Energy Saving and Green Building Design of Libraries: the case study of Zhengzhou Library

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Abstract:

As a public building and a cultural service institution, library should take the initiative to protecting environment. A new project named Energy Saving and Emission Reduction of Libraries (ESERL) has been launched and convened many experts to conduct research. According to the research and analysis, two solutions by project experts are proposed to help reduce energy consumption and energy cost in the library. First, reconstruct high energy-consuming libraries by EMC. Second, add energy saving design and technology in the new building. The construction of new building of Zhengzhou Library is a successful example of such concept. The energy saving and green building design of new building of Zhengzhou Libraries consists five parts: integrating energy management system in monitoring and control systems, complex vacuum glazing of building envelope, energy saving illuminating system, convertible frequency air-conditioner of HVAC and rainwater utilization system.

Figure 1: New building of Zhengzhou library

1 Background

In recent years, building energy consumption increased fast in China, especially the public buildings. From 1996 to 2008, the total building energy consumption increased by 1.5 times, rose to 655 million from 259 million tce.[1] Now, building energy consumption accounts for about 23%-30% of the total energy consumption. [2] Public building area is approximately 10% of the total building area, but its energy consumption (excluding heating) accounts for 22%.[3] Large-scale public building area is approximately 5% of the total public building floor area, and consumes 17% energy.[4] In order to solve the above problems, the Chinese government put much emphasis on publicize and promote the concept of energy

[1] Data from *2010 Annual Report on China Building Energy Efficiency.*

[2] Data from *2010 Annual Report on China Building Energy Efficiency* shows that: in 2007, building energy consumption is 607million tce(excluding biomass energy)，it accounts for about 23% of social total energy consumption. An expert from Ministry of Housing and Urban-Rural Development of the PRC (MOHURD) said it accounts for 30% now, at a press conference of State Council Information Office of the PRC, in September 2010.

[3] Estimated based on data from *2010 Annual Report on China Building Energy Efficiency* and China National statistical database（http://219.235.129.58/reportYearBrowse.do）

[4] Data from *2010 Annual Report on China Building Energy Efficiency.*

conservation and emissions reduction. As a public building and a cultural service institution, library should take the initiative to protecting environment.

In China, many libraries have slowly come to realizations that the energy cost is over the book-purchasing fund. Thus, it is necessary and important for Chinese libraries to reduce energy consumptions.

Tang Gengsheng[5], the general secretory of Library Society of China (LSC), launched a new project named Energy Saving and Emission Reduction of Libraries (ESERL). The project convened some experts from Academic Professional Committee of LSC, Beijing Zhongguancun International Environmental Protection Industry Promotion Center Co., Ltd (ZIEPC), China Institute of Building Standard Design & Research, Beijing Institute of Architectural Design (BIAD), Virtelwise Technology Inc. and some libraries to research and practice how can become energy-conserving and environment-protective buildings.

The large of number of research and analysis had been conducted by Project team, some recommendations have been suggested. In July 2010, this project was recognized by the Ministry of Culture in China. The subproject "Survey and Countermeasure Analysis for Library energy save" was established as the scientific and technological innovation projects by the Ministry of Culture. In December 2010, the first demonstration project - the energy saving design for new building of Zhengzhou Library was formally implemented.

2 Research, analysis and strategy

Several years ago, some libraries' expenses of purchasing book always impropriates by labor cost in the less developed regions of the western China, which is named "people eat books". 6 Recently, with the construction of public cultural service system, many large and new

[5] Tang Gengsheng is director of Social Education Department of National Library of China from January 2011. She also is the leader of this project now.

[6] In August 2005, Li Guoxin, a professor of Peking University, raised the issue and point of view which caused widespread concerns from the media and society. The leadership of CPC Central Committee and State Council pay more attentions to the construction of public cultural service system. Nearly 6 years, this problem has been improved to some extent. At that time, Dr. Li found this issue through inquiry. Few governments funding for many county libraries support the normal operation of the library thereby leading to "people eat books" (the staff resources diverted to textbook costs), and "book eat man" (Library deducts of employees for purchase of books).

buildings were constructed. If we do not pay more attention to the concept of Green Libraries, maybe we will face the phenomenon of “building eats books” (the energy expense diverted to textbook costs).

In China, Chinese public libraries were established in accordance with national administrative divisions. There are 34 provincial administrative regions in China, 333 prefecture-level administrative regions, 2862 district and country level administrative regions, totally 2833 public libraries[7]. About 300 libraries are over 10,000 square meters (floor area) [8]. To investigate the energy situation and prepare for the countermeasures, LSC sent an Energy Consumption Status Questionnaire including 48 items to 100 public libraries and university libraries in May 2010. Some effective energy saving solutions will be presented in factors such as configuration, wall, window, air-conditioning, illuminating system, water circulation system and other factors, based on quantitative questionnaire analysis.

According to 54 valid questionnaires, research analysis shows that: libraries built before mid-1990s, under 10000 m^2, with window light and no air-conditioning cost less power. However, library constructed after mid-1990s consume over RMB 0.1 billion, over 20000 m^2, which is a big energy consumer. The older library’s energy consumption is less than 40 KWH per square meter per year. Moreover the total consumption is less than 50 million a year. There are several reasons why newer libraries need more than 70 KWH per square meter per year. These reasons are as follow:

- The large area of building;
- The poor natural lighting and more artificial lighting during the day;
- Rely on mechanical ventilation to get fresh air;
- Basically maintain the indoor air quality by the central air conditioning or heating

[7] Data from *The People's Republic of China Administrative Divisions Table*.

[8] According to *Public Library Construction Standards of China,* more than 50 million service population should built medium-sized library which should larger than 7500 square meters; a population of 1.5 million to be built large-sized library (20,000 - 60,000 square meters).

- More lifts in building.

The research also indicates high energy cost caused by air-conditioning systems, lighting systems, elevators, computers, servers, security, package of counter and fire monitoring.

Therefore, solutions of solving higher energy cost will be suggested from research analysis in library:

Firstly, high energy-consuming libraries should be reconstructed by energy management contract (EMC) thereby reducing large expense of energy. The Heilongjiang Provincial Library is a good example. The Heilongjiang Provincial Library has paid more attentions to the importance of energy conservation. Thus, usage of inverter air-conditioner system replacing with ordinary air-conditioning system significantly reduces energy consumption by nearly 40%. In March 2010, to further reducing energy cost, ESERL came up with an energy-saving plan based on analyzing the energy data of the past two years combined with onsite research. The reconstruction plan of this building consists of two steps. This plan will be paid by an EMC company. The first phase is to rebuild illuminating system. To avoid reducing former illumination (illumination may be improved to some extent), more energy-efficient fluorescent energy-saving lamps will be used during reconstruction. It is estimated that cost of such project is approximately 800,000 RMB thereby reducing 33% energy cost from illuminating system, meanwhile saving RMB 200,000.

Supply the water storage and automatic air-conditioning system will be rebuilt at the second phase, which is followed by a reconstruction of solar domestic hot water system. In addition, an energy-saving reconstruction plan of air conditioning system for Nanjing Library has been conducted by experts from ESERL.

Secondly, other solutions also include choosing energy saving technology and products when construction of the new building.

As a typical and successful case of the construction of new building in Zhengzhou Library, the next will further research and discuss it.

3 Energy Saving and Green Building Design of Zhengzhou Library

3.1 Overview of the climate, location and architecture

Zhengzhou is the capital and largest city of Henan Province in North-Central China. The city is known as the political, economic, technological, and educational center of the province, as well as a major transportation hub for Central China. There are 7,356,000 people living in this prefecture-level city[9]. The prefecture spans 34° 16' ~ 34° 58 N latitude and 112° 42' ~ 114° 14' E longitude, covering a total area of 7,446.2 square kilometers. The climate in Zhengzhou is humid and subtropical. Four seasons can be clearly defined, with cool and dry winters, hot and humid summers, and warm and early springs, and mild autumns. The city has an annual average temperature of 14.4 °C, with the highest average monthly temperature at 27.0 °C in July and coldest monthly average temperature at 0.1 °C in January. There are approximately 2200 hours of sunshine per year. *Table 1* below shows that in Zhengzhou during the summer season, the higher the temperature and the strong sunshine, In winter, the lower the temperatures, the shorter sunshine time. Thus, according to analysis of Zhengzhou climate data, the key point of building energy-saving depends on insulation and insulation of building envelope.

[9] See: People's Government of Zhengzhou Municipality. Overview of Zhengzhou. http://www.zhengzhou.gov.cn/viewCmsCac.do?cacId=fdae9f5d2880d70e012880ebfba0005e

Table 1: Climate data for Zhengzhou (1971–2000)

Climate data for Zhengzhou (1971–2000)													
Month	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Year**
Average high °C	5.7	8.6	14	21.7	27.2	31.6	31.8	30.5	26.7	21.5	14.1	8	20.1
(°F)	-42.3	-47.5	-57.2	-71.1	-81	-88.9	-89.2	-86.9	-80.1	-70.7	-57.4	-46.4	-68.2
Average low °C	−4.3	−1.9	2.9	9.5	14.7	19.8	22.8	21.7	16.2	9.9	3.1	−2.4	9.3
(°F)	-24.3	-28.6	-37.2	-49.1	-58.5	-67.6	-73	-71.1	-61.2	-49.8	-37.6	-27.7	-48.7
Precipitation mm	8.8	12	28.5	39.6	58	62.8	155.5	112.5	77.4	45.1	22.3	9.8	632.4
(inches)	-0.346	-0.472	-1.122	-1.559	-2.283	-2.472	-6.122	-4.429	-3.047	-1.776	-0.878	-0.386	-24.898
Sunshine hours	144.3	139	164.8	202.8	234	229.5	199.9	199.6	179.2	182.4	158.3	148.1	2,181.90
Source: China Meteorological Administration. China Meteorological Data Sharing Service System. http://cdc.cma.gov.cn/shuju/index3.jsp?tpcat=SURF&dsid=SURF_CLI_CHN_MUL_MMON_19712000_CES&pageid=3													

Zhengzhou library is located in Zhengdong newly developed area of Zhengzhou city. The entire project covers a land area of about 12.52 acres and costs about 6 hundred million. The library's total area of structure is 72095 m^2, underground 19053 m^2, overground 53042 m^2,and the height of the building 30.6m.There are 5 over ground layers in main building, two layers of podium, 1 underground layer and equipment interlayers in some parts. The total planned number of collected books is 2,400,000 and 1600seats for reader. The core idea of the library building is customized service, reflection of public participation and interaction.

The project started in June 2009， will be completed in June2011 and open to the public in January 2012. The new building is designed by Beijing Institute of Architecture Design.

Compared with traditional functions of library, new building as a multifunctional citizen culture activity center plays an important role to the public, in terms of literature collection, retrieval and consulting, academic exchange, culture creativity, education and training and entertainment.

The new building of Zhengzhou library is very close to noisy street. Thus library actives will be usually influenced by traffic noise jamming. Actually, noised from commercial service facilities and the crowds also did similar efforts too.

To highlight its inclusiveness and openness and create a good sense of space, large glass

curtain wall has been used in the building envelope. The facade area ratio of window to wall is 67% and area ratio of glass roof is 20%, which are all close to the upper limit of the public architecture energy-saving design criteria[10]. Especially, to build peripheral effect of the building, there is a high light transmission pulling cable glass curtain wall separately in the south, east and west beyond the requirement of *Design Standard for Energy Efficiency of Public Buildings of Henan Province.* This puts forward higher requirement to other parts' thermal property of the building envelope.

Figure 2: Large glass curtain walls

3.2 Energy Saving and Green Building Design: new building of Zhengzhou Libraries

The new building is designed according to *Design Standard for Energy Efficiency of Public Buildings* and *Detailed Rules of Design Standard for Energy Efficiency of Public Buildings of Henan Province.* In the design and construction, they uphold the principle of energy conservation, and the building saves energy in the following five aspects.

[10] See *Detailed Rules of Design Standard for Energy Efficiency of Public Buildings of Henan Province.*

3.2.1 Monitoring and Control Systems：Integrating Energy Management System

The building's energy-saving and cost-reduction function is a complicated process, which is comprehensively operated by each system. The energy measurement and monitoring system efficiently monitors operation effect of the energy-saving methods in the building, thereby making a better combination of system energy-saving control and use. Moreover, based on findings of anomalous situation in the operation, real-time analysis efficiently avoids problems that have occurred and solve them in time, finally reduce the abnormal spoilage. (See *Figure 3*) Thus, six specific measures will be concluded in the below:

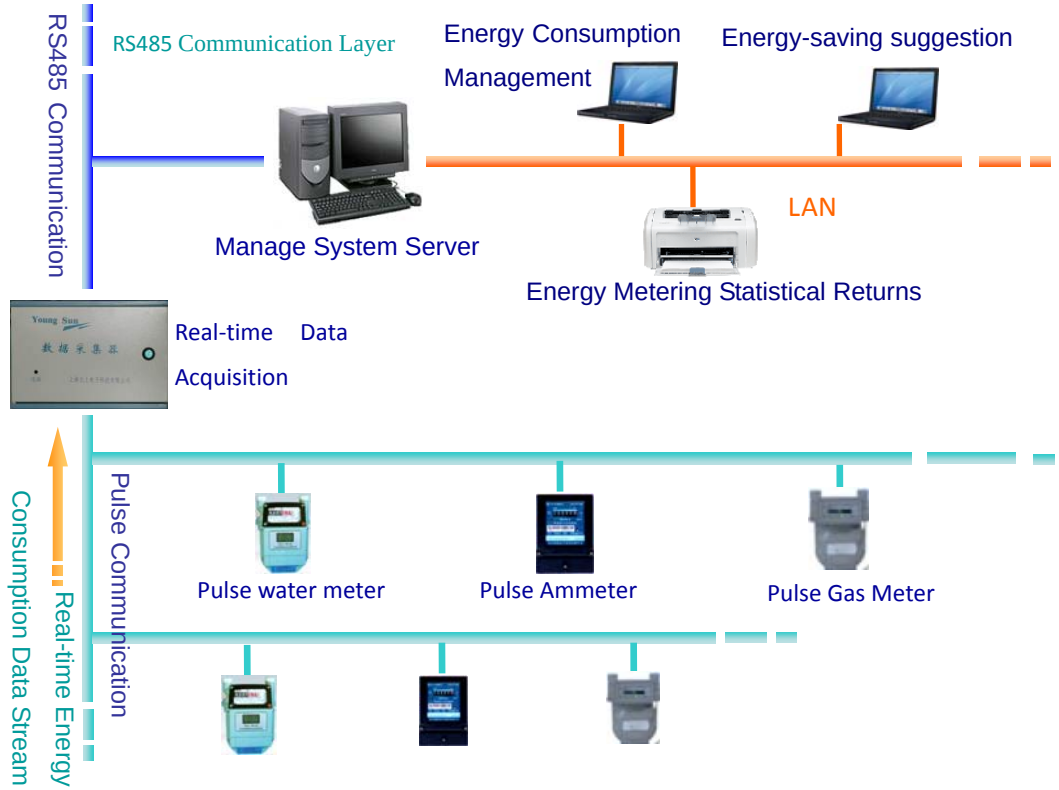

Figure 3: Energy Management System

- System monitors quality of environment in real-time and adjusts automatically to ensure human safety, healthy and comfort and to maintain a quiet reading environment.
- Energy consumption overall online control, to ensure all equipment run in the best

status, in order to be both safe and energy saving, meanwhile extend the working life of equipment as long as possible.

- Ensure the easy measurement appraisal management, charge the meterage to external authorities and partners and eliminate waste.
- Terminal energy control of Central air-conditioning can remotely set temperature, on-off function, and timing control online, so as to reduce management cost on the premise of comfort.
- Depend on an ideal energy-saving mathematical model built by real data, to realize the linkage control of the equipment.
- Combine with the building control systems such as group control of central air-conditioning host machine, frequency energy-saving control of pumps, intelligent control of fresh air, intelligent control of lighting; finally achieve the best result of energy-saving control.

According to the system's actual energy-saving effect analysis in other projects, the system will save 20%-30% energy consumption. The new building of Zhengzhou library is 72,000 m^2, energy consumption in each year is about: 7.2m^2 *118KWH/m^2=8,496,000 KWH /year.[11] Thus, usage of the system will efficiently save 1,700,000~2,550,000 KWH electricity.

3.2.2 Building Envelope: usage of complex vacuum glass technology

Air conditioning and heating systems always cost 50%—60% annual energy consumption in public buildings. Over 50% is consumed by heat transfer of windows, doors and curtain wall. Especially in the building which has large area of glass curtain wall. Lots of glass curtain walls are included in the designs of this library and posed a challenge for the energy conservation.

[11] Public summons system about energy-saving investigation, evaluation and effect of government office buildings and large public building from executive office of building energy-saving projects of Housing and rural construction information center indicates that library's energy consumption is about 118°/ m^2.

In addition, in order to achieve goals of the design concept to architectural features, sharing hall in the first floor installed single-layer glass curtain wall which is poor thermal insulation but good permeability. Thus, to meet the shortfall and achieve energy conservation, the following three methods will be introduced.

- The single-layer glass curtain wall install area is controlled fewer than 9.1% of all glass curtain wall;
- Strengthening insulation of other parts of the curtain wall based on composite vacuum glass as the main material;
- Considering the impacts of direct sunlight to indoor space, to install motorized solar control blinds on dormer window.

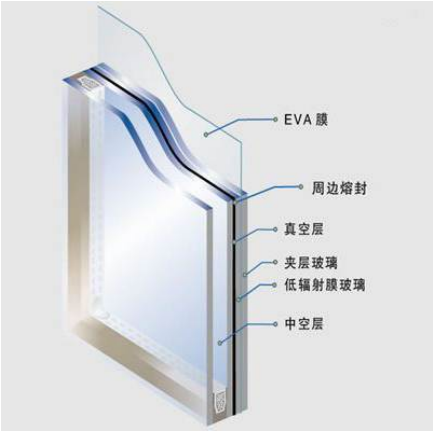

Figure 4: Structure diagram of composite vacuum glass

The most effective measure is the composite vacuum glazing. After the insulating glass, vacuum glass is the latest generation of high-performance glass. Vacuum glass has been used for more than 10,000 square meters and seven years in a building. Composite vacuum glazing (*Figure 4: Structure diagram of composite vacuum glass*) can reduce the convection, conduction and radiation heat transfer. Its U value is lower than 0.8 W/M^2K, weighted sound transmission Rw can reach above 42dB (*Figure 5*), which is comparable to the same level of insulation wall used by other meoths. Vacuum glazing can effectively prevent condensation and the condensation between two layers of glass, meanwhile has lower sheltering coefficient (0.76～0.23), which can prevent the entry of far-infrared light and minimize radiation heat transfer of sun in summer. (*Figure 6*)

Figure 5: Sound insulation

Figure 6: Thermal insulation

Usage of vacuum glass can significantly improve the comfort level and provide a quieter reading environment. When it 10 degrees below zero outside, the surface temperature inside of vacuum glazing is only 3-4 ℃ lower than the indoor air temperature. Visitors will not feel cold when they sitting beside the window. In addition, better sound insulation value solves the noise problems in the building. Not only can it prevent the entry of UV light, but it can also protect books from UV radiation.

The most important effect of vacuum glazing is energy-saving. Once eligible Low-e hollow glazing was replaced with vacuum glazing, research shows 32% energy will be saved, equal to 390MWH of electricity or 300,000 RMB. (See *Table 2-4*, the specific parameter and calculation)

Table 2: Parameters table of Low-e Hollow Glazing & Vacuum Glazing

Type	Exterior protected construction	Part Exposed Framing Glass Curtain Wall			Hidden Framing Glass Curtain Wall		
		Bridge-cut aluminum alloy	Glazing	Entire	Bridge-cut aluminum alloy	Glazing	Entire
Low-e Hollow Glazing	U value (W/M^2K)	3.7	1.7	2.2*	3.7	1.7	2.0*
Vacuum Glazing	U value (W/M^2K)	3.7	0.8	1.4	3.7	0.8	1.1

* Sharing lobby must be installed by single-layer glass curtain wall; its U value is 5.22 W/M^2K.

Through the building envelope trade-off option, when U value of glass curtain wall is lower than 1.86 W/M^2K , the building can reach the standards of *Design Standard for Energy Efficiency of Public Buildings*. Normal Low-e hollow glazing cannot meet the standard. Thus, analysis data of the eligible U value will be indicted in the following tables.

Table 3: Energy consumption of Eligible Low-e Hollow Glazing & Vacuum Glazing

Summer					
Type	**Exterior protected construction**	**Area**	**U Value**	**Total Energy Consumption /year**	**Total Power Consumption /year**
		m^2	**$W/m^2 K$**	**KWH**	**MWH**
Eligible Low-e Hollow Glazing	Part Exposed Framing Glass Curtain Wall	5238	1.86*	41497.00	153.7
	Hidden Framing Glass Curtain Wall	1886	1.86*	14941.45	
	Glass Daylighting Roofs	2574	1.86*	20392.00	
Vacuum Glazing	Part Exposed Framing Glass Curtain Wall	5238	1.4	31234.30	104.3
	Hidden Framing Glass Curtain Wall	1886	1.1	8836.346	
	Glass Daylighting Roofs	2574	1.1	12059.78	
Winter					
Type	**Exterior protected construction**	**Area**	**U Value**	**Total Energy Consumption /year**	**Total Power Consumption**
		m^2	**$W/m^2 K$**	**KWH**	**MWH**
Eligible Low-e Hollow Glazing	Part Exposed Framing Glass Curtain Wall	5238	1.86*	285787.88	1058.3
	Hidden Framing Glass Curtain Wall	1886	1.86*	102901.10	
	Glass Daylighting Roofs	2574	1.86*	140438.72	
Vacuum Glazing	Part Exposed Framing Glass Curtain Wall	5238	1.4	215109.16	718.0
	Hidden Framing Glass Curtain Wall	1886	1.1	60855.49	
	Glass Daylighting Roofs	2574	1.1	83055.15	

Table 4: Energy efficiency of envelope

Power Saving in Winter	Power Saving in Summer	Power Saving/Year	Saving Tce
MWH	MWH	MWH	Ton
340.3	49.4	389.7	13675

Notes:

1. In winter, indoor design temperature: 10℃ during 20:00-7:00, 20℃ during 8:00-19:00, heating season from November 25 to February 28. In summer, indoor design temperature: 26℃ during 7:00-20:00, cooling season from May to September.
2. Glazing load calculation formula: $Q=KF\Delta t_{total}/1000(KWH)$, Δt_{total} is the total indoor

and outdoor temperature contrast in a heating season (cooling season).
3. The above table shows cold/heat load from glazing only, excluding single-layer glass and glass which do not come into direct contact with indoor air.
4. Conversion rate of power and energy is 0.5(ϕ=0.5)

3.2.3 Illuminating system: LED illumination, lighting control system and photovoltaic system (PV)

There are three energy-saving measures in illuminating system:

- **Energy-saving products minimize the energy consumption.**

The reasons why LED is installed in the stacks and reading rooms are as follow:

Firstly, LED lamp excludes flicker, weak glare, and green, thereby protecting vision health. There is no ultraviolet and infrared in its spectra. Neither heat, no radiation can penetrate the surface, therefore it is conducive to the protection of books. It is a typical green lighting, recyclable, no pollution, no mercury elements and touchable. Secondly, LED lamp can last for 50,000 hours, which is 6.25 times of the traditional fluorescent.[12] The different angles light distributions improve the utilization efficiency, and the horizontal illuminance and vertical illuminance can make readers feel more comfortable. *(Figure 7, Figure 8)*

[12] Traditional fluorescent can work 8,000 hours.

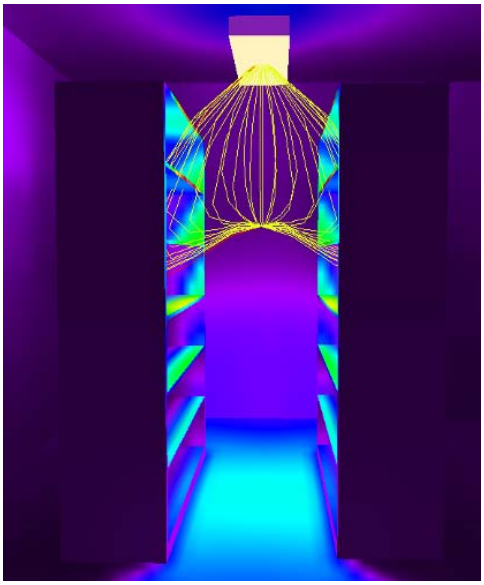

Figure 7: Traditional fluorescent light

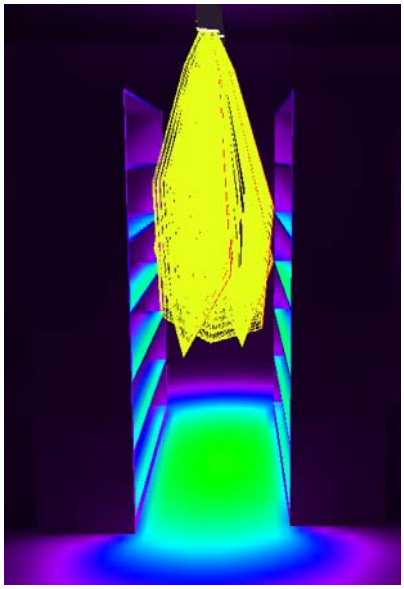

Figure 8: LED from different angles

The main advantage of LED lighting is energy consumption. LED lighting can save 64.2%, 10512kwh every year. (See *Table 5*)

Table 6

Type	Power	Number	8 Hours/day	1 Year
2*28W Fluorescent Lamp	56	100	44800	16532KW
20*1W LED	20	100	16000	5840KW

In addition, LED lighting can be dimmed according to different environment using infrared sensor control system, which can save 30%-40% energy.

- **Usage of lighting control system to cooperate with energy management system.**

Under the premise of reaching the lighting quality, reasonable dimmer can save much more energy. In public lighting, intelligent lighting control system will be chose and installed. Thus, compared with conventional stand-alone switching, a major advantage of a lighting control system is the lights or devices can be controlled in any location. In other words, the micro control unit can manage on-off of light and dimmer controls by the preset scenes. By the simulation analysis, daylight can be used effectively. According to different environments, induction system controls the lighting arrangement. For example, when the natural light

decreases, system automatically increases the volume and brightness. On the contrary, it automatically reduces the number and intensity when natural light is strong. In addition, to staff in library management, based on checking the monitoring unit and monitoring the lighting status of all sites to change or control the lighting, finally reach goal of reducing energy consumption.

- **Energy supply from the PV system supports garden and lawn light outside.**

Solar energy will be collected by solar electric set of garden lamp, and support garden and lawn lamp at night.

Annual sunshine time of Zhengzhou is about 2,200 hours, is appropriate to use solar energy technology. Indeed, the solar panel's lifetime is over 20 years, which is publically identified as clean, saving, safe, attractive in appearance and easy to use. For example, 1KW solar PV system installed can reduce CO_2 emissions 600-2300 kg every year.

3.2.4 HVAC: Convertible Frequency Air-conditioner

In terms of heating and air conditioning, the following aspects of measures in new building of Zhengzhou library will be the focuses:

- Using hot water as heating medium, designed based on fully full understand of the flexibility, convenience and possibility of zoning heat calculation.
- Energy-saving air-conditioning and heating equipment as equipment of air-conditioning system. Setting up heating (cooling) index reasonably. Meanwhile configuring reasonably capability and numbers of equipment, thereby improving adjusting methods to prevent under load or overload and saving energy.
- Because of large space and frequency of visits in the reading area, lecture hall, exhibition hall, and so on in the new library building, all-air-conditioning system should be started and equipments should be under frequency control of motor speed technology in order to improve total efficiency and further reduce electricity consumption.

3.2.5 Water: rainwater utilization system

The average rainfall of Zhengzhou is 632.4mm.[13] siphon drainage will be installed on roofing, catchment area is about 5000m³, volumetric runoff coefficient is 0.9. Annual average available rainwater: QP ＝ 5000×0.6324×0.9 ＝ 2845.8m³.Collected rainwater is mainly supplied for green, landscape and roads poured.

The initial runoff of prophase rainfall stored in the system, and then clean rainwater stored in water tank. In addition, under field conditions, part of the rainwater collection pipeline can be set into seepage and drain pipeline, in order to reach effort of infiltration-overall rainwater. Moreover, 450 meters rainwater permeation pipe under green space can store 94.5m³ rainwater once.[14]

Actually, rainwater utilization is used not only in water saving but also in achieving ecological benefits. According to analysis, 2845.8m³ water will be save and directly save water expense 130090.7 RMB by the system. In addition, it also can reduce the emissions to the municipal stormwater pipe; at the same time, indirectly reduce the municipal investment in the construction of drainage facilities.

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http://www.zhengzhou.gov.cn/viewCmsCac.do?cacId=fdae9f5d2880d70e012880ebfba0005e

[13] See *Table 1*

[14] Qs＝450×1×0.21＝94.5m³

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Ms. Wang is in charge of the managing and planning of professional projects in Library Society of China (LSC) and responsible for tasks of Academic Professional Committee of LSC. She has been participating in researching and legislating for ***Public Library Construction Standards of China***, ***Township Integrated Cultural Station Construction Standards of China*** and ***Public Library Law of China***. She also participated in the project of ***Energy Saving and Emission Reduction of Libraries***. She has published five articles on Legal Construction of Libraries and library resources construction.

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Ms. Li is the president of the Zhengzhou Library Association, the vice president of the Henan Library Association and the member of Academic Professional Committee of LSC. She has become a librarian since 1987, which awarded Advanced Individual Awards for many times in Henan Province, won the excellent academic achievements award at the provincial level for 4 times, co-wrote 5 books, and participated in 4 major projects. She is a member in the project of ***Energy Saving and Emission Reduction of Libraries***. Published paper is “Energy Saving and Emission Reduction: Implementation of Environmental Protection Responsibility of Libraries” on Library Development.