ZERO ENERGY BUILDING (ZEB) DEVELOPMENT IN MALAYSIA

28 February 2019

Ready for Zero Energy Building (Ready ZEB)
Nearly Zero Energy Building (nZEB)
Net Zero Energy Building (NZEB)

STEVE ANTHONY LOJUNTIN
SUSTAINABLE ENERGY DEVELOPMENT AUTHORITY
(SEDA MALAYSIA)
steve@seda.gov.my / asetip@damansara.net
Tel : +6019- 2829102

INTRODUCTION

- Zero Energy Building (ZEB) is an advance Low Carbon Building initiatives.
- Focus mainly to building and operational features that have direct impact on total energy & carbon reduction, which is the sustainable energy (EE & RE).
- It is steps ahead towards achieving 100% RE mix power supply to the buildings and achieving Carbon Neutral Building (operational carbon).
- Focus on basic, practical & viable elements in sustainable building (quantitative – measurable, recordable and reportable).

INTRODUCTION

- Zero Energy Building (ZEB) Program is a global race, target to make building become super energy efficient and with deployment of on site RE technology to achieve ZEB;
  - EU Countries (by Directive), Japan, Singapore, etc.
  - **Target by 2020 : All new public buildings.**
  - **Target by 2030 : Average new buildings (Public & private).**
- Building sector contribute about 2/3 of global CO2 emission.
- In Low Carbon Cities Program, building sector offer the highest chance to reduce emission at affordable cost (quick wins).
- Development of international standard, ISO/TC 205 (in progress).

GLOBAL PROBLEM – ENERGY SECURITY

SOLUTION :
– IMPLEMENT TOTAL SUSTAINABLE ENERGY PROGRAM

ENHANCING ENERGY EFFICIENCY!

Managing the energy demand to control the rate of demand

+

PROMOTE RENEWABELE ENERGY!

Offsetting the fossil fuel in order to supply clean & green energy

GLOBAL PROBLEM - CLIMATE CHANGE, GHG

PROBLEM!

CLIMATE CHANGE IS THE PROBLEM [MAINLY CAUSED BY GREEN HOUSE GASES (GHG)]

GHG : Carbon dioxide, Methane, NOx, SOx, CFC, etc

SOLUTION!

GREEN TECHNOLOGY AND GREEN LIVING IS THE SOLUTION

"CO2 is the most important anthropogenic of GHG and the main sources of atmospheric CO2 is from burning of fossil fuels – 75% of increase in atmospheric CO2 since industrial times ***(Source: Cities and Climate Change – Global Report on Human Settlements 2011, UN-Habitat).***

LOW CARBON DEVELOPMENT IN MALAYSIA

2009 : COP 15 in Copenhagen

"...Malaysia is adopting an indicator of a voluntary reduction of up to 40% in terms of emissions intensity of GDP by the year 2020 compared to 2005 levels."

12 December 2009

2016 : COP 21 in Paris

"... Malaysia intends to reduce its greenhouse gas (GHG) emissions intensity of GDP by 45% by 2030 relative to the emissions intensity of GDP in 2005."

- Malaysia ratified the Paris Agreement on 16 November 2016

NATIONAL POLICIES / DOCUMENTS THAT INDIRECTLY RELATED TO PROMOTION OF ZERO ENERGY BUILDING (ZEB) IN MALAYSIA

- At this moment the is **no specific policy and regulation** related to promotion & development of ZEB.
- However, there are several programs and policies that **be able to be used towards** the promotion & development of ZEB, using the low carbon building development and sustainable energy development program.

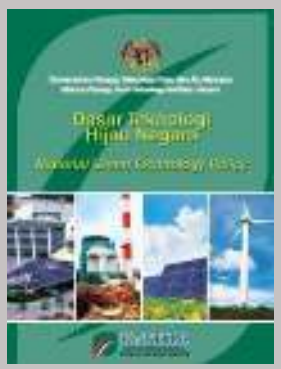
a) **Climate Change Mitigation Program.**
b) **National target to reduce 45% GHG intensity by 2030 (COP21 Paris).**
c) **Green Technology Policy (2010).**
d) **Renewable Energy Act (2011).**
e) **Malaysia Green Technology Master Plan (2017)**
f) **Low Carbon Cities Framework (2011)** – Low Carbon Buildings.
g) **National Energy Efficiency Action Plan** - Component Energy Audit & EE Design.
h) **Energy Efficient Program under the 11th Malaysia Plan (2016 – 2020).**
i) **Construction Industry Transformation Program (CITP).**
j) **Minimum Energy Performance Standards (MEPS).**
k) **Standards (MS1525, MS2680, MS1837, CIS20-GreenPASS, ISO50001)**

2010 : Green Technology Policy (to support green and low carbon development)

Definition of "Green Technology"

Green technology is the development and application of products, equipment, and systems used to conserve the natural environment and resources, which minimises and reduces the negative impact of human activities

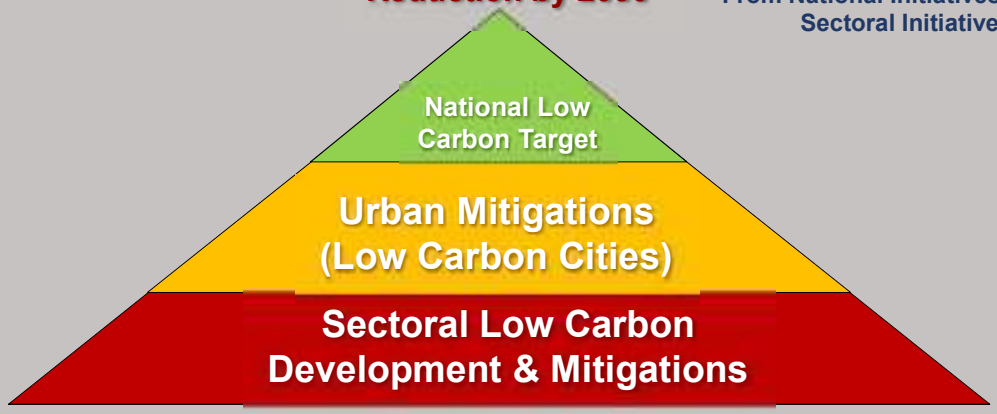
- **Minimises the degradation of the environment.**
- **It has zero or low green house (GHG) emission.**
- **It safe for use and promotes healthy and improved environment for all forms of life**
- **It conserves the uses of energy and natural resources; and**
- **It promotes the use of renewable resources.**



CLIMATE CHANGE MITIGATIONS – LOW CARBON PROGRAM

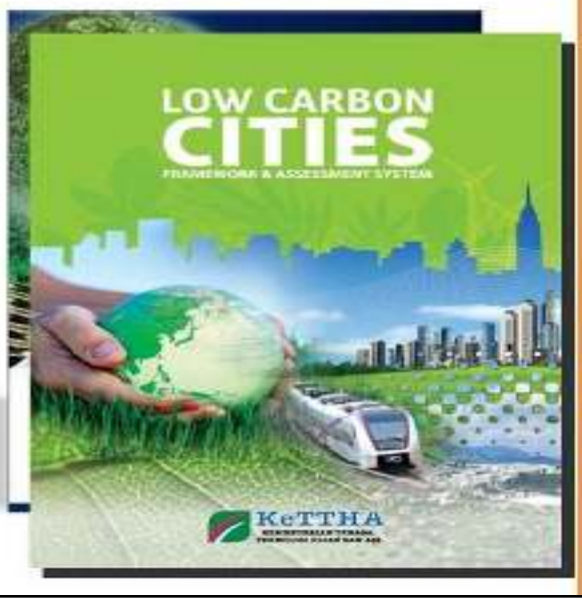
45% GHG Intensity Reduction by 2030

From National Initiatives down to Sectoral Initiatives)



Low Carbon Cities Framework & Assessment System - Use of Document

This document is to *assist local authorities, township developers, designers and individuals* in assessing whether developments carried out within the city contributes towards the reduction or decrease in GHG.

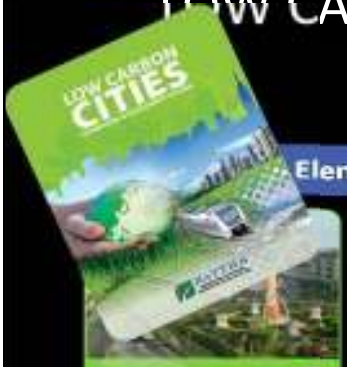


Was Launched in Sept 2011 by YAB Prime Minister

LOW CARBON CITIES FRAMEWORK (LCCF)

PERFORMANCE CRITERIA

Base on Carbon Footprint



Elements for GHG Reductions in Cities and Townships

Urban Environment
- Site Selection
- Urban Form
- Urban Greenery & Air Quality

Urban Transportation
- Shift of Transport Mode
- Green Transport Infrastructure
- Green Vehicles
- Traffic Management

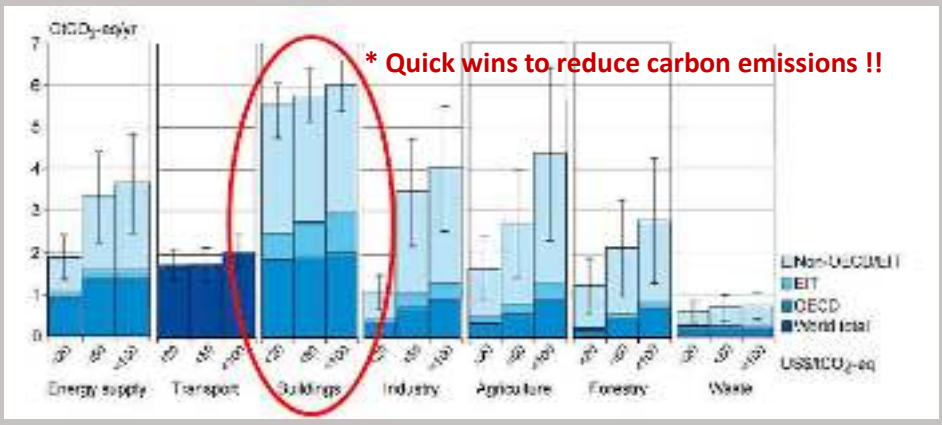
Urban Infrastructure
- Infrastructure Provision
- Waste
- Energy
- Water

Buildings
- Low Carbon Building
- Community Service

** ZEB = High performance Low Carbon Building

Elements Contribute to GHG emission → 33 Performance Criteria* → 35 Sub Criteria

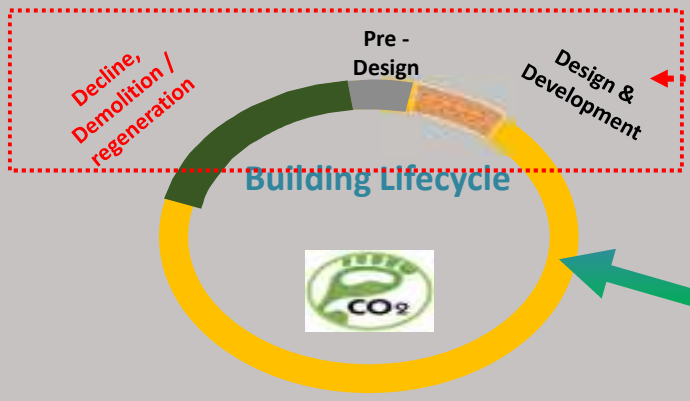
FACT : CHANCES TO REDUCE CARBON EMISSIONS (report by IPCC)



Building sector has the higher chances to reduce carbon emission in a township

States & Local Government / PBTs that keen to have low carbon cities program MUST give attention to this key and important fact.

IMPORTANT FACT (by UNEP SCBI)
Carbon Emission in a life cycle of a building



During development phase
[Embodied CO2 footprint]
~ 20%

Operation Phase : Use, Management & Maintenance
[Higher Operational CO2 footprint] From Energy Usage !!
80%

Next Step: After Energy Efficiency then Use Renewable Energy to off-set further the CO2 emission in building

FACT! Most of the CO2e emission is during the operation phase !!
ENERGY MANAGEMENT to tackle the source of the CO2 emission

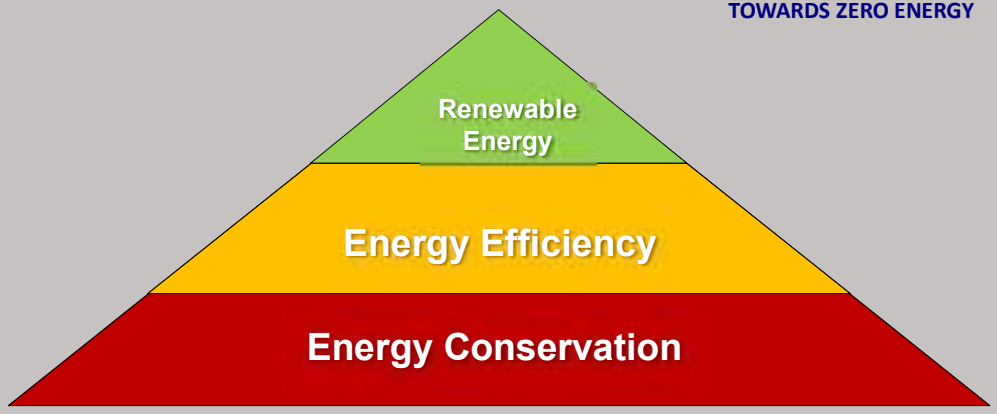
CONCEPT OF ZERO ENERGY BUILDING PROGRAM

To promote the adoption of super energy efficient (low carbon) building by using alternative method focusing purely on sustainable energy practices, starting with advance energy efficiency measures in reducing overall energy demand or consumption and offsetting the balance of minimum energy needed by using on-site renewable energy.

ZEB = (EE + RE) X Sustainable Practices

PRACTICAL APPROACH
to achieve Zero Energy Building (ZEB)

TOWARDS CARBON NEUTRAL
TOWARDS ZERO ENERGY



SUSTAINABLE ENERGY PYRAMID !!
BASIC PRINCIPAL FOR SUSTAINABLE ENERGY & LOW CARBON PROGRAM

PRACTICAL APPROACH
to achieve Zero Energy Building (ZEB)

STOP WASTAGE FIRST !!

DEFINITION (by some EU Countries)

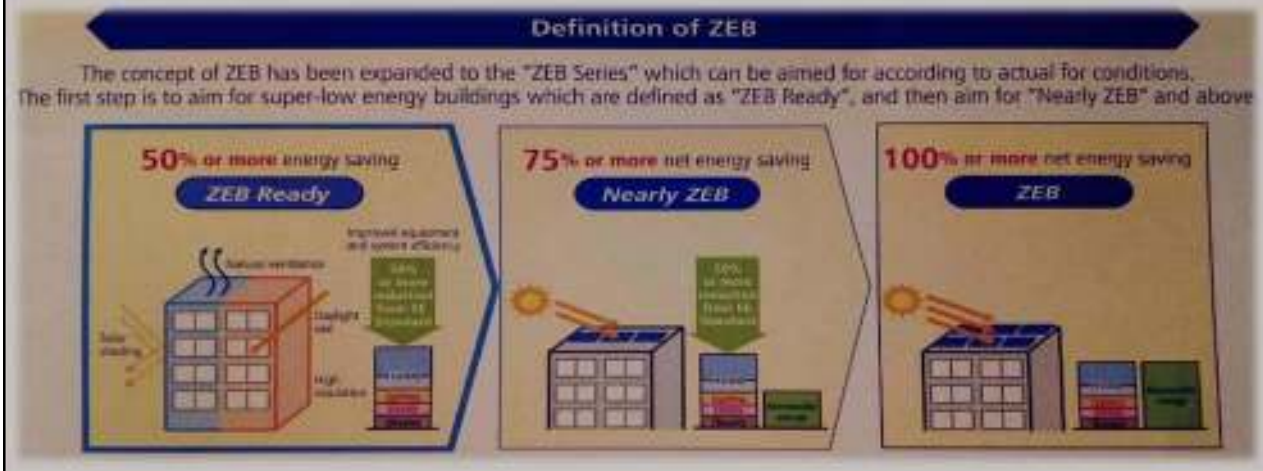
1) **Net Zero Energy Site;**
   - Conservative approach to achieving ZEB.
   - EE building designs.
   - Own RE Generations.

2) **Net Zero Source Site;**
   - EE building designs.
   - Purchase RE from nearby source.

3) **Net Zero – Energy Costs;**
   - EE building designs.
   - Purchase RE based on Net Energy Billing from grid.

4) **Net Zero – Energy Emissions;**
   - EE building designs.
   - Purchase power supply that have lower GHG factor (higher RE Mix).
   - Purchase carbon credit to off-set the operational carbon (energy usage).

DEFINITION (By JAPAN)



ZERO ENERGY BUILDINGS (ZEB) SERIES
(Malaysia suitable to adopt the Japanese definition on ZEB)

FACTS ABOUT ZEB

- **Zero Energy Buildings is <u>not necessary MUST be Net ZEB</u>. It is normally achieved step-by-step, started with EE.**
  - Ready to go ZEB.
  - Nearly ZEB.
  - Net ZEB / Positive ZEB.
- **ZEB is not part of conventional green buildings category.**
  - It has different assessment / performance metric.
  - It focus purely on sustainable energy (EE + RE).
- **ZEB is not new in Malaysia.**
  - Already started since 2002.
  - Some buildings already achieved ZEB performance.
  - SEDA Malaysia had started the voluntary ZEB Facilitation Program under the current Low Carbon Building Facilitation Program.
  - Some existing initiatives already exist to support the ZEB eco-system.

PROPOSED STANDARDISATION OF ZEB (METHODOLOGY) (ISO TC 205 WG)

1) **At Planning Stage:**
   - Have **clear 'policy' or 'need statement'** to achieve ZEB.
   - Step-by-step (Ready to go ZEB , Nearly ZEB & Net ZEB).
2) **At Design Stage:**
   - To **select proper strategy** to achieve ZEB.
   - Translate design to specifications : Design, materials, equipment certified by local / international standard.
3) **At Construction stage:**
   - **According to specification.**
   - To install the right selected materials / equipment.
4) **At Commissioning stage:**
   - Commissioning **according to performance** requirement.

Six Core Elements for Standardisation (ISO)

5) **At Monitoring & Verifications stage:**
   - To **inspect the actual energy consumption**.
   - To inspect the actual and compare to design energy consumption target.
6) **At Reporting stage:**
   - To analyse the actual and design target energy system performance report, by simulation, etc.
   - To **report the actual performance and ZEB achievement**.

Voluntary Initiatives By the Government & Private Organisations

Compiled by SEDA Malaysia

Sustainable Tools in Malaysia (by chronology)

1. GreenMARK (BCA – Singapore)
2. Green Building Index (GBI)
3. LEED (USGBC – US)
4. GreenRE (REHDA)
5. Melaka Green Seal (Melaka)*
6. CIS 20:2012 – GreenPASS (CIDB, now adopted by SEDA)* - Suitable for ZEB
7. Penarafan Hijau (PH-JKR)*.
8. MyCREST (CIDB-JKR)*.
9. CASBEE Iskandar (IRDA-Japan)
10. BEI Labelling (Energy Commission)*

** Government tools*
*** * The underlined are tools made in Malaysia.*

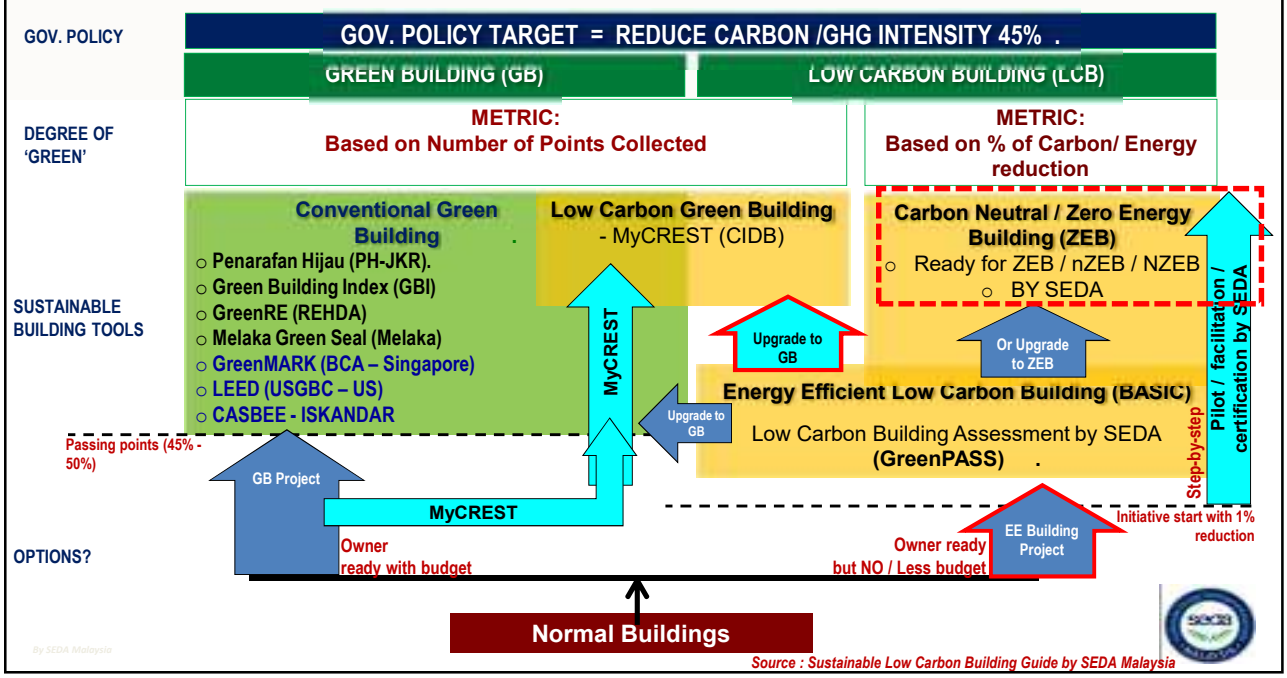
STANDARDS

- MS 1525
- ISO 50001
- ISO 14000

Notes:
- *GreenPASS is based on 100% CO2 reduction assessment.*
- *MyCREST is based on partially CO2 reduction assessment.*

*** FACTS : No single tool can provide fair assessment to all types of buildings. That is why more tools have been created and adapted to different assessment methods for the combination of various elements of sustainability (usually the final evaluation in the form of accumulated marks) or only subject to a single sustainability metric (such as GHG, Carbon, water or ecology index).*

SUMMARY / MAPPING OF GREEN BUILDING / LOW CARBON BUILDING / ZEB



Source : Sustainable Low Carbon Building Guide by SEDA Malaysia

COST OF IMPLEMENTATION (Research by SEDA Malaysia)
(For Low Carbon Building / ZEB)

ENERGY MANAGEMENT / ENERGY EFFICIENCY

- **RM0.60 to RM2.00 per kWh reduction**
- **RM 0.80 to RM 2.70 per KgCO2 reduction**

(payback within 3 – 8 years)

** Based on several energy auditing, retrofitting and low carbon buildings at commercial, industries and residential buildings in Malaysia by SEDA Malaysia.*

RENERWABLE ENERGY – RE (Solar PV)

- **(RM 6.70 to RM 8.40) per kWh reduction**
- **RM 7.30 to RM 11.20 per KgCO2 reduction**

** Based on installation of solar PV on roof pricing (RM6.5k – 10k/kWp)*

SEDA MALAYSIA's VOLUNTARY INITIATIVE

ZERO ENERGY BUILDING FACILITATION PROGRAM

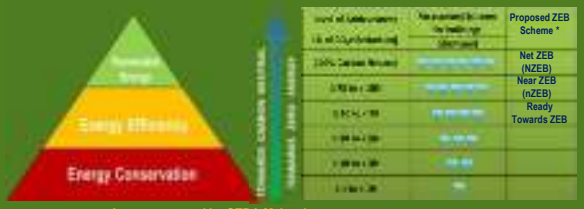
NEARLY ZERO ENERGY BUILDING (nZEB)
NET ZERO ENERGY BUILDING (NZEB)

- *Ready-to-go ZEB* is a beginner after achieving energy savings more than 50%.
- *Nearly Zero Energy Building* (nZEB) is an advance Low Carbon Building initiatives.
- It is a few steps ahead towards achieving *Net Zero Building* (NZEB) or Carbon Neutral Building (operational carbon)

OBJECTIVE

To promote the adoption of super low carbon green building by using alternative method focusing purely on sustainable energy practices, starting with advance energy efficiency measures in reducing overall energy demand or consumption and offsetting the balance of minimum energy needed by using on-site renewable energy.

ZEB = (EE + RE) X Sustainable Practices



Assessment tool by SEDA Malaysia :
Adopted Construction Industry Standard (CIS-20:2012) – GreenPASS developed by CIDB Malaysia

Info at:

www.seda.gov.my/ZEB

Tel / Mobile / SMS: +6019 - 282 9102
Tel: +603 - 8870 5841

Sustainable Energy Development Authority Malaysia (SEDA Malaysia)
Level 9, Galeria PJH, Jalan P4W, Persiaran Perdana, Presint 4, 62570 PUTRAJAYA
Tel: 03-8870 5800 Fax: 03-8870 5900
E-mail: steve@seda.gov.my hambali@seda.gov.my

SUSTAINABLE ENERGY LOW CARBON BUILDING ASSESSMENT

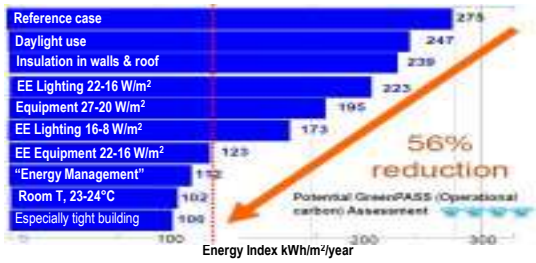
(Under the Low Carbon Building Facilitation Program)

- A voluntary & industry driven initiatives by SEDA.
- The assessment using UNEP-SBCI Common Carbon Metric, MS 1525 & CIDB's CIS20-GreenPASS.

Objective ??

- ✓ To support the low carbon cities development.
- ✓ To provide national consistency and a common language around the definition of low carbon building.
- ✓ To provide systematic assessment to encourage energy efficiency in building implementation.
- ✓ As platform for building owners to declare the performance of the buildings.
- ✓ To support government initiatives (RMK-11, LCCF, NEEAP, Energy Audit Program).
- ✓ To provide a basis for ongoing assessment and evaluation of low carbon building.
- ✓ As alternative platform towards achieving Green Building Certification (MyCREST, GBI, etc.)
- ✓ To facilitate local authorities to develop Common Carbon Metric for various building typologies.

NEW BUILDING: Example of CO_2 Reduction for LEO Building:



Carbon Reduction in Existing Building:

Low Carbon Building / Zero Energy Building Assessment Tool by SEDA Malaysia.

* Adopted the CIDB's Construction Industry Standard (CIS-20:2012) – GreenPASS Operation

GreenPASS is a Performance Based **Assessment** System for Building

Green PASS assessment is **100% based on actual carbon emission** from building construction and / or operations

Applied for :

1) Building Construction;
2) Building Operations

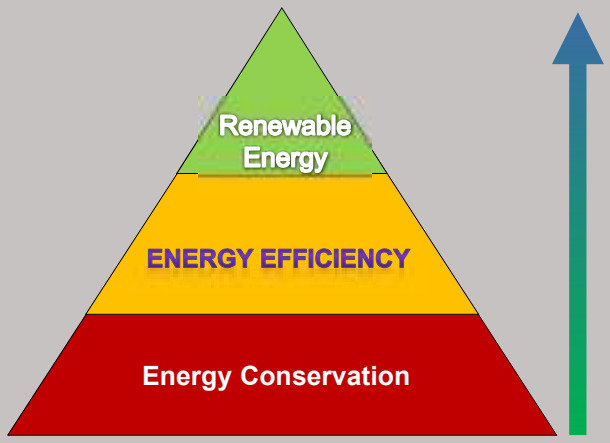
Recognised as one of the sustainable building tools together with PH (JKR) and GBI under RMK11

Low Carbon Building / Zero Energy Building Assessment Tool by SEDA Malaysia.

* Adopted the CIDB's Construction Industry Standard (CIS-20:2012) – GreenPASS Operation

TOWARDS ZERO ENERGY
TOWARDS CARBON NEUTRAL

ZEB = (EE + RE) X Sustainable Practices



Level of Achievement (% of CO_2e Reduction)	Assessment Scheme for buildings (diamond)	ZEB Certification Scheme *
100% Carbon Neutral		Net ZEB (NZEB)
≥ 70 to < 100		Near ZEB (nZEB)
≥ 50 to < 70		Ready Towards ZEB
≥ 30 to < 50		
≥ 10 to < 30		
≥ 1 to < 10		

* Note : Possible aligning to Japan ZEB Scheme Concept

EXAMPLE OF NEARLY ZERO ENERGY BUILDING (nZEB) IN MALAYSIA

2007

Net BEI = 30 (86% reduce)
65 TonCO2/year
GBI : Certified (2009)
ASEAN EA : 2009/2010/2011

2004

Net BEI = 114 (58% reduce)
1,490 TonCO2/year
GBI : Silver (2011)
ASEAN Energy Award : 2006

2010

Net BEI = 63 (70% reduce)
637 TonCO2/year (**To verify)
GBI & GreenMark : Platinum (2011)
ASEAN EA : 2012

PRACTICAL APPROACH
to achieve Nearly Zero Energy Building (nZEB)

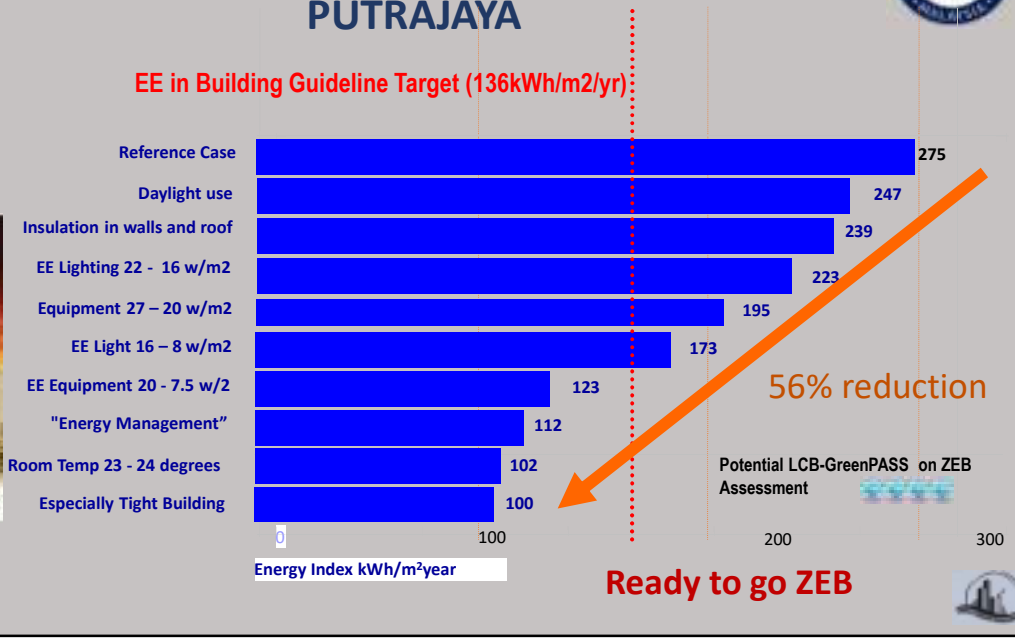
NEW BUILDING DESIGN

Energy Management Features & The Building Performance

In 2002: KeTTHA's LEO BUILDING IN PUTRAJAYA

In-house Energy Manager + Operation monitoring team by SEDA

In 2002: KeTTHA's LEO BUILDING IN PUTRAJAYA



Some nearly ZEB Projects

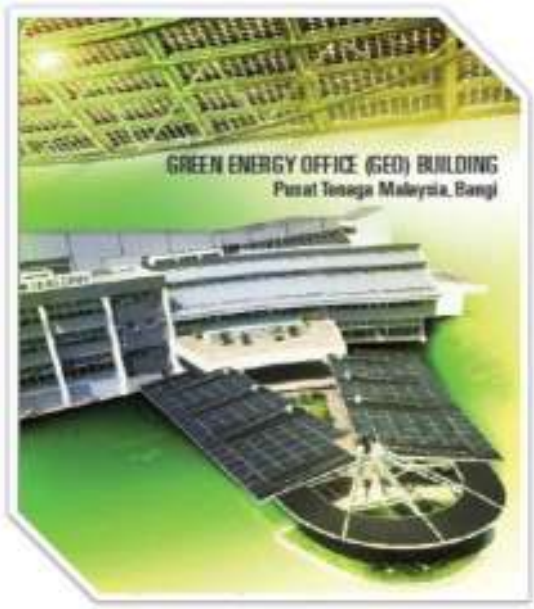
2007

GreenTech Malaysia's GEO Building

Net BEI = 30 (86% reduce)
65 TonCO2/year
GBI : Certified (2009)
ASEAN EA : 2009/2010/2011

Potential LCB-GreenPASS (Operational carbon) Assessment

Nearly ZEB



2011 ESB – PANASONIC GREEN WAREHOUSE in SHAH ALAM

-Green Features:

- 100% Daylighting.
- EE Lighting Design and features.
- Inverter Aircond System (office)
- Almost 100% Cross ventilation.
- Solar Compund Lighting.
- Rain water Harvest System

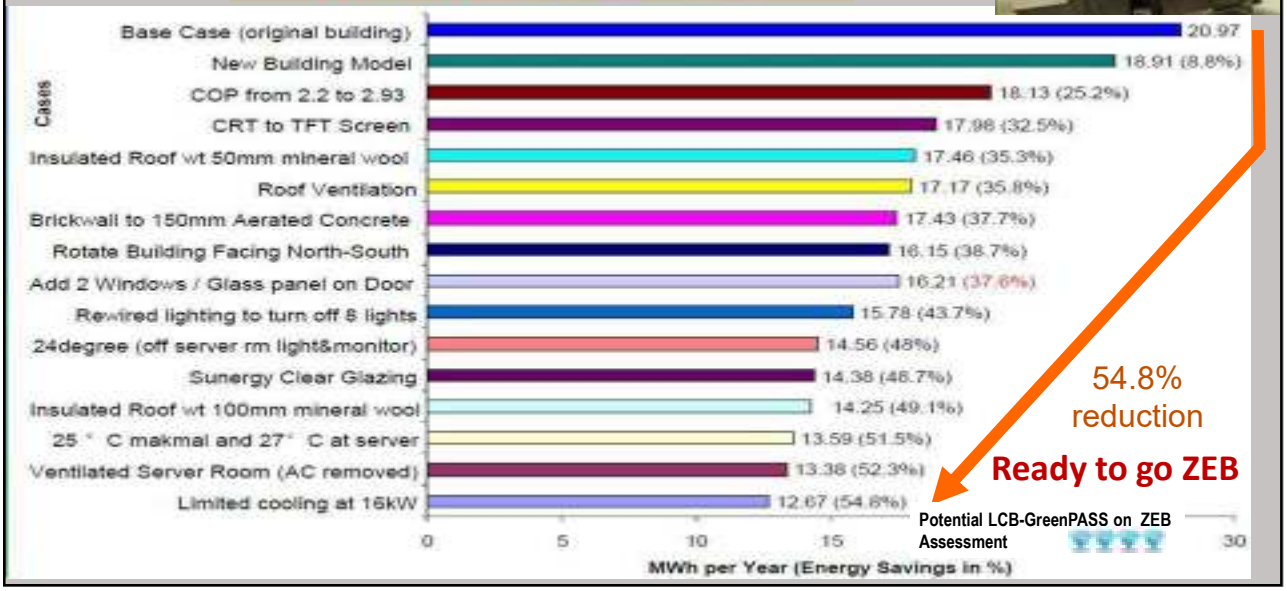
APPROCHING CARBON NEUTRAL BUILDING

- Net BEI = 15.6kWh/m2/year (more than 70% energy reduced)
- 384.2 TonCO2/year
- SME Green Award 2012
- ASEAN Energy Award : 2012 : 1st Runner-up Tropical Buildings

Potential LCB-GreenPASS on ZEB Assessment

Nearly ZEB

A Government School Computer Lab : ENERGY DESIGN ELEMENTS



PRACTICAL APPROACH
to achieve Nearly Zero Energy Building (nZEB)

EXISTING / RETROFITTED BUILDING / PARTIALLY BUILDING

Through energy auditing and energy saving implementation

ENERGY AUDITING

A systematic energy management process

To identify the potential energy saving measures in quantitative method and life cost cycle analysis

2007 – RETROFFITED OLD WAREHOUSE IN SHAH ALAM with enhance energy management program

Measures	Annual Saving Electrical	
	kWh/yr	RM/yr
No Cost Measures		
De-lamping office lighting	13,476	3,153.38
Low Cost Measures		
Use timer controller for temperature and operate silo ventilation	687,760	160,935.84
Use of daylight in warehouse	19,943	4,666.66
Replace normal EXIT signage to LED	2,208	516.67
Awareness campaigns	703,931	164,719.85
High Cost Measures		
Replace the Metal Halide lamps to T5HO lamps	957,012	223,940.81
Lighting zoning	498,584	116,668.66
TOTAL	2,882,914	674,602

Actual Energy & CO2 Reduction more than 50%

Potential LCB-GreenPASS on ZEB Assessment

Ready to go ZEB

2010 – LOW CARBON HOUSE P14 @ PUTRAJAYA
(A Net Zero Energy Home)

Only need 2 – 3 kWp Solar PV to make zero energy house

Since 2010 – Nearly Zero Energy Home (nZEB)
In 2017 – Net Zero Energy Home (NZEB)

- The Green Features:
  - East-West building orientation.
  - Landscape to absorb heat (IR and UV).
  - Natural cross ventilation & Daylighting.
  - Energy efficient light & appliances.
  - Energy efficient Interior Design.
  - Waste management.
  - Awareness and Green Practice.
  - EE (61.4%) + RE (38.6%) =

EE (61.4%) + RE (38.6%)
= 100% reduction
Net BEI = 0 kWh/m2/year

Potential LCB-GreenPASS on ZEB Assessment

2014 – PARTIALLY BUILDING CASE (Strata properties)

SEDA Low Energy Office @ Kota Kinabalu

Only need 2.5kWp Solar PV to make zero energy office

- The Energy Efficient Features:
  - Maximise use of Daylighting.
  - Energy efficient light & appliances.
  - Energy efficient Interior Design.
  - Low Carbon ICT system
  - Awareness and Practice.

BEI = 27 kWh/m2/year
CO2 = 16 KgCO2 / m2 / year
= 86.4% reduction

Potential LCB-GreenPASS on ZEB Assessment

Nearly ZEB

ECO SYSTEM TO SUPPORT NEARLY ZERO ENERGY BUILDING (nZEB)

EXISTING & PLANNED PROGRAM & INITIATIVES

CURRENT ECO SYSTEM TO SUPPORT ZERO ENERGY BUILDING (ZEB)

READY ASSESSMENT TOOL for ZEB / LCB by SEDA adopted CIDB's *CIS20:2012 - GreenPASS (Operation)*

Low Carbon Cities Framework (LCCF) : Low Carbon Building

STANDARDS on Sustainable Energy: MS1525, MS2680, MS1837, ISO15001 / AEMAS

Guidelines & References Cases

Energy Efficient products ready in Malaysia (ST MEPS)

Existing professional NGOs & experts in Malaysia (government & private)

Supporting ZEB = High Performance Low Carbon Building in Malaysia

EE & RE Trainings & Capacity Building Program by agencies / private.

INCENTIVES: Current incentives on sustainable energy & financial facilities (EPC)

R & D Experts for local universities on Sustainable Energy

NET ENERGY METERING (NEM) Program by SEDA : To off-set further balance of energy needed by RE.

SEDA's Low Carbon Building / ZEB Facilitation Program: PBTs, Gov Agencies & Private

Existing Sustainable Energy Service Provider (ESCOs & Solar PV Service Provider)

Affordable Online Energy Monitoring System (by SEDA, etc)

STANDARDS THAT ALREADY AVAILABLE IN MALAYSIA (Minimum performance)

- ❑ DESIGN & RETROFITTING PHASE:
  - ✓ BUILDING ENERGY STANDARD - MS1525 – Code of Practice in Energy Efficiency & Use of Renewable Energy for Non-residential Buildings.
  - ✓ MS1837 - Installation of Grid Connected Solar PV System.
  - ✓ MS2680 - Code of Practice in EE & RE for Residential Buildings.
- ❑ OPERATION AND USE PHASE:
  - ✓ ISO 15001 – Energy Management System.
  - ✓ AEMAS by GreenTech Malaysia.

LOCAL PROFESSIONAL EXPERTS THAT CAN BE TRAINED FOR ZEB DEVELOPMENT PROGRAM

Available local experts in sustainable energy ;

- Energy efficiency – Energy management, Energy Audit, EPC, etc.
- Renewable Energy – PV Services providers, NEM / SELCo.
- Sustainable Energy management.
- Integrated design – Sustainable / green building professionals.

- **Government :** Building experts from JKR, CIDB, SEDA Malaysia, Universities, etc.
- **Professional NGOs :** IEM, PAM, MGBC, MAESCO, MAREEM, MEPA, AEE, PVSP, etc.

- **Private & Businesses :**
  - ✓Building experts such as Engineers, architects, QS, ID, Energy, ICT, FM, etc.
  - ✓Energy Service Companies (ESCOs)- retrofitting.
  - ✓ Solar Photovoltaic PV Service Providers.

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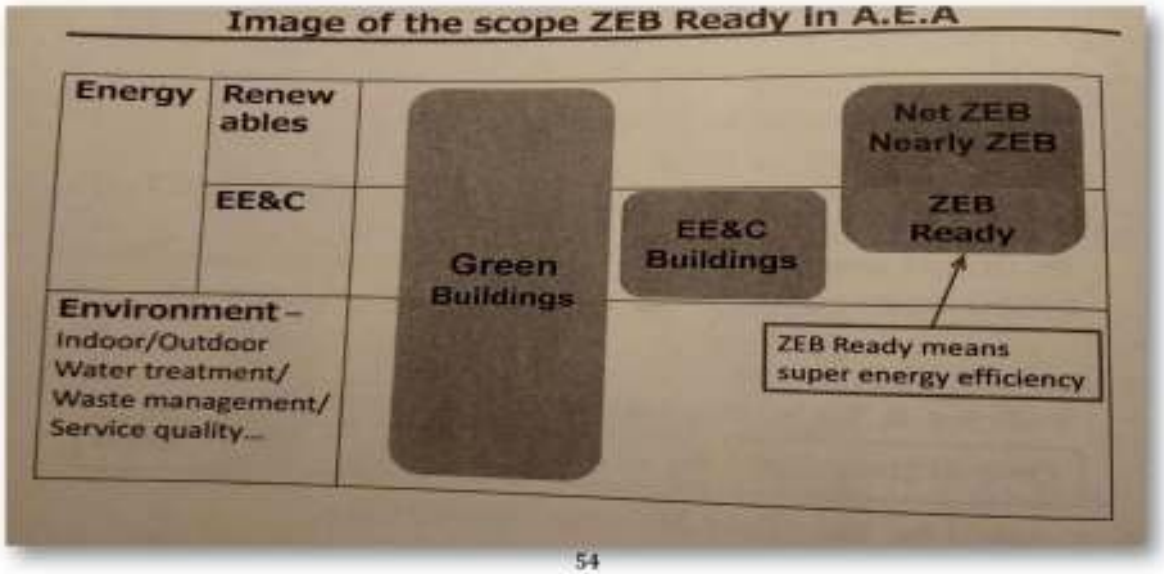
TRAINING ON ZERO ENERGY BUILDINGS (ZEB)

ZERO ENERGY BUILDINGS (ZEB)
- ZEB Category in ASEAN Energy Award (NEW)



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ZEB PROMOTION & COOPERATION SUPPORTED BY JAPAN

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ZERO ENERGY BUILDINGS (ZEB) FOCUS DISCUSSION GROUP

FUTURE ZEB PROGRAM IN MALAYSIA PLANNED BY SEDA MALAYSIA

- **More engagement** with government & building industry;
  - More awareness program to public and industry.
  - Technical trainings to developers & building professionals.
- **Facilitation on demonstration projects**;
  - Existing buildings.
  - New buildings.
- **Promotion & development of suitable technologies** for ZEB in Malaysia (with technology providers).
- **Collaborations, etc.**

Thank you for your attention

FACILITATION ON LOW CARBON BUILDING / ZEB PROGRAM?

- Tel / SMS : +6019-2829102

steve@seda.gov.my / asetip@damansara.net

http://www.slideshare.net/asetip

SEDA Malaysia,
Galeria PjH, Level 9
Jalan P4W, Persiaran Perdana,
Presint 4, 62100 Putrajaya, Malaysia.

+ **Steve Anthony Lojuntin**

Phone : +603-8870 5800 / 5841
Email: steve@seda.gov.my
Web: www.seda.gov.my