Perdana Putra, The Making of a High Performance Green Building

Ir. Mohd Fadzil Shah
19 April 2016
About KFM

Integrated Asset Management Services & Technology

- Operating in Kuala Lumpur, Penang, Dubai and Abu Dhabi
- More than 10 million SF of Assets Under Management
- Solutions for Built Environment with integrated Design, Build and Manage capabilities

GREEN
Mitigate & Adapt to Climate Change

Cities present a real opportunity to minimise environmental impacts by improving energy efficiency, minimising urban sprawl, promoting the use of energy-efficient public transport and improving adaptation to climate change.

SMART
Running a city on an intelligent platform

“Smart-city” projects have been multiplying around the world. They aim to integrate the recent efforts to introduce smart features in a variety of sectors and use this “system of systems”, to manage the urban environment better. Smart systems may well be humankind’s best hope for dealing with its pressing environmental problems, notably global warming.

CONNECTED
The Internet of Things meets The Internet of People

Connected sustainable cities employ ubiquitous, networked intelligence to enable collaboration between people in government, businesses and consumers—thereby improving efficiency, increasing trade and commerce and provide better healthcare, safety and security to all citizens.
Qualified and Accredited
5* Ranking by SME Corp and Class A Contractor

- 5* ranking by SME Corp
- TeraS status company
- PKK Class A
- CIDB G7
- ISO 9001
- Malaysian Green Building Confederation
Award Winning SME
Excellence Recognized by Government, Customers & Business Partners

We have been rated 5 Stars in the SCORE rating by SME Corp and ascertained by Deloitte. KFM has won awards from WASL/Dubai Real Estate Company. Furthermore KFM has received multiple awards by Schneider Electric.
Track Record
Prestigious Government Buildings and Corporate Headquarters in Malaysia and United Arab Emirates.
Track Record

Prestigious Government Buildings and Corporate Headquarters in Malaysia and United Arab Emirates.

- **KLCC BMS Upgrade, Installation and Maintenance** to achieve **GBI Gold Rating**
  - Awarded in 2015

- **Design and build of Memorial Tun Hussein Onn** which will be **green certified**
  - Awarded in 2015

- **FM services for MAB office buildings, hangar, workshop space and hotel**
  - Awarded in February 2016

- **Green Chiller installation at Silterra’s plant in Kulim** under **EPC model**
  - Awarded end of February 2016
Government’s Vision
Putrajaya as the “Flagship” Green Township

“Putrajaya and Cyberjaya will serve as flagship green townships. The Government will take the lead in adopting green building standards. New Government buildings will be designed to meet green standards. Energy efficiency of existing buildings will be enhanced and as a showcase example, the Prime Minister’s Office complex will be upgraded to meet the Gold Standard Green rating.”

Source: PM’s speech in Parliament to table Malaysia’s 10th Economic Plan
INTRODUCTION

Several initiatives have been introduced and policies developed to making Putrajaya, the administrative city of Malaysia, as a model township for Sustainability and Green Technology.

**Putrajaya Structure Plan 2005**
- Provides guidance in planning and development of Putrajaya including vision, direction and policies to transform Putrajaya from a Garden City into Green City.

**Putrajaya Corporation’s Strategic Plan 2011 - 2015**
- Establishes strategic plans and steps to lead Putrajaya along the green city, low-carbon sustainable development path.

**Putrajaya Green City 2025 (PGC 2025)**
- Specifies preliminary baseline report to provide direction for the preparation of the roadmap for Putrajaya Green City development.

**11th Malaysia Plan**
- Government to lead by example on sustainability practices for the industry by retrofitting Government buildings to be energy efficient.
Perdana Putra
The Nation’s Top Administrative Building

- The structural design for Perdana Putra is influenced by Malay, Islamic and European cultures such as Palladian and Neoclassicism.
- It was designed by aQidea Architect with inspiration from the former prime minister, Tun Dr. Mahathir bin Mohamad.

BUILDING AT A GLANCE

| Gross Floor Area: About 1 million square feet. |
| Location : Parcel A, Presint 1, Putrajaya, Malaysia |
| Occupancy: 2,200, Houses the Prime Minister and Deputy Prime Minister Office, Chief Secretary Office, Implementation Coordination Unit, PEMANDU, National Security Council, etc. |
Perdana Putra High Performance Green Building

Major Challenges

- High Aspiration set by PM for Perdana Putra to achieve the highest Green Certification
- PFI Project Financing
- Building Lifecycle Issues
- Our design approach
- Is a building upgrade project where most of the works have to be executed after working hours.
Perdana Putra High Performance Green Building
Green Building Index (GBI) Platinum

- 20 year PFI project
- Reduce energy consumption by 33%
- Reduce carbon emission by 40%
- Savings in utilities of approximately RM2m per annum
# Building Performance in Putrajaya

## Performance Data

<table>
<thead>
<tr>
<th>Rank</th>
<th>Building</th>
<th>Building Energy Intensity kWh/m²/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Diamond Building – Energy Comm.</td>
<td>65</td>
</tr>
<tr>
<td>2.</td>
<td>Perdana Putra - PMO</td>
<td>85</td>
</tr>
<tr>
<td>3.</td>
<td>Low Energy Office - KeTTHA</td>
<td>110</td>
</tr>
<tr>
<td>4.</td>
<td>2G1 – Customs Department</td>
<td>185</td>
</tr>
<tr>
<td>5.</td>
<td>Ministry of Finance (MoF)</td>
<td>200</td>
</tr>
<tr>
<td>6.</td>
<td>Wisma Putra</td>
<td>222</td>
</tr>
</tbody>
</table>

Source: Data Year 2014, KFM’s Building Energy Study
## Achievement in Efficiency

**Perdana Putra - High Performance Green Building**

<table>
<thead>
<tr>
<th></th>
<th>Before (2010 Baseline)</th>
<th>After (2014, GBI Certification)</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Intensity</td>
<td>138 kWh/m²/year</td>
<td>85 kWh/m²/year</td>
<td>38%</td>
</tr>
<tr>
<td>Annual Water Usage</td>
<td>133,614 m³</td>
<td>80,535 m³</td>
<td>40%</td>
</tr>
<tr>
<td>CO₂</td>
<td>7,268,738 kg</td>
<td>4,884,908 kg</td>
<td>33%</td>
</tr>
<tr>
<td>Chilled Water</td>
<td>4,071,552 kWh</td>
<td>1,255,334 kWh</td>
<td>69%</td>
</tr>
<tr>
<td>Total Energy</td>
<td>13,435,744 kWh</td>
<td>9,031,253 kWh</td>
<td>33%</td>
</tr>
</tbody>
</table>
## GBI CRITERIA

### Non-Residential Existing Building (NREB)

#### Assessment Criteria

<table>
<thead>
<tr>
<th>Part</th>
<th>Item</th>
<th>Maximum Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Energy Efficiency (EE)</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>Indoor Environmental Quality (EQ)</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>Sustainable Site Planning &amp; Management (SM)</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Material &amp; Resources (MR)</td>
<td>9</td>
</tr>
<tr>
<td>5</td>
<td>Water Efficiency (WE)</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>Innovation (IN)</td>
<td>10</td>
</tr>
</tbody>
</table>

**Total Score**: 100

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[Image of table showing GBI criteria for non-residential existing buildings]
<table>
<thead>
<tr>
<th>PART</th>
<th>ITEM</th>
<th>POINT SCORED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Energy Efficiency</td>
<td>35</td>
</tr>
<tr>
<td>2</td>
<td>Indoor Environmental Quality</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>Sustainable Site Planning &amp; Management</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Material &amp; Resources</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>Water Efficiency</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>Innovation</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL SCORE</strong></td>
<td><strong>88</strong></td>
</tr>
</tbody>
</table>

**GBI SCORE SUMMARY**

**SUMMARY OF FINAL SCORE**

**ORIGINAL GBI SCORESHEET CERTIFYING 88 POINTS**
ENERGY CONSERVATION MEASURE
PERDANA PUTRA ENERGY INTENSITY 2010 : 138.86 kWh/m²/year

Base case from Data Logging 138.86
Repair of BMS, etc 5.67 133.19
Simulation Base Building 0.12 133.07
Temperature Setting to 24 degrees C / 65% RH 4.75 128.32
Changing of Lighting to LED Lights 17.90 110.43
Occupancy Sensors and Photo Sensors 0.22 110.21
Change of All AHUs motors to EFF1 motors 0.21 110.00
Change of All CHWP motors to EFF1 motors 0.02 109.98
Day lighting Design with Photo Sensor at Office 0.80 109.17
Reduction of Plug Load (Smart Infrastructure) 6.04 103.13
Installation of 650kWp BIPV 13.93 89.20
Changing of Façade Lighting to LED Lights 1.92 87.28
ENERGY EFFICIENCY
35 out of 38 GBI Points

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

Building Management System
LED Lights – Indoor and Outdoor
650kWp Solar Power System – Sustainable Power Source
ENVIRONMENT QUALITY
14 out of 21 GBI Points

- Electrostatic Filter
- Ultra Violet Germicidal Irradiation
- Light Shelf - Daylighting
- Manual and Motorized Blinds – Glare Control

Pre AHU
- Low VOC & Zero Urea Formaldehyde
- No Smoking
- CO2 Sensors
- Thermal Comfort Control
SUSTAINABLE & SITE PLANNING
10 out of 10 GBI Points

Prioritized Green and Carpool Parking

Greenery Application

Roof Garden

Pest Management
Erosion Control
Management
MATERIAL & RESOURCES
8 out of 9 GBI Points

Promote Recycle Content Material – Ceiling with recycle content

Promotion of Recycling

Clean Agent
Sustainable Timber
Sustainable Purchasing Policy
WATER EFFICIENCY
11 out of 12 GBI Points

- Recycling of Ablution Water
- Water Efficient Plumbing and Sanitary Fitting
- Rain Water Harvesting
- Irrigation System
- Water Leakage Detection System
INNOVATION
10 out of 10 GBI Points

- Condensate Water Recovery
- Heat Pipes
- Central Vacuum System

Solar Fiber Light System - Daylighting

Composite Machine – Production of Compost from organic waste

Mini Wetland – Natural Filter and Habitat
Perdana Putra: The Making of A High Performance Green Building

Click Here for Video Presentation
PROGRAM PENGURANGAN TENAGA DAN KECEKAPAN TENAGA

STRATEGI PERLAKSANAAN BERTERUSAN

Oleh KFM HOLDINGS SDN. BHD.
Green and Energy Efficiency Implementation

CONSULTING
- Energy Management
- Sustainability
- Asset Condition Audit

ENGINEERING
- Building Envelope
- Energy Efficiency
- Water Efficiency
- Indoor Environmental Quality
- Sustainable Features
- Renewable Energy
- Building Management System

OPERATIONS
- Integrated Facilities Management
- Integrated Operations Centre
- Asset Lifecycle Management
Integrated Operation Centre (IOC)

- Continuous Commissioning
- Data monitoring
- Energy Management
- CVA Monitoring
- Call Center
Utility Monitoring

PMO Electricity Consumption Details

Year 2010: 9,364,192 kWh/yr

Year 2015: 6,562,200 kWh/yr

30% Saving
Utility Monitoring

PMO Chilled Water Consumption Details

Year 2010: 4,399,175 RTh/yr
Year 2015: 1,587,349 RTh/yr

Chilled Water Consumption (RTh)

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>161,900</td>
<td>126,400</td>
<td>169,924</td>
<td>198,925</td>
<td>151,716</td>
<td>119,506</td>
<td>100,858</td>
<td>111,624</td>
<td>111,624</td>
<td>111,624</td>
<td>111,624</td>
</tr>
<tr>
<td>2014</td>
<td>142,100</td>
<td>108,500</td>
<td>133,100</td>
<td>121,700</td>
<td>96,600</td>
<td>103,700</td>
<td>85,500</td>
<td>116,300</td>
<td>109,500</td>
<td>101,900</td>
<td>131,900</td>
</tr>
<tr>
<td>2013</td>
<td>243,100</td>
<td>152,800</td>
<td>177,900</td>
<td>193,800</td>
<td>204,700</td>
<td>179,900</td>
<td>168,500</td>
<td>139,000</td>
<td>122,800</td>
<td>153,500</td>
<td>106,100</td>
</tr>
<tr>
<td>2012</td>
<td>311,523</td>
<td>232,921</td>
<td>274,608</td>
<td>298,766</td>
<td>285,700</td>
<td>225,600</td>
<td>199,300</td>
<td>164,000</td>
<td>177,300</td>
<td>201,900</td>
<td>173,900</td>
</tr>
</tbody>
</table>

64% Saving
Utility Monitoring

PMO Water Consumption Details

Year 2010: 133,614 m³/yr

Year 2015: 85,199 m³/yr

36% saving
# Utility Monitoring

Using The Formula Given by GDC:

\[
\text{kWh} = \text{RTh} \times \frac{3.517}{3.8}
\]

Combining GDC Usage and Electricity Usage in kWh results into:

40% saving
Carbon Footprint Monitoring

**CO₂ Usage**

(1 kWh = 0.741kgCO₂)

**CO₂ PMO Consumption in kg**

- **Year 2010:** 3,017,020.20 kgCO₂
- **Year 2015:** 1,088,627.75 kgCO₂

64% Saving!!!
Monthly Dashboard

**ENGINEERING**

- **ENERGY SAVING**
  - 9.7% Savings of Overall Energy Consumption
  - 7.6% Savings of Gas District Cooling (GDC) Consumption
  - 9% Solar Energy Contribution from the total energy used

- **ECONOMIC**
  - 6.6% Reduction of Electricity Bill
  - 1.8% Reduction of Water Consumption

**ENVIRONMENT**

- 1,080 Kg of Organic Waste diverted from landfills
- 2,410 Nos New Plants planted
- 8,496,530.9 M3 Recycled Natural water resources from nearby lake for irrigation

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Other text in the image includes:

- 32
-
-
- [681x7]

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KFM Solutions for built environment
Experience Sharing
The Making of A High Performance Green Building in Live Occupied Government Building

- **Commitment from stakeholders are key to success**
  - Integrated Design Process through active collaboration and participation from the users and clients

- **Active Project Planning and Execution Capabilities**
  - To accommodate and mitigate for uncertainties in the project.

- **Continuous Improvements**
  - To engage the knowledge and experience horizontally and vertically and continuously seeking further improvement jointly with internal and external parties of interest.

- **Green and Sustainability pay off over the long run**
  - The benefits of green building go beyond cost. Once the systems are in place, it is satisfying to see the end results and maintain such a facility
THE FUTURE IS GREEN, SMART & CONNECTED
Solutions for the Built Environment – A Better Future for All