



# Green Building Certification as a Policy to Promote Green-Building - A Study of Singapore, Taiwan, Australia, UK, US and Lessons for Vietnam

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**Abstract:** To cope with global environmental crisis and warming, Green Building (GB) has become a world-wide common trend in construction industries and each country has adopted different policies, programs, strategies to promote GBs in accordance to its own conditions and context. This paper looks at GB certification from the lens of a GB promotion policy, therefore, it concerns about the governments' points of view and actions related to GB certification. The paper summarizes a study of GB certification policies in five countries: Singapore, Taiwan, Australia, UK and US; then overviews current state of GB development in Vietnam, reviews current policy context and analyzes roles of different stakeholders in the market. Through the understanding of the local context, the lesson learnt from the international experiences, this paper suggests a policy orientation for accelerating GB development in Vietnam

**Keywords:** Green building, green building certification system, green building policy

## 1. Introduction

Since the global energy crisis in the 1960s, critical research and activities have been promoted to improve energy efficiency and reduce environmental degradation. The construction industry is considered to be the sector with the highest GHG emissions and also the largest resource consumer. According to statistics in many countries, the construction industry accounts for about 40% of total energy consumption and 25% of total annual water consumption; of which 80% of energy consumption is in the operation stage of the project [1]. An economical and efficient construction industry in terms of natural resources and energy will be the decisive 'solution' to the common energy problem of this planet. Awareness on global climate change (CC) and political commitment of nations on reducing CC have also pushed GB a hot topic as it was recognized that construction industry emits 1/3 total GHG emission globally [1]. Therefore, 'Green Building' (GB) has become the trend of the time. According to the World Green Building Council (WGBC), "a green building is a building that, in its whole life cycle from design, construction or operation, reduces or eliminates negative impacts and can create positive impacts, on our climate and natural environment; preserves precious natural resources and improve our quality of life" [2]

Policies to promote GB have become an important part of the developmental policy reform in many countries. GB strategy, GB Master Plan, phase-based GB Action Plans are common measures to promote interdisciplinary integration to transform the old construction industry into a more radical, greener one. Among various policies and policy frameworks, using GB certification system to promote GB is one of the most essential and important policy tools. Today,

there are about 50 GB certification systems (or rating tools) have been developed and applied around the World [3]. GB certification is a fundamental part of any policy framework to promote GB in all countries.

This paper looks at GB certification from the 'lense' of a GB promotion policy, therefore, it concerns about the governments' points of view and actions related to GB certification. At first, the study collected and analyzed secondary documents about GB promotion policies in general (part 1) and chose five countries including Singapore, Taiwan, Australia, UK, US as case-studies for further investigation (part 2) about their GB certification policy. Primary data on the Vietnamese GB market is collected through surveys and interviews with stakeholders - focusing on the current debates around GB certification policy for Vietnam (part 3). The last part is the conclusions and recommendations for Vietnam related to the selection and promulgation of GB certification policy in the current context.

## 1. Overview of Common Policy Framework to promote GB in Countries Around the World

GB policy is an overarching factor and has a key meaning for the take-off of the GB market in many countries. There are several good studies overviewing many GB policies in various countries, at national and local level, such as 'A Survey of the Status and Challenges of Green Building Development in Various Countries' by Yinqi, Zhang and other [4], or the report 'Urban Efficiency: A Global Survey of Building Energy Efficiency Policies in Cities' by the Tokyo Metropolitan Government and the C40 Cities [5], or 'Green building policy options for the public sector' by Annie R. Pearce [6], or 'Low Carbon Green Growth Roadmap for Asia and the Pacific: Building - Policy recommendations for the development of eco-efficient infrastructure' of United Nations [7] and [1], [8] [9] [2]. From these literature review, it is possible to synthesize a 'policy framework' of common policy tools, put in nine common groups as in the table 1.

**Table 1 - 'Policy framework' with nine common types of policies**

Type of policies	Explanation
<b>1. Building energy codes</b>	Any building codes containing energy efficiency requirements for a whole building, part of a building, or equipment embedded in a building, or other regulations, laws and ordinances based on such codes
<b>2. Reporting and benchmarking of energy performance data</b>	Any policy or programme requiring reporting (to the government), benchmarking or disclosing data for building energy consumption and GHG emissions, etc..
<b>3. Mandatory auditing and retro-commissioning</b>	Any policy or programme mandating auditing and/or retro-commissioning of buildings
<b>4. Green building certification and energy performance labelling</b>	Any scheme run by a government to rate or certify levels of building environmental performance or energy performance. Alternatively, any regulatory policy or programme based on existing green building certification/rating schemes or energy performance certification/labelling schemes.
<b>5. Government leadership</b>	Any initiative to demonstrate governmental leadership in building energy efficiency and sustainability through implementation measures in government owned or occupied buildings or government operations
<b>6. Awareness raising</b>	Awareness raising programmes for building owners, tenants or the wider public, such as free or subsidised energy efficiency advice, weatherization programmes, open online sources for energy efficiency tips, educational programmes and public campaigns, etc.
<b>7. Financial incentives</b>	Any financial incentive (e.g. tax incentives, rebates, etc.) offered to offset costs associated with the implementation of one or more specific energy efficiency measures for building envelopes or equipment
<b>8. Non-financial incentives</b>	Any non-financial incentive (e.g. accelerated permitting, floor area bonus) to encourage implementation of one or more specific energy efficiency measures for building envelopes or equipment.
<b>9. Other</b>	Any other initiatives that contribute to building energy efficiency or GB.

In general, countries apply the above groups of policies with varying degrees implementation and different priority orders. This paper focuses on comparative analysis of the fourth group of policies '**Green building certification and energy performance labelling**' in the 5 case-study countries.

## 2. Green Building Certification Tools and Policies in the Five Case-Study Countries

### a. Singapore's Policies and the Green Mark (GM)

Singapore is a small island-nation with a total national area of 721.5 km<sup>2</sup> and a population of 5,639 million people. Aware that the construction industry in Singapore consumes up to half of the country's total energy, Singaporean

Government has always focused on promoting green construction industry and sustainable urban development. Today, Singapore is ranked the 3rd in the World in terms of GB development [9]; a country with excellent GB promotion policy which is integrated, comprehensive, consistent and effective

Green Mark (GM) is the official GB rating system of Singapore. It was developed and adopted in 2005 by the Building and Construction Authority of Singapore (BCA) - an agency under the Ministry of National Development, whose mission is to shape a safe, high quality, sustainable and friendly built environment [9]. GM “provides a comprehensive framework for assessing the overall environmental performance of new and existing buildings to promote sustainable design, construction and operation practices in the built environment; and increase the environmental awareness of developers, designers and builders as they initiate project concept, design and during the construction” [10]. Since its enforcement, GM has become the foundation of GB development in Singapore.

Since 2007, it was stipulated that all projects invested by the Government and renovating or expanding projects of more than 5000 square meters must be certified with the minimum level of GM (pass). In 2008, Singapore adjusted the Building Control Act which ensures that all new constructions meet at least GM certified. This is a very important step for GB development to take off. Since 2005 to now, Singapore has promulgated three comprehensive Green Building Master Plans [11] [12], in those, GM is used as fundamental standard to set up targets, allocated financial and non-financial incentives, as well as GB education and raising awareness of the people.

GM includes 5 groups of criteria: Climatic Responsive Design, Buildings energy performance, Advanced green effort, Resource stewardship), and Smart and Healthy Buildings. The five main groups above include 16 sub-criterias and 52 sustainability indicators. Total score is 140 with 4 certification levels: GM Certification, GM Gold, GM GoldPlus and GM Platinum as the highest level.

Since the 1st version in 2005, GM has been regularly researched, supplemented, modified and enhanced every year or every 2 years. Today, it has upgraded to Ver. 4 and developed into the GM family with available versions for all different building categories. All GM certified projects are reviewed every 3 years based on the actual situation of the project. Other than Singapore, GM has been used widely in more than 70 cities in 15 other countries around the world.

## **b. Taiwan’s Policies and the EEWH**

Taiwan is also an island country with a total area of 36,197 square kilometers and a population of 23.8 million people. The GB movement in Taiwan started in 1999 when the government issued the EEWH (stand for Ecology, Energy, Waste and Health) as the official rating tool for GB in Taiwan. By 2019, Taiwan’s GB development has had outstanding achievements: as of July 2018, Taiwan has 7257 certified GB projects. The private sector's share set a record of 6% in 2002 to over 40% in 2015, 42% in 2016 and at 44% in 2017. GBs have saved about 1761 billion kWh of electricity and 8347 million tons of water, equivalent to 6997 billion \$ annually [13].

The first version of the EEWH only provided up to 7 evaluation indicators, which are: greenery, in-situ water retention, material, energy savings, CO2 reduction, waste reduction and utilization. waste and wastewater. In 2003, EEWH was supplemented with two additional criteria: biodiversity, and indoor air quality. In 2007, the EEWH toolkit was further improved, adding specific weights to the criteria; and it was classified into grades of green: pass, copper, silver, gold, and platinum according to the scores achieved. In 2012, EEWH version was developed into five versions: EEWH-NC for new construction projects, EEWH-EC for ecological residential (community) areas, EEWH-GF for green plants, EEWH -EB for existing building improvements, and EEWH-RS for residential buildings. In 2017, an EEWH-OS version was added for the projects of Taiwan invested abroad.

According to direct interview with Taiwanese green building experts in 2018, it was explained that the EEWH is applied as a mandatory and a voluntary tool in Taiwan. In 2003, it was imperative that projects with investment of more than 50 million TWD from central budget must obtain EEWH pass, in which the minimum saving of water is 30% and of energy is 20% [13]. From January 2014, all projects with central investment even below 50 million TWD must also achieve EEWH pass. The local governments are required to develop their own GB policy, and choose the budget threshold to apply (they have autonomy in this after getting approval from the central level). For investments from the private sector, EEWH is voluntary. The government of Taiwan encourages the private sector to do GB under any type of green certification.

The EEWH is operated by the central government. The Taiwan Institute of Architecture and Buildings (ABRI), under the Ministry of the Interior, is the certifying agency while the Architecture Center and Construction Taiwan (TABC) under ABRI is evaluating and appraising body of projects follow EEWH.

## **c. Australia’s Policies and the Green Stars (GS) and the NABERS**

In Australia, there are two rating systems for GB, which are quite difference from each other yet recognized and applied by the Australian Government.

**The Green Star:** Green Star was developed and operated by an NPO, the the Green Building Council of Australia (GBCA) since 2003 [14]; and soon thereafter it was accepted by the Australian Government as an official Australian toolkit. Green Star evaluates by scoring against the following 10 key groups of criteria: Energy, Transport, Water, Indoor

Environment, Emissions, Materials, Land Use and Ecology, Management, and Initiative. Each criterion group has many sub-criteria and weighted scales [14].

On the basis of these 10 criteria framework, each state or territory in Australia can apply a different weight (coefficient) to each group of criteria, reflecting environmental priorities differences from place to place due to the very different regional climates in Australia. The total number of points (not including the bonus points of the Initiative group) is 100 points. Green Star is classified according to the number of stars (from 1 to 6). Only projects with 4 stars or above, which are really quality works, can be certified: 4 stars (45 points / 100), 5 stars (60 points) and 6 stars (75 points or more). The Green Star also has various versions for various building types: Office Design (most applied), Office Construction (both newly built and renovated), Office Furniture, Retail centers, schools (built new or renovated); and is continually reviewed and upgraded [14].

**The NABERS:** Nabers stands for National Australian Built Environment Rating System, developed and operated by the Australian Government [15]. Unlike the Green Star, NABERS includes separate tools, calculates and evaluates the performance of an (or a part) of existing buildings for 4 types of environmental indicators: Energy, Water, Waste and Environment at a certain time. The Green Star aggregates environmental performance towards design efforts, while NABERS measures real energy or resource consumption and savings of buildings in operations [16]. NABERS has been developed for: apartment buildings, offices (whole), offices (partial), hotels, shopping centers, data centers, public hospitals. NABERS also has 6 ranks from 1 star to 6 stars, of which 1 star is poor, 2 stars are below average, 3 stars are average, 4 stars are good, 5 stars are excellent and 6 stars are "leading market leader". The NABERS label is valid for only 1 year, because it is evaluated based on 1 year data [15].

Both Green Star and NABERS are voluntary, equally recognized and applied tools in Australia [16]. Each state or city has mandatory policies that apply flexibly for public works, or to encourage private works, with varying degrees of support and incentives.

#### **d. UK's Policies and the BREEAM**

BREEAM was developed in 1990 as Environmental Assessment Method (EAM) by the Building Research Establishment (BRE) - a pioneering British professional organization, founded in 1921 [17]. BREEAM is the oldest and most widely used GB certification system in the world. Currently, there are 572,640 certified projects and nearly 2.3 million projects registered for BREEAM from over 87 countries around the world; holds 80% market share in Europe [17].

BREEAM is based on 10 main criteria: Energy, Water, Health, Land Use, Materials, Pollution, Waste, Transport, Management, and Initiative; and includes 6 rankings: Acceptable (only applicable to buildings in operation) Pass, Good, Very Good, Excellent and Outstanding, shown by the number of stars on the certificate. Today, BREEAM includes 5 groups of tools for: Communities, Infrastructure, New Construction, In-use, Refurbishment & Fit-out. With the last 3 groups devoted to buildings, BREEAM has separated versions for offices, retail centers, industry, educational data centers, medical, residential, mixed and others [17].

The process of getting BREEAM certification for the project is quite simple. The project owner must engage a BREEAM expert to delegate a variety of tasks during the certification process. This requirement by BRE helps to confirm the role of the BREEAM specialist in the construction market. From the BRE side, on the basis of the preliminary assessed documents submitted, the application will be verified by other experts with BREEAM professional certificate to ensure objectivity. The whole process of online interaction is fast, time-standard and objective.

It is interestingly to notice that BREEAM is not developed by UK Government nor by Green Building Council as in other countries. It is a completely voluntary tool and the UK government has no policy directly related to BREEAM. However, thank to the quality of the tool and the world-wide reputation of the BRE, it is used widely not only in UK, but Europe and many other countries.

#### **e. US's Policies and the LEED**

LEED, standing for Leadership in Energy and Environmental Design - is a set of tools that US Green Building Council (USGBC) developed in 1993 [18]. Since then, it has become a trademark of USGBC and been used widely in 167 countries [4] with a total of 126202 certified projects until July 2020 [18]. LEED's assessment criteria include the following 8 main groups: Location and Traffic, Sustainability of the site, efficient use of water, Energy and Atmospheric Environment, Materials and Materials Supplies, Indoor environment Quality, Innovation, and Locational priority.

LEED is graded on the basis of a total score achieved out of a maximum of 110 points. Project with 80+ points gets Platinum, with 60 - 79 points gets Gold, with 50 - 59 points gets Silver and with 40 - 49 points gets Certified. The system of LEED has been developed for all building types and execution phases, including new construction, interior installation, operations, maintenance, or structures and enclosures. To ensure transparency and objectivity in LEED certification audits, USGBC transfers assessment - certification and human resource training to an independent third party, the Green Building Certification Inc (GBCI). This creates an independence between the tool development body and the certification-rating agency. GBCI offers professional training and certification exams that assess GB.

Regarding US governmental policy about GB and certification tool, at Federal level, there are general policies on energy efficiency, while each State in the US has its own and diversified GB policies [6]; in many places LEED is designated as a mandatory standard for public investment works, some states require it to apply to all new projects regardless of funding source; other states develop their own GB standards without using LEED. Regardless governmental policies at different levels, LEED is used widely in US and worldwide [6].

#### f. Discussion on the Relationship between to Role of Government and Certification System in the in the Five Countries

The introduction of a GB certifications is often the first step in journey to promote GB development in a country. Regarding the relationship between available certification system and the government, three models can be generalized as follows:

- Model 1: The Certification is developed by a NGO, professional organization which is independent from Government, as in the cases of BREEAM in UK, LEED in US.
- Model 2: The State (through an affiliated professional body or a council established by the State) develops the tool, then supervises evaluation and certification processes, as in the cases of Singapore, Taiwan where government plays a leading role.
- Model 3: As in the case of Australia, it is a harmonious, cooperative combination of the two above models.

Therefore, the use of GB Certification System is varied, depending on the specific conditions in each place, yet is a foundation for GB promotion policies in all countries. Table 2 below summarizes main features of the certification systems in the 5 countries and the involvement of the governments.

**Table 2 - Summarizes main features of the certification systems in the 5 countries**

	Technical aspect of GB system		Initiating actor	Appraising actor	Certifying actor	
	Criteria- Indicator	Certifying levels				
<b>Singapore</b>	<b>Green Mark (2005)</b>	Climatic Responsive / energy performance, Advanced green effort, Resource stewardship), Smart & Healthy Buildings 16 sub-criterias and 52 sustainability indicators. Total score is 140	4 level: GM Certification, GM Gold, GM GoldPlus GM Platinum	BCA (Building and Construction Authority)	BCA	
<b>Taiwan</b>	<b>EEWH (1999)</b>	Ecology, Energy, Waste and Health with 9 indicators: greenery, in-situ water retention, material, energy savings, CO2 reduction, waste reduction utilization, waste and wastewater, biodiversity, and indoor air quality	5 level: EEWH Pass, EEWH Copper, EEWH Silver, EEWH Gold, EEWH Platinum	ABRI – Architecture and Building Research Institute, Ministry of Interior	TABC (Taiwan and Building Architecture and Building Center, affiliated to ABRI)	
<b>Australia</b>	<b>NABERS (1998)</b>	4 separate themes: Energy, Water, Waste, Environment; Performance measured separately	6 ranks: from 1 star to 6 stars; only from 4 – 6 stars are labelled. Valid 1 year.	DPIE – NSW Department of Planning, Industry and Environment	NABERS experts	DPIE – NSW
	<b>Green Star (2003)</b>	10 groups of criteria: Energy, Transport, Water, Indoor Environment, Emissions, Materials, Land Use and Ecology, Management, Initiative	3 labelled levels: 4 stars 5 stars 6 stars	GBCA (Green Building Council of Australia)	GBCA experts	GBCA
<b>UK</b>	<b>BREEAM (1990)</b>	10 main criteria: Energy, Water, Health, Land Use, Materials, Pollution, Waste, Transport, Management, and Initiative	6 levels: Acceptable (for buildings in operation) Pass, Good, Very Good, Excellent and Outstanding	BRE Group	BRE experts	BRE
<b>US</b>	<b>LEED (2000)</b>	8 main groups: Location and Traffic, Sustainability of the site, Efficient use of water, Energy and Atmospheric Environment, Materials and Materials Supplies, Indoor environment Quality, Innovation, and Locational priority	Platinum, with 60 - 79 points gets Gold, with 50 - 59 points gets Silver and with 40 - 49 points gets Certified	USGBC	GBCI	GBCI
Note:		Governmental body		Non-governmental body		

## 2. The Situation of GB Development in Vietnam

In Vietnam, by December 2020, there are about 165 GB certified projects and about 150 registered for certification (according to IFC report). Among those GB buildings in Vietnam, 55% are factories, 26% are offices - shopping centers, 7% are houses, 7% are educational buildings and 5% are furniture [19]. The data shows that the GB market in Vietnam has been formed in its early stage and tends to grow slowly. The GB achievement in Vietnam is still modest, incommensurate with strong growth and potential of the construction industry.

### a. Existing Legal bases for GB in Vietnam

Currently, the Government of Vietnam has issued a number of legal documents and policies related to energy saving, natural resources and sustainable development, but there is no specific policy and intervention to promote GB such as: the Law on Economical and Efficient Use of Energy (2010), Decision 403/2014/QĐ-TTg on the National Action Plan on Green Growth for the period 2014-2020, Decision No. 622/2017/QĐ-TTg on the National Action Plan to implement the 2030 Agenda for Sustainable Development, Decision No. 1670/2017/QĐ-TTg on the Target Program to respond to climate change and green growth for the period 2016-2020, and Decision No. 84/2018/QĐ-TTg on the Plan for urban development of green growth in Vietnam until 2030, Decision No. 280/2019/QĐ-TTg approving the National Program on economical and efficient use of energy for the period 2019 - 2030. At the construction sector level, the Ministry of Construction has also issued a series of the following important legal documents: Circular No. 13/2017 / TT-BXD on the regulations on the use of unburnt building materials in construction works, Decision No. 419/2017/QĐ-BXD promulgating the action plan of the construction industry on green growth through 2020, with a vision to 2030 or Circular 01/2018/TT-BXD on Urban Green Growth Indicators. The most important legal basis available is the Building Code on energy efficient (QC 09/2017/QCVN) revised in 2017 mandatorily applied to buildings with total floor area from 2500m<sup>2</sup> and above. In 2014, Ministry of Construction assigned a research task the Vietnam Association of Construction Environment to establish a GB rating tool for Vietnam – called the CTX. Unfortunately, the task was accomplished but the tool wasn't put into practice for many operational reasons and was forgotten.

### b. The Vietnam Green Building Council and the LOTUS

In another development by another actor, the Vietnam Green Building Council (VGBC) is an NGO, established in 2007 as an initiative of the Green Cities Fund, Inc., California, USA with an aim to raise awareness and to build capacity for the development of green building in Vietnam [20]. In 2010, VGBC launched for the first time LOTUS – the first GB rating tool exclusively for Vietnam. Based on LEED, LOTUS covers 7 groups of criteria, including Energy, Water, Material and Resources, Health and Comfort, Site and Environment, Project Management and Exceptional Performance totalling 108 points [20]. LOTUS Certification consists of four levels of ranking: Certified (40 – 54 points), Silver (55-64 points), Gold (65 – 74 points) and Platinum (75 – 108 points). Today, LOTUS has been developed into 6 categories, including LOTUS NC v3 for new construction, LOTUS BIO for buildings in operation, LOTUS Homes for single-dwelling homes, LOTUS SB for small non-housing projects, LOTUS Interiors for interiors fit-out projects and LOTUS Small Interiors for small interiors fit-out projects (GFA less than 1000 m<sup>2</sup>).

### c. Analysis on Current Governmental Policy on GB Certification

Looking at GB certification from policy's point of view, the situation in Vietnam is unlike any of the five countries mentioned above. There are a number of certification systems in operation in Vietnam and spontaneously chosen by building owners or developers. Out of 149 GBs in Vietnam in 2020, 28 are LOTUS (by VGBC), 79 are LEED (USGBC), 39 are EDGE (IFC), 4 are Green Mark (Singapore), and only 1 was certified with the CTX. Only 2 of out 149 GB are public funded buildings. The Vietnamese government, initially tend to follow model 2 (mentioned in part 2.6) to take lead on providing and operating GB rating tool, but actually fail. They, then, stand still, neither improve and promulgate CTX nor adopt any rating tool as an official certification system. Interview with developers reveals a common concern that even though developers want to build a GB but having neither orientation on what standard should be used, nor any incentive or guidance to do so.

It can be concluded that, the group 4 of policy in Table 1 “Green building certification and energy performance labelling” isn't available in Vietnam. In other word, the Vietnamese Government has not yet promulgate proper policies directly related to GB certification: neither announce or adopt any official tool nor provide any mandate or incentives.

### d. Policy Recommendation for Vietnam

From international experiences through the 5 case-study countries, GB certification is the foundation of the actual development of GB in any countries. Whether developed by government or NGO, a relevant tool that endorsed by government helps to boost number of certified GB projects effectively. Therefore, governmental attitude and intervention matter significantly. Given the current context of GB market in Vietnam, it is recommended that:

- The Vietnamese Government should adopt one rating tool as an official GB certification for Vietnam by considering and selecting one among those tools that are already popular in the market such as LEED, LOTUS, EDGE. The official certification system must be suitable to Vietnam's climatic and socio-economic conditions, consistent to Vietnamese construction codes and standards, user-friendly, market-acceptant and cost-affordable. With these criteria, LOTUS appears to be the most suitable one.
- The government should take lead in implementing GB by mandating public new construction or large-scale renovation must go green. These can be applied in phases and increasing requirement. In the next few years, pilot LOTUS application for 5 projects (of different types and scales) for trial. Then, in the next five years, mandatory LOTUS Certified to all big civil construction projects, then extending to all civic works In the following years, it is possible to continue to expand the scope of application and increase the ranking requirement.
- For private construction sector, the Government should encourage private investors to choose any GB certification, not only LOTUS. However, if financial or financial related incentives are given, the government should use the selected official certification system (LOTUS, if adopted) as a reference.

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