

Net-Zero and Carbon Neutral Buildings Now

Presented by: Albert Bicol, P. Eng.
August 1, 2023



Firm's Commitment – NZE as Norm

We are in full support with the World Building Council and United Nations that all buildings/developments need to be Net-Zero Energy (NZE) to stop the 2-degree temperature rise of our planet.

- If hired as a mechanical engineering consultant, we provide an NZE design including complex building/energy modelling on all our projects for the client's consideration at no extra fees.
- If at any reason this design is not accepted, we will design to their requirements (no extra charge and no risk).

We feel our responsibility is to at least show our clients the NZE design and give them free choice to decide with no commitment or risk to them.

Definitions

Net-Zero Energy:

A building with zero net energy consumption, meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site.

Carbon Neutral:

Achieving net zero carbon emissions by balancing a measured amount of carbon released with an equivalent amount sequestered or offset, or buying enough carbon credits to make up the difference.

Net-Zero Ready:

Basically Net-Zero Energy buildings without renewable energy.

Why Net-Zero?

Professional Responsibility



WORLD
GREEN
BUILDING
COUNCIL



“All buildings must be net zero by 2050 to avert 2°C rise”

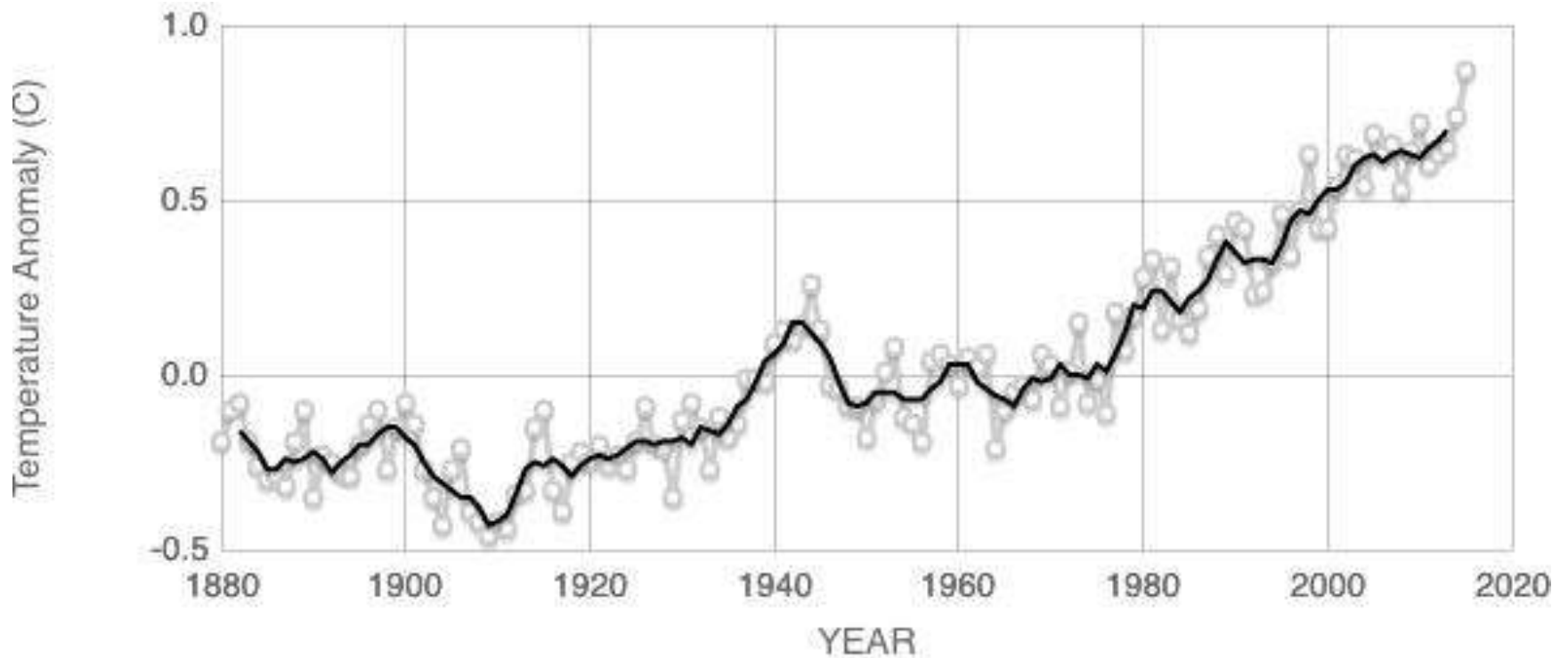
- New by 2030
- Existing by 2050

Personal Responsibility



“Sustainability is not an option. Our actions today effect the lives of the future.”
– Alberto Bicol

Global Temperatures



Source: climate.nasa.gov

The Bad News



Carbon dioxide has Jumped to the Highest Level in Human History:

Canada Warming at Twice the Global Rate:

One Million Species Face Extinction, U.N. Panel Says:

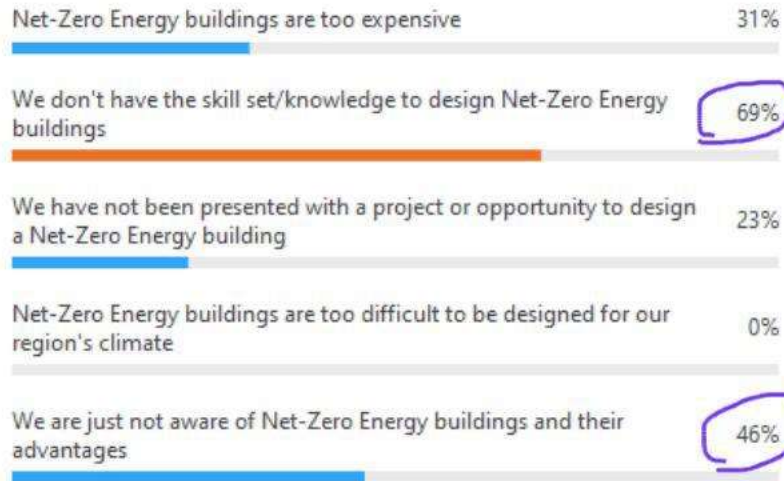
**"The world will not be destroyed by those who do evil,
but by those who watch them without doing anything." -
Albert Einstein.**



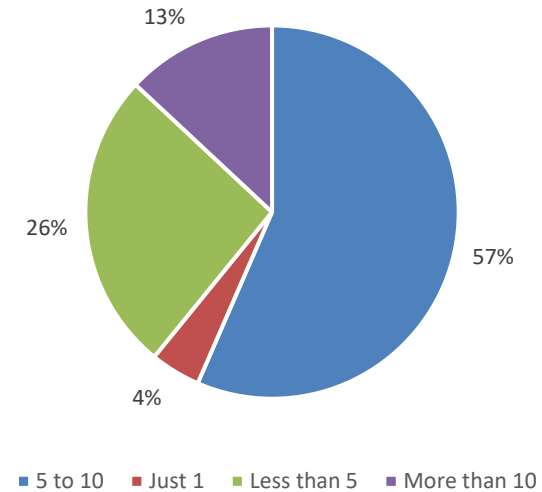
“We already have solutions to stop climate change – STOP EMISSIONS”

Poll Results

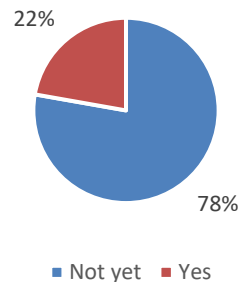
1. Why do you think Net-Zero or Carbon Neutral buildings are not typically being design or built today? (Multiple choice)



How many Net-Zero Energy buildings /developments are you aware of?

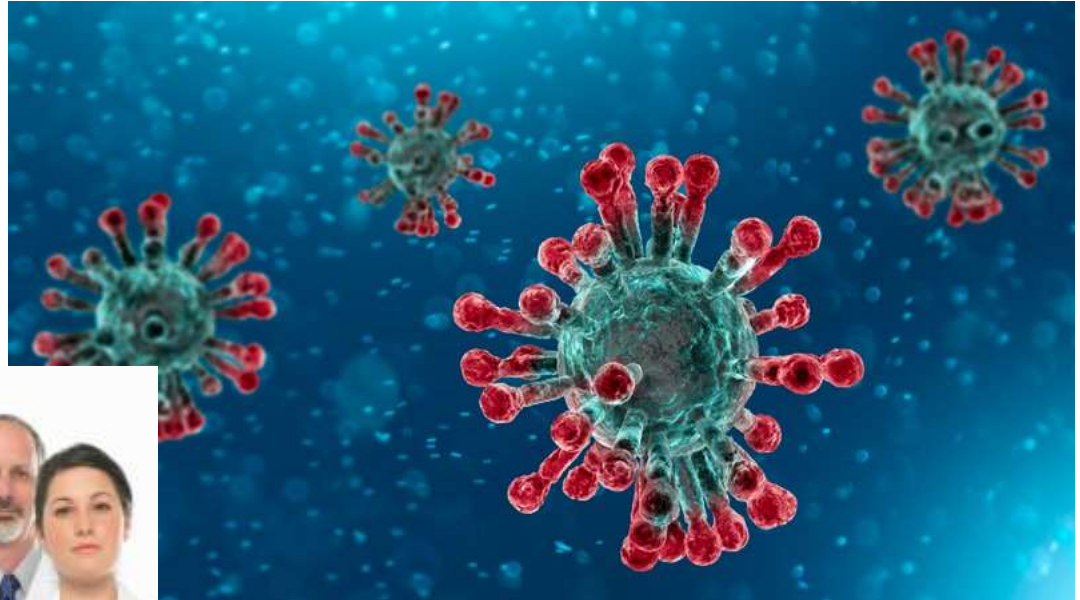


Have you been part of a Net-Zero Energy building/development project?



Why is NZE not the Norm Presently?

Coronavirus Cases:
XXX Million+
Deaths:
X.XX Million+



800 million people: Eleven percent of the world's population is currently vulnerable to climate change impacts such as droughts, floods, heat waves, extreme weather events and sea-level rise.

150,000 deaths per year.

Million of Species: Extinct due to climate change

Energy Codes

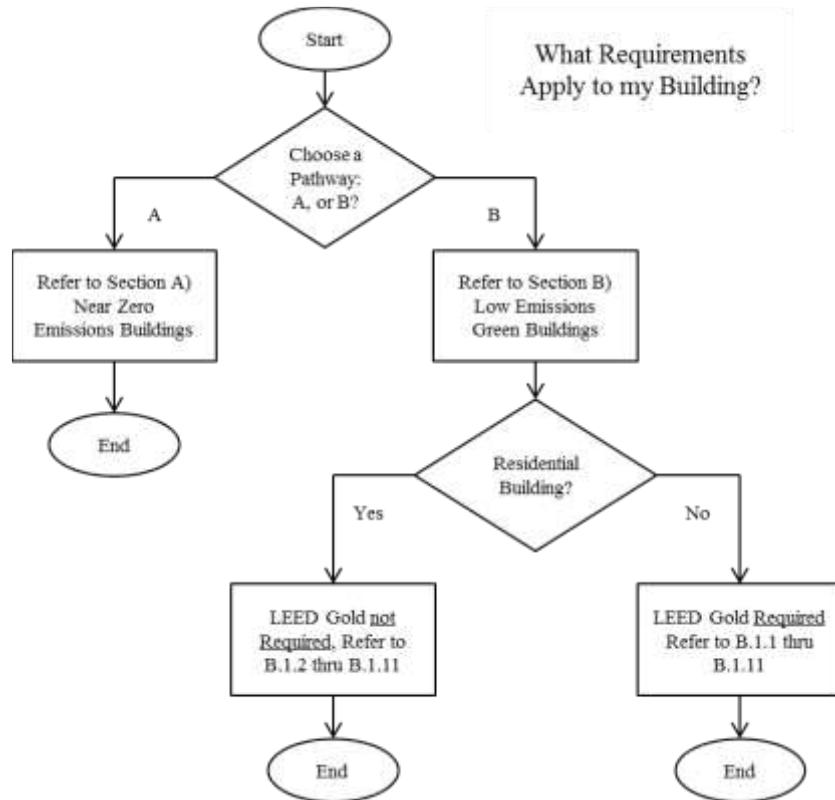


Table B.1.2a: Performance Limits - Buildings Not Connected to a City-Recognized Low Carbon Energy System

Building Type	TEUI (kWh/m ²)	TEDI (kWh/m ²)	GHGI (kgCO ₂ /m ²)
Residential Low-Rise (< 7 storeys)	100	15	5
Residential High-Rise (7+ storeys)	120	32	6
Office	100	27	3
Retail	170	21	3
Hotel	170	25	8
All Other Buildings	EUI 35% below 90.1-2010		

Table B.1.2b: Performance Limits - Buildings Connected to a City-recognized Low Carbon Energy System

Building Type	TEUI (kWh/m ²)	TEDI (kWh/m ²)	GHGI (kgCO ₂ /m ²)
Residential Low-Rise (< 7 storeys)	110	25	5
Residential High-Rise (7+ storeys)	130	40	6
Office	110	27	3
Retail	170	21	3
Hotel	210	25	8
All Other Buildings	EUI 35% below 90.1-2010		

TEUI: Total Energy Use Intensity
 TEDI: Thermal Energy Demand Intensity
 GHGI: Greenhouse Gas Intensity"



Net-ZERO Approach – Now, NOT Future

Recognize – (Don't assume, look at what you have)

Reduce

Remember (Mother Nature)

Resourceful (Innovation)

Recycle/**R**eclaim

Renewable (**R**eady for Renewable)

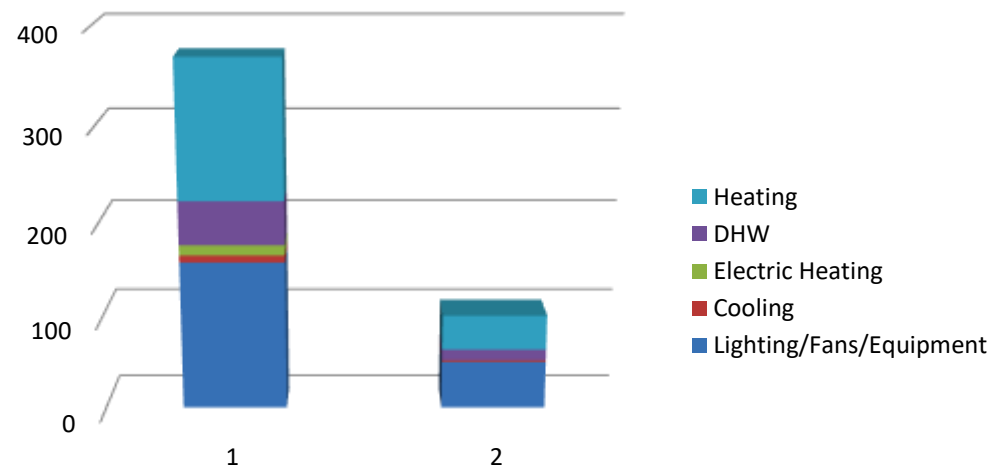
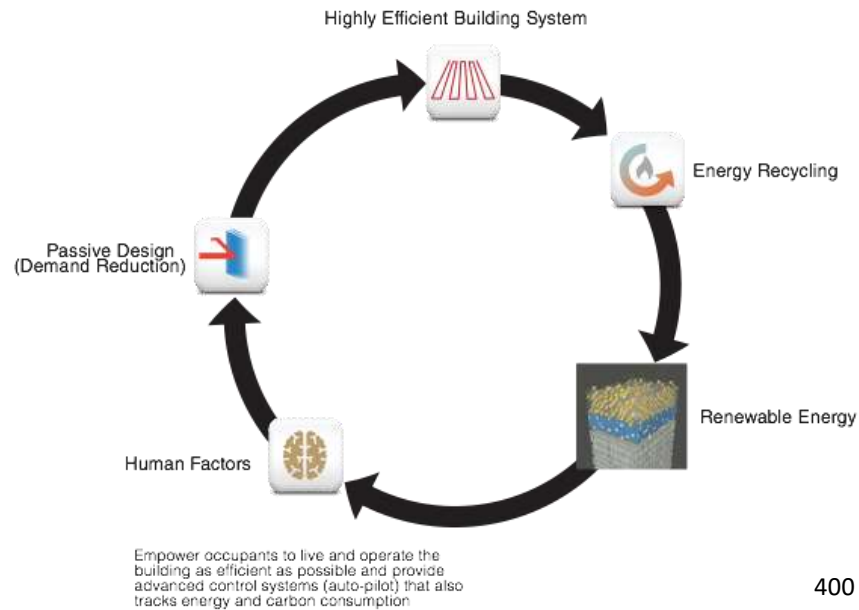
Regenerate

Real Value (Not just Costs)

“If you want to be where you never been, you have to do what you have never done”

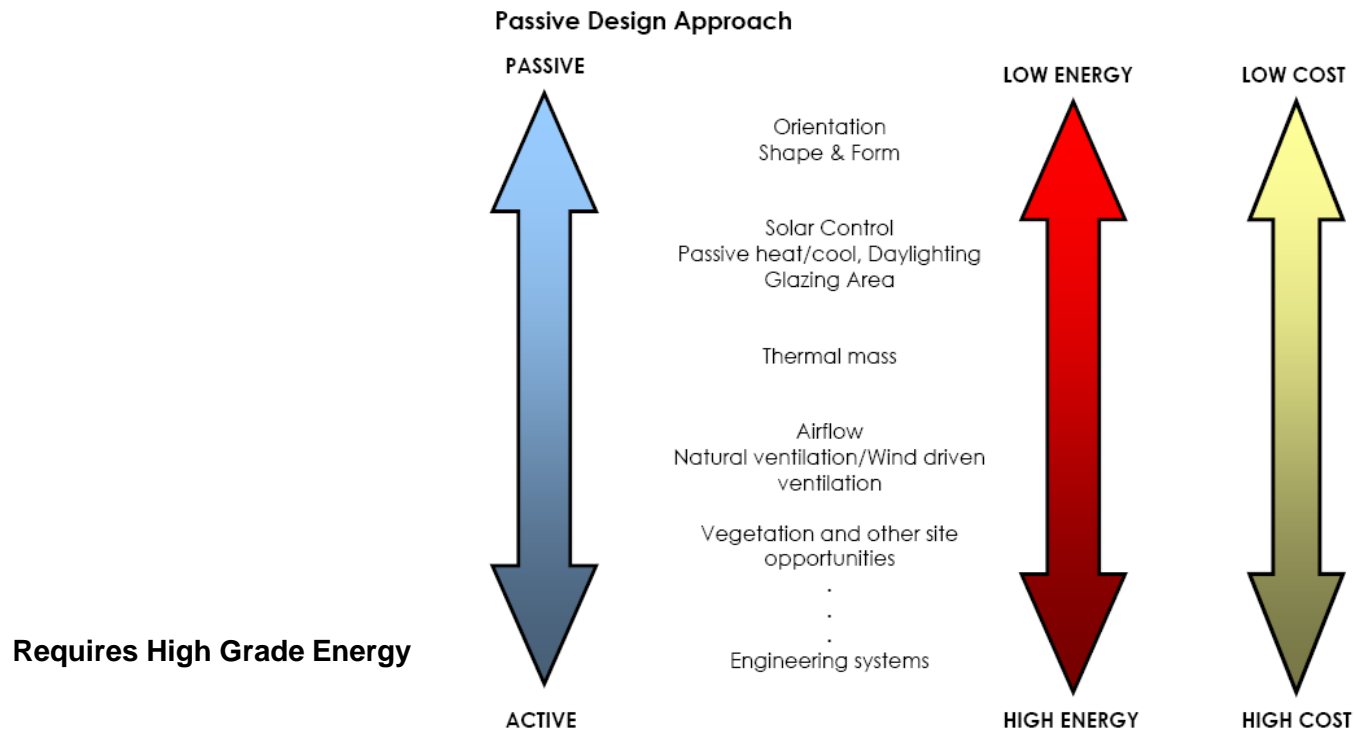
Demand Reduction

Net-Zero Approach



Reduce Demand: Passive vs. Active

High Comfort Level



Goals:

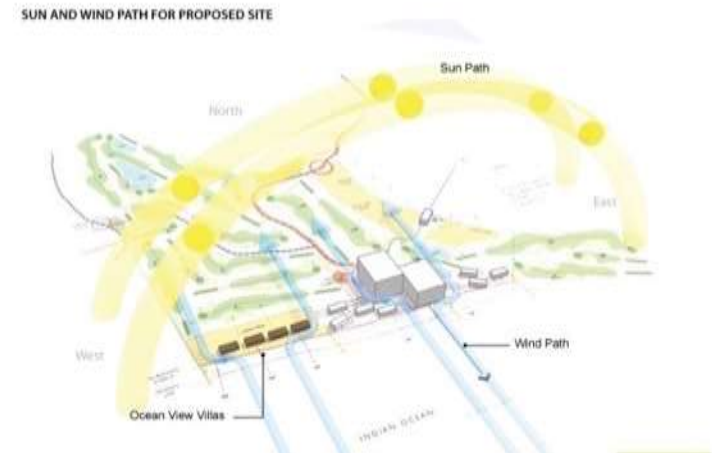
- Human well being
 - Comfort
 - Daylighting
 - Noise
 - Indoor air quality
- Energy

Proactive vs. Reactive

City of Vancouver Passive Design Best Practice Guide

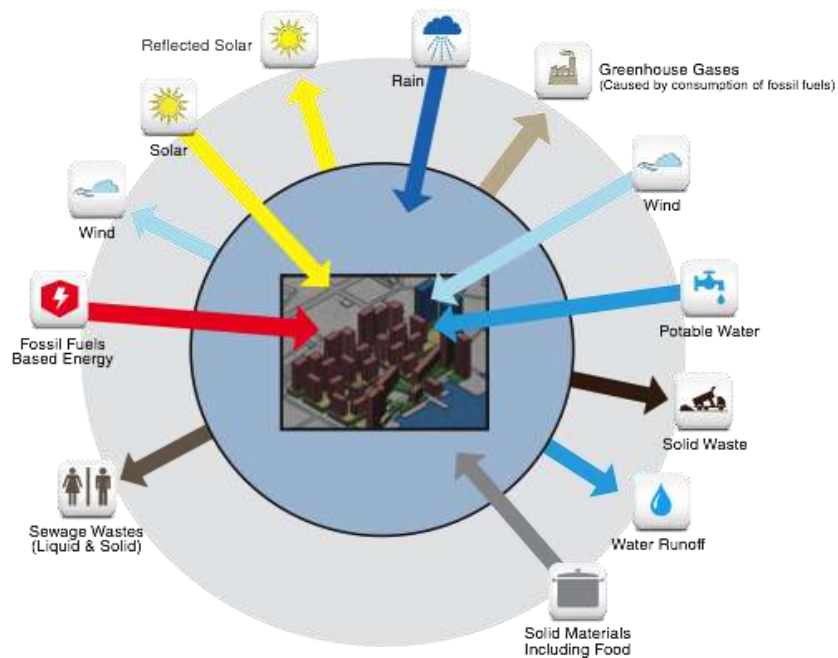
Common Features of Net-Zero/Carbon Neutral Buildings

- Integrated Design
- Passive Design First
- Natural Ventilation
- Thermal Mass / Radiant Sy:
- Utilize Local Heat Sources / Sinks: to reduce heating / cooling loads (i.e. sea water, data centres) – Recycle Energy
- On-Site Energy Generation
- Inspired/Determined Team
- Fully Electric (Location Specific)

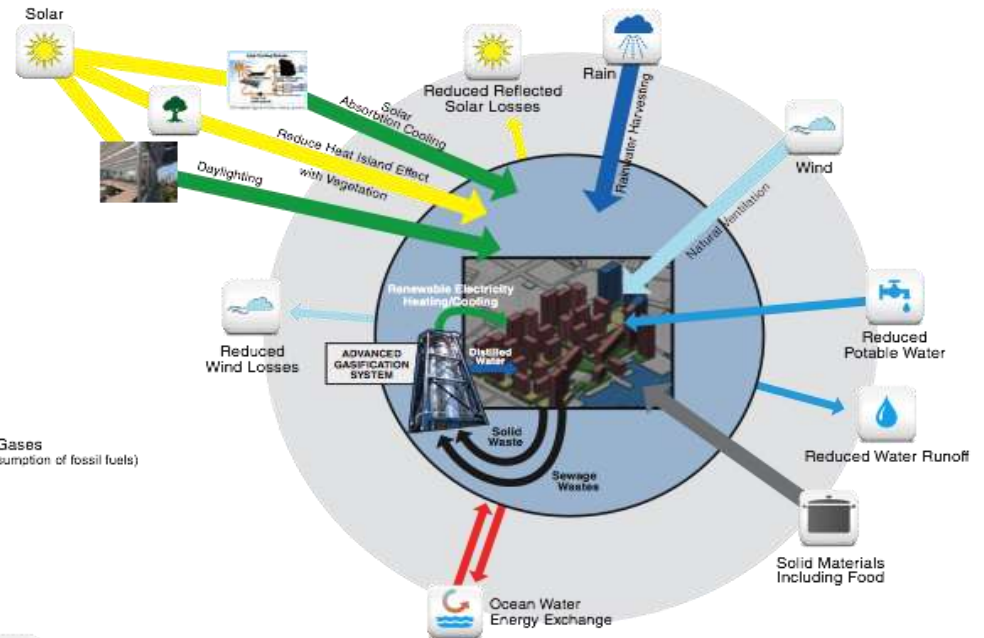


Closed Systems

TRADITIONAL DEVELOPMENT RESOURCE BALANCE



CLOSED SYSTEMS
(POSSIBLE CONCEPTS TO NET-ZERO)



Burnaby Community Centre



Project Oshidori – Nagasaki, Japan



HQ Office, Mexico



PACTT Learning Center - Chicago



High-End Resort - USA





A FUTURE-READY COMMUNITY



NZE Resort – Chennai, India



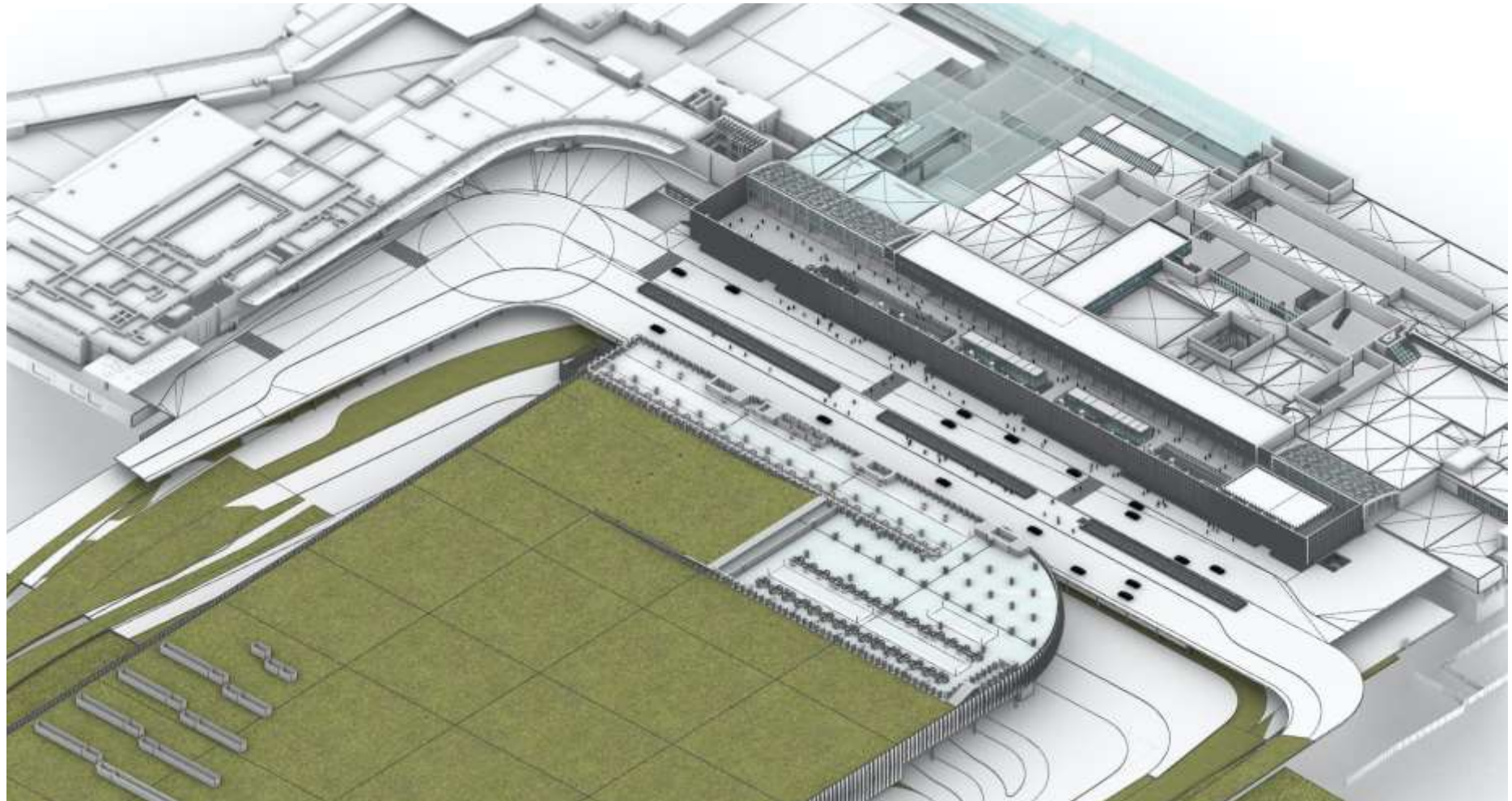
Supreme Court Building, Philippines



Balmoral Housing - Winnipeg



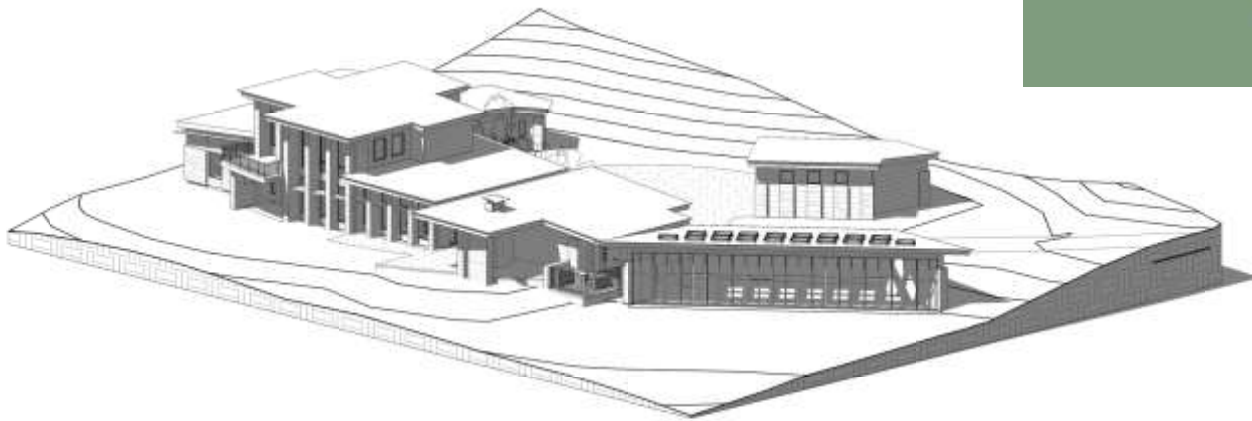
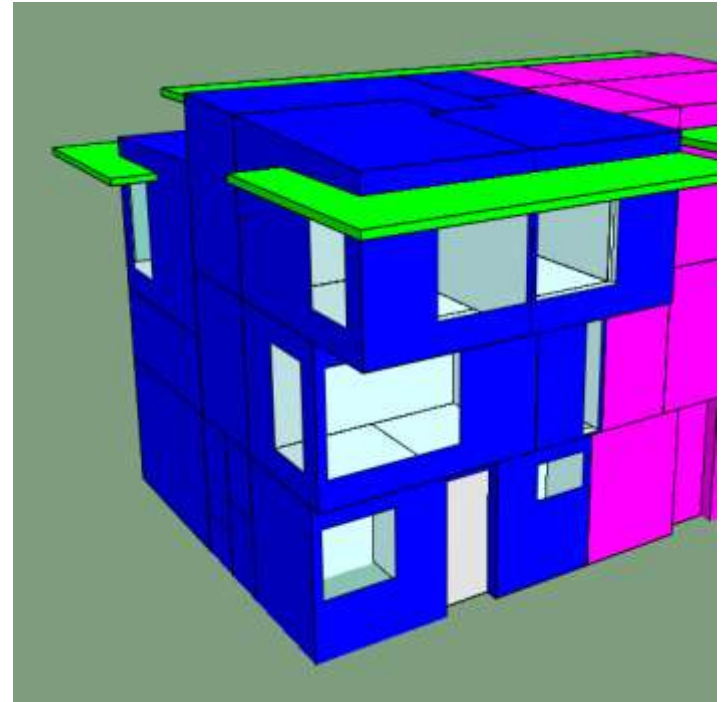
Montreal Airport



Landmark Tower, China

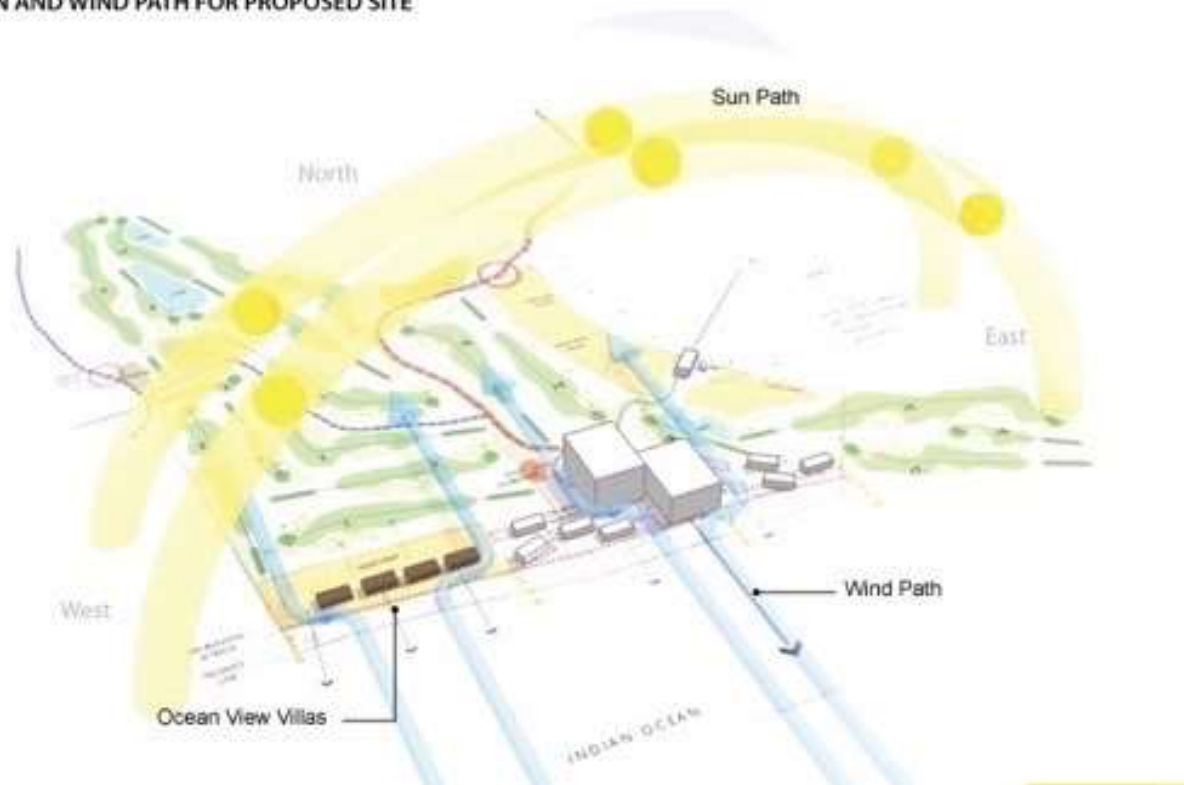


NZE Single Family Homes



Sri Lanka Resort

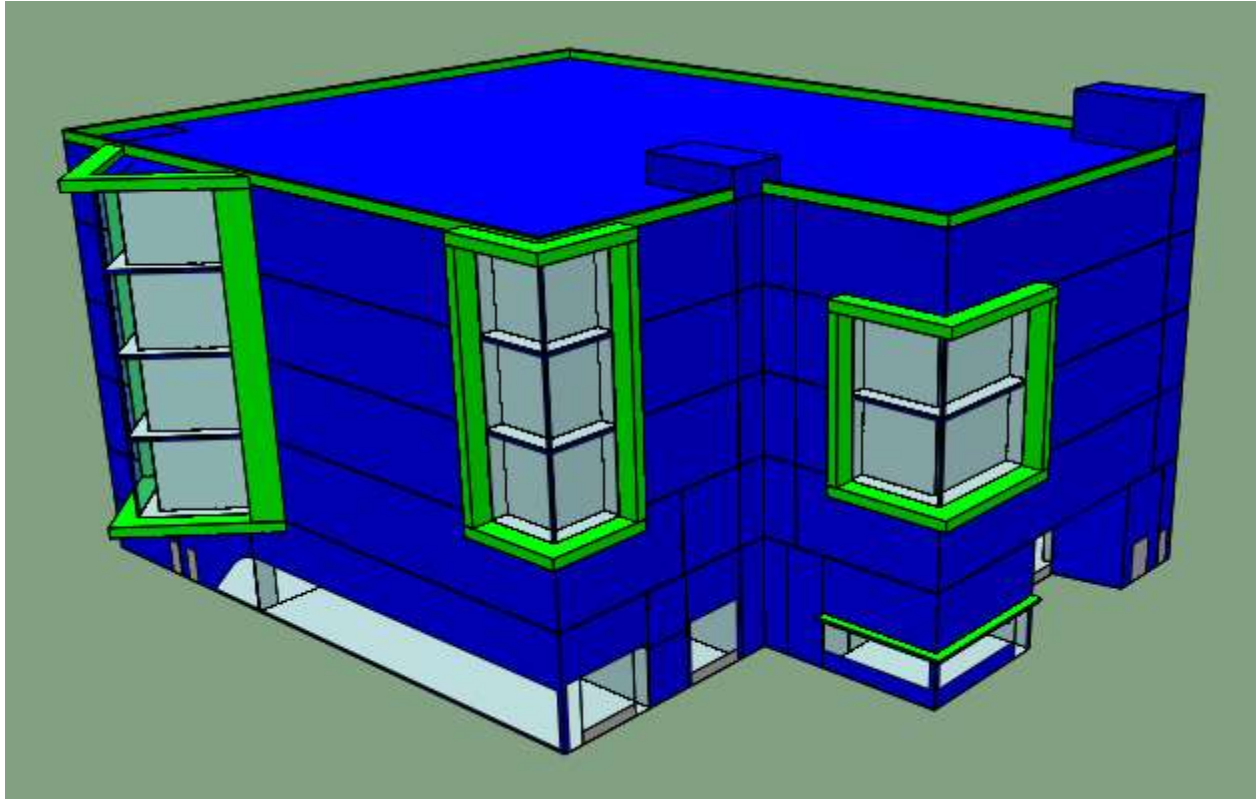
SUN AND WIND PATH FOR PROPOSED SITE



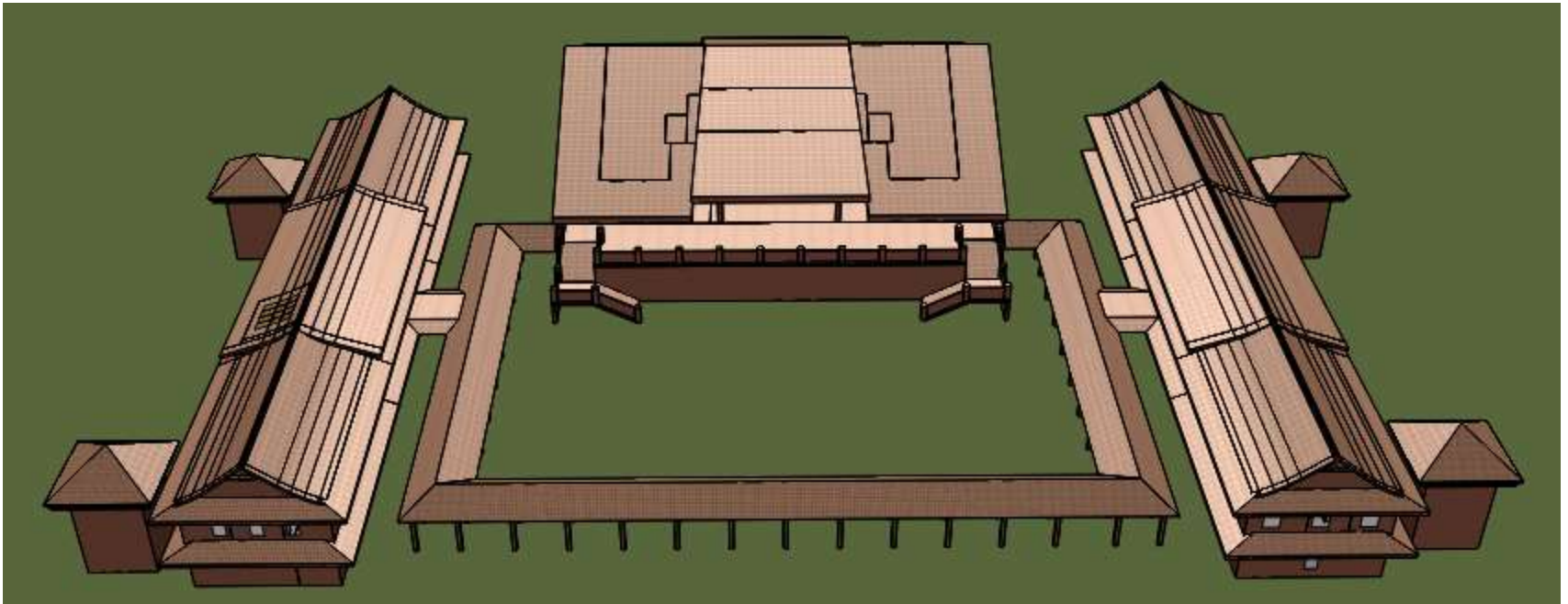
Wildlife Park/Resort - UAE



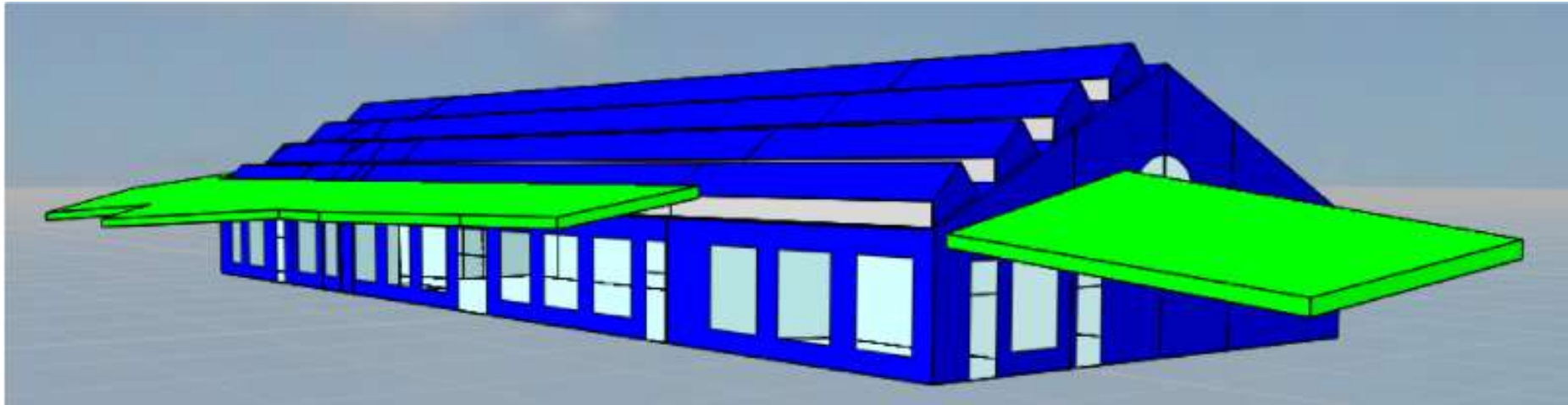
Nationwide Storage and Carwash



Pho Lam Temple



Northern Ontario Community Centre



Saint Andre Bessette Church - Toronto, ON



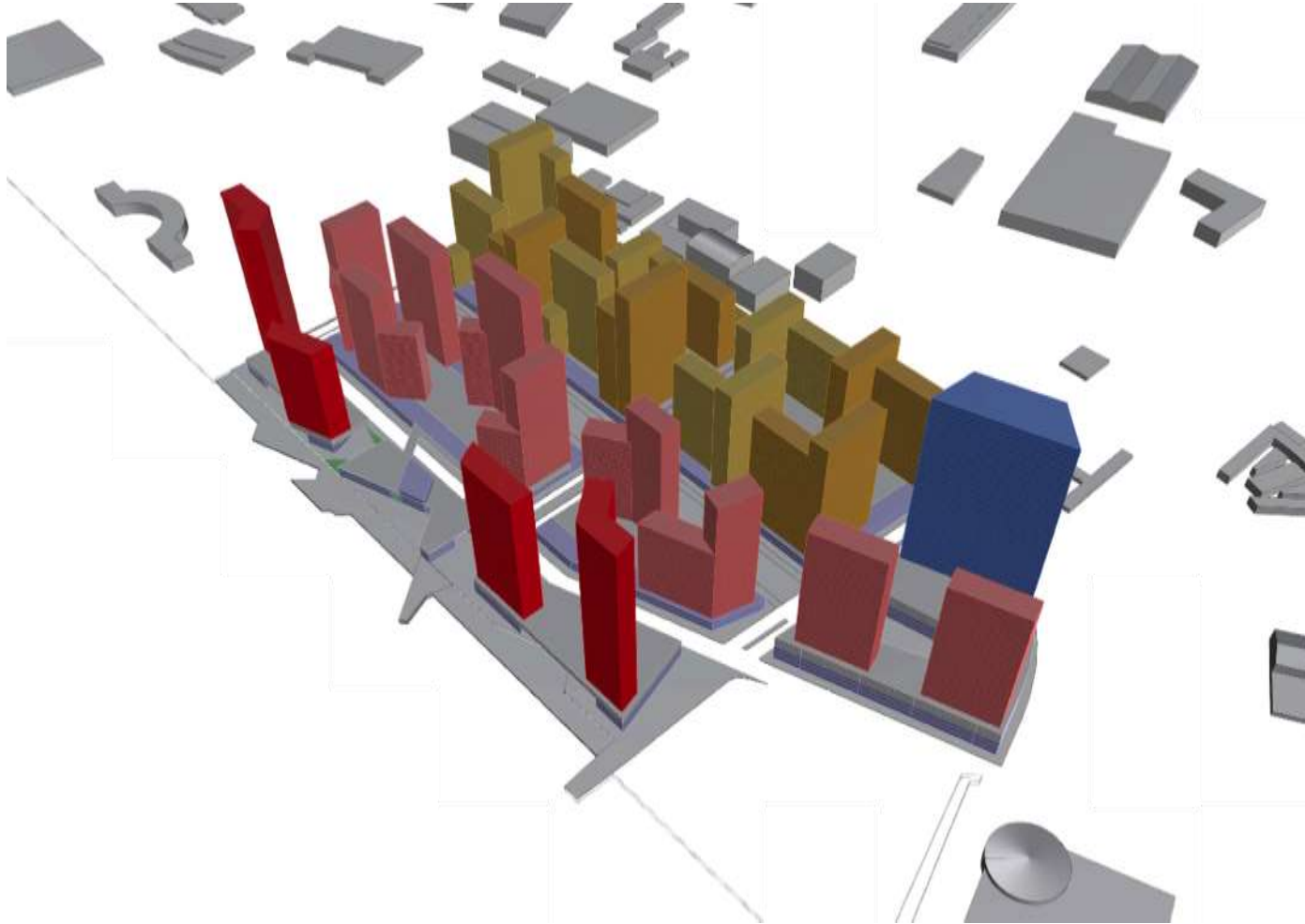
2010 Olympic Village NZ Building - Vancouver, BC



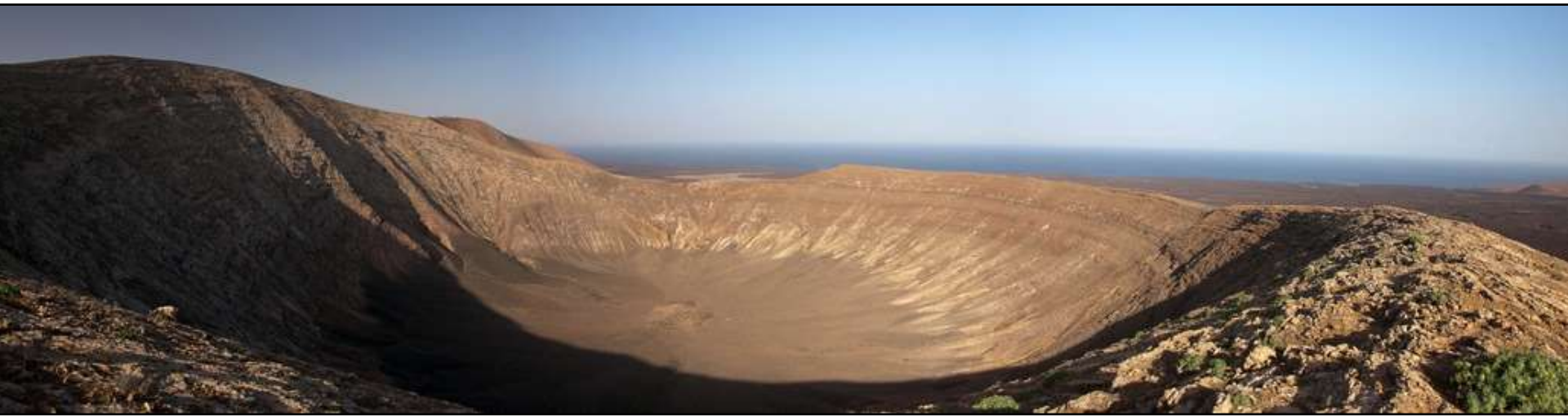
George St. Long Term Care - Canada



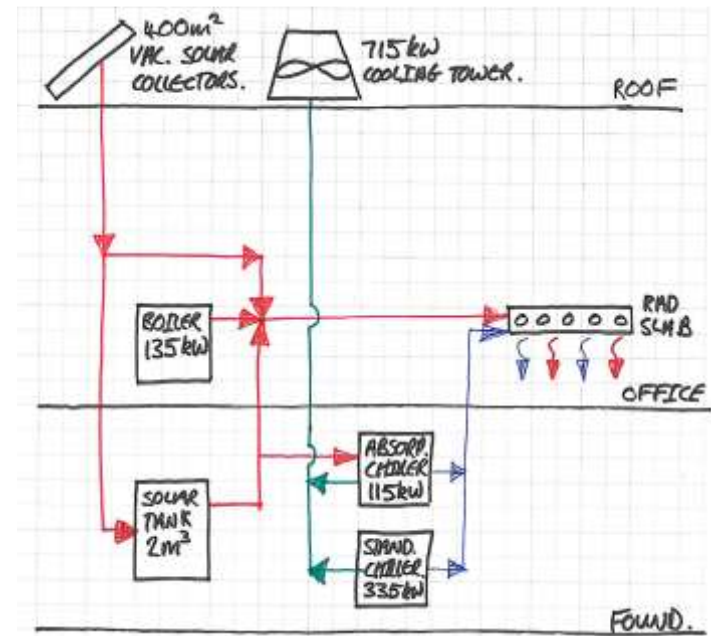
Mandani Bay - Philippines



Nali Nature Observatory Lodge, Canary Islands



Office Building - LA

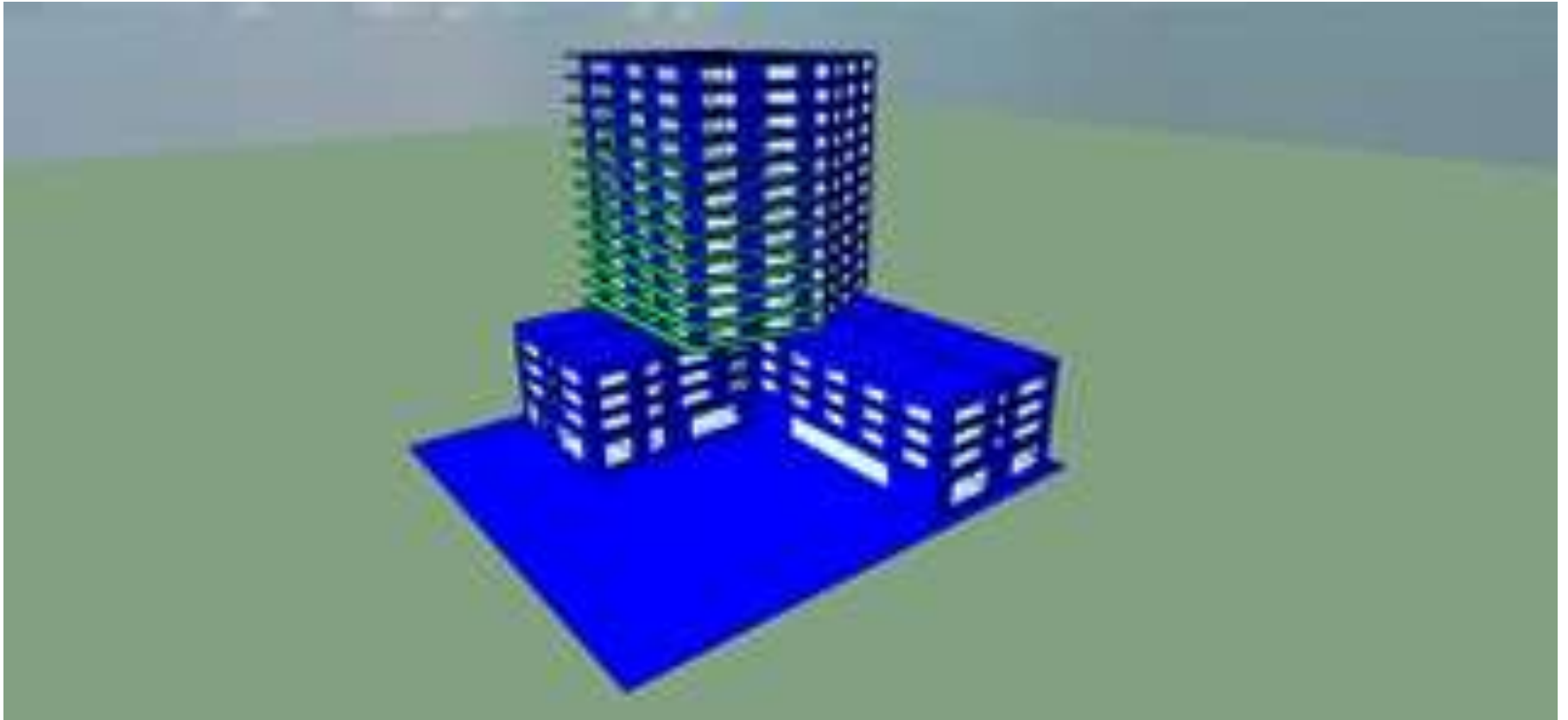


South Capital Campus – State of NM



Images Courtesy of Integral Group

Retirement Facility

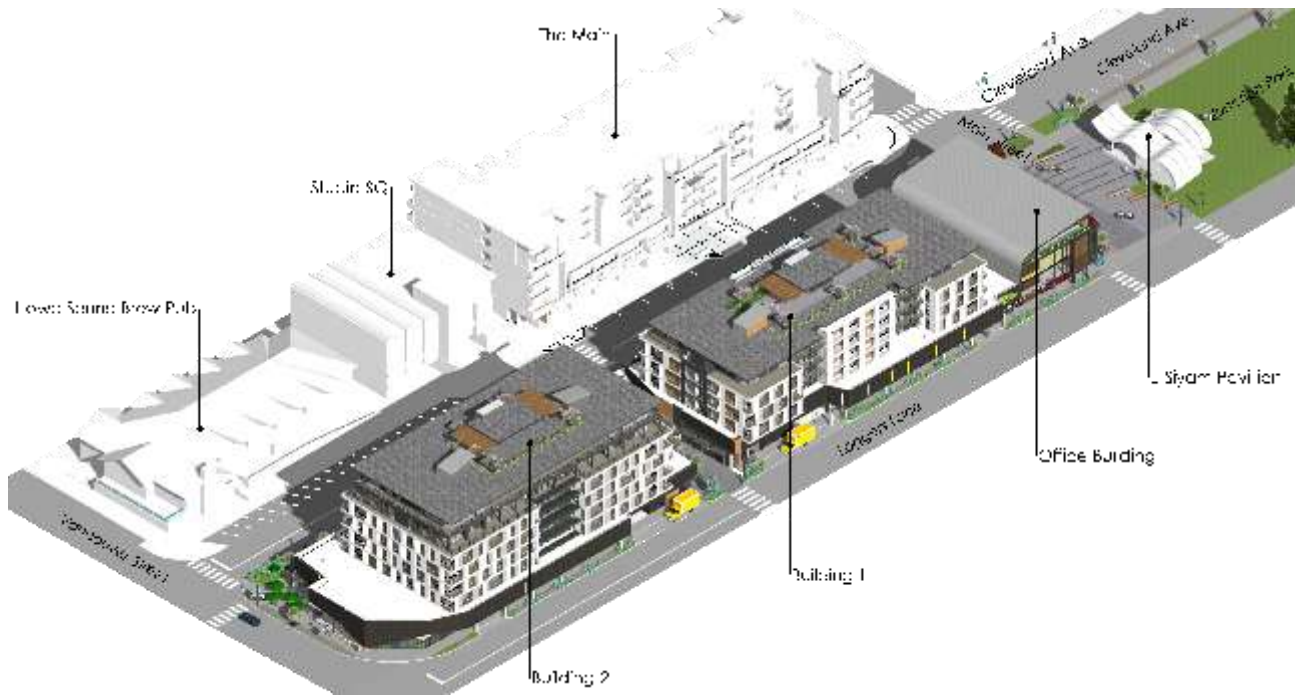


Carbon Neutral Example - Rental



- Demand Reduction/Passive Design
- Electrify
- ONLY 7% Solar Panels (approx. \$100K CND)
- = Carbon Neutral

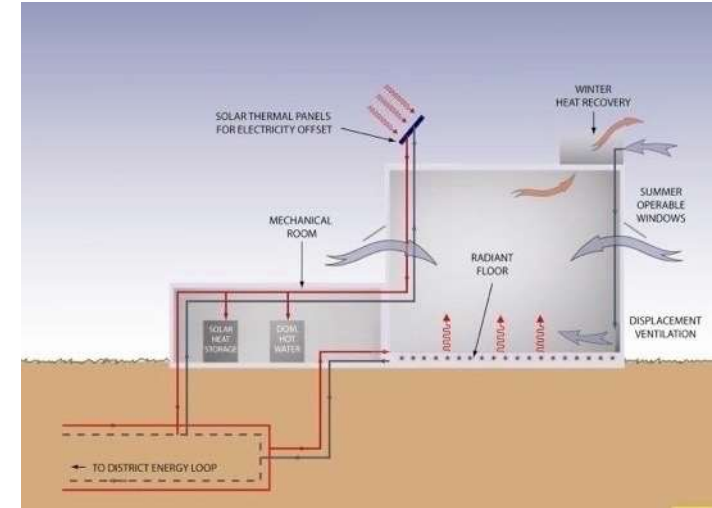
Carbon Neutral Example - Rental



- Demand Reduction/Passive Design
- Electrify
- ONLY 7% Solar Panels (approx. \$200K CND)
- = Carbon Neutral

SFU Daycare – NZ Buildings Economical

Living Buildings



Images Courtesy of Integral Group

"If you want to be where you never been, you have to do what you have never done"

UniverCity Childcare Centre Costs and Comparisons

Basic Statistics and Building Information

Site	21,625 sf
Site Coverage	4,844 sf
Total Building	5,950 sf
Outdoor Play	13,695 sf

Space Beyond Licensing Req's. (Community Room & Mezz.)	1,700 sf
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Child Spaces	50
Staff	9

Cost	Price/sf	Price/child
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Hard Construction Costs Only

Total Cost (incl. outdoor play)	\$3.22M	\$544/sf	\$64,400
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Full Turn-Key Costs incl. design, soft costs, permits, fit-out

Total Cost (incl. outdoor play)	\$4.4M	\$739/sf	\$88,000
Building Cost	\$4.1M	\$689/sf	\$82,000

Current Municipal Childcare Construction Rates *

Total Cost	\$5.3M	\$895/sf	\$106,000
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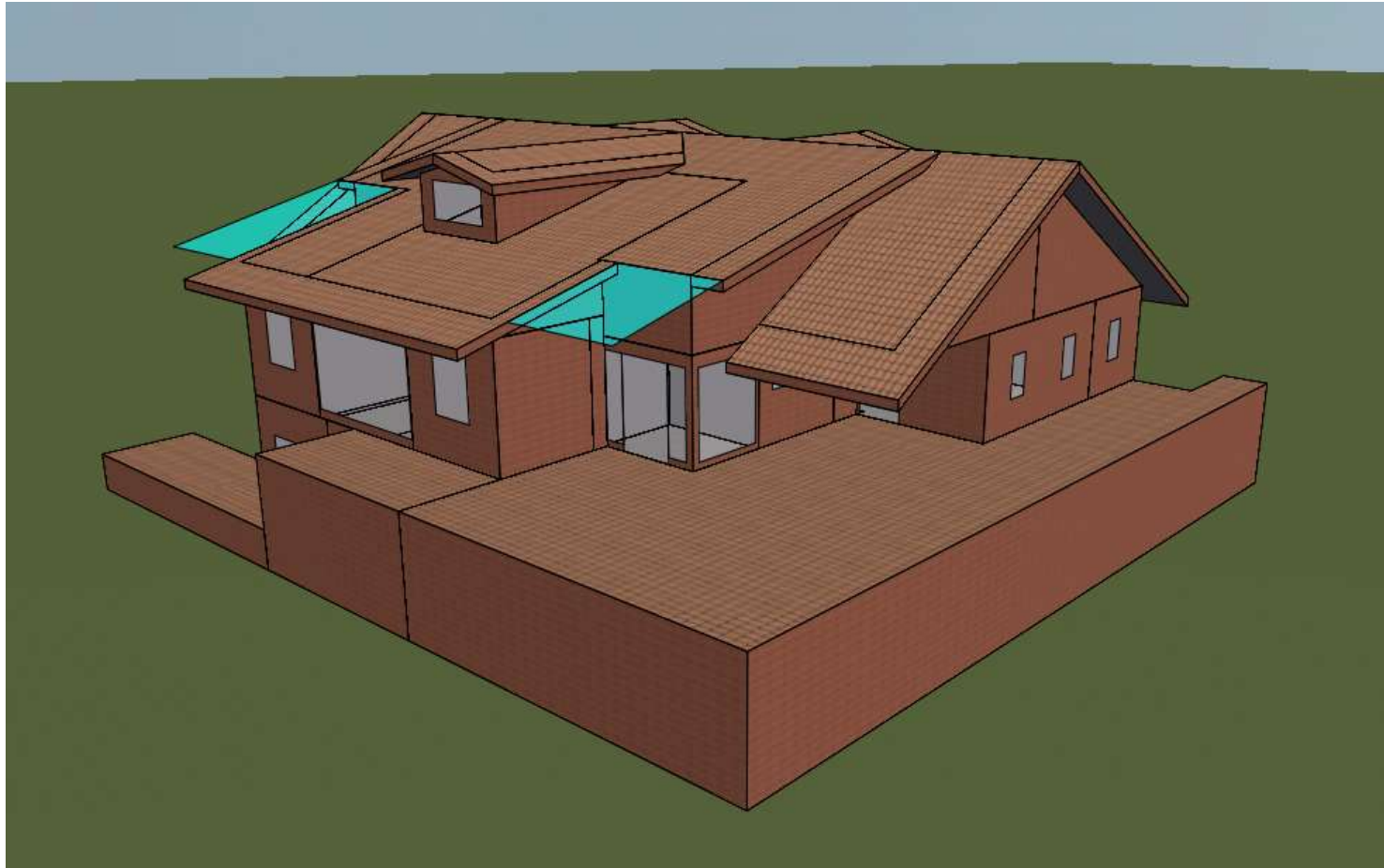
* City of Vancouver Facilities Estimates for provision of childcare (2011)

\$750 - \$900/sf (depending on construction type) + 5% LEED + \$2,500/child fit-out = \$895/sf blende

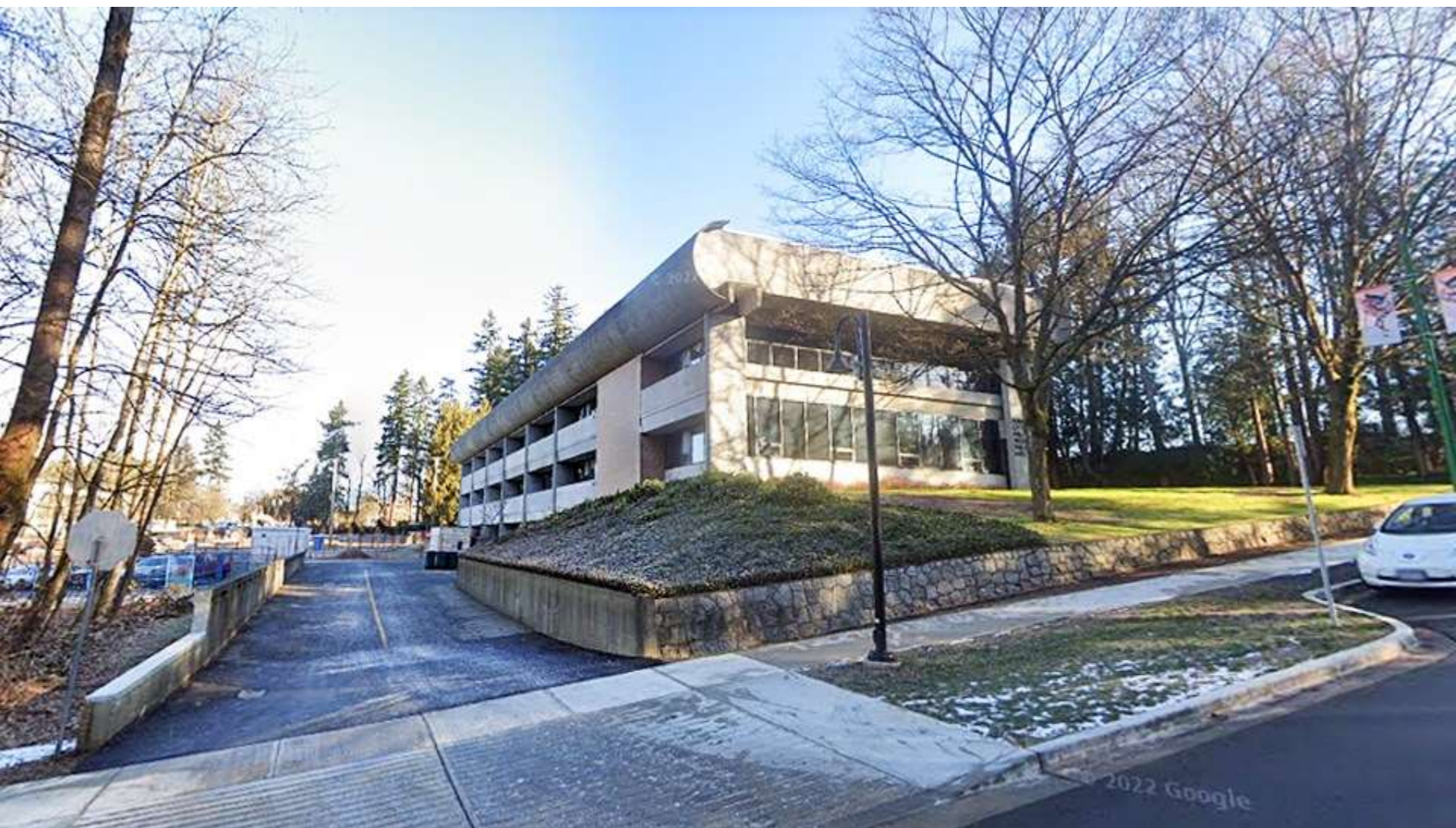
Current Municipal Childcare Delivery Turn-Key Costs

SEFC (as-built)	\$6.5M	\$812/sf + \$2,500/child	\$130,000
EFL (DCL estimate)	\$5.0M	sf not determined	\$100,000

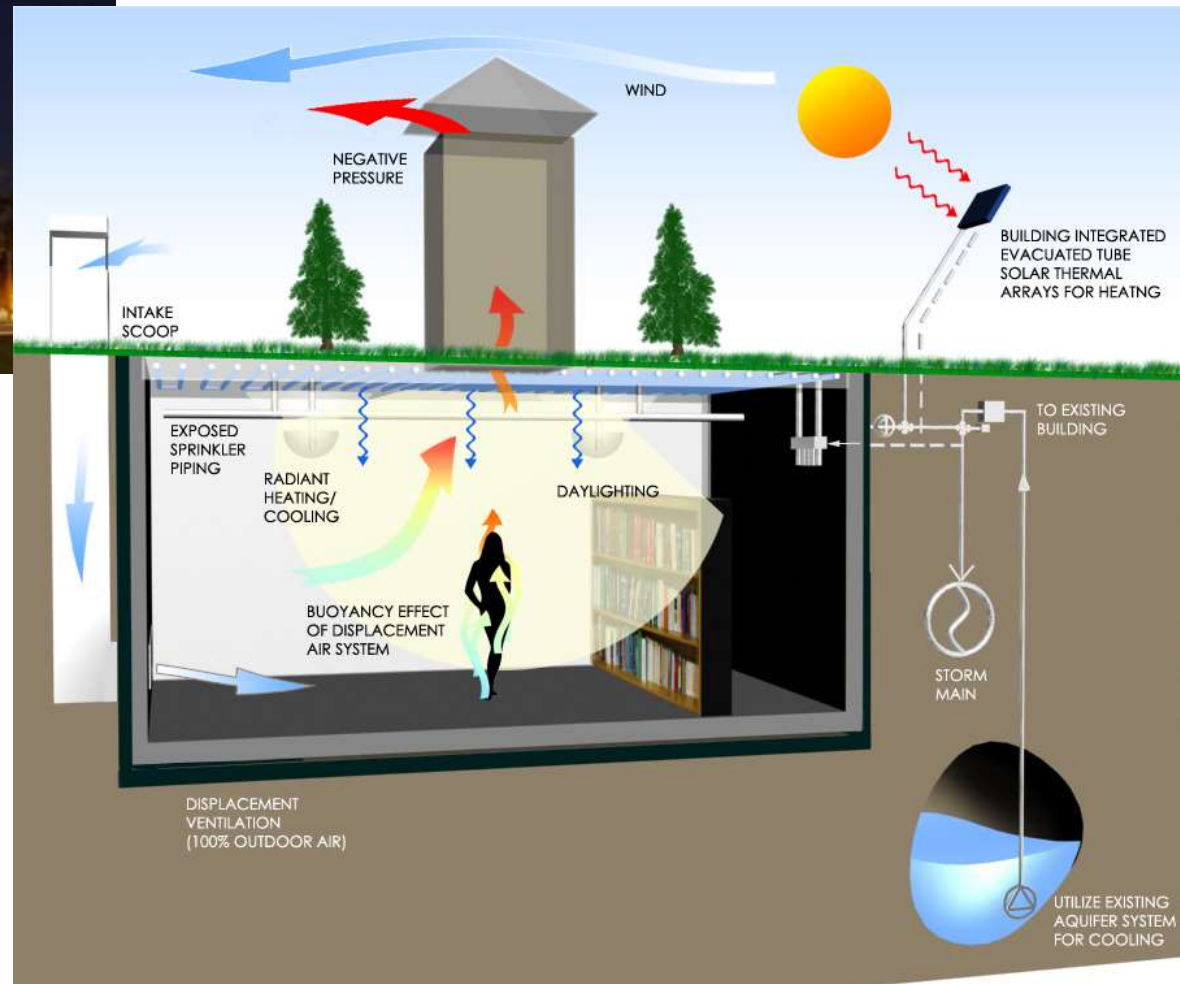
Bowen Island Medical Centre - BC



RCMP Detachment



Regent College Library Expansion



1916 Boren, Seattle



OPTION B - VIEW FROM BOREN

09/15/2017
1916 BOREN



Net-Zero High Rise Office, Canada



FortWhyte, Canada



VanDusen Botanical Garden, Canada



Preliminary Rendering by Busby Perkins+Will

Uvic – Integrated Energy Master Plan

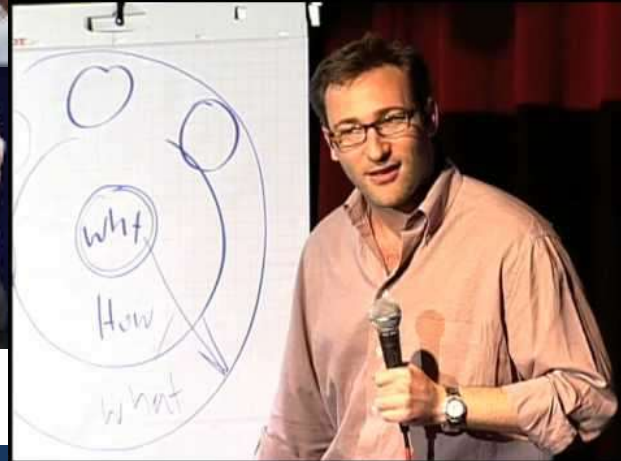


College of the Desert – Palm Springs



Personal/Emotional Attachment Communications/Visionary/Inspiration

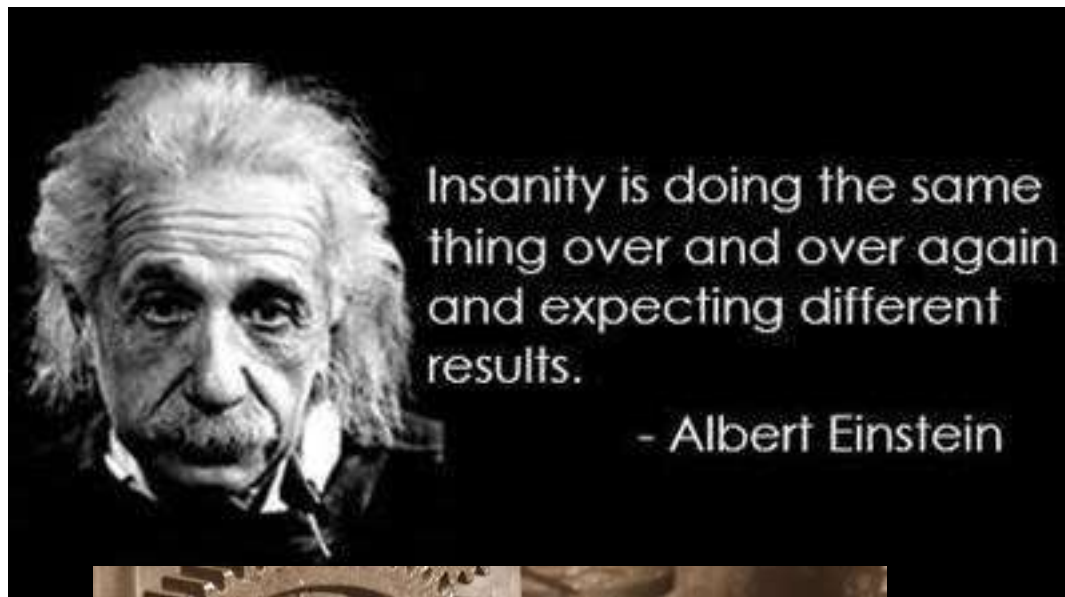
- Enrolment – move, touch and inspire
- Passion
- Articulation
- Who, What and Why



**Cause for
Change
Paradigm Shift**

NZE Can be the Norm....





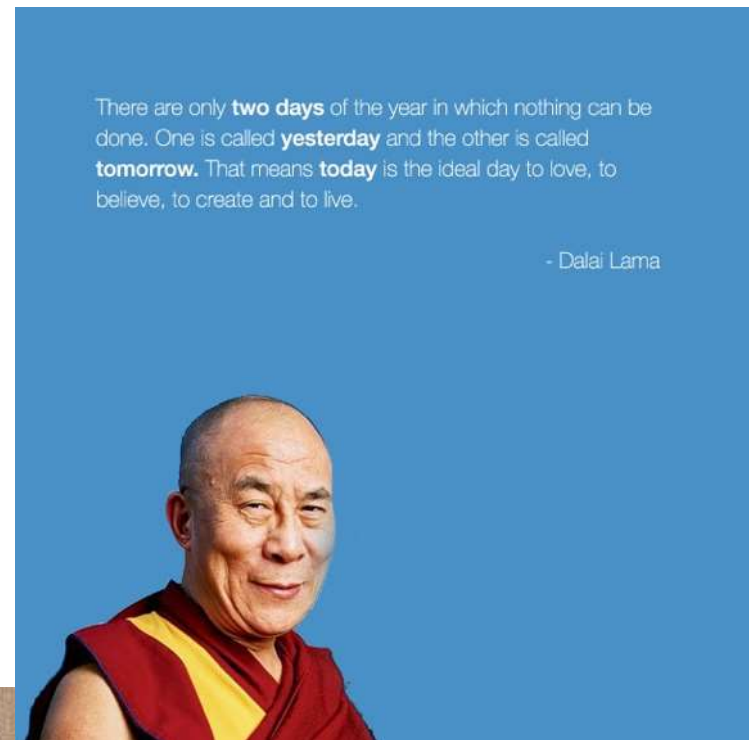
Insanity is doing the same thing over and over again and expecting different results.

- Albert Einstein



"The fewer moving parts, the better.' Exactly. No truer words were ever spoken in the context of engineering."

~Christian Cantrell



There are only **two days** of the year in which nothing can be done. One is called **yesterday** and the other is called **tomorrow**. That means **today** is the ideal day to love, to believe, to create and to live.

- Dalai Lama

The greatest ideas are the simplest.

William Golding

meetville.com

"The world will not be destroyed by those who do evil, but by those who watch them without doing anything." - Albert Einstein.