

Technical Note

Research on the suitability improvement of the standard of green campus in China based on STARS

B.F. Zhu¹, Y. Zhou² and J. Ge³

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ABSTRACT

Under the tide of green building, many countries introduce actively evaluation standards of green campus and develop the construction of green campus. China introduced the Green Campus Evaluation Standards (CSUS / GBC04-2013) (short for *Standard* in the following) subsequently. While compared with green campus evaluation standards of other countries, it is still in the start stage and has many shortcomings, for this reason, in order to optimize *Standard* by studying United States green campus evaluation standard STARS. Comparing China's standard with the US STARS2.0 to analyze the differences and the cause of differences from the three aspects including the organization model, methods and contents of evaluation. Then combined with China's actual situation to analyze the suitability of application of STARS in our country. Finally, study the reasonable place of the STARS, from three aspects to provide *Standard* with concrete improvement suggestions and give China's green campus construction a better guidance.

1. Introduction

Under the tide of green building, various countries actively issued the evaluation standard for green campus and launched extensive green campus construction. The concept of green campus has been constantly changing and improving, moreover, there is no clear definition at present. However, there are several similarities on the definition and connotation of green campus at home and abroad: firstly, the philosophy of sustainable development is the basis or guidance of its definition, use this idea to direct the campus construction, campus management, teaching and research and other work; Secondly, put the sustainable education on the prominent position, most of them including green campus construction, green campus operation and management, green humanistic activity and so on (WANG Wei et al., 2013), lastly, the goal of creating a green campus is to penetrate the

sustainable development idea and the concept of protecting the ecological environment to every corner of the university. Schools as a microcosm of harmonious development of humans and nature, a sustainable campus can provide professional quality talents for the society and promote the sustainable development of the whole society (Liu Feng et al., 2013).

Compared the development of green campus abroad, China's green campus has gone through two-step, from conservation-oriented campus to green campus, which is still at its starting stage at present (LUAN Caixia et al., 2014). In 2003, the Association standard---Green Campus Evaluation Standards (CSUS / GBC04-2013) (CHINAGBC et al., 2013) (short for *Standard* in the following) issued, as a trial of China's green campus evaluation criteria, it laid a certain foundation for publication of the national standard of green campus. However, *Standard* is based on the old version of

¹ Postgraduate, College of civil engineering and architecture, Zhejiang University, CHINA, 512126134@qq.com

² Corresponding author, Postgraduate, College of civil engineering and architecture, Zhejiang University, CHINA, 412034260@qq.com

³ Professor, College of civil engineering and architecture, Zhejiang University, CHINA, gejian1@zju.edu.cn

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Table 1. The evaluation information of STARS and Standard.

Standard	STARS 2.0 (AASHE, 2013)	Evaluation Standard for Green Campus (CSUS/GBC04-2013) (CHINAGBC et al., 2013)
Basis of Evaluation Frame	Sustainable Education proposed by AASHE	Evaluation Standard for Green Building (GB-T50378-2006) (China Academy of Building Research, 2006)
Evaluation Content	Academics	Land Saving and Outdoor Environment
	Engagement	Energy Saving and Energy Utilization
	Operations	Water Saving and Water Efficiency
	Planning & Administration	Material Saving and Material Utilization
		Indoor Environment and Pollutant Control
		Operations Management
		Education Promotion
Evaluation Object	Colleges and universities in North America and Canada	Ordinary Universities and Colleges
Evaluation Method	Weighted total scoring items to class	Evaluated by the numbers meet general term and preferences
Valid Time	3 years	Permanent
Terms Categories	No Qualitative Evaluation Terms, self-reporting	Control Term、General Term、Preferences
Stage Classification	One stage of Green campus construction	2 Stage: Green campus Planning and Design; Operations Management
Evaluation Classification	Reporter, Bronze, Silver, Gold, and Platinum.	One-star, Two-star, Three-star

Evaluation standard for green building (GB-T50378-2006) (China Academy of Building Research, 2006), which has many issues worthy of further exploration both in the evaluation methods and evaluation content, Most noteworthy is this standard focuses on building evaluation which is contrary to the true meaning of green campus. Therefore, it is quite important to update and further refine the green campus evaluation standard to guide the construction of green campus in China.

Throughout the research on green campus in worldwide nowadays, the construction of green campus in the United States through 40 years development, they have lots experience which worth studying, such as construction experience, theory promulgation and evaluation standard. Their green campus evaluation STARS 2.0 (The Sustainability Tracking, Assessment & Rating System) (AASHE, 2013) developed from STARS 1.0 and has great influence in the world. Currently, more than 700 colleges and universities of 21 countries joined them and shared its sustainable data on campus through STARS. Compared China's standard with STARS to find out and analyze the shortcoming of *Standard*, provide it with a new method for the optimization and learning goals.

Nowadays a lot of research and discussion about green campus focused on the evaluation categories and its engineering application, most scholars put forward suggestions according to the results of their own

research corresponding to evaluation criteria in *Standard*. While such studies too concentrate on a certain point to grasp the whole evaluation standard and research on the science of the evaluation system This paper compares China's Evaluation Standard for Green Campus (CSUS/GBC04-2013) (CHINAGBC et al., 2013), with America's evaluation standard—STARS2.0 (AASHE, 2013) to analyze the differences and the reason causes the differences. Analyze the suitability of using STARS to evaluate the construction of green campus in China. Discuss our green campus evaluation standard and provide the issue of national standard with improvement suggestions.

2. Methodology

Firstly, literature view used to research the two evaluation standard systematically to give a brief introduction about the two subjects' development history and evaluation system. Secondly, compare the two subjects from three aspects respectively: Mode of Organization, evaluation method and evaluation content. Among them, evaluation content includes evaluation scope and categories, and the proportion of each evaluation category, use statistical graph to compare the differences between the two subjects. Analyze merits and

Table 2. The merits and demerits of the mode of organization and development, evaluation method and evaluation content of *Standard*.

	Merits	Demerits
Mode of Organization & Development	Top-down mode government-oriented type Easy to implement and operate	Lack of feedback mechanism Poor in flexibility Hard to mobilizes the enthusiasm of all parties
Evaluation Method	Basic level in each construction controlled by prerequisite balanced development in all evaluation aspects	Inflexibility of evaluation method Ignore the difference between importance of evaluation Hard to distinguish differences of the same grade
Evaluation Content	Evaluation data is clear and easy to obtain Consider software construction on the basis of hardware construction of green campus	Focus on green school building construction Excessive emphasis on the construction of campus hardware

Table 3. The merits and demerits of the mode of organization and development, evaluation method and evaluation content of STARS.

	Merits	Demerits
Mode of Organization & Development	Down-top mode Personal accountability system Easy to mobilizes the enthusiasm of all parties	Realize data sharing firstly, Weak in enforcement and result
Evaluation Method	Self selection Emphasize characteristic development	Evaluation too flexible to guarantee the basic level in each construction, Overgeneralization will happen
Evaluation Content	Conform to the connotation of the green campus Hardware and software equally, Reasonable score setting	Lack of priority during construction due to the widely evaluation range and equal score in all aspects

demerits of each from the three aspects. Finally, according to China's practical situation to analyze whether STARS suits for China and give brief and targeted suggestions for improvement of *Standard*.

3. Green campus construction status

3.1 Development status of green campus in foreign countries

Since the first time the concept of "Green School" was put on the United Nation human Conference on the Human Environment in Stockholm in 1972, paid the public's attention to the 'environmental education (UNCHE, 1972) to the International Sustainable Development Campus Alliance (ISCN) conference held in 2013, in the past semi-century, foreign green campus has and a leap in development, it experienced from environmental education to play a demonstration role among green campus construction.

In 1977 issued the Tbilisi declaration (UNESCO et al., 1977) and in 1987 the United Nations formally proposed the idea of "sustainable development in *Our Common Future*, both laid a theoretical basis for the construction of

green campus. The United Nations Educational scientific and Cultural Organization (UNESCO), formally proposed the concept of sustainable education (Huckle et al., 2002) in 1997. The George Washington University (USA) firstly issued the pilot project of green college under this guiding ideology, so as to promote the concept and construction of green campus in the global scope. In 2007, International Sustainable Campus Network (ISCN) established in Switzerland (ISCN, 2007), which provides the construction of sustainable development of the campus a diverse and comprehensive platform in the worldwide.

From George Washington University (USA) put forward the pilot project of green college so as to spread the green concept to "green campus", "ecological campus" and "sustainable development" and other ideas appeared in the college campus construction. The concept of "Green Campus" to be defined, recognized and promoted. The development of foreign green campus can be concluded from theoretical to the practice. According to the characteristics of the campus buildings, how to popularize the concept of green campus, and guide green behavior of staffs, teachers and students, leading the sustainable development of campus is the main topic of the present construction of foreign countries.

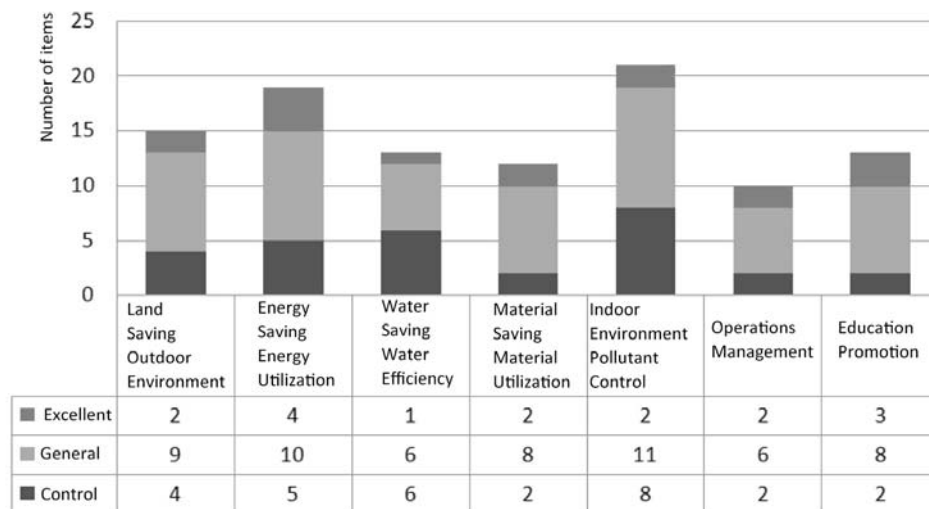


Fig. 1. The distribution of seven rating items of *Standard*.

Since “Green our campuses, Teach sustainable development concepts” became the hot topic of 2012 Rio+20 (United Nations Conference on Sustainable Development), now the development of green campus has become a worldwide proposition.

3.2 Development status of green campus in China

Compared the development of green campus abroad, China's green campus has gone through two-step, from conservation-oriented campus to green campus. In 1996 NEPA(National Environmental Protection Administration), SEC(the State Education Commission) 、CPC(the Publicity Department of the Communist Party of China Central Committee) jointly released *The national environmental publicity and education Platform for Action (1996-2010)*(NEPA et al., 1996), it firstly proposed the idea of “Green Campus” in view of the primary and secondary school buildings in China. Tsinghua University put forward to create a “green college” in 1998, which starts China's construction of green campus and it further proposed the “Green College Program” ,moreover, Tsinghua University was the first “Green College” named by NEPA in 2001.

Construction of green college in China in the 21st century was influenced by the international environment, it established the concept of sustainable development and used a developing eyes to organize schools' operational plan. However, due to limited understanding of green campus, the construction work had slogans but difficult to implement. Focused on this problem in construction, China released *Conservation-oriented Campus Construction in Higher Education Management and Technical guidelines (Trial) (Jianke [2008] No.89)*

(Housing and urban-rural development of the People's Republic of China et al., 2008), and implemented throughout the country. The promulgation of the *guide* provided the technical and theoretical basis for the construction of the conservation-oriented campus in China. CGUN (China Green University Network) was established in 2011(CGUN, 2011), which provides a cooperation and communication platform for colleges and universities. In 2013, CHINAGBC (China Green Building Council) promulgated and implemented the *Evaluation Standard for Green Campus (CSUS/GBC04-2013)* (CHINAGBC et al., 2013), the concept of green campus in China is constantly updating, *Standard* gives a clearly definition for China's green campus, providing China's green campus construction a standardized technical route and theoretical guidance. Since then, the construction activities in China step into a new and a more complicated stage, schools' construction has a scientific and standardized evaluation system and the guiding ideology.

4. Evaluation standards of green campus in China and US

Evaluation Standard for Green Campus (CHINAGBC et al., 2013) is based on *Evaluation Standard for Green Building* (GB/T 50378-2006) (China Academy of Building Research, 2006), and combined the characteristics of campus buildings in China. *Standard* can be applied to both new and existing campus construction and operation, including educational occupancy, ancillary rooms, administrative offices, life-support services buildings and other buildings, and it can also be used to

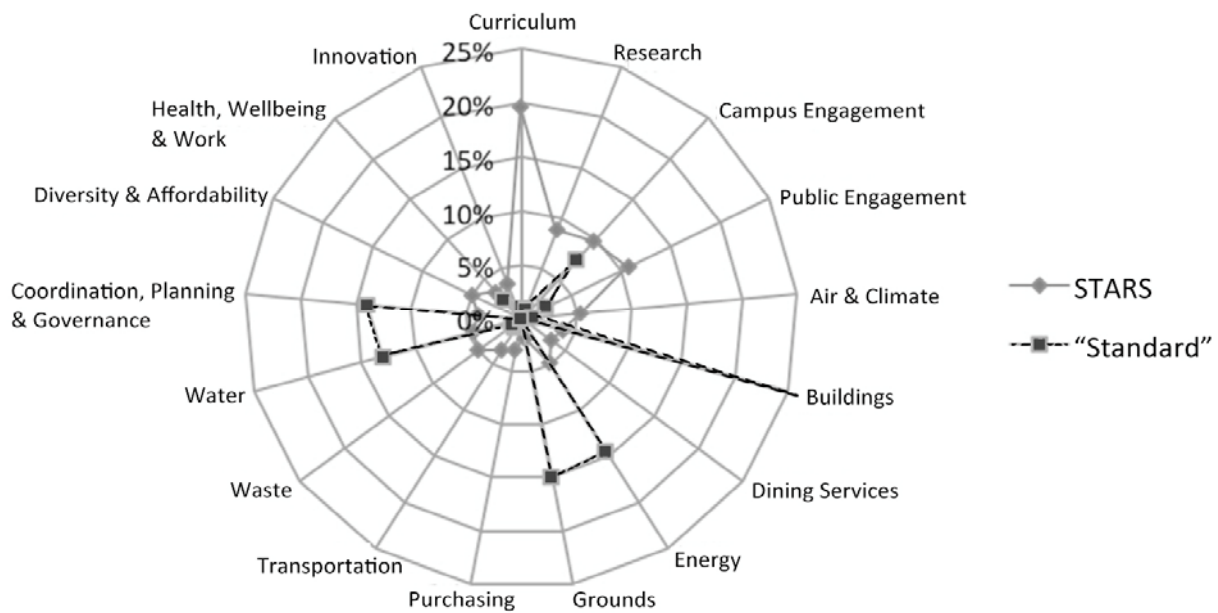


Fig. 2. Evaluation categories and its' proportion of STARS and *Standard*.

evaluate organization system of green campus construction, campus planning, campus energy utilization management, green education, green humanity and other aspects of green campus (Wu et al., 2013). (see Table 1).

The advantages and disadvantages of the mode of organization development, evaluation method and evaluation content of *Standard* are listed in Table 2.

The United States green campus evaluation standards STARS edited by AASHE, aims to evaluate the sustainable development of campuses, which is independent of the *LEED FOR SCHOOL* evaluation standard. STARS is a voluntary, with self-reported framework rating system to help colleges track and measure their sustainable development. It provides a clear and complete system can be used as an evaluation criteria for higher education institutions which can help universities set targets nowadays or in the future, and focuses every aspect of green campus construction, containing research and curriculum, school business, planning and institutional capacity, stratagem layout target, and with aims to promote dialogue of sustainable development between the different departments in the campus and stimulate the communication and studying of institutions (see Table 1).

The merits and demerits of the mode of organization development, evaluation method and evaluation content of STARS are listed in Table 3.

5. The comparison and suitability analysis of STARS & Standard

5.1 The mode of organization and development

STARS is organized by AASHE, and is a spontaneous organization launched by colleges and universities, the purpose of the alliance is clear, which is using STARS to promote the popularization of sustainable development among them. It emphasizes the soft power construction, this down-top way of organization spreads over an whole area from one point, which is beneficial to mobilize the participation and enthusiasm of all parties, but due to lack of government guidance, it is weak in terms of enforcement strength and implementation result; While compared with the United States' standard, *Standard* uses the top-down model dominated by the government the authorities compiled the evaluation system and decided the evaluation method, this kind of development model, from top to bottom, has relatively stronger executive force and operability, therefore, it is lack of effective positive feedback to regulate, its flexibility is weaker than STARS.

The self-assessment report of STARS used the method of personal accountability, which needs AD hoc committee for students to realize the date sharing in all directions. First, because of the administrative body in our country, many departments on campus are relatively independent, it is not very feasible to set up a dedicated dispatching management in our country for the present

situation. Secondly, what the current evaluation system in our country lacks of is the effective feedback regulation mechanism, so we can't reflect the green campus construction level. Therefore the potential of green campus construction in our country is inside the school, so we should give full play to the campus resources, given priority to the government guidance and make all the voluntary participation to be complementary, the two complement each other to realize the great development of green campus.

5.2 Evaluation method

STARS evaluation system adopts the way of controlling total score, applicants only need to select the terms which they want to be evaluated, as long as the total points achieve the rating standard. This evaluation method highlights the applicants' characteristic development. But *Standard* uses the method of controlling the number of the clauses the applicants achieved, it pursues all-round development of campus buildings. Evaluation system sets three evaluation indexes: prerequisite items, general items and optimal items. Figure 1 shows the seven categories in the evaluation system of *Standard*, and the number of the three evaluation indexes in each category. General evaluation serves as ecological technology of school in routine design, which accounts for larger proportion among the number of evaluation items (Fig. 1). On the one hand, this setting method guarantees the general level of green campus construction in China, on the other hand, the weights of each general item is equal, to some extent, it ignores the differences of the importance in each aspect of the green campus construction.

The evaluation process of STARS needs applicants studying *Stars technical manual* (the latest version is *Stars2.0 technical manual*) (AASHE, 2014) and related cases in order to make sure the applicants have a systematic and comprehensive understanding about sustainable development. However, the way of "count the number of items in *Standard* goes against all parties' understanding of the connotation of the green campus; China's new green building standard *Assessment standard for green building (GB - T50378-2014)* (China Academy of Building Research, 2014), which upgraded "count the number of items " to "scoring system", it can not only testify the result of situation of green buildings construction but also motivate the creativity and initiative of building green buildings. Therefore, *Green campus evaluation standard* (CSUS/GBC04-2013) should do corresponding improvement, retains the prerequisite items introducing scoring system.

5.3 The Evaluation Content

5.3.1 The evaluation types and categories

STARS includes 17 categories while *Standard* contains 13 categories. They both have 13 evaluation items as follows : Curriculum, Research ,Campus Engagement, Public Engagement, Air & Climate, Buildings, Energy, Grounds, Transportation, Waste, Water, Coordination, Planning & Governance, Health & Work. Compared with the STARS. Compared to STARS, *Standard* is lacks of four aspects of evaluation: Investment, Diversity & Affordability, Purchasing, Dining Services (see Fig. 2).

In the investments aspect, most expenditures are supported by schoolfellow and companies in USA, compared to schools in China, American schools more emphasis on its own capital operation of sustainability, China's universities mostly belong to the states or local governments, unified planning, funding support by national finance, so investment does not have an important influence on the development of schools. The category of Diversity & Affordability includes two aspects, one is promoting the fair competition and individual diversity of campus, the other is reflecting care for minority groups and disadvantaged groups. For the United States, it needs to eliminate racial discrimination, advocating the fusion of multicultural exchange; for China, it needs to unit all ethnic minorities and support the development remote, backward region, so it is necessary to take the Diversity & Affordability Ability into content of the green campus evaluation in China, it reflects the level of civilization of a campus, even a society and the development potential of sustainable. Purchase represents the material products input in colleges and universities, the construction of green campus should control at source so some basic items in this category can be added to evaluation standard and provide the purchase products with certain requirements and standards, such as prefer to buy products which meet national green standards or use clean energy products. In catering services, STARS mainly puts forward it in two aspects: one is the choice of food and suppliers; the other is offering vegetarian meals. The former can be completely evaluated in Procurement, the latter involves personal eating habits, which is largely influenced by religion, geography, national culture and other factors, so it cannot be enforced.

5.3.2 Scores proportion

In the view of categories of STARS evaluation systems, Operation (OP) and Planning & Administration (PL&AD), Engagement (EN) and Academic (AC) account for half of the score (see Fig. 3), the former group is largely focused on the situation of hardware construction

in campus infrastructure, while the latter group is concerning the evaluation of the campus sustainable culture and the degree of education construction. The setting of evaluation content and Scores proportion, STARS leads the construction of software and hardware with two hands.

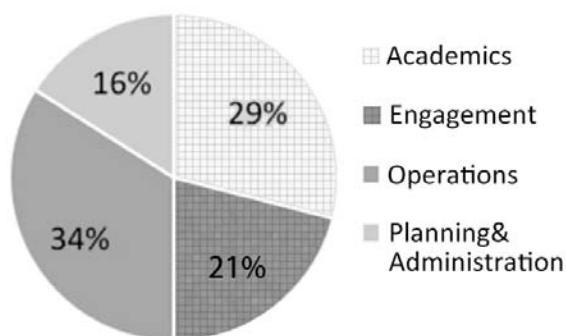


Fig. 3. The proportion of four categories in STARS2.0.

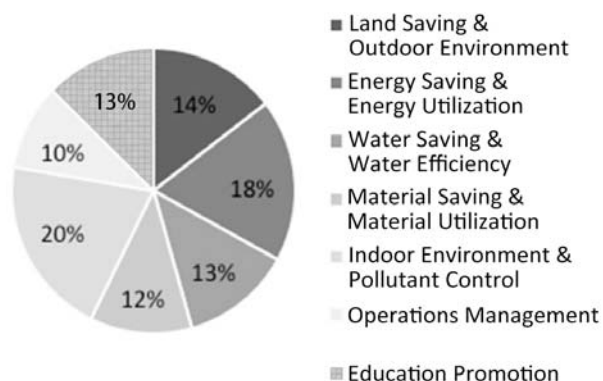


Fig. 4. The proportion of college seven categories in Standard.

However, *Standard* emphasizes the hardware construction, software construction only contains one evaluation item: Education promotion, and its proportion merely occupied 13% (see Fig. 4). The ratio shows that the construction of green campus in China, at present, practically, it pays more attention to green construction in campus buildings, use the construction of green campus buildings to promote the construction of green humanistic in campus.

Figure 2 shows the percentage of each evaluation category in STARS and *Standard*, In the 17 categories of STARS, the top five with the largest score proportion are Curriculum (19.6%), Public Engagement (10.8%), Campus Engagement (9.8%), Research (8.8%) and Air & Climate (5.4%). The smallest is Grounds (2.0%); the top five with the largest score proportion in *Standard* are Buildings (26.4%), Grounds (14.9%), Energy (14.4%), Coordination, Planning & Governance (13.9%) and Water (12.9%). The smallest percentage is Curriculum, Research, Air & Climate, Transportation and Waste

which all accounts for 1% (see Fig. 2). By comparison found that the highest proportion of categories in each evaluation standard tend to be lowest proportion of other standard, therefore, it is evident that the concerns in China and the United States for green campus are completely different. The former pays more attention to campus material construction, such as buildings and energy saving, however, this situation is relevant to the development history that China's green campus has evolved from energy-saving campus, which emphasizes campus infrastructure construction and energy-using systems management. From the development history of green campus, China's level of green campus is still well behind that in America. The difference in construction also reflects that it is necessary to transfer the emphasis of green campus construction, from infrastructure construction to the sustainable spiritual civilization.

The sum of the previous five accounts for 82.5% in *Standard*, which is far more than that in STARS (the sum of the previous five merely accounts for 54.4%). Such disparities in proportion of evaluation contents and score in *Standard* would limit the evaluation scope of green campus. For a university or a college, it can be rated as green campus by meets five major proportion of *Standard*, which is obviously biased.

Therefore, this paper suggests to adjust the proportion of various categories in *Standard*, decrease the gap between the score of each categories. Decline the current score of five major categories, especially the proportion of buildings. The proportion of Curriculum, Research, Air & Climate, Transportation and Waste should be increased. Moreover, advocate green campus education, green management, green consumption and green service in campus, and promote the software construction of green campus.

6. Conclusion

According to the development history of the green campus in America and China, the paper analyzes the social context and priority in construction of green campus between them, and research their advantages, disadvantages and applicability. The result may help China's green campus evaluation system update and optimize, moreover, it may provide China's actual green campus construction with further guidance.

Through the comparative analysis between STARS and *Standard* above, green campus evaluation standard in China can be improved in the following three aspects:

- (1) Promoting the organizational system which adopts the government guidance mainly supplemented by voluntary participation, in the meantime, exploring the potential of green campus construction in

campus, improve the participation of universities and colleges, faculty members and students.

- (2) Adopting scoring items with the periodically evaluation method on the basis of prerequisite items, this method not only ensure the general level of green campus construction but also meet individualized need of different universities and colleges, promote the sustainable construction of green campus as well.
- (3) Add Diversity & Affordability and Purchasing to evaluation content, decline the gap between the score of each categories and reduce the proportion of high score categories effectively. Focused on green campus software construction, strengthen the construction on the green education, green management, green consumption and green service on the basis of campus greening construction, make the software and hardware construction with two hands.

Optimizing and upgrading *Standard*, meanwhile, the construction activities should still guide by current evaluation standard. It includes not only reasonable and effective of energy-saving transformations and energy audit on the campus (TIAN Guo-hua et al., 2014), which reduces the campus energy consumption, but also proceed from the campus planning (FAN Lifei et al., 2012), life service, green ecology education, adhere to the principle of sustainable development and ecological construction, and popularize the concept of green campus.

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