ZERO ENERGY BUILDING (ZEB) DEVELOPMENT IN MALAYSIA

18 OCTOBER 2018

1st version presented during UNDP-JKR-BSEEP National Conference: 11 May 2017 in KLCC
2nd version presented during ZEB Focus Group Discussion by Mitsubishi MRI: 12 Mar 2018 in SEDA
2nd version briefing presented during ZEB Workshop in Japan: 7 September 2018

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

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 - 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).
GLOBAL PROBLEM – ENERGY SECURITY

SOLUTION:
– IMPLEMENT TOTAL SUSTAINABLE ENERGY PROGRAM

ENHANCING ENERGY EFFICIENCY!
Managing the energy demand to control the rate of demand

PROMOTE RENEWABLE ENERGY!
Offsetting the fossil fuel in order to supply clean & green energy
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.”

17 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 there 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 Policy.
  b) National target to reduce 45% GHG intensity by 2030 (COP21 Paris).
  c) Green Technology Policy (2010).
  e) Malaysia Green Technology Master Plan (2017)
  i) Construction Industry Transformation Program (CITP).
  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 is 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.

Download copy @ www.kettha.gov.my
CLIMATE CHANGE MITIGATIONS – LOW CARBON PROGRAM

From National Initiatives down to Sectoral Initiatives

- National Low Carbon Target
- Urban Mitigations (Low Carbon Cities)
- Sectoral Low Carbon Development & Mitigations
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
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
Performance Criteria for GHG Reductions for Cities

- Urban Environment
- Urban Transportation
- Urban Infrastructure
- Building

LOW CARBON CITIES FRAMEWORK (LCCF)

**Performance Criteria**

- Policy control, Technological development, better process & product management, change in procurement system, carbon capture, consumption strategies & others.

**ZEB = High performance Low Carbon Building**
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.

\[
\text{ZEB} = (\text{EE} + \text{RE}) \times \text{Sustainable Practices}
\]
Use, Management & Maintenance

Higher Operational CO2 footprint

Mostly addressed by most conventional tools

Embodied CO2 footprint

~ 20%

SUSTAINABLE ENERGY PYRAMID !!

BASIC PRINCIPAL FOR SUSTAINABLE ENERGY & LOW CARBON PROGRAM

PRACTICAL APPROACH to achieve Zero Energy Building (ZEB)

TOWARDS CARBON NEUTRAL
TOWARDS ZERO ENERGY

Towards High Performance Low Carbon Development

Important Fact!

Energy Conservation

Renewable Energy

Energy Efficiency

Energy Conservation

TOWARDS CARBON NEUTRAL TO TOWARDS ZERO ENERGY

SUSTAINABLE ENERGY PYRAMID !!

BASIC PRINCIPAL FOR SUSTAINABLE ENERGY & LOW CARBON PROGRAM
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)

The concept of ZEB has been expanded to the “ZEB Series” which can be aimed for according to actual conditions. The first step is to aim for super-low energy buildings which are defined as “ZEB Ready”, and then aim for “Nearly ZEB” and above.
FACTS ABOUT ZEB

- **Zero Energy Buildings is not necessary MUST be Net ZEB. 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.
1) **At Planning Stage:**
   - Have clear ‘policy’ or ‘need statement’ to achieve ZEB.

2) **At Design Stage:**
   - To select proper strategy to achieve ZEB.
   - Proper materials, equipment certified by local / international standard.

3) **At Construction stage:**
   - To install the right selected materials / equipment.
   - According to specification.

4) **At Commissioning stage:**
   - Commissioning according to performance requirement.

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.
### 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)**

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

**STANDARDS**
- MS 1525
- ISO 50001
- ISO 14000

**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

GOV. POLICY

GOV. POLICY TARGET = REDUCE CARBON / GHG INTENSITY 45%.

GREEN BUILDING (GB) | LOW CARBON BUILDING (LCB)

DEGREE OF 'GREEN'

SUSTAINABLE BUILDING TOOLS

OPTIONS?

Conventional Green Building
- Penarafan Hijau (PH-JKR).
- Green Building Index (GBI).
- GreenRE (REHDA).
- Melaka Green Seal (Melaka).
- GreenMARK (BCA – Singapore).
- CASBEE - ISKANDAR.

Low Carbon Green Building
- MyCREST (CIDB).

Pilot / facilitation / certification by SEDA.

Low Carbon Building Assessment by SEDA (GreenPASS).

Carbon Neutral / Zero Energy Building (ZEB)
- Ready for ZEB / nZEB / NZEB.
- By SEDA.

Energy Efficient Low Carbon Building (BASIC)
- Owner ready with budget.
- Upgrade to GB.

METRIC:
Based on Number of Points Collected

METRIC:
Based on % of Carbon/ Energy reduction

Passing points (45% - 50%)

Owner ready but NO / Less budget

By SEDA Malaysia

Source: Sustainable Low Carbon Building Guide by SEDA Malaysia.
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.

RENEWABLE 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 CO₂ Reduction for LEO Building:

<table>
<thead>
<tr>
<th>Reference case</th>
<th>Daylight use</th>
<th>Insulation in walls &amp; roof</th>
<th>EE Lighting 22-16 W/m²</th>
<th>Equipment 27-20 W/m²</th>
<th>EE Lighting 16-8 W/m²</th>
<th>EE Equipment 22-16 W/m²</th>
<th>“Energy Management”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Carbon Reduction in Existing Building:

<table>
<thead>
<tr>
<th>MEASURES</th>
<th>ANNUAL SAVING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electrical kWh/yr</td>
</tr>
<tr>
<td></td>
<td>13,475</td>
</tr>
<tr>
<td></td>
<td>Low cost measures</td>
</tr>
<tr>
<td></td>
<td>Use timer controller for temperature and operate air ventilation</td>
</tr>
<tr>
<td></td>
<td>Use of daylight in warehouse</td>
</tr>
<tr>
<td></td>
<td>Replace normal EXIT signage to LED</td>
</tr>
<tr>
<td></td>
<td>Awareness campaigns</td>
</tr>
<tr>
<td></td>
<td>High Cost Measures</td>
</tr>
<tr>
<td></td>
<td>Replace the Metal Halide lamps to TSHC lamps</td>
</tr>
<tr>
<td></td>
<td>Lighting zoning</td>
</tr>
</tbody>
</table>

Total | 674.602
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

<table>
<thead>
<tr>
<th>Level of Achievement (%) of CO₂e Reduction</th>
<th>Assessment Scheme for buildings (diamond)</th>
<th>ZEB Certification Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% Carbon Neutral</td>
<td></td>
<td>Net ZEB (NZEB)</td>
</tr>
<tr>
<td>≥ 70 to &lt; 100</td>
<td></td>
<td>Near ZEB (nZEB)</td>
</tr>
<tr>
<td>≥ 50 to &lt; 70</td>
<td></td>
<td>Ready Towards ZEB</td>
</tr>
<tr>
<td>≥ 30 to &lt; 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 10 to &lt; 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥ 1 to &lt; 10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Note: Possible aligning to Japan ZEB Scheme Concept
EXAMPLE OF NEARLY ZERO ENERGY BUILDING (nZEB) IN MALAYSIA

2007

Malaysia 2009  30sen
Net BEI = 30 (86% reduce)
65 TonCO2/year
GBI : Certified (2009)

2004

Malaysia 2009  50sen
Net BEI = 114 (59% reduce)
1,490 TonCO2/year
GBI : Silver (2011)
ASEAN Energy Award : 2006

2010

Malaysia 2009  RM1
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

- Windows Design
- Roof and wall Insulation
- Innovative Atrium Design
- Use of Daylight
- Interior Design
- Building Orientation
- M & E Installation
- Energy Management System (EMS)
- Low Energy Office Appliances

In-house Energy Manager + Operation monitoring team by SEDA
In 2002: KeTTHA’s LEO BUILDING IN PUTRAJAYA

Energy Index kWh/m²/year

Reference Case 275
Daylight use 247
Insulation in walls and roof 239
EE Lighting 22 - 16 w/m² 223
Equipment 27 – 20 w/m² 195
EE Light 16 – 8 w/m² 173
EE Equipment 20 - 7.5 w/2 123
"Energy Management" 112
Room Temp 23 - 24 degrees 102
Especially Tight Building 100

56% reduction

Potential LCB-GreenPASS on ZEB Assessment

Ready to go ZEB
Some nearly ZEB Projects

2007

GreenTech Malaysia’s GEO Building

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

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 Compound Lighting.
- Rain water Harvest System

- 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

APPROACHING CARBON NEUTRAL BUILDING

Nearly ZEB
# A Government School Computer Lab: ENERGY DESIGN ELEMENTS

### Baseline Results

<table>
<thead>
<tr>
<th>Cases</th>
<th>MWh per Year (Energy Savings in %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Case (original building)</td>
<td>20.97 (0%)</td>
</tr>
<tr>
<td>New Building Model</td>
<td>18.91 (8.8%)</td>
</tr>
<tr>
<td>COP from 2.2 to 2.93</td>
<td>18.13 (52.2%)</td>
</tr>
<tr>
<td>CRT to TFT Screen</td>
<td>17.98 (32.5%)</td>
</tr>
<tr>
<td>Insulated Roof wt 50mm mineral wool</td>
<td>17.46 (35.3%)</td>
</tr>
<tr>
<td>Roof Ventilation</td>
<td>17.17 (35.8%)</td>
</tr>
<tr>
<td>Brickwall to 150mm Aerated Concrete</td>
<td>17.43 (37.7%)</td>
</tr>
<tr>
<td>Rotate Building Facing North-South</td>
<td>16.15 (38.7%)</td>
</tr>
<tr>
<td>Add 2 Windows / Glass panel on Door</td>
<td>16.21 (37.6%)</td>
</tr>
<tr>
<td>Rewired lighting to turn off 8 lights</td>
<td>15.78 (43.7%)</td>
</tr>
<tr>
<td>24degree (off server rm light&amp;monitor)</td>
<td>14.56 (49.7%)</td>
</tr>
<tr>
<td>Sunergy Clear Glazing</td>
<td>14.38 (48.7%)</td>
</tr>
<tr>
<td>Insulated Roof wt 100mm mineral wool</td>
<td>14.25 (49.1%)</td>
</tr>
<tr>
<td>25 °C maksal and 27 °C at server</td>
<td>13.59 (51.5%)</td>
</tr>
<tr>
<td>Ventilated Server Room (AC removed)</td>
<td>13.38 (52.3%)</td>
</tr>
<tr>
<td>Limited cooling at 16kW</td>
<td>12.67 (54.8%)</td>
</tr>
</tbody>
</table>

The total potential LCB-GreenPASS on ZEB Assessment is 54.8% reduction. Ready to go ZEB!
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

<table>
<thead>
<tr>
<th>Measures</th>
<th>Annual Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>kWh/yr</td>
</tr>
<tr>
<td>No Cost Measures</td>
<td></td>
</tr>
<tr>
<td>De-lamping office lighting</td>
<td>13,476</td>
</tr>
<tr>
<td>Low Cost Measures</td>
<td></td>
</tr>
<tr>
<td>Use timer controller for temperature and operate silo ventilation</td>
<td>687,760</td>
</tr>
<tr>
<td>Use of daylight in warehouse</td>
<td>19,943</td>
</tr>
<tr>
<td>Replace normal EXIT signage to LED</td>
<td>2,208</td>
</tr>
<tr>
<td>Awareness campaigns</td>
<td>703,931</td>
</tr>
<tr>
<td>High Cost Measures</td>
<td></td>
</tr>
<tr>
<td>Replace the Metal Halide lamps to T5HO lamps</td>
<td>957,012</td>
</tr>
<tr>
<td>Lighting zoning</td>
<td>498,584</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>2,882,914</td>
</tr>
</tbody>
</table>

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:
  o East-West building orientation.
  o Landscape to absorb heat (IR and UV).
  o Natural cross ventilation & Daylighting.
  o Energy efficient light & appliances.
  o Energy efficient Interior Design.
  o Waste management.
  o Awareness and Green Practice.
  o EE (61.4%) + RE (38.6%) = EE (61.4%) + RE (38.6%) = 100% reduction
Net BEI = 0 kWh/m2/year

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

Potential LCB-GreenPASS on ZEB Assessment
2014 – PARTIALLY BUILDING CASE

SEDA Low Energy Office @ Kota Kinabalu

Approaching Carbon Neutral Office

Only need 2.5kWp Solar PV to make zero energy office

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

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

Nearly ZEB
ECO SYSTEM TO SUPPORT NEARLY ZERO ENERGY BUILDING (nZEB)

EXISTING & PLANNED PROGRAM & INITIATIVES
CURRENT ECO SYSTEM TO SUPPORT ZERO ENERGY BUILDING (ZEB)

Supporting ZEB = High Performance Low Carbon Building in Malaysia

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

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

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

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

**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)**

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

**R & D Experts for local universities on Sustainable Energy**

**Affordable Online Energy Monitoring System (by SEDA, etc)**

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

**Existing Sustainable Energy Service Provider (ESCOs & Solar PV Service Provider)**
STANDARDS THAT ALREADY AVAILABLE IN MALAYSIA (Minimum performance)

- **DESIGN & RETROFITTING PHASE:**
  - **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.
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.
Workshop on The Dissemination and Promotion of ZEB (Zero Energy Building) and ZEB Family /Series Concept.
Organised & Coordinated by METI Japan & AOTS

3-7 September 2018 @ Tokyo
Image of the scope ZEB Ready in A.E.A

<table>
<thead>
<tr>
<th>Energy</th>
<th>Renewables</th>
<th>Environment – Indoor/Outdoor Water treatment/ Waste management/ Service quality...</th>
</tr>
</thead>
<tbody>
<tr>
<td>EE&amp;C</td>
<td></td>
<td>Green Buildings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZEB Ready</td>
</tr>
</tbody>
</table>

Net ZEB Nearly ZEB

EE&C Buildings

ZEB Ready means super energy efficiency
ZEB PROMOTION & COOPERATION SUPPORTED BY JAPAN
ZERO ENERGY BUILDING (ZEB) CONCEPT:
Discussion, Promotion & Gap Analysis Study by Mitsubishi Research Institute (MRI), UTM with Focus Group Stakeholders in Malaysia.
KeTTHA, SEDA Malaysia, MRI, UTM, Energy Commission, GreenTech Malaysia, JKR CAST, Dept of Standard, MGB, IEM, MBPJ, MP Sepang, Perbadanan Putrajaya, IRDA
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

+ Steve Anthony Lojuntin

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

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