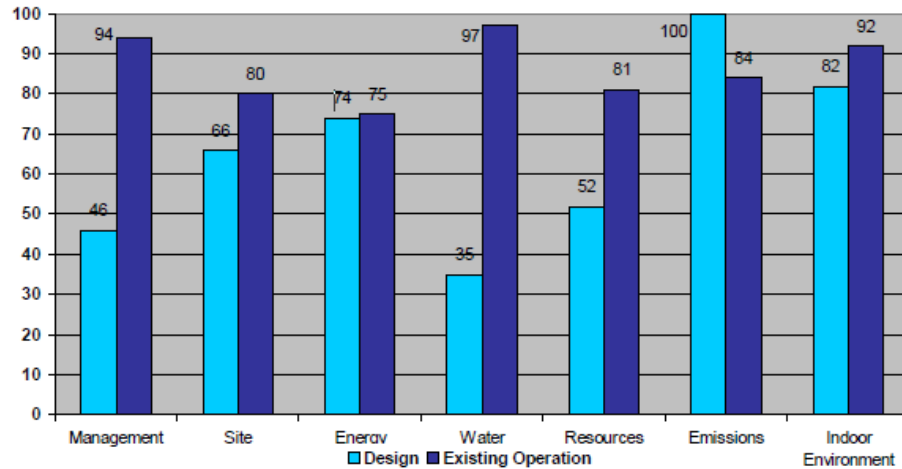
# Green Globes Continuum

- supports High Performance buildings

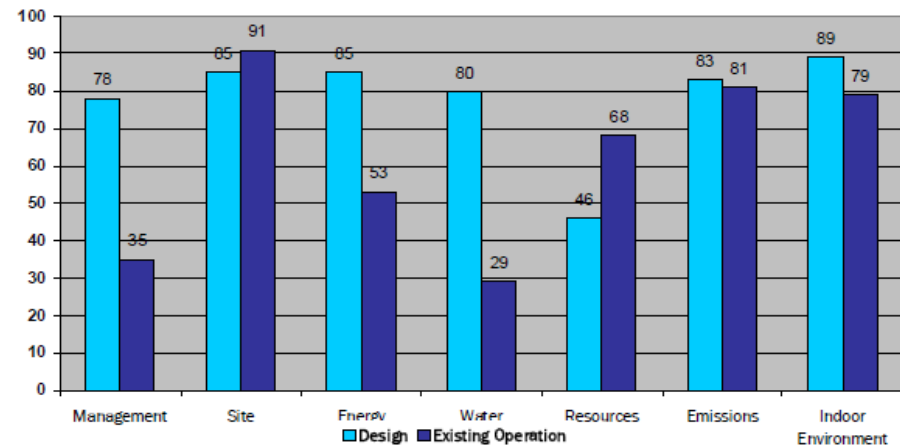


# Green Globes Continuum

## 180 Queen Street West

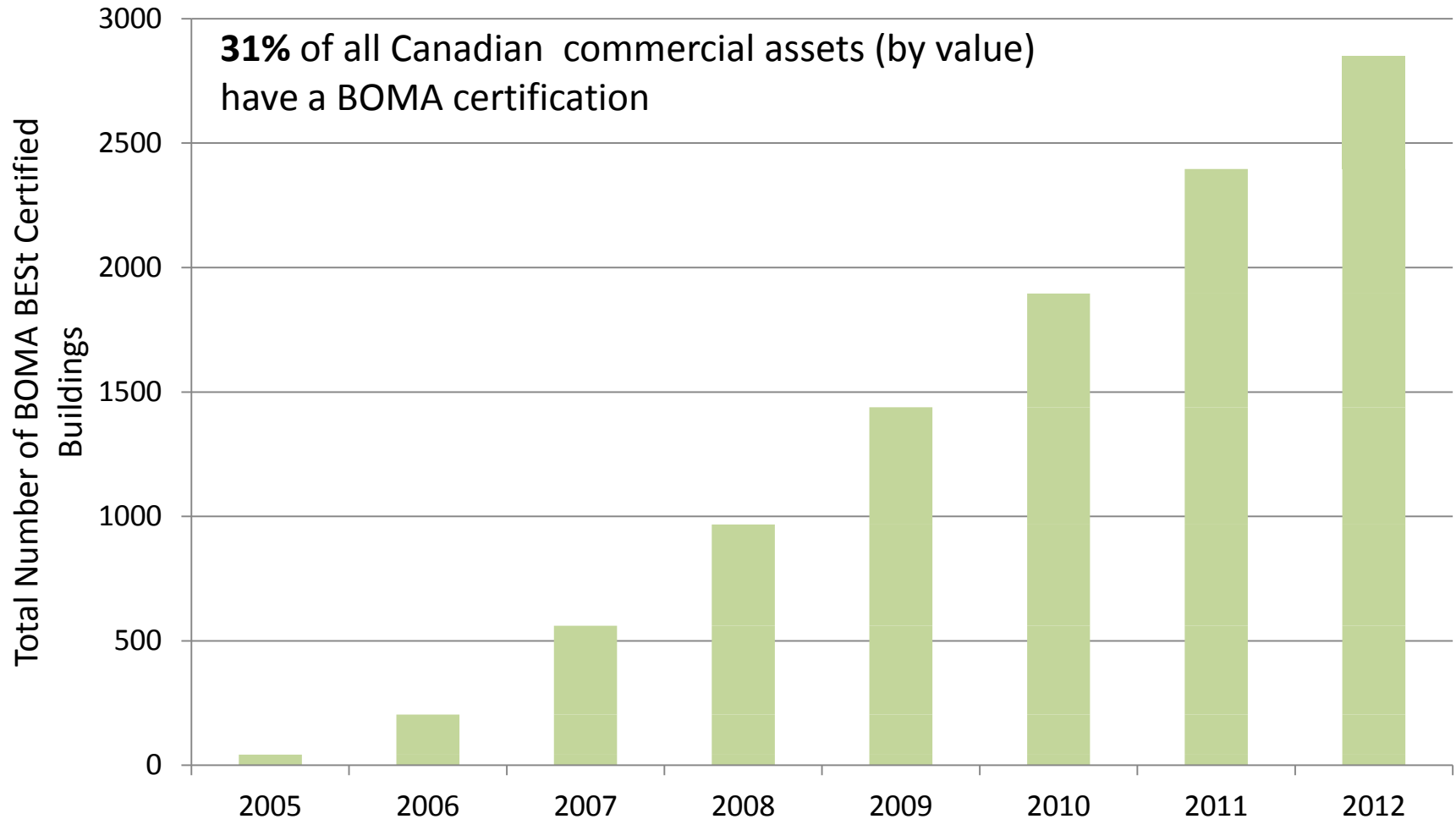


## TMFRC



# Databases

BOMA BEST – statistically significant database on performance of certified existing buildings





# Portfolio Reporting



## 2010 BOMA BEST Energy and Environmental Report



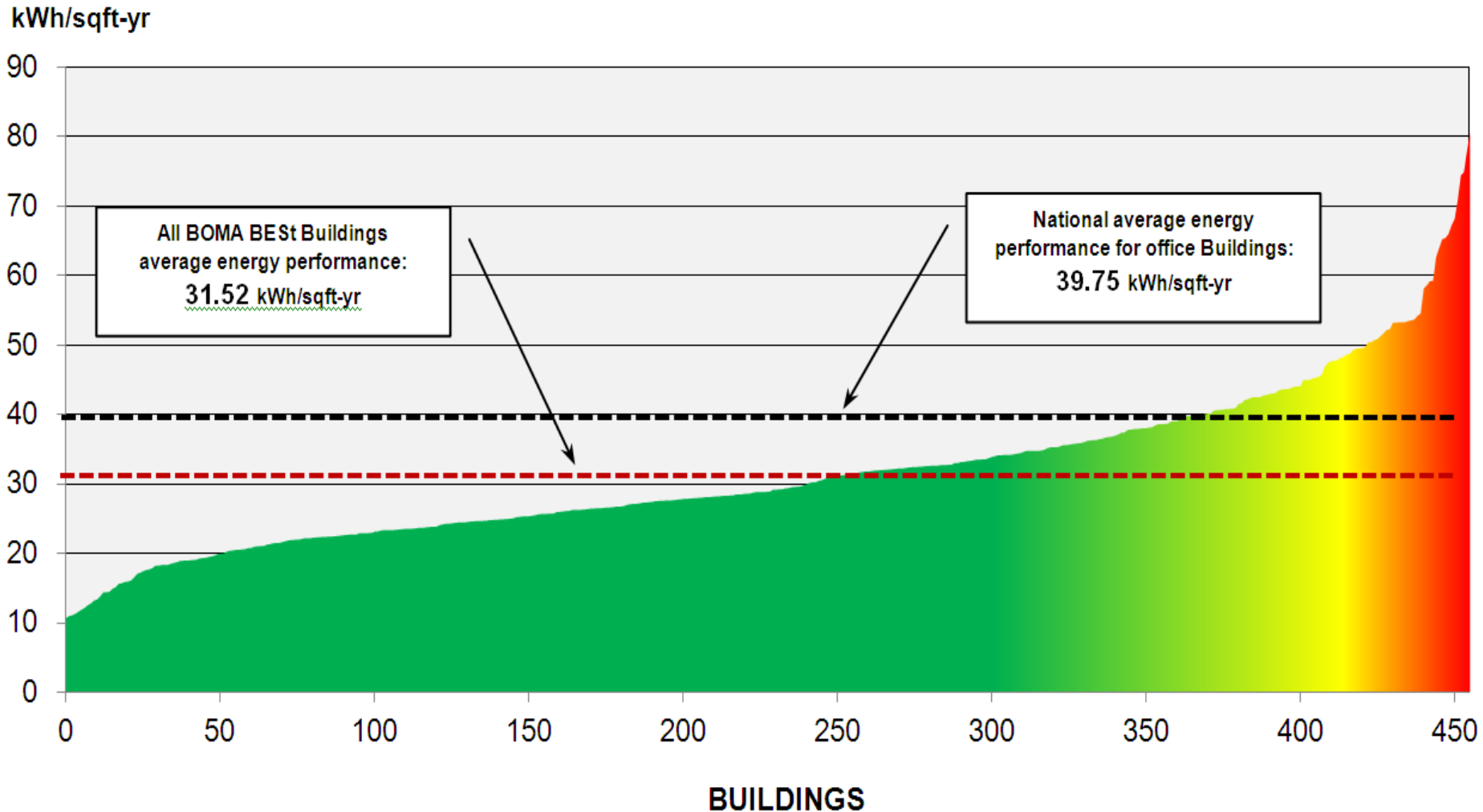
## 2013

BOMA BEST  
ENERGY AND  
ENVIRONMENT  
REPORT



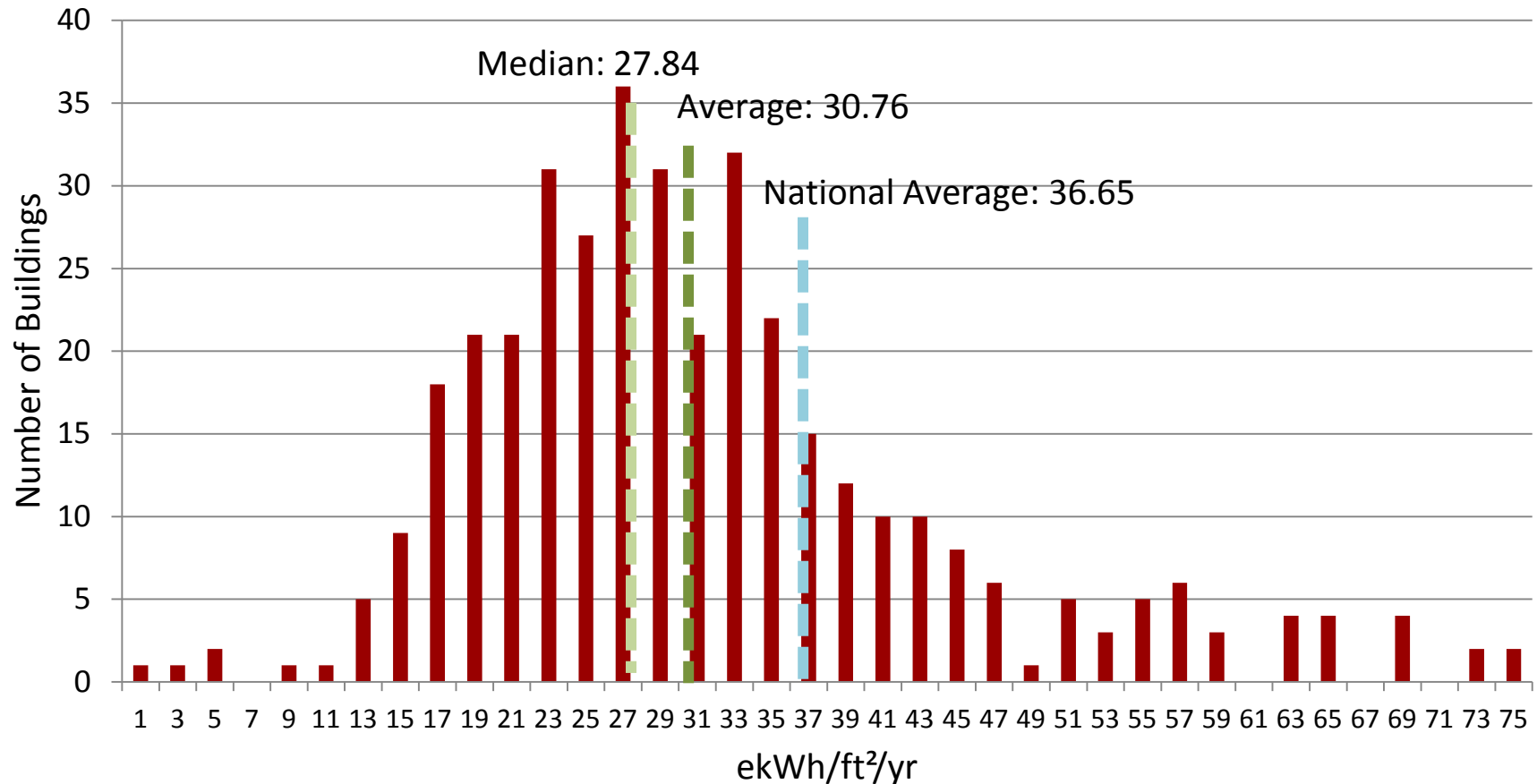
# Industry performance benchmarks

## Energy Consumption All BOMA BEST Certified Buildings



# Energy Use Intensity

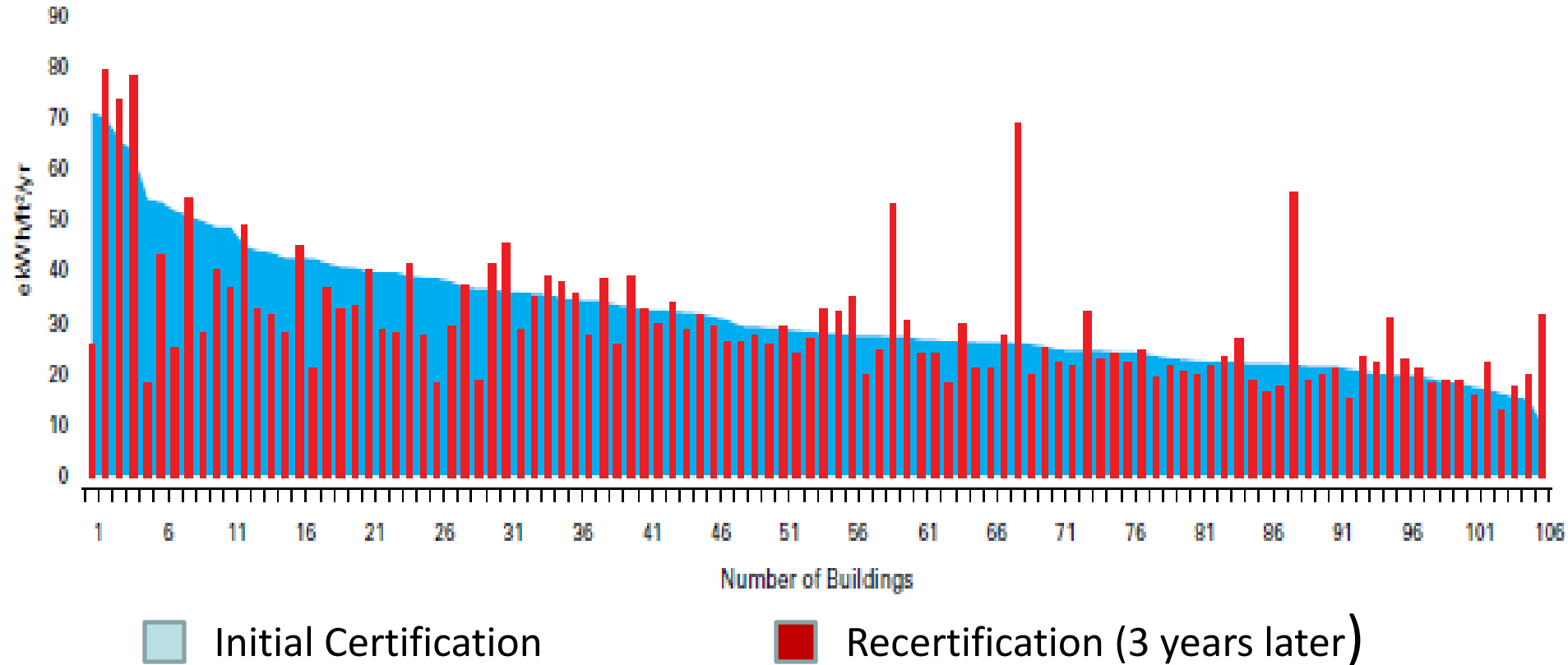
## Energy Use Intensity of BOMA BEST Certified Office Buildings



# Tracking Improvements

BOMA BEST – compares consumption

Reduced energy use intensity of 10% in  
re-certified buildings in 2012



# Green Globes addresses the needs of the Stakeholders

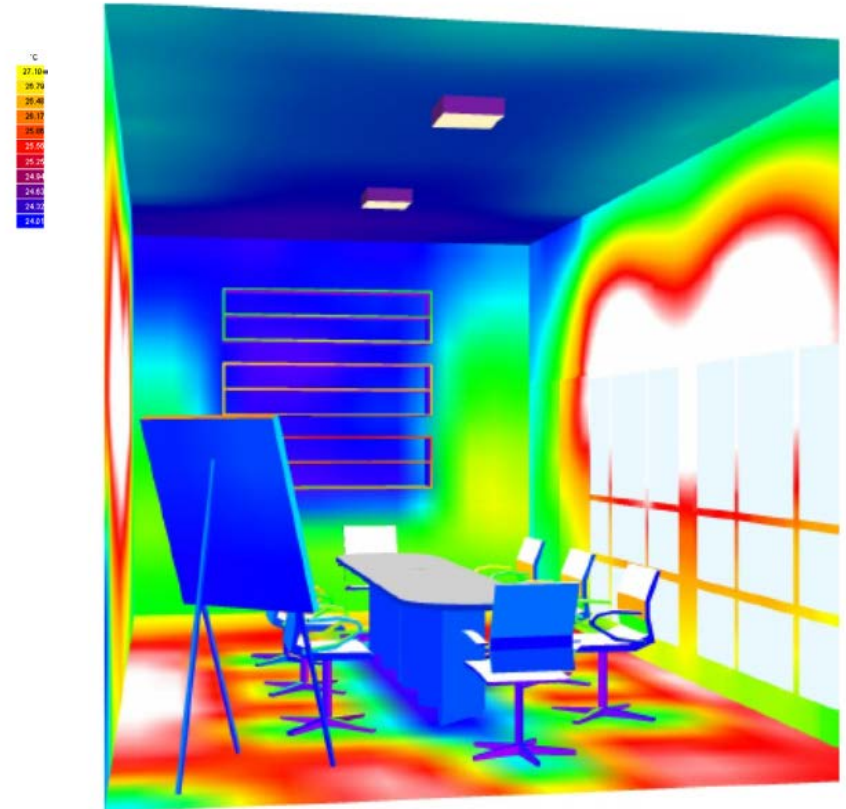
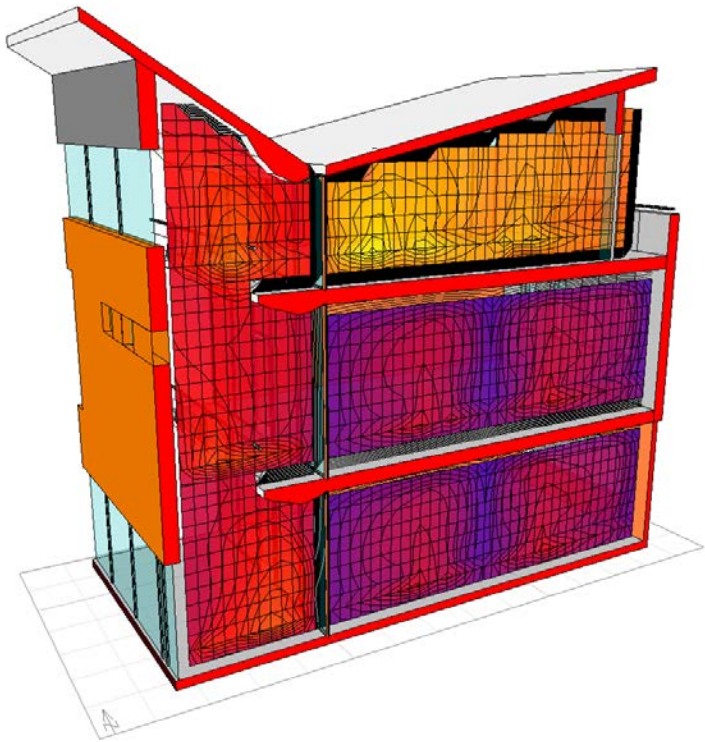
- **Designer** (Architect, Engineer)- identification and verification of strategies for sustainable design
- **Building Owner** -validation of building sustainability
- **Property Manager and Operator**- framework for environmental asset management
- **Institutional Investor** - future-proofing of building value
- **Occupant** - insurance of healthy and productive environment



# Designer

## Identification and Verification of Green Strategies

### Lighting Analysis

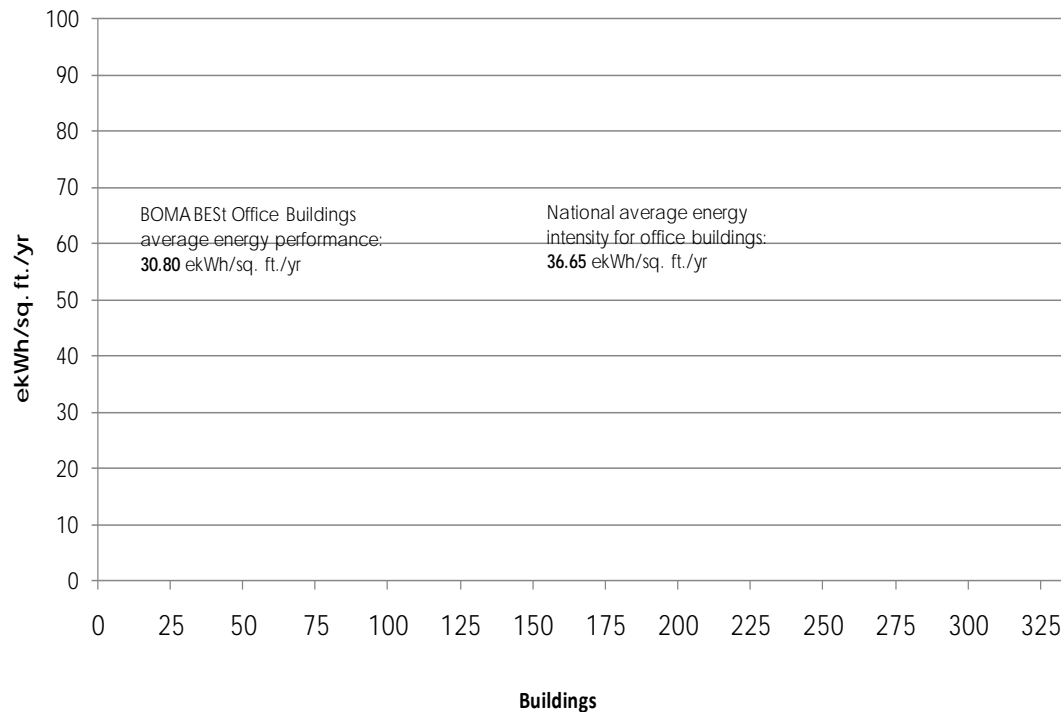


### CFD Analysis - Internal Temperature

# Building Owner

## Validation of a sustainable building

BOMA BEST buildings perform 16% better in terms of energy intensity than the national average



Energy Intensities of BOMA BEST certified Office Buildings

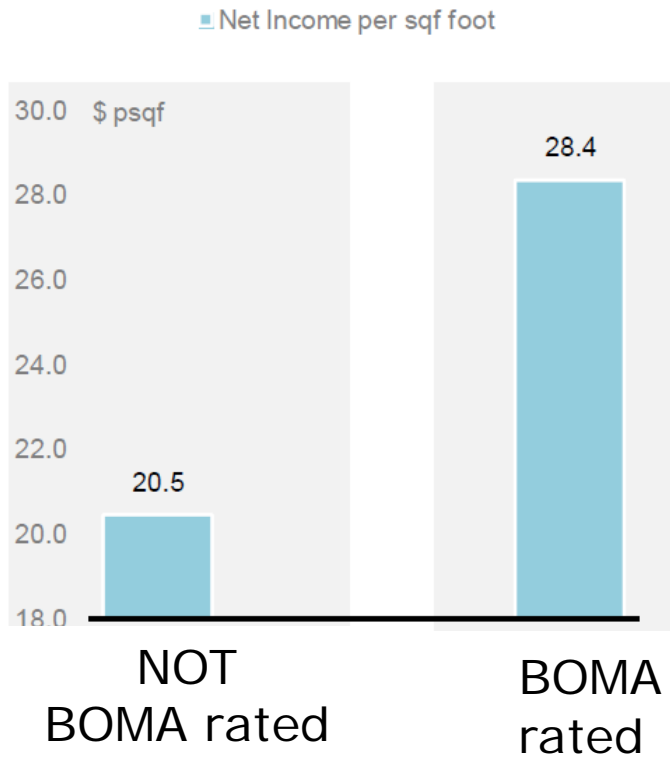


Bell Trinity Square, Toronto, BOMA BEST Level 4 (certified 2011)

# Institutional Investor

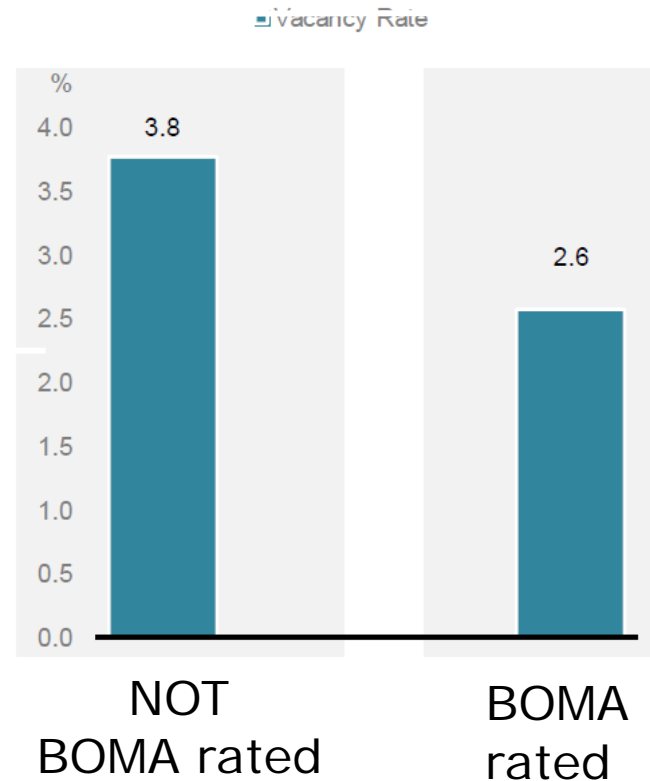
## Future-proofing building assets

### Income per SF



Source: IPD Canada

### Vacancy rate (%)

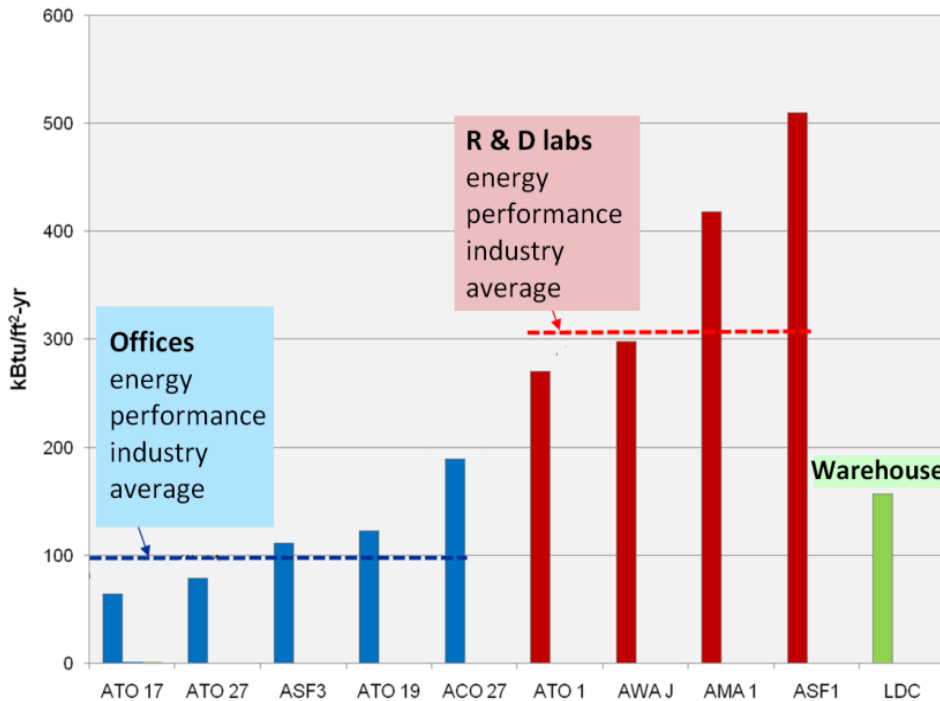


Source: IPD Canada

In December 2011, Office and Retail assets with a BOMA BESt rating had lower vacancy and higher net operating income per square foot

# Property Manager and Operator

## Framework for sustainable asset management



### Case Study

- Identified energy and water savings totaling \$700K (10% annual utility costs ) with a 6 yr. payback
- Estimated potential annual GHG reductions across 10 sites in the range of 2700 tons CO<sub>2</sub>

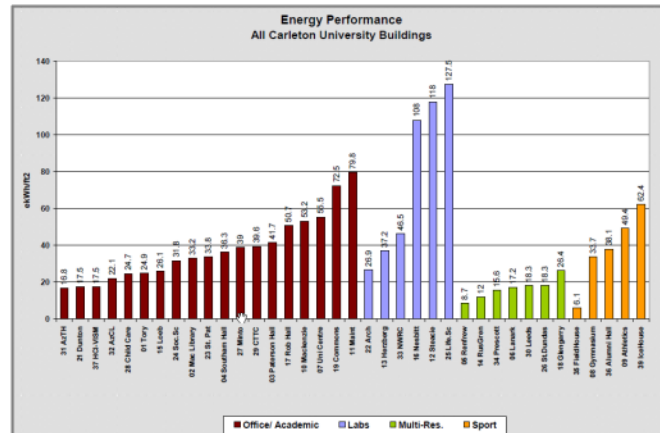


## RECOMMENDATIONS

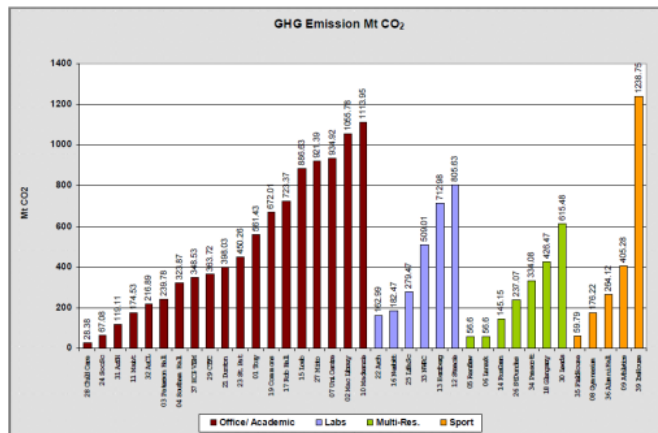
- Focus on buildings with the highest ekWh/ft² for maximum reduction
- Establish policies
- Assign role to monitor utility data
- Energy upgrades
- Energy management measures integrated into building operations

# Facility Manager

## University Campus Portfolio



## Performance Benchmarking



## Costs

## Savings

### PART 2 : CAMPUS-WIDE MANAGEMENT AND OPERATIONS

Operations and management best practices were assessed for the campus as a whole with respect to:

- Energy management
- Water management
- Site and grounds operation and maintenance
- Waste management
- Emissions, effluents and pollution controls
- Indoor environment management
- Environmental management system

Note that the following achievements listed in this report are self-reported, and no references have been provided for many of the criteria. Should the university seek third party certification, the facility manager will need to supply certain supporting documents as evidence that the criteria are being met. This could include written policies, plans, procedures, maintenance schedules and records. In some cases, the names of persons would be required who have been assigned specific roles, for example the person designated to be responsible for managing and disposing safely of hazardous materials and wastes.

Carleton University achieved an overall score of 66% for Management and Operations best practices as well as some of the site features that cover the campus as a whole. The assessment is scored for the following: energy, water, waste reduction and site (grounds) management, emissions and effluents, indoor environment and environmental management system. The following chart gives scores for each of the sections.

### Green Globes Scores for Campus-wide Management and Operations

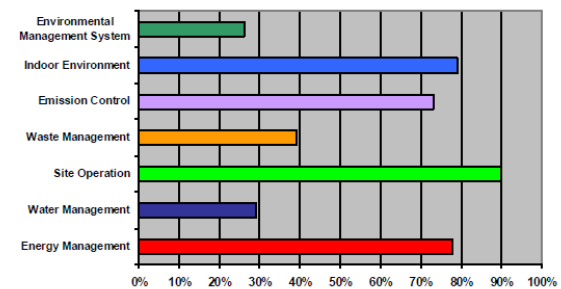


Table 4- Labs Estimated Energy and Water Systems Upgrade Implementation Costs

Building	Lighting Systems and Plug Load	Fans and Pumps Upgrade and HVAC Control	Cooling Equipment and Systems	Heating and DHW Equipment and Systems	Water Fixtures Upgrade and Water Optimization	Total Retrofit Cost Estimate
12 Shear	\$ 54,000	\$ 35,000	-	\$ 64,000	-	\$ 153,000
13 Hertzberg	\$ 14,000	-	\$ 85,000	\$ 103,000	-	\$ 199,000
18 Huxford	-	\$ 191,000	-	\$ 175,000	-	\$ 366,000
22 Arch	\$ 13,000	\$ 40,000	\$ 162,000	\$ 270,000	-	\$ 485,000
25 Life Sc	\$ 15,000	\$ 83,000	\$ 34,000	\$ 34,000	-	\$ 166,000
33 NWRC	\$ 60,000	\$ 70,000	\$ 20,000	-	\$ 150,000	\$ 380,000
Totals	\$ 156,000	\$ 419,000	\$ 276,000	\$ 649,000	-	\$ 1,499,500

Table 5- Office/Academic Estimated Energy and Water Cost Savings Potential

Building	Lighting Systems and Plug Load	Fans and Pumps Upgrade and HVAC Control	Cooling Equipment and Systems	Heating and DHW Equipment and Systems	Water Fixtures Upgrade and Water Optimization	Total Estimated Utility Cost Savings	GHG Emissions Emissions Tons CO <sub>2</sub>	Pre BEPI kWh/m²	Post BEPI kWh/m²	Utility Reduction %
01 Tory	\$ 9,362	-	-	\$ 334	\$ 7,779	\$ 17,276	64.29	24.87	24.00	3.0%
02 Mac Library	\$ 21,416	\$ 16,797	\$ 4,679	\$ 11,070	\$ 2,425	\$ 56,396	349.68	33.16	20.79	10.1%
03 Patterson Hall	\$ 3,529	\$ 3,529	\$ 1,526	\$ 36,778	\$ 1,632	\$ 29,906	145.19	41.75	36.79	11.9%
04 Southern Hall	\$ 8,858	\$ 7,278	\$ 1,332	\$ 28,717	\$ 1,526	\$ 41,541	271.85	36.34	29.13	18.8%
07 Uni Centre	\$ 26,136	\$ 13,291	\$ 13,950	\$ 13,950	\$ 13,950	\$ 81,286	684.44	53.17	43.98	17.5%
10 Macdonald	\$ 25,130	\$ 13,291	\$ 13,950	\$ 63,887	\$ 19,200	\$ 136,463	694.44	53.17	43.98	17.5%
11 Main	\$ 11,283	\$ 10,419	\$ 8,679	\$ 12,540	\$ 1,626	\$ 44,906	271.54	26.05	23.95	9.2%
19 Leach	\$ 22,219	\$ 11,110	\$ 6,479	\$ 12,540	\$ 3,269	\$ 57,857	350.86	26.05	23.10	11.3%
17 Robt Hall	\$ 9,369	\$ 4,398	\$ 4,747	\$ 19,511	\$ 2,763	\$ 31,548	179.82	36.70	46.46	8.4%
19 Commons	\$ 10,755	\$ 13,575	\$ 3,968	\$ 23,077	\$ 7,754	\$ 59,131	308.80	72.53	63.97	11.8%
21 Dunton	\$ 1,562	\$ 5,090	\$ 13,915	\$ 7,362	\$ 8,025	\$ 36,259	193.15	17.47	15.33	12.3%
23 St. Pat	\$ 2,444	\$ 7,001	\$ 8,095	\$ 963	-	\$ 19,627	131.51	33.79	30.59	9.0%
24 Soc Sc	\$ 241	\$ 461	\$ 2,875	\$ 3,834	\$ 564	\$ 7,945	24.24	33.75	26.00	16.1%
27 Munro	\$ 32,961	\$ 14,292	\$ 2,352	-	\$ 1,789	\$ 51,445	339.08	39.01	33.88	13.2%
28 Child Care	\$ 240	-	\$ 306	\$ 348	\$ 463	\$ 1,366	3.32	24.75	23.00	7.1%
29 CTC	\$ 7,739	\$ 4,919	\$ 2,459	\$ 5,957	\$ 2,004	\$ 23,076	133.89	39.59	35.52	10.3%
31 Acft	\$ 1,611	\$ 1,800	\$ 521	-	\$ 6,789	\$ 10,721	28.95	36.70	15.82	7.3%
32 Acad	\$ 5,521	\$ 3,105	\$ 1,121	-	\$ 8,792	\$ 11,540	66.50	22.12	19.87	10.2%
37 HCLVIM	\$ 3,120	\$ 4,713	\$ 5,541	-	\$ 3,476	\$ 20,850	105.07	17.53	15.72	10.3%
Totals	\$ 209,288	\$ 135,947	\$ 66,154	\$ 261,787	\$ 101,560	\$ 904,186	4,264.4	34.77	30.84	12.2%



# Occupant

## Base Building - Occupant Space Assessments – basis for dialogue



### Base Building

Applicable Points	Rating	Category
167 out of 242	69%	Overall Total
0 out of 0	0%	Environmental Certification
20 out of 30	67%	Energy
25 out of 25	100%	Commuting
33 out of 55	60%	Water
20 out of 30	67%	Waste
12 out of 20	60%	Hazardous Materials
54 out of 57	95%	Indoor Environment
0 out of 15	0%	Tenant Communications
3 out of 10	30%	Documentation

### Tenancy

Applicable Points	Rating	Category
723.6 out of 971	75%	Overall Total
34.6 out of 50	69%	Space Use
189 out of 251	75%	Energy
50 out of 50	100%	Sub Metering
29 out of 40	72%	Plug Load
80 out of 126	63%	Lighting
30 out of 35	86%	Heating & Cooling
70 out of 100	70%	Commuting & Travel
70 out of 70	100%	Water
65 out of 80	81%	Resource Use
75 out of 100	75%	Waste Management
105 out of 120	88%	Indoor Environment
100 out of 100	100%	Procurement
15 out of 100	15%	Green Team

# Questions?

**David Stewart MS P. Eng.**

**David C. Stewart & Associates Inc.**

16 Shawinigan Road

Dartmouth, NS

902 266 3663

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

