Peking University

21st Century State of Art Low Carbon Building Landmark Project

Sponsorship Proposal

CONFIDENTIAL

Program Coordinator

EnviroTech Foundation

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EnviroTech Foundation
環保科技中心

Background

Preface

The importance of sustainable development and environmental issues are increasingly recognized in China, as is the increasing role of China in global sustainability. Since the country has developed to become the second largest global economic power house, China has come under increasing pressure from environmental degradation. In response, the "Hu-Wen" leadership has demonstrated a clear commitment to address these concerns and cooperate with the international community to build a sustainable future both for China and the world. Hence Peking University (PKU), as the universally acknowledged institution of advanced educations for high profile leadership development in China, is prepared to invest its resources to build a Green College to develop the required expertise and solutions in environmental and sustainable development.

It is the decision of PKU to design and construct a "Low Carbon Building" for the new premises of the PKU College of Environmental Studies. This new "Low Carbon Building" will provide a unique educational opportunity and living laboratory for students to learn the processes involved in the environmental changes and impacts on the Earth. It will also serve as a national demonstration project for 21st Century world standard, environmental friendly building and learning facility. The project is expected to have its ground breaking ceremony in early 2012, as a major historic construction in the development of the University.

With the support of our Presidential Advisor, Prof. Alex Ng, the adjunct professor of the PKU College of Environmental Studies, Environmental Technology Foundation (ETF) is working together with our strategic partner, the Peking University, for the sustainable development in China. In particular, ETF is privileged to be the University's fund raising coordinator in the Hong Kong SAR for this meaningful project.

The Irreplaceable Peking University

PKU had been ranked as the "number one university in Asia" by the London Times, and has been one of the most important pioneers in China's modernization since the beginning of the 20th Century. It has played an irreplaceable role in reviving the nation, liberating the people, developing the

country as well as advancing its society and culture. The University is irreplaceable not just because of its academic achievements, but also because of its very important and influencing role as a think-tank of the Central Government. PKU is a comprehensive university focusing on the research and education of the arts and sciences. PKU has produced many high quality graduates for the country, among them about 400 become Fellows of the Chinese Academy of Sciences (CAS) and the Chinese Academy of Engineering (CAE). Additionally, many others made significant contributions and became highly influential in the fields of humanities and social sciences. Meanwhile, there are numbers of professors, doctoral advisors, CAS Fellows, state-level key laboratories and key disciplines at PKU all rank the top in the country. In addition, its global alumni network has been making significant contribution on international cooperation between China and the rest of the World in the context of economic, social, political and commercial issues along with the country's unprecedented development in the past three decades.

The Blooming "Green Education" in the University

The University's environmental studies integrated the sciences, the arts, the engineering fields in the stream of environmental subjects as well as physical and human geographies. It is a collaboration of two institutional level disciplines, the Geology and Environmental Sciences & Engineering, and three key ministry-level disciplines of the Ministry of Education, structured under the University's Department of Urban & Environmental Sciences and Center for Environmental Engineering & Sciences, combining multiple disciplines, including environment, geography, ecology, architect and planning. It also becomes an organization of 1200 students of rising young talents and a good number of 147 well-known experts and scholars. Amongst them 3 are CAS Fellows, 3 Chang Jiang Scholars, 38 professors and 45 associate professors, who collectively have an excellent track record for high quality and influential research. These works had been widely recognized by global leaders such as Mr. Kofi Annan, the past UN Secretary General, and the College has proved to be fully capable of building a Chinese characteristic world class and globally influential College of Environmental Sciences.

The Environmental Technology Foundation

EnviroTech Foundation (ETF) is a Hong Kong based government recognized charitable organization (File No: 91/9253), dedicated to empowering sustainable development in Hong Kong and the mainland China with

environmental technologies. The inspiration for the foundation is derived from Founding President, Dr William CG Ko's lifetime of service to safeguard Hong Kong water resources, in the capacity of Director of Water Supply of Hong Kong.

We are an advocate for sustainable business solutions and a platform for exploring the latest development and best practices of low carbon and other environmental technologies. Our vision is to connect people, ideas and resources to solving climate change challenges and environmental problems in both Hong Kong and our motherland – the People's Republic of China.

Our Actions

- **Empowering Environmental Movements** – raise widespread awareness and encourage broader application of environmental resources management in the region via our exclusive Green Directory, advisory, education, training and events.

- **National Networking** – establish connection to leaders in the industry and benchmark cutting-edge environmental technologies applications with ETF's strong partnerships with a number of local and national businesses

- **Brand Reinforcement** – demonstrate partners' green credentials on our Green Directory, supported with advisory service in project financing. ETF offers extensive opportunities to sponsor and speak at wide-ranging programmes collaborated with universities and other recognized bodies

- **Enhancing Policy** – support market transformation to a sustainable city by stimulating the uptake of sustainable and enviromental principles. With industry and goverment support and engagment with the community, ETF will foster a sustainable future for Hong Kong and furthermore the mainland.

ETF comprised of leading academics, experts and entrepreneurs in the fields of sustainable technologies, environmental management systems, and waste sorting and recovery. We strive for quality improvement of service with our extensive researches on environmental technologies and pro-active contribution to the local community. These six strategic focus areas will expand and continue to be areas of focus for us into coming years.

1. *Clean Water*

2. *Sustainable Energy*
3. *Low Carbon Building*
4. *Bio-farm*
5. *Waste Management*
6. *Quality Air*

For more details please refer to our website www.etf.org.hk

The Project

This new "Low Carbon Building" will comprise of a single block of 7 levels, catering for multi-functional use, through a total approximate usable floor area of 16,000 m^2. It is intended to deliver a state- of-art design in terms of architectural and engineering considerations, with an emphasis on environmental performance. This is guaranteed by a very severe scanning committee comprising a team of reputable high quality experts led by the University.

The Design Concept

The Low Carbon Building must be exemplary of ecological architecture and a symbol of sustainability and environmental protection. It is intended to develop a world class demo facility embodying a green hope for life and the environment. It must achieve the effect of environmental protection, though the selection of materials, energy saving, health and well-being, high efficiency, high intelligence, noble sensation, and a landmark for the development of green architecture in China.

The Low Carbon Building must also embody the scientific essence of the College of Environmental Sciences. It must become the base for the education of first-class graduates, first-class scientific research, first-class technological development, and first-class international training center. It must become a unique piece of architecture of PKU in the 21st century.

The Design Principles

1. Achieve flexibility and adaptability while meeting all functional requirements and creating new functions, new spaces and new ways of

space utilization and accomplish high quality environment for education and research through optimizing space organization.

2. Apply the principle of green architectural experimentation throughout the life-cycle of the building, i.e. the stages of its design, construction, and operation. While mainly using mature green technologies, materials, and equipments, PKU encourages the use of the newest energy saving technologies and environmental protection methods, which can accomplish design that is adaptive to the environment of Beijing.

3. Reserve and cohere with the affluent but distinctive history and culture of PKU's spirit of patriotism, progressivism, democracy and science. While creating a world first-class university that is congenial to the PKU campus cultural milieu, its styles of architecture must articulate the natural and human landscape of a national cultural relic protection site at PKU, the Yanyuan and Weiming Lake.

The Prestigious Location

The site reserved for the "Low Carbon Building" is located at the intersection of the University's administrative centre, academic zone and the national cultural relic protection spots. It is neighboring to the College of Life Science Building at the East, the Department of Science to the South, the Yanyuan and Weiming Lake to the West and adjacent to an area of beautiful grassland leading to the Weiming Lake at the North. In addition, it is in close vicinity to a number of notable buildings within the University campus, including the President's office, the famous Guanghua Business School and the HO Ying Kit's Academic Complex, the Library donated by Mr. LI Ka Shing, the Centenary Grand Hall donated by Sir Run Run SHAW. They are all well known Hong Kong businessmen and philanthropists.

The Sponsorship Program

The sponsorship program for the building, targeting both philanthropic individuals and business corporations is outlined below:

The total budget for the construction of the Low Carbon Building is set at RMB 80 millions and the enclosed Project Catalogue detailed the break down of construction costs indicating:

- Structure, enclosure, fenestration, windows;
- Mechanical system, interior finishing, energy, monitoring system;
- Green technologies - life mechanisms: Natural Water Treatment system, Solar Energy & In-door Air Quality Monitoring System. (Please refer to Technical Fact Sheet in the Appendix)

The Building is a seven-level building being two underground levels (LG2 – LG1) and 5 aboveground levels (L1 – L5). LG2 being car and mechanical floor. The rest of the six levels (LG1 – L5) are for teaching, researches and administrative purposes, which will be offered for inviting sponsors to acquire naming right. There are three options initially recommended as follows:

1. The permanent naming right of **PKU XXX Low Carbon Building** will be granted to a single sponsorship ideally supporting the total fund of RMB 80 millions required, or any other offering whereas the University considered substantial.

2. Each level and/or facility in the building will be named after the sponsor's name permanently for respective amount open to proposal from the sponsors, which may vary from level to level or from facility to facility, and subject to final mutual agreement between the sponsor and the University.

3. Any other options for discussion.

The Honorary Appointment

In addition to the permanent naming rights, sponsor(s) will be offered appropriate honorary appointment(s) of relevant membership for the University's Boards in accordance with the mode and scale of the sponsorship. Additional honors will be awarded whereas both the sponsors and the University authority find appropriate.

Other Benefits

PKU will try its best efforts to help the sponsor(s) in the following ways:

1) To build up a high profile nation-wide reputable corporate image;
2) To support the sponsor's China business development strategy by associated research;
3) To provide the sponsor(s) useful advice on facilitating institutional public relation with respective authorities within the manageable capacity of PKU;
4) To build up strategic partnership with PKU and/or its alumni networks on the varieties of commercial and/or public projects development or implementation, ranging from energy, properties, infra-structure construction, technologies and others;
5) Other possible alternatives whereas both PKU and the sponsor(s) find applicable.

The Procedural Matters

A Letter of Intent is expected from the potential sponsor(s) indicating to the University their genuine interest to sponsor and stating any further queries they may required for their final consideration. If necessary, ETF will arrange meetings with the relevant members of the project team to explain further details on design and construction aspects of the "Low Carbon Building". In addition, ETF will arrange PKU and finalized sponsor(s) to sign formal sponsorship agreement in Hong Kong SAR to stipulate all terms and conditions in details. For enquires relating to this sponsorship program please feel free to contact us at:

1) Dr. William C.G. KO, SBS, Founding President.
Tel: (852) 2111 4600 Email: william@etf.org.hk

2) Ms. Junia HO, JP, Vice President
Tel: (852) 9024 1138 Email: junia@etf.org.hk

3) Prof. Alex NG, Presidential Advisor
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APPENDIX

Technical Fact Sheet on the Design of PKU Low Carbon Building

1. Building Envelope

Thermal transfer coefficient of the building envelope (unit: W/(㎡·k)): External walls (including non-transparent curtain wall) ≤0.80, external windows (including transparent curtain wall) 1.8~2.3, window/wall area ratio of single direction 0.35~0.75. Area ratio of roof transparent to non-transparent part less than 0.2, glass ceiling ≤2.7, others parts ≤0.6, sun shading coefficient ≤ 0.50. Comply with *Standard of Energy Saving Design of Public Architecture* (DBJ 01-621-2005) of Peking.

Main elevation is suggested to adopt completed walls with light weight and heat protecting feature, apply recycling thermal insulation materials and the blocks with low cost and mature technique. Energy consumption modeling can be calculated in the next designing phase.

2. Ventilation Strategies

1) The building is making maximum use of natural ventilation via openable windows, which take the proportion of more than 30%. Promote ventilation efficiency with complex application of the outdoor conditions, such as to organize and introduce natural ventilation with the elements of surrounding environment, architecture layout, architecture construction, solar radiation, climate, indoor heating source etc. And to realize favorable natural ventilation with atrium, double curtain wall, doors and windows, and elements on the roof in terms of architecture construction.

2) Concerning the restrictions of planning condition and architecture scale, it is not sufficient for practical usage by total natural ventilation. In addition, considering the weather condition of Beijing with serious seasonal air pollution and noise pollution, to adopt direct natural

ventilation will introduce the dirt and noise into the interior space, which will bad effect on people physical condition. Therefore, it is reasonable to design a complete air circulation passage by adopting natural ventilation system with mechanical assistant. The passage should be based on ecological air-conditioning and speed up interior ventilation mechanically.

3) There are still some other strategies in the air-conditioned area, as follows: adopting free cooling storage by phase change material(PCM) with night ventilation; recovering energy from exhaust air to precool/preheat fresh air ; taking measures in air-air system for changing the ratio of fresh air , control the ratio of fresh air in winter/summer according to the concentration of CO_2 , the temperature and humidity of indoor air , and run under full fresh air in transitional season according to outdoor temperature.

3. Atrium

To design two courtyards or atriums with different styles according to architectural function division, one of which functions as the open interior courtyard in connection with the sunken square on the first floor providing natural lighting and outdoor air for underground architecture and rooms along the interior courtyard. The other one is covered with ceiling, which adopts effective sun-shading methods.

Automatic louver is installed on the ceiling with the openable part as 25%. It will be open in summer time, which improves ventilation efficiency with temperature difference of the atrium. While in wintertime, it will be closed to increase indoor temperature with greenhouse effect.

Further CFD calculation and modeling analysis needs to be conducted concerning airflow organization to finalize the optimum scheme.

4. Energy Recovery

Energy recovery efficiency: summer condensation heat from chiller can be reclaimed by selecting heat-recovery ground-source heat pump according to the domestic hot water requirement of this project .selecting

full heat exchangers, with the full-heat net recovery efficiency no less than 60%, for reclaiming energy from exhaust air.

5. HAVC Equipment Efficiency

In terms of efficiency ,HAVC equipments selection will be complied with *Design standard for energy efficiency of public buildings* (DBJ 01-621-2005) of Peking, products of higher efficiency will have priority in the selection. Service radiuses of the HVAC system will be controlled to reduce the power consumption of unit air volume of fan and the ratio of axial power to transfer heat quality (ER).

6. Indoor Environment

Installing Auto-adjusting devices at the HVAC terminal to control indoor temperature and humidity in the acceptable scope (temperature19~27℃ and relative humidity 30%~60%).

According to national standards, fresh air will be guaranteed in public area as $30m^3/(h \cdot p)$. Installing mechanical exhausting equipments with supply equipments air at the place with high temperature and heat as well as polluted air; Installing Low & medium efficiency filters at the air inlet, Sterilizers will also be adopted in air supply duct, if necessary, to guarantee the indoor air quality.

Installing a monitoring & control system for indoor air pollution to collect data of CO_2 concentration, temperature, humidity, and air pollution concentration, which will be used to control and adjust HVAC system and guarantee acceptable IAQ.

7. Lighting

Natural light will be utilized according to the architecture design with the unit LPD value as 11 W/m^2 for regular offices, meeting rooms and classrooms which complies to the *standard for lighting design of buildings* (GB50034-2004), and $9W/m^2$ is the objective value we are trying to get by using light source with high efficiency (with comparatively higher cost). By this

method, LPD value will be reduced to save energy as long as it complies with the illumination level. Concrete quantity of light saving will be determined after the selection of light source and its price. Lighting area above ground comply national relating standards with maximum natural lighting. Utilize surrounding sunken squares and patio for basement lighting so as to provide natural illumination for basements.

8. Photovoltaic Panels

Cost of solar photovoltaic generation is 1Wp/70 RMB (Wp refers to Watts peak value as 0.7 W), with solar panel area as 1Wp/0.1 ㎡. Solar photovoltaic panel will be installed in accordance of the architecture roof design, which could only be the assist method of the building power supply for it is highly influenced by building orientation. The maximum proportion is 10% of buildings total electricity consumption for the reason of the power system.

9. Solar Water Heating

No solar heating water system as there is no need for heating water in this construction.

10. Recycled Materials

Sustainable renewable construction material is adopted in which the insurant complies with the existing national standard GB 1858～GB 18588 and *Limit of radionuclide in building materials* (GB 6566).

1) To make modest simplified architecture elevation and to reduce slather used decorated material. To avoid repeated decoration by integrated construction of structure and decoration engineering.

2) Optimize architecture structure system with light weighted concrete unit floor slab, steel plane truss as horizontal bearing elements, which forms the structure system with steel columns and steel frames. The advantages of the system are that it costs less material with light weight, and the second is that thanks to the hollow truss, all the piping work for ventilation,

plumbing and electricity can be installed at the building roof structure level and there is no need for preserving certain room at the roof structure. High-Grade Cement and High Strength Steel are used to reduce cost.

3) Recycled material weights more than 10% of the total construction material on the condition of security and non-pollutive. Movable separations are adopted for offices to reduce material waste and garbage producing during redecoration.

With required performance, adopt the waste for raw material production including renewable glass, gypsum panel, felt and blocks etc. with the proportion of no less than 30% of the similar building material. Concrete selected material and proportion will be determined in the further designing process.

11. Grey Water Recovery

To collect rainwater from unit building roof, exterior rainwater within redline, which includes the following two aspects:

1) Improve ground water content. To get outdoor renewable rainwater with green Infiltration, dankly ground Infiltration, outdoor infiltration elements such as pools or wells.

2) Used water will be reused for washroom water supply and landscape water supply. To collect rainwater from unit building roof ascended to water devices after water collection, screen, sediment, deposition, filtration, disinfection, and water storage. The washroom water consumption takes the proportion 60% of the building consumption. If it is not sufficient, apply municipal intermediate water for additional supply.

12. Overall Building Performances

Annual energy consumption, additional expense and CO2 exhaustion will be calculated with certain software such as EnergyPlus for further simulation and analysis, which can be conducted by professional

companies entrusted by the client. The technical center of our institute can also provide annual energy consumption calculation under the client's request.