



*"NORMAL BAHARU BANDAR RENDAH KARBON,
JADIKAN IA REALITI"*

Steps to Greening Building Services

A Webinar Presentation by **MAESCO**
22nd September 2020

Introducing Speaker

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Fadzil is a registered professional engineer with over 20 years of experience in building & infra sector in Malaysia & Middle East

Fadzil was instrumental in the retrofitting of Bangunan Perdana Putra to become a High-Performance Green Building achieving GBI Platinum. Currently he is the GBI Commissioner for Perdana Putra's Renewal Verification Assessment (GBI RVA). He also involved on commercial & technical development of several EE & RE projects in Malaysia and the Middle East.

He holds a BSc in Electrical Engineering from the University of South Alabama, United States. Fadzil is Certified GBI Commissioning Specialist, Certified Energy Manager and M&V Professional.



Green Building

Buildings use significant amount of energy and resources during their construction and later on operations.



Green building is sustainability methodology that provides a viable applicable solution from construction till full life building operation while effectively reducing overall carbon footprint.

Solution

- The sustainable design, construction and operation which is often called “*Green Building*”, is the fundamental necessity that gives us the right tool to reduce the harmful effects on the environment.



Examples of Popular Green Building Certification Tools

THE GBI RATING SYSTEM



BUILDINGS WILL BE AWARDED THE GBI RATING BASED ON 6 KEY CRITERIA:

| CRITERIA | MAXIMUM SCORE |
|---|---------------|
| Energy Efficiency (EE) | 38 |
| Indoor Environmental Quality (IEQ) | 21 |
| Sustainable Site Planning & Management (SM) | 10 |
| Material and Resources (MR) | 9 |
| Water Efficiency (WE) | 12 |
| Innovation (IN) | 10 |



People

- GBI ACCREDITED FACILITATORS (GBIF)
 - To provide services to enable building projects to achieve GBI accreditation
- GBI COMMISSIONING SPECIALISTS (CxS)
 - To be an independent, third-party expert who serves as an objective advocate of the owner, directs the commissioning process, and presents final recommendations to the owner regarding the performance of commissioned building systems.

Key Steps to Greening Your Building Services

1) Energy Efficiency (EE)

Improve energy consumption by optimizing building orientation, minimizing solar heat gain through the building envelope, harvesting natural lighting, adopting the best practices in building services including use of renewable energy, and ensuring proper testing, commissioning and regular maintenance.

2) Indoor Environment Quality (IEQ)

Achieve good quality performance in indoor air quality, acoustics, visual and thermal comfort. These will involve the use of low volatile organic compound materials, application of quality air filtration, proper control of air temperature, movement and humidity.

3) Sustainable Site Planning & Management (SM)

Selecting appropriate sites with planned access to public transportation, community services, open spaces and landscaping. Avoiding and conserving environmentally sensitive areas through the redevelopment of existing sites and brownfields. Implementing proper construction management, storm water management and reducing the strain on existing infrastructure capacity.

Key Steps to Greening Your Building Services

4) Materials & Resources (MR)

Promote the use of environment-friendly materials sourced from sustainable sources and recycling. Implement proper construction waste management with storage, collection and re-use of recyclables and construction formwork and waste.

Examples include using recycled material for ceiling and doors.

5) Water Efficiency (WE)

Rainwater harvesting, water recycling and water-saving fittings.

Examples include collecting rainwater for toilet flushing, ablution wastewater used for plants, and using 4 litres flush system.

6) Innovation (IN)

Innovative design and initiatives that meet the objectives of the GBI.

Examples are Air-Conditioning Condensate water collected for chiller make-up, and providing a Herb Garden.

CASE EXAMPLE



PERDANA PUTRA BUILDING

GBI PLATINUM

Below are the energy savings measures implemented to achieve the targeted energy consumption :

1. A/C Space Thermostat to be set to 24deg C
2. Changing of all Office Space Light Fittings to LED
3. Changing of Car Park Lighting to T5
4. Changing all AHU's motors to EFF1 motors
5. Changing Chilled Water Pumps to EFF1 motors
6. Changing all Halogen Bulbs to LED and Cove Lighting to T5 at other spaces
7. Daylighting Design with Photo Sensor for Office
8. Redesign of Electric Lighting (8.17W/m^2 to 4.6W/m^2)
9. Reduction of Plug Load (10W/m^2 to 1.8W/m^2) by replacing desktop to laptop PC
10. Installation of 650kWp Building Integrated Photovoltaic (BIPV)

Requirements

Individual switched lighting zones less than 100m² for 90% NLA

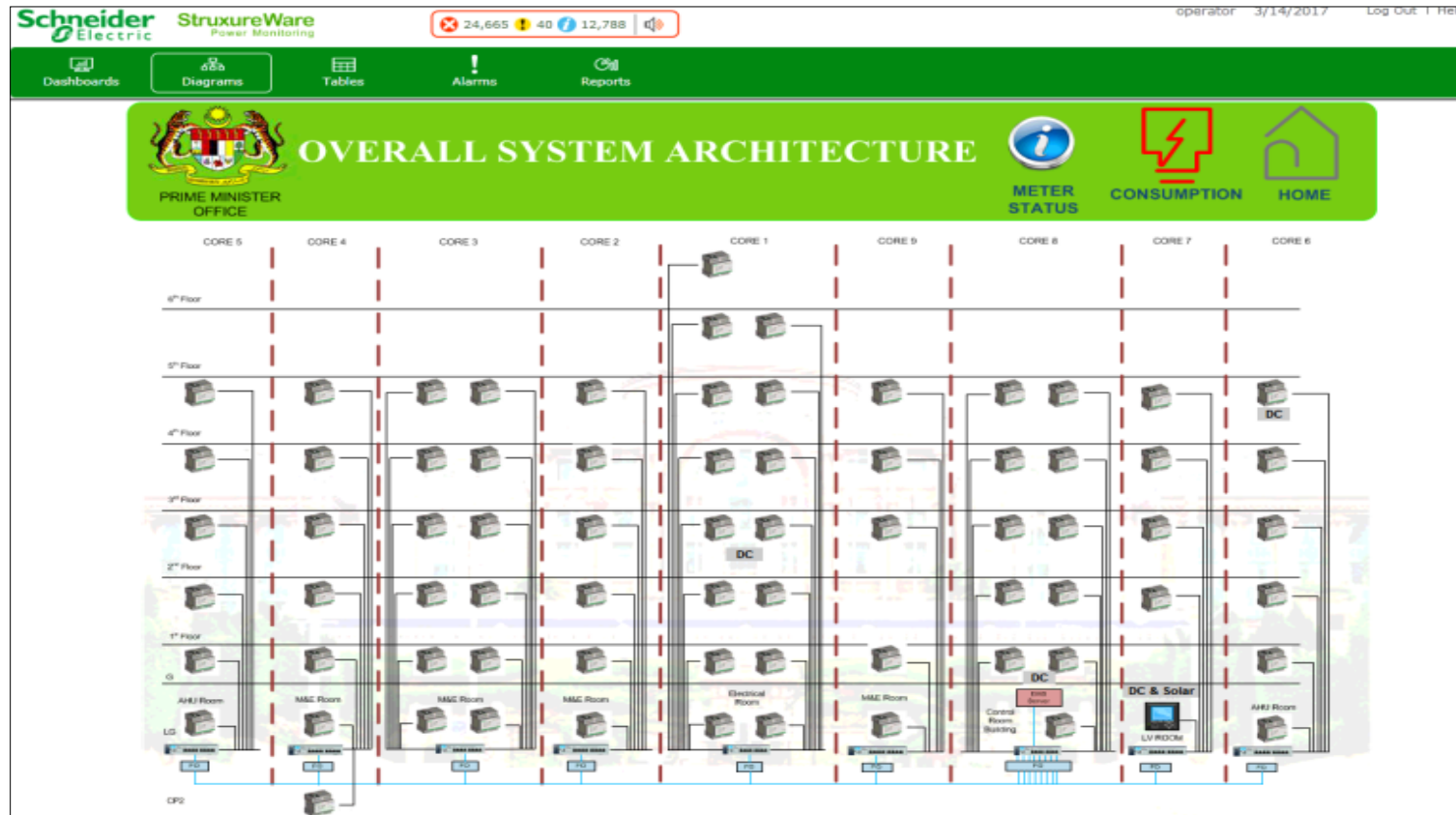
Installed photo sensors for perimeter zones and daylit areas

Installed motion sensors for at least 25% NLA

After the retro-fitting works, a totals of 52% of the NLA is now equipped with motion sensor and the breakdown is displayed in table below.

| Level | Motion-Sensors (m ²) |
|--------------|----------------------------------|
| Lower Ground | 2199 |
| Ground | 4705 |
| 1st | 3375 |
| 2nd | 4125 |
| 3rd | 3598 |
| 4th | 3294 |
| 5th | 354 |
| Total | 21650 (NLA:41615) |
| | 52% |

| Requirements | Points |
|--|--------|
| Sub-metering for all energy use $\geq 100\text{kVA}$ | 1 |
| Sub-metering for lighting and power each floor | 1 |

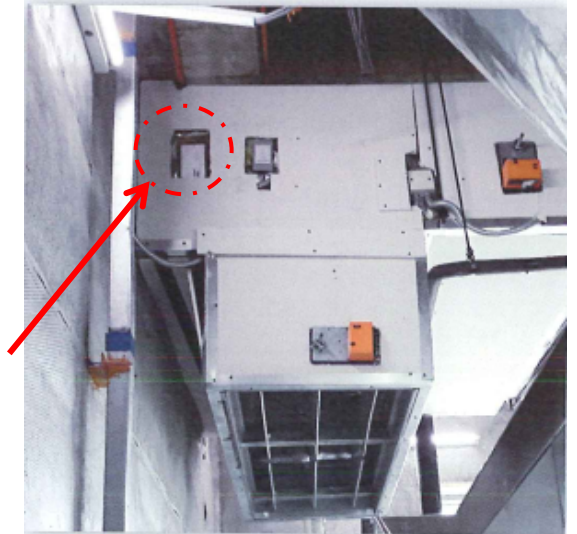


EQ3

CARBON DIOXIDE MONITORING AND CONTROL

The Building Automation System (BAS) integrated with CO₂ sensors input will be able to monitor the CO₂ level of the return air and then instruct the air-conditioning system to provide fresh air when CO₂ level is above 900ppm.

The existing installed air conditioning and mechanical ventilation system fresh air intake in the Prime Minister's Office Building is controlled via CO₂ monitoring in the return air from the air-conditioned spaces. The CO₂ sensors are installed in all AHU return air duct.



CO₂ Sensor Location



Fresh Air Damper

EQ6

THERMAL COMFORT : DESIGN & CONTROLLABILITY OF SYSTEMS

The building HVAC system has been designed to ASHRAE 55 standard and MS1525:2007 parameters including 24 degree C dry bulb temperature, below 70 % RH and 0.15-0.50 m/s air movement. The building is equipped with BMS system which control Air Handling Unit and VAV air distribution system to allow adjustment to suit individual task needs and preferences.

| AH_GF2_1 | | | | | | | | | | | | |
|--------------|------------|--|----------------------|-----------|--|-------------------|-------------|--|-------------|--|-----------------|-----------------|
| NAME | SPACE TEMP | | SPACE TEMP SET POINT | AIR FLOW | | AIR FLOW SETPOINT | MIN AIRFLOW | | MAX AIRFLOW | | DAMPER OVERRIDE | DAMPER POSITION |
| VAV_GF2_1_1 | 23.2 °C | | 23.0 °C | 253.7 L/S | | 498.0 L/S | 149.0 L/S | | 498.0 L/S | | 0% | 100% |
| VAV_GF2_1_2 | 23.2 °C | | 23.0 °C | 331.1 L/S | | 331.0 L/S | 102.0 L/S | | 331.0 L/S | | 0% | 85% |
| VAV_GF2_1_3 | 23.5 °C | | 24.0 °C | 106.2 L/S | | 107.0 L/S | 107.0 L/S | | 321.0 L/S | | 0% | 91% |
| VAV_GF2_1_4 | 23.7 °C | | 24.0 °C | 131.6 L/S | | 130.0 L/S | 130.0 L/S | | 360.0 L/S | | 0% | 83% |
| VAV_GF2_1_5 | 22.8 °C | | 23.0 °C | 95.4 L/S | | 99.0 L/S | 99.0 L/S | | 350.0 L/S | | 0% | 70% |
| VAV_GF2_1_6 | 23.3 °C | | 24.0 °C | 140.6 L/S | | 140.0 L/S | 140.0 L/S | | 410.0 L/S | | 0% | 46% |
| VAV_GF2_1_7 | -327.7 °C | | 24.0 °C | 75.9 L/S | | 75.0 L/S | 75.0 L/S | | 249.0 L/S | | 0% | 68% |
| VAV_GF2_1_8 | 23.2 °C | | 24.0 °C | 121.3 L/S | | 120.0 L/S | 120.0 L/S | | 340.0 L/S | | 0% | 61% |
| VAV_GF2_1_9 | 22.9 °C | | 23.0 °C | 101.5 L/S | | 101.1 L/S | 100.0 L/S | | 320.0 L/S | | 0% | 80% |
| VAV_GF2_1_10 | 23.8 °C | | 23.0 °C | 318.0 L/S | | 320.0 L/S | 140.0 L/S | | 320.0 L/S | | 0% | 91% |
| VAV_GF2_1_11 | 23.8 °C | | 23.0 °C | 301.1 L/S | | 300.0 L/S | 100.0 L/S | | 300.0 L/S | | 0% | 76% |
| VAV_GF2_1_12 | 23.8 °C | | 24.0 °C | 104.2 L/S | | 100.0 L/S | 100.0 L/S | | 300.0 L/S | | 0% | 96% |
| VAV_GF2_1_13 | 24.6 °C | | 23.0 °C | 300.8 L/S | | 300.0 L/S | 100.0 L/S | | 300.0 L/S | | 0% | 80% |
| VAV_GF2_1_14 | 24.3 °C | | 23.0 °C | 321.0 L/S | | 320.0 L/S | 110.0 L/S | | 320.0 L/S | | 0% | 45% |
| VAV_GF2_1_15 | 23.2 °C | | 23.0 °C | 321.8 L/S | | 320.0 L/S | 120.0 L/S | | 320.0 L/S | | 0% | 80% |
| VAV_GF2_1_16 | 23.1 °C | | 23.0 °C | 359.6 L/S | | 360.0 L/S | 120.0 L/S | | 360.0 L/S | | 0% | 86% |
| VAV_GF2_1_17 | 23.5 °C | | 23.0 °C | 281.2 L/S | | 280.0 L/S | 100.0 L/S | | 280.0 L/S | | 0% | 87% |
| VAV_GF2_1_18 | 25.3 °C | | 24.0 °C | 227.2 L/S | | 350.0 L/S | 150.0 L/S | | 350.0 L/S | | 0% | 100% |

Graphic of VAV System in BMS

SM4

GREEN VEHICLE PRIORITY

Strategy:

Encourage the use of green vehicles, i.e. hybrid or electric vehicles, by providing preferred parking lots, at least 5% of the total parking bays for the use of green vehicles.

Total parking bays for green vehicles = **40 bays**



Hardscape & Greenery Application

The following is an approximate comparison of a typical local urban development site and the existing Prime Minister's Office Building.

| | Typical (%) | PMO (%) |
|------------|-------------|---------|
| Building | 50 | 9.6 |
| Hardscape | 20 | 20.4 |
| Greenery | 30 | 70.0 |
| Total Site | 100 | 100 |

This project has achieved this intent via > 50% extensive landscape areas.

Roof Application

The installed vegetated roof area of the total roof area is calculated as follows:

| | Area (m ²) | % |
|----------------|------------------------|------|
| Vegetated Roof | 11,185 | 52.0 |
| Total Roof | 21,499 | 100 |

The vegetated roof accounts for 52% of the flat roof area of the building (including domes / cupolas). This is more than the 50% requirement.



➤ **System Description:**

Taking control of waste disposal and processing is one of the way in implementing the cost saving at the Prime Minister Office (PMO). This can be accomplished with the use of standalone composters. In order for landscape waste to be recycle, on-site composting is introduced so that the composted waste at site can be reused as fertilizer.



Operator is using the composter machine by mixing the waste disposal with additives.



Operator is collecting the final product after the compost process is done.



Fertilizer is the final product of the composted waste.

Perdana Putra's Greening Steps

SUMMING IT UP

ENERGY EFFICIENCY

Scoring GBI Points 35 out of 38



Building Management System



LED Lights – Indoor and Outdoor



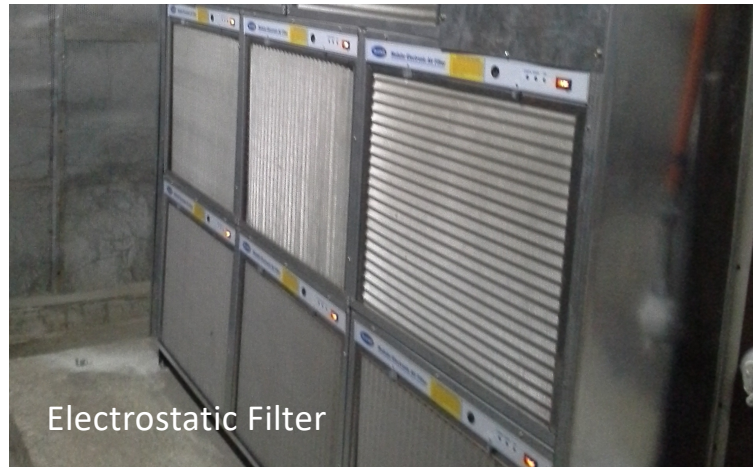
ACMV Repair & Upgrade
EFF1 Motors
Smart Infra System
Energy Management System
Lighting Management System

650kWp Solar Power System – Sustainable Power Source

ENVIRONMENT QUALITY

Scoring GBI Points 14 out of 21

Pre AHU
Low VOC & Zero Urea Formaldehyde
No Smoking
CO2 Sensors
Thermal Comfort Control



SUSTAINABLE & SITE PLANNING

Scoring GBI Points 10 out of 10

Pest Management
Erosion Control
Management



MATERIAL & RESOURCES

Scoring GBI Points 8 out of 9

Clean Agent
Sustainable Timber
Sustainable Purchasing Policy



WATER EFFICIENCY

Scoring GBI Points 11 out of 12



Recycling of Ablution Water



Water Efficient Plumbing and Sanitary Fitting

Rain Water Harvesting
Irrigation System
Water Leakage Detection System

INNOVATION

Scoring GBI Points 10 out of 10



Perdana Putra's Greening Steps

VIDEO

BUILDING PARAMETERS - 2010

ENERGY INTENSITY 138 kWh/m²/yr

ANNUAL WATER USAGE 133,614 m³

CO2 EMISSION 7,268,738 kg

CHILLED WATER 4,071,552 kWh

TOTAL ENERGY 13,435,744 kWh





MAESCO is a NGO association that brings together energy services companies whose main focus is providing of services and expertise to bring about energy efficiency opportunities to end users of all sectors.

MAESCO helps ESCOs be proactive with the Government and relevant authorities on promoting viable practices and solutions inline with the Government's target to recognize EE as a 5th. fuel policy.

MAESCO is recognized for Training Programs namely Certified Energy Managers, Certified Energy Auditors, Thermal Training, Measurement and Verification EE Equipment Specialists, and others.

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President MAESCO Ar. Zulkifli b. Zahari &
Vice President MAESCO Ir. Ong Ching Loon @ MAESCO AGM 2019

THANK
YOU