

## The Application of green construction in the Universities in South China

Xiong Lin<sup>1, a</sup>

<sup>1</sup>Qu Zhou University, Qu Zhou, Zhejiang province, China

<sup>a</sup>E-mail: xionglin7227@126.com

**Keywords:** Green building technology, Campus construction, Design strategy, Practice research.

**Abstract.** This paper combines the architectural characteristics, in summer hot and winter cold area building energy efficiency design specification analysis proposed measures and application of a series of green building technology. In campus planning, architectural design, detail processing on, provide ideas for solving in the construction of green university campus planning and architectural design.

### Introduction

Since 1990s, With enrollment expansion in universities and acceleration of urbanization process, the University City has sprung up in the land of China. There are a lot of universities. These campus have the following characteristics.

### The characteristics of China university campus

#### 1.1. The large scale the project covers area

What The project covers area is unprecedented. The new campus are more than the old campus on the scale of land acquisition. a small area is about one thousand acres of university, but most of universities cover more than a few thousand mus, It is a large area.

#### 1.2. The diversity and complexity of construction project

Building has large size and different types. It mainly includes: public teaching building, teaching building, laboratory building, library, gymnasium, stadium, restaurants, teachers apartment, student apartments. It also includes underground pipeline in road construction, all kinds of power supply, water supply, gas supply, planting landscape and other infrastructure constructions.

#### 1.3. High energy consumption use up

Building energy consumption high: the national campus energy consumption accounted for 8% of the total social energy consumption. The value of energy consumption of college students is 4 times of the social ordinary people.

### Building energy-saving design specifications

At present, both residential buildings or public buildings in hot summer and cold winter area, all implement the JGJ134 - 2010 "living in hot summer and cold winter area construction of energy-efficient design standards", but in hot summer and cold winter area, climate also exist difference in difference areas.

At present, there is no special technical requirements and measures for the construction of colleges and universities, it is only recommended to comply with the local civil building energy efficiency design norms. So the current situation energy waste phenomenon in the university building.

This situation is more widespread. The university teaching cost is increasing, but also the construction of the conservation oriented campus is hindered. Therefore, it is imperative to apply energy saving technology in the construction of the university.

## Application of green building technology

### Passive design concept of green building design

Green building design methods should optimize the passive design method, as Lennox Mike Ian said, "Take the least amount of effort to adapt". That minimize or without the use of refrigeration, heating and lighting equipment, designers should tap the potential of building design fully, aim of designers is guided by architectural designers and make the best use of the circumstances. High quality of the indoor environment and outdoor environment. It must start from the early design stage, throughout the entire design process, focusing on the details of the processing.

### Essentials of green campus architectural design

Green building design with appropriate technology for the protection of the ecological environment, improvement of energy, resource utilization, comfortable environment. In order to come true these aims, the following points should be put in effect.

#### Campus physical environment analysis

- (1) wind environment analysis
- (2) light environment analysis
- (3) thermal environment analysis
- (4) analysis of acoustic environment

#### Planning and design optimization

Make full use of the campus in natural waters and mountains, vegetation, Yishanbangshui the building layout, rational organization of natural ventilation. Through the summer dominant wind direction (East or southeast, creating a pond and landscape, the natural wind is cooled then run into the building. further green vegetation is used, and campus wind, light, thermal environment are adjusted and improved. Mutual shielding and self shielding are formed between the constructions by reasonable control of building spacing. especially in the East and west to the block, at the same time to increase the shadow.

#### passive green building design

- (1) building plane and body control
- (2) the design of the courtyard and atrium

Courtyard and atrium are important factors to improve the thermal environment and natural ventilation of buildings. Fig. 1 Schematic diagram of natural ventilation.

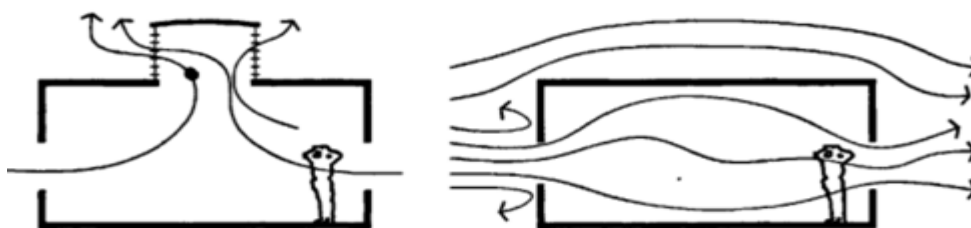


Fig.1 The principle of natural ventilation (left: natural ventilation; hot pressing under the action of hot pressure right: natural ventilation under the action of wind pressure)

#### (3) Interior patio design

Applying to large space office and corridor - type teaching building design, the ventilation simulate and practice. The plane linear depth should be controlled within 25 m, this design can ensure the daylighting efficiency of double-sided cloth real, If depth more than 27 m, it is recommended setting the internal courtyard, to meet the ventilation and lighting requirements. Ventilation schematic diagram of horizontal section and Horizontal shading and vertical sun shading are shown in Fig. 2/ Fig. 3.

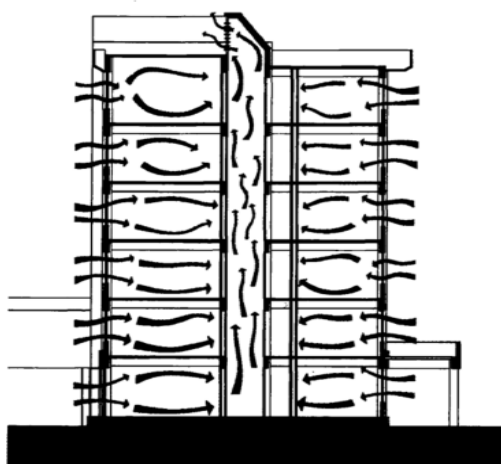


Fig. 2 Cross section ventilation schematic Fig. 3 Horizontal shading and vertical sun shading

#### (4) Passive detail energy saving design

By detailed energy-saving design and construction simulation software combined constructed green building optimization design model, the designers can provide to many kinds of optimized design scheme.

By analyzing the energy consumption ratio of each part of the building parts(including roof, wall, door and window, basement), the detail design of building energy saving green design is applied in doors and windows, wall and roof.

Reasonable choice of building shape coefficient, orientation, internal and external shading, natural ventilation, natural lighting, room functional layout, high performance windows, high performance insulation structure and air tightness and so on , do well detail design.

#### Excellent case

Jiangsu urban and rural construction of the new campus of Career Academy to "green campus" as the goal, in 2015 Jiangsu urban and rural construction in Jiangsu province was awarded the first prize of green building innovation in Jiangsu Province, province is the only list of colleges and universities.

##### Planning and design

The planning and design stage comprehensive docking green campus and green building standards and the preparation of the campus green transportation, physical environment, energy, water resources utilization, landscape ecology, energy regulation, waste utilization of special planning.

##### Design scheme

By studying the local meteorological data for nearly 10 years, the campus and the individual buildings are applied simulation analysis for wind, light, heat and other building physical environment simulation analysis, optimization design, see Table 1 comprehensive use of green technology summary table.

**Comprehensive application of green technology summary table 1**

Serial number	Name of green technology	Serial number	Name of green technology
1	Solar photovoltaic power generation system	10	Civil decoration integration
2	Solar energy hot water system	11	High efficiency light source
3	Double heat source heat pump heat source circulating system	12	Ecological landscape water treatment technology
4	Adjustable external shading system	13	Energy consumption monitoring system
5	Ground source heat pump cold and heat source supply system	14	Bottom overhead natural ventilation technology
6	Rainwater collection and treatment system	15	Light guide green lighting system
7	Reclaimed water reuse system	16	Roof greening
8	Self insulation wall technology of steam pressure aerated concrete block wall	17	Multi form permeable pavement technology
9	Comprehensive utilization of underground space	18	Wetland water treatment technology

#### Economic benefit analysis

New campus construction funds to introduce social capital, ease capital pressure. Incremental cost: 90 million yuan, financing methods: the school self financing 20 million 140 thousand yuan, 12 million 640 thousand yuan of financial subsidies, 57 million 950 thousand yuan of social financing.

Capital recovery: annual water, electricity cost savings: 3 million 100 thousand yuan a one-time investment recovery period: half past six years (no calculation the country and Jiangsu Province, the green building subsidies).

Conclusion: the application of green building technology apply the construction of colleges and universities in hot summer and cold winter areas, from the research on the planning and architectural design details of the passive to reduce energy consumption.

## Conclusions

The application of green building technology apply the construction of colleges and universities in hot summer and cold winter areas, from the research on the planning and architectural design details of the passive to reduce energy consumption, Except to achieve high quality indoor environment and outdoor environment. The construction of green campus is conducive to the restoration of the ecological environment of the region, so as to promote the construction of ecological city.

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