ZERO ENERGY BUILDING
Conversion Retrofitting of Existing Building in Malaysia

ASTAKA SPORT COMPLEX

Majlis Perbandaran Petaling Jaya
National & ASEAN Energy Award

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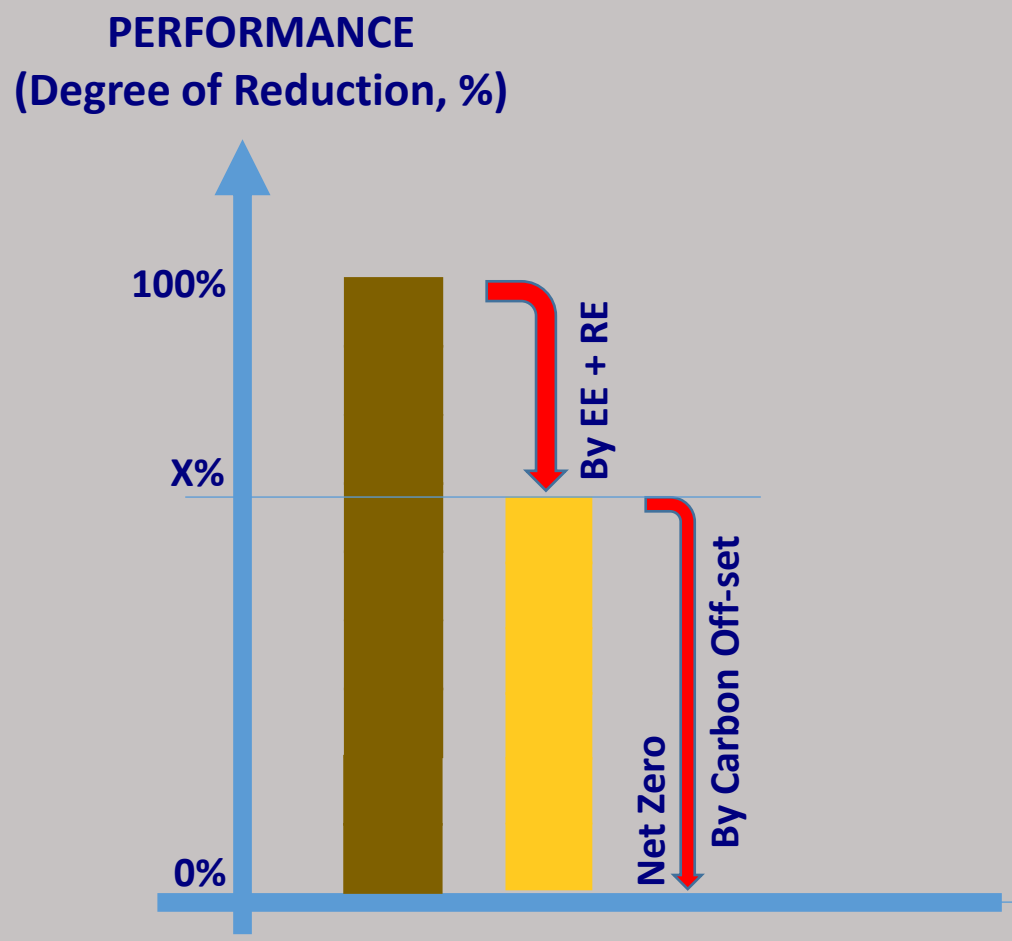
INTRODUCTION

Case of Retrofitting of Existing Building
THE ASTAKA BUILDING

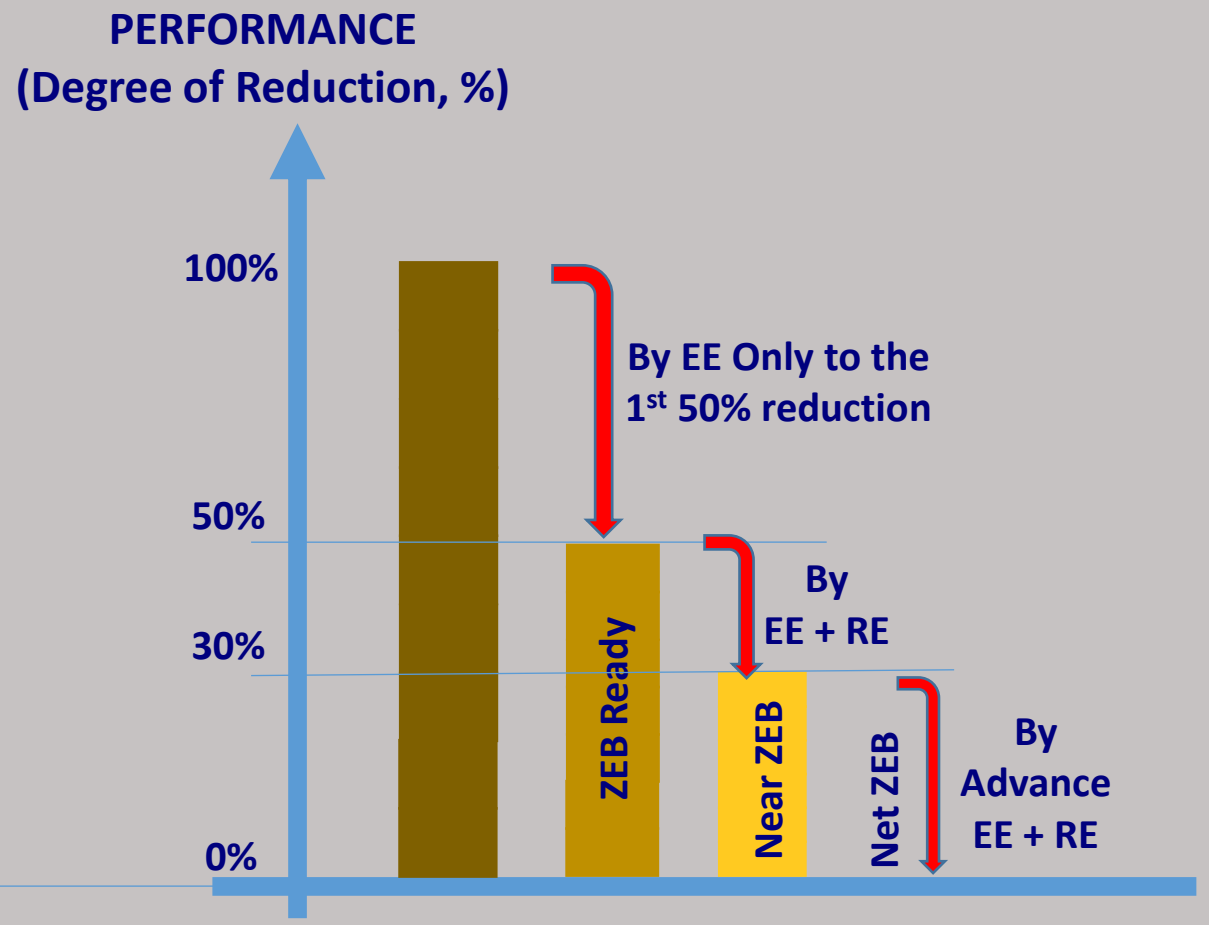
- Simple and straight forward retrofitting.
- According to ZEB Ready target performance.
- Step-by Step approach & affordable.
- Reduced energy up to 64.8 % on Energy Efficiency
  - **Sustainable Energy GreenPASS (ZEB Ready) 2019.**
  - **National Energy Award (ZEB Ready) 2022**
  - **ASEAN Energy Award (ZEB Ready) 2022**

ZERO CARBON & ZERO ENERGY CONCEPT

Looks the same but it is different and will have different impact

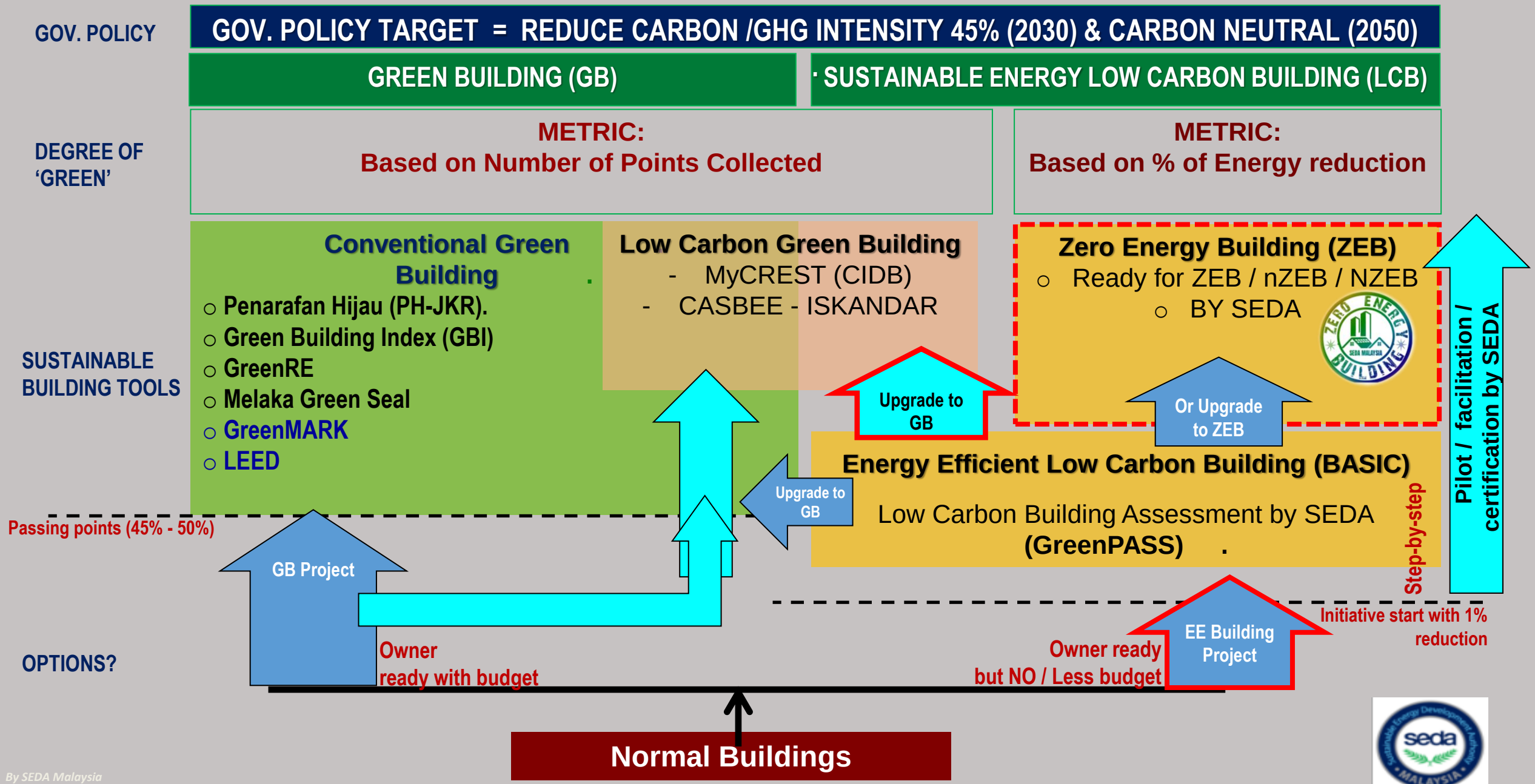


Zero Carbon Concept



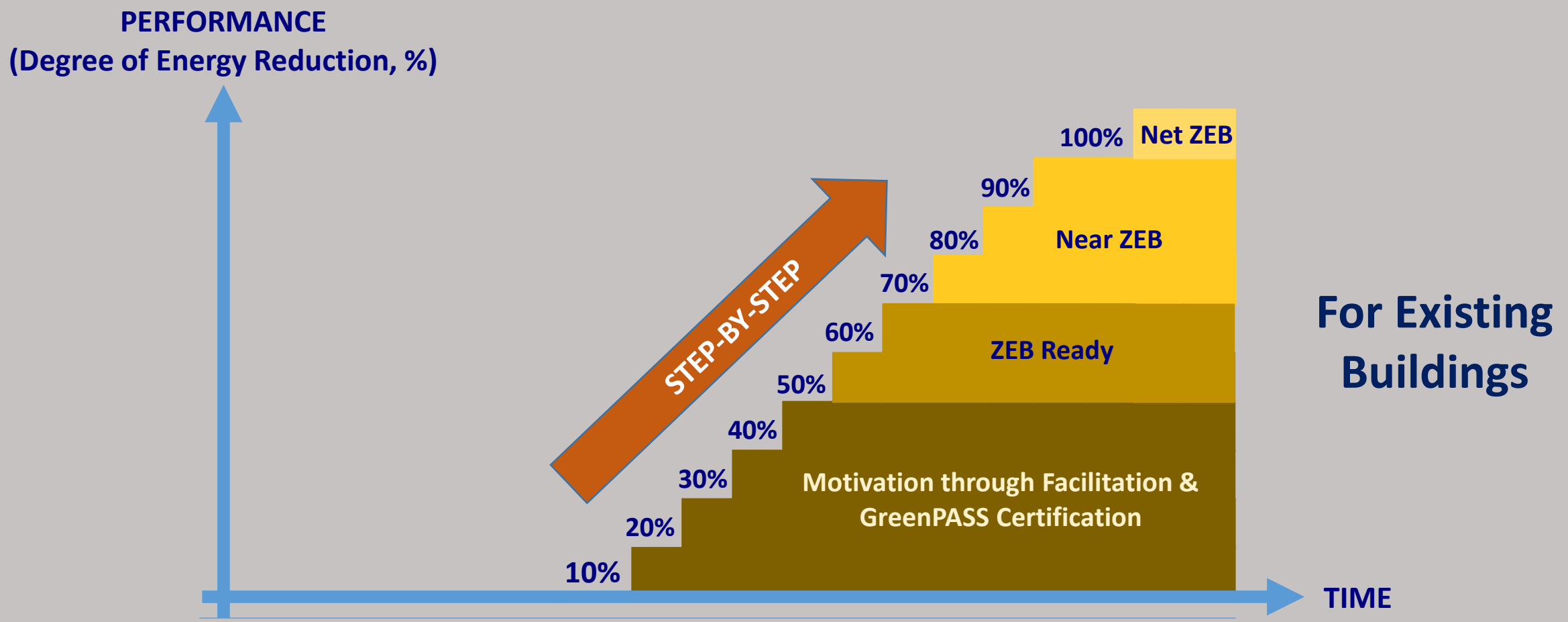
Zero Energy Concept
(ISO/TC 23764)

SUMMARY / MAPPING OF GREEN BUILDING / SUSTAINABLE LOW CARBON BUILDING / ZEB IN MALAYSIA



By SEDA Malaysia

Affordable Way to Achieve Zero Energy Building (ZEB) For Existing Building



STEP-BY-STEP APPROACH

The objective of retrofitting the ASTAKA

To Building Operation

- **To reduce operation cost / overhead** by reducing electricity bill

For The Community

- To enjoy more **conducive, comfortable, safety and good facilities services at affordable rates.**
- Indirectly, the use of better technology (efficient products) will **promote and enhance the awareness of energy savings.**

To MBPJ

- **To reduce the overhead burden, the building must operate at minimum cost.**
- **Capacity building / new experience to MBPJ** on energy savings and reduce carbon emission.
- Pilot demonstration of the **1st high performance energy efficiency retrofitting** at MBPJ's assets. This **creates example and motivation to MBPJ's staffs**. After the success, MBPJ had **embarked the Energy Management Program in 2021** and several MBPJ's building has undergo energy auditing and, in the progress, to implement phase by phase retrofitting.
- To demonstrate **as pioneer among the PBTs, government to lead by-example** in managing and reducing energy and carbon.

To Government & Industry

- Shows that **simple, straight forward / practical but affordable zero energy building (ZEB) for existing building is achievable**. No need to construct new ZEB buildings.
- Same concept **can be applied** to private and government buildings.
- Direct support the national **45% carbon intensity** reduction target by 2030 and **carbon neural target by 2050.**

The ASTAKA BUILDING

Name of Building	Astaka Sport Complex (Kompleks Sukan Astaka)
Owner	Majlis Bandaraya Petaling Jaya (MBPJ)
Address	Jalan Utara, Seksyen 52, 46200 Petaling Jaya, Selangor
Type of Building	Multipurpose Building (Sport Complex) (Single Storey)
Age of Building	Operated since 1982 (40 Years)
Gross Floor Area (GFA)	4,625.08 sq.m
Net Floor Area (NFA)	**2,060.69 sq.m**
Building Energy Consumption of Baseline Year (2015)	**106,218 kWh/yr**
Building Energy Consumption of Reporting Year (2019)	**37,366.00 kWh/yr**
Nature of Business	A building complex of sport facilities, meeting rooms, surau and common activities.
ZEB Category	**ZEB Ready** **(64.82% Energy Saving excluding Renewable Energy)**

Energy Savings Approach & Method

1 — Identify the main energy consumer / activities or process

- Quick energy audit with energy consumption data.
- Analyse and obviously found that lighting and air-conditioning system uses about 81% from the total energy. That is mean the focus is on lighting and air-conditioning system.

2 — Identify the potential Energy Saving Measures (ESMs)

- Propose to change the inefficient lighting system. The efficient power rated is lower about 50% compared to the current one.
- Propose to change the old and inefficient air-conditioning to high efficiency one.
- Choose possibly the most viable cost.

3 — Implement Retrofitting

- Appoint contractor or Energy Service Company (ESCO) to implement the retrofitting.
- Testing and Commissioning

4 — Implement energy management and finetuning during operation

- Operate the building according to the function.
- Keep finetuning in order to get the best configuration.
- Monitor and collecting monthly energy consumption and recording it using cloud-based system (Building Energy Online Data Monitoring -BEDOS) www.seda.gov.my/bedos
- Analyse and compare the performance with the baseline data.

Summary of retrofitting work in Astaka

1.0 Improvement of Passive Design
Installation of metal cladding at some part of the building to provides shades and reduce direct heat from the sun
2.0 Improvement of Active Design
• Replacement of conventional Metal Halide spot light (400W/lamp) & florescent light (40W/lamp) to high-efficient light especially (20 Watt/ lamp) & (18 Watt/lamp). • Replacement of old air-conditioning system (ACSU) with 5-Star Rating air condition. • Replacement of old air-conditioning system (ACPU Type) to high-efficient system.
3.0 Other sustainable feature
Installation of Rainwater Harvesting System

Building Energy Performance/Savings

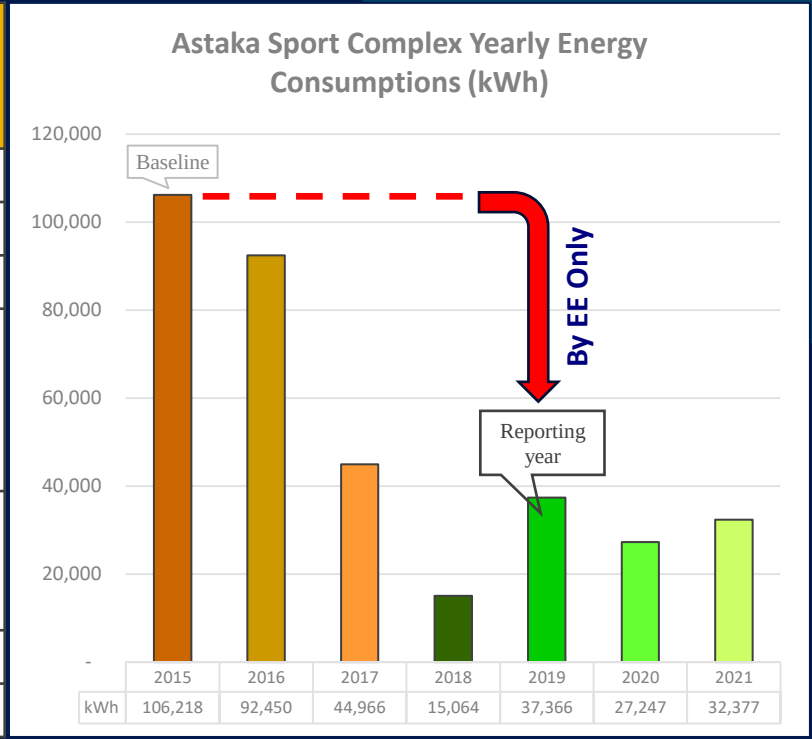
Building Energy Performance/Savings

Item	Energy Saving Measures	Retrofitting / Improvement Taken	Estimated Savings	Overall Savings Based on Total Energy.
1	Retrofitting the **internal lighting system.**	Replacement of conventional florescent light (40W) to high-efficient light LED (20W and 18W). - Saving is based on **power reduction**.	60%	**106,218 kWh/year** **Baseline (2015)** **37,366 kWh/year** **Reporting Year (2019)** **68,852 kWh/year** **The Total Reduction** = Baseline – Reporting Yr = 106,218 - 37,366.00
2	Retrofitting of **the air-conditioning system.**	Replacement of electrical appliances to high-efficient unit only (ACPU). Equipment obsolete (1 Unit) - Saving is based on **COP improvement.**	30%	
3	Retrofitting of **the air-conditioning system**.	Replacement of electrical appliances to high-efficient unit only (ACSU). 5-Star Rating ACSU (6 Unit) - Saving is based on **COP improvement.**		
4	Improvement of the **passive system**	Building painting, building shading (new cladding), improve building wall and floor. - Saving is based on **lower heat penetration** into the building and **reduced cooling load**., light colour painting **promotes good daylight and use less artificial lighting** during the day.	Unable to calculate the savings.	**40 Ton CO_2 Carbon Reduction** *Note: Based on emission factor of 0.585 tCO2/MWh (Peninsular Malaysia) - 2017 CDM Electricity Baseline for Malaysia.
5	**Energy management** (Since 2016)	Energy management practice, awareness and finetuning in operation. - Saving is based on integrated action **by awareness, energy monitoring and action, finetuning.** - This also help to reduce further energy **from lighting and air-conditioning system.**	Unable to calculate the savings due to lack of collected data.	**Percentage savings** **64.8% reduction** (qualify for ZEB READY)

Yearly Energy Consumptions

ASTAKA BUILDING

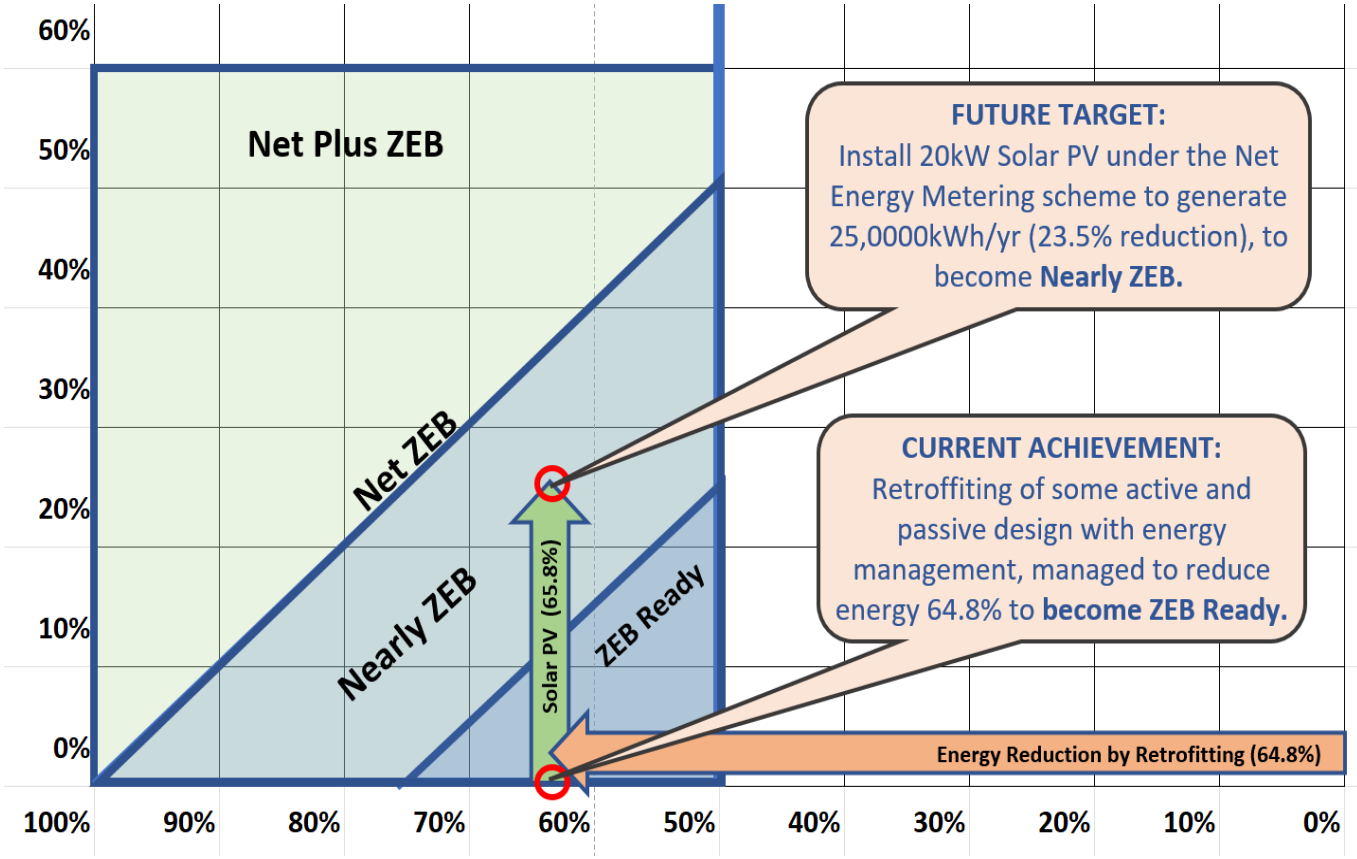
Year	Energy consumptions, kWh	Reduction compared to baseline	Activities / Remarks
2015	106,218.00	Baseline	• No retrofitting
2016	92,450.00	-12.96%	• Basic energy management.
2017	44,966.00	-57.67%	• Retrofit lighting and air-conditioning system.
2018	15,064.00	-85.82%	• Improve passive design – provide cladding as shades, painting, etc • Operation interruption due to some interior design repair / renovation.
2019	37,366.00	-64.82%	• As Reporting Year • Normal operation. • Retrofitting and Renovation completed.
2020	27,247.00	-74.35%	• MCO and affect the operation.
2021	32,377.00	-69.52%	• MCO and affect the operation.



- 2015 as baseline since the energy management program to reduce energy has started.
- 2009 as the reporting year, which is 64.82 % energy reduction compared to 2015 (Baseline Year).
- The reason why not using energy consumption in 2020 and 2021 is due to factor of Movement Control Order (MCO). The Covid-19 cases has forced the government to close down all major activities in all sectors for several month in 2020 and 2021.

NEXT ZEB Realization Plan

ASTAKA BUILDING (To become Nearly ZEB)



Further improvement for future target is planned by harvesting Renewable Energy implementation as follows:

Baseline [kWh/yr]	106,218
Reporting [kWh/yr]	37,366
Reduction by EE	68,852 kWh/yr
EE rate	64.8%
Potential RE	20 kWp
	25,000 kWh/yr
RE rate	23.5%
Net reduction (EE+RE)	93,852
Future Target	88.4%

Photos

Improvement of Passive Design

Main Entrance Before Renovation	Main Entrance After Renovation
	
Figure 7: Photo was captured on Year 2016	*Figure 8: Photo was captured on Year 2022*

Figure 9: The Passive Design Improvement by installing metal cladding

Figure 10: Every Interior Wall of the Building is Painted in White

The installation covered the South-East of the building area.

Installation of floor tiles (anti slip ceramic) for 300mmx600mm area

Three (3) layered of painting- one basis layer and two layer of weather shield paint with white colour

Figure 11 Replacement of Floor Material at Foyer (left)and Ventilation Window (Right)

Replacement of Conventional Lighting to LED Lights

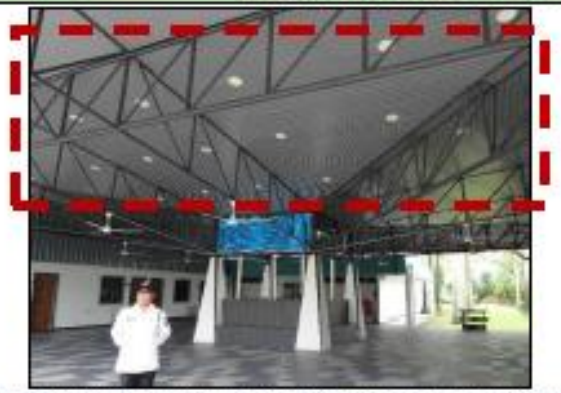


Figure 12: The common area is equipped with 72 units of LED Downlights

Figure 13: The main corridor of the building is equipped with LED Downlights

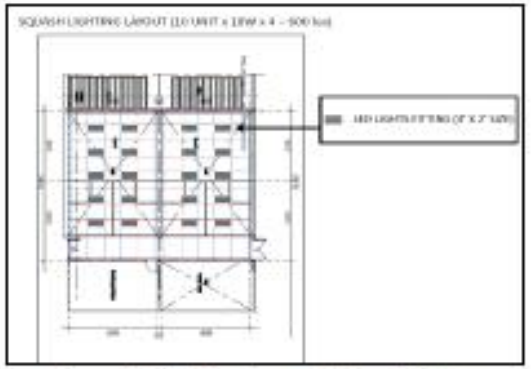


Figure 14: Lighting layout at Squash Courts

Figure 15: The lighting is installed according to Squash Court Lux Level Standard

Figure 16: The stair corridor is equipped with LED Lights

Figure 17: The building's toilet is equipped with LED Lights

Replacement of AC System to Energy Efficient Unit

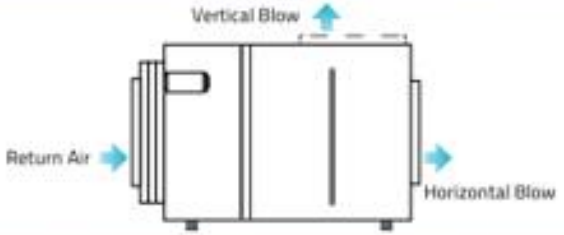


Figure 18: Ducted Split System with Energy-Efficient Feature located at main Squash Court for 2-units

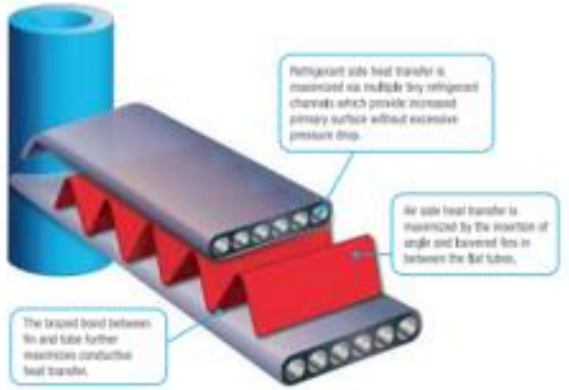


Figure 19: PFC Heat Exchanger (Energy Efficient Feature) Yield Better Efficiency Compared to Conventional One

Figure 20: 5-Star Labelling Air-Conditioning Split Units

The ACSU has been replaced from 3-star to 5-star energy rating Energy Efficiency Label by Suruhanjaya Tenaga

Figure 21 The ACSU Ceiling Expose with R410A refrigerant located at each Squash Court

Improvement of Active Design

ZEB Certification (voluntary)

Tool : Sustainable Energy Low Carbon Building Assessment GreenPASS by SEDA Malaysia (www.seda.gov.my/greempass)

ASSESSMENT TOOL SUITABLE FOR ZERO ENERGY BUILDING (ZEB) IN MALAYSIA

SUSTAINABLE LOW CARBON BUILDING ASSESSMENT

(Under the Low Carbon Building Facilitation Program)

A voluntary & industry driven initiative by:

Using: Sustainable Buildings and Climate Initiative – UNEP Common Carbon Metric

greenPASS performance assessment system

SUSTAINABLE ENERGY LOW CARBON BUILDING ASSESSMENT

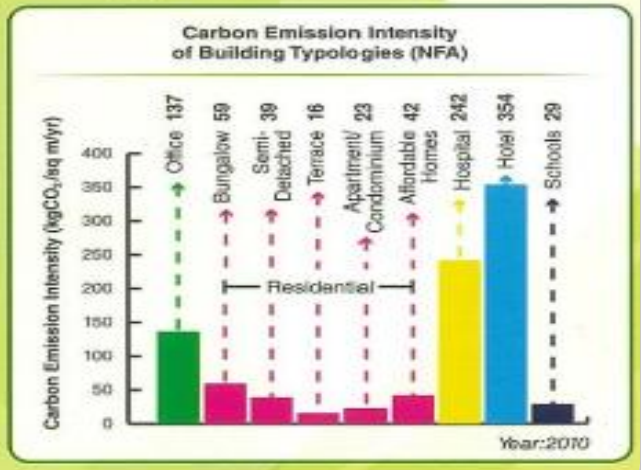
Carbon Reduction in Existing Building:

MEASURES	ANNUAL SAVING Electrical kWh/yr	RM/yr
No Cost Measures		
De-lamping office lighting	13,476	8,153.38
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	228,940.81
Lighting zoning	498,584	116,668.66
TOTAL	**2,882,914**	**684,601.87**

Actual Cost Reduction 50%

Potential GreenPASS (Operational Carbon) Assessment

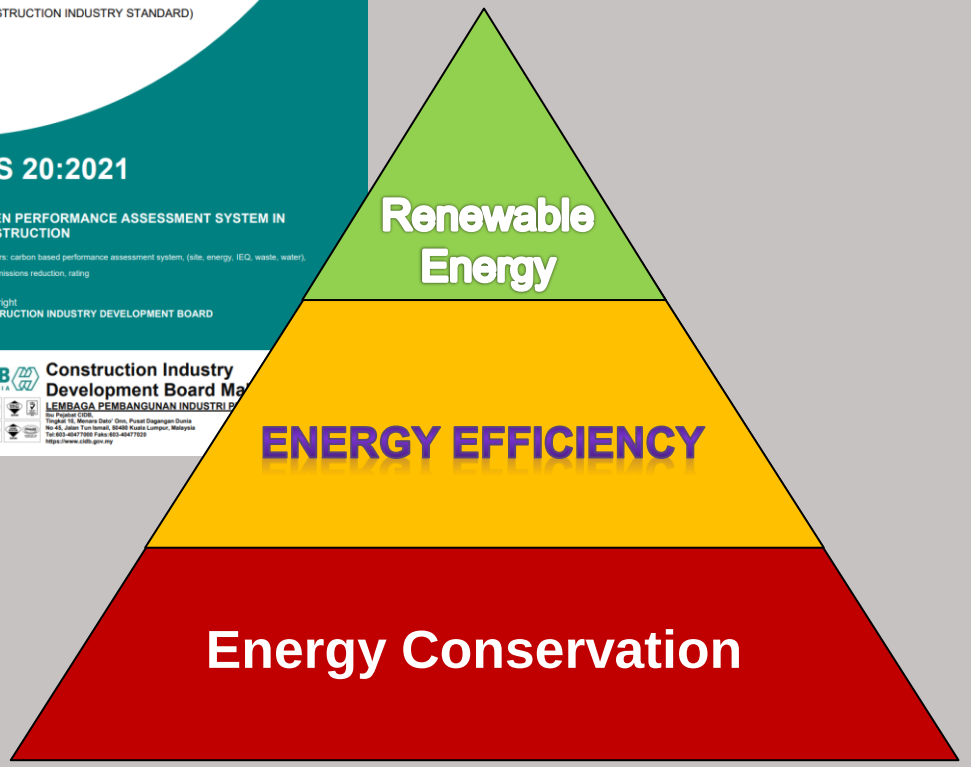
Sample of Carbon Common Metric in Putrajaya:



www.seda.gov.my/greenpass

SUSTAINABLE ENERGY LOW CARBON BUILDING ASSESSMENT
GREENPASS BY SEDA

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



TOWARDS ZERO ENERGY

Level of Achievement % Energy reduction	Assessment Scheme for buildings (diamond)	ZEB Certification Scheme *
100% or more	💎💎💎💎💎💎	Net ZEB (NZEB)
≥ 70 to < 100	💎💎💎💎💎	Near ZEB (nZEB)
≥ 50 to < 70	💎💎💎💎	ZEB Ready
≥ 30 to < 50	💎💎💎	
≥ 10 to < 30	💎💎	
≥ 1 to < 10	💎	

ZEB = (EE + RE) X Sustainable Practices

* Note : Aligning to ISOTC 23764 & Japan ZEB Scheme Concept

PILOT ASSESSMENT & CERTIFICATION (VOLUNTARY) USING GREENPASS FOR ASTAKA BUILDING

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	💎	

greenPASS performance assessment system
SUSTAINABLE ENERGY LOW CARBON BUILDING ASSESSMENT


SEDA LCB Certificate No: SEDA LCB/No. 139

CERTIFICATE 2019

SEDA MALAYSIA SUSTAINABLE ENERGY LOW CARBON BUILDINGS ASSESSMENT GREENPASS OPERATION

It is hereby awarded to

KOMPLEKS SUKAN ASTAKA
Petaling Jaya

DIAMOND RATING:

ZERO ENERGY BUILDING
(Ready for ZEB Category)

Successfully achieved emission reduction of
59.58%
Equivalent to
38.23 tonne CO_2/year
55,084 kWh/ year

Baseline year : 2016 Reporting year : 2019 (absolute reduction)
Assessment boundary: Operational Energy (Electrical Energy only) based on Common Carbon Metric & GreenPASS assessment method

(Dato' Hamzah Bin Hussin)
Chief Executive Officer
Sustainable Energy Development Authority (SEDA) Malaysia

*This certificate is a voluntary initiative by SEDA Malaysia to promote energy saving & carbon reduction and does not intended for any other purposes

ZEB voluntary certification by SEDA to existing building`

Thank you for your attention

FACILITATION ON ZERO ENERGY BUILDING (ZEB) PROGRAM?

Call / text +6019 2829102 / +603 88705800

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