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Buildings in Smart Cities:
Reducing their Environmental Impact

OVERVIEW

1. Buildings, Energy & Carbon Emissions & Malaysia
2. Impact of Sustainable Certification – Green Building Index (GBI) on the Commercial Sector
3. Enhancing the Value Certification
4. Case Study:
   a) Singapore
   b) Denmark
5. Summary

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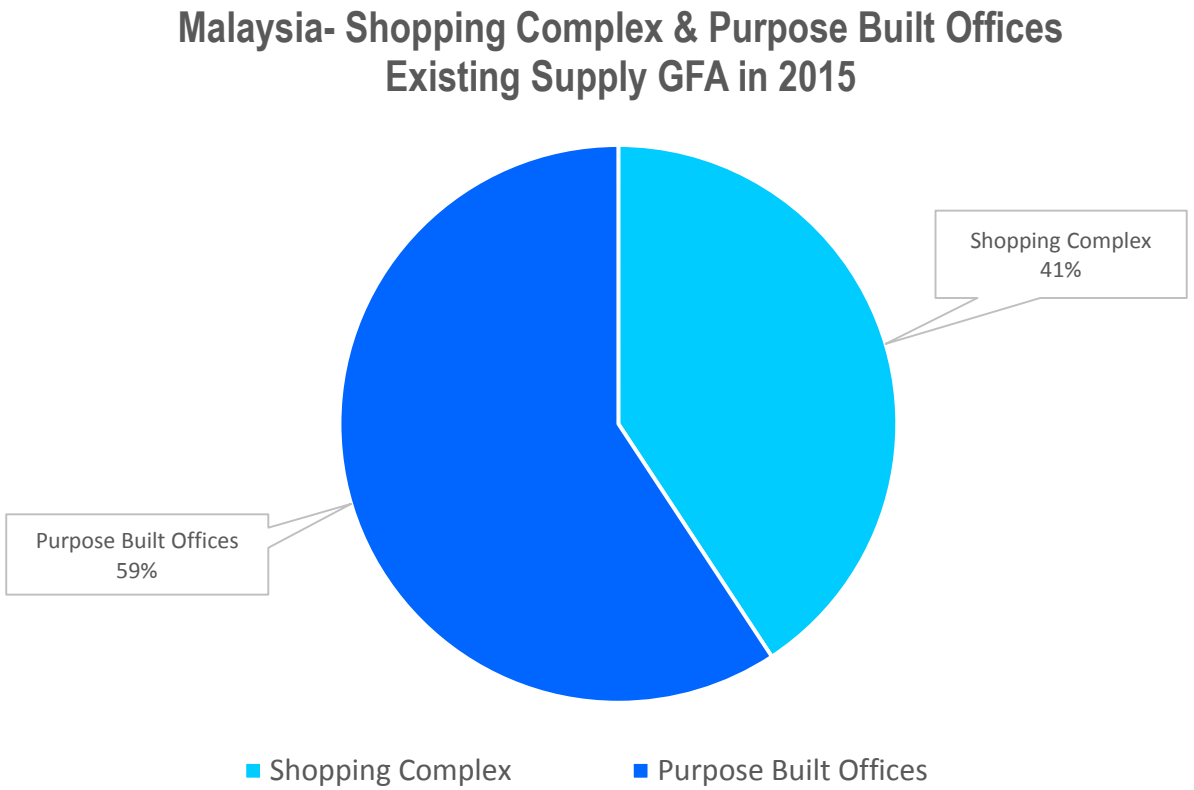
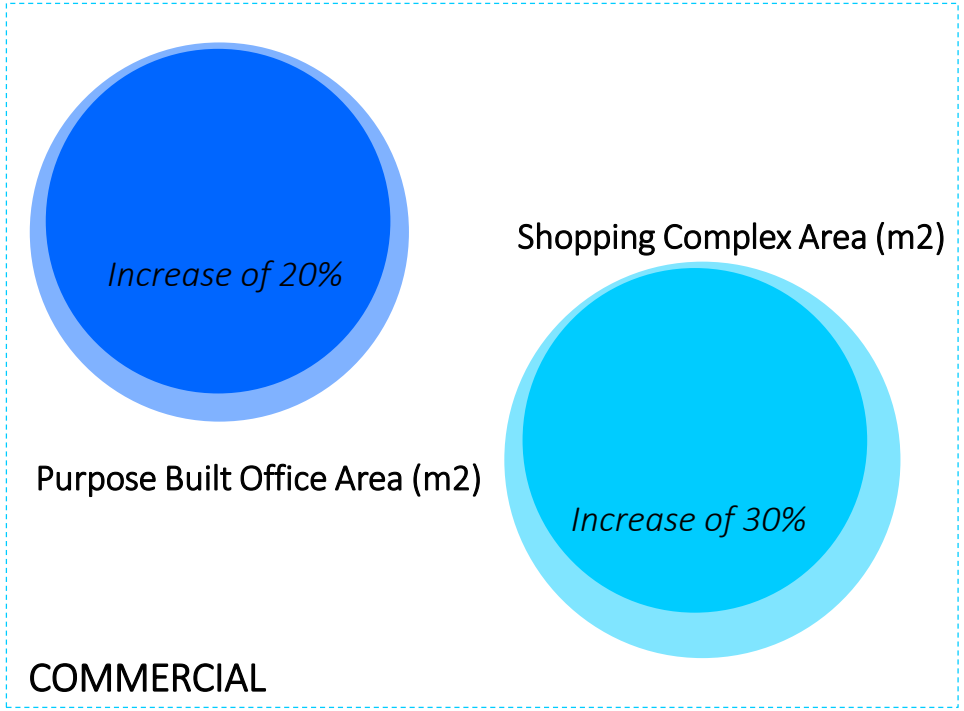
The Built Environment & Energy

"It is estimated that at present, buildings contribute as much as one third of total global greenhouse gas emissions, primarily through the use of fossil fuels during their operational phase"

(IPCC Note on the Built Environment's Carbon Emissions)



Malaysia's Building Stock Growth from 2010 to 2015



Key Data http://napic.jpph.gov.my/portal/key-statistics

Green Building Certification Uptake

GBI Offices + Shopping Malls

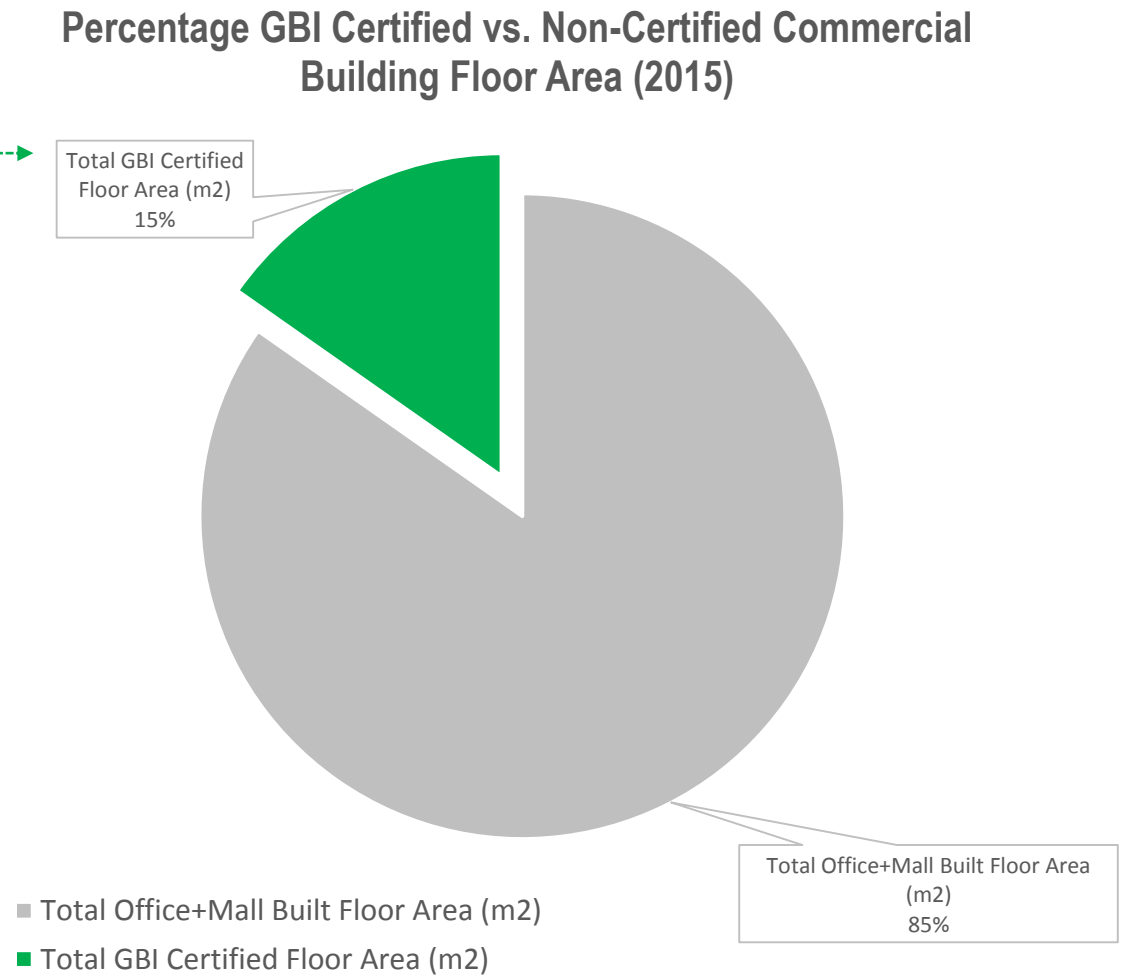
Approximately 15% of the total non-residential building stock in Malaysia has obtained a GBI Certification

How much energy consumption & carbon emissions are we decreasing?

Total Existing GFA (m2) = 33,960,765
Total GBI Certified GFA (m2) = 5,218,024

Total Estimated Elec Consumption if Business-as-Usual (MWh per year) = 10,527,837
Decreased Elec Consumption w GBI Certification Uptake (MWh per year) = 559,633
Decreased CO2 (tonne per year) = 491,078

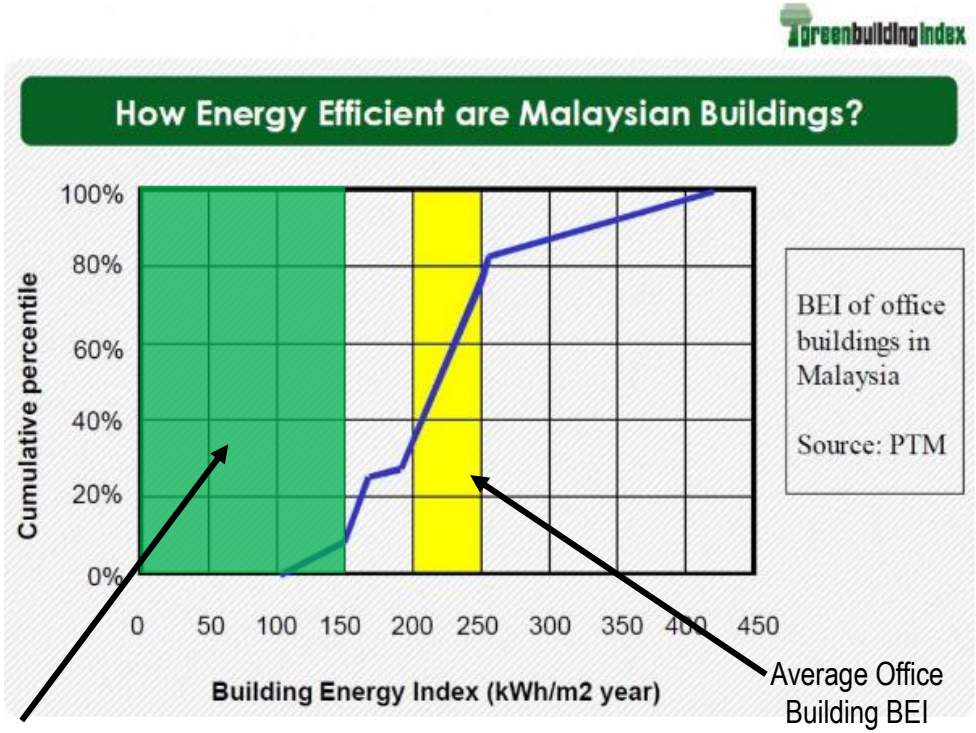
5% **Overall decrease in Building Energy Intensity (BEI) due to GBI Certification.** This corresponds to saving 10kWh per m2 per year

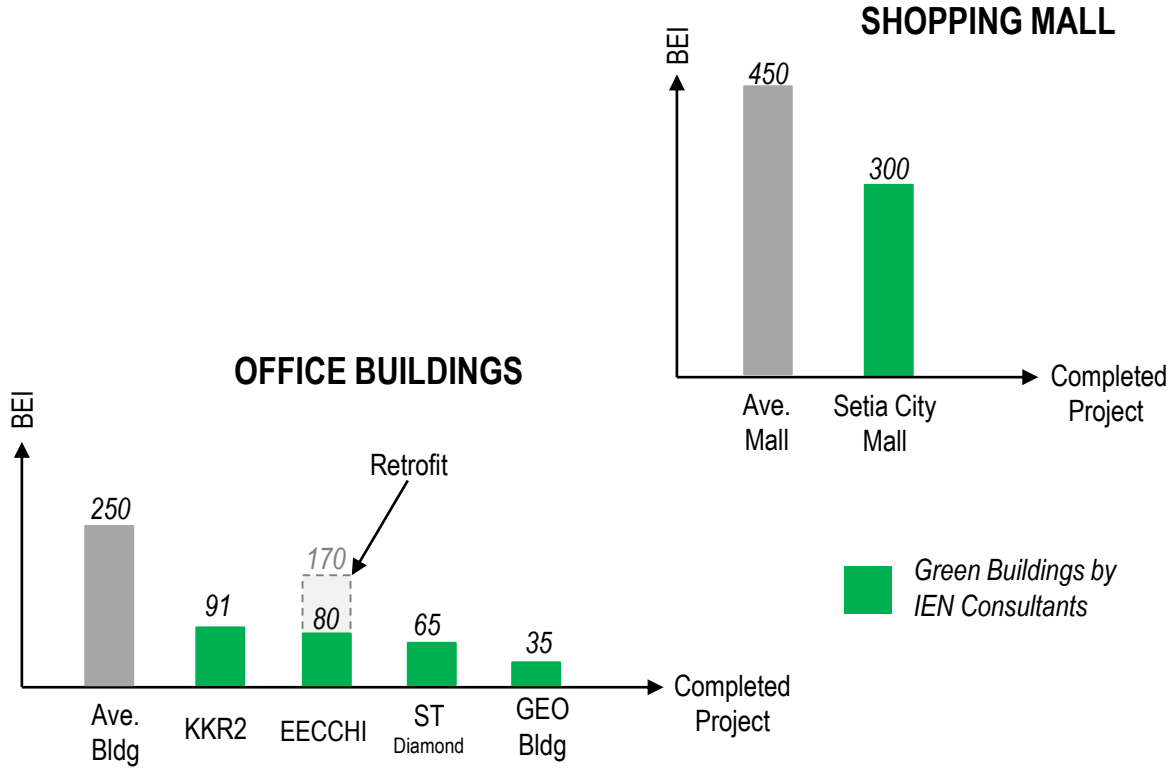


http://new.greenbuildingindex.org/Files/Resources/GBI%20esp/Green%20Buildings%20and%20Parks%20World%202015%20Green%20Building%20Index.pdf

What are the energy saving potentials GBI & Case Studies?

GBI Offices + Shopping Malls





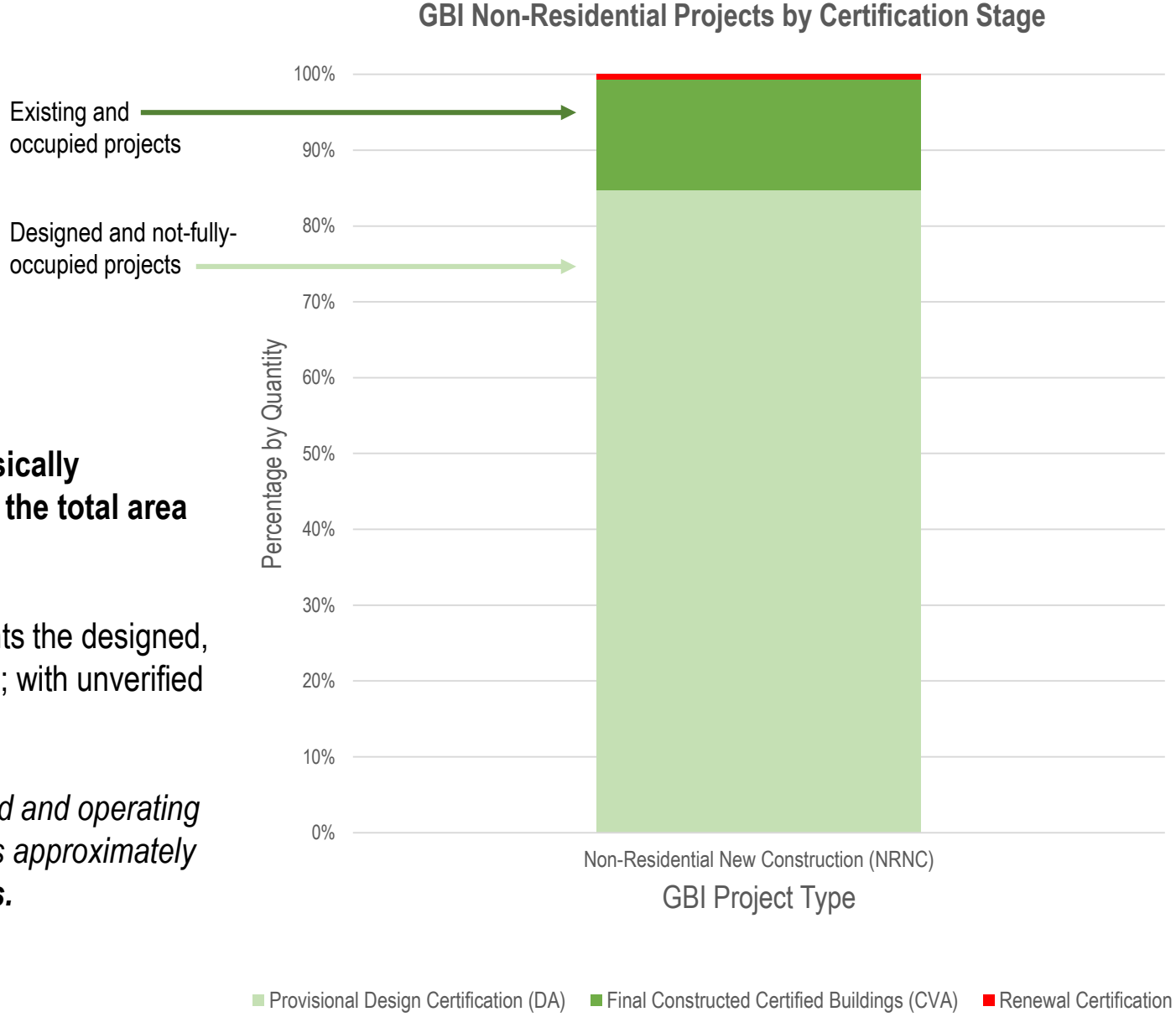
Compared to the average office building....

GBI Certified Office buildings fare better; with an average overall decrease of energy demand of 100kWh/m2 per year. But they can do a lot better as noted above….

http://new.greenbuildingindex.org/Files/Resources/20100426%20-%20Launch%20of%20GBI%20Existing%20Building%20Rating%20Tool/20100426%20-%20GBI%20NREB%20Launch%20-%20Presentation%201%20-%20GBI%20and%20the%20Green%20Transformation%20-%20KL%20Von.pdf

What stage are the green buildings in?

GBI Offices + Shopping Malls



However;

Of the total GBI Certified projects considered, the **physically constructed and occupied projects (by quantity) of the total area considered as GBI Certified is noted in dark green.**

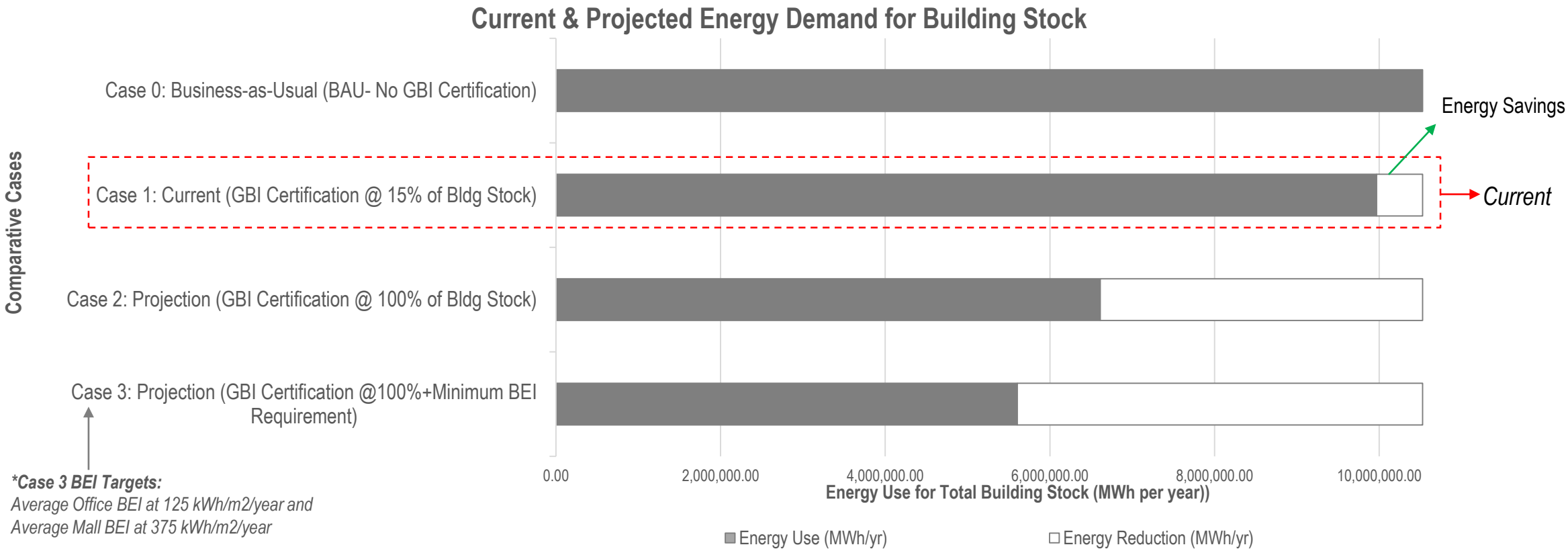
The highlighted **light green** area in the graph represents the designed, on-going construction and not fully operational projects; with unverified savings of energy.

This highlights that the physically constructed, occupied and operating GBI Certified NRNC buildings in Malaysia in 2015- was approximately ***15% of the estimated GBI NRNC Certified Buildings.***

GBI Resources: http://new.greenbuildingindex.org/Files/Resources/GBI%20esp/Green%20Buildings%20and%20Parks%20World%202015%20Green%20Building%20Index.pdf

What is the Potential for Savings with Mandatory Policies?

GBI Offices + Shopping Malls



Case 3 BEI Targets:
Average Office BEI at 125 kWh/m2/year and
Average Mall BEI at 375 kWh/m2/year

IF mandatory Green Building Certification and Energy Efficiency targets for building performance implemented for **ALL** buildings; the total building emissions should be decreased by almost 50%.

**EE Policies to consider overall BEI Reduction target- which include, but are not limited to incorporating daylight usage, air conditioning usage,*

***Building stock growth and efficient technology assumed at 10% over 5 years- therefore, balancing each other out*

GBI Resources: http://new.greenbuildingindex.org/Files/Resources/GBI%20esp/Green%20Buildings%20and%20Parks%20World%202015%20Green%20Building%20Index.pdf

How do we ensure energy savings happen?

POLICY

1. BUILDING STANDARDS, CODES or BY-LAWS

2. BUILDING APPROVAL CONDITIONS

3. CLEAR & TRANSPARENT

4. ENFORCEMENT

5. INCENTIVES

Green Mark Building Certification

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	GM Tier	GM Category	Year of Completion	Total Floor Area (m^2)	Population (excluding visitors)	District Cooling System (DCS)	Number of occupants surveyed
Building 1	Platinum (P)	New	2009	30,800	2,100	Yes	529
Building 2	Platinum	New	2009	33,599	1,596	No	139
Building 3	Gold Plus (GP)	New	2009	14,358	400	No	322
Building 4	Gold Plus	New	2009	11,520	636	No	163
Building 5	Gold (G)	Existing	2002	186,886	8,000	No	201
Building 6	Gold	New	2008	15,235	374	Yes	180
Building 7	Certified (C)	Existing	1985	34,736	1,650	No	67
Building 8	Certified	New	2009	9,481	544	No	88
Building 9	Non-Certified (NC)	New	2008	119,139	4,372	Yes	161
Building 10	Non-Certified	New	2004	56,220	4,814	No	162
Building 11	Non-Certified	New	2005	29,408	500	No	191

Table 1 – Summary of buildings selected

Buildings not compared to due to being cooled by District Cooling and lacking data

Contributing Factors to Low Occurrence of Energy Savings

1. Building Management
2. Occupant Behaviour
3. Small sample size- Only seven buildings data

Building	GM Tier	Observed EEI ($kwh/m^2/yr$) based on 12 month utility bill	Population Density	EEI* ($kwh/m^2p/yr$)	EEI* ($kwh/m^2p/yr$ weighted average by GM tier	EEI* ($kwh/m^2p/yr$ weighted average GM vs non GM
Building 2	P	142	21	136	136	154
Building 3	GP	119	36	194	182	
Building 4	GP	203	18	166		
Building 5	G	152	23	157	157	
Building 7	C	167	18	135	135	
Building 10	NC	269	10	122	147	147
Building 11	NC	94	46	198		

Green

Grey

Table 4 - EEI (excluding Building 8 and the DCS projects)*

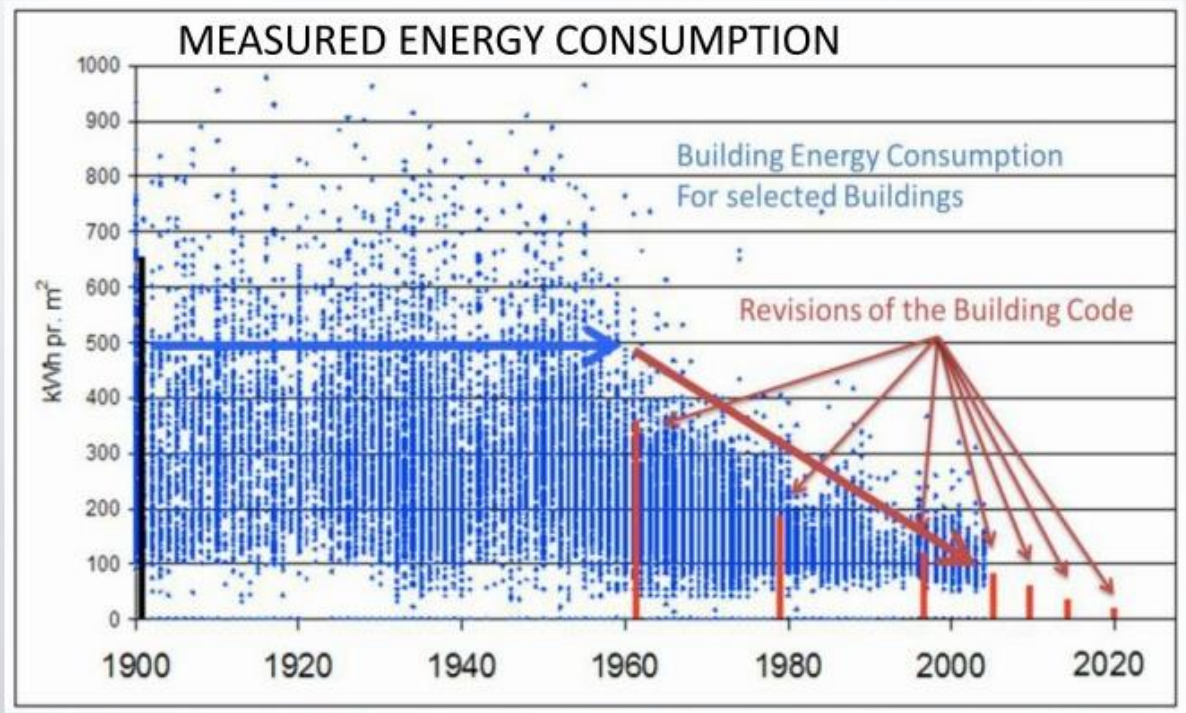
Notes:
Definition of EEI: Energy Efficiency Index

Negligible difference… in fact, the Non-Certified performs slightly better than Certified

Source: Kishnani et al (2014). Post-Occupancy Evaluation of Green Mark- Rated Buildings in Singapore. World SB14.

Danish Building Codes

50% reduction in heating per square meter of entire Danish residential building stock



Measured Energy Consumption in Danish Buildings

Contributing Factors to High Occurrence of Energy Savings

1. Mandatory requirements!
2. Energy Cost as a driver for Occupant Behaviour

Recommendations

National Targets for Carbon Emission Reductions

At COP 15 in Copenhagen, Prime Minister YAB Dato' Sri Mohd Najib Tun Abdul Razak announced ***that Malaysia would voluntarily reduce its emissions intensity of GDP by up to 40% based on 2005 levels by 2020. We have an extended target to 45% by 2030.***

How do we make energy savings from buildings happen?

1. **Increase National Carbon Emission Reduction Targets** – *based on absolute emissions, rather than emissions intensity of GDP*

2. **Increase Political Commitment & Create Building Performance-Related Policy** - *to ensure increased efforts compared to current largely market-driven scenario*

3. **Encourage Sustainability-Related Businesses & Technology** – *driving innovation, economy and providing more options to consumers*

4. **Creating Potential Revenue for Local, State or Federal Governments** – Example: *Property tax discount or penalty based on BEI performance; incentive for citizens and a potential source of revenue for local councils.*

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THE END

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