a sustainable FUTURE

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Sustainable

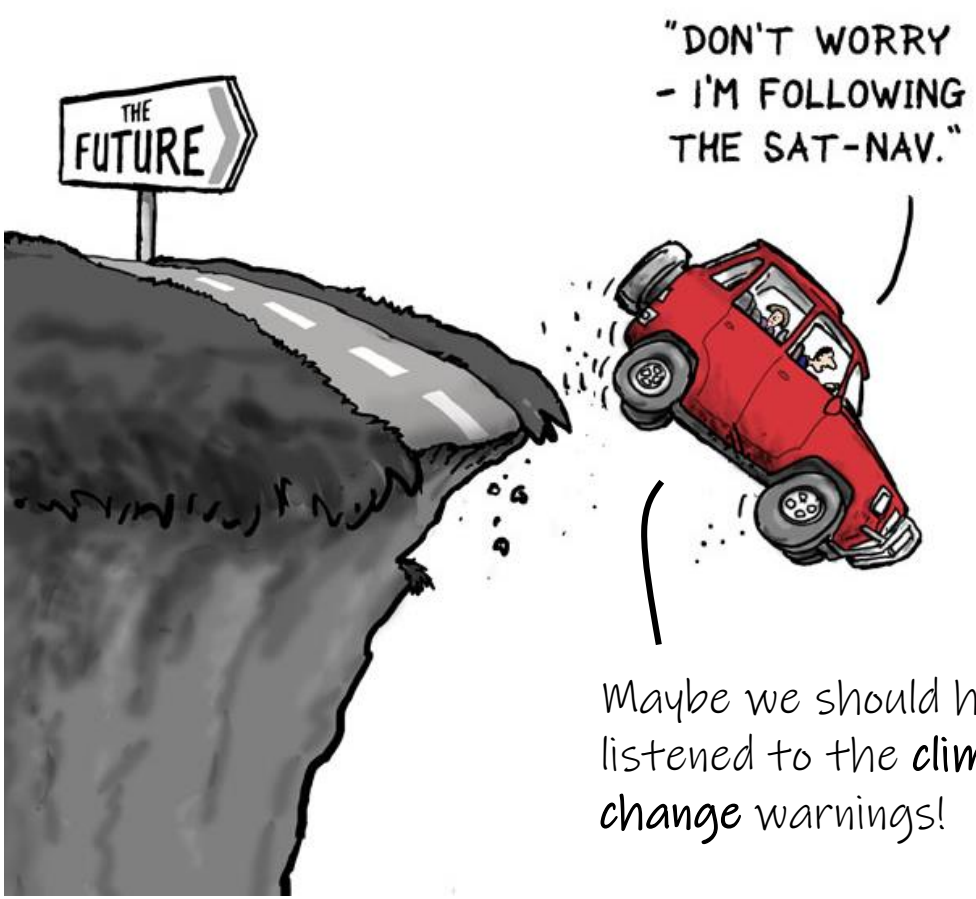
a big word!

Sustainable

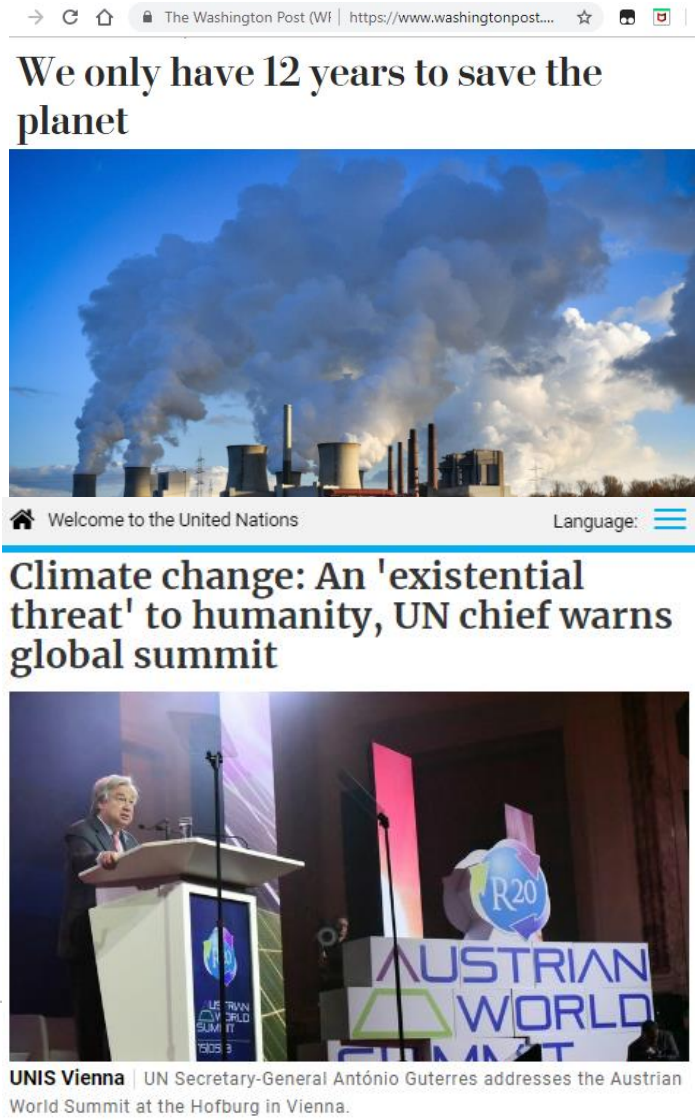
My preferred definition from the 1987 Brundtland Report by the World Commission on Environment and Development (WCED):

"**Sustainable** development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

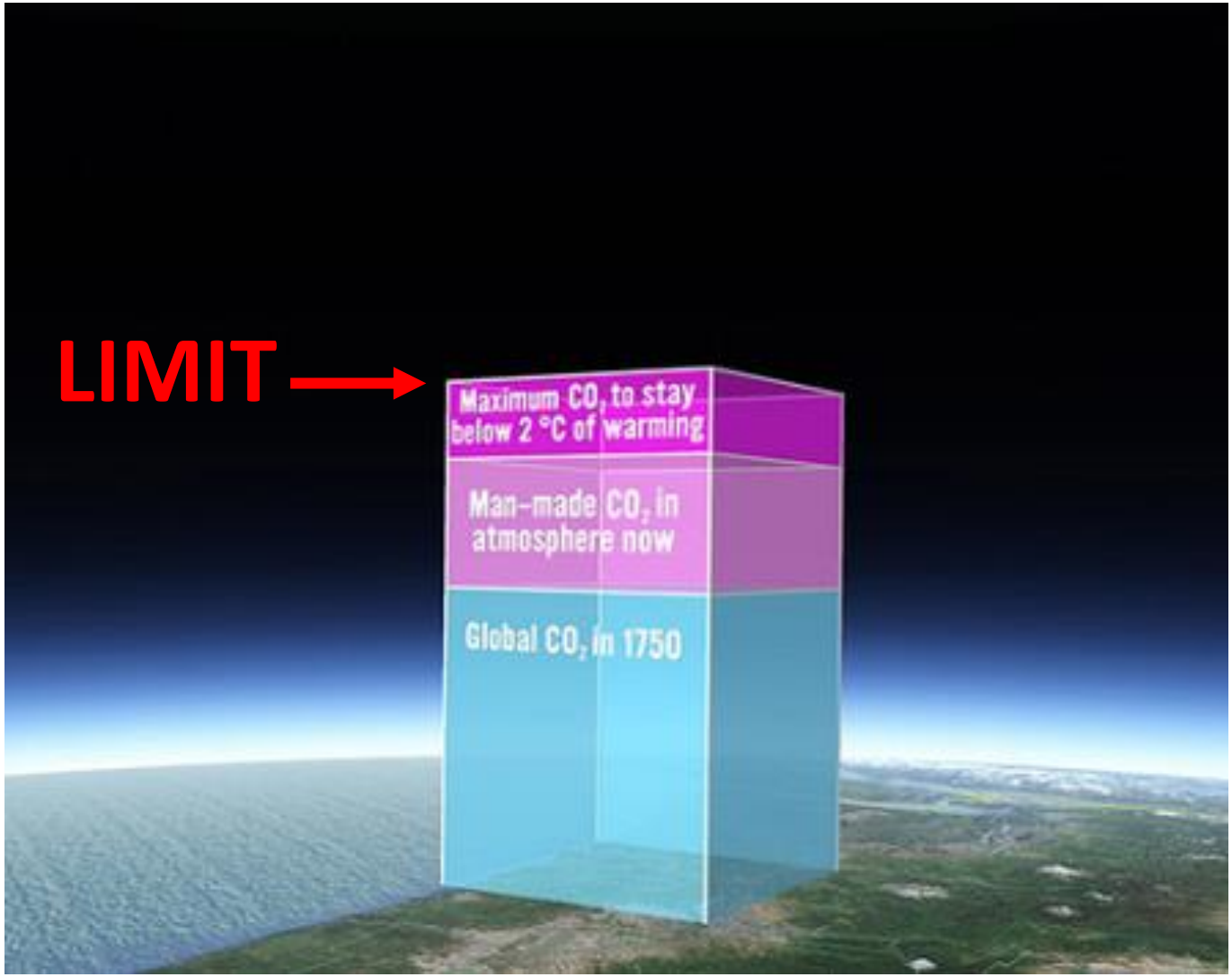
Unfortunately, our current development is not sustainable



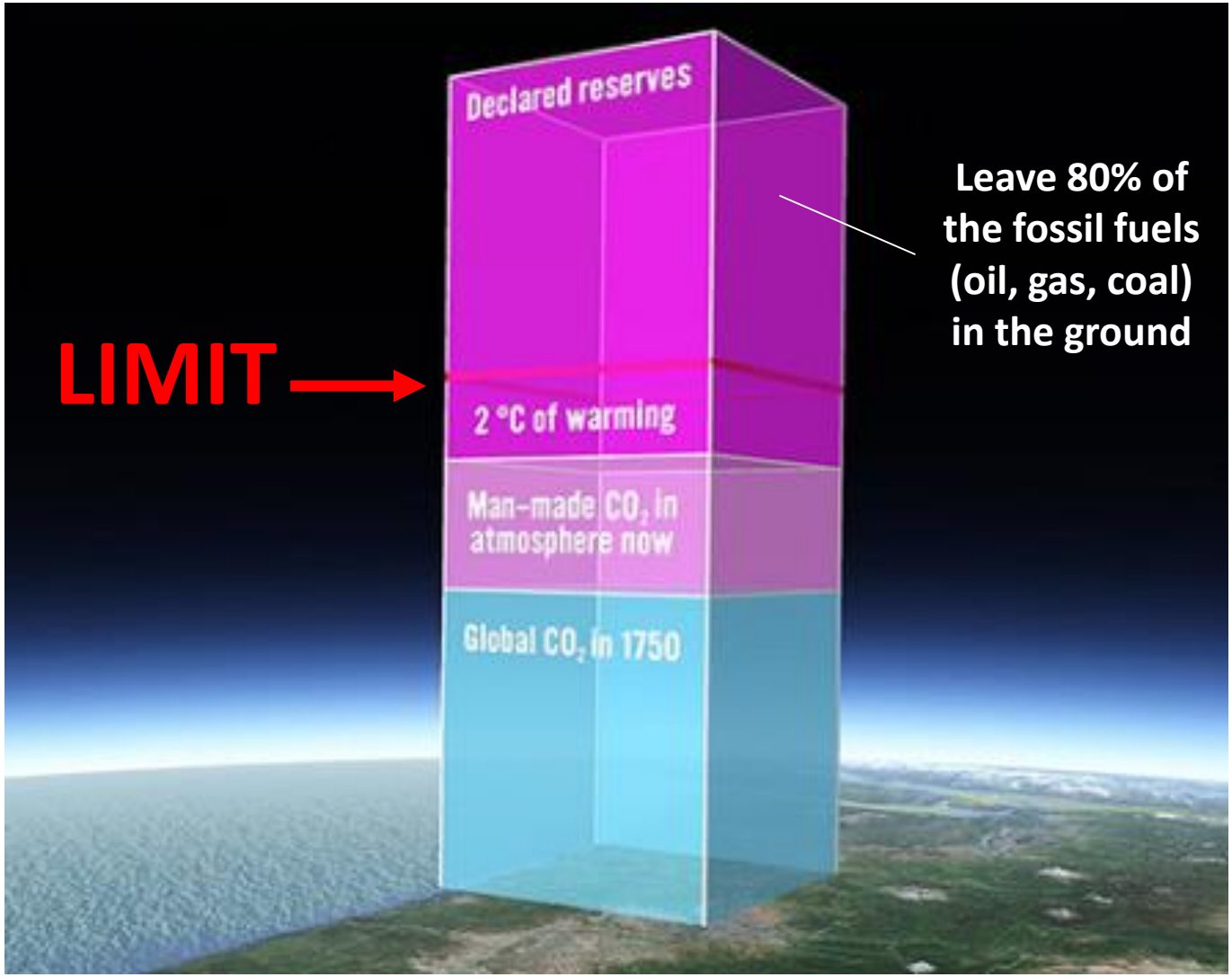
Maybe we should have listened to the **climate change** warnings!



Our Global CO_2 Emission Limit



Our Global CO_2 Emission Limit



Solving Climate Change:

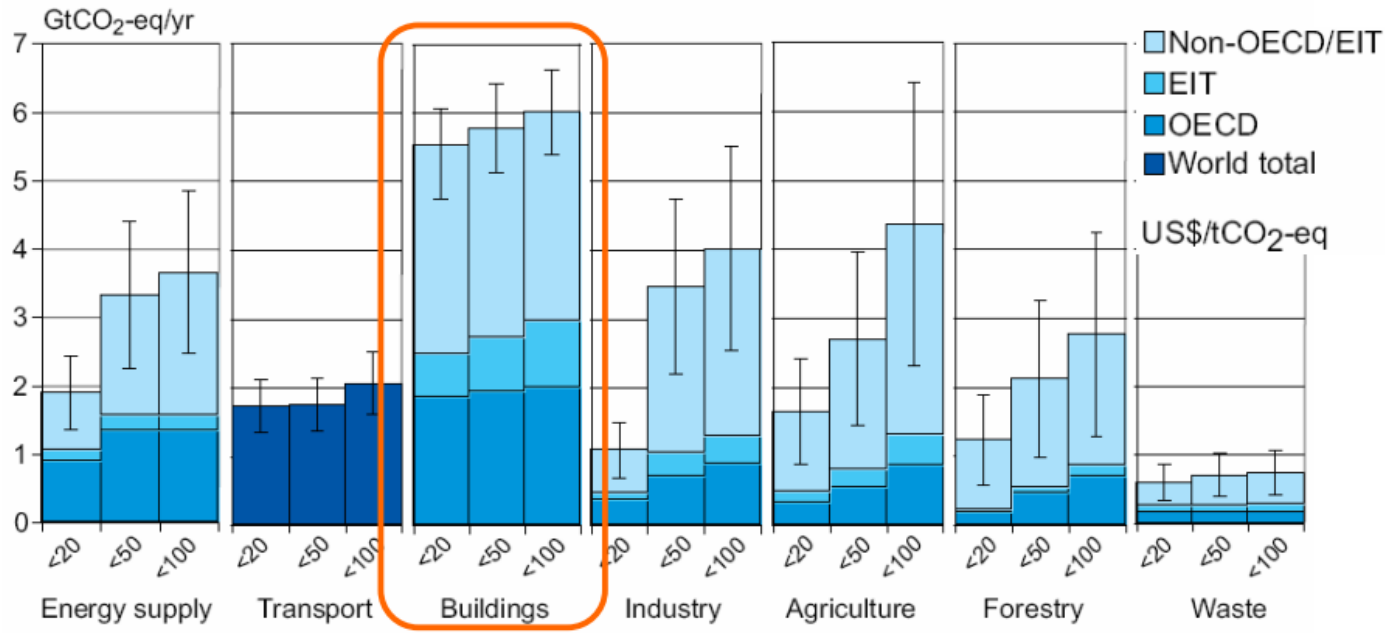
We are the first generation who cannot say that "we did not know"

And this makes us the **most important generation** in human history

GOOD NEWS!

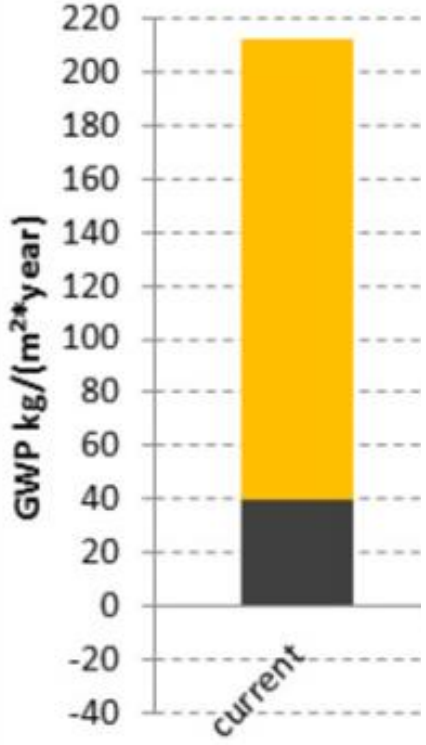
Building Sector to play key to combat climate change

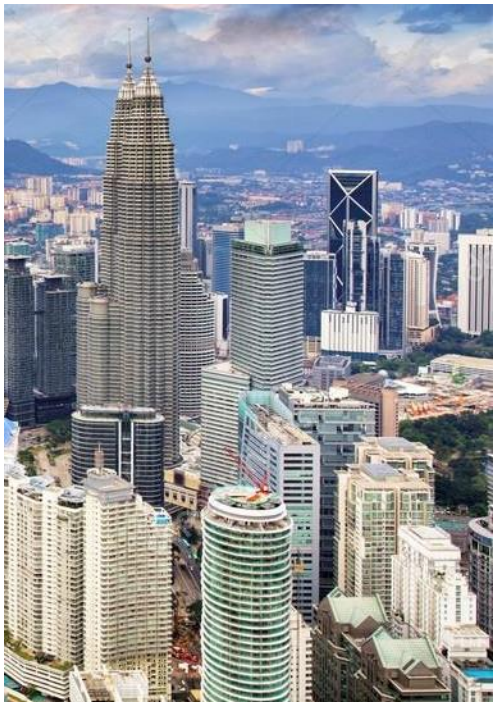
The buildings sector offers the largest low-cost potential in all world regions by 2030



(potential at <US$100/ tCO_2-eq: 2.4 - 4.7 Gt CO_2-eq/yr)	*(potential at <US$100/ tCO_2-eq: 1.6 - 2.5 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 5.3 -6.7 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 2.5 - 5.5 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 2.3 -6.4 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 1.3 - 4.2 Gt CO_2-eq/yr)*	*(potential at <US$100/ tCO_2-eq: 0.4 - 1 Gt CO_2-eq/yr)*

CO_2 emissions from Malaysian office buildings over **50 year lifecycle**



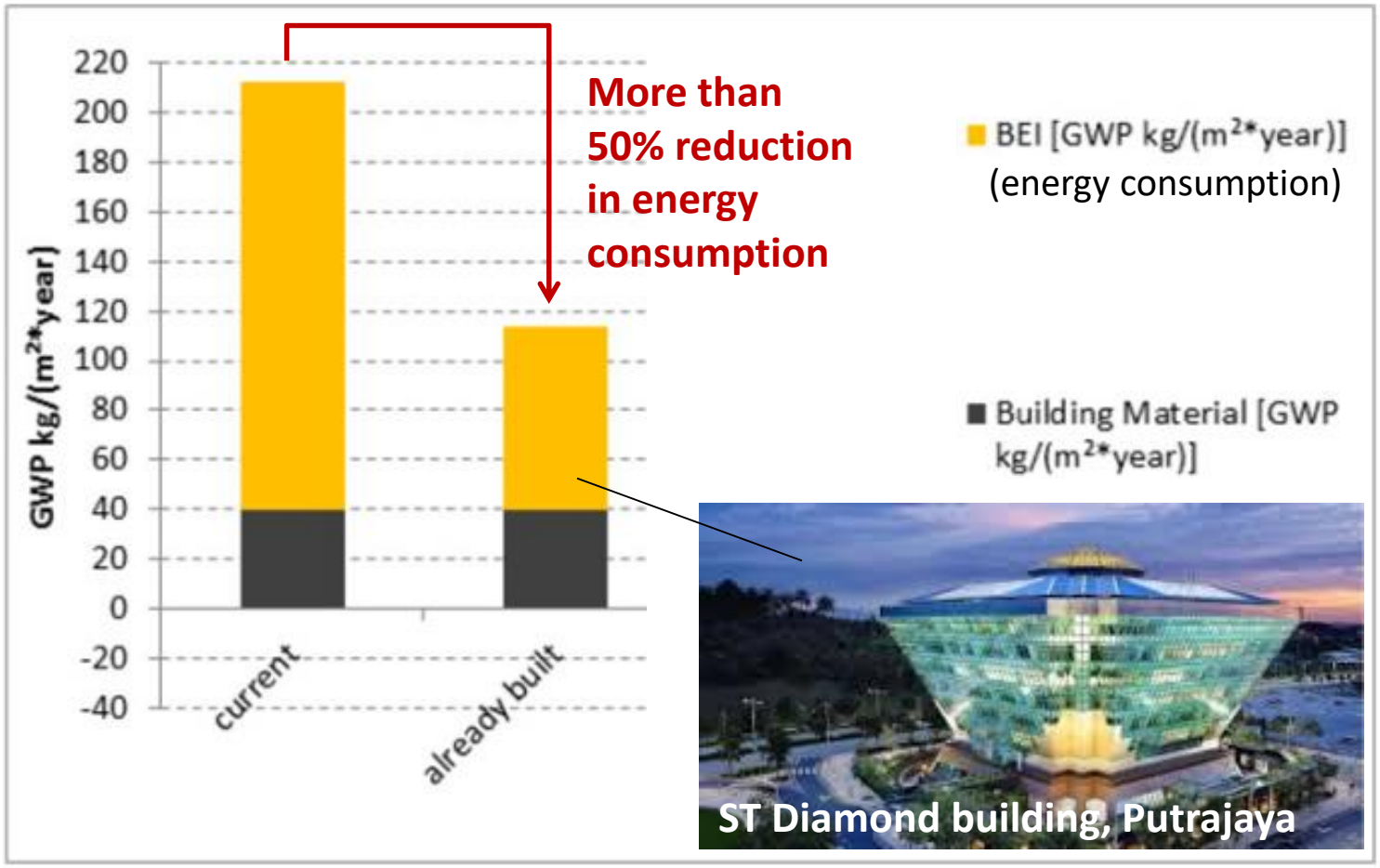


BEI [GWP kg/(m²*year)]
(energy consumption)

Building Material [GWP kg/(m²*year)]

Source: http://ien.com.my/downloads/2017.09.01%20GreenPlus%20LCA%20Article%20with%20Alexander%20Graul.pdf

CO_2 emissions from Malaysian office buildings over 50 year lifecycle: **Energy Efficiency**



Highly energy efficient building case studies in Malaysia:
http://ien.com.my/projects/st.html | http://ien.com.my/projects/kkr2.html | http://ien.com.my/projects/geo.html

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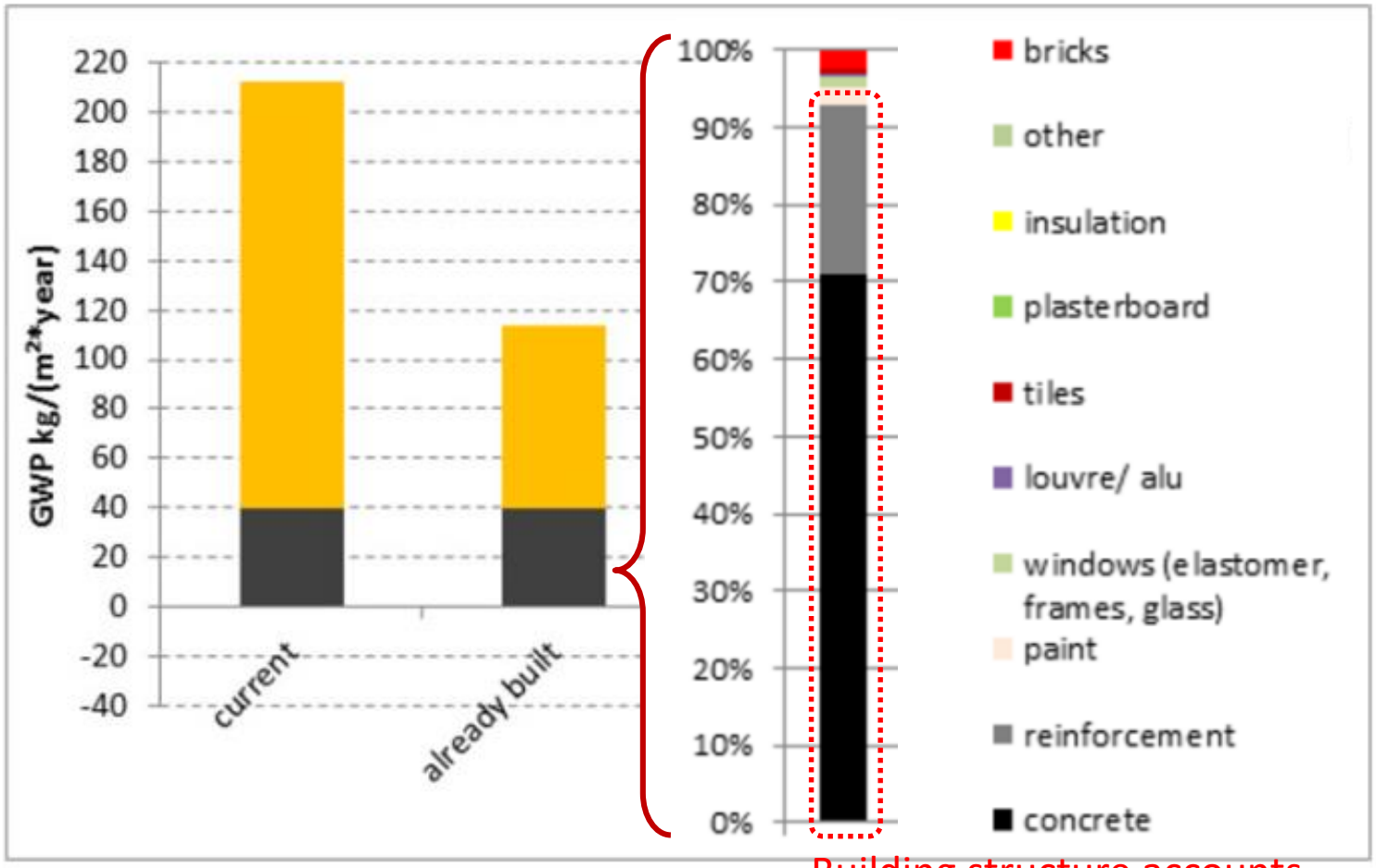
Source: http://ien.com.my/downloads/2017.09.01%20GreenPlus%20LCA%20Article%20with%20Alexander%20Graul.pdf

CO_2 emissions from Malaysian office buildings over 50 year lifecycle: **Building Materials**



Building structure accounts for bulk of CO_2 emission

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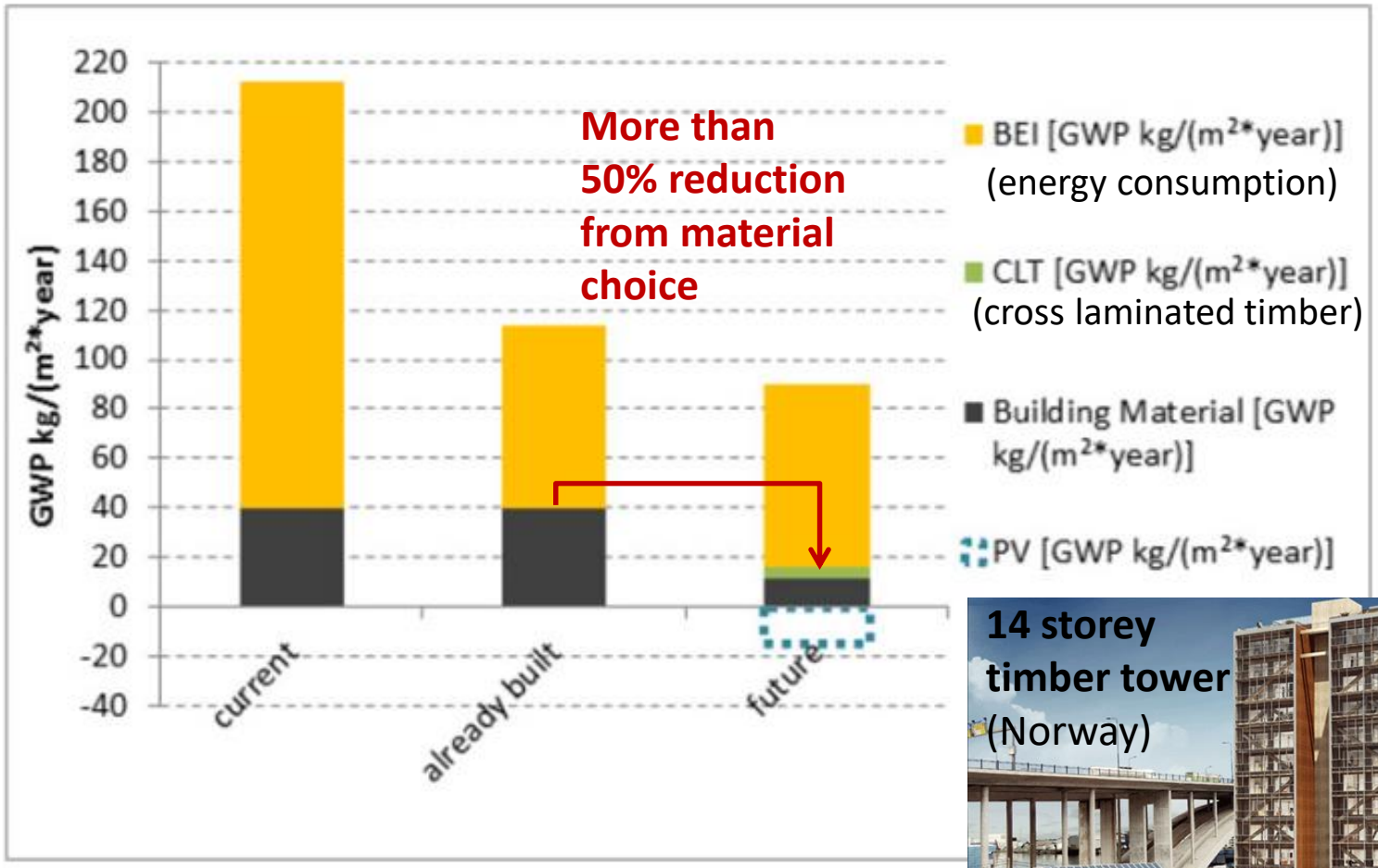
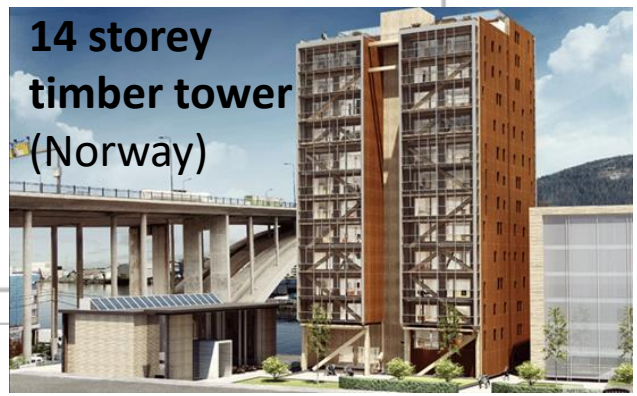
Source: http://ien.com.my/downloads/2017.09.01%20GreenPlus%20LCA%20Article%20with%20Alexander%20Graul.pdf

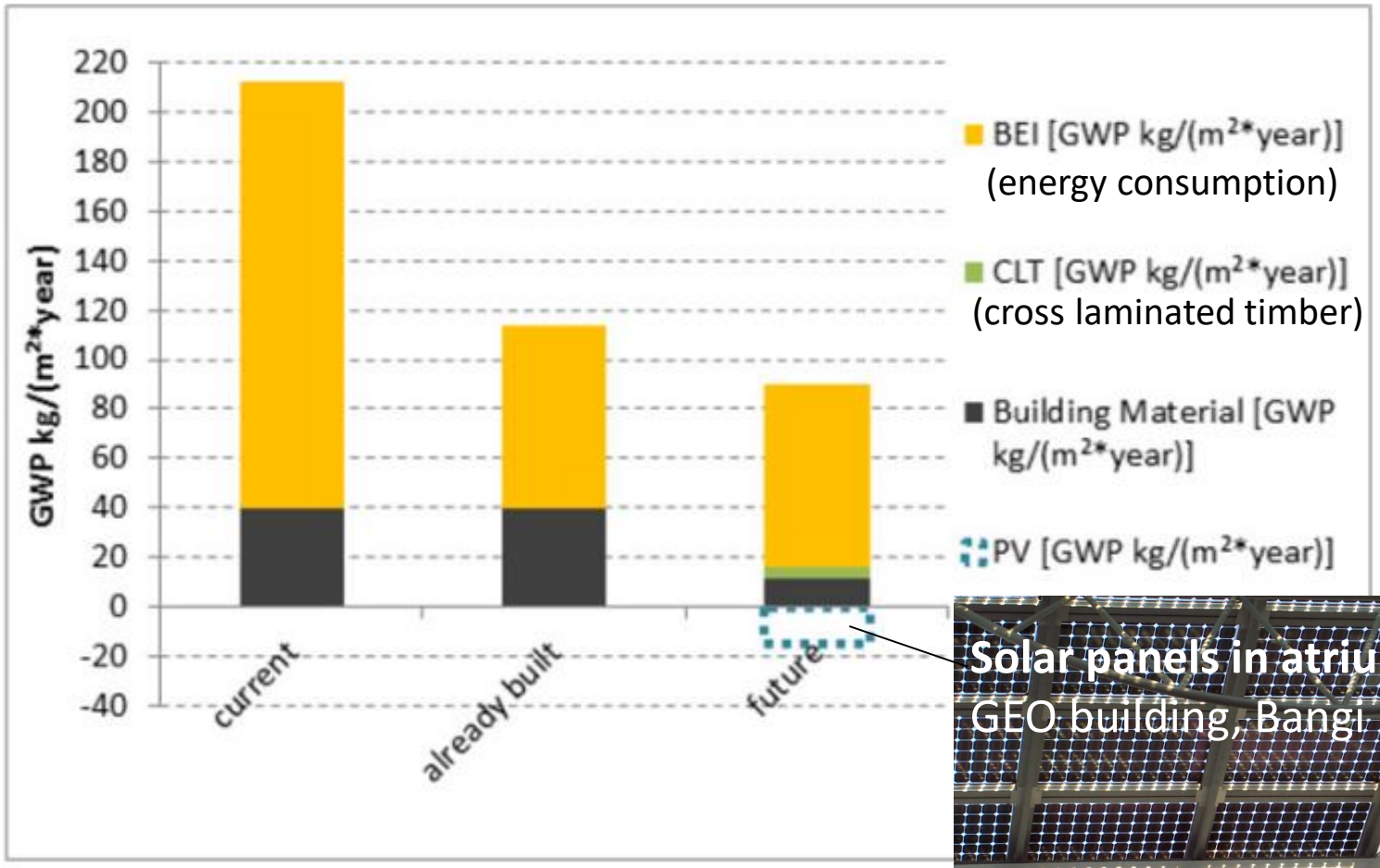
CO_2 emissions from Malaysian office buildings over 50 year lifecycle: **Building Materials**

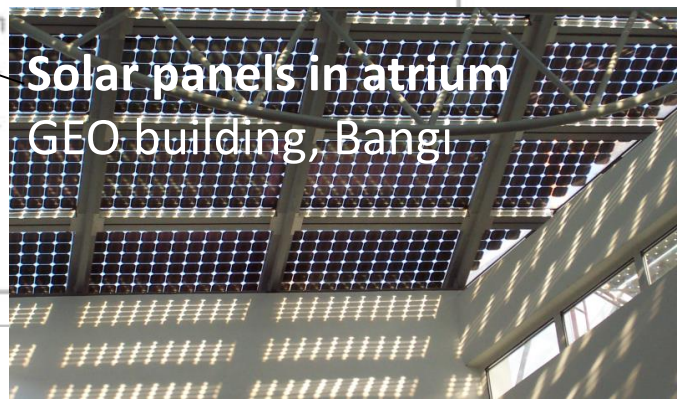




Source: http://ien.com.my/downloads/2017.09.01%20GreenPlus%20LCA%20Article%20with%20Alexander%20Graul.pdf

CO_2 emissions from Malaysian office buildings over 50 year lifecycle: **Building Integrated Solar Panels**





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Source: http://ien.com.my/downloads/2017.09.01%20GreenPlus%20LCA%20Article%20with%20Alexander%20Graul.pdf

Facade Integrated Solar Panels

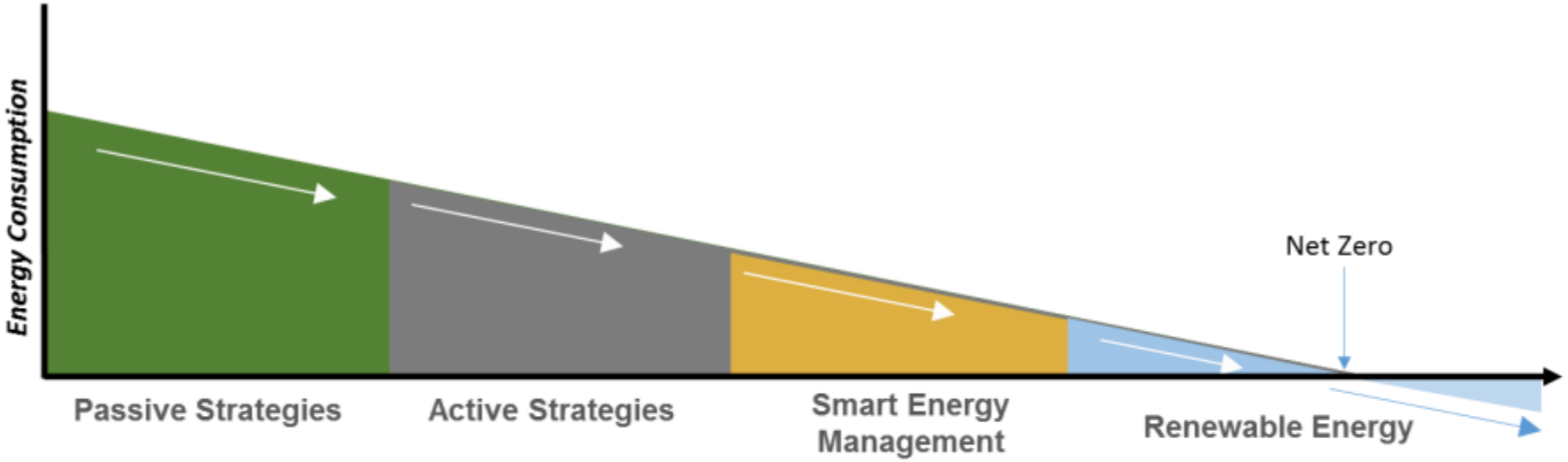
Note: In the tropics, the vertical solar panels yield is about 50% less than horisontal panels

Facade panels

Windows

Sustainable Building Design Direction

Achieving zero energy buildings that do not contribute to climate change



Passive Strategies	Active Strategies	Smart Energy Management	Renewable Energy
Sunlight Shading & Daylighting	Air-conditioning	Building Automation	Site Optimisation
Natural Ventilation	Mechanical Ventilation	Smart Building	Solar PV
Dynamic Facade	Lighting Technologies	Plug Load Management	Buildings-to-Grid Integration

Passive Strategies for Buildings

BCA report "Super Low Energy Technology Roadmap", Singapore (2019)

Passive Strategies

Strategies	Technologies	Description	Potential Energy Performance[13]
Temperature control through Insulation	Thermal insulation	Reduction of the conductive heat transfer components of external loads, contributing to lower use of air-conditioning.	L-M
	Insulated glazing	Reduction of conductive heat transfer through glazing, contributing to lower use of air-conditioning.	L-M
Temperature control through Shading	Double skin façade	Reduction of the cooling load, contributing to lower use of air-conditioning.	M
	Façade greenery	Shades the surfaces and cools the air through evapotranspiration.	M
	Cool paints	Reflect solar IR, reducing heat absorption reducing the cooling load.	M
Temperature control through Ventilation	Wind-driven natural ventilation	Linked to the architectural features of new building, though can be difficult to incorporate successfully for refurbishment for existing buildings.	M-H

L: Low
M: Medium
H: High

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[13] *Impact on Building EEI: Low (L) : < 5 kWh/m²/year; Medium (M) : 5 - 10 kWh/m²/year; High (H) : >10 kWh/m²/year*

Passive Strategies for Buildings

BCA report "Super Low Energy Technology Roadmap", Singapore (2019)

Passive Strategies

Strategies	Technologies	Description	Potential Energy Performance[13]
Daylight redirecting technologies	Light shelves	Increases the depth of penetration of useful daylight into the building, and reduces the use of artificial lighting. In hotels, most of the lighting load is consumed by the clients during night-time.	L-M
	Tubular Daylight	Application is design-specific. Can bring daylight to unlit spaces like corridors, bathrooms. Complicated and expensive implementation in refurbishment, in new projects good design should achieve similar or better lighting conditions.	L-M
Building Envelope	Insulation materials	A light weight (200 ~ 300 kg/m^3) construction material that improves building's thermal properties (U-value 0,149 ~ 0,183 W/m^{2}K) and water insulations.	M

L: Low
M: Medium
H: High

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[13] *Impact on Building EEI: Low (L) : < 5 kWh/m^2/year; Medium (M) : 5 - 10 kWh/m^2/year; High (H) : >10 kWh/m^2/year*

Passive Strategies for Buildings

BCA report "Super Low Energy Technology Roadmap", Singapore (2019)

Passive Strategies

Strategies	Technologies	Description	Potential Energy Performance[13]
	Heat Reflective Coating	Optimize current epoxy-based coating formulation to be applied on bare as well as powder coated aluminium window frames in order to obtain a glossy surface finish without any dripping effect and develop polyurethane and acrylic-based coatings which are more resistant to weathering.	M
	Cool Paint Incorporating Phase Change Material (PCM)	An innovative cool paint through the incorporation of multi-functional Phase Change Material (PCM) capsules with high solar reflectance (>0.8), self-cleaning capability and PCM thermal buffering.	M-H
	Photochromic glass	Enhance home-based photocatalytic coating product for different substrates with supply price less than half of its imported one.	M
	Electrochromic glass	Enable to change the visible and thermal transmittance characteristics to be able to obtain a desired level of lighting or heating from solar energy.	M

L: Low
M: Medium
H: High

[13] *Impact on Building EEI: Low (L) : < 5 kWh/m²/year; Medium (M) : 5 - 10 kWh/m²/year; High (H) : >10 kWh/m²/year*

Passive Strategies for Buildings

BCA report ”Super Low Energy Technology Roadmap”, Singapore (2019)

Passive Strategies

Strategies	Technologies	Description	Potential Energy Performance[13]
	Energy harvesting clear glass	Reduce the solar heat whilst producing renewable energy. Clear glass with high daylight transmittance level	M
	Solar heat shielding film	Effective in both UV and IR blocking without affecting visible light transmittance too much, thus to lower indoor cooling demand and associated cooling energy use. May reduce light transmittance which makes the indoor environment darker.	M

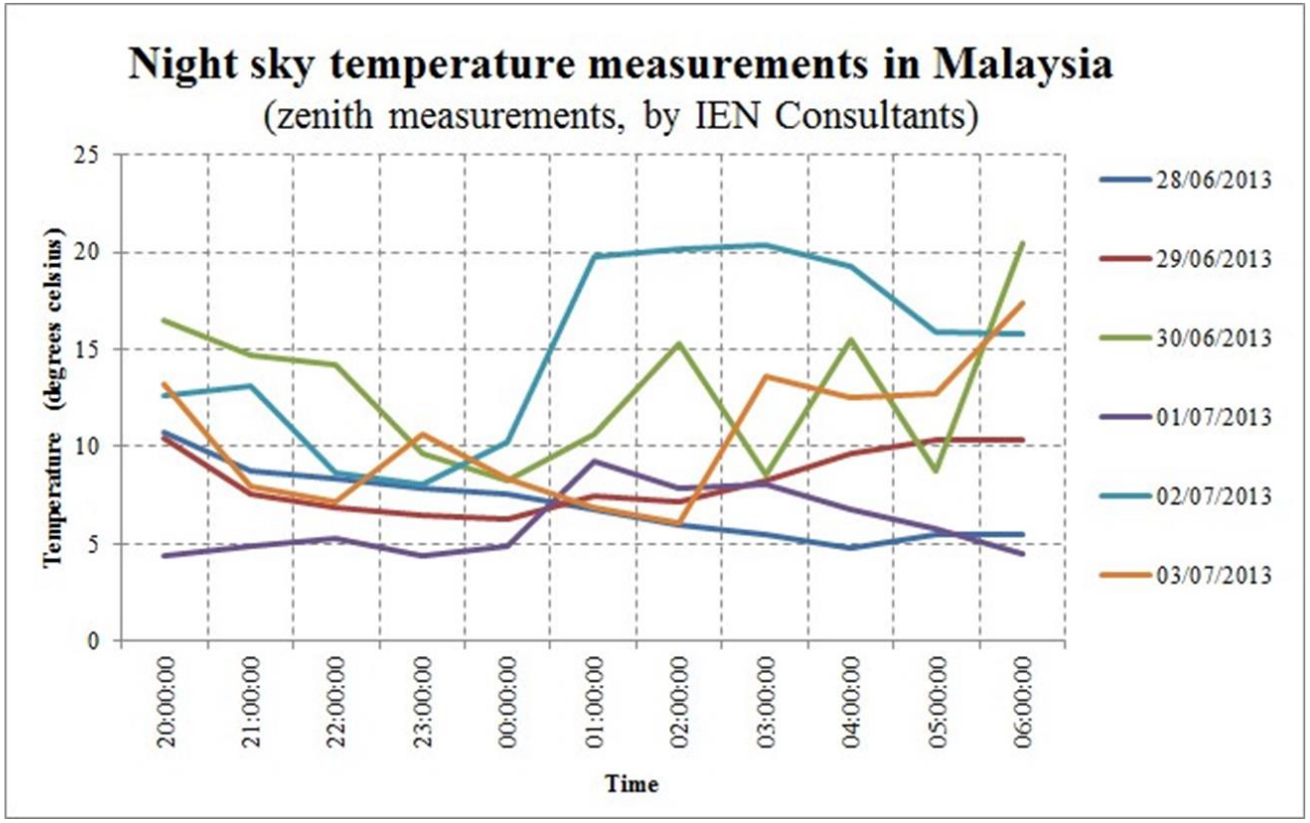
L: Low
M: Medium
H: High

[13] *Impact on Building EEI: Low (L) : < 5 kWh/m²/year; Medium (M) : 5 - 10 kWh/m²/year; High (H) : >10 kWh/m²/year*

Mind-blowing Design Case Study no. 1:

Innovative cooling for tropical bungalow

Mind-blowing Design Case Study no. 1:
Innovative cooling for bungalow in Subang



Temperature gun pointed to the sky

Mind-blowing Design Case Study no. 1:

Innovative cooling for tropical bungalow

The first measurements show a roof temperature of down to 22°C,
which is 7°C cooler than the indoor temperature (29°C)

Architect: Design Unit Sdn. Bhd.
Energy Efficiency: IEN Consultants Sdh Bhd.

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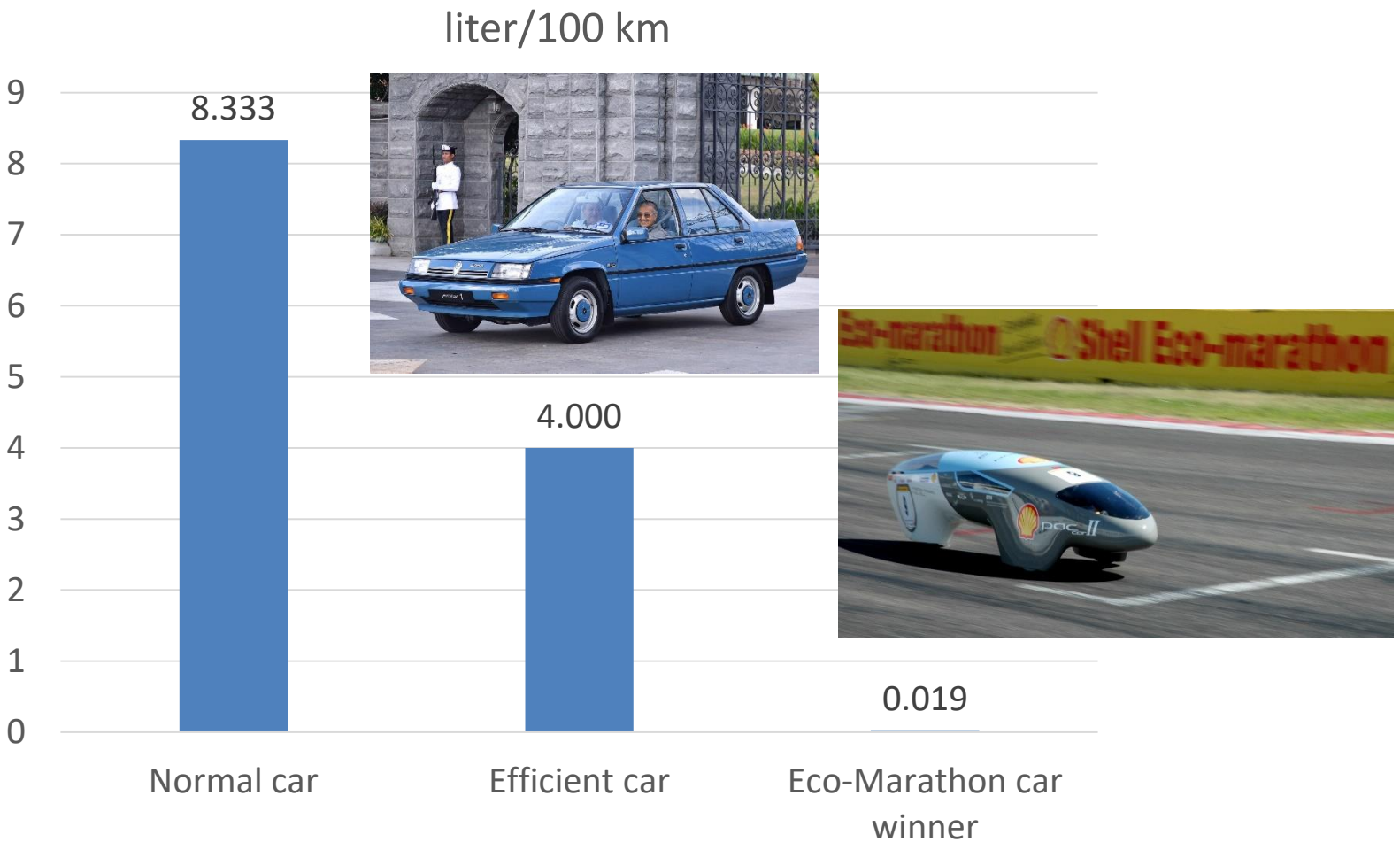
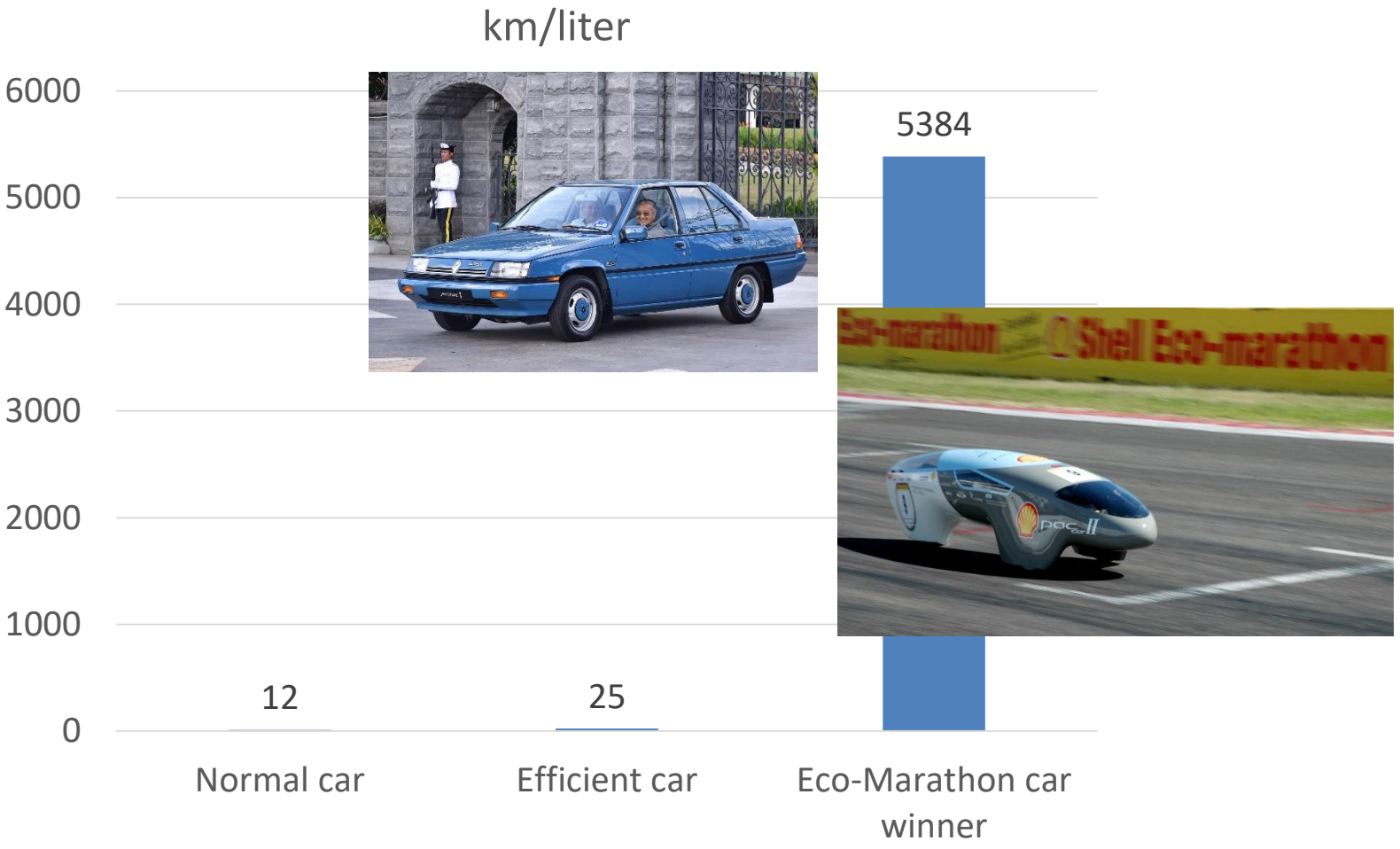
Mind-blowing Design Case Study no. 2:

Energy Efficient Car competition



Mind-blowing Design Case Study no. 2:
Energy Efficient Car competition



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Shell Eco-marathon Asia will be held in Malaysia
29 April – 2 May 2019 (Sepang circuit)

Thank you and remember:

We must design a sustainable future.

We are the most important generation!

Gregers Reimann

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Energy Efficiency and Green Building Consultancy

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Appendix slides

IEN Consultants Expert Staff

IEN Consultants

Hover the cursor over a person's head to see a short presentation and click to see a detailed personal description or click on a name in the list below.

We are a diverse group of individuals

5 different degrees
6 different nationalities
4 LEED AP
8 GBI Facilitators

IEN Consultants

3.2 million square meters
of green building space

Gregers (MD) Poul (Founder)

Malaysia | Singapore | China