Green Building Promotion in Taiwan: Current Development and Future Perspectives

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1. Background of Green Building Development in Taiwan

- Global warming

- Temperature rise of the earth in the last century has a close relationship with energy uses and CO$_2$ emission
Today the global warming is continuing. The extreme weather causes many severe catastrophic conditions, such as wildfires, floods, heat waves, pests and diseases, epidemics, hurricanes, unusually high temperatures, etc. All these have resulted in substantial losses and significant detriments of the ecosystem.

We have to face such a circumstance and to raise concrete strategies to tackle global warming and climate change.
Warming issues are very challenging in Taiwan

- According to the statistics of the Central Weather Bureau, the temperature of the past 10 years is ranked highest over the past 100 years.
- The average temperature of Taiwan increased 1 ℃ to 1.39 ℃ which is higher than the world’s average increase.
- Considering Taiwan’s metropolitan areas in summer, the temperature difference between the CBD and the suburbs can reach 3 ℃ to 4 ℃.
- According to the statistics from Tai Power Company, the HVAC energy consumption increases about 6% as the temperature increases 1 ℃.
- Greater warming challenges in Taiwan than in the world.
LOCAL ISSUES

Environmental Issues in Taiwan

- High independence on imported energy accounting for 99.3% (the building sector accounting for 28.3% of total energy consumption).
- Abundant rainfalls but limited available water resources.
- The second highest rank of cement consumption in the world causing the generation of nearly 11 million tons construction wastes annually.
- Worsening indoor environmental quality threatens people’s health.
- Inappropriate building design for energy saving and accelerating heat gain from building HVAC systems also cause a vicious circle of greater urban warming and more energy consumption.

Facing the deteriorating global warming and climate change situations, the pursuit of sustainable development since 1990 has thus facilitated the better development and adoption of green building practices.
Green building assessment systems vary from country to country in accordance with local environmental and socioeconomic conditions.
Green Building Design in Taiwan

1. Accommodate local environmental issues in Taiwan and correspond to the requirements for energy saving, water conservation, waste reduction, and health protection.

2. Focus on heat insulation and ventilation, to agree with the subtropical/tropical climatic condition in Taiwan

Definition of the Green Building in Taiwan

A healthy and comfortable building that is capable of efficiently reducing the consumption of energy and natural resources, and the pollution caused by wastes during the life cycle of the building.
Overview of the Green Building Development of Taiwan

- 1998 – Established the “Green Building Evaluation System.”
- 1999 – Launched the “Green Building Labeling System.”
- 2001 – The Executive Yuan ratified “Green Building Promotion Program (GBPP)” and its pioneer implementation starting from the central government.
- 2003 – Involved the GBPP into the “Challenge 2008 National Development Plan” and extended its implementation to local governments.
- 2004 – Revised the GBPP and promoted the adoption of green building in the private sector and its institutionalization.
- 2004 – Established the “Green Building Material Evaluation and Labeling System.”
Overview of the Green Building Development of Taiwan (Cnt’d)

- 2005 – Completed the green building institutionalization and implemented the “Green Building Basic Chapter” in the “Building Technical Regulations (BTR).”

- 2006 – Required at least of 5% of green building material utilization in public buildings.

- 2007 Green building rating system implemented.


- 2009 – Raised the percentage of green building material utilization up to 30%.

- 2010 – “Intelligent Green Building Promotion Program (2010 to 2015)” ratified and implemented.
2. Green Building Labeling System and its Achievements

2009 World Games Stadium (Kaohsiung)

Taipei Municipal Library – Beitou Branch (Taipei)

Delta Inc. Green Factory (Tainan)

Green Magic School (Tainan)
### 2.1 Taiwan’s GB Evaluation System

#### EEWH SYSTEM

<table>
<thead>
<tr>
<th>Categories</th>
<th>Indicators</th>
</tr>
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<tbody>
<tr>
<td>Ecology</td>
<td>Biodiversity</td>
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<td></td>
<td>* Greenery</td>
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<tr>
<td></td>
<td>* Soil Water Content</td>
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<tr>
<td>Energy Saving</td>
<td>* Energy Conservation</td>
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<tr>
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<td>* CO₂ Emission Reduction</td>
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<td>Waste Reduction</td>
<td>* Construction Waste Reduction</td>
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<tr>
<td>Health</td>
<td>* Indoor Environment</td>
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<td></td>
<td>* Water Conservation</td>
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<td></td>
<td>* Sewage and Garbage Improvement</td>
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**Green Building Label System**
- Green Building Label for completed buildings
- Green Building Candidate Certificate for building projects.

**Minimum Requirements**
Pass two prerequisites (Energy Saving and Water Conservation) and two optional indicators from among the other seven.
In 2007, a new rating system was established to aim at improving green building design and innovative techniques, which was classified into five levels: certified, bronze, silver, gold, and diamond.

<table>
<thead>
<tr>
<th>Categories</th>
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<th>Minimum</th>
<th>Maximum</th>
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<tr>
<td></td>
<td>Greenery</td>
<td>2</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soil Water content</td>
<td>2</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Energy Saving</td>
<td>Shell</td>
<td>2</td>
<td>12</td>
<td>28</td>
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<tr>
<td></td>
<td>HVAC</td>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lighting</td>
<td>2</td>
<td>6</td>
<td></td>
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<tr>
<td>Waste Reduction</td>
<td>CO₂ emission</td>
<td>2</td>
<td>9</td>
<td>18</td>
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<tr>
<td></td>
<td>Waste reduction</td>
<td>2</td>
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<td>Health</td>
<td>IEQ</td>
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<td></td>
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</tbody>
</table>

Certified: 12*~26  Bronze: 26~34  Silver: 34~42  Gold: 42~53  Diamond: 53 and above
2.3 Certifying Process

- A publicly-owned building costing **more than 50 million NTD** shall acquire a **Green Building Candidate Certificate** prior to construction started and a **Green Building Label** prior to the official acceptance and auditing process.
2.4 Achievements

By the end of August 2011, a total of 3,062 buildings or building projects were certified as green buildings.

- Total building floor areas: 37.30 million m²
- Water saving: 41.87 million tons
- Energy saving: 935 million Kilowatt-hours (annual CO₂ emission reduction of 630 million CO₂-kg/year)
- Water and electricity bills saving: annually 2.67 billion NTD
- Other benefits: ecology, water retention and infiltration, waste reduction, resource conservation, etc.
Varied shadows creating a unique subtropical building feature makes the Delta building a paradigmatic green factory design.

Daylighting and indoor greenery

Ecological pond design for runoff management and water retention

Façade with rhythmic balconies forming multilayer ecological corridors
Diamond-rated Green Building – Taipei Municipal Library Beitou Branch

A Timber and Steel Structure with surrounding terrain to reduce heat gain

Daylighting and natural ventilation for indoor environment

Green Roof as an ecological connectivity with surrounding natural landscape

Adoption of Renewable Energy

Greenery
Green Campus - Tainan Yizai Elementary School

- A base of ecological education
- Solar Energy
- Demonstrative Wind Power
- Multilayer Greenery
- Ecological Wetland
2.5 Green Building Renovation and Diagnosis Projects

- By the end of 2011, a total of 175 green building renovation and diagnosis projects for central government buildings is completed with a total investment of 700 million NTD.

- **Existing buildings account for more than 97% of total buildings.** Despite higher renovation costs, its overall economic benefits covering energy saving, water conservation, carbon reduction, waste reduction and environmental protection should be simultaneously considered. These demonstrative projects also progressively expanded the effects to promote the green remodeling for existing buildings.
2.6.1 Green Building Renovation Projects (I)

Renovation and Restoration of an Old Winery (Taichung)

BEFORE
Lack of natural lights  Poor natural ventilation and IEQ

AFTER
Introduce Daylighting
Ventilation Tower
Sun-shading and Reuse of Tile Wastes
Indoor Environment Improvement
In 2003, a 900-ton rainwater collection system for irrigation to conserve water resources 11,600 tons annually and to increase stormwater detention up to 85 minutes.
2.7 Improvement Projects of Building Energy Efficiency

The project that launched in 2003 aimed at improving the air-conditioning and water heating equipment and introducing the energy management system. To date, a total of 216 projects is completed with a total cost of 900 million NTD and a significant 20% saving in electricity.
2.8 Green Building Awards of Excellence

• A national competition of the Green Building Awards of Excellence has been held for architects and developers to encourage innovative green building technologies and practices.

• The Ministry of the Interior has bestowed a total of 52 awards from 2003 to 2007.

• The ABRI resumed the competition in 2011.
A series of educational tours to demonstrative green buildings being held to showcase green building concepts and techniques so that every citizen can experience Green and get to be Green!

• By the end of June 2011, 89 tours have been held with a total of 2,478 participants.

• 35 Tours to be held this year, welcome join the tour and register at TGBC’s website: http://www.taiwangbc.org.tw/chinese/
2.10 Stride Forward from Green Building to Eco-City

- Promote Green Building towards Eco-Cities:
  a) Eco-City and Green Building Promotion Program: to adapt with global environmental change and to mitigate urban heat island effect, so as to achieve homeland sustainability.
  b) Promotion Period: from 2008 to 2011

- Promotion Directions:
  a) Strengthening the mandatory green building certification for public-owned buildings
  b) Improvement of existing buildings and building energy efficiency
  c) Protection of human health and enhancement of indoor environmental quality
  d) Development of Eco-Community and Eco-City
### 3.1 Green Building Material Label

In order to achieve a comfortable and healthy living environment and to drive the building material industry upgrade, the ABRI established the Green Building Material (GBM) Evaluation and Labeling System in 2004. The GBM Label is divided into four categories:

<table>
<thead>
<tr>
<th>Healthy</th>
<th>Recycling</th>
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<tbody>
<tr>
<td>Healthy GBM</td>
<td>Recycled GBM</td>
</tr>
<tr>
<td>A GBM is not harmful for human health, which characteristics include low-emission, low-pollution, low-odor, and low physical harm.</td>
<td>A GBM focuses on the regeneration of recyclable building materials through proper remanufacturing process to achieve the goal of “Reduce, Reuse, and Recycle (3R).</td>
</tr>
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<th>Ecological</th>
<th>High-performance</th>
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<td>Ecological GBM</td>
<td>High-Performance GBM</td>
</tr>
<tr>
<td>A GBM is a natural material requiring less processing and energy consumption, that can also be easily decomposed and rapidly growing. Conforming with the local industry market is considered as well.</td>
<td>For sound insulation, a GBM is capable of effectively preventing the noise. For permeability, a GBM capable of promoting water infiltration and retention through its high permeability.</td>
</tr>
</tbody>
</table>
3.2 Requirements of GBM Utilization in the Building Technical Regulations

- Building Technical Regulations (BTR)

- Effective July 1, 2006, green materials must be used for interior furnishing and flooring of a public building and must constitute at least 5% of all decorating materials.

- Effective July 1, 2009, the utilization percentage has been raised up to 30%.

- Currently the enhancement of more than 45% utilization is being proposed and the extension to 10% outdoor utilization to be involved.
By the end of August 2011, a total of 542 GBM Labels has been conferred covering 4,718 green products.

The healthy GBM occupies 77% of total certification and its percentage distribution indicates that health issues have been highly emphasized and points out the development trend of the building material market in Taiwan.
4. Future Perspectives – A Dual-Track Move of Green Buildings and Intelligent Buildings

- Develop the EEWH green building evaluation system family covering various aspects of eco-community, green factory, and green renovation, so as to comprehensively improve the overall living environment with ecological environment protection, energy saving and carbon reduction, as well as sustainability.
- Integrate the ICT industry advantage of Taiwan with the concept of energy saving and carbon reduction to create an interdisciplinary practice of Intelligent Green Building for continually promoting the development of national technology industry.
4.2 Intelligent Green Building

- **Intelligent Building**: A building introducing information and communication technologies to construct a space with active sensing and controlling system to create a living environment of safe, health, convenience, comfort, energy efficiency, as well as sustainability.

- **Intelligent Green Building**: A building serves as a carrier synthesizing the introduction of green building design and the application of advanced high-tech products and materials so that the objectives of safe, health, convenience, comfort, energy efficiency, carbon reduction, environmental protection can be attained.

- A dual-track implementation with both green building and intelligent building certifications.

\[
\text{Intelligent Green Building} = \text{Green Building} + \text{Intelligent Building}
\]
Scopes of the Smart Green City

1. Scenario simulation of future life
2. Indoor environment control
3. Safety & security
4. Information acquisition and delivery
5. Housework assistance function
6. Household intelligent control platform
7. Home information appliance development

G

1. Concierge security
2. Resident and visitor identification system
3. Certified mail reception system
4. Waste automatic classification system
5. Surveillance system of community public spaces

1. Urban information network infrastructure
2. Urban function management center
3. Intelligent traffic system
4. Intelligent crime prevention system
5. E-administration & e-government
6. Urban intelligent control platform
5. Conclusions

1. The implementation of the eco-city and green building policy in Taiwan has been gradually forming a viable scheme of sustainable development and circulation from large scale practices in cities and communities to small scale applications within a single building and its indoor quality.

2. The enforcement of the mandated green building basic chapter in the Building Technical Regulations has effectively extended the green building design for all newly-constructed buildings in Taiwan.
5. Conclusions

3. The introduction of the green building rating system has successfully encouraged the builders/owners to pursue a better and higher-rated green building design. The effect of energy saving has now reached 25% and water conservation more than 30%.

4. The evaluation of green building material and its testing mechanism have adequately prevented inferior materials from dumping to ensure citizen’s health and to further facilitate the domestic green building material market.

5. The Executive Yuan has ratified and implemented the “Intelligent Green Building Promotion Program (2010-2015) to be the guideline of the future development of green building and intelligent living space of Taiwan.
Thank you for your attention

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