26th November 2013

MONASH UNIVERSITY MALAYSIA – ELP Leadership Summit
- Greening the Built Environment for a more Sustainable Future

Ir. KOK Yen-Kwan (Board Member)
PEng | MIEM | CEng | MIET | GBIF | REEM
In the late 21st century Earth was diseased, polluted and vastly overpopulated.
THE CARBON STORY: Where Does It Come From?

Carbon dioxide emissions are from two major sources. The burning of fossil fuels (oil, gas, coal) is responsible for 2/3rd of the emissions of carbon dioxide since the beginning of the Industrial Revolution. The second source comes from the conversion of land, mainly from forests to pastures and croplands.

source: Global Carbon Project
THE CARBON STORY: Who Produced It?

North America and Europe are responsible for half of all carbon dioxide emitted since the beginning of the Industrial Revolution. The emerging economies of China and India account for little over 13%, while the rest comes from the remaining 150 plus countries.

source: Global Carbon Project
THE CARBON STORY: Where Does It Go?

- IN THE ATMOSPHERE
- ON LAND
- IN THE OCEAN

- 5 Gt of CO₂ (cumulated emission in human history)

Only half of all emissions of carbon dioxide from human activities have remained in the atmosphere, leading to warming of the planet and other climate changes. The rest of emissions has been removed in equal parts by the ocean and land (vegetation and soils), and thus slowing down greatly the pace of climate change.

source: Global Carbon Project
THE CARBON STORY: When Was It Emitted?

Humans have a long history of releasing carbon dioxide to the atmosphere through multiple activities, beginning with deforestation. Around 1750, the industrial revolution began with the invention of steam power, launching an era of unprecedented carbon dioxide release into the atmosphere. With the industrial use of fossil fuels, first coal, then oil and gas, emissions have grown exponentially.

source: Global Carbon Project
WHAT’S NEXT?

~ THE 6° PHENOMENON ~

1°C Increase
- Arctic Starts To Melt

2°C Increase
- Lost of Coral Reefs

3°C Increase
- Rainforest Dries Up

4°C Increase
- Coastal Flooding

5°C Increase
- Climate Refugees

6°C Increase
- Global Wipeout!
THE MAGICAL NUMBER: 350

Atmospheric CO₂

October 1958 - October 2013
October CO₂ | Year Over Year | Mauna Loa Observatory
Data: U.S. National Oceanic and Atmospheric Administration (NOAA)

<table>
<thead>
<tr>
<th>Year</th>
<th>Concentration of Atmospheric CO₂ (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct. 2013</td>
<td>393.66</td>
</tr>
<tr>
<td>Oct. 2012</td>
<td>391.01</td>
</tr>
<tr>
<td>Oct. 2011</td>
<td>388.96</td>
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</tbody>
</table>

CO₂Now.org Featuring NOAA-ESRL data of November 8, 2013

MONASH UNIVERSITY MALAYSIA – ELP Leadership Summit
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26th November 2013

www.mgbc.org.my
CITIES & POPULATION: Mega Cities

World Population: 7,126,310,750 (as of 24.11.2013, 14:45)

CITIES & POPULATION: Land Surface & Resources

Consider This…

IF EVERYONE ON EARTH LIVED AS THE AMERICANS DO…

...WE WOULD NEED 4.5 PLANET EARTHS TO SUSTAIN OURSELVES!
SUMMARIZING THE GLOBAL ISSUES...

source: Live The Solution
SUSTAINABILITY – The Asian Green City Index

Urban population in Asia from 1990 - 2025

% of population living in cities

Source: United Nations Population Division
### SUSTAINABILITY – The Asian Green City Index (con’t)...

**So, how is Kuala Lumpur doing?**

<table>
<thead>
<tr>
<th>Performance</th>
<th>Kuala Lumpur</th>
<th>Other cities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy and CO₂</td>
<td><img src="image1" alt="Graph" /></td>
<td><img src="image2" alt="Graph" /></td>
</tr>
<tr>
<td>Land use and buildings</td>
<td><img src="image3" alt="Graph" /></td>
<td><img src="image4" alt="Graph" /></td>
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<tr>
<td>Transport</td>
<td><img src="image5" alt="Graph" /></td>
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<tr>
<td>Waste</td>
<td><img src="image7" alt="Graph" /></td>
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<tr>
<td>Water</td>
<td><img src="image9" alt="Graph" /></td>
<td><img src="image10" alt="Graph" /></td>
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<tr>
<td>Sanitation</td>
<td><img src="image11" alt="Graph" /></td>
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<tr>
<td>Air quality</td>
<td><img src="image13" alt="Graph" /></td>
<td><img src="image14" alt="Graph" /></td>
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<tr>
<td>Environmental governance</td>
<td><img src="image15" alt="Graph" /></td>
<td><img src="image16" alt="Graph" /></td>
</tr>
</tbody>
</table>

**Overall results**

The order of the dots within the performance bands has no bearing on the cities’ results.
MALAYSIA: Water Woes...

Amount of piped water lost in 2012

<table>
<thead>
<tr>
<th>States</th>
<th>Piped water produced (billion litres)</th>
<th>Amount lost (billion litres)</th>
<th>Non-revenue water (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penang</td>
<td>352.8</td>
<td>62.1</td>
<td>17.6</td>
</tr>
<tr>
<td>Labuan</td>
<td>21.1</td>
<td>4.3</td>
<td>20.4</td>
</tr>
<tr>
<td>Malacca</td>
<td>173.4</td>
<td>41.2</td>
<td>23.8</td>
</tr>
<tr>
<td>Johor</td>
<td>561.0</td>
<td>155.7</td>
<td>27.8</td>
</tr>
<tr>
<td>Sarawak</td>
<td>397.1</td>
<td>116.8</td>
<td>29.4</td>
</tr>
<tr>
<td>Perak</td>
<td>422.7</td>
<td>127.3</td>
<td>30.1</td>
</tr>
<tr>
<td>Selangor</td>
<td>1,578</td>
<td>521.6</td>
<td>33.1</td>
</tr>
<tr>
<td>Terengganu</td>
<td>224.5</td>
<td>82.5</td>
<td>36.8</td>
</tr>
<tr>
<td>N. Sembilan</td>
<td>269.1</td>
<td>108.7</td>
<td>40.4</td>
</tr>
<tr>
<td>Sabah</td>
<td>386.0</td>
<td>192.8</td>
<td>49.9</td>
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<tr>
<td>Kedah</td>
<td>471.6</td>
<td>238.4</td>
<td>50.6</td>
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<tr>
<td>Kelantan</td>
<td>148.6</td>
<td>80.1</td>
<td>53.9</td>
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<tr>
<td>Pahang</td>
<td>395.0</td>
<td>214.0</td>
<td>54.2</td>
</tr>
<tr>
<td>Perlis</td>
<td>73.1</td>
<td>48.6</td>
<td>66.4</td>
</tr>
</tbody>
</table>

Water losses are due to:
1. Faulty pipes (75%-80%)
2. Theft and inaccurate water meters (15%-20%)

Source: Malaysian Water Association

© The Star Graphics
Sustainable Energy Development Authority seeks extra 1% levy

source: MEIH (ST)

BY LEONG HUNG YEE
WHY THE BUILT ENVIRONMENT?

BUILDINGS ARE RESPONSIBLE FOR OVER 40% OF THE WORLD’S TOTAL PRIMARY ENERGY CONSUMPTION.

Buildings use 12% of the world’s water.

Buildings are responsible for 40% of world’s global greenhouse gas emissions.

Buildings are responsible for 40% of solid waste generation globally.

Air quality in buildings typically contains up to 5x more pollutants than outdoor air.

- Greening the Built Environment for a more Sustainable Future
SUSTAINABILITY – The Evolution

How Are Buildings Rated For ‘Sustainability’?

- before 1990s
  - Health
  - Safety

- since 1990s to end 2000
  - Health
  - Safety
  - Smart Building
  - Energy Efficient

- since 21st Century
  - Health
  - Safety
  - Smart Building
  - Energy Efficient
  - Water Efficient
  - Environment Friendly
  - Community
  - Material & Resources

MONASH UNIVERSITY MALAYSIA – ELP Leadership Summit
- Greening the Built Environment for a more Sustainable Future

26th November 2013
A Green building focuses on increasing the efficiency of resource use – energy, water, and materials – while reducing building impact on human health and the environment during the building’s lifecycle, through better sitting, design, construction, operation, maintenance, and removal. Green Buildings should be designed and operated to reduce the overall impact of the built environment on its surroundings.
GREEN BUILDING: in Malaysia

MESINIAGA, MALAYSIA
T.R. HAMZAH & YEANG 1989

SECURITIES COMMISSION (SC)
HIJJAS KASTURI ASSOCIATES 1999
GREEN BUILDING TOOLS: THE GLOBAL PICTURE

1990

Leadership in Energy and Environmental Design

breeam

1990

World Green Building Council
www.worldgbc.org

BCA Green Mark

CASBEE

green star

2000

2001

2002

2003

2004

2005

2006

2007

2008

2009

2010

greenbuildingindex

MONASH UNIVERSITY MALAYSIA – ELP Leadership Summit
- Greening the Built Environment for a more Sustainable Future

www.mgbc.org.my

26th November 2013
THE GREEN BUILDING INDEX (GBI)

What is the Green Building Index?

The Green Building Index (GBI) is Malaysia’s industry recognised green rating tool for buildings to promote sustainability in the built environment and raise awareness among Developers, Architects, Engineers, Planners, Designers, Contractors and the Public about environmental issues and our responsibility to the future generations.

The GBI rating tool provides an opportunity for developers and building owners to design and construct green, sustainable buildings that can provide energy savings, water savings, a healthier indoor environment, better connectivity to public transport and the adoption of recycling and greenery for their projects and reduce our impact on the environment.

GBI is developed specifically for the Malaysian-tropical climate, environmental and developmental context, cultural and social needs and is created to:

- Define green buildings by establishing a common language and standard of measurement;
- Promote integrated, whole-building designs that provides a better environment for all;
- Recognise and reward environmental leadership;
- Transform the built environment to reduce its negative environmental impact; and
- Ensure new buildings remain relevant in the future and existing buildings are refurbished and upgraded to improve the overall quality of our building stock.
In addition, GBI Malaysia is a good example of how the private sector, professionals and NGOs can work together to come up with an internationally accepted standard for Green Buildings in the tropics. We appreciate and encourage more of such innovation and creative input.

I support and wish you every success in its implementation.

“1 MALAYSIA” People First. Performance Now.

YAB DATO’ SRI MOHD NAJIB
<table>
<thead>
<tr>
<th>Concerns Addressed</th>
<th>Malaysia GBI</th>
<th>USA LEED</th>
<th>Singapore Greenmark</th>
<th>Indonesia GreenShip</th>
<th>UK BREEAM</th>
<th>Hong Kong BEAM</th>
<th>Japan CASBEE</th>
<th>Germany DGNB-Seal</th>
<th>Australia Green Star</th>
<th>France HQE</th>
<th>Canada/USA Green Globes</th>
<th>Italy Protocol ITACA</th>
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<tr>
<td>Energy</td>
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<td>X</td>
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<td>Innovation</td>
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<td>Management</td>
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<td>Materials</td>
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<td>Pollution</td>
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<tr>
<td>Renewable Energy</td>
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<td></td>
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<tr>
<td>Transport</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Waste</td>
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</tr>
<tr>
<td>Rating Classifications</td>
<td>Platinum Gold</td>
<td>Platinum Gold</td>
<td>Platinum Gold</td>
<td>Excellent Very Good Good Pass</td>
<td>Platinum Gold</td>
<td>Gold Silver Bronze</td>
<td>3.0 (Class S)</td>
<td>1.5 (Class A)</td>
<td>1.1 (Class B+)</td>
<td>Gold Silver Bronze</td>
<td>6 Star</td>
<td>5 Star</td>
</tr>
</tbody>
</table>
1) GBI ACCREDITATION PANEL (GBIAP)

The GBI rating system will be regulated by the GBI Accreditation Panel (GBIAP), an independent committee consisting of senior building professionals that will be reviewing and awarding the GBI rating to qualified projects.

The GBIAP comprises leading industry professionals recognised for their contribution in sustainable developments in Malaysia. They have been actively involved in every step of the rating system’s development, ensuring that the rating system is fully tested and compliant to both local and international standards and best practices.

2) GBI CERTIFIERS

The roles and responsibility of GBI Certifiers are to perform the detailed assessment and accreditation of building projects submitted to the GBI Accreditation Panel for GBI Certification.

3) GBI FACILITATORS

The roles and responsibility of GBI Facilitators are to provide services to enable building projects to achieve GBI accreditation.
ENERGY EFFICIENCY (EE)
Improve energy consumption by optimising 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.

INDOOR ENVIRONMENT QUALITY (EQ)
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.

SUSTAINABLE SITE PLANNING (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.

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.

WATER EFFICIENCY (WE)
Rainwater harvesting, water recycling and water-saving fittings.

INNOVATION (IN)
Innovative design and initiatives that meet the objectives of the GBI.
GBI: THE ASSESSMENT PROCESS

PRE-REGISTRATION CONSULTATION
• Optional

APPLICATION & REGISTRATION

Design Assessment (DA)
• Provisional Certification

PROVISIONAL CERTIFICATE
• Due for CVA 12 months after completion, or after 50% occupancy, whichever earlier.
• Valid 3 years

COMPLETION & VERIFICATION ASSESSMENT (CVA)
• Final Certification

FINAL CERTIFICATE
• Valid for 3 years
• Green Cost Assessment (Optional)

FINAL CERTIFICATE RENEWAL
# GBI: Rating & Classifications

## Green Building Index Classification

<table>
<thead>
<tr>
<th>Points</th>
<th>GBI Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>86+ points</td>
<td>Platinum</td>
</tr>
<tr>
<td>76 to 85 points</td>
<td>Gold</td>
</tr>
<tr>
<td>66 to 75 points</td>
<td>Silver</td>
</tr>
<tr>
<td>50 to 65 points</td>
<td>Certified</td>
</tr>
</tbody>
</table>
GBI: The Available Tools

**THE GBI RATING TOOLS**

**Residential New Construction (RNC)**

The GBI Residential New Construction (RNC) Rating tool evaluates the sustainable aspects of residential buildings, including single detached houses, apartments, condominiums, townhouses, semi-detached and bungalows. It emphasizes on the environmental impacts of homes that are inhabited by people to ensure their safety and comfort. Ongoing maintenance and servicing are also taken into consideration.

**Industrial New Construction (IIC)**

The GBI Industrial New Construction (IIC) Rating tool assesses the sustainable aspects of industrial buildings, including offices, hospitals, airports, colleges, hotels and shopping complexes. It considers the environmental impact of industrial buildings and the геошарм™ (GBI) rating emphasizes on Energy Efficiency (EE) and Indoor Environmental Quality (IEQ) to achieve a green and safe working environment. Industry standards set in the GBI gives a basis for the calculation of Energy Efficiency and Indoor Environment Quality. Credit points are also included for Water Efficiency (WE), Waste Efficiency (WE), and Carbon Efficiency (CE).

**Industrial Existing Building (IEB)**

The GBI Industrial Existing Building (IEB) Rating tool evaluates the sustainable aspects of existing industrial buildings. The tool emphasizes on Energy Efficiency (EE), Indoor Environmental Quality (IEQ), and Water Efficiency (WE). The tool considers the environmental impact of industrial buildings and the геошарм™ (GBI) rating emphasizes on Energy Efficiency (EE) and Indoor Environmental Quality (IEQ). Credit points are also included for Water Efficiency (WE), Waste Efficiency (WE), and Carbon Efficiency (CE).

**Non-Residential New Construction (NRNC)**

The GBI Non-Residential New Construction (NRNC) Rating tool evaluates the sustainable aspects of non-residential buildings. The tool emphasizes on Energy Efficiency (EE) and Indoor Environmental Quality (IEQ) to achieve a green and safe working environment. Industry standards set in the GBI give a basis for the calculation of Energy Efficiency and Indoor Environment Quality. Credit points are also included for Water Efficiency (WE), Waste Efficiency (WE), and Carbon Efficiency (CE).

**Non-Residential Existing Building (NREB)**

The GBI Non-Residential Existing Building (NREB) Rating tool evaluates the sustainable aspects of existing non-residential buildings. The tool emphasizes on Energy Efficiency (EE) and Indoor Environmental Quality (IEQ) to achieve a green and safe working environment. Industry standards set in the GBI give a basis for the calculation of Energy Efficiency and Indoor Environment Quality. Credit points are also included for Water Efficiency (WE), Waste Efficiency (WE), and Carbon Efficiency (CE).

**NRNC: Data Centre**

The MRNC: Data Centre rating tool is derived from the generic NRNC rating tool with additional specific criteria relevant in Data Centre design and operation, for instance, in terms of Building Energy Intensity (BlEI). The tool encourages the use of energy-efficient practices and technologies in data centers. Performance-based requirements are set in all aspects of data center design and operation, such as thermal management, energy efficiency, and operational efficiency. Credit points are also included for Water Efficiency (WE), Waste Efficiency (WE), and Carbon Efficiency (CE).

**NREB: Data Centre**

The NREB: Data Centre rating tool is a technical tool based on the generic NRNC rating tool with additional specific criteria relevant in Data Centre design and operation, for instance, in terms of Building Energy Intensity (BlEI). The tool encourages the use of energy-efficient practices and technologies in data centers. Performance-based requirements are set in all aspects of data center design and operation, such as thermal management, energy efficiency, and operational efficiency. Credit points are also included for Water Efficiency (WE), Waste Efficiency (WE), and Carbon Efficiency (CE).

**With Local Authorities**

- MAH/MHO
- PPK
- MAH/MHO
- PPK
- MAH/MHO
- PPK
- MAH/MHO
- PPK
- MAH/MHO
- PPK

**Hotel**

Opened for Industry Consultation October 2013

**Interior**

Opened for Industry Consultation October 2013
# GBI: Executive Summary

## EXECUTIVE SUMMARY AS OF 15 NOVEMBER 2013

### GBI Certified Projects by Categories

<table>
<thead>
<tr>
<th>Update to Green Building Index</th>
<th>TOTAL as of 15 NOVEMBER 2013</th>
<th>MNRC Non-Residential New Construction</th>
<th>RNC Residential New Construction</th>
<th>INC Industrial New Construction</th>
<th>NREB Non-Residential Existing Building</th>
<th>GIB Industrial Existing Building</th>
<th>T Township</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied</td>
<td>492</td>
<td>260</td>
<td>109</td>
<td>13</td>
<td>16</td>
<td>3</td>
<td>11</td>
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<tr>
<td>Registered</td>
<td>458</td>
<td>234</td>
<td>182</td>
<td>12</td>
<td>19</td>
<td>3</td>
<td>11</td>
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<tr>
<td>Total Certified</td>
<td>1,350</td>
<td>500</td>
<td>291</td>
<td>25</td>
<td>35</td>
<td>6</td>
<td>22</td>
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<tr>
<td>Received with Provisional Certification after DA</td>
<td>165</td>
<td>81</td>
<td>73</td>
<td>0</td>
<td>5</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Received Final Certification after CVA</td>
<td>17</td>
<td>7</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
</tbody>
</table>

### Gross Floor Area (GFA) of GBI Certified Buildings

<table>
<thead>
<tr>
<th></th>
<th>TOTAL as of 15 NOVEMBER 2013</th>
<th>MNRC Non-Residential New Construction</th>
<th>RNC Residential New Construction</th>
<th>INC Industrial New Construction</th>
<th>NREB Non-Residential Existing Building</th>
<th>GIB Industrial Existing Building</th>
<th>T Township</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Floor Area, sqm (As Submitted)</td>
<td>7,324,385.39 (7,760,025 sqft)</td>
<td>2,993,107.37</td>
<td>3,998,297.39</td>
<td>303,399.62</td>
<td>27,500</td>
<td>9,829</td>
<td></td>
</tr>
</tbody>
</table>

### Carbon Dioxide (CO2) Emission Reduction by GBI Certified Buildings

- **CO2 REDUCTION PROJECTION**
  - TOTAL as of 15 NOVEMBER 2013
  - MNRC Non-Residential New Construction: 224,292
  - RNC Residential New Construction: 198,227.92
  - INC Industrial New Construction: 194,324
  - NREB Non-Residential Existing Building: 20,061
  - GIB Industrial Existing Building: 949
  - T Township: 719

## GBI Certified Projects by Rating Categories

### RATING | TOTAL as of 15 NOVEMBER 2013 | MNRC Non-Residential New Construction | RNC Residential New Construction | INC Industrial New Construction | NREB Non-Residential Existing Building | GIB Industrial Existing Building | T Township |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PLATINUM (90+ points)</td>
<td>7</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>GOLD (75 to 90 points)</td>
<td>51</td>
<td>32</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SILVER (60 to 75 points)</td>
<td>10</td>
<td>10</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Certified (50 to 60 points) (55%)</td>
<td>103</td>
<td>43</td>
<td>50</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total Certified</td>
<td>182</td>
<td>88</td>
<td>80</td>
<td>2</td>
<td>7</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

### GBI Projects by States/Territories

### GBI Certified Projects by Year/Quarter

## MONASH UNIVERSITY MALAYSIA – ELP Leadership Summit

- **Greening the Built Environment for a more Sustainable Future**

26th November 2013

www.mgbc.org.my
## GBI: Total Projects (by States)...

<table>
<thead>
<tr>
<th>GBI Projects by State/Territory</th>
<th>Registered Projects</th>
<th>Certified Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuala Lumpur</td>
<td>136</td>
<td>69</td>
</tr>
<tr>
<td>Selangor</td>
<td>192</td>
<td>61</td>
</tr>
<tr>
<td>Penang</td>
<td>38</td>
<td>17</td>
</tr>
<tr>
<td>Putrajaya</td>
<td>24</td>
<td>17</td>
</tr>
<tr>
<td>Johor</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Melaka</td>
<td>14</td>
<td>3</td>
</tr>
<tr>
<td>Sarawak</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Sabah</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GBI Projects by State/Territory</th>
<th>Registered Projects</th>
<th>Certified Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perak</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Pahang</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Negeri Sembilan</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Kelantan</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Kedah</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Perlis</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### GBI: Total Projects (by Certifications)

<table>
<thead>
<tr>
<th>Rating</th>
<th>Total as of 15 November 2013</th>
<th>NRC Non Residential New Construction</th>
<th>RNC Residential New Construction</th>
<th>INC Industrial New Construction</th>
<th>NREB Non Residential Existing Building</th>
<th>IEB Industrial Existing Building</th>
<th>Township</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Platinum</strong></td>
<td>7 (5%)</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td><strong>Gold</strong></td>
<td>50 (24%)</td>
<td>32</td>
<td>18</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Silver</strong></td>
<td>23 (14%)</td>
<td>10</td>
<td>10</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td><strong>Certified</strong></td>
<td>103 (57%)</td>
<td>43</td>
<td>50</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Certified</strong></td>
<td>182</td>
<td>88</td>
<td>80</td>
<td>2</td>
<td>7</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>
# GBI: Total Projects (by Floor Space)

<table>
<thead>
<tr>
<th></th>
<th>NRNC</th>
<th>RNC</th>
<th>NREB</th>
<th>INC</th>
<th>IEB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non Residential New Construction</td>
<td>Residential New Construction</td>
<td>Non Residential Existing Building</td>
<td>Industrial New Construction</td>
<td>Industrial Existing Building</td>
</tr>
<tr>
<td><strong>GFA (ft²)</strong></td>
<td>32,131,428</td>
<td>43,040,996</td>
<td>3,265,766</td>
<td>296,008</td>
<td>105,799</td>
</tr>
<tr>
<td><em>(As Submitted)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total Certified as of 15th November 2013**

<table>
<thead>
<tr>
<th></th>
<th><strong>GFA</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>78,839,028 ft²</strong></td>
<td></td>
</tr>
</tbody>
</table>

of Green Buildings
GBI: Trained Facilitators (GBIFs)

- Architects (600) 29%
- Engineers (1,035) 49%
- Other Building Professionals (217) 10%
- Developers & Managers (64) 3%
- Manufacturers etc. (184) 9%

Total 2,327 attendees
GBI: Registered GBIFs and GBI CxS

facilitators  660 GBIFs Registered

17 GBI CxS Registered  Commissioning Specialists
## GBI: ESTIMATED COST OF GOING GREEN

<table>
<thead>
<tr>
<th>GBI</th>
<th>Ave. M’sian Bldg</th>
<th>Meets MS1525</th>
<th>GBI Certified</th>
<th>GBI Silver</th>
<th>GBI Gold</th>
<th>GBI Platinum</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEI kWh/m²/yr</td>
<td>250</td>
<td>200 - 220</td>
<td>150 - 180</td>
<td>120 - 150</td>
<td>100 - 120</td>
<td>&lt;100</td>
</tr>
<tr>
<td>Energy Savings %</td>
<td>Baseline</td>
<td>10 - 20</td>
<td>30 - 40</td>
<td>40 - 50</td>
<td>50 - 60</td>
<td>&gt; 60</td>
</tr>
<tr>
<td>Incremental construction cost %</td>
<td>Baseline</td>
<td>0 – 3%</td>
<td>1% – 5%</td>
<td>5% - 8%</td>
<td>5% - 10%</td>
<td>7% - 13%</td>
</tr>
</tbody>
</table>
GREENING BUILDINGS: “Tip of the Iceberg”

Upfront / Building Construction Cost
15% - 20%

Energy Consumed / Maintenance Cost over Lifetime of the Building
80% - 85%
GREENING BUILDINGS: Barriers To Implementation

Fragmentation of Interest

Professional and Trade Responsibilities (Functional gaps)

Building Delivery Process (Management discontinuities)

Operational Islands (Ineffective coordination; poor communication)

source: WBCSD
CASE STUDY #1: ST’s Corporate Headquarters

1st GBI PLATINUM BUILDING

GM PLATINUM BUILDING
CASE STUDY #1: ST’s Corporate Headquarters (con’t)...

OVERALL DESIGN STRATEGY

REDUCE DEMAND

ENERGY EFFICIENCY
- Strategies:
  - Light zoning
  - Advance EE Performance BEI
  - Sustainable maintenance
  - Active Measures Energy efficient cooling, lighting systems
  - Renewable Energy production with PV

INDOOR ENVIRONMENTAL QUALITY
- Strategies:
  - Use low VOC, non-toxic materials
  - Maintain odour free indoor environment
  - Thermal comfort
  - Daylight Glare control

SUSTAINABLE SITE PLANNING & MGMT
- Strategies:
  - Landscaping to reduce heat island effect
  - Reduce use of virgin resources by using recycled content materials
  - Reduce waste during construction and during occupancy

EFFICIENCY

MATERIAL & RESOURCES
- Strategies:
  - Recycle content material
  - Regional materials
  - Drip Irrigation system for landscaping

WATER EFFICIENCY
- Strategies:
  - Rainwater harvesting
  - Water Recycling
  - Efficient water fittings and fixtures
  - Metering & Leak detection system

GENERATION

INNOVATION
- Strategies:
  - Heat pipe technology
  - Thermal Mass Storage
  - Advance air filtration
  - Composting
CASE STUDY #1: ST’s Corporate Headquarters (con’t)

ARCHITECTURAL PASSIVE DESIGN

- The diamond form with the Tilting Façade avoid direct sun rays into building
- Tilting Façade results in smaller building footprint which allows for more area for landscape.
- Surrounding landscape reduces heat gain into the building.
CASE STUDY #1: ST’s Corporate Headquarters (con’t)...

GREEN ROOF: SOLAR PHOTOVOLTAIC (PV)

'Seamless' Integration of PV with metal roof

Integration of PV & Metal Decking

Access to view PV panel

PV inverter room

Roof Plan: Integration of PV with metal roof

View of PV panels on the roof

PV panels on metal frame
CASE STUDY #1: ST’s Corporate Headquarters (con’t)...

GREEN ROOF: RAINWATER HARVESTING

Rainwater from the dome is harvested

Stainless steel gutter

Rainwater Harvesting Tanks

Rainwater used for irrigation

Stainless steel gutter

Rainwater downpipe

Rainwater used for toilet flushing system

MGBC
CASE STUDY #1: ST’s Corporate Headquarters (con’t)...

GREEN ROOF: LIGHT TROUGH

View of Roof Light Trough from dome access panel platform

Lounge area on Level 7 below the Roof Light Trough

Indirect daylight drawn into the Roof Light Trough to the space below
CASE STUDY #1: ST’s Corporate Headquarters (con’t)...

DAYLIGHTING: LIGHT SHELVES

Typical Cross Section

Mirror light shelf

Fixed blinds for glare control

Daylight reflected onto ceiling
CASE STUDY #1: ST’s Corporate Headquarters (con’t)...

WATER EFFICIENCY: WE FITTINGS

Annual Water Consumption (m3)

- Dual flush toilets
- Waterless urinals (with water tap for Muslim users)
- Taps with aerators

67% reduction in annual water consumption from conventional to water efficient fittings.
CASE STUDY #1: ST’s Corporate Headquarters (con’t)...

WATER EFFICIENCY: GREYWATER RECYCLING

Greywater from wash basins & floor traps

Mini-wetlands (top & side view)

View of Main Meeting Room
CASE STUDY #1: ST’s Corporate Headquarters (con’t)...

ENVIRONMENTAL FRIENDLY MATERIALS

- Recycled Plaster Board (Green Label)
- Low VOC Paint (Green Label)
- Recycled Content Carpet (Green Label)
CASE STUDY #2: Energy Auditing Commercial Towers

DEFINING ENERGY INDICES

Energy Efficiency Index (EEI) – kWh/m².yr

Energy Use Intensity (EUI) – kBtu/ft².yr

Building Energy Intensity (BEI) – kWh/m².yr

Measurement of Rate of Energy Used: 
Amount of Energy consumed per unit Area in a period of one year.
CASE STUDY #2: Energy Auditing Commercial Towers

WHY ENERGY INDEXING?

<table>
<thead>
<tr>
<th>GBI Points</th>
<th>BEI Less Than or Equal (kW.h/m².yr)</th>
<th>PUE Less Than or Equal</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRNC</td>
<td>Retail (low energy Malls)</td>
<td>Retail (high energy Malls)</td>
</tr>
<tr>
<td>2</td>
<td>150</td>
<td>240</td>
</tr>
<tr>
<td>3</td>
<td>140</td>
<td>225</td>
</tr>
<tr>
<td>5</td>
<td>130</td>
<td>210</td>
</tr>
<tr>
<td>8</td>
<td>120</td>
<td>195</td>
</tr>
<tr>
<td>10</td>
<td>110</td>
<td>180</td>
</tr>
<tr>
<td>12</td>
<td>100</td>
<td>160</td>
</tr>
<tr>
<td>15</td>
<td>90</td>
<td>145</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GBI Points</th>
<th>BEI Less Than or Equal</th>
<th>EUI Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRNC</td>
<td>Industrial</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>180</td>
<td>10%</td>
</tr>
<tr>
<td>3</td>
<td>150</td>
<td>25%</td>
</tr>
<tr>
<td>4</td>
<td>140</td>
<td>30%</td>
</tr>
<tr>
<td>5</td>
<td>130</td>
<td>35%</td>
</tr>
<tr>
<td>6</td>
<td>120</td>
<td>40%</td>
</tr>
<tr>
<td>7</td>
<td>110</td>
<td>45%</td>
</tr>
<tr>
<td>8</td>
<td>100</td>
<td>50%</td>
</tr>
<tr>
<td>10</td>
<td>90</td>
<td>55%</td>
</tr>
</tbody>
</table>

Knowing where you are in terms of Energy Consumption
CASE STUDY #2: Energy Auditing Commercial Towers

DPMs – Your Energy Monitors

REMEMBER THIS:

“If you cannot measure it, you cannot improve it”

Lord Kelvin (1824 – 1907)
CASE STUDY #2: Energy Auditing Commercial Towers

HISTORICAL DATA: IMPORTANT FOR TRENDING

Annualized Data (2 Years)

<table>
<thead>
<tr>
<th>Month</th>
<th>Annualized Energy Consumption (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec '10</td>
<td>109,000,000</td>
</tr>
<tr>
<td>Jan '11</td>
<td>108,000,000</td>
</tr>
<tr>
<td>Feb '11</td>
<td>107,000,000</td>
</tr>
<tr>
<td>Mar '11</td>
<td>106,000,000</td>
</tr>
<tr>
<td>Apr '11</td>
<td>105,000,000</td>
</tr>
<tr>
<td>May '11</td>
<td>104,000,000</td>
</tr>
<tr>
<td>June '11</td>
<td>103,000,000</td>
</tr>
<tr>
<td>July '11</td>
<td>102,000,000</td>
</tr>
<tr>
<td>Aug '11</td>
<td>101,000,000</td>
</tr>
<tr>
<td>Sept '11</td>
<td>100,000,000</td>
</tr>
<tr>
<td>Oct '11</td>
<td>99,000,000</td>
</tr>
<tr>
<td>Nov '11</td>
<td>98,000,000</td>
</tr>
<tr>
<td>Dec '11</td>
<td>97,000,000</td>
</tr>
<tr>
<td>Jan '12</td>
<td>96,000,000</td>
</tr>
<tr>
<td>Feb '12</td>
<td>95,000,000</td>
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<tr>
<td>Mar '12</td>
<td>94,000,000</td>
</tr>
<tr>
<td>Apr '12</td>
<td>93,000,000</td>
</tr>
<tr>
<td>May '12</td>
<td>92,000,000</td>
</tr>
<tr>
<td>June '12</td>
<td>91,000,000</td>
</tr>
<tr>
<td>July '12</td>
<td>90,000,000</td>
</tr>
<tr>
<td>Aug '12</td>
<td>89,000,000</td>
</tr>
<tr>
<td>Sept '12</td>
<td>88,000,000</td>
</tr>
<tr>
<td>Oct '12</td>
<td>87,000,000</td>
</tr>
<tr>
<td>Nov '12</td>
<td>86,000,000</td>
</tr>
<tr>
<td>Dec '12</td>
<td>85,000,000</td>
</tr>
</tbody>
</table>

HISTORICAL DATA: IMPORTANT FOR TRENDING
CASE STUDY #2: Energy Auditing Commercial Towers

DATA LOGGING: for CONSUMPTION PATTERN

Weekday Consumption

At 2.2MW, almost 40% of Peak Demand BASELOAD

Weekend Consumption

Night-load  Start-up  Operation  Ramp-down
CASE STUDY #2: Energy Auditing Commercial Towers

DATA LOGGING: LIGHTING LEVEL FOR ARTIFICIAL LIGHTING

AVERAGE LUX LEVEL: > 400

Task Lighting Required?
EMERGING GREEN TECHNOLOGIES

Heat Pipe Technology

- Heat enters the heat pipe at its evaporator where it causes working fluid to vaporize. The vaporized fluid creates a pressure gradient which forces the vapor towards the condenser.

- The wick serves as a pump using capillary pressure to return the fluid from the condenser to the evaporator. The wick also acts as an extended surface to allow higher heat fluxes.

Self Cleaning Facade

www.mgbc.org.my
EMERGING GREEN TECHNOLOGIES (con’t)...

Mixed Mode Ventilation System

Green Curtain System
EMERGING GREEN TECHNOLOGIES (con’t)...

Urban Farming

Light Pipe System
SUSTAINABILITY: Inspiring Thoughts...

Let us ponder this...

"There must be a better way to make the things we want, a way that doesn't spoil the sky, or the rain or the land"

Sir Paul McCartney

“There is a sufficiency in the world for man's need, but not for man's greed”

Mohandas K. Gandhi (1869 – 1948)

“We do not inherit the earth from our ancestors; we simply borrowed it from our children”

David Brower (1912 – 2000)

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