GREEN

is NOT a Colour

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Associate Director :: School of Architecture :: University of Waterloo

GREEN

is NOT a Colour

“The world will not evolve past its current state of crisis by using the same thinking that created the situation.”

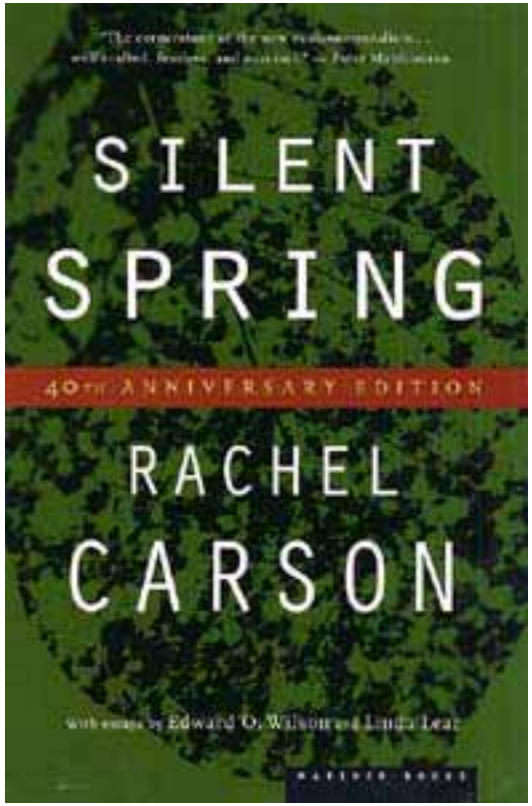
– Albert Einstein


COMMERCIAL
GOING GREEN
Environmental efficiency is actually the hottest trend in
Special
Reprint
Edition
USA TODAY
NO. 1 IN THE USA
As seen in
USA TODAY
Money
July 26, 2006
Building 'green' reaches a new level
REAL ESTATE FINANCE
Real Estate's Latest Movement
green
by
DESIGN
The Gre
in A
Adobe has turned its headquarter
and is saving millions of d
The New York Times
Editorial
FRIDAY, AUGUST 11, 2006
Build Green,
Make Green
ew York Times
ucation Life
The Greening of America's Campus
cling anymore. The sustainability movemer
w campuses are built, and how students live
CONDOLiving
It's Easy Being Green
The Washington Post
REAL ESTATE

GREEN

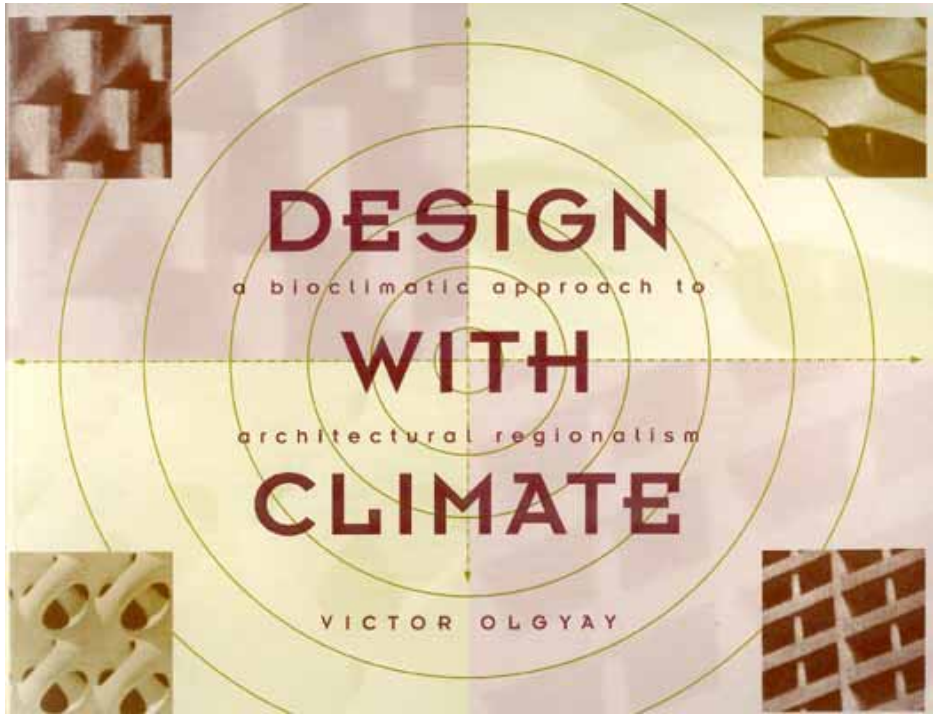
Has a HISTORY

Origins



The first significant piece was written by Rachel Carson in 1963. It highlighted the toxins that were being sprayed on crops and that were making their way into the food chain. Subsequently, the spraying of DDT was halted.

Origins



Design with Climate, by Victor Olgyay, written in 1963, initiated a bioclimatic approach to architectural design that was quite in opposition to the modern ethics of International Style architecture -- a tradition that had become entirely dependent upon mechanical and electrical systems to provide for thermal comfort and lighting.

Environmental Impact of Buildings in Canada

- 38% of total Canadian secondary energy use
- 30% of total Canadian greenhouse gas emissions
- 40% (3 billion tons annually) of raw materials used globally

- Energy Efficient (mid 1970s “Oil Crisis” reaction)

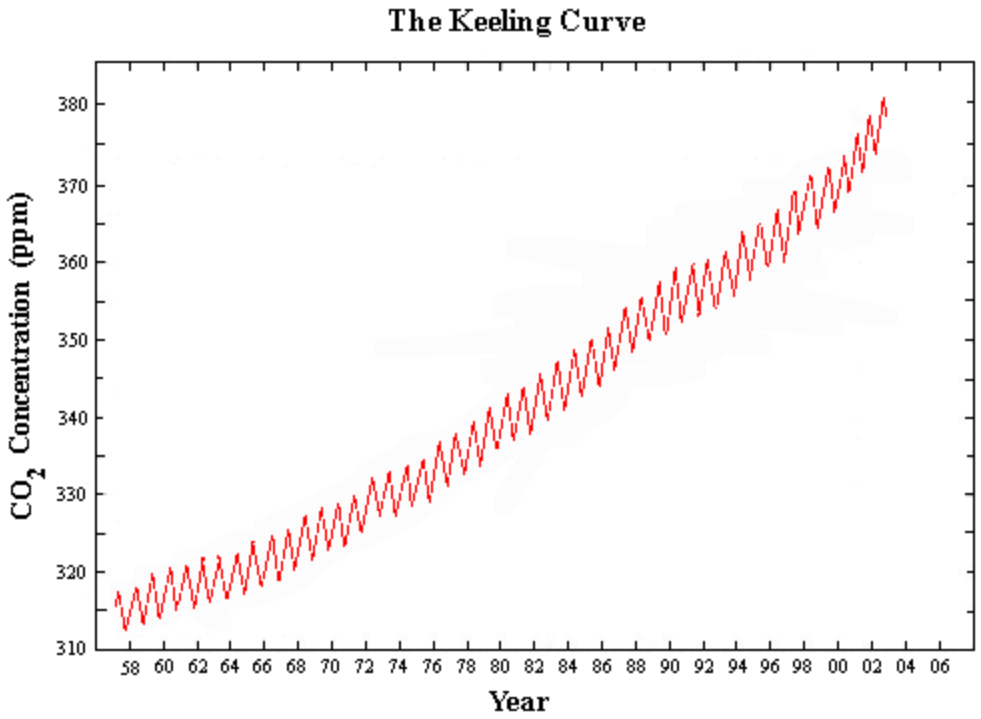
- Energy Efficient (mid 1970s “Oil Crisis” reaction)
  - Green (environmentally responsive)
    - Sustainable (holistic and accountable)
      - High Performance (accountable)
        - Carbon Neutral

        ...a steady increase in the nature and expectations of performance criteria

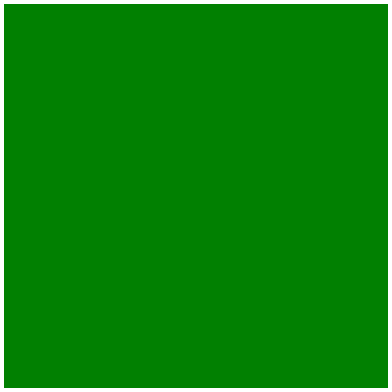
GREEN

is about GLOBAL WARMING


by far the most terrifying film
you will ever see.
an inconvenient truth
A GLOBAL WARNING
now playing in select theaters


The Keeling Curve
CO_2 Concentration (ppm)
380
370
360
350
340
330
320
310
58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 00 02 04 06
Year

GREEN



building CHARACTERISTICS

Solar Geometry

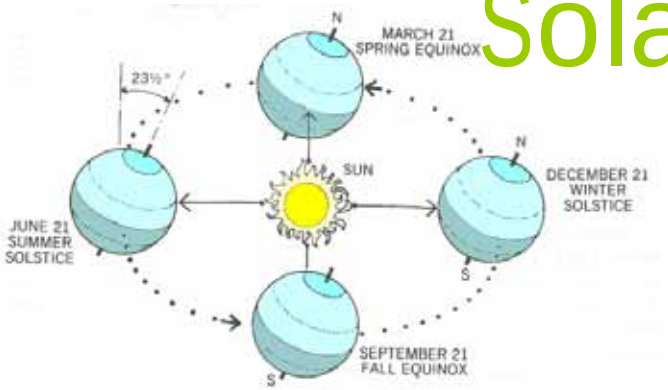


Figure 6.4a The seasons are a consequence of the tilt of the earth's axis of rotation. [From *Solar Dwelling Design Concepts* by AIA Research Corporation. U.S. Dept. Housing and Urban Development, 1976. HUD-PDR-154(4).]

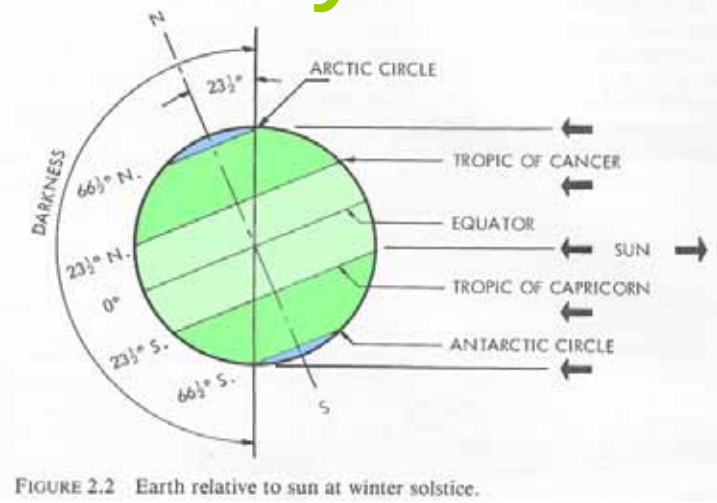


FIGURE 2.2 Earth relative to sun at winter solstice.

Figure 6.8a The sky dome and three sun paths. (From *Architectural Graphic Standards*, Ramsey/Sleeper 8th ed. John R. Hoke, ed. copyright John Wiley, 1988.)

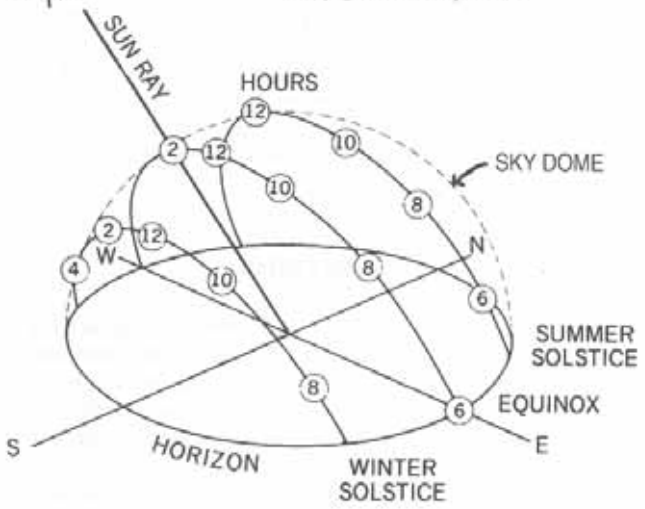
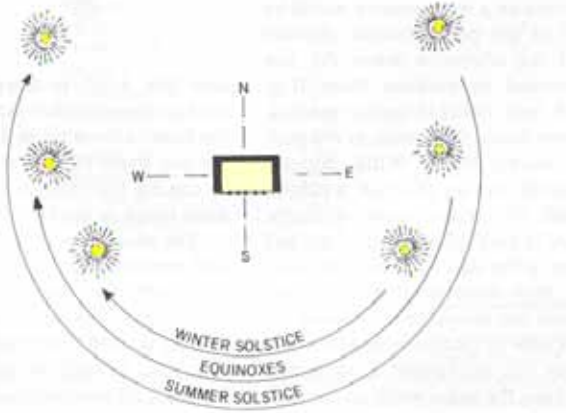
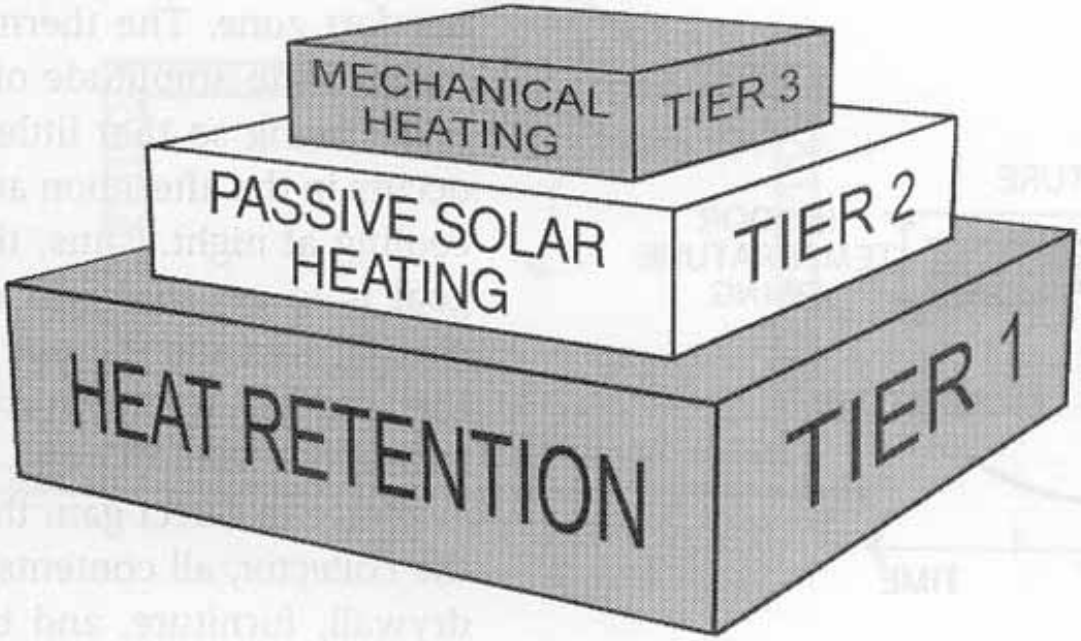


Figure 9.10b This plan view illustrates the sweep of the sun's azimuth angle at different times of the year from sunrise to sunset.



Passive Solar Heating



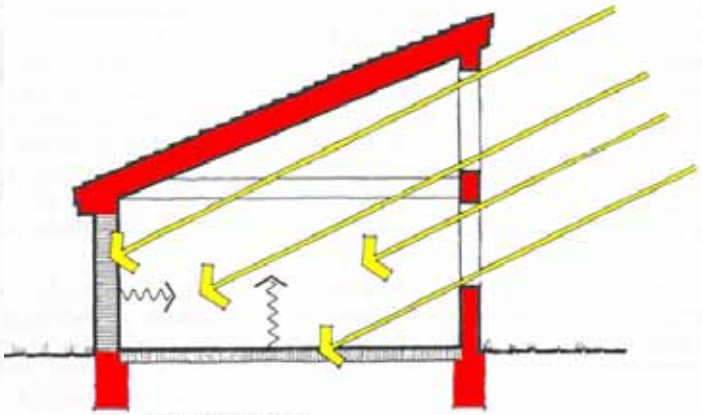


FIG. 19a. Direct Gain

Figure 7.5b Passive solar heating is the second tier of the more efficient and sustainable three-tier design approach. The first tier is heat retention.

Passive Cooling

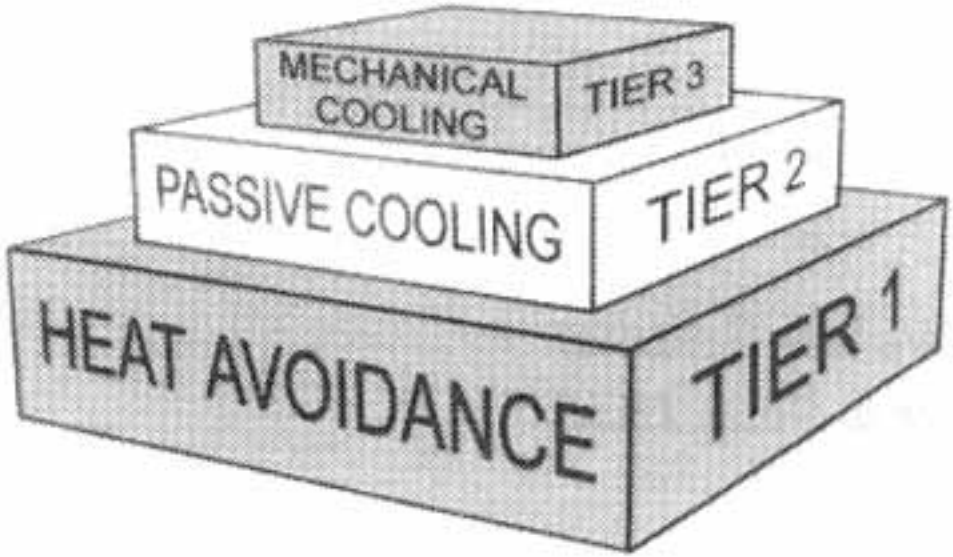


Figure 10.1 Cooling needs of buildings are best and most sustainably achieved by the three-tier design approach, and this chapter covers tier two.

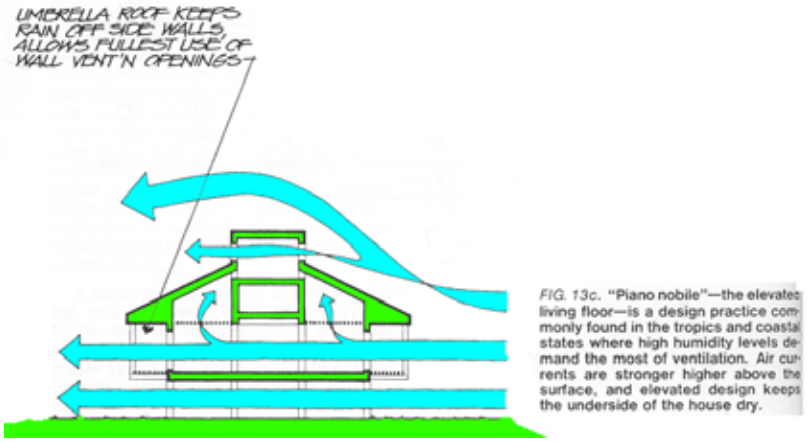


FIG. 13c. "Piano nobile"—the elevated living floor—is a design practice commonly found in the tropics and coastal states where high humidity levels demand the most of ventilation. Air currents are stronger higher above the surface, and elevated design keeps the underside of the house dry.

Shading

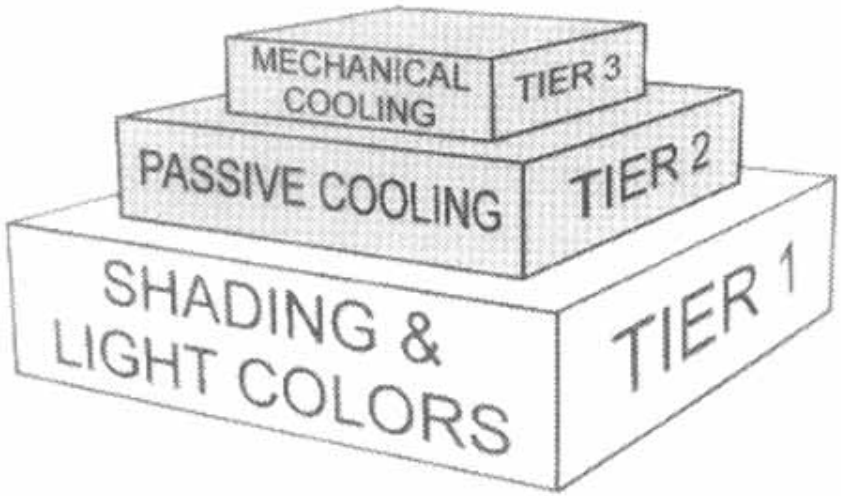
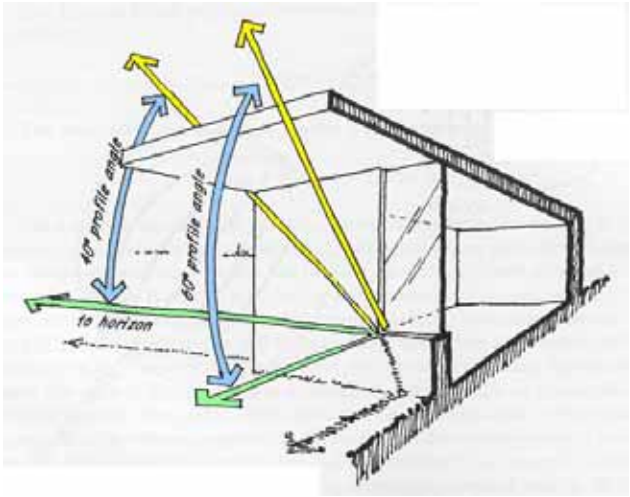
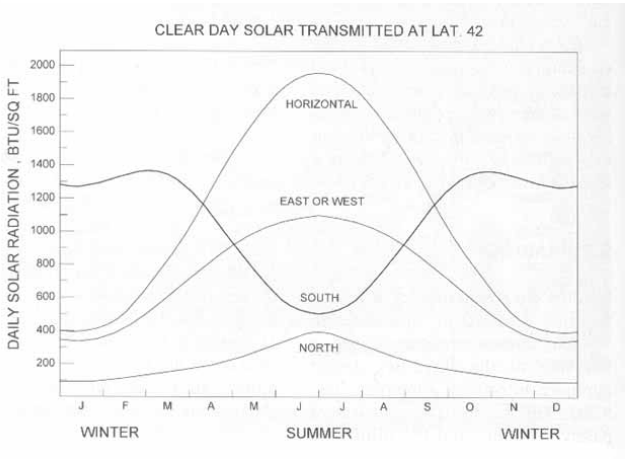


Figure 9.2a The three-tier approach to design is the most logical and sustainable method for achieving thermal comfort in the summer.





Sustainable Systems

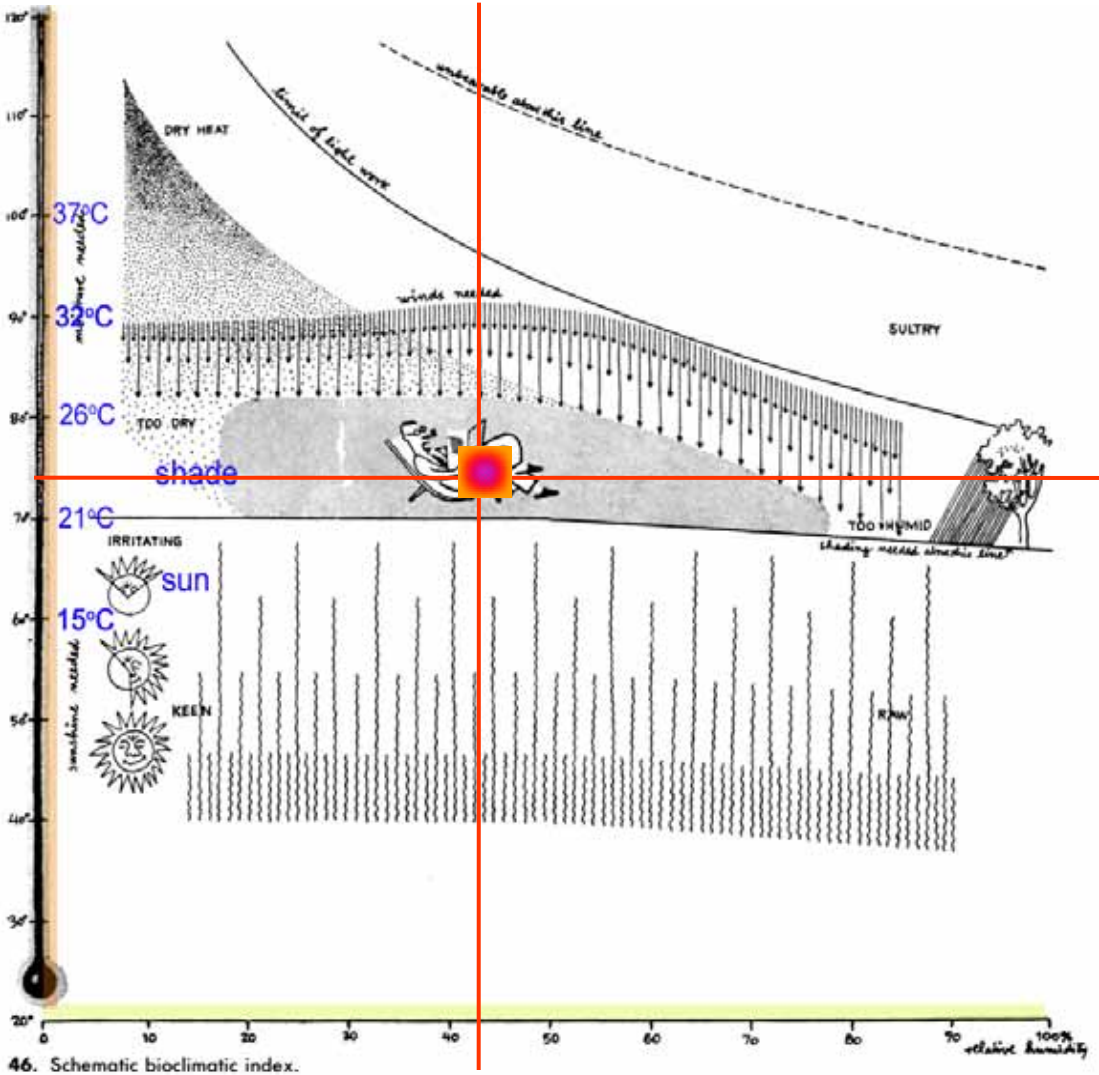
- Use of local/regional materials
- Use of renewable materials
- Use of materials with high recycled content
- Efficient water and energy systems
- Indoor air quality and daylighting
- Renewable energy: PV, wind, green power
- Innovative approaches to design

Green and Comfort

In order for buildings to be more sustainable; i.e. use less energy, people will have to adjust their expectations of comfort

- Put on a sweater
- Maybe take that sweater off!
- Open a window
- Shut that same window….

The Comfort Zone:



46. Schematic bioclimatic index.

This famous illustration is taken from “Design with Climate”, by Victor Olgyay, published in 1963.

This is the finite point of expected comfort for 100% mechanical heating and cooling.

Carbon Neutral Methodology

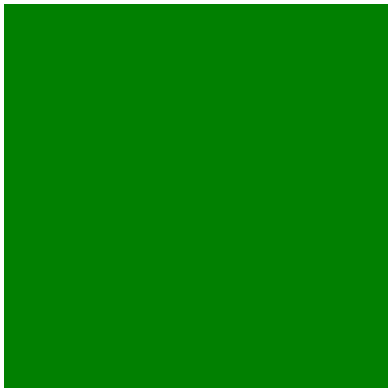
Builds on "sustainable" and "high performance" initiatives:

#1 - Reduce loads/demand FIRST (passive heating and ventilation, daylighting, shading, orientation, etc.) – BACK TO BASICS!

#2 - Meet loads efficiently (energy efficient lighting, high-efficiency MEP equipment, controls, etc.)

#3 - Use on-site generation/renewables to meet energy needs (doing the above steps *before* will result in the need for much smaller renewable energy systems, making carbon neutrality achievable.)

GREEN



CAN be Evaluated

Green Rating Systems

- Developed to provide a firmer comparison between buildings
- Initiated in the UK under BREEAM
- Modified by the USGBC into LEED
- Modified by the British Columbia branch of the USGBC into LEED for Canada
- CaGBC handles LEED Certification for Canada

What is the LEED System?

LEADERSHIP in ENERGY and ENVIRONMENTAL DESIGN

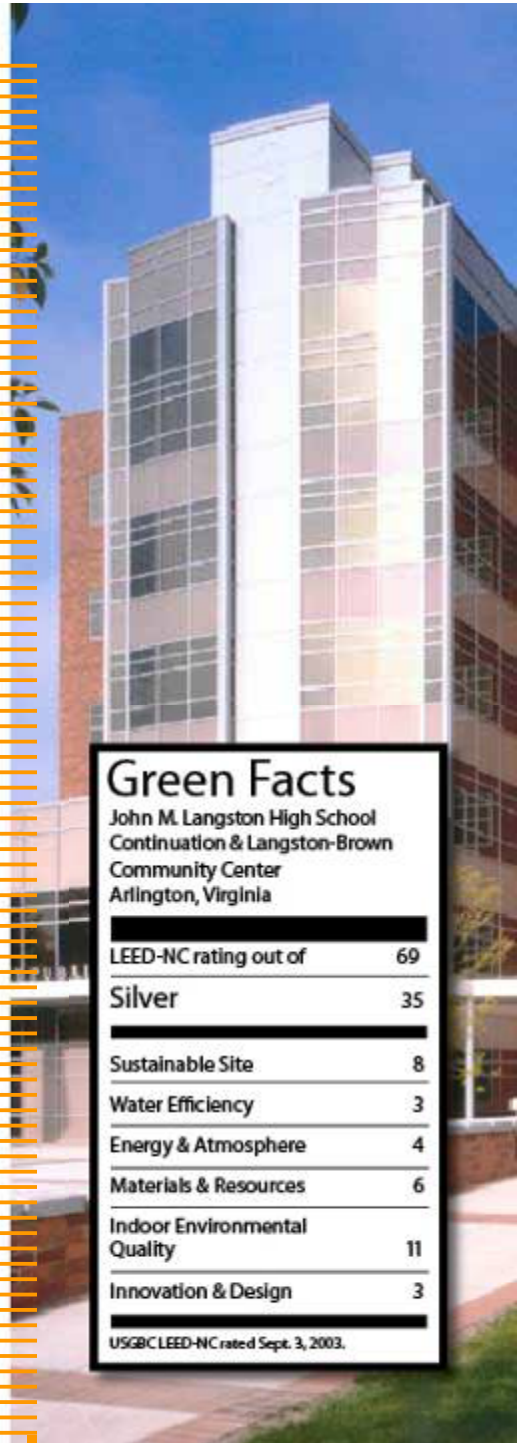
A Rating System for Sustainable Buildings

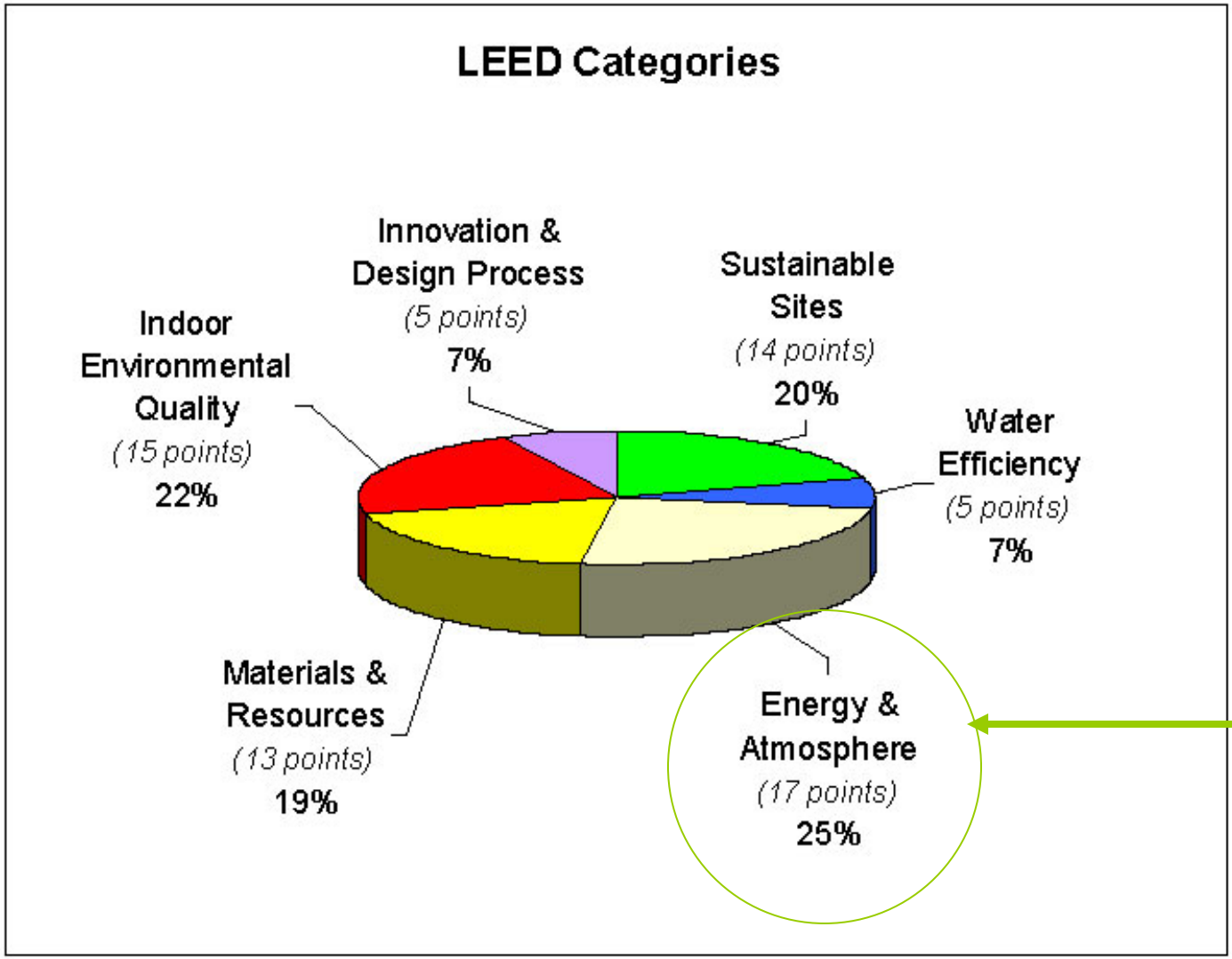
DESIGN, CONSTRUCTION, & OPERATIONS

Scores are tallied for different aspects of efficiency and design in appropriate categories.

For instance, LEED assesses in detail:

1. Site Planning
2. Water Management
3. Energy Management
4. Material Use
5. Indoor Environmental Air Quality
6. Innovation & Design Process





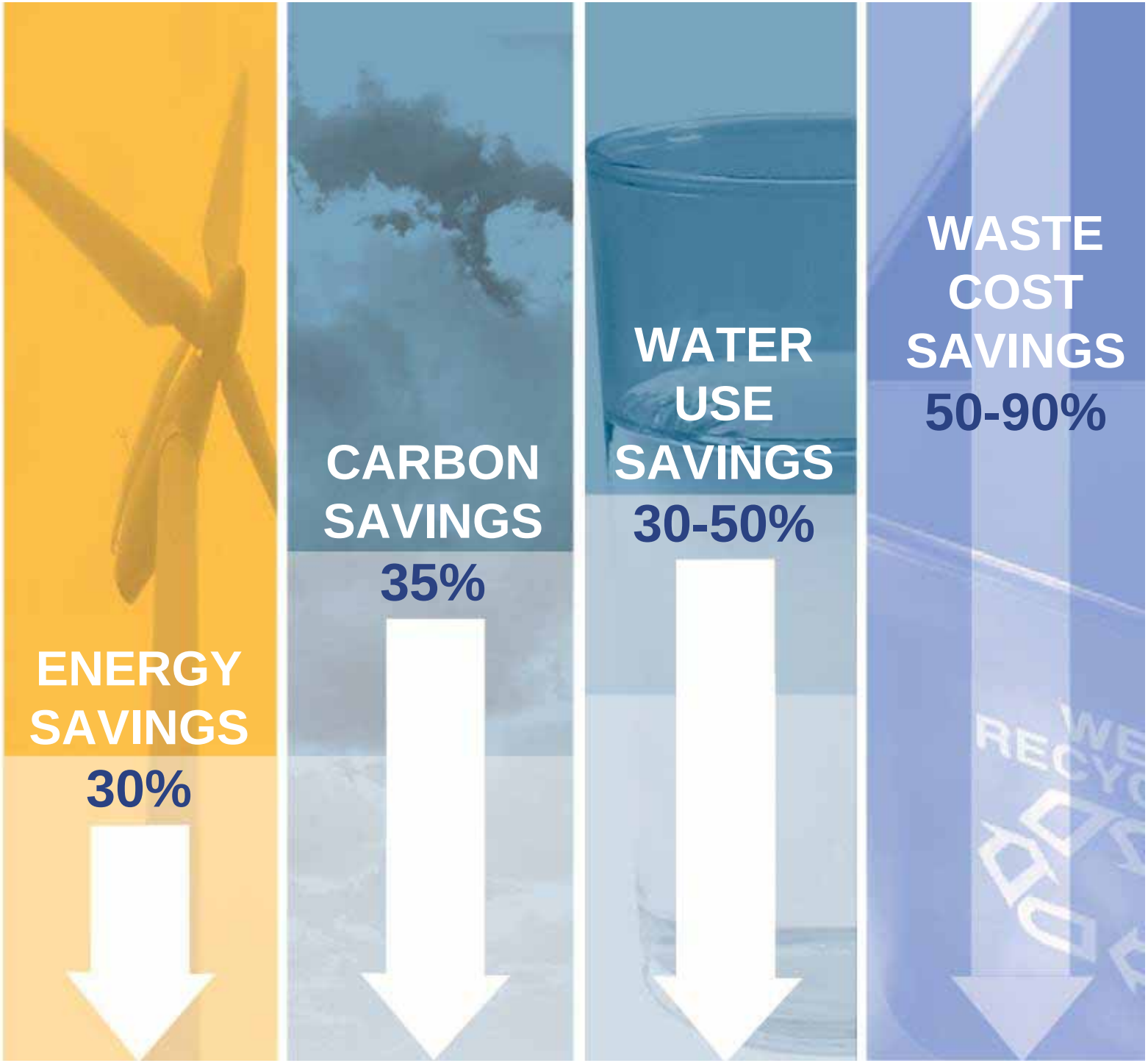
The energy crisis of the 1970s only looked at "energy efficiency"

LEED Rewards

- Platinum 52-70 points
- Gold 39-51 points
- Silver 33-38 points
- Bronze 26-32 points

Gaining ground as a very successful marketing system for high performance buildings!

Average Savings of Green Buildings



Source: **Capital E**

Being less BAD is not GOOD enough

Because we need to REVERSE the trend towards Global Warming

GREEN

is NOT UGLY it’s COOL!

Canadian

Green Buildings

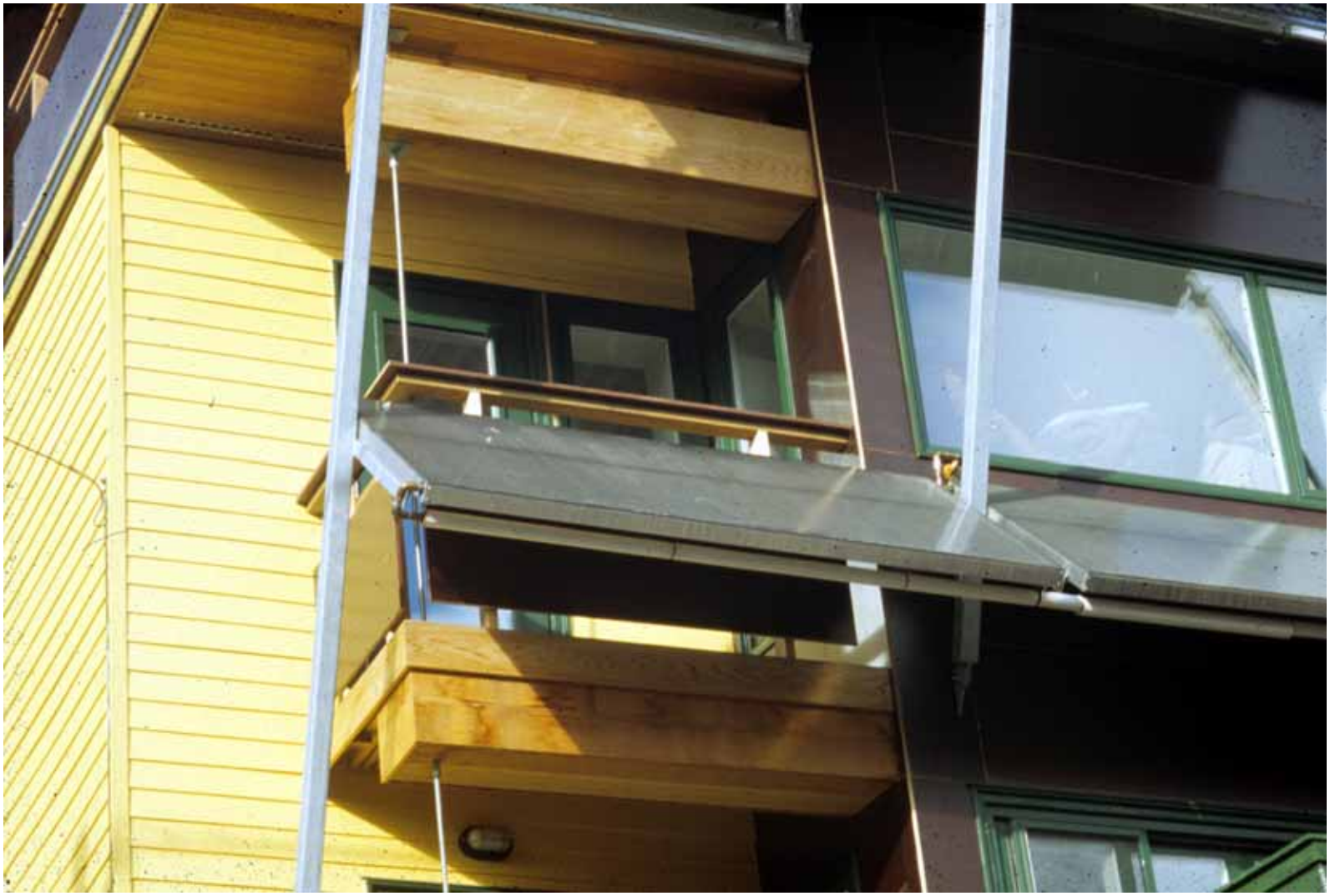
CMHC Healthy House

1992

Toronto, Ontario

Martin Liefhebber Architect

CMHC Healthy House



CMHC Healthy House

CMHC Healthy House

CMHC Healthy House

Green on the Grand

1996
Kitchener, Ontario
Snider, Reichard and March Architects
Enermodal Engineering
Canada's First "C-2000" Building

Green on the Grand

Green on the Grand


HEAT
EXCHANGER

YMCA Learning Centre

BURROWS RESIDENCE
1995
Paradise Lake, Ontario
Charles Simon Architect

YMCA - Burrows

YMCA - Burrows

YMCA - Burrows

YMCA - Burrows

YMCA - Burrows

YMCA Learning Centre

SOLARIUM BUILDING
1996
Paradise Lake, Ontario
Charles Simon Architect

YMCA - Solarium

YMCA - Solarium

YMCA - Solarium

YMCA - Solarium

YMCA - Solarium

CK Choi Institute, UBC

1996

Vancouver, British Columbia

Matsuaki Wright Architects

CK Choi

CK Choi

CK Choi

Banff Town Hall

1996

Banff, Alberta

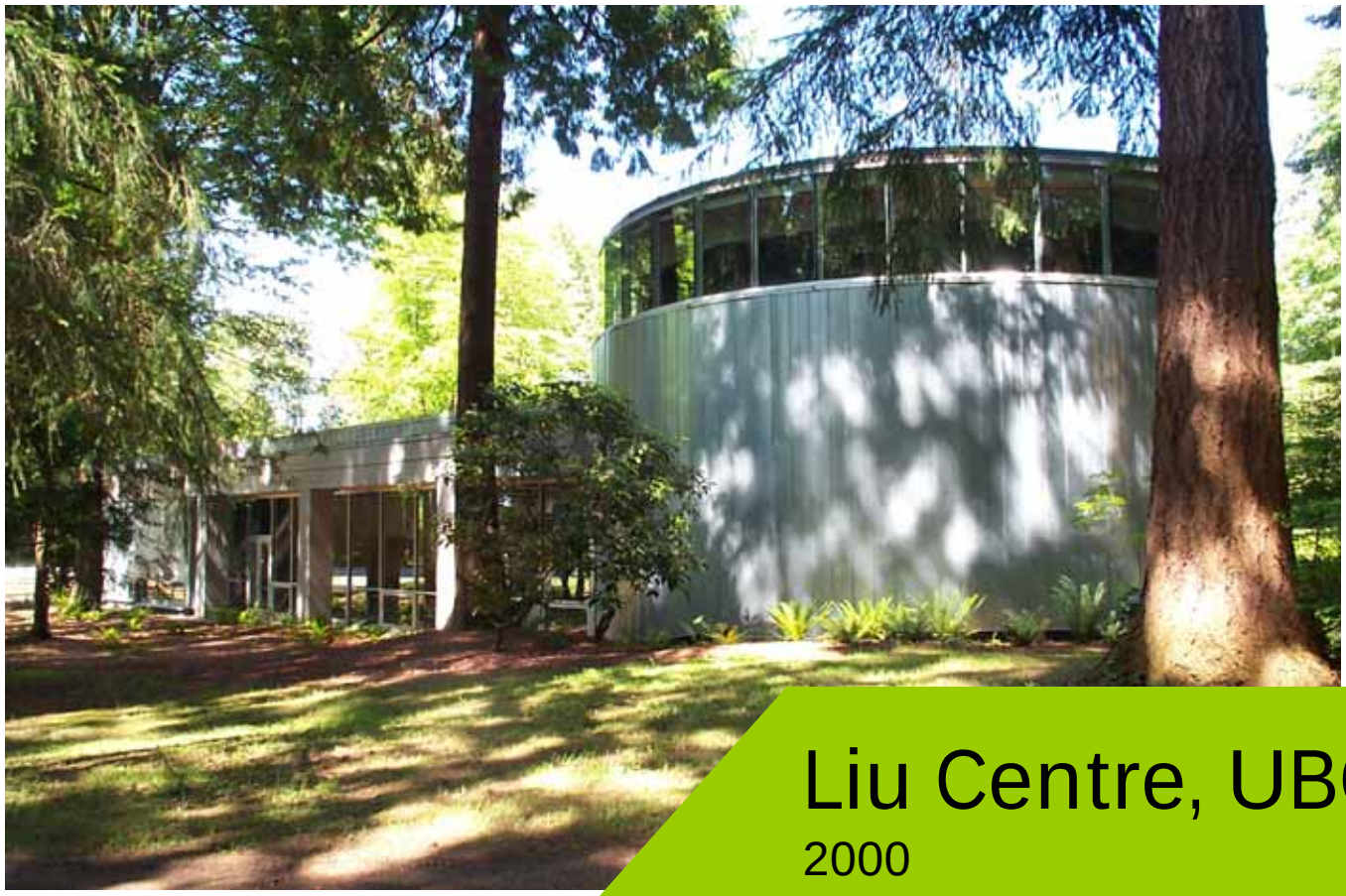
Manasc Isaac Architects

Banff Town Hall

Banff Town Hall

Banff Town Hall

Banff Town Hall



Liu Centre, UBC

2000

Vancouver, British Columbia

Architectura with Arthur Erickson

Liu Centre

Liu Centre

Liu Centre

Liu Centre

Telus Building

1996

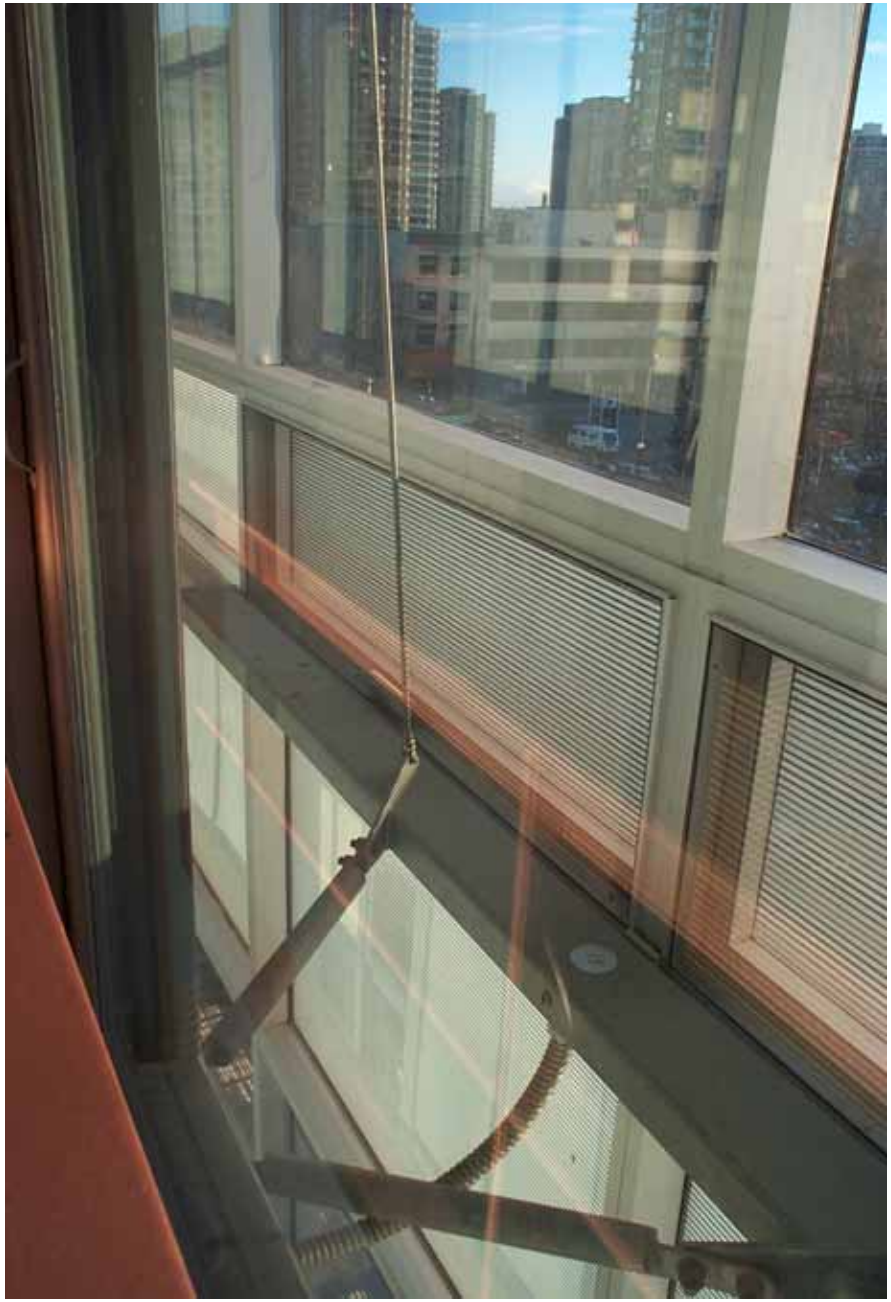
Vancouver, British Columbia

Peter Busby + Associates

Telus Building

Telus Building

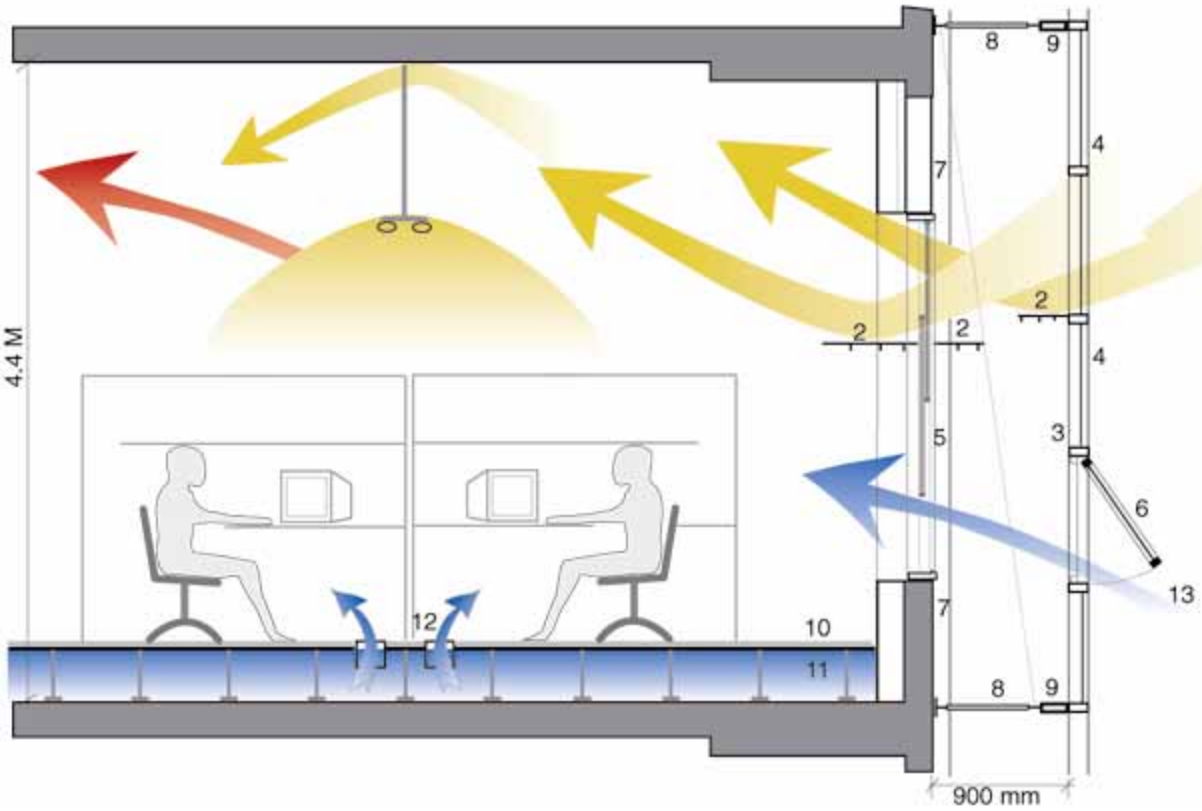
Telus Building



Telus Building

Fritted ceramic glass on the south west façade helps to keep excess sun out

Telus Building



1 Interstitial space- seasonal climate buffer zone
2 Daylight reflector and sunshade
3 Aluminum framed glazing curtain wall
4 Solar shade glass panel- ceramic frit glass panel reduces solar heat gain
5 Operable windows-existing restored
6 Operable windows- new mechanized
7 Existing exterior wall- exposed concrete
8 Curtain wall hangers
9 Steel reinforcing for curtain wall frame
10 Raised office floor
11 Air plenum in raised floor
12 Air diffusers
13 Natural ventilation possible in moderate temperatures

Revenue Canada Building

1998

Surrey, British Columbia

Peter Busby + Associates

Revenue Canada

Revenue Canada

Revenue Canada

Terasen Gas

2000

Surrey, British Columbia

Musson Cattell Mackey Partnership

Terasen Gas

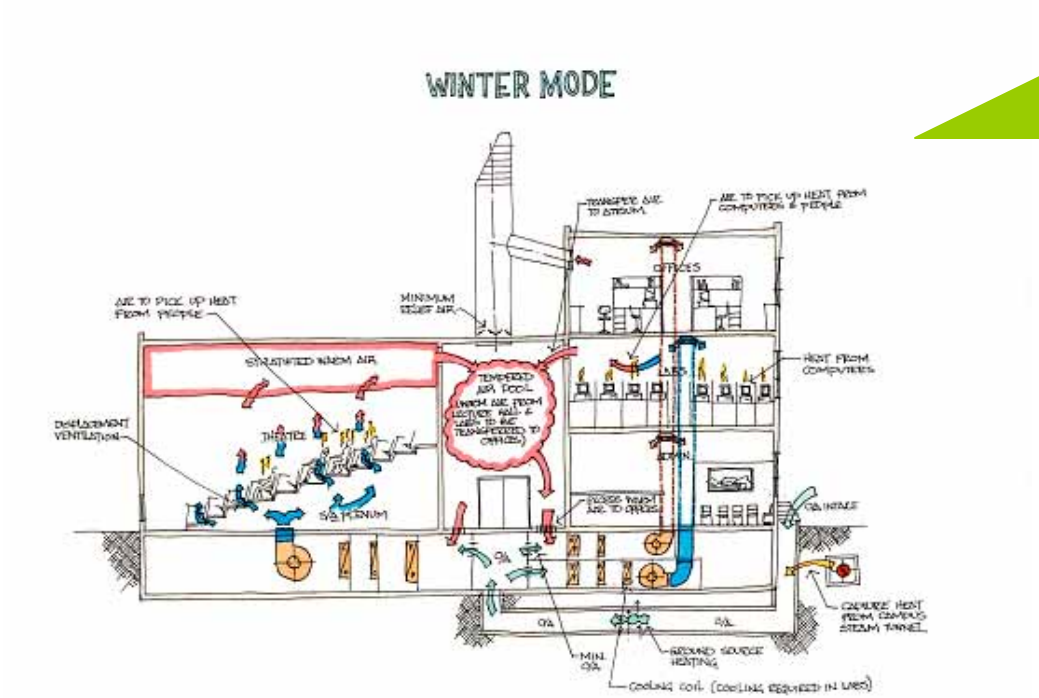
Terasen Gas

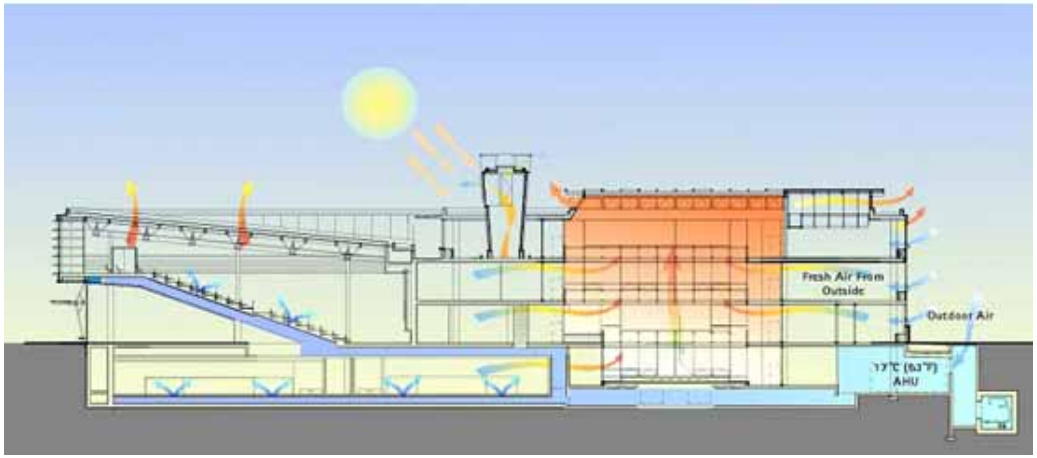
Terasen Gas

Terasen Gas

York University

COMPUTER SCIENCE BUILDING
2001
Toronto, Ontario
Busby w/ architects Alliance





This building was different in that the entire TEAM sat around and worked out the planning at the beginning of the project, with an effort to save energy.

MEC

MOUNTAIN EQUIPMENT COOP
2000
Toronto, Ontario
Stone Kohn McQuire Vogt Architects

MEC Toronto

Bicycle racks encourage environmentally friendly transportation!

MEC Toronto

MEC Toronto

Richmond City Hall

2000

Richmond, British Columbia

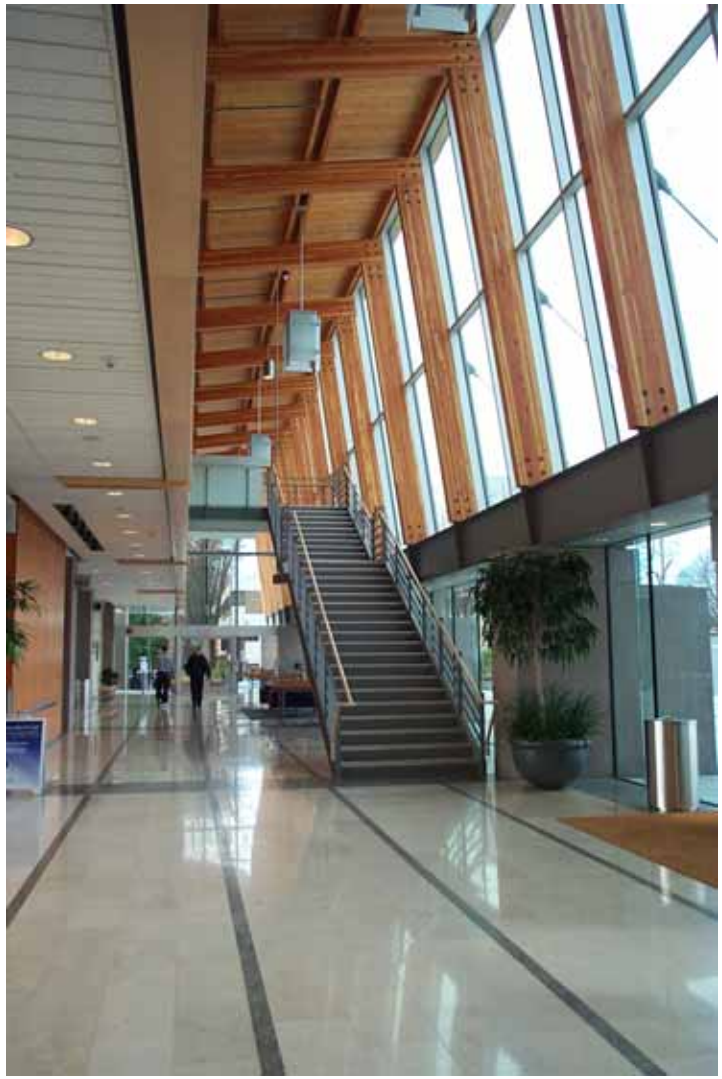
KPMB and Hotson Bakker Architects

Richmond City Hall

Richmond City Hall

Richmond City Hall

Richmond City Hall



Bahen Centre, UofT

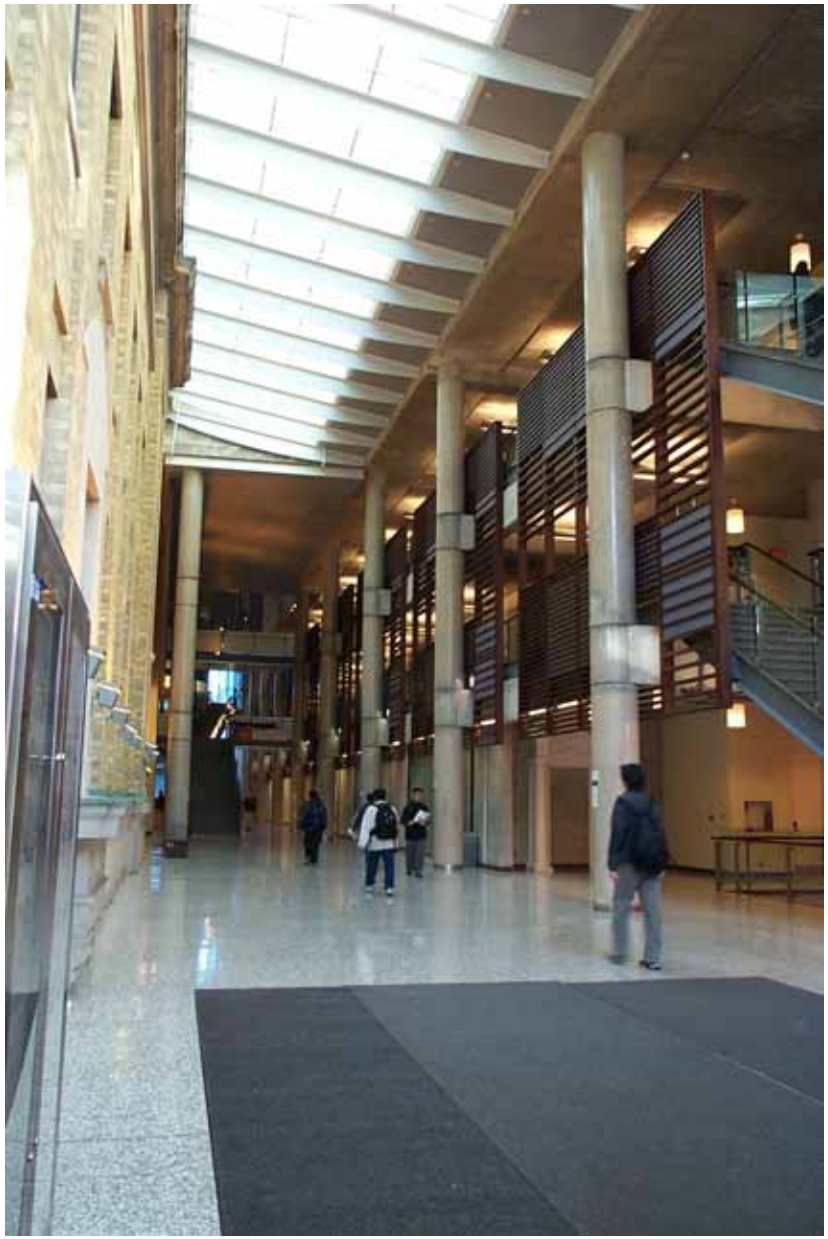
2001

Toronto, Ontario

Diamond and Schmitt Architects

Bahen Centre UofT

Bahen Centre UofT



Bahen Centre UofT

Skylighting in the atrium provides natural light which relieves the load for electrical lighting during the daytime.

Bahen Centre UofT

MEC

MOUNTAIN EQUIPMENT COOP
2000
Ottawa, Ontario
Linda Chapman, Christopher Simmons

MEC Ottawa

Sunshades on the windows keep out unwanted heat in the summer time.

MEC Ottawa

The water cistern collects rainwater that is used to keep the plants watered.

Notice the PV array on top of the cistern to collect the energy needed to run the pump.

MEC Ottawa

Jackson Triggs Winery

2001

Niagara-on-the-Lake, Ontario

KPMB Architects

Jackson Triggs

Jackson Triggs

Jackson Triggs

The space is predominantly daylit.

National Works Yard

2004

Vancouver, British Columbia

Omicron Engineers and Architects

LEED Gold

National Works Yard

National Works Yard

National Works Yard

National Works Yard

APEGBC

2000

Vancouver, British Columbia

Peter Busby + Associates

APEGBC

An open office allows daylight to penetrate and reduce the requirements for electric lighting – even into the offices at right with the glazed walls.

APEGBC

Boake :: University of Waterloo :: March 2008

Semiahmoo Library

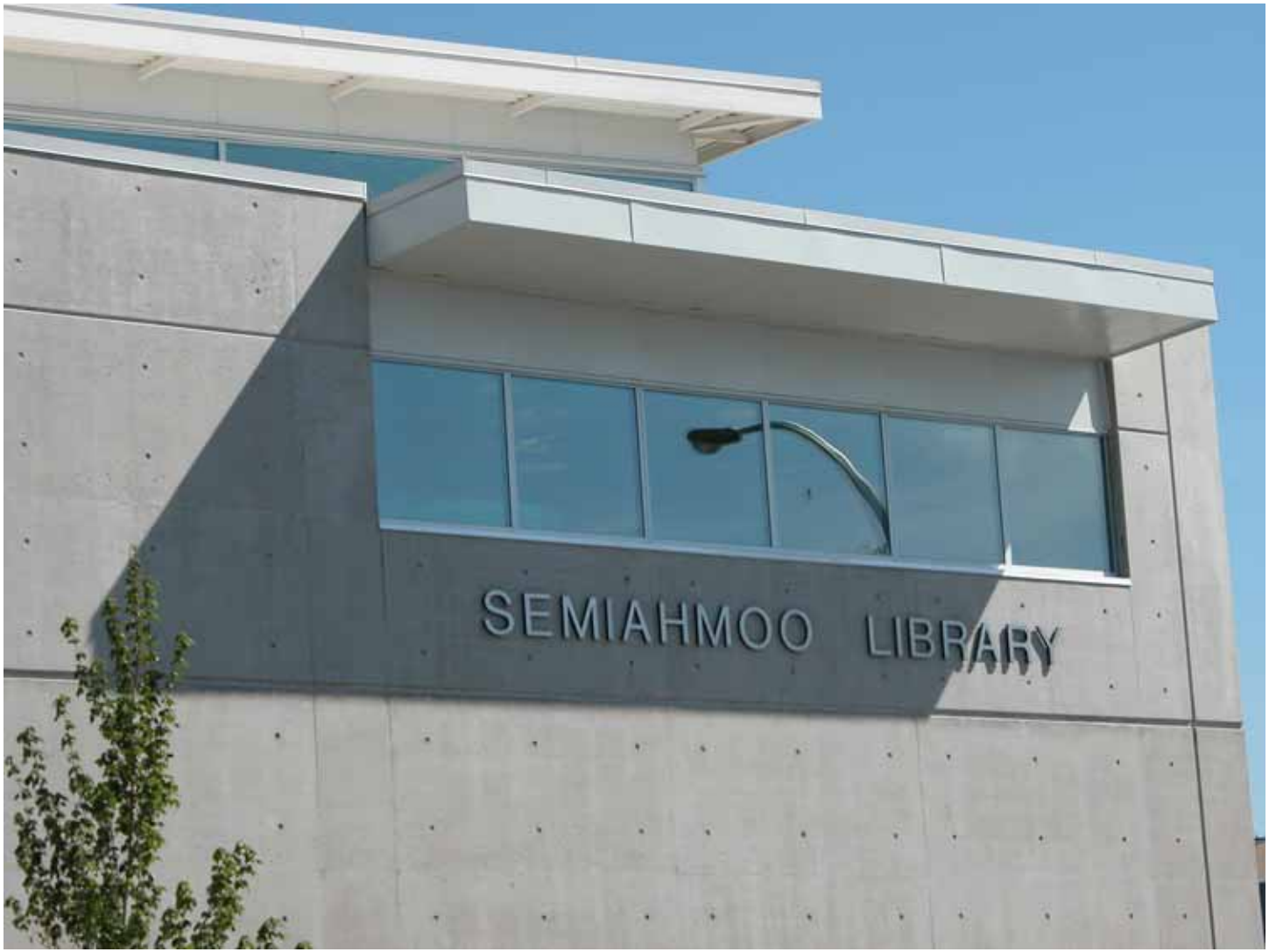
2004

Surrey, British Columbia

Musson Cattell Mackey Partnership

LEED Silver

Semiahmoo Library



Semiahmoo Library

Indigenous (local) planting helps to reduce water requirements.

Semiahmoo Library

Boake :: University of Waterloo :: March 2008

Semiahmoo Library

White Rock Operations

2003

White Rock, British Columbia

Peter Busby + Associates

LEED Gold

White Rock Operations

White Rock Operations

White Rock Operations

White Rock Operations

White Rock Operations

Canmore Civic Centre

2004
Canmore, Alberta
Marshall Tittemore Kristina Pompura
Architects

LEED Silver

Canmore Civic Centre

Canmore Civic Centre

Canmore Civic Centre

Canmore Civic Centre

St. John Ambulance

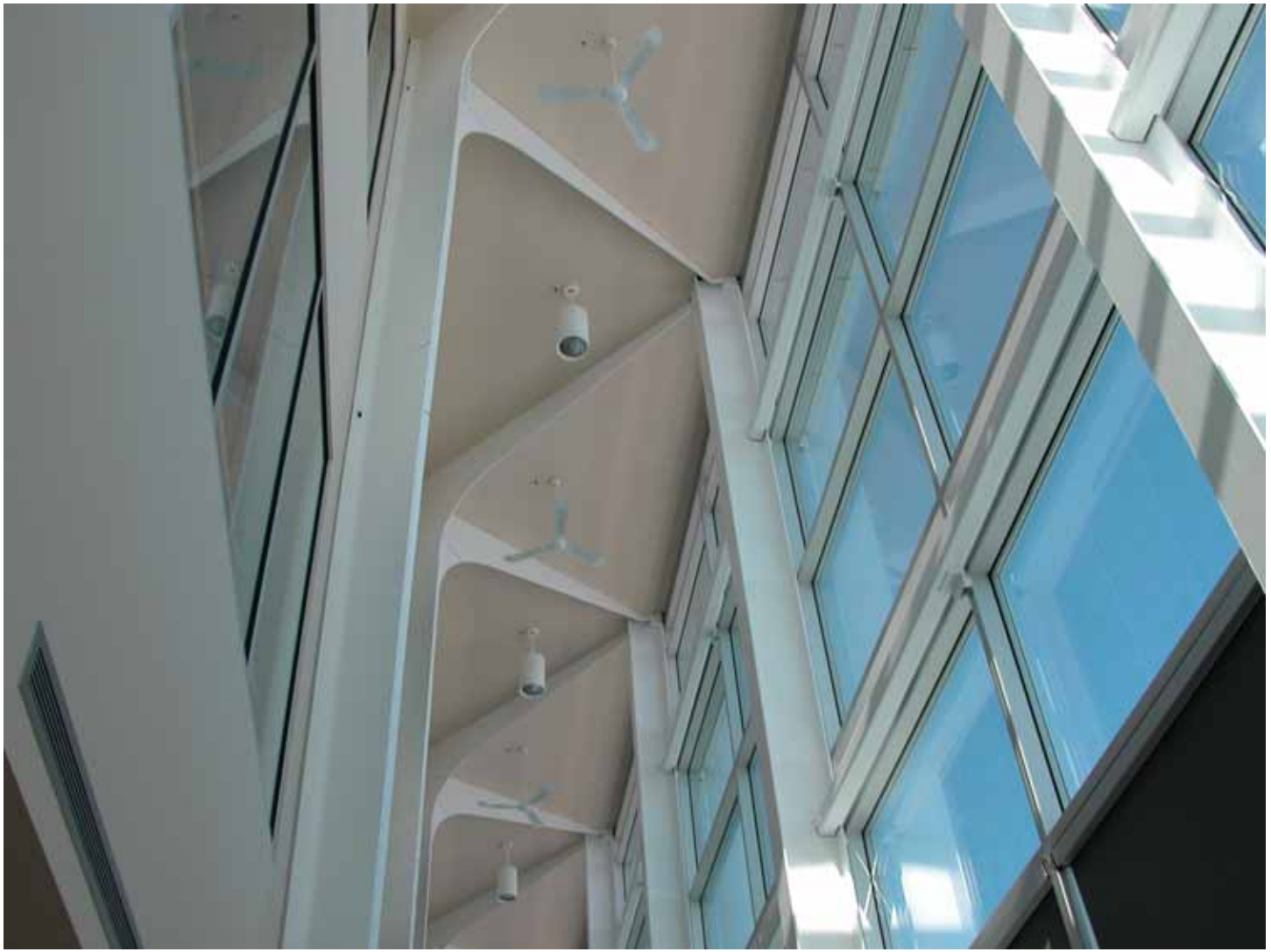
2004
Edmonton, Alberta
Manasc Isaac Architects

LEED Silver

St. John Ambulance

St. John Ambulance

St. John Ambulance



St. John Ambulance

Princess St. Campus

RED RIVER COMMUNITY COLLEGE
2003
Winnipeg, Manitoba
Corbett Cibinel Architects

Princess St. Campus

Princess St. Campus

Princess St. Campus

Princess St. Campus

Princess St. Campus

MEC

MOUNTAIN EQUIPMENT COOP
2004
Winnipeg, Manitoba
Prairie Architects

LEED Gold

MEC Winnipeg

MEC Winnipeg

MEC Winnipeg

MEC Winnipeg

Caisse du Depots

2003

Montreal, Quebec

Eric Gaultier and Consortium

Caisse du Depots

Caisse du Depots

Caisse du Depots

Caisse du Depots

Caisse du Depots

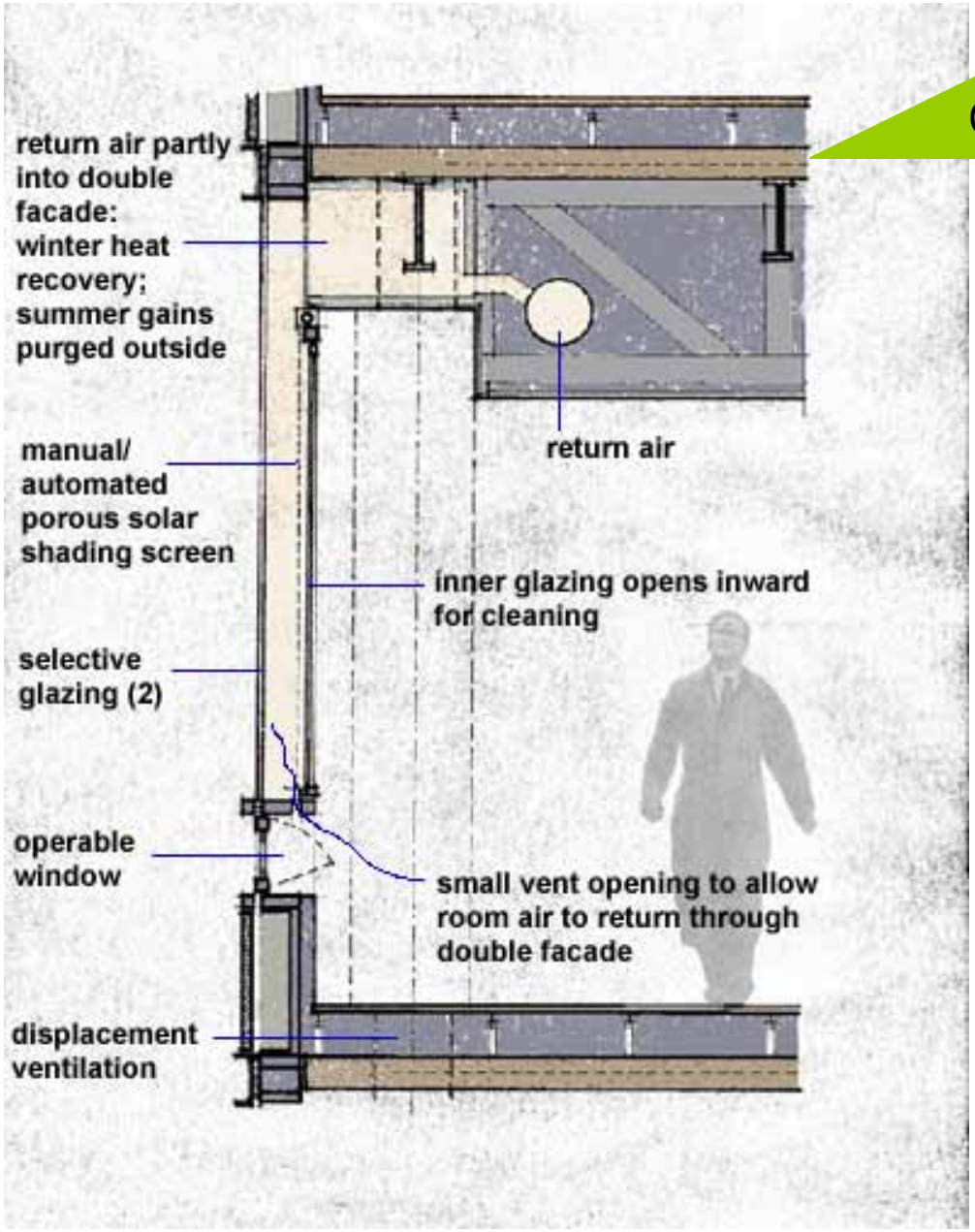


Image: Rufina Wu

TOHU

2004
Montreal, Quebec
Scheme consultants, Jacques Plant
Architect and Jodoin Lamarre Pratte

LEED Gold

TOHU

Image: Rufina Wu

TOHU

Image: Rufina Wu

TOHU

Stantec Atrium Building

2004
Edmonton, Alberta
Stantec Architecture

LEED Silver

Stantec Atrium

Stantec Atrium

Stantec Atrium

CCBR, UofT

2005

Toronto, Ontario

Benish Benish and Architects Alliance

CCBR UofT

CCBR UofT

Stratus Winery

2006

Niagara-on-the-Lake, Ontario

Les Andrew Architect

LEED Silver

Stratus Winery

Stratus Winery

Boake :: University of Waterloo :: March 2008

Stratus Winery

Stratus Winery

EMS Fleet Centre

2004
Cambridge, Ontario
Sather McCallum Architects

LEED Silver

EMS

Image: Renping Wang

Image: Renping Wang

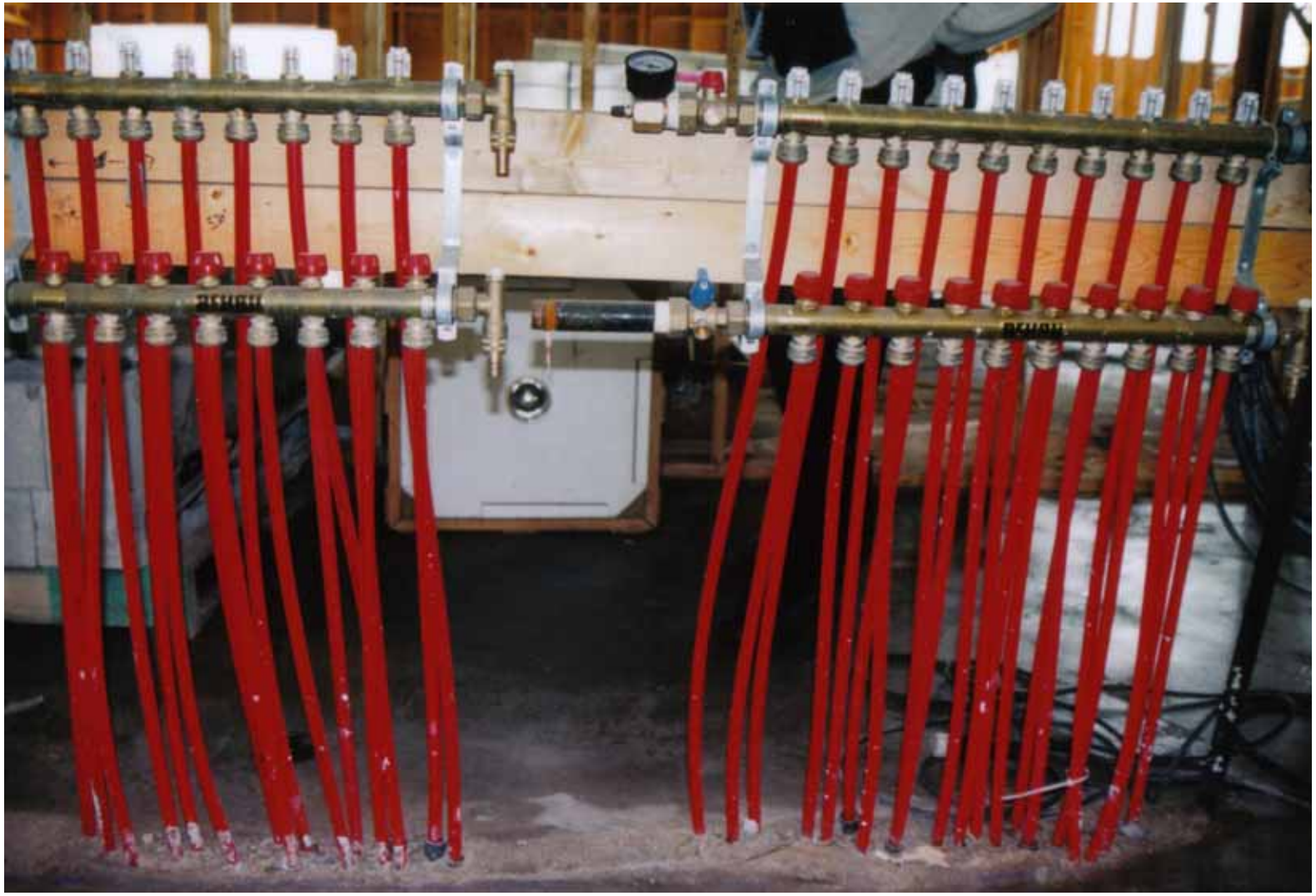


Image: Renping Wang

Cambridge City Hall

2007

Cambridge, Ontario

Diamond and Schmitt Architects

Cambridge City Hall

Cambridge City Hall

Cambridge City Hall

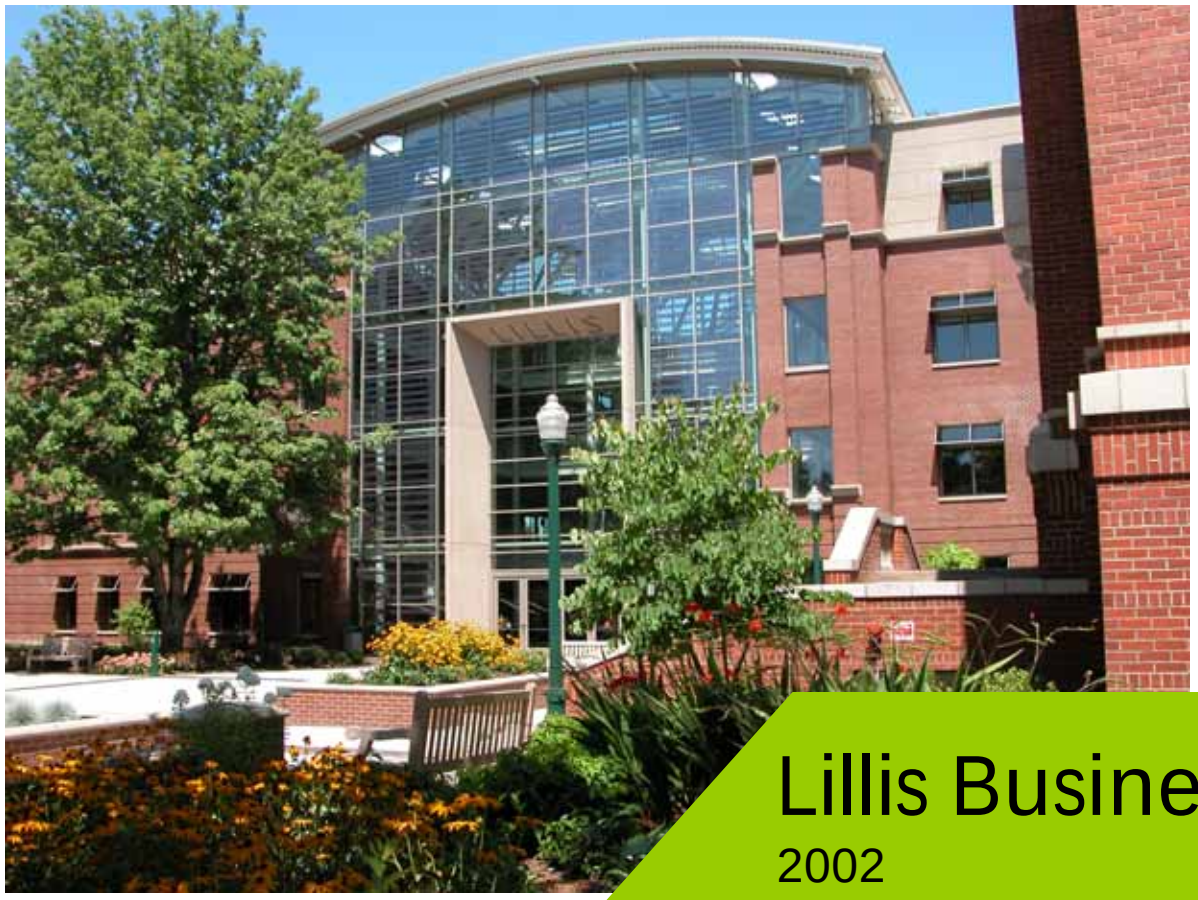
Cambridge City Hall

The atrium provides daylight to the entire interior core of the building and also houses a “breathing wall”.

Cambridge City Hall

United States

Green Buildings



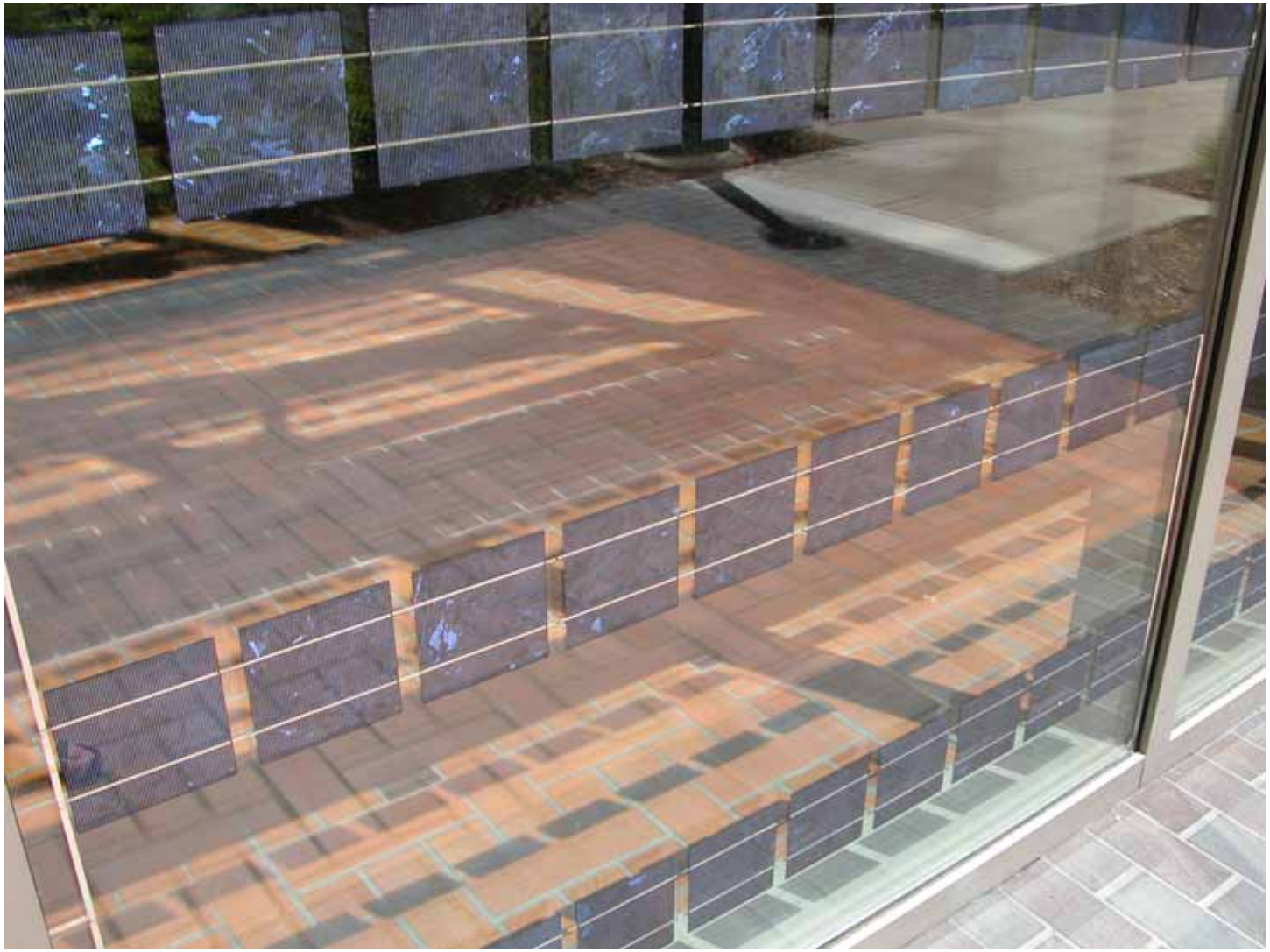
Lillis Business School

2002
Eugene, Oregon
Architects

Lillis Business School

Lillis Business School

Lillis Business School



Lillis Business School

Lillis Business School

Seattle City Hall

2005
Seattle, Washington
Bassetti Architects/Bohlin
Cywinski Jackson

LEED Gold

Seattle City Hall

Seattle City Hall

Seattle City Hall

Seattle City Hall

Seattle City Hall

IslandWood Retreat

2005
Seattle, Washington
Mithune Architects

LEED Gold

IslandWood Retreat

Boake :: University of Waterloo :: March 2008

IslandWood Retreat

IslandWood Retreat

IslandWood Retreat

IslandWood Retreat

International

Green Buildings

Greater London Authority

2002
London, England
Foster and Partners

GLA

GLA

GLA

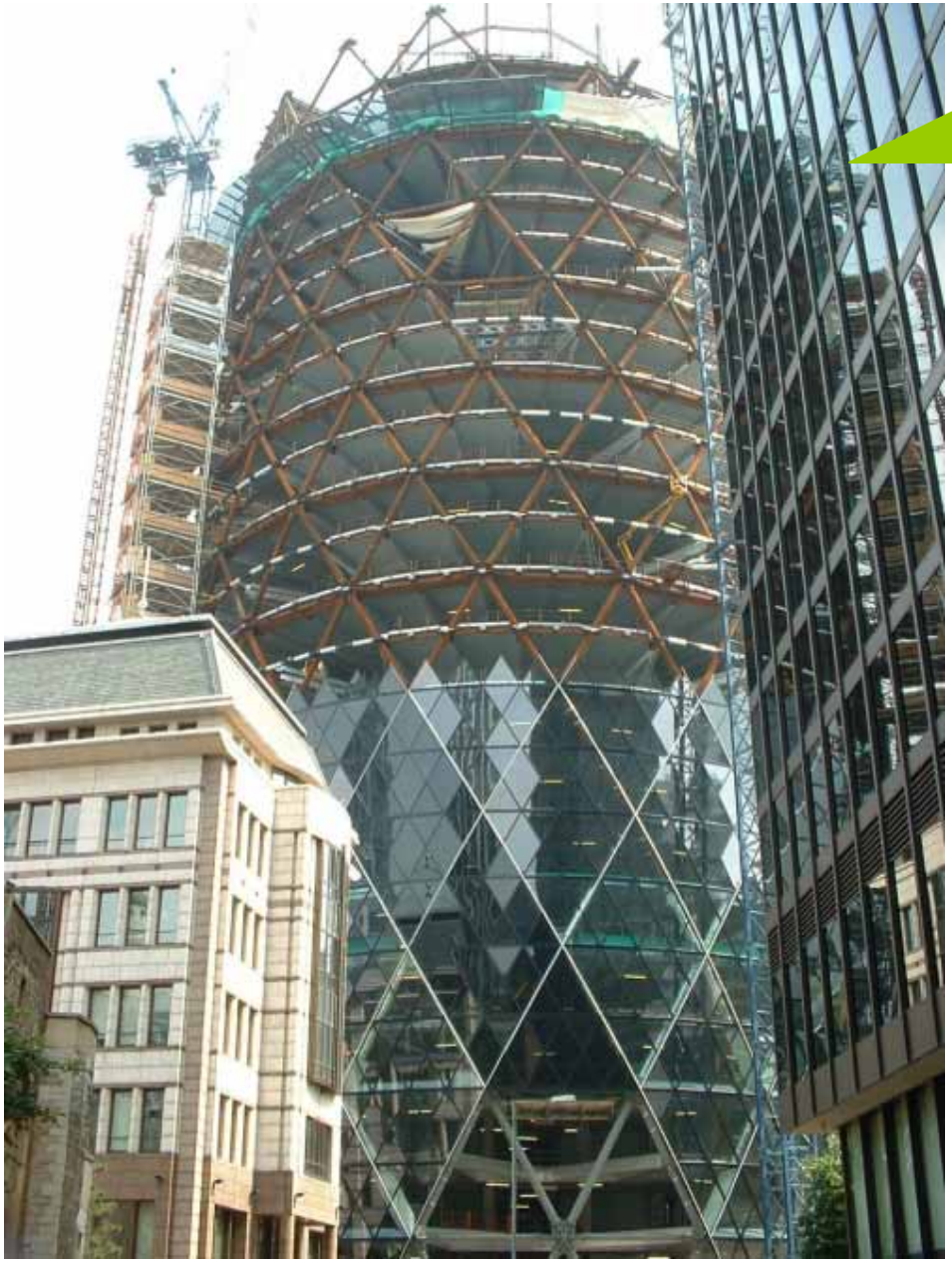
The “Gherkin”

Swiss Re Headquarters
2004
London, England
Foster and Partners

The Gherkin

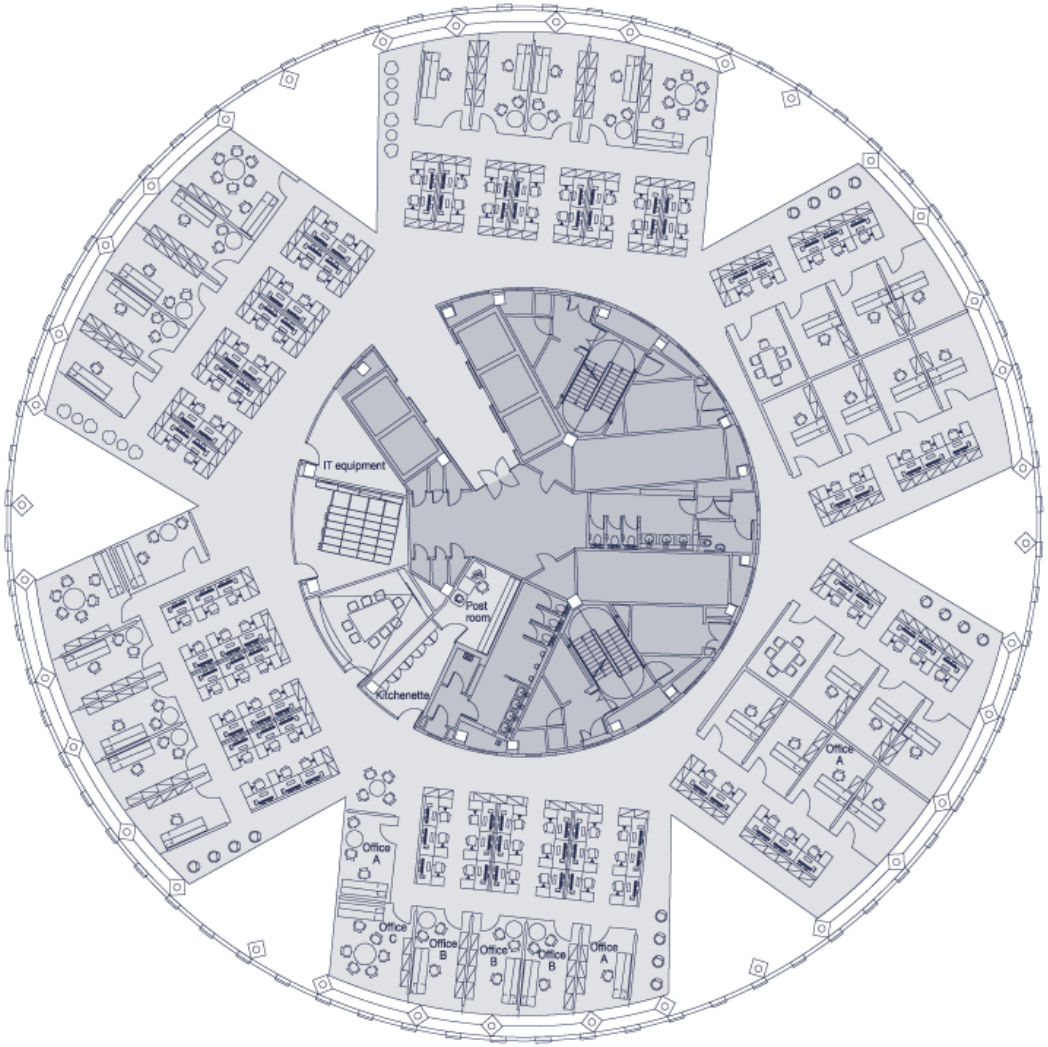
The Gherkin

The Gherkin



The Gherkin

The Gherkin


IT equipment
Post room
Kitchenette
Office A
Office C
Office B
Office B
Office B
Office A
Office A

BedZED

Beddington Zero Energy Development
2002
Hackbridge, England
ZedFactory Architects

BedZED

BedZED

BedZED

BedZED

BedZED

GREEN

Conclusions….

GREEN

is coming along…

But if we are to win the race against Global Warming, we need to pick up the pace.


UofL


CANMORE
CIVIC CENTRE
CANMORE MUSEUM
GEOSCIENCE CENTRE

「無後為大」－ 孔子

"Future generation is the most important" --- Confucius.

"Treat the Earth well. It was not given to you by your parents. It was loaned to you by your children." --- Kenyan Proverb.

"It's not easy being green." -- Kermit the Frog, 1972.