Beijing Rooftop Solar PV Scale-Up
(Sunshine Schools) Project

Environmental Management Plan

Owner Company:
Beijing YuanShen Energy-saving technology Co., Ltd

EIA Company:
Energy and Environmental Development Engineering Limited

August 2012, Beijing
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1 General Information

1.1 Background

Currently the environmental pressures, such as the shortage of global fossil energy resources and climate change, have increased. It is difficult for relying on limited fossil resources to achieve the coordinating development of economy, society and environment. New energy and renewable energy like solar power, wind and biomass have been treated as important strategic alternative source by governments over the world. Especially the photovoltaic power generation as one of the globally focused renewable energy technologies has broad developing prospects without the restriction of energy resources, raw materials and application environment.

In order to develop the photovoltaic power generation in a larger scale, the national Renewable Energy Development 12th Five-Year Plan has indicated that the cumulative installed capacity of solar power shall reach 15GW in 2015 and reach 500GW in 2020. In the 12th Five-Year Plan, 100 new energy demonstration cities and 1000 new energy demonstration sites shall be built in 2015. It proposes to promote the distributed photovoltaic power generation, and combine with other renewable energy technical demonstration to satisfy the energy demands of electricity, heating and cooling. 30 new energy micro-grid demonstration projects for exploring the technical characteristics and business models of grid-friendly renewable energy distributed generation with energy storage devices shall be built up before 2015. It aims to lay the foundation for the further large-scale promotion of renewable energy distributed generation.

Based on the Renewable Energy Law, National Long-term Technology Development Plan (2006-2020), and Renewable Energy Long-term Development Plan (NDRC Energy [2007] No.2174) etc. files, the central government has allocated some funds from the renewable energy special funds. The funds shall be used for promoting the technological progress and scaled development of national photovoltaic power generation industry, as well as fostering the strategic emerging industries. The form of the "Golden Sun" demonstration project model will be used as the base for supporting the key photovoltaic technologies of application and industrialization in various fields.

Besides, Beijing Municipal Government intends to implement six solar power ‘Golden Sun’ projects. In order to accelerate the development and utilization of solar energy, and revitalize the local new energy industry, it will build up a first-class ‘Sunny City’. One of aims is to accelerate the implementation of the ‘Sunny Campus Project’. It will build several projects like solar hot water, solar light, small grid-connected photovoltaic power generation and solar science classrooms for qualified primary schools and secondary schools in Beijing, as fostering teenagers the use of renewable-conscious.

As the above context, the Beijing Municipal Education Commission, the Beijing Municipal Development and Reform Commission, and Beijing Municipal Finance Bureau have jointly issued a notice On the Construction of the Golden Sun Project of Sunny Campus in Beijing in 2011. It has explicitly pointed that to involve the project into the general plans of school planning and saving-type campus building-up plan. Furthermore, it shall well prepare the
selection, survey, in-situ implementation and operation of school implementation, as well as to increase the facility-using of new energy and renewable energy on campus for fully using the teaching functions. Beijing YuanShen Energy-saving technology Co., Ltd is the implementing agency, the duty of them is to coordinate with campus for completing the preparation and construction jobs, in order to achieve the transition of operational phase and ensure the normal operation of power generation facilities.

The Word Bank has attached importance to developing the energy-saving and emission reduction work in China. One of loan supporting projects is the energy-saving and emission reduction project. The energy-saving and emission reduction demonstration project in Beijing has formally been included in the 2012-2013 fiscal year alternative project plans of National Development and Reform Commission and the Ministry of Finance.

The Sunny Campus Golden Sun Project is one of the sub-projects of Energy-saving and Emission Reduction demonstration project in Beijing. It is implemented the roof construction of photovoltaic power generation system in well-conditioned municipal schools and kindergartens over 1000. This project has been allocated 1421.7 million China Yuan.

The implementation of this project is aiming to try and accumulate experience for making larger-scale of Sunny Campus Golden Sun project in Beijing. It will take in several areas, such as business model, interests of all parties, economic data, technical solutions, grid connecting and risk prevention.

1.2 Objective of the environmental management plan

The purpose of EMP is to develop a couple of technically feasible, financially sustainable and operational environmental strategies for inevitable environmental impacts. It shall make sure the contractor, supervisor, operator and environment management sector, as well as the construction measurement and arrangement of environment mitigation and management during the implementing period. It shall try the best to eliminate or compensate the negative impacts for society and environment, and be minimized to an acceptable level. Specific objectives include:

(1) To explicated the environmental management obligations of contractors and operators

EIA Sector and Design Company are responsible for detailed in-situ checking and confirming of environmental conservation objectives, then put forward effective environmental mitigation measures and incorporated into project design as the contractual obligations of contractors and operators.

(2) As the operation guidelines for the environmental management

The environmental management plan which proposed the environmental monitoring plan for construction and operation period could ensure the effective implementation of the environmental mitigation measures. It will be provided to construction supervision sector, environmental supervision sector and other related departments in construction and operation period as the Environmental Protection Text. It has clarified responsibilities and roles of the relevant functional departments, as well as the communication ways between each department.
(3) Ensure the outlay of environmental management actions

The estimated outlays of environmental conservation, environmental management, environmental supervision and capacity building have been mentioned in Environmental Management Plan. It shall explain the sources of funding to ensure the smooth implementations of environmental management actions, including the labor fee and operating expenses.

The role of Environmental Management Plan is to avoid and control the environment impact during the process of project implementation and operation, in order to put forward the necessary implementation for impact mitigation measures, legal supervision means and safeguards measures. It is the important link between environmental impacts and EIA evaluation and the detailed description of the effects mitigation measures and alternative measures. As each environmental management measure, the Environmental Management Plan has defined the technical content, investment estimation, implementation plan, the functions of governmental agencies and the sources of funding. In order to achieve the reduction targets, all approaches which mentioned in the Environmental Impact Assessment Report and Environmental Management Plan must be implemented.

1.3 Technical details for authorization

The Environmental Management Plan has been modified based on the Construction Project Environmental Impact Assessment Report. The Environmental Management Plan is a separate file, including all environmental conservation actions during the construction period and the operation period. It has implemented the mitigation measures for adverse effects, environmental supervision and environmental management and provided an action guide and framework.
2 Environmental management institution, Framework of law and Safeguard policy in WB

2.1 Environmental management institution

According to the administrative spirit of the Environmental Protection Law of the People's Republic of China and Construction Project Environmental Protection Management Regulations, the Beijing Municipal Environmental Protection Bureau is responsible for the approval of this EIA report table. Beijing Municipal Environmental Protection Bureau is the environmental management agency of this project. The main duty of this Bureau is to propose environmental protection requirements according to the project environmental impact assessment report, to coordinate between departments of environmental management, and to be responsible for organizing the "three simultaneous" acceptance of environmental protection facilities. It also includes the execution of project implementation program, and the implementing technical standards of day-to-day supervision of the environmental management. World Bank Loan Project Office is responsible for the project planning, design, supervision and management of environmental protection projects, as well as to organize citywide environmental project management skills training. The supervising engineer which commissioned by the owners is responsible for the environmental supervision of project construction process.

The project owners intend to set up a dedicated environmental management department which is responsible for the environmental management of different stages, implementation of environmental laws and regulations, checking the environmental conservation status, promotion of the advanced technologies and experience, and to organize the technical training for related staff. After the end of construction, the management agency shall be revoked, then the operational management institution shall begin to work. According to the specific situation, a certain period of crossing is allowed.

2.2 Legal and regulatory framework

2.2.1 Environmental laws and regulations

(1) Environmental Law of the People's Republic of China
(2) PRC Environmental Impact Assessment Law
(3) Water Pollution Prevention Law of the People's Republic of China
(4) Air Pollution Prevention Law of the People's Republic of China
(5) Noise Pollution Prevention Law on Environment of the People's Republic of China
(6) Solid Waste Pollution Prevention Law in the People's Republic of China
(7) Water Law of the People's Republic of China
(8) Construction Project Environmental Protection Management Regulations
(9) Environmental impact assessment of public participation in the Interim Measures
(10) Disclosure of Environmental Information (Trial)
(11) Beijing Water Pollution Control Ordinance
(12) The People's Republic of China Air Pollution Prevention Law (Implementation in Beijing)
(13) Beijing Construction Engineering Construction site management approach
(14) Beijing Implementation of the <Water Law of the People's Republic of China> Measures
(15) Beijing Municipal People's Government Order No. 181, Beijing Noise Pollution Prevention Measures
(16) Implementation of the national "Construction Project Environmental Protection Classification Management Directory Supplementary Provisions in Beijing"

2.2.2 Environmental impact assessment of technical guidelines and specifications

(1) Environmental Impact Assessment Technology Guide - General (HJ/T2.1-2011);
(2) Environmental Impact Assessment Technology Guide - Atmospheric Environment (HJ2.2-2008);
(3) Environmental Impact Assessment Technology Guide - Surface Water Environment (HJ/T2.3-93);
(4) Environmental Impact Assessment Technology Guide - groundwater environment (HJ610-2011);
(5) Environmental Impact Assessment Technology Guide - acoustic environment (HJ2.4-2009);
(6) Environmental Impact Assessment Technology Guide - ecological impact (HJ/T19-2011);
(7) Residential building codes (GB 50368-2005).

2.3 Environmental standards

2.3.1 Environmental quality standards

(1) GB3095-1996 Air Quality Standards
(2) GB3838-2002 Surface water environmental quality standards
(3) GB3096-2009 Acoustic environmental quality standards

2.3.2 Pollutant emission standards

(1) GB 12523-2011 Construction site environmental noise emission standards
(2) DB11/501-2007 Atmospheric pollutant emission standards
(3) DB11/307-2005 Water pollutant discharge standards
2.4 Word Bank security policy

(1) OP/BP 4.01 Environmental Assessment
(2) BP17.50 Information Disclosure
(3) Environmental, Health, and Safety General Guidelines
3 Description of subproject

3.1 Subproject objective

(1) Increase the proportion of energy consumption of renewable energy in the optional schools, reduce the consumption of non-renewable energy and reduce carbon dioxide emissions though the demonstration project of energy saving and emission reduction in the field of education in Beijing.

(2) Promote the dialogue with National Grid for policy of the implementation of photovoltaic power generation and metering through the implementation of the project using contract energy management mode as an opportunity.

(3) Help the majority of young people in Beijing to understand the status and role of the solar energy and publicize solar achievements and future direction, and arouse the students' families and related community on important of energy saving and emission reduction.

(4) Promote the coordination of the various stakeholders (government, industry authorities, enterprise, social and public institution), and coordination of between administration management and business management.

3.2 Subproject overview

Beijing YuanShen Energy-saving technology Co., Ltd. (hereinafter referred to Yuanshen Company), which is the implementation agency of Beijing Sunshine Campus Golden Sun Project, is one of the subsidiaries of Beijing Energy Investment Holding Co., Ltd. Yuanshen Company establish a total capacity of 100MW polysilicon photovoltaic power generation system in about 1000 schools in according with conditions of building. Component layout way is mainly fixed, partly daily tracking. Supporting construction is inverter and related facilities. Inverters unify use less than 20kW outdoor inverter and electricity generation yearly is about 110 million kWh.

The total building area of 1000 schools is about 12 million m$^2$; including a total roof area of about 2 million m$^2$ with condition of installed PV power plant (middle school roof area is about 1.5 million m$^2$ and elementary school roof area is about 0.5 million m$^2$).

Beijing Sunshine Campus Golden Sun Project is divided into two parts, Phase A and B. Phase A is aim to construct 5MW rooftop solar photovoltaic power user side and network systems for 100 schools in Beijing from 2011 to 2012 and support experience for Phase B. Phase A is approved by the Beijing Municipal Development and Reform Commission on July 25, 2011 ("Approval of Beijing Sunshine Campus Golden Sun Project " Beijing Municipal Development and Reform Commission [2011]No.1269).Phase B is approved by the Beijing Municipal Development and Reform Commission on March 9, 2012 ('Approval of Beijing Sunshine Campus Golden Sun Overall Project' Beijing Municipal Development and Reform Commission [2012]No.289) to select other 900 schools to install 95MW rooftop solar photovoltaic power user side and the network systems.
3.2.1 Location and relation with surrounding

The project is planned to be located in about 1,000 schools, distributed in different districts and counties in Beijing. Due to many reason, e.g. willingness of school, project implementation stage, most of schools aren’t be determined. Identified schools are listed in the Annex.

It is investigated that schools located within the city and some suburban county are in the residential area surrounded by mostly residential buildings, bungalows and other buildings, not involved other sensitive environmental protection goals. Moreover schools basically don’t set up night classes (except some boarding schools) while some schools exists on Saturdays and holidays and some school have tutorial classes and some teachers live on campus.

3.2.2 Construction scale and content

The proposed total investment of the project is estimated to be 1.4217 billion Yuan. The total installed capacity is 100MW divided to two phases. Phase B will install 95MW rooftop solar photovoltaic power user side and network systems for 900 schools.

Selected schools will install roof-mounted solar power panel and auxiliary facilities. The installation way is load-bearing and installed capacity of each school is according to each transformer capacity and available area.

The solar cell power generation system consists of solar array, array junction boxes, inverters and other parts. The solar panels produce DC power under the sunlight, which will be converted to AC power by inverter automatically according to current voltage, frequency, and phase of commercial power grid with the same electrical characteristics.

The lists of main and auxiliary facilities used in the projects during the power is generated are shown in Table 3-1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment name</th>
<th>Type</th>
<th>Quantity</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PV module</td>
<td>Polycrystalline</td>
<td>1.555</td>
<td>MWp</td>
</tr>
<tr>
<td>2</td>
<td>DC lightning junction box</td>
<td>Multiple way in- one way out</td>
<td>67</td>
<td>Set</td>
</tr>
<tr>
<td>3</td>
<td>Grid connected inverter</td>
<td>5kVA</td>
<td>5</td>
<td>Set</td>
</tr>
<tr>
<td></td>
<td>Grid connected inverter</td>
<td>10kVA</td>
<td>29</td>
<td>Set</td>
</tr>
<tr>
<td></td>
<td>Grid connected inverter</td>
<td>20kVA</td>
<td>62</td>
<td>Set</td>
</tr>
<tr>
<td></td>
<td>Grid-connected power box</td>
<td>380V 10kW</td>
<td>4</td>
<td>Set</td>
</tr>
<tr>
<td></td>
<td>Grid-connected power box</td>
<td>380V 15kW</td>
<td>2</td>
<td>Set</td>
</tr>
<tr>
<td></td>
<td>Grid-connected power box</td>
<td>380V 20kW</td>
<td>4</td>
<td>Set</td>
</tr>
<tr>
<td></td>
<td>Grid-connected power box</td>
<td>380V 25kW</td>
<td>3</td>
<td>Set</td>
</tr>
<tr>
<td></td>
<td>Grid-connected power box</td>
<td>380V 30kW</td>
<td>15</td>
<td>Set</td>
</tr>
<tr>
<td></td>
<td>Grid-connected power box</td>
<td>380V 40kW</td>
<td>15</td>
<td>Set</td>
</tr>
</tbody>
</table>

Table 3-1 Lists of main and auxiliary facilities used in the projects (Partly)
<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment name</th>
<th>Type</th>
<th>Quantity</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grid-connected power box</td>
<td>380V 50kW</td>
<td>3</td>
<td>Set</td>
</tr>
<tr>
<td></td>
<td>Grid-connected power box</td>
<td>380V 60kW</td>
<td>1</td>
<td>Set</td>
</tr>
<tr>
<td></td>
<td>Grid-connected power box</td>
<td>380V 70kW</td>
<td>1</td>
<td>Set</td>
</tr>
<tr>
<td>5</td>
<td>Cable</td>
<td>ZRC-YJV-0.6/1-1×4</td>
<td>8883</td>
<td>m</td>
</tr>
<tr>
<td></td>
<td>Cable</td>
<td>ZRC-YJV-0.6/1-2×10</td>
<td>644</td>
<td>m</td>
</tr>
<tr>
<td></td>
<td>Cable</td>
<td>ZRC-YJV-0.6/1-3×10+1×6</td>
<td>4503</td>
<td>m</td>
</tr>
<tr>
<td>6</td>
<td>Cable protection pipe</td>
<td>DN20</td>
<td>4165</td>
<td>m</td>
</tr>
<tr>
<td></td>
<td>Cable protection pipe</td>
<td>DN25</td>
<td>594</td>
<td>m</td>
</tr>
<tr>
<td></td>
<td>Cable protection pipe</td>
<td>DN32</td>
<td>4157</td>
<td>m</td>
</tr>
<tr>
<td>7</td>
<td>Environment tester</td>
<td>Monitoring wind speed, wind direction, radiation, temperature and other environmental parameters</td>
<td>35</td>
<td>Set</td>
</tr>
<tr>
<td>8</td>
<td>Communication terminal cabinet</td>
<td>Including data acquisition and transmission server and software</td>
<td>35</td>
<td>Set</td>
</tr>
<tr>
<td>9</td>
<td>Computer cable</td>
<td>DJYPV 2×2×1</td>
<td>3500</td>
<td>m</td>
</tr>
<tr>
<td>10</td>
<td>Network cable</td>
<td>Super VI network cable</td>
<td>1000</td>
<td>m</td>
</tr>
<tr>
<td>11</td>
<td>Electric energy meter</td>
<td></td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Grounding flat iron</td>
<td>-40X4</td>
<td>3</td>
<td>ton</td>
</tr>
<tr>
<td>13</td>
<td>The battery bracket</td>
<td>41 PV special materials</td>
<td>1.555</td>
<td>MW</td>
</tr>
<tr>
<td>14</td>
<td>Liquid crystal display</td>
<td>32 inch</td>
<td>35</td>
<td>Set</td>
</tr>
<tr>
<td>15</td>
<td>Miniature</td>
<td>1.5m×1.5m</td>
<td>35</td>
<td>Set</td>
</tr>
<tr>
<td>16</td>
<td>Battery plate</td>
<td>245Wp</td>
<td>2</td>
<td>Set</td>
</tr>
<tr>
<td>17</td>
<td>Cable</td>
<td>ZRC-YJV-0.6/1-1×4</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
3.2.3 Construction program

The project's major construction programs are summarized below:

(1) Position line

Determine the position of engineering PV module infrastructure, grounding system and grid inverter based on-site solar power station orientation, engineering construction drawing, benchmark points and control points.

(2) Concrete frusta installation

- Lay prefabricated concrete frusta in place according to the basic location map.
- Lay prefabricated foundation bed smoothly and orderly, and shall not damage the roofing layer.
- Smear anticorrosive paint on steel foundation bed and inserted piece on top of concrete bed and properly protect them.

(3) Solar PV stent installation

- Install solar PV stent and steel structure stent and weld.
- Prepare antiseptic treatment according to the design requirements.
(4) PV component installation

- Fix the lowermost battery components of arrays in accordance with the requirements of the drawings and then fix other components of arrays from the bottom to the top.
- Fix PV component group on stent and connector.

The main equipment in each construction site is as follows:

**Table 3-2 Lists of construction equipment (in one site)**

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Rated Power</th>
<th>Quantity (unit)</th>
<th>Total</th>
<th>Including</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Own</td>
<td>Buy</td>
</tr>
<tr>
<td>Crane</td>
<td>QY8</td>
<td>105</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Electric drill</td>
<td>GSB 18-2-LI</td>
<td>305W</td>
<td>8</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Electric Hammer</td>
<td>GSB 16RE</td>
<td>650W</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Cutting machine</td>
<td>J3G-400</td>
<td>2.2KW</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Welding machine</td>
<td>BX1-330</td>
<td>6.4KW</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
4 Environmental screening and management program

It is implemented for 1000 schools located in different districts and counties in Beijing. The main factors of determining whether implemented are surrounding environment, available area of implementation, installed capacity and school willingness. There are 59 identified schools.

Due to the wide scope of the project, the differences of school environment and campus internal situations and management system exist. We conduct a survey of identified schools and formulate procedure of project environmental screening and management. The procedure is aim to provide environmental screening and assessment management guide for the project owner of Beijing the Sunshine Campus Golden Sun engineering construction projects. It is included about subproject assessment content, process and responsibility according to the laws and regulations of EIA in China and the World Bank’s EIA policy and related processes in OP/BP4.01.

The environmental screening and management processes of the project for project owner are as follows:

1. Carry out inspections on project surrounding environment to determine the project whether if in the environmentally sensitive area or the forbidden area and determine project site feasibility and screen schools.

2. Investigate school basic information, surrounding environment, and teachers and students opinions to determine project sensitivity and whether if need special protective measures. The measures should be included in the contractor’s construction contract if need.

3. Investigate project surrounding neighborhood scale and project construction impact to determine whether of make public project environmental impact conditions and environmental management plan.

Specific environmental screening and management of the program is shown below:
Selected items in the list

Understand the basic situation, the surrounding environment of the school and campus opinion

Recognition the potential environmental impact

Manage according to the proposed EMP of environment management measures.

Whether site selection is ok

School environment survey

No

Project exclusion

Yes

Selected items in the list

Recognition the potential environmental impact

Distinction with EMP

Yes

Identify process of environmental distinction

Reduce environmental impact

Involved the environmental measures into contract executed by contractor

Supervise implementation of environmental measures and regularly report to project owner

No

Distinction with EMP

Impact for residents

No public for residents

Little

Big

Public for environment impact in construction field and issue environmental management plan to related schools

Figure 4-1 Environmental screening and management flowchart
Environmental screening and management processes are as follows:

Beijing Sunshine Campus Golden Sun Project

Environmental impact and measures screening table

<table>
<thead>
<tr>
<th>School Number:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>School Name:</td>
<td></td>
</tr>
<tr>
<td>Address:</td>
<td></td>
</tr>
<tr>
<td>Project Contact:</td>
<td>Phone:</td>
</tr>
<tr>
<td>Installation site, roof area:</td>
<td>Installed capacity:</td>
</tr>
</tbody>
</table>

Table 4-1 Planned start and end time of construction

<table>
<thead>
<tr>
<th>Environmental problems screening</th>
<th>Conclusion and necessary specific measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whether involved special environmentally sensitive conservation goals (such as heritage, groundwater source protection zone)</td>
<td></td>
</tr>
<tr>
<td>Project equipment installation site, whether involving office buildings, school buildings and protecting building.</td>
<td></td>
</tr>
<tr>
<td>Sensitive point of distribution around the project site, including the position, distance and scale</td>
<td></td>
</tr>
<tr>
<td>Construction areas and access and whether there is a potential safety hazard?</td>
<td></td>
</tr>
<tr>
<td>Transport of equipment and materials, stacking and installation process will make inconvenience to students?</td>
<td></td>
</tr>
<tr>
<td>Transport of equipment and materials, stacking and installation process will make inconvenience to residents?</td>
<td></td>
</tr>
<tr>
<td>Whether the project environmental management plans will be sent to the project schools and participate group?</td>
<td></td>
</tr>
<tr>
<td>Public participation in history: (time, number of participants and participation form, main problems and solutions)</td>
<td></td>
</tr>
</tbody>
</table>

Special environmental impact mitigation measures: (that is not explicitly covered by the general environmental management measures in the Environmental Management Plan)

<table>
<thead>
<tr>
<th>Site visitor:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners Auditor:</td>
<td>PMO approval:</td>
</tr>
<tr>
<td>Date:</td>
<td>Date:</td>
</tr>
</tbody>
</table>

Environmental impact and measures that are not listed in the environmental management plan and environmental issues identification process against special items for environmental
impacts are as detailed below:

(1) School which belongs to special school

Develop targeted pollution prevention measures, such as establish warning signs so that persons with disabilities are able to recognize on the construction period.

(2) Exist heritage, scenic area, water source protection zones and other special sensitive protection targets around the project

Set the following protective measures:

- Strengthen construction personnel management and not damage the heritage, the surrounding scenic landscape, as well as water source protection areas;
- Stack construction vehicles and materials considered the impact on heritage and not affect the normal traffic;
- Prohibiting land occupation of heritage

Equipment installation location should be considered by the surrounding influence and solicit cultural department opinion if necessary.

(3) Other environmental issues

If exists other environmental problems unsolved and not judged around the projects, a professional environment impact assessment personnel or environmental consulting expert will assess and propose appropriate measures.
5 Environmental management plan organization

Environmental management plan requires the involvement of all parties, and give full attention to their respective functions in order to ensure the scheme implementation. It is include such as the project sponsor (i.e., Project Management Office (PMO) or project owners), contractors and supervision company. One agencies / department organizational structure and contact lines listed in the following chart. The roles and responsibilities of the major departments are also listed in the following chart.

In order to get satisfactory results of the project's environmental management plan, the project owner will be entrusted to the supervision company to monitor the environmental management plan of the project during the construction period. The owner's Environmental supervision consultant reports directly to the project owner. The intervention of supervision Company can ensure the full implementation of the project's environmental management plan. Supervision Company checks vivificates and approves the overall environmental performance by the way of supervision and inspection, which will supply the credibility of the report effective results, and make sure the appropriate regulatory procedures or codes of practice of project environmental management plan fully abbey.

![Diagram](Figure 5-1 Organization chart of the construction phase environmental management plan)

5.1 Project owner

The project owner (Yuanshen) is ultimately responsible for the environmental performance of the project during the construction and operation of the site security. As daily management institution, the company is responsible for managing all aspects of project preparation and construction. The project owner will be fully responsible for the project's environmental, safety, and in particular the following aspects:

(1) Assess and prepare EIA report for the project, including support and supervise environmental evaluation team to complete EIA report and environmental management plan in order to meet the requirements of the relevant laws and regulations and security policy of the World Bank and get approved by regulatory authorities and get permissions.
from the security maintenance file of the World Bank.

(2) Assess and prepare EIA report for the project, including support and supervise environmental evaluation team to complete EIA report and environmental management plan in order to meet the requirements of the relevant laws and regulations and security policy of the World Bank and get approved by regulatory authorities and get permissions from the security maintenance file of the World Bank.

(3) Integrate project mitigation measures during the construction and other environmental protection measures supervisors to construction contract, including the environment, the safety requirements. Organize contractors and construction supervision training to ensure other environmental management programs implementation and regularly inspections of environment and safety on site.

(4) Consult and / or contact for the local public, the project affected people, related agencies, the World Bank and other stakeholders during project preparation and construction phase to fully understand the course of the project, potential problems and mitigation actions, and listen and respond to their concerns, suggestions and requirements on the environment and public protection.

5.2 Contractor and environmental staff

Obligations of contractors and their environment, including, but not limited to:

(1) Strictly measure implement listed in the Environmental Management Plan;

(2) Strengthen the cooperation among the environmental supervision consultancy and construction supervision companies and owners;

(3) Follow the relevant environmental laws and requirements;

(4) Work in the range of contract and other tender conditions;

(5) Equipped with 1-2 full-time environmental commissioner for each contractor cooperated with the supervision company to make sure the implementation of the mitigation measures, inspection on-site and any corrective measures indicated by owners and / or supervision company;

(6) Provide and update possible work activities and negative environmental information for the supervision company;

(7) Carry out an investigation and submit recommendations on mitigation measures, and implement remedial measures to reduce the environmental impact if there is a breach of contract or disjunction;

(8) Stop the adverse impact construction activity after received owners’ instructions or Supervision Company’s’ instructions. If necessary, it is proposed to carry out corrective actions and use another construction method to reduce environment impact;

(9) Strict comply with the instructions of the environmental management plan and project owners’ supplemental agreement.
5.3 Project Management Company

Commissioner's responsibilities include:

1. Review the construction organization design to ensure compliance with project engineering design and environmental management plans to take into account environmental protection and mitigation. The construction will begin until the environmental review finished.

2. Provide necessary help to the Supervision Company for auditing

3. Regularly supervise the contractor's environmental management staff, e.g. supervise the contractor's environmental management staff who did not perform their duties or failed to comply with the requirements of the contract, instruct the contractor to replace the contractor's environmental management staff;

4. Instruct the Contractor to take remedial action within the stipulated time. If there is behavior of breach contract and strong public complaints at the contractor's environmental effects, the supervising engineer will command the contractor to rectify, change or stop working, and report to the relevant agencies and project owners.

5. Supervise contractor's activities to ensure of meeting the requirements of the environmental management plan and the provisions of the contract.

6. Instruct the contractor to take action to reduce the impact and in accordance with the procedural requirements of the environmental management plan to prevent the breach behavior/ disjointed phenomenon.

7. Investigate complaints according to procedures.

8. Review the construction organization design meeting the requirements of the environmental impact assessment report and environmental management plan, particularly with requirements of on-site environmental and safety management and mitigation measures on behalf of the owners.

9. Monitor and inspect contractor site environment management system staff and construction supervision engineers, including their performance, experience and ability of dealing with on-site environmental issues. The Supervision Company has the right to recommend owners to replace the contractor and / or supervising engineer environmental management personnel if it is necessary.

10. To daily check environmental management plan contractors and implementation of supervision.

11. The contractor only gets paid after solving the problem and getting recognized by the environmental supervision if the contractor disobeys environmental and safety regulations.

12. Audit the environmental impact assessment report on the recommendations of the environmental protection measures and requirements.

13. Check and identify validity of mitigation measures and regularly report options to project
owner;

(14) Investigate and assess complaints of local residents and potential environmental problems; Order the contractor to take corrective action in response to the public. The supervision company must be involved in the coordination when environmental or safety emergency happened.

(15) Monitor the environmental performance of the contractor, if any breach contract and / or breach of the requirements of the environmental management plan, it should temporarily stop work from the owners and provide corrective measures and / or penalties recommended if necessary.

(16) Provide timely reports to the owners and environmental management agencies and other relevant institutions.

(17) Participate in environmental inspection, review and other related activities to meet the requirements of the World Bank group, owners and relevant government agencies.
6 Construction project environmental impact mitigation measures

6.1 Major environmental impact

6.1.1 Construction period

Pollutants generated in the project construction process are as follows:

(1) Waste gas

The waste gas is generated from construction materials, transportation vehicles, etc.; welding fume during the welding and structure process and painting gas during the surface treatment process.

Based on similar construction, dust particles particle size is generally more than 100μm, easy settled in flying process, up to 30mg/m3, will exceed value two standard limits of Air Quality Standards (GB3095-1996).

The amount of welding fume during the welding and structure process and painting gas during the surface treatment process are small because of the welding and structure are little.

(2) Noise

The noise is from construction equipment and transport vehicles. According to analog data, the noise source strength reaches 40 ~ 90dB (A).

(3) Solid waste

The solid waste is generated from construction waste and waste materials and packaging of solar panels and other facilities and so on, if not properly treated, it will cause dust secondary pollution and impact campus landscape.

(4) Light pollution

Light pollution is generated from night construction lighting and welding operation, which may affect the normal life of surrounding residents.

6.1.2 Operation period

The solar panels generate electricity and the surfaces of panels are regularly cleaned by the project contractor and replaced according to the life of solar panels and components.

Pollutants generated during the process of project operation are as follows:

(1) Sewage

It need a regular maintenance of solar board and cleans them after operation in order to avoid decline of power generation efficiency. It mainly due to the surface of the solar panels is falling dust. So cleaning wastewater pollutants contain the suspended substance (SS) , about 300mg/m3, to meet Emission limit values of water pollutions discharged into the municipal sewage treatment plant (standard value: 400mg/m3)of Beijing Water pollutant discharge standards (DB11/307-2005).
(2) Solid waste

The solar panels and component life is approximately 20 to 25 years after operation and renew when reaches lifespan. Abandoned solar panels and components are electronic waste and sent to the national e-waste disposal units by property unit. So there is no effect on campus.

(3) Light pollution

Solar panels, installed in a campus building roof, receive sunlight. It may cause light pollution impact on the surrounding sensitive building because of reflection rays.

The solar cell module comprises monocrystalline silicon, polycrystalline silicon, and silicon membrane battery components. Monocrystalline silicon, polycrystalline and silicon membrane are used as the absorbing layer of the solar cell material, only have differences with silicon atoms structures. Monocrystalline or polycrystalline silicon have a thickness of about 180 microns, a silicon membrane have a thickness of about 400 nanometers plated on the glass of amorphous silicon or microcrystalline silicon membrane.

Silicon solar cells absorb the visible and near-infrared part of sunlight (wavelength range of 400nm ~ 1100nm). Photoelectric conversion effect of PN junction in silicon material produce photo-generated electrons, and directional flow, resulting in silicon or membrane both sides to form a voltage difference and convert direct current into alternating current for the load use DC inverter.

Silicon-based solar cells are encapsulated between the two layers of architectural glass. The battery itself is not absorbing any form of light and electromagnetic wave. Unabsorbed sunlight will be reflected back to the front of panel glass, which is common building tempered glass. Another part will penetrate the front panel and silicon material absorbing layer and the back panel glass just like ordinary glass, without any change.

Monocrystalline silicon and polycrystalline silicon have less reflection design to reduce the reflection of incident light and increase light absorption and improve the photoelectric conversion efficiency. Monocrystalline and polycrystalline silicon cells use laser grooving or chemical etching method. The silicon surface form rugged suede, presented the aperiodic arranged pyramid under a microscope. The reflection was only 4% to 11% for visible and near-infrared light (wavelength 400nm ~ 1050nm).

Silicon membrane contains a suede transparent conductive layer (TCO layer, materials is SnO_2) as an antirefection layer. The reflectance for visible light and near infrared light (wavelength is 400nm ~ 1100nm) is 10 ~ 13%. Other wavelengths of light, including ultraviolet and infrared light (wavelength is less than 400nm or more than 1100nm) across the glass and silicon materials. The light reflected by diffuse reflection, not point to one fixed direction.

Therefore, silicon-based solar cells installed either on the roof or on the side of the glass curtain are much lower than 30% of national regulations on the surrounding environment and will not result in light pollution. The figure below shows the incident light map under the function of the suede structure.
(4) Electromagnetic radiation
Project produce direct current, through solar photovoltaic panels DC and collect and switch into alternating current by the inverter and supply for the school's existing grid power supply to the school. The inverter will produce a certain amount of electromagnetic radiation in the course of work.

The environment requirements for impact prediction and evaluation of photovoltaic power plants, included in Technical Specifications of Photovoltaic Power Plant Environmental Impact Evaluation:

(5) Operation period of PV power plant
Predictor of photovoltaic power plants should be selected the characteristic factors related to the environmental impact caused by the operation of the photovoltaic power plant, selected focus should include:

- Access 110kV and above-scale new photovoltaic power plants and focus from the noise, electromagnetic environment and light pollution, oily wastewater of transformer and waste batteries stacked storage.
- Select the environmental characteristics factor of noise, electromagnetic environment and waste batteries stacked storage for rebuild and expansion of photovoltaic power plants.

Although the project is a photovoltaic power generation project, the project generation supply for campus grid, below the size of 110kV new photovoltaic power plant. But it is because that particular installation site of the project is necessary considered to protect teachers and students’ safety. It is analyzed as below:

The project is part of the Golden Sun Project. Selected materials are required to meet the Technology Conditions of Dedicated Inverter from Grid-connected Photovoltaic Power Generation and get certification. The requirements are as follows:

(6) Radiated Emission
Radiated emission limits of A-type and B-type inverter in range of 30MHz ~ 1000MHz
frequency is shown in Table 6-1. The radiated emission of inverter should not exceed the requirements of Table 6-1.

Table 6-1 Radiated emission limits of A-type and B-type inverter in range of 30MHz ~ 1000MHz frequency

<table>
<thead>
<tr>
<th>Frequency/MHz</th>
<th>Limit dB (μv/m) A-type inverter, distance 10m</th>
<th>Limit dB (μv/m) B-type inverter, distance 10m</th>
</tr>
</thead>
<tbody>
<tr>
<td>30~230</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>230~1000</td>
<td>47</td>
<td>37</td>
</tr>
</tbody>
</table>

According to requirements of Electromagnetic Radiation Protection Regulations (GB8702-88), the average amount of the radiation of environmental electromagnetic field in any continuous 6min should meet requirements for public exposure during the day within 24h as seen in below parameters table.

Table 6-2 The public exposure export limit (excerpt)

<table>
<thead>
<tr>
<th>Frequency range MHz</th>
<th>Electric field strength V/m</th>
<th>Field strength A/m</th>
<th>Power density W/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>30~3000</td>
<td>12</td>
<td>0.032</td>
<td>0.4</td>
</tr>
</tbody>
</table>

For radiator of small equivalent radiated power without screen space, it is free of management according to Electromagnetic Radiation Protection Regulations. The exempt equivalent radiated power is seen as below:

Table 6-3 Exempted equivalent radiated power of electromagnetic radiation

<table>
<thead>
<tr>
<th>Frequency range MHz</th>
<th>Equivalent radiated power W</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1~3</td>
<td>300</td>
</tr>
<tr>
<td>&gt;3~300000</td>
<td>100</td>
</tr>
</tbody>
</table>

The survey shows that selected inverter of projects meet Grid-connected Photovoltaic Power Generation Inverter Technical Conditions. Equivalent radiated power generated during the operation is much less than the exemption equivalent of electromagnetic radiation radiated power limit requirements. The radiation levels are lower than the existing campus transformer. So the electromagnetic radiation generated from operation of the project has little impact on the surrounding environment.

Bayi secondary school as a pilot project in the project has been pre-implemented, with installed capacity of 139KW and run now. In order to learn more about the amount of electromagnetic radiation generated in the project, as well as the impact on the surrounding environment, the project owner commissioned the Beijing Municipal Institute of Labor Protection to monitor equipment electromagnetic radiation around Bayi secondary school on July 10, 2012. Monitoring results are as follows:

Table 6-4 Electromagnetic field test results of solar photovoltaic power user side and network system
<table>
<thead>
<tr>
<th>No.</th>
<th>Test site</th>
<th>Test height m</th>
<th>Field strength V/m</th>
<th>Magnetic induction intensity/μT</th>
<th>Vertical component</th>
<th>Horizontal component</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>5cm at the front of the battery board</td>
<td>1.5</td>
<td>1.26</td>
<td>0.014</td>
<td>0.013</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Power transmission line</td>
<td>0.5</td>
<td>1.89</td>
<td>0.052</td>
<td>0.018</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5cm at the front of PV array combiner box</td>
<td>1.5</td>
<td>0.41</td>
<td>0.102</td>
<td>0.027</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>5cm at the front of the inverter</td>
<td>1.5</td>
<td>39.6</td>
<td>1.088</td>
<td>1.112</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5cm at the rear of the inverter</td>
<td>1.5</td>
<td>0.42</td>
<td>3.500</td>
<td>1.473</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>5cm in front of AC box</td>
<td>1.5</td>
<td>12.2</td>
<td>1.880</td>
<td>0.779</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Classrooms up inverter</td>
<td>1.5</td>
<td>0.71</td>
<td>0.021</td>
<td>0.031</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Playground</td>
<td>1.5</td>
<td>0.42</td>
<td>0.017</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>School distribution room transformer</td>
<td>1.5</td>
<td>0.80</td>
<td>52.3</td>
<td>37.8</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Distribution cabinet of school distribution room</td>
<td>1.5</td>
<td>4.24</td>
<td>5.48</td>
<td>16.26</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Solar installations classroom (at the power switch)</td>
<td>1.5</td>
<td>14.1</td>
<td>0.142</td>
<td>0.131</td>
<td></td>
</tr>
</tbody>
</table>

By comparing the conventional distribution room transformers and distribution cabinet with the playground and the classroom (at the power switch) far from the photovoltaic power generation system, results of electric and magnetic field strength are: The maximum measured value of electric field strength of photovoltaic power generation system equipment at the front of inverter (5cm distance) is 2.8 times than the solar device classrooms (at the power switch) far away from solar system. The measured values at the front of AC box are similar to the solar installations classroom (at the power switch) far away from solar system while the former is much lower than the latter on other fields. The magnetic flux density around the photovoltaic power generation system equipment is much lower than the magnetic flux density at the front of the transformer of school distribution room and at the front of the distribution cabinet of school distribution room.

In addition, all measured points of the frequency electric field strength are lower than the standard limits, 4000V / m from "500KV EHV Transmission and Distribution Project Electromagnetic Radiation Environment Impact Assessment of Technical Specifications. All measured points of the Power frequency magnetic induction intensity are lower than the standard limits, 100 μT from "500KV EHV Transmission and Distribution Project Electromagnetic Radiation Environment Impact Assessment of Technical Specifications. The impact of electromagnetic radiation ambient is small.

Installation scale of other schools is the same as Baiyi second school. So other schools also
bas lower intensity of electromagnetic radiation and has few affect on electromagnetic radiation environment.

6.2 Mitigation Measures

The project take the following mitigation measures to mitigate the environmental, health and safety impacts of project construction and process operation according to the requirements of domestic laws and regulations and the Word Bank's environment, health and safety general guideline:

6.2.1 Construction period

(1) Waste gas control measures

The construction unit must take the following measures for school’s sensitivity.

- Sprinkle and prevent dust during the construction process regularly. Watering moderately and necessary to prevent dust and to avoid watering too much affected by the construction activities.
- Selection of vehicles and equipment: Construction vehicles, machinery and equipment exhaust emissions shall comply with the emission standards prescribed by the nation and Beijing. Scrap transport vehicle use a closed vehicle.
- Avoid loading and unloading catechesis and powder materials in the case of the high winds.
- Building materials should be qualified.
- Plan the construction site within the city limits. It should use the ready-mixed concrete if the concrete pouring reaches more than 100m³. It should be ready-mixed mortar, and shall not concrete and mixing mortar on-site.
- For projects of less than 100m³ pouring, it should be set up in the open zone for storage, cement mixing. Light building materials and cement should be confined to storage. Lime and on construction site should be concentrated stacking, coverage and other measures.
- Take administrative and economic penalties for mishandling or not timely corrected items
- Welding areas shall be away from the crowd, Mobile welding fume purifier should be set in the welding process.
- The stents and other materials should be used pre-painting pieces. It must use environmentally-friendly paint on site. Mobile welding smoke purifier should at spraying room.

(2) Noise control measures

To mitigate the impact of noise generated in construction and surrounding residents, the construction units must take the following measures:

- Arrange construction time reasonably to avoid a large number of high noises at the same time.
• Choose advanced low-noise construction technology instead of the high noise construction process.

• Comply with the relevant regulations in Beijing for close-sensitive points of campuses, especially prohibited at 22:00-6:00 in residential areas. If necessary, barrier should be set.

• Coordinate operation time with school, so as not to affect the surrounding residents. It is prohibited during the periods of senior high school entrance examination and college entrance examination.

• Carry out regular maintenance of machine equipment due to vibration of loose parts or muffler's damage.

(3) Solid waste control measures

• Reduce and clear solid waste generated on construction.

• Separate collect, storage, remove and transport solid waste, e.g. construction waste, waste materials and packaging.

• Remove construction garbage by the way of the closed special trash road or closed container transport

• light pollution control measures

• Block the light at the construction site of lighting or boundary in order to reduce the impact on the campus and surrounding residents.

(4) Security measures

Contractor solve road traffic, pipeline equipment machining, materials & equipment stacking, site office, personnel living and logistical support as well as the supply of materials machining under various stages of construction to make a reasonable scientific field plane and temporary layout. Contractor also deals with the relationship between the construction and safety facilities to meet the needs of the project and create a safe and civilized construction environment and operating conditions. Specific measures are as follows:

• Equipment transport and lifting

  a) Set protective template, dedicated channel of construction personnel and vehicles.

  b) Strict comply with the primary and secondary traffic safety management system and send full-time staff responsible for traffic safety management, establish a management system of motor vehicles and motor vehicle drivers, develop effective traffic safety measures.

  c) Strengthen publicity and education on traffic safety regulations for motor vehicle drivers and construction workers, subject to the management of school security departments; Regular and occasional check the unit’s vehicles or leased motor vehicles, forbid "Sick car" and "Scrapped" vehicles traveling inside the campus; forbid drunk -driver driving.

  d) Strict comply with the relevant regulations of school to protect safety of teachers.
Limit 15 km/h speed into school, forbid honking during class. Not access the dedicated lanes outside the campus student activities area.

e) Set up an each liaison on the roof and on the ground for vertical transportation security when lifting. Use walkie-talkies for the three parties and unified obey the command password.

f) Stop aerial lifting operations in the case of wind speed is greater than 6 Level, heavy rain, fog and other inclement weather.

g) Pre-lifting is a necessary step before formal lifting. It should hang off the ground about 0.5m for 5 minutes and carefully check the crane work whether machine rotation is normal, turning system with or without murmur, and the position of the spreader is reliable. After confirmed no abnormality, the formal lifting continues.

h) When formal lifting is going on, ground personnel should pull steering rope and stable cable. Construction workers in the lifting process should remain calm and obey the command. Ground personnel should hand rope over to the platform staff until the lifting height exceeds the height of the mounting platform.

i) After rotated to the specified location, it should be completely stable and then slowly drop off the hook, not one-time. The crane should keep stress state. After platform personnel check it, the crane can loose and decouple hook.

j) Fix lifting material immediately and take precautions and then continue next lifting.

k) Take erection walking channel and wooden pedal to remove product during construction.

l) Protect equipment and remove slowly and forbid collision during transport.

m) Command lifting by a full-time staff on the roof to avoid a collision in the process of lifting causing damage.

n) Handling gently on the horizontal roof to avoid damage of the roof.

• Waterproof exposed treatment

Lay SBS waterproof membrane below cement counterweight to prevent SBS membrane strain roof of waterproof exposed layer. Lay some time Firstly after the SBS membrane subsidence stereotypes and then use structural adhesive to enhance stability.

• Cross-operation

a) Set safety fencing and warning signs and send someone to supervise before cross-operation. Not allow teachers and students enter to safety fencing or a dedicated channel below the cross-operation.

b) Forbid throw tools, materials and garbage and use application bag, sling or lifting hoists to lifting. Not allow people stand below the cross-operation.

• Site safety use of electricity

c) Implement a "3 Level" protective measure, including one machine, one gate and one
leakage protection.

d) Require work grounding and repeat grounding protection measures for mechanical equipment.

e) The current of gates, leakage, fuses of electric box are the same as equipment rated current. Not use larger or smaller rated electric fuse. Not use metal wire instead of fuse.

f) Required certificate of electrician.

6.2.2 Operation period

(1) Wastewater control measures

For the control of impact on the environment of cleaning wastewater, it is recommended to take the following precautions:

- Clean solar panel, such as rain washed way. The scour wastewater should be integrated into the storm sewer system.
- Collect cleaning waste water and discharge waster into the sewer network and treat.

(2) Solid waste control measures

Waste solar panels and components belong to the electronic waste generated by the operation period. Not dispose freely and should send to national e-waste processing unit by management maintenance unit.

(3) Light pollution control measures

- Use silicon solar cells to make the light reflection rate far below 30% of the state regulations.
- To processing solar panel encapsulation material for bring light diffuse reflection. Not use mirror material to prevent the formation of specular reflection caused by light pollution nuisance

(4) Security measures

- Warning marks

Establish warning signs at working and operational area of solar photovoltaic systems. Forbid non-running manager entering.

- Running management system

Establish management system and comply with them.

- Inspection on-site

Regularly check on site, which should provide detailed technical service, user satisfaction surveys, and make inspection records, and feedback on file to ensure that the equipment run reliably and chronically.
7 Implementation of the environmental management plan

7.1 Project management

The project owner is responsible for coordination of the overall management and supervision of subprojects' environmental management.

The specific responsibilities of the environmental management agencies are: Project environmental management, Project construction feasibility study, Environmental management coordination among departments and construction units, Guide project contractor implementation of management measures, and coordinate project preparation and operation matters within the area, Environmental protection measures and management for the construction period and the operation period. EPA in various districts supervises the implementation of the project's environmental management plan.

7.1.1 Specific implementation tasks for environmental protection plans

The project’s environmental supervision agencies are composed by Beijing Municipal Environmental Protection Bureau and EPA where the project located.

The phase of implementation is:

(1) Feasibility study stage: Beijing Municipal Environmental Protection Bureau and local EPA are responsible.

Beijing Municipal Environmental Protection Bureau has overall responsibility for the environmental management of the project, approving the environmental impact form.

Local EPA has overall responsibility for implementation regulations and acceptance environmental protection facilities.

(2) Design stage:

Environmental protection department of PMO is responsible.

(3) Construction stage: Beijing Municipal Environmental Protection Bureau is responsible.

Local EPA accepts Beijing Municipal Environmental Protection Bureau guidance and supervise environmental action plan of the construction, i) implement environmental regulations and management standards; ii) coordinate among various departments to environmental protection; iii) responsible for project construction of environmental protection facilities and final acceptance, and iv) inspection of operation and management.

(4) Operational stage: Beijing Municipal Environmental Protection Bureau and local EPA are responsible.

The subproject engineering departments are responsible for the implementing of environmental protection regulations and standards, developing of environmental regulations, and supervision, assessing environmental quality control objectives and proposing measures and reporting to higher environmental protection authorities and industry authorities, organize environmental certificates assessment and training, and carrying out environmental
technology exchange and scientific research.

7.2 Contract requirements for Environmental Management

During project construction process, the contractor will play a key role in terms of environmental management, pollution control and prevention measures. Therefore, the contractor need comply with the following requirements:

(1) Select powerful contractors to ensure that the environmental management plan can be effectively implemented;

(2) Require training on Environmental Protection and Management for contractors and construction the supervision company;

(3) The contractor's tender documents should contain environmental mitigation measures, finally including in the requirements of the construction contract.

(4) Make a weekly environmental journal for contractor. PMO and construction Supervision Company review these records.

(5) Require a full-time environmental staff for each subproject, which accept program training, and thus qualified for their work.

(6) Communicate and consult with masses of the project area during construction to establish a bulletin board, including construction activities and construction time and contact so as to collect public complaints and suggestions.

7.3 Information exchange and solution of not matching scenario

In order to focus on the most important issues of management, the projects are divided into the following three levels according to the importance:

Level I: The definition of not-meet status is not matching the original requirements, which has no immediate impact on particularly important resources. The first level is recurring. If not pay attention, it will lead to the second level. Measures are as below: Use appropriate cooperation and regular exchange of level can properly handle this situation. For example, we discussed with the construction unit and the operating unit employees. So remedial action can be implemented quickly and the official exchange typically is weekly report from environment supervising engineer to enterprise environment managers and construction manager on-site.

Level II: The not-meet status has no apparent and irreversible impact on sensitive and important resources. But it need immediately remedy and on-site disposal to prevent above influence. The Second level is recurring. If not pay attention, it will lead to the third level. Measures are as below: Use appropriate cooperation and regular exchange of level can properly handle this situation. For example, we find event and enterprise environment managers should report to PMO environmental manager and construction building manager on the same day. It need immediately remedy measures, which is proposed within one week after discovered under normal circumstances.

Level III: The not-meet status has foreseeable and immediate impact on special sensitivity
object, including forbidden international behavior. Measures are as below: Environmental manager report to PMO environmental manager and construction building manager once manager find event and propose remedy measures, which is proposed within three days after discovered under normal circumstances (Except that special condition need more time). If necessary, enterprise environment managers can stop some special construction before the implementation of remedy measures proposed by construction manager.

7.4 Training

7.4.1 Requirement

The main objects of environmental capacity-building are environmental managers and environmental supervision company. The training is one of the components of the technical support of the project. Training courses also train building workers in the implementation process. All construction units and operating units, and construction supervision officer are compulsorily requested to participate in the environment, health and safety training prior to the start of construction of the project.

7.4.2 Content

(1) Environmental Management staff

Training is organized by the project owners and invites environment & security experts from the World Bank. or the project owners. The training time is 0.5 to 1 day, including the environmental and safety aspects of training for Supervision Company and the contractor's environmental management staff for this project.

(2) Contractor internal training

The project contractor organizes construction workers to take project-related environmental and safety training by trained environmental management manager before construction. The training time is 0.5 to 1 day.

7.5 Temporary site restoration

The project contractor must timely complete restoration of temporary land area during construction. It should achieve restoration of all temporary land area before constructions are completed.
8 Estimation for environment conservation cost

8.1 Distribution of budget

Environmental management plan for the implementation of the measures involved a lot of units. The channels of funding sources are different. The vast majority of environmental activities are engineering measures, project construction units and operating units should be included in project costs, and those costs will be clear and listed in its bid for the tender.

The cost of the environmental management plan is mainly used for the construction and operation of the environmental management, including: investment in environmental protection measures, staff training costs and running costs of the environmental management agencies, some of the projects also risk prevention costs.

8.2 Cost estimation for sub-projects

8.2.1 Investment for environmental conservation measures

Environmental protection measures include atmospheric processing measures during construction period, noise and solid waste environmental protection measures. They were estimated charges in accordance with the relevant national standards and local regulations. Each construction site costs about 10 thousand Yuan.

8.2.2 Individual cost

The project independent fee includes the environmental impact assessment fees and staff training costs. The environmental impact assessment fee is 200,000 CNY and the personnel training costs about 10,000 CNY.

8.2.3 Reserve fund

About 10% of the investment in environmental protection will be treated as the reservation funds as motorized use.

The project environmental costs are summarized as follows:

<table>
<thead>
<tr>
<th>Project</th>
<th>Types</th>
<th>Unit Price</th>
<th>Number</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental protection measures</td>
<td>Atmospheric processing measures, noise and solid waste environmental protection measures</td>
<td>1</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>Independent Cost</td>
<td>Impact assessment fee</td>
<td>-</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Training fees</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Reserve fund</td>
<td>Approximately 10% of the investment in environmental protection</td>
<td></td>
<td></td>
<td>102.1</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>1123.1</td>
</tr>
</tbody>
</table>
9 Information management of the environmental management plan

9.1 Information exchange

Environmental management requires the necessary exchange of information among owners, contractors, operators in different departments and positions, but also communicates with the relevant information to the external (stakeholders, the public, etc.).

Internal information exchange can be carried out in a various ways like meeting and internal briefings. But the monthly formal meeting must be hold, and all the exchanged information should be recorded and archived. External information exchange shall be hold every six months or 1 year, the exchanged information collaborated units need to be formed as minutes and archived.

9.2 Record mechanism

For the effective operation of the environmental management system, the organization must establish a sound system of record, and retain the following records:

(1) Legal and regulatory requirements;
(2) License;
(3) Environmental factors and the related environmental impact;
(4) Environmental impact measures screening table;
(5) Training;
(6) Check and maintenance activities;
(7) The effectiveness of corrective and preventive actions;
(8) The information of the parties;
(9) Audit;
(10) Assess.

Furthermore, control of all types of records is necessary, including: the identification, collection, cataloging, archiving, storage, management, maintenance, query, save deadline and disposal sectors.

9.3 Report mechanism

Contractors and project owners in the process of project implementation progress of the project management plan (EMP) implementation should be recorded and promptly reported to the relevant authorities. Mainly include the following three parts:

(1) The contractor for detailed record of the implementation of the EMP, and timely reporting to the project owner;

(2) Progress report on the project prepared by the project owners the EMP progress, such as
the progress made in the implementation of the EMP and perform the effect must be included (such as monthly, quarterly and annual reports, etc.);

(3) Project implementation of the EMP report must be completed and submitted to the World Bank at a specified time.

EMP implementation report may include the following main elements:

- The implementation of the training program;
- Project status, such as solar panel mounting area, supporting cabinet installation and commissioning progress;
- Whether the complaints from the public, the event of complaints, records of complaints, solutions and public satisfaction;
- EMP implementation plan for next year.
10 Public participation

10.1 The basis for public participation

In accordance with the State Environmental Protection Administration *Public participation in the EIA Interim Measures* released in February 2006 may have a significant impact on the environment. The construction projects should prepare an environmental impact report, the need for public participation in environmental impact assessment, and environmental construction projects impact statement for the preparation of the public participate chapters.

10.2 The object of public participation

Public participation in the project was mainly targeted at involving neighboring schools and regions to directly or indirectly influence the masses, and officials of the relevant government departments and experts, as well as other industry staff.

10.3 The form and content of public participation

10.3.1 Scene investigation

The public participation is formed as a conversation, by the owners of construction projects carried Introduction EIA units of project construction phase and the operational phase may produce the environmental problem. They intend to take introduced environmental protection measures which made by school leaders, teachers and neighboring residents’ questions and suggestions. The owners and the EIA unit shall answer the questions raised, and summary the adoption of the proposal.

The projects public participation records are as follows:

<table>
<thead>
<tr>
<th>No.</th>
<th>Investigated School</th>
<th>Investigated Time</th>
<th>Investigator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Peixin Primary School</td>
<td>2011.12.28</td>
<td>ZHANG Ruiqin</td>
</tr>
<tr>
<td>2</td>
<td>The Second High School Attached to CNU</td>
<td>2011.12.29</td>
<td>Headmaster Zhao, LI Tao</td>
</tr>
<tr>
<td>3</td>
<td>Xiyi Primary School</td>
<td>2011.12.29</td>
<td>TIAN Quanshan</td>
</tr>
<tr>
<td>4</td>
<td>Dewai Second Primary School</td>
<td>2011.12.30</td>
<td>Ms QIN</td>
</tr>
<tr>
<td>5</td>
<td>Beijing Chaoyang District, Fatou No. 2 Primary School</td>
<td>2012.1.10</td>
<td>Mr. GUO</td>
</tr>
<tr>
<td>6</td>
<td>No. 43 Secondary School</td>
<td>2012.1.11</td>
<td>CHANG Yaowen</td>
</tr>
<tr>
<td>7</td>
<td>No. 43 Secondary School South Campus</td>
<td>2012.1.11</td>
<td>CHANG Yaowen</td>
</tr>
<tr>
<td>8</td>
<td>Xuanwu Branch Affiliated Middle School</td>
<td>2012.1.12</td>
<td>Residents</td>
</tr>
<tr>
<td>9</td>
<td>Xuanwu Branch Affiliated High School</td>
<td>2012.1.12</td>
<td>Residents</td>
</tr>
<tr>
<td>10</td>
<td>Beijing Haidian District, Jidu School</td>
<td>2012.1.12</td>
<td>YU Zhengguo</td>
</tr>
<tr>
<td>11</td>
<td>Qiushi Vocational Schools Anzhen</td>
<td>2012.1.18</td>
<td>Residents</td>
</tr>
<tr>
<td>No.</td>
<td>Investigated School</td>
<td>Investigated Time</td>
<td>Investigator</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------------------------------</td>
<td>-------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>12</td>
<td>Qiushi Vocational Schools Wangjing Campus</td>
<td>2012.1.18</td>
<td>Residents</td>
</tr>
<tr>
<td>13</td>
<td>Qiushi Vocational Schools Tuanjiehu Campus 2</td>
<td>2012.1.19</td>
<td>Residents</td>
</tr>
<tr>
<td>14</td>
<td>Qiushi Vocational Schools Tuanjiehu Campus 1</td>
<td>2012.1.19</td>
<td>Residents</td>
</tr>
<tr>
<td>15</td>
<td>Primary School Attached to BAU</td>
<td>2012.1.4</td>
<td>LI Zhen</td>
</tr>
<tr>
<td>16</td>
<td>Haidian District Dongbeiwang Central Primary School</td>
<td>2012.1.6</td>
<td>Residents</td>
</tr>
<tr>
<td>17</td>
<td>Huayanli Primary School</td>
<td>2012.1.9</td>
<td>Mr. ZHANG</td>
</tr>
<tr>
<td>18</td>
<td>Anzenli No.1 Primary School</td>
<td>2012.1.9</td>
<td>Mr. LU</td>
</tr>
<tr>
<td>19</td>
<td>Jinsong No. 2 Primary School</td>
<td>2012.1.9</td>
<td>HE Jianxing</td>
</tr>
<tr>
<td>20</td>
<td>Jinsong No. 1 Primary School</td>
<td>2012.1.9</td>
<td>LIU Jing</td>
</tr>
<tr>
<td>21</td>
<td>Beijing Jinsong No. 1 Secondary School</td>
<td>2012.1.9</td>
<td>HAI Qing</td>
</tr>
<tr>
<td>22</td>
<td>Beijing steel College Affiliated High School</td>
<td>2012.4.13</td>
<td>Residents</td>
</tr>
<tr>
<td>23</td>
<td>Anhuili Central Primary School (Anzenli School District)</td>
<td>2012.4.13</td>
<td>Residents</td>
</tr>
<tr>
<td>24</td>
<td>Anhuili Center School (High Level)</td>
<td>2012.4.26</td>
<td>Residents</td>
</tr>
<tr>
<td>25</td>
<td>Beijing No. 24 Secondary School</td>
<td>2012.4.26</td>
<td>Mr. GAO</td>
</tr>
<tr>
<td>26</td>
<td>Anzenli No.1 Primary School</td>
<td>2012.4.27</td>
<td>LI Chunling</td>
</tr>
<tr>
<td>27</td>
<td>Cuwei Secondary School</td>
<td>2012.4.27</td>
<td>Mr. AN</td>
</tr>
<tr>
<td>28</td>
<td>Beijing No. 65 Secondary School</td>
<td>2012.5.20</td>
<td>WANG Defeng</td>
</tr>
<tr>
<td>29</td>
<td>Beijing No. 165 Secondary School</td>
<td>2012.5.20</td>
<td>WU Yuzhang, WANG Yansheng</td>
</tr>
<tr>
<td>30</td>
<td>Anzenli No.2 Primary School</td>
<td>2012.5.4</td>
<td>LI Quiting</td>
</tr>
<tr>
<td>31</td>
<td>Anyuanbeili Primary School</td>
<td>2012.5.4</td>
<td>Mr. CHENG</td>
</tr>
<tr>
<td>32</td>
<td>Beijing No. 177 Secondary School</td>
<td>2012.5.8</td>
<td>YUAN Ming</td>
</tr>
<tr>
<td>33</td>
<td>Beijing No. 1 Secondary School</td>
<td>2012.6.3</td>
<td>Deputy Headmaster ZHAO Pengqi</td>
</tr>
<tr>
<td>34</td>
<td>Beijing Modern vocational school</td>
<td>2012.6.3</td>
<td>LIU Zehuai</td>
</tr>
<tr>
<td>35</td>
<td>Primary School Attached to BAU</td>
<td>2012.6.3</td>
<td>ZHANG Shulan</td>
</tr>
<tr>
<td>36</td>
<td>Beijing Chaoyang District, Science Park Primary School</td>
<td>2012.6.4</td>
<td>XU Bin</td>
</tr>
<tr>
<td>37</td>
<td>Xiangshan School attached to PU</td>
<td>2012.4.26</td>
<td>DONG Xiuying</td>
</tr>
<tr>
<td>38</td>
<td>Beijing No. 18 Secondary School</td>
<td>2012.4.27</td>
<td>LI Guiming</td>
</tr>
<tr>
<td>39</td>
<td>Beijing Hepingli No. 4 Primary school</td>
<td>2012.4.27</td>
<td>WU Tianrong</td>
</tr>
<tr>
<td>No.</td>
<td>Investigated School</td>
<td>Investigated Time</td>
<td>Investigator</td>
</tr>
<tr>
<td>-----</td>
<td>---------------------------------------------------------</td>
<td>-------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>40</td>
<td>Beijing No. 27 Secondary School</td>
<td>2012.5.20</td>
<td>WANG Shi</td>
</tr>
<tr>
<td>41</td>
<td>Cuiwei Primary School</td>
<td>2012.5.20</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Erligou Central Primary School</td>
<td>2012.5.4</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Beijing Fangshan Secondary School</td>
<td>2012.5.4</td>
<td>ZHANG Lihua</td>
</tr>
<tr>
<td>44</td>
<td>Beijing Gaojiayuan Secondary School</td>
<td>2012.1.9</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Gucheng Senior Secondary School</td>
<td>2012.1.9</td>
<td>CAO Yanyan</td>
</tr>
<tr>
<td>46</td>
<td>Huoying Central Primary School</td>
<td>2012.1.9</td>
<td>WANG Bin</td>
</tr>
<tr>
<td>47</td>
<td>Luhe Secondary School</td>
<td>2012.4.13</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Luzhou Secondary School</td>
<td>2012.4.13</td>
<td>WANG Dehua</td>
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<tr>
<td>49</td>
<td>Mentougou Dayu No. 2 Primary School</td>
<td>2012.4.26</td>
<td>WANG Shujuan</td>
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<tr>
<td>50</td>
<td>Miyun Shuiku Secondary School</td>
<td>2012.1.10</td>
<td>WANG You</td>
</tr>
<tr>
<td>51</td>
<td>Beijing Xicheng District, Qinglongqiao Primary School</td>
<td>2012.1.11</td>
<td>ZHAO Qingli</td>
</tr>
<tr>
<td>52</td>
<td>Beijing Shangzhuang Secondary School</td>
<td>2012.1.11</td>
<td>ZHANG Zenqing</td>
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<td>53</td>
<td>Beijing No. 14 Primary School</td>
<td>2012.1.12</td>
<td>WANG Jianzong</td>
</tr>
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<td>54</td>
<td>Shijia Primary School Tongzhou Branch</td>
<td>2012.1.12</td>
<td>Headmaster ZHUO</td>
</tr>
<tr>
<td>55</td>
<td>Shunyi Yangzhen No.1 Secondary School</td>
<td>2012.1.12</td>
<td>SUN Mengyuan</td>
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<tr>
<td>56</td>
<td>Yinhe Primary School</td>
<td>2012.1.18</td>
<td>LI Hui</td>
</tr>
<tr>
<td>57</td>
<td>Secondary School Attached to CNU Yongding Branch</td>
<td>2012.1.18</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Changgou Secondary School</td>
<td>2012.3.5</td>
<td>WEI Hecai</td>
</tr>
<tr>
<td>59</td>
<td>Zhoukoudian Secondary School</td>
<td>2012.3.7</td>
<td></td>
</tr>
</tbody>
</table>

According to the survey, the school and the surrounding residents asked the following questions and comments:

1. Produce light radiation on the surrounding residential buildings
2. Produce light radiation on the surrounding residential buildings
3. Better for construction during the holidays or at weekends.

**10.3.2 Construction can not disturb the normal teaching.**

Doubt for the school and the surrounding residents, the possible environmental problems caused by the construction period and the operation period were analyzed and explained, and solar panel selection, surface treatment and packaging materials, does not produce specular reflection described. Residents expressed understanding.

The requirement for not disturbing the normal teaching for school construction has been fully
accepted, and written into environmental protection measures. They have required the contractor in the construction process does not disturb the surrounding residents in the case of normal rest. It will investigate if schools hold holiday tutorial classes and the night classes, and in coordination with the school operating time for not disturbing the students in class. The school has authorized this.

10.3.3 Online information disclosure

On July 5, 2012, the project determined, the second installment of 59 schools, work that may arise during the construction and operation period of the environmental impact and mitigation measures Yuanshen Energy Technology Co., Ltd., Beijing website publicity and provide contact information, so that the peripheral understanding of the situation in a timely manner. Project publicity URL: http://www.bj-emc.com.cn/.
Appendix 1:
Generic Environmental Code of Practices

1. Noise management should arrange construction time reasonably to avoid a large number of high noises at the same time.

1.1 Choose advanced low-noise construction technology instead of the high noise construction process.

1.2 Comply with the relevant regulations in Beijing for close-sensitive points of campuses, especially prohibited at 22:00-6:00 in residential areas. If necessary, barrier should be set.

1.3 Coordinate operation time with school, so as not to affect the surrounding residents. It is prohibited during the periods of senior high school entrance examination and college entrance examination.

1.4 Carry out regular maintenance of machine equipment due to vibration of loose parts or muffler's damage.

2. Waste gas control should watering moderately and necessary to prevent dust and to avoid watering too much affected by the construction activities.

2.1 Selection of vehicles and equipment: Construction vehicles, machinery and equipment exhaust emissions shall comply with the emission standards prescribed by the nation and Beijing. Scrap transport vehicle use a closed vehicle.

2.2 Avoid loading and unloading catechesis and powder materials in the case of the high winds.

2.3 Building materials should be qualified.

2.4 Plan the construction site within the city limits. It should use the ready-mixed concrete if the concrete pouring reaches more than 100m³. It should be ready-mixed mortar, and shall not concrete and mixing mortar on-site.

2.5 For projects of less than 100m³ pouring, it should be set up in the open zone for storage, cement mixing. Light building materials and cement should be confined to storage. Lime and on construction site should be concentrated stacking, coverage and other measures.

2.6 Take administrative and economic penalties for mishandling or not timely corrected items.

2.7 Welding areas shall be away from the crowd, Mobile welding fume purifier should be set in the welding process.

2.8 The stents and other materials should be used pre-painting pieces. It must use environmentally-friendly paint on site. Mobile welding smoke purifier should at spraying room.

3. Solid waste management

3.1 Reduce and clear solid waste generated on construction.
3.2 Separate collect, storage, remove and transport solid waste, e.g. construction waste, waste materials and packaging.

3.3 Remove construction garbage by the way of the closed special trash road or closed container transport.

4. **Light pollution prevention**

4.1 Block the light at the construction site of lighting or boundary in order to reduce the impact on the campus and surrounding residents.

4.2 Take obscured measures during welding work at height to avoid exposure of the arc light.

5. **Construction management**

5.1 Construction management should be regulated to construction camps and workers by contractors.

5.2 Prepare construction camp management solution approved by relevant management units.

6. **Construction Safety Management**

6.1 Equipment transport and lifting

- Set protective template, dedicated channel of construction personnel and vehicles.
- Strict comply with the primary and secondary traffic safety management system and send full-time staff responsible for traffic safety management, establish a management system of motor vehicles and motor vehicle drivers, develop effective traffic safety measures.
- Strengthen publicity and education on traffic safety regulations for motor vehicle drivers and construction workers, subject to the management of school security departments; Regular and occasional check the unit's vehicles or leased motor vehicles, forbid "Sick car" and "Scrapped" vehicles traveling inside the campus; forbid drunk -driver driving.
- Strict comply with the relevant regulations of school to protect safety of teachers. Limit 15 km/h speed into school, forbid honking during class. Not access the dedicated lanes outside the campus student activities area.
- Set up an each liaison on the roof and on the ground for vertical transportation security when lifting. Use walkie-talkies for the three parties and unified obey the command password.
- Stop aerial lifting operations in the case of wind speed is greater than 6 Level, heavy rain, fog and other inclement weather.
- Pre-lifting is a necessary step before formal lifting. It should hang off the ground about 0.5m for 5 minutes and carefully check the crane work whether machine rotation is normal, turning system with or without murmur, and the position of the spreader is reliable. After confirmed no abnormality, the formal lifting continues.
- When formal lifting is going on, ground personnel should pull steering rope and stable cable. Construction workers in the lifting process should remain calm and obey the
command. Ground personnel should hand rope over to the platform staff until the lifting height exceeds the height of the mounting platform.

- After rotated to the specified location, it should be completely stable and then slowly drop off the hook, not one-time. The crane should keep stress state. After platform personnel check it, the crane can loose and decouple hook.
- Fix lifting material immediately and take precautions and then continue next lifting.
- Take erection walking channel and wooden pedal to remove product during construction.
- Protect equipment and remove slowly and forbid collision during transport.
- Command lifting by a full-time staff on the roof to avoid a collision in the process of lifting causing damage.
- Handle gently on the horizontal roof to avoid damage of the roof.

6.2 Waterproof exposed treatment

Lay SBS waterproof membrane below cement counterweight to prevent SBS membrane strain roof of waterproof exposed layer. Lay some time Firstly after the SBS membrane subsidence stereotypes and then use structural adhesive to enhance stability.

6.3 Cross-operation

- Set safety fencing and warning signs and send someone to supervise before cross-operation. Not allow teachers and students enter to safety fencing or a dedicated channel below the cross-operation.
- Forbid throw tools, materials and garbage and use application bag, sling or lifting hoists to lifting. Not allow people stand below the cross-operation.

6.4 Site safety use of electricity

- Implement a "3 Level" protective measure, including one machine, one gate and one leakage protection.
- Require work grounding and repeat grounding protection measures for mechanical equipment.
- The current of gates, leakage, fuses of electric box are the same as equipment rated current. Not use larger or smaller rated electric fuse. Not use metal wire instead of fuse.
- Required certificate of electrician.
## Appendix 2

### School status list

<table>
<thead>
<tr>
<th>No</th>
<th>School Name</th>
<th>District</th>
<th>Address</th>
<th>No. of Staff</th>
<th>No. of Student</th>
<th>Accommodation</th>
<th>Area (m²)</th>
<th>Construction area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beijing No. 24 Secondary School</td>
<td></td>
<td>No.31 Waijiaobu Street</td>
<td>1375</td>
<td>1203</td>
<td></td>
<td>28191</td>
<td>18291</td>
</tr>
<tr>
<td>2</td>
<td>Beijing Modern vocational school</td>
<td></td>
<td>No.7 Yongnei East street</td>
<td>1978</td>
<td>1786</td>
<td>Boarders190, 9month/year</td>
<td>26476</td>
<td>20803</td>
</tr>
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<td>400</td>
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