The 2005 World Sustainable Building Conference, Tokyo, 27-29 September 2005 (SB05Tokyo)

NEW RATING SYSTEM FOR GREEN BUILDING ASSESSMENT IN TAIWAN BASED ON A DATABASE OF 185 EVALUATED GOVERNMENTAL BUILDINGS

Hsien-Te Lin Ph.D[1]

[1] Professor, Department of Architecture, National Cheng-Kung University, Taiwan

Keywords: green building, EEWH, labeling system, innovative design

Summary

This paper introduces a new advanced rating system of Green Building Assessment which is established through the analysis of 185 qualified green building projects in 2003. A hypothesis of logarithm normal probability distribution of scoring and a weighting system of nine indicators were adopted in this analysis. This rating system will create four levels of awards which are diamond, gold, silver, and bronze, with the scoring probabilities of top 5, 15, 30, 50%. Therefore, the system will become an important index of Green Building Promotion Program of Taiwan government in the future.

1. Introduction

An unique Green Building Evaluation System in Taiwan, called EEWH system, with four evaluation categories, which are ecology, energy saving, waste reduction, and health, including nine environmental indicators were established since 1999 as shown in Table 1. At the same time, a Green Building Logo encouragement system was set up and a Green Building Committee was organized for green building evaluation. Every existing building and every new building scheme before construction is encouraged to pursue the Green Building Logo. Based on this system, Taiwan government acted very aggressively to demand all the governmental buildings to pass the evaluation of this system from 2001. Under such circumstance, about 500 newly designed building projects had already passed the Green Building Evaluation until the end of 2004.

However, the above nine indicators were evaluated independently with no total scoring for final judgment between nine separate indicators, the previous EEWH system could not became an ideal tool for the promotion policy of green building. At the same time, due to the compulsive policy of Green Building Evaluation on official buildings, the passing standard had to set at a low level so as not to become big obstacles to public construction. The passing standard for Green Building Evaluation was required at a very

Table 1. Categories, Indicators and factors for Green Building Evaluation in Taiwan

Categories	Indicators	Climate	Biology	Water	Soil	Energy	Materials	Evaluation factors and units
Ecology	1.Biodiversity	*	*	*	*			Biotope, green network system
	2.Greenery	*	*	*	*	*		CO_2 absorption（CO_2-kg/m^2）
	3.Soil Water Content	*	*	*	*			water contentment of the site (-)
Energy Saving	4.Energy conservation	*				*		ENVLOAD、Req、PACS、energy saving techniques
Waste Reduction	5. CO_2 Emission	*				*	*	CO_2 emission of building materials（CO_2-kg/m^2）
	6. Waste Reduction				*		*	waste of building demolition（-）
Health	7.Indoor Environment				*	*	*	Ventilation, daylight, noise control, Eco-material
	8. Water Resource			*				water usage(L/person), water saving hygienic instrument (-)
	9.Sewer and Garbage			*			*	sewer plumbing , sanitary condition for garbage gathering

basic level, only four indicators among the nine indicators, and about 85% of the previous qualified projects have maintained at very low scores of pass line. This kind of compulsive policy and low standard of evaluation has become an obstacle to the promotion policy of green building. In order to resolve the above problems, this paper is to establish a new rating system based on the analysis from the previous qualified green building projects.

2. New Rating System for EEWH

2.1 New score of weighting for nine indicators

The new rating system for EEWH system has to maintain the previous quantitative indices, criteria of evaluation and to develop a new scoring system for nine indicators. This paper establish a new scoring system, as shown in Table 2, through a questionnaire investigation of 34 EEWH specialists including 25 Green Building Committee members, 5 assistants of Green Building Logo certification and 4 officials of green building management. Although the average weighting is obtained from the questionnaire as shown in Table 2, the final weighting for four categories, ecology, energy saving, waste reduction, health, was modified as 27, 28, 18, 27 following the next principles:

(1) Each score of category has to be easily accumulated and calculated according to the separate indicators.

(2) The weighting for categories of energy saving and health should be maintained as highest scoring in regard to the sustainable policy.

(3) The weighting for nine indicators have to response to the influence of construction cost and design technology,

(4) The scoring weighting for each indicator is assumed to be a normal probability distribution with a three standard deviation range of minimum and maximum scores according to the statistical analysis of previous 185 evaluated green building projects in 2003.

Table 2 New scoring system for nine indicators

categories	nine indicators		average weighting of questionnaire	New scoring system			
				minimum score	maximum score	Standard deviation	Total score
ecology	1.Biodiversity		23.5%	2.0	9.0	0.184	27.0
	2.Greenery			2.0	9.0	0.408	
	3.Soil Water Content			2.0	9.0	1.313	
energy saving	4.	Envelope	32.3%	2.0	12.0	R4(＊1)	28.0
		Air Conditioning		2.0	10.0	0.143	
		Lighting		2.0	6.0	0.121	
waste reduction	5.CO_2 Emission		17. 6%	2.0	9.0	0.187	18.0
	6.Waste Reduction			2.0	9.0	0.111	
health	7.Indoor Environment		26.5%	2.0	12.0	0.121	27.0
	8.Water Resource			2.0	9.0	-----	
	9.Sewer and Garbage			2.0	6.0	0.233	
Minimum total score：22.0 Maximum total score ： 100.0							
＊1:office or commercial department building 0.084, hospital or hotel 0.225, residential building 0.280, school and big space building 0.132, others 0.258.							

2.2 New rating system for EEWH system

Based on the mentioned new scoring system, the score of new system can easily be calculated from the score of old system and its deviation. We established a new probability distribution, as shown in Fig. 1, using new total scores of the mentioned 185 projects and found a very special type of logarithm normal distribution, prone to the low score side for the new rating system. This logarithm normal distribution means that the new rating system has the characteristic of "easy to pass but difficult to get a high score". With this hypothesis of logarithm normal distribution, the new rating system created four labeling levels which are diamond, gold, silver, and bronze, as shown in Fig. 2. Their scoring probabilities are of top 5, 15, 30, 50% and with the scores of 53, 43, 37, 31. It is believed that the new rating system can avoid low level standard in the old system and act as an excellent evaluation tool for the Green Building Promotion policy of Taiwan government.

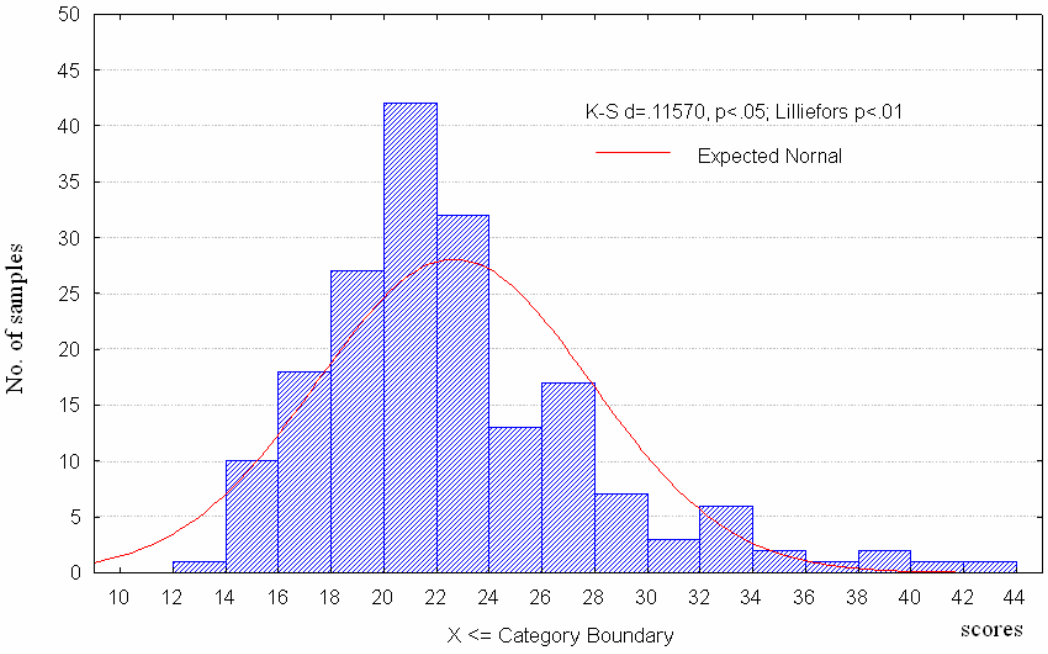

Figure 1 Histogram for the score distribution of 185 cases

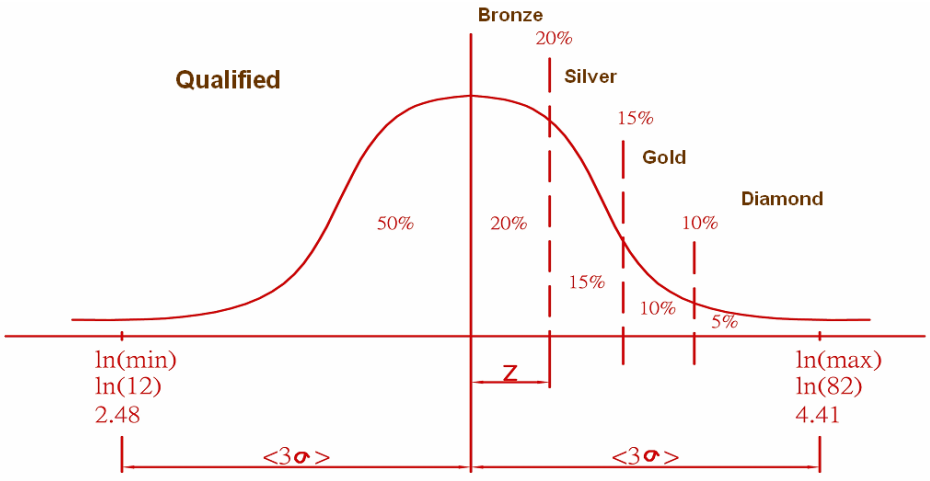

Figure 2 New rating classification of EEWH

2.3 Promotion for Innovative Design of Green Building

No matter how sophisticated the evaluation system is, it can not cover all aspects of the green technology, so we have to keep flexible for evaluating unknown innovation of green building. In order to promote the innovative design of green technologies, the new EEWH system create an extra encourage scoring method to compensate the good design which can't be evaluated by existing indicators and categories. This method can give extra 10~50% score for each scoring of category according to the compromised judgment of the Green Building Committee based on the proposed report or explanation of the innovative design by the designer. However, this promotion mechanism can only be approved for qualified Green Building projects of EEWH and on unique ideas or technologies with close relation to the four categories of ecology, energy saving, waste reduction and health.

3. Investigation for New Rating System of EEWH

In order to investigate the evaluated efficiency of the new rating system, an accumulated probability distribution of previous 185 Green Building samples was established as shown in Fig.3. We can find that the scoring distribution of previous 185 qualified green building projects slopes prone to the low score side and only 1(0.5%), 4(2.0%), 11(6.0%) projects pass the evaluation of gold, silver, and bronze awards and no project could reach the criterion of diamond award. It is a very satisfactory result due to the previous qualified green building projects are evaluated in a low level standard as mentioned in the beginning, and it is acceptable for only 9% samples receiving the honor of award. This analysis shows that the new EEWH system can create a very remarkable improvement for green building design in the future. To be a national Green Building Promotion Tool, the EEWH with new rating system is believed to be very efficient to eliminate inappropriate design and to promote the upper level standard of green building design.

4. Conclusion

Due to the easy-accessible and practical of EEWH system, Taiwan government has achieved greatly in Sustainable Building Policy. Since 2002, Taiwan government even raised the green building policy as one of the Six Years National Development Plan of “Challenge, 2008” and provided substantial budget for Green Remodeling Program for Governmental Buildings to improve the green environment of existing governmental buildings. A new “Green Building Chapter” which applied some parts of EEWH evaluation is introduced into a compulsive building code of Building Construction Regulation and starts from Jan 1st 2005.

EEWH system has been well developed, simplified and modified for the subtropical climate of Taiwan and was regarded as a standard evaluation method for green buildings by the Ministry of the Interior of Taiwan since 1999. Owing to the compulsive policy of green building design for governmental building from 2001, this paper developed a new rating system based on a huge database of qualified green building projects. According to the scientific analysis of logarithm normal distribution of scoring and real data of green building projects, as shown in this paper, the new HHWH system is believed to be very reliable, practical and localized for green building evaluation in Taiwan. It has become the newest edition of Green Building Design Manual from 2005 and will be applied as a standard tool of Green Building Promotion Policy in the future.

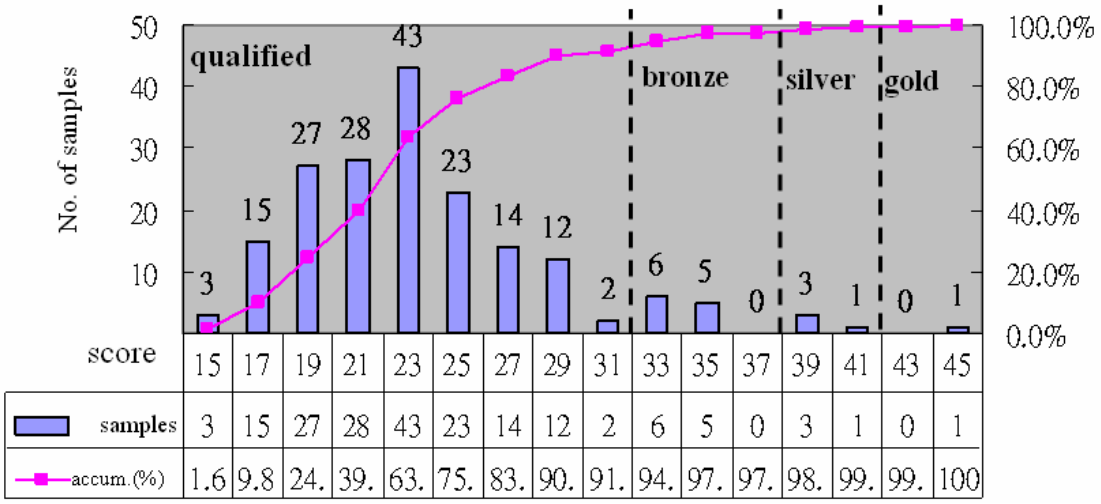

Figure 3 Classification and distribution for existing qualified Green Building projects

Reference

Hsien-Te Lin, 2005, “Evaluation Manual for Green Building in Taiwan“(in mandarin) , Architecture and Building Research Institute, Taiwan

Hsien-Te Lin, Oct. 22-27,1999,”Evaluation System and Policy of Green Building in Taiwan”, International Conference of Sustainable Building 2000, Mastrich, Holland