

Document of  
The World Bank

Report No: 69589-CN

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US\$120 MILLION

TO THE

PEOPLE'S REPUBLIC OF CHINA

FOR A

BEIJING ROOFTOP SOLAR PHOTOVOLTAIC SCALE-UP (SUNSHINE SCHOOLS)  
PROJECT

February 7, 2013

China and Mongolia Sustainable Development Unit  
Sustainable Development Department  
East Asia and Pacific Region

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CURRENCY EQUIVALENTS  
(Exchange Rate Effective September 1, 2012)

Currency Unit = RMB (Chinese Yuan Renminbi)  
US\$ 1 = RMB 6.30

FISCAL YEAR  
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

BDRC	Beijing Development and Reform Commission	FIT	Feed-in Tariff
BFB	Beijing Finance Bureau	FM	Financial Management
BGC	Beijing Grid Company	FMM	Financial Management Manual
BMAO	Beijing Municipal Audit Office	FSR	Feasibility Study Report
BMG	Beijing Municipal Government	FYP	Five-Year Plan
BP	Bank Procedures	GDP	Gross Domestic Product
CDM	Clean Development Mechanism	GEF	Global Environment Facility
CO <sub>2</sub>	Carbon Dioxide	GOC	Government of China
CPS	Country Partnership Strategy	GW	Gigawatt
CQS	Selection Based on Consultants' Qualification	IBRD	International Bank for Reconstruction and Development
CRR	Cost Recovery Rate	ICB	International Competitive Bidding
DA	Designated Account	IEA	International Energy Agency
DSCR	Debt Service Coverage Ratio	IFC	International Finance Corporation (WB Group)
DRC	Development and Reform Commission	IFRs	Interim Financial Reports
EA	Environmental Assessment	KPIs	Key Performance Indicators
EBITDA	Earnings before interest, taxes, depreciation and amortization	kWh	Kilowatt hour
ECOP	Environmental Codes of Practice	M&E	Monitoring and Evaluation
EE	Energy efficiency	MOF	Ministry of Finance
EHS	Environmental Health and Safety	MOST	Ministry of Science and Technology
EIA	Environmental Impact Assessment	MW	Megawatt
EIRR	Economic Internal Rate of Return	MWh	Megawatt hour
EMP	Environmental Management Plan	NA	Not Applicable
FDI	Foreign Direct Investment	NCB	National Competitive Bidding
FIRR	Financial Internal Rate of Return	NEA	National Energy Administration
NPV	Net Present Value	RMB	Renminbi (Chinese Yuan)

O&M	Operation and Maintenance	SBD	Standard Bidding Documents
OECD	Organisation for Economic Co-operation and Development	SCADA	Supervisory Control and Data Acquisition
ORAF	Operational Risk Assessment Framework	SCC	Social Cost of Carbon
PAD	Project Appraisal Document	SGC	State Grid Company
PDO	Project Development Objective	SIL	Specific Investment Loan
PLG	Project Leading Group	SLA	Subsidiary Loan Agreement
PMO	Project Management Office	SSS	Single-source selection
PP	Procurement Plan	TA	Technical Assistance
PV	Photovoltaic	TOR	Terms of Reference
QBS	Quality-Based Selection	TPEC	Total Primary Energy Consumption
RE	Renewable Energy	WACC	Weighted Average Cost of Capital
RESCO	Renewable Energy Service Company	WB	World Bank
REDP	Renewable Energy Development Project	Wp	Watt Peak
RES	Renewable Energy Sources	WTP	Willingness-to-Pay

Regional Vice President:	Axel van Trotsenburg, EAPVP
Country Director:	Klaus Rohland, EACCF
Sector Director:	John Roome, EASSD
Sector Managers:	Mark R. Lundell, EASCS Charles Feinstein, EASWE
Task Team Leader:	Chongwu Sun, EASCS



**CHINA**  
**Beijing Rooftop Solar Photovoltaic Scale-Up (Sunshine Schools) Project**

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## PAD DATA SHEET

*China*

*Beijing Rooftop Solar Photovoltaic Scale-Up (Sunshine Schools) Project*

### PROJECT APPRAISAL DOCUMENT

*EAST ASIA AND PACIFIC REGION (EAP)*

*China and Mongolia Sustainable Development Unit (EASCS)*

Report No.: PAD259

Basic Information			
Project ID P125022	Lending Instrument Specific Investment Loan	EA Category B - Partial Assessment	Team Leader Chongwu Sun
Project Implementation Start Date 19-Mar-2013		Project Implementation End Date 31-Dec-2018	
Expected Effectiveness Date 31-Jul-2013		Expected Closing Date 31-Dec-2019	
Joint IFC No			
Sector Manager Mark R. Lundell	Sector Director John A. Roome	Country Director Klaus Rohland	Regional Vice President Axel van Trotsenburg
Borrower: International Department, Ministry of Finance			
Responsible Agency: Beijing Project Management Office			
Contact: Telephone No.:	Mr. Zhiqing Shao 86-10-82289551	Title: Director Email: bjpmoshaozq@bjpc.gov.cn	
Responsible Agency: Beijing Yuanshen Energy Saving Technology Company Limited			
Contact: Telephone No.:	Jibo Nie 86-10-88131055	Title: President Email: yuanshen@powerbeijing.com	
Project Financing Data(US\$M)			
<input checked="" type="checkbox"/> Loan	<input type="checkbox"/> Grant	<input type="checkbox"/> Other	
<input type="checkbox"/> Credit	<input type="checkbox"/> Guarantee		
<b>For Loans/Credits/Others</b>			

Total Project Cost (US\$M): 239.70

Total Bank Financing (US\$M): 120.00

<b>Financing Source</b>	<b>Amount (US\$M)</b>
Borrower	115.4
International Bank for Reconstruction and Development	120.0
Local Sources of Borrowing Country	4.3
Financing Gap	0.0
<b>Total</b>	<b>239.7</b>

**Expected Disbursements (in US\$ Million)**

Fiscal Year	2014	2015	2016	2017	2018	2019			
Annual	10.0	20.0	35.0	40.0	10.0	5.0			
Cumulative	10.0	30.0	65.0	105.0	115.0	120.0			

**Project Development Objective(s)**

The project Development Objectives of the proposed project are to increase the share of clean energy in electricity consumption and to demonstrate the viability of the renewable energy service company model for scaling up the deployment of rooftop solar photovoltaic systems in schools and other educational institutions in Beijing Municipality.

**Components**

<b>Component Name</b>	<b>Cost (US\$ Million)</b>
Component one: Sunshine Schools Program Support – installation of 100 MW rooftop solar PV systems in Beijing	226.0
Component two: Technical assistance for developing local capacity for scaling up solar energy deployment, project implementation, and other priority energy policy initiatives of the BMG	4.0

**Compliance**

**Policy**

Does the project depart from the CAS in content or in other significant respects?	Yes [ ]	No [ X ]
Does the project require any waivers of Bank policies?	Yes [ ]	No [ X ]
Have these been approved by Bank management?	Yes [ ]	No [ X ]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [ X ]
Does the project meet the Regional criteria for readiness for implementation?	Yes [ X ]	No [ ]

<b>Safeguard Policies Triggered by the Project</b>	<b>Yes</b>	<b>No</b>

Environmental Assessment OP/BP 4.01	X	
Natural Habitats OP/BP 4.04		X
Forests OP/BP 4.36		X
Pest Management OP 4.09		X
Physical Cultural Resources OP/BP 4.11		X
Indigenous Peoples OP/BP 4.10		X
Involuntary Resettlement OP/BP 4.12		X
Safety of Dams OP/BP 4.37		X
Projects on International Waterways OP/BP 7.50		X
Projects in Disputed Areas OP/BP 7.60		X

### Legal Covenants

Name	Recurrent	Due Date	Frequency
Debt Service Coverage Ratio	X		Yearly

### Description of Covenant

Except as the Bank shall otherwise agree, the Beijing Yuanshen Energy Saving Technology Company Limited, shall not incur any debt for its PV business unless a reasonable forecast of the revenues and expenditures of Yuanshen's PV business shows that the estimated net revenues of Yuanshen for each fiscal year during the term of the debt to be incurred shall be at least 1.1 times the estimated debt service requirements of Yuanshen in such year on all debt of Yuanshen including the debt to be incurred.

Name	Recurrent	Due Date	Frequency
Subsidiary Loan Agreement			

### Description of Covenant

The conclusion of a subsidiary loan agreement between Beijing Municipality and Yuanshen prior to implementation of Component 1 of the Project.

### Team Composition

#### Bank Staff

Name	Title	Specialization	Unit
Chongwu Sun	Senior Environmental Specialist	Task Team Leader	EASCS
Feng Liu	Senior Energy Specialist	Energy Sector Policy	SEGES
Gailius J. Draugelis	Lead Energy Specialist	Operations Advisor	EASCS
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Yi Dong	Senior Financial Management Specialist	Financial Management	EASFM		
Mei Wang	Senior Counsel	Legal	LEGAM		
Sameena Dost	Senior Counsel	Senior Counsel	LEGES		
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Hua Zhu	Program Assistant	Program Assistant	EACCF		
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Kun Cao	Team Assistant	Team Assistant	EACCF		
Dan Xie	Team Assistant	Team Assistant	EACCF		
<b>Non Bank Staff</b>					
<b>Name</b>	<b>Title</b>	<b>Office Phone</b>	<b>City</b>		
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Yibo Wang	Solar PV Energy Consultant	86-13671355662	Beijing		
Sicheng Wang	Solar PV Energy Consultant	86-13901388270	Beijing		
<b>Locations</b>					
<b>Country</b>	<b>First Administrative Division</b>	<b>Location</b>	<b>Planned</b>	<b>Actual</b>	<b>Comments</b>
China	Beijing Municipality	Beijing	<b>X</b>		
<b>Institutional Data</b>					
<b>Sector Board</b>					
Energy and Mining					
<b>Sectors / Climate Change</b>					
Sector (Maximum 5 and total % must equal 100)					
<b>Major Sector</b>	<b>Sector</b>	<b>%</b>	<b>Adaptation</b>	<b>Mitigation</b>	

			<b>Co-benefits %</b>	<b>Co-benefits %</b>
Energy and mining	Other Renewable Energy	100		
Total		100		
<input checked="" type="checkbox"/> I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.				
<b>Themes</b>				
Theme (Maximum 5 and total % must equal 100)				
<b>Major theme</b>	<b>Theme</b>	<b>%</b>		
Environment and natural resources management	Climate change	34		
Environment and natural resources management	Other environment and natural resources management	33		
Urban development	Other urban development	33		
Total		100		





## I. STRATEGIC CONTEXT

### A. Country Context

1. **China has achieved rapid economic growth in recent decades although many imbalances remain.** In the past decade, GDP grew by about 10 percent per annum with effective macroeconomic management. Inflation has been kept largely under control. While China's economy was affected by the global financial crisis through its trade and foreign direct investment (FDI), a forceful fiscal and monetary stimulus helped keep China's growth rate at a high level.

2. **China's double-digit economic development has spurred massive consumption of total primary energy and electricity.** Total Primary Energy Consumption (TPEC) increased annually by 8.8 percent during 2000-2011, more than triple the global TPEC increase. Electricity consumption grew by 12 percent over the same period and such rapid growth is expected to continue in the coming years. According to the latest International Energy Agency (IEA) New Policies Scenario forecast, China's primary energy demand is expected to grow by 2 percent annually up to 2035, a growth rate that is 0.7 percent higher than the world growth rate and 1.7 percent above the OECD growth rate. The China Electricity Council predicts that China's power generation capacity will reach 1950 GW by 2020. Currently, coal dominates China's energy mix, contributing 68.5 percent of primary energy consumption, and fueling about 53 percent of power generation in 2011. According to the IEA forecast, coal will remain the dominant fuel and would account for more than 50 percent of primary energy up to 2035.

3. The Government of China (GOC) has come to recognize that such tremendous primary energy and power growth cannot be met by fossil fuels. Coal combustion has already caused a certain amount of damage to the eco-environment. Past growth trends are unsustainable and the GOC is increasing its efforts to reduce the energy and carbon intensity of the economy. Shifting to a greener energy supply will benefit both China and the world.

4. **Energy efficiency (EE) and renewable energy (RE) are two critical elements of sustainable urban development strategy and are central in China's push to reduce the carbon footprint of its economy.** The GOC has pledged to reduce the economy's 2005 carbon intensity by 40-45 percent by 2020. Binding targets were set in the 12<sup>th</sup> Five-Year Plan (FYP) period to cut GDP energy intensity by 16 percent and GDP carbon intensity by 17 percent. Targets were also set for increasing the share of non-fossil energy, that is, nuclear and RE energy sources, in primary energy use from 8 percent in 2010 to 11.4 percent by 2015 and to 15 percent by 2020. The GOC also plans to increase the installation of rooftop solar PV systems from under 1 GW in 2010 to 3 GW by 2015.

5. **Cities have led and will continue to drive China's rapid economic transformation.** Urbanization in China exceeded 50 percent in 2011 and is projected to reach almost 70 percent in 2030. In 2010, cities with prefectural or higher level administrative status (287 out of a total of over 657 officially recognized cities) contributed to 61 percent of national GDP, while accounting for 29 percent of the national population. This dominance in economic activities and the decentralized urban management in China give cities great power to shape their own development outcome and that of the nation. A key measure of cities' development success will be its environmental sustainability in terms of local and global impacts.

6. **Cities account for about 75 percent of China’s energy consumption and are key to meeting China’s energy intensity and carbon emission reduction targets.** Per capita carbon emissions in some major Chinese cities are among the highest of major cities in the world (in part due to large contributions from industries and power generation)<sup>1</sup>. At the onset of the 12<sup>th</sup> FYP (2011-2015), many Chinese cities have made continuous and active efforts to change the growth pattern and implement low-carbon development strategies. By 2030 China’s cities are projected to add about 45 percent more residents (about 300 million) and about 60 percent more buildings compared to 2010. Accompanied by high economic growth, this rapid urbanization puts tremendous pressure on all forms of urban services: energy, water, transport, and waste management. It also, however, affords Chinese cities the opportunity to reshape their development pathways.

7. **Implementing programs and policies to reign in carbon emissions in urban areas will be a central feature of China’s emission reduction strategy.** The National Development and Reform Commission (NDRC) announced in 2012 that areas in 29 provinces and cities (including Beijing) are to pilot low-carbon growth while specific plans are also being developed to pilot carbon-emissions trading schemes. Such initiatives are expected to intensify as the implementation of the 12<sup>th</sup> FYP unfolds. In response to the emerging focus on environmentally sustainable growth, many other Chinese cities are also trying to develop eco-city and low-carbon city initiatives. These cities will look to national demonstration pilots for ideas and successful programs to replicate.

## **B. Sectoral and Institutional Context**

8. **As the nation’s capital and a pilot city for low-carbon growth, Beijing (with a metropolitan population of about 20 million) is striving to become a model for other Chinese cities in promoting resource-efficient and environmentally-friendly urban economic growth.** Following a successful effort during the 11<sup>th</sup> FYP period, the Beijing Municipal Government (BMG) has set more stringent targets for the 12<sup>th</sup> FYP than those of the GOC: reducing GDP energy intensity by 17 percent (vs. 16 percent nationwide) and reducing GDP CO<sub>2</sub> intensity by 18 percent (vs. 17 percent nationwide) by 2015. To achieve these targets, the BMG has developed a plan to increase the share of renewable energy in the total final energy consumption from the 2010 level of 3.2 percent to 6 percent in 2015. Beijing already achieved a 26.5 percent reduction in GDP energy intensity during the 11<sup>th</sup> FYP period (from 2006 to 2010), the highest reduction among all Chinese cities, in large part due to economic and industrial structural adjustment.

9. **The Golden Sun Program for solar photovoltaic (PV) generation.** To stimulate the domestic PV installation market, the Ministry of Finance (MOF), the National Energy Administration (NEA), and the Ministry of Science and Technology (MOST) jointly initiated the Golden Sun Program in 2009. The purpose of this program is to support the installation of PV generation—mainly rooftop PV systems in urban areas. Under the program, the central government subsidizes about half of the initial capital investment in PV systems. In addition, the Program also encourages and recommends user-side grid connection for PV systems as well as energy service company business model. The program is designed to promote distributed PV generation, but it faces several barriers.

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<sup>1</sup> World Bank. 2012. *Sustainable Low-Carbon City Development in China*.

10. **Barriers to the deployment of rooftop PV systems in China.** Despite the availability of significant public capital subsidies to help scale up commercial investments in rooftop PV systems, the sector is facing the following operational, institutional, and policy barriers:

- Large-scale deployment is hindered by a lack of tested business models for developing projects and operating and maintaining installed systems;
- The Renewable Energy Service Company (RESCO<sup>2</sup>) operational model faces regulatory challenges in the distributed power generation business segment;
- Local capacity to provide sustained institutional and technical support for continued scale-up efforts is lacking; and
- There is still no clear policy allowing rooftop solar PV systems to send the excess electricity to the grid.

11. **The Beijing “Sunshine Schools” Program.** Under the umbrella of the Golden Sun Program, which supports nation-wide installation of PV generation, Beijing will install 100 MW of rooftop PV systems in schools and other educational institutions in Beijing Municipality. It is the largest of such initiatives in China so far. Most projects under the Golden Sun Program involve large PV capacity installed at one place. The proposed “Sunshine Schools” program, however, will involve distributed PV capacity (100 MW in aggregate) in about 800 schools and other educational institutions. The capacities of most systems are expected to range from 50 to 200 kW. The program will test the RESCO business model for distributed rooftop solar PV systems, with enhanced after-sale service. It is also expected to pilot two-way metering for rooftop PV systems. If proven commercially successful, the project would provide valuable experience, and demonstrative and educational effects and benefits (technical feasibility, economic viability, safeguards, and project management) for developing similar schemes in other Chinese cities with promising solar resources.

### **C. Higher Level Objectives to Which the Project Contributes**

12. The project’s objectives are fully consistent with the Country Partnership Strategy (CPS) for FY2013-FY2016, which was discussed by the Board on November 6, 2012. It directly supports one of the two strategic themes of the new CPS: supporting greener growth, in particular, shifting to a sustainable energy path. The project also contributes to China’s efforts to expand use of renewable energy (RE) and to address climate change. It also supports the World Bank Group’s corporate commitment to increase RE investments.

## **II. PROJECT DEVELOPMENT OBJECTIVES**

### **A. PDO**

13. The PDO of the proposed project are to increase the share of clean energy in electricity consumption and to demonstrate the viability of the renewable energy service company model for scaling up the deployment of rooftop solar photovoltaic systems in schools and other educational institutions in Beijing Municipality.

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<sup>2</sup> Renewable Energy Service Company (RESCO): When using the ESCO (Energy Service Company) model in renewable energy sector, the ESCO is usually called RESCO, which is a business model that develops, installs, and arranges financing for projects designed to increase renewable energy and to improve the energy efficiency and maintenance costs for facilities over a range of time period, approximately seven to twenty years.

14. The PDO will be achieved by:
1. Supporting a large scale rooftop PV program (Sunshine School Program) for installation of 100 MW PV systems in about 800 schools and other educational institutions in Beijing Municipality;
  2. Demonstrating the RESCO model for scaling up the deployment of rooftop solar PV systems; and the development and strengthening of institutional capacity, enabling policies and educational programs for renewable energy deployment in the city; and
  3. Supporting institutional capacity building, educational programs for renewable energy deployment in the city, and piloting two-way metering in selected institutions and schools.

#### **B. Project Beneficiaries**

15. The main direct stakeholders of this project are the Beijing Municipal Government (BMG), and Beijing Yuanshen Energy Saving Technology Company Limited (Yuanshen Company, a municipal energy service company that will serve as a project implementation company). Citizens of Beijing municipality will benefit from the reduction of emissions, participating schools and other educational institutions, their staff and students will benefit, in particular, from the educational program supported by the TA component.

#### **C. PDO Level Results Indicators**

16. Achievement of the Project Development Objective would be measured by the following indicators (see Annex 1):
- Materialized share of renewable energy from rooftop solar PV systems in electricity consumption in selected schools;
  - Number of RESCO contracts signed; and
  - CO<sub>2</sub> emission reduction (metric tons/year) as a result of the project.

### **III. PROJECT DESCRIPTION**

#### **A. Project Components**

17. The proposed project will be implemented over six years and consists of two main components: (a) the Sunshine Schools Program--installation of 100 MW rooftop solar PV systems in about 800 schools and other educational institutions; and (b) technical assistance (TA) to develop local capacity for scaling up solar energy deployment, project implementation, and other priority energy policy initiatives of the BMG.

18. **Component 1: Sunshine Schools Program Support - Installation of 100 MW Rooftop Solar PV Systems in Beijing** (estimated cost: \$226.0 million; \$110.3 million IBRD financing). The proposed component will install 100 MW of distributed rooftop PV systems in about 800 schools and other educational institutions in Beijing under the RESCO model for large-scale

rooftop solar PV deployment. Similar to the ESCO business model adopted by the central government as a key market mechanism to scale up energy efficiency investments, the RESCO will take the performance and financial risk of the investment by signing an energy service performance contract (ESPC) with each school/university, which will pay the RESCO only for the solar PV electricity it consumes. The RESCO will install, maintain, and operate the rooftop solar PV installations during the period of the ESPC, and thereafter hand over the installation to the school/university, which themselves pay no up-front capital for the investment. Capital subsidies will be provided by the Golden Sun Program on a graduated scale (RMB8.0/Wp for the first 5 MW and RMB5.5/Wp for the remaining 95 MW). It is expected that the BMG would provide an additional RMB1.0/Wp per year as subsidy limited to the first three years. The Bank loan will be on-lent to the RESCO by the Beijing Municipality.

19. Given that there will be about 800 schools and other educational institutions under this component, a programmatic approach will be adopted for project implementation. Yuanshen Company, the project company for component 1, has developed a Project Implementation and Operations Manual (see Annex 3 for details) acceptable to BMG and the Bank, that outlines school selection criteria, school survey information, technical design and evaluation requirements, environmental management and safety requirements, and procurement and financial management frameworks that are consistent with the World Bank and GOC rules and procedures. During project implementation, relevant Beijing government agencies, including the Beijing Development and Reform Commission (BDRC), Beijing Education Commission (BEC), Beijing Finance Bureau (BFB) and the Project Management Office (PMO), will assist Yuanshen with school selection, if there are any issues and difficulties experienced, and supervise project implementation.

**20. Component 2: Technical assistance for developing local capacity for scaling up solar energy deployment, project implementation, and other priority energy policy initiatives of the BMG** (estimated cost: US\$4.0 million). The proposed TA activities include development of local capacity for scaling up commercially viable solar energy deployment; and engineering and technical support to Yuanshen for the design, procurement, construction supervision and project management of the PV systems. Part of this TA may be financed from Component 3 (for scaling-up commercially viable rooftop solar PV deployment) under a proposed GEF grant supported Urban-Scale Building Energy Efficiency and Renewable Energy Project, which would then replace part of the Borrower's counterpart funding under this project.

21. The proposed TA activities include: (i) Demonstration of the RESCO model for large-scale grid-connected rooftop solar PV deployment in Beijing Municipality, provision of engineering and technical support in relation to PV systems to Yuanshen Company, and independent monitoring and evaluation of implementation and results of such model; (ii) demonstration of two-way metering in Beijing Municipality; (iii) establishment of an online monitoring system for rooftop PV systems and a solar energy information portal in Beijing Municipality; and (iv) improvement of renewable energy education in schools and other educational institutions in Beijing Municipality.

## **B. Project Financing**

### **Lending Instrument**

22. The lending instrument is a Specific Investment Loan (SIL). The loan will be a single currency of US Dollar, variable spread loan of US\$120 million, with a maturity of 25 years, including a 5-year grace period, and a front-end fee of 0.25 percent.

### Project Cost and Financing

23. The table below indicates the project cost and the Bank's financing by component.

Project Components	Project cost (US\$ million)	IBRD Financing (US\$ million)	% Financing
1. Sunshine Schools Program	198.6	96.9	48.8%
2. Technical Assistance	4.0 <sup>3</sup>	0.0	0.0%
<b>Total Baseline Costs</b>	<b>202.6</b>	<b>96.9</b>	<b>47.8%</b>
Physical contingencies	17.9	8.7	48.8%
Price contingencies	9.5	4.7	49.0%
Total Project Costs	230.0	110.3	47.9%
Interest During Construction	9.4	9.4	100%
Front-End Fees	0.3	0.3	100%
<b>Total Financing Required</b>	<b>239.7</b>	<b>120.0</b>	<b>50.1%</b>

### C. Lessons Learned and Reflected in the Project Design

24. China's solar PV industry emerged in the early 1970s and before 2008 PV generation was used mainly for rural electrification. China's solar PV module manufacturing industry started booming over the past decade, but most solar PV modules were exported to the international market, which relies heavily on the existence of incentive policies in developed countries. In 2010, Chinese solar PV manufacturers sold 13 GW, accounting for 45 percent of the global solar PV market. At the same time, in large part because of the Golden Sun Program and the Solar Building Demonstration Project (sponsored by the Ministry of Housing and Urban-Rural Development), the domestic market also entered a fast-track development period. By the end of 2010, the total accumulated installation of solar PV systems reached 900 MW, nine times that of 2008. Current installations are mostly rural generation systems, desert power stations, and some big size rooftop systems. But there is no example yet of a large scale distributed generation system like the proposed project.

<sup>3</sup> Beijing Municipality will provide the funding for the technical assistance component, potentially including \$2 million of support from a proposed GEF grant supported Urban-Scale Building Energy Efficiency and Renewable Energy Project, for which Beijing Municipality is one of the proposed recipient municipalities.

25. From 2001 to 2008, the Bank supported the implementation of the China Renewable Energy Development Project (REDP). Lessons learned from REDP were fully taken into account in the design of the proposed project, as follows:

- Taking into account specific country circumstances when designing grid-connected electrification;
- Fostering synergies between market and technology development (with TA assistance);
- Providing adequate support and adapting the procurement process based on the implementing agency's capacity and the technologies involved; and
- Designing flexible TA programs, which are responsive to changing circumstances.

26. In the mid 1990s, China established three pilot ESCO companies with the support of the World Bank to promote the ESCO business model. With two decades development, the ESCO business model has widely been adopted in China's energy conservation sector and the member companies of the Chinese Energy Management Contract Association have reached 787 (up to October 17, 2012). In a circular issued by the State Council in mid 2011, the ESCO business model was recommended as the main tool to be used for realizing the government's energy conservation target in its 12<sup>th</sup> FYP. Yuanshen Company is one of the three ESCO companies established with the Bank's support. When using the ESCO model in the renewable energy sector, the implementing company is usually called RESCO instead of ESCO. Some user-side connection projects are under operation in China now, but few of them use the RESCO business model. The proposed project will therefore use user-side connection and consumption as base case with the RESCO business model and a few schools will be selected to pilot two-way metering for policy innovation.

27. Experiences from developed countries, such as Germany and the US, as well as from developing countries, such as Mexico, indicate that allowing free-flowing between the distributed solar PV systems and local grid poses no essential technical problems for grid operation when the connected capacity is a small share of the overall local capacity (20 percent is usually considered a threshold). It also opens up opportunities for energy service companies to aggregate distributed projects to achieve economies of scale. Beijing will be the first case where a large number of grid-connected rooftop solar PV systems will come online in a short period of time. The local utility needs to be aware of the potential operational issues arising from grid-connected rooftop solar PV systems and have the solutions. There are also significant potential benefits of having these distributed systems. Local distribution companies in China have not been exposed to these issues until now.

28. Several incentive policies to support PV projects are in use in various countries. For distributed PV projects that are normally connected to the distribution grid, countries use either a Feed-In Tariff (FIT) policy or net-metering rules. In Germany and in most European countries, PV electricity is purchased by utilities with a special FIT that is higher than the price of electricity generated from conventional energy to promote PV application. The difference between the PV FIT and the conventional price is subsidized by governments. In the United States, a mix of incentives, including net-metering rules, tax-credit, Renewable Energy Portfolio Standards, and FIT is applied.

## IV. IMPLEMENTATION

### A. Institutional and Implementation Arrangements

29. The management structure of the proposed project has already been set up at various levels. The Project Leading Group (PLG) has been established to provide overall policy and strategic guidance during project implementation and to facilitate inter-agency coordination. Under the leadership of the PLG, a Project Management Office (PMO) has been set up to carry out day-to-day project management and monitoring and evaluation activities. It will be supported by an independent monitoring and evaluation mechanism with inputs from the Beijing Energy Conservation and Environmental Protection Center and Yuanshen Company.

30. Yuanshen Company, one of the three ESCO companies established with support from the World Bank, was selected prior to the Bank's involvement by the Beijing municipal government to implement the "Sunshine Schools Program", the first component of the proposed project through the RESCO model, prior to the Bank's involvement in this project. The company will take full responsibility for project implementation as well as all operational service obligations after the rooftop PV systems have been put into utilization.

31. The PMO, together with four other agencies, namely the Beijing Education Commission, the Beijing Energy Conservation and Environmental Protection Center, Beijing Grid Company, and Yuanshen Company, will be responsible for the implementation of the TA components under the project. The PMO will perform a role mainly of guidance and supervision to make sure all activities implemented by the various agencies comply with rules and procedures.

32. A detailed description of the project management structure is presented in Annex 3.

### B. Results Monitoring and Evaluation

33. Annex 1 lists the performance indicators to be tracked during the project implementation and specifies the source and schedule for data collection. The PMO (with relevant inputs from Yuanshen Company and the Beijing Energy Conservation and Environmental Protection Center) will be responsible for the overall M&E system, including regular data collection to assess progress towards achieving results. It will furnish to the Bank semi-annual progress reports on project implementation by February 15 and August 15 of each year, starting with August 15, 2013. In addition, it will prepare a mid-term review report by February 15, 2016. Based on the recommendations of these reports and the Bank's reviews and comments on them, the PMO will take actions, satisfactory to the Bank, to address any emerging issues in order to meet the targets set in the results framework.

### C. Sustainability

34. Development of renewable energy to improve the energy structure, and reduce GHG emissions is a long term development strategy of both the GOC and the BMG and both will support the project financially. MOF will provide an investment subsidy through the Golden Sun Program to support the installation and sustainable operation of the project. These subsidies will be provided to Yuanshen Company. With support from its parent company (Jingneng Group, fully owned by the BMG) and the designed TA activities, Yuanshen Company will have required financial, technical, and managerial capacity to operate the project in a sustainable way.



Established as one of the three energy service companies (ESCO) established under the WB/GEF China Energy Conservation Project ten to fifteen years ago, its management team and key staff are familiar with World Bank procedures and rules. Financial sustainability is also supported by the BMG providing a RMB1.0/Wp subsidy for the first three years.

## KEY RISKS AND MITIGATION MEASURES

### D. Risk Ratings Summary Table

<b>Stakeholder Risk</b>	<b>Moderate</b>
<b>Implementing Agency Risk</b>	
- Capacity	<b>Substantial</b>
- Governance	<b>Low</b>
<b>Project Risk</b>	
- Design	<b>Substantial</b>
- Social and Environmental	<b>Low</b>
- Program and Donor	<b>Moderate</b>
- Delivery Monitoring and Sustainability	<b>Substantial</b>
- Other (Optional)	<b>N/A</b>
- Other (Optional)	<b>N/A</b>
<b>Overall Implementation Risk</b>	<b>Substantial</b>

### E. Overall Risk Rating Explanation

35. The overall implementation risk rating for the project is Substantial. Risks and associated mitigation measures are presented in the Operational Risk Assessment Framework (Annex 4). The main risks to the achievement of the PDO are: a) cross-sectoral coordination may cause project delays; b) since the large number of schools involved in the project, the capacity of the project company may be weak to coordinate and manage the project; c) participating schools may lack commitment to the project if proper incentives are not included in the project design; and d) rooftop PV systems may not be properly maintained if roles and responsibilities are not clearly defined.

36. Mitigation measures were included in the project design to: a) involve representatives from all relevant agencies in the Project Leading Group and in the PMO to allow smooth cross-sectoral coordination at various levels during project implementation; b) prepare a Project Implementation and Operations Manual and Project Management Manual to apply standard technical requirements for the construction work at the various sites; c) include incentives under the TA component, for example to help schools develop renewable energies laboratories and educational training programs, to enhance their proactive participation in project implementation and ensure their long-term commitment; and d) define clearly the roles and responsibilities of each party in the RESCO contracts that will be signed between Yuanshen Company and participating schools to ensure that the installed solar PV systems will be well maintained and operated.

## V. APPRAISAL SUMMARY

### A. Economic and Financial Analyses

37. **Economic Analysis.** The project aims to promote the use of renewable energy by installing 100 megawatt (MW) of distributed rooftop Photovoltaic (PV) systems in about 800 schools and other educational institutions in Beijing Municipality. The economic costs and benefits of the project have been identified. Economic benefits include consumer satisfaction (via consumption of the electricity generated), avoided environmental and health costs (both global and local) owing to providing electricity by clean solar power instead of thermal power, and the benefits of demonstrative and educational effects provided by the project. Economic costs include the capital investment for the installation of the rooftop PV systems and operation and maintenance (O&M) costs.

38. A cost-benefit analysis was used to evaluate the economic viability of the project. The economic benefit of electricity consumption was valued based on the concept of the consumers' willingness-to-pay for the electricity generated by the rooftop PV systems. In the environmental and health benefits, the global environmental benefit of avoided CO<sub>2</sub> emissions and local environmental benefits of SO<sub>2</sub>, NO<sub>x</sub>, and TSP reduction were taken into account in the analysis. The analysis also quantified the benefits of demonstrative and educational effects. In particular, the demonstrative benefits include cost reduction and environmental externalities owing to the replication of the roof-top solar PV system in more schools beyond the project. They were estimated under the assumptions of 300 more schools each year from 2015 to 2024 and the unit cost decreased by 15 percent in the same period because of increased production and economies of scale.

39. The cost-benefit analysis concluded that the project is economically viable, with an economic internal rate of return (EIRR) of 8.78 percent. A sensitivity analysis shows that the EIRR will drop to 7.32 percent if the estimated benefit decreases by 10 percent. But if there would be 400 more schools each year and a 20 percent cost reduction in the estimation of the demonstrative benefit, the EIRR would go up to 10.33 percent. Considering that the project aims to increase the share of renewable energy in Beijing's schools, the EIRR is of an acceptable level.

40. **Financial Analysis.** A financial analysis was conducted at the municipal level, project level, and entity level respectively to assess the certainty of counterpart funds, the profitability of the project, and the financial viability of the project company. Detailed analysis is available in Annex 6.

41. In addition to the Bank loan, the Ministry of Finance (MOF) and the Beijing Municipal Government (BMG) will provide subsidies to the project. The total MOF subsidy for the project will amount to RMB 562.5 million (39 percent of the total project investment cost). The BMG would also provide a RMB1.0/Wp subsidy to rooftop PV systems for 3 consecutive years. The total subsidy from the BMG is expected to be RMB 300 million, of which 42 percent or RMB 125.2 million will be used to subsidize the investment cost of the project, accounting for 9 percent of the total project investment cost. The remaining 58 percent or RMB174.8 million will be used to support the operation and maintenance (O&M) of the project.

42. The revenues of the project include tariff revenues paid by project schools and the subsidy provided by the BMG. The operation and maintenance (O&M) costs include expenses for cleaning the PV system, data transfer, bank services, and project management expenses. The financial analysis shows that the project is not financially profitable, and the financial rate of return is negative. It will only break even if the investment costs are lowered by 10 percent and revenues from tariffs are increased by 10 percent.

43. However, the Yuanshen (Project Company) will generate positive cash flows from the project. With the effort to reduce the investment cost and O&M expenses, the cost recovery rate of Yuanshen's PV business could be 1 and its debt service coverage ratio could be 1.1.

### **B. Technical**

44. The proposed project will meet Chinese technical standards for design, equipment specifications, project size, layout, structure, construction, and safety, including the regulations from the Golden Sun Program and the State Grid Company. These standards also generally meet international good practice.

### **C. Financial Management**

45. A Project Management Office (PMO), established under the Beijing Development and Reform Commission, will be responsible for handling overall management and coordination during project implementation, as well as providing guidance and supervision during the implementation of the technical assistance component. The Bank loan proceeds, including overseeing the Designated Account, will be managed by the Beijing Finance Bureau (BFB). A financial management capacity assessment has been conducted by the Bank and actions to strengthen the project's financial management capacity have been agreed with the relevant implementing units. The Financial Management (FM) assessment concluded that with the implementation of these proposed actions, the financial management arrangements would satisfy the Bank's minimum requirements under OP/BP 10.02. Annex 3 of the PAD provides additional information on financial management.

### **D. Procurement**

46. A procurement assessment was conducted. Procurement risks were identified and mitigation measures were devised. The PMO will provide guidance and supervise the procurement activities carried out by Yuanshen Company to procure PV systems through International Competitive Bidding (ICB) or National Competitive Bidding (NCB), according to the thresholds indicated for this project (in Annex 3). The main procurement risk is that Yuanshen Company lacks experience with Bank procurement procedures for supply and installation of equipment through ICB or NCB. This risk will be mitigated by hiring a qualified procurement agent and technical consultants to assist the company in its procurement work. Procurement training was provided by the Bank and Tsinghua University during preparation which has further strengthened the PMO's and Yuanshen's procurement capacities. An initial 18-month procurement plan, acceptable to the Bank, has been developed. It will be updated annually (or as required) to reflect project implementation needs.

## **E. Social (including Safeguards)**

47. **OP4.12 on Involuntary Resettlement.** The project will not trigger the Bank’s Involuntary Resettlement (OP/BP4.12) Safeguards Policy, as all civil works related to the project will be conducted within the selected existing schools and other educational institutions; therefore no land acquisition will be needed.

48. **OP4.10 on Indigenous People.** According to Beijing census data, more than 95 percent of Beijing’s residents belong to the Han Chinese majority. Ethnic minority populations include Manchu, Hui, Mongols, and Koreans. Most of these ethnic minority populations live scattered within the territory of Beijing municipality. Some Manchu and Hui populations live collectively within ethnic minority townships/villages. However, these Manchu and Hui groups share similar economic, social, and political institutions as those of the Han majority. They are not collectively attached to geographically distinct habitats, or to ancestral territories, or to natural resources in their land. Moreover, they do not use an indigenous language in their daily lives. Therefore, it is agreed that Manchu and Hui groups in Beijing are not indigenous people as defined in the Bank’s OP4.10, and therefore this policy is not triggered.

49. **Other Social Concerns – Public Participation and Gender Issue.** In order to encourage active participation of project schools in the project design and implementation, and to balance the different interests between Yuanshen Company and schools, a “project school participation outline”, as part of the Project Implementation and Operations Manual, was developed by the client. Yuanshen Company used the outline to carry out a school survey covering the following key topics: a) project content; b) potential environmental impacts; c) proposed commercial model and energy service contract; d) energy saving education component; e) construction/installation plan; f) maintenance and emergency plan; and g) other suggestions schools might raise. Yuanshen Company collected the concerns and suggestions through the survey, analyzed them, and incorporated the suggestions in the project design. The outline will also be used for additional school surveys.

50. The gender dimension of the project was also analyzed. Some of major beneficiaries of the project are school teachers, staff, and students, many of which are female, especially in the primary and middle schools. The project is therefore expected to have an overall positive impact on women.

## **F. Environment (including Safeguards)**

51. The project is a Category B project as per Bank OP4.01. The proposed rooftop PV system installation and operation will have limited environmental, safety and health impacts. PV systems will be installed on the roofs of existing buildings, without any land acquisition or resettlement. The main potential environmental impacts are health and safety concerns during the operation of the PV systems, as well as potential impacts related to the installation of rooftop PV systems, e.g., potential construction nuisance (noise/dust/waste), disturbance of school activities and construction safety, etc. These impacts are site-specific and minor, and can be avoided, minimized and mitigated with a good design and sound construction management.

52. An Environmental Management Plan (EMP), acceptable to the Bank, has been prepared by Beijing Energy and Environmental Development Engineering Ltd. It includes thorough

screening of possible environmental impacts, and a management plan to avoid, minimize and mitigate potential impacts, including environmental health and safety guidelines. It also includes a set of standard environmental codes of practice (ECOPs) for common environmental and safety issues that are likely to be met during the installation and operation. The ECOPs will be included in the Project Implementation and Operations Manual as a guiding tool for project implementation.

53. Extensive consultations were conducted with project schools during the preparation of the EMP. The EMP was publicly disclosed on the websites of the Beijing Energy Conservation and Environmental Protection Center, the project company, and through the World Bank InfoShop (disclosed on September 6, 2012).

## Annex 1: Results Framework and Monitoring

**Project Development Objective (PDO):** The PDO of the proposed project are to increase the share of clean energy in electricity consumption and to demonstrate the viability of the renewable energy service company model for scaling up the deployment of rooftop solar photovoltaic systems in schools and other educational institutions in Beijing Municipality.

PDO Level Results Indicators	Core	Unit of Measure	Baseline	Cumulative Target Values					Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				FY 2014	FY 2015	FY 2016	FY 2017	FY 2018				
<b>Indicator One:</b> Materialized share of renewable energy from rooftop solar PV systems in electricity consumption in selected schools.	<input type="checkbox"/>		NO					YES	Upon project completion	Progress report	PMO	
<b>Indicator Two:</b> Number of RESCO contracts.	<input type="checkbox"/>	Number	0	200	435	700	765	800	Annual	Progress report	PMO	
<b>Indicator Three:</b> CO <sub>2</sub> emission reduction as a result of the project <sup>4</sup> .	<input type="checkbox"/>	metric tons/year	0	31360	62720	80640	85120	89590	Annual	Progress report	PMO	

<sup>4</sup> The carbon intensity of the North China Grid is 925 g CO<sub>2</sub>e/kWh; average electricity transmission & distribution loss is about 6.5 percent.

INTERMEDIATE RESULTS												
Intermediate Results Indicators	Core	Unit of Measure	Baseline	Cumulative Target Values					Frequency	Data Source/ Methodology	Responsibility for Data Collection	Description (indicator definition etc.)
				FY 2014	FY 2015	FY 2016	FY 2017	FY 2018				
<b>Intermediate Result (Component One): Sunshine Schools Program – 100 MW of distributed rooftop PV systems in about 800 schools and other educational institutions in Beijing Municipality</b>												
Generation capacity of renewable energy constructed under the project.	<input checked="" type="checkbox"/>	MW	0	35	70	90	95	100	Annual	Progress report	PMO	
Number of people provided with access to electricity generated under the project.	<input type="checkbox"/>	Number	0	100,000	250,000	400,000	550,000	650,000	Annual	Progress report	PMO	
<b>Intermediate Result (Component Two): Technical Assistance Component</b>												
Successful demonstration of two-way metering pilot.			NO					YES	Upon project completion	Progress report	Beijing Grid Company	
Number of renewable energy demonstration laboratories established.	<input type="checkbox"/>	Number	0			15		20	Upon mid-term review and project completion	Progress report	PMO	
Operationalization of an online monitoring system for rooftop PV systems and a solar energy information portal.	<input type="checkbox"/>		NO					YES	Upon project completion	Progress report	PMO	
Organization of training and capacity building workshops on RESCO business model for Yuanshen Company.	<input type="checkbox"/>		NO					YES	Upon project completion	Progress report	PMO	

## Annex 2: Detailed Project Description

1. The proposed project consists of two main components: (1) Sunshine Schools Program - installation of 100 MW rooftop solar PV systems in about 800 schools and other educational institutions; and (2) technical assistance (TA) in the development of local capacity for scaling up solar energy deployment, project implementation, and other priority energy policy initiatives of the BMG.

2. **Component 1: Sunshine Schools Program Support - Installation of 100 MW Rooftop Solar PV Systems in Beijing** (estimated cost: \$226.0 million; \$110.3 million IBRD financing). The proposed component will install 100 MW of distributed rooftop PV systems in about 800 schools and other educational institutions in Beijing. The rooftop PV systems for each primary and middle school are expected to range from 50 to 200 kW, while systems in colleges can be larger. Central and municipal government subsidies will finance about half of the estimated investment, while the Bank loan will cover the remainder. The Sunshine Schools Program will also include pilots on two-way metering in a few selected schools. The duration of the project is estimated to be six years, from 2013 to 2018. The installation of the system will be carried out in two stages and in several batches. The first stage—5 MW to be installed before the signing of the Bank loan agreement—will use retroactive financing and receive a RMB8.0/Wp subsidy from the central government. The second stage—95 MW to be installed after the signing of the Bank loan agreement—will receive a RMB5.5/Wp subsidy from the central government.

3. Installation will be carried out by contractors selected through competitive bidding. The selected contractors will be responsible for the detailed design, construction, and operation and maintenance of the system for a period agreed with Yuanshen. Yuanshen will own the rooftop systems and also be responsible for signing Energy Service Performance Contracts with the schools and collect RESCO service fees from the schools based on actual PV electricity consumption. Yuanshen will take full responsibility for the operation and maintenance of the systems according to the contract with the schools during the life of the contract.

4. Once the installation of the rooftop PV systems is completed, Yuanshen will report to the China General Certification Center (CGC), who is designated in the Golden Sun Program, to carry out the acceptance procedure according to the regulations issued by the National Energy Administration (NEA) [2011-109]. The system will be put into operation after this acceptance procedure is passed. The estimated electricity generated by the installed rooftop systems will be around 100 GWh when the entire project is under operation. Electricity from PV rooftop system is estimated to be equivalent to about 10 to 15 percent of the schools' annual electricity consumption.

5. Five main constraints exist for the design of rooftop PV systems. They are:

- Available building rooftop area;
- Rooftop strength for holding the PV system;
- Requirements of the Golden Sun Program that installed capacity should not exceed 25 percent of the upper level transformer's capacity;
- Capacity of the electrical devices in the corridor of PV power output; and
- The load of schools on non-school days.



6. In most cases, with the constraints of the rooftop area, rooftop strength, the capacity of the upper level transformer, and the capacity of the existing cable line, the installed capacity of the system will be less than the load on non-school days. This is verified in the first batch of the project with retroactive financing. Nonetheless, since the load is always changing, surplus will occur whenever the generation is bigger than the load, in which case the surplus will flow to the grid if no anti flow back device is installed.

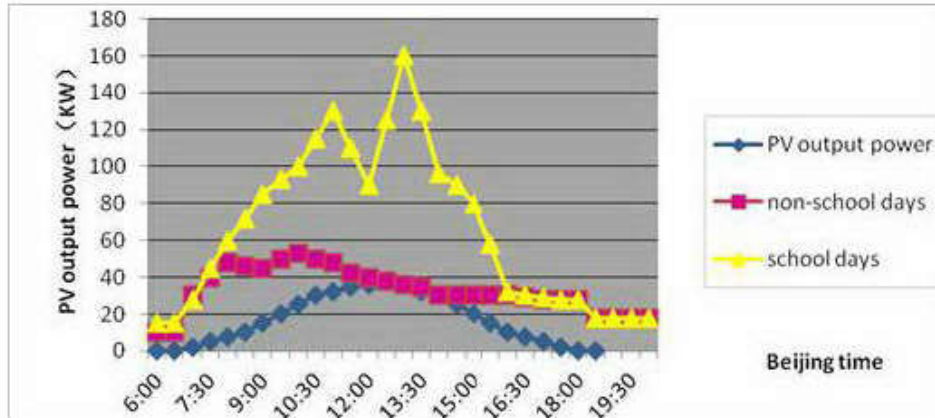
7. According to the design and practice in the first batch for retroactive financing, in each school, “N+M” meters should be installed (N stands for the number of PV rooftop systems at the school, each of which should have a meter to measure the electricity generated from the system. Meanwhile “M” stands for the number of feeders, and those M meters will measure the total surplus electricity flow to the grid from the N PV rooftop systems). Currently, there is no clear regulation on two-way metering and pricing mechanisms on the surplus electricity flow to the grid from PV rooftop systems. Table A2-1 gives an overview of the design criteria.

**Table A2-1: Design Criteria of the Rooftop PV Systems In Terms of Scale and Capacity**

Items	Criteria
Available building rooftop area	Rooftop areas should be without shading
Rooftop strength to hold the PV system	The strength of the rooftop should meet the requirements in the safety standards
Requirements of the Golden Sun Program for installed capacity	System capacity should not exceed 25 percent of the capacity of the upper level transformer
Capacity of electrical devices in the corridor of PV power output	System should meet the requirements for electrical safety in the whole corridor of the PV power output
Load on non-school days	System capacity should not exceed the load on non-school days during the early stage of the project. When two-way metering policy is clear, this criteria may be removed

8. An example of the relationship between the daily load curve and the PV daily output in the month of April for a typical school is given below (Figure A2-1)<sup>5</sup>:

<sup>5</sup> Since the survey was done with one hour intervals between measuring points, the curves are very smooth and don't show the actual fluctuation of the load. Whenever the load is smaller than the generation from the PV rooftop system, surplus electricity will flow to the grid.



**Figure A2-1: Daily load curve and PV output in April for a typical school**

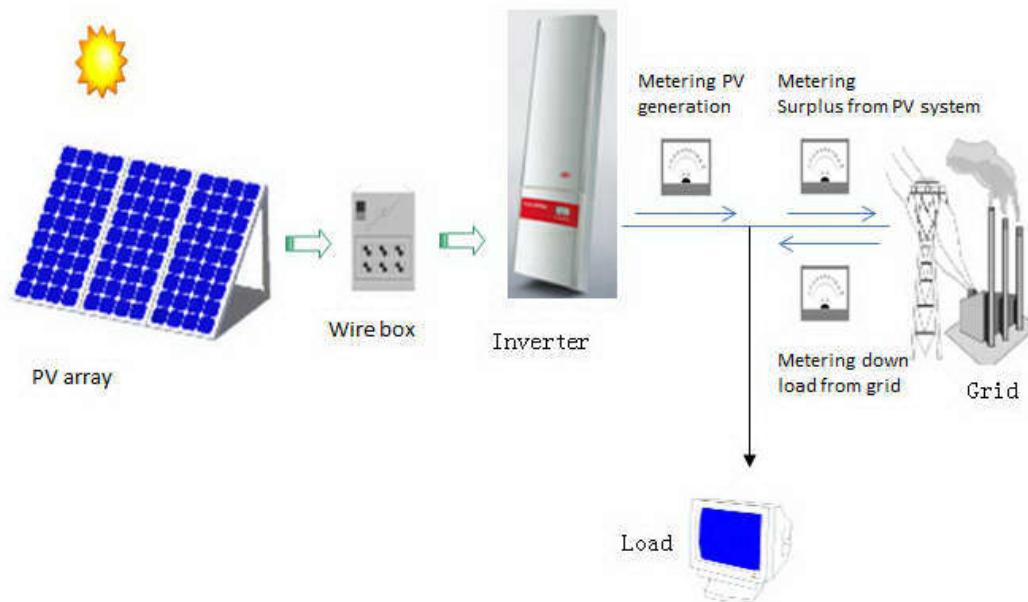
9. In the case of a larger rooftop area and a smaller load, there will be more surplus electricity flow to the grid on weekends and holidays. The amount of surplus electricity will depend on the size of the rooftop PV system. Around 10-15 schools of this kind will be selected for two-way metering demonstration during the early stage of the implementation.

10. The information presented above is based on the survey in selected schools in April 2012. Public data on solar radiation shows that the month of April on average has the third highest solar radiation within a year (see table A2-2). April radiation at the time of the survey was even above average. This means rooftop PV systems will generate more electricity in April than in most other months. Since the outside ambient temperature in April is mild, creating no need for heating or cooling, the load is smaller than it is in other months. As a result, most surplus will happen at this time of year, with less surplus expected in other months.

**Table A2-2: Monthly Average Solar Radiation for 2012 (KWh/m<sup>2</sup> per day)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily average solar radiation	2.15	3	3.94	4.9	5.48	5.19	4.59	4.38	3.93	3.1	2.23	1.83

11. Figure A2-2 shows the design of the PV rooftop system. The electricity generated by the rooftop PV systems will be converted from DC into AC by an inverter. It will then be directly consumed by the load in the low voltage side, which is encouraged by the Golden Sun Program in its grid connection guidelines. The surplus will flow back to the grid. It is estimated that the total surplus from the proposed project will be around 0.25 percent of the total generation.



**Figure A2-2: Layout of the rooftop system**

12. **Component 2: Technical Assistance Component** (estimated cost: US\$4.0 million). The proposed TA activities include development of local capacity for scaling up commercially viable solar energy deployment; and engineering and technical support to Yuanshen Company for the design, procurement, construction supervision and project management of the PV systems. Part of this TA may be financed from Component 3 (for scaling-up commercially viable rooftop solar PV deployment) under a proposed GEF grant supported Urban-Scale Building Energy Efficiency and Renewable Energy Project, which would then replace part of the Borrower's counterpart funding under this project. The proposed TA activities are summarized below.

- (i) Supporting the demonstration of the RESCO business model for large-scale grid-connected rooftop solar PV deployment. This will include provision of engineering and technical support in relation to PV systems to Yuanshen Company, as well as support for independent monitoring and evaluation of the implementation and results of the RESCO approach, along with related outreach and dissemination efforts;
- (ii) Supporting the demonstration of two-way metering, including providing support for Beijing Grid Company to analyze the impact of two-way metering for grid-connected rooftop PV systems on the operation and management of the local grid and developing technical and business solutions for incorporating rooftop solar PV systems into the local grid;
- (iii) Establishing a solar energy information portal, including an online monitoring system for rooftop PV systems, information on rooftop solar PV installations, relevant policies and procedures, local project developers and equipment suppliers, and other relevant information; and

- (iv) Supporting improvement of renewable energy education in Beijing's schools by improving student access to hands-on activities, supporting student leadership and innovation activities, and improving the content and delivery of the renewable energy education.

## **Annex 3: Implementation Arrangements**

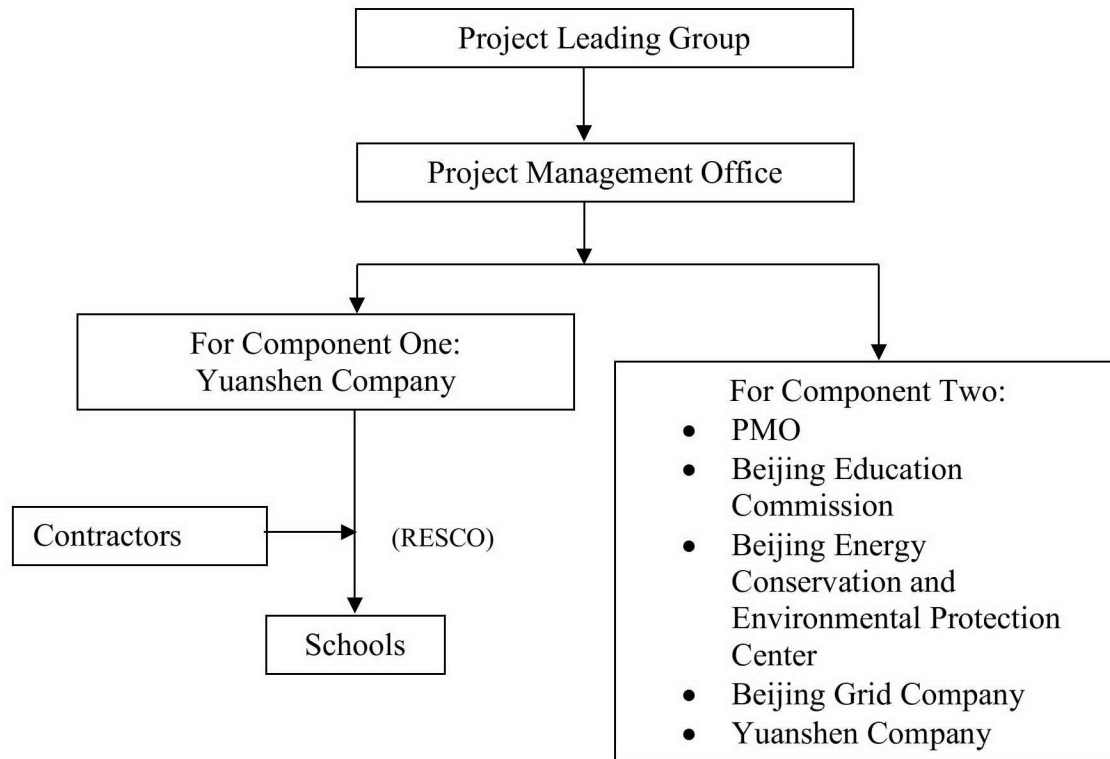
### **Project Institutional and Implementation Arrangements**

1. The management structure of the proposed project has already been set up at various levels. A Project Leading Group (PLG) has been established and is chaired by the Deputy Director-General of the Beijing Development and Reform Commission (BDRC). The PLG comprises senior leadership from relevant departments of BDRC, Beijing Finance Bureau, Beijing Education Commission, Beijing Grid Company, and Yuanshen Company. The PLG will provide overall policy and strategic guidance, and review the work program. It will also be responsible for facilitating inter-agency coordination and for solving any major issues during project implementation.
2. Under the leadership of the PLG, a Project Management Office (PMO) has been set up in BDRC. The project team includes staff from BDRC, Beijing Finance Bureau, Beijing Education Commission, and Yuanshen Company. The PMO is staffed with competent and committed staff in the field of procurement, financial management, and safeguards, and has about 20 years of experience with World Bank financed projects. It will have overall responsibility for daily inter-agency coordination during project implementation and project management, and will prepare the annual project implementation plan, monitor the project progress, and compile project progress reports for review by the PLG and the World Bank. An independent monitoring and evaluation mechanism will be established by the PMO for overall monitoring and evaluation of all project activities. This includes monitoring the quality for project outputs and results, data consolidation for outcome and impact analysis, and making sure project results indicators are available to measure the achievement of the project development objectives. The detailed TOR, acceptable to the Bank, has been finalized. An on-line tracking and monitoring system is available at the Beijing Energy Conservation and Environmental Protection Center and will be further improved under a project TA activity.
3. Yuanshen Company is the Project Company for the first component. It is one of the three energy service companies (ESCO) established under the WB/GEF China Energy Conservation Project ten to fifteen years ago, and its management team and key staff are relatively familiar with World Bank procedures and requirements for project implementation. Its main responsibilities under the proposed project are to organize implementation activities, select qualified contractors for the installation of the rooftop PV systems in participating schools, coordinate with schools and organize construction in an efficient and safe manner, handle procurement and contract management in compliance with World Bank guidelines and procedures, prepare the detailed work program, select a qualified construction supervision team, carry out daily supervision and quality control of the installation work, and prepare and submit project reports (project progress reports and financial reports) to the PMO on a timely basis.
4. Prior to the Bank's involvement, Yuanshen Company was selected by the BMG to implement the "Sunshine Schools Program" (the first component of the proposed project) using the RESCO model. Yuanshen Company will take full responsibility for project implementation as well as all operational service obligations. After the rooftop PV systems are installed and put into operation, the company will collect fees for the electricity generated by the systems and consumed by the schools. The due diligence and responsibilities of both Yuanshen and the schools are clearly stated in a Renewable Energy Service Company (RESCO) contract signed by

both parties. Yuanshen Company will be responsible for the maintenance of the rooftop PV systems during the life of the contract.

5. For the TA component, the PMO will mainly perform a guidance and supervision role to ensure activities implemented by the various agencies all comply with rules and procedures.

6. Figure A3-1 presents an overview of the project’s institutional structure.



**Figure A3-1: Institutional structure for project management**

## **Financial Management, Disbursements and Procurement**

### ***Financial Management***

7. The financial management (FM) capacity assessment identified the large number of parties involved in the project—the PMO, finance bureau, DRC, education bureau, Yuanshen, and participating schools, among others—as the main risk. Cooperation and coordination among these parties will be a challenge for project implementation. Mitigation measures to address this risk, which have been agreed, include: a) preparation of a project management manual that will clearly state the responsibilities of each party (the manual has been developed and approved) and b) World Bank supervision and guidance on these requirements during project implementation. The residual financial management risk, after these mitigation measures, is assessed as Moderate.



8. **Budgeting.** The annual project implementation plan, including the budget and resources, will be prepared by Yuanshen Company and consolidated by the PMO. Budget variance analysis will be conducted on a semi-annual basis by Yuanshen and by the PMO for the respective components they implement, with necessary actions taken to make sure that the project can be implemented as planned. The Bank will work with the PMO and Yuanshen on supervising project budgeting systems to enhance their budget preparation and execution during project implementation.

9. **Funds flow.** The Bank loan proceeds will flow from the Bank into the project Designated Account (DA) to be set up at and managed by the Beijing Finance Bureau (BFB). The BFB will be directly responsible for the management, maintenance, and reconciliation of DA activities. Supporting documents required for Bank disbursements will be prepared and submitted by Yuanshen to the PMO for review, and then to the BFB for further disbursement processing. Funds will be disbursed to Yuanshen based on their withdrawal applications.

10. The Bank loan will be signed between the Bank and the People's Republic of China through the Ministry of Finance (MOF). On-lending arrangements for the Bank loan will be signed between the PRC through MOF and the Beijing Municipal Government through BFB, then between BFB and Yuanshen Company, a wholly-owned subsidiary of the Beijing Energy Investment Holding Company Limited (Jingneng Group).

11. **Accounting and financial reporting.** The administration, accounting, and reporting of the project will be set up in accordance with Circular #13: "Accounting Regulations for World Bank-financed Projects" issued in January 2000 by MOF.

12. The Yuanshen Company will manage, monitor, and maintain project accounting records for the activities they execute, retaining all original supporting documents. The PMO will be responsible for preparing the project consolidated financial statements. The unaudited semi-annual project interim financial reports (IFRs) (with format and content in accordance with the aforementioned Circular #13 agreed with MOF) will be prepared and furnished to the Bank by the PMO no later than 60 days following each semester (February 15 and August 15).

13. **Internal control.** The related accounting policy, procedures, and regulations have been issued by MOF to uniformly align the financial management and disbursement requirements for Bank financed projects. The internal control system, which is consistent with those issued by MOF, has been established in Yuanshen and the same system will be used to oversee project funds.

14. **Audit.** The Beijing Municipal Audit Office (BMAO) has been identified as auditor for the project. An annual audit report will be issued by BMAO and will be due to the Bank within 6 months after the end of each fiscal year. Following the World Bank's formal receipt of the audited financial statements from the borrower, the World Bank will make them available to the public in accordance with the World Bank Policy on Access to Information.

## ***Disbursements***

15. Four disbursement methods are available for the project, which are: advance payment, reimbursement, direct payment, and special commitment. Supporting documents required for Bank disbursement using these various methods are documented in the Disbursement Letter issued by the Bank.

16. One DA in U.S. dollar will be opened at a commercial bank acceptable to the Bank and will be managed by BFB. The ceiling of the DA is documented in the Disbursement Letter.

17. The Bank loan would be disbursed against eligible expenditures (inclusive of tax) as shown in the following table:

<b>Disbursement Categories</b>	<b>IBRD Loan</b>	
	<b>Allocated Amount (US\$)</b>	<b>percentage of Expenditures to be financed (percentage)</b>
(1) Goods (including supply and installation) and non-consulting services	110,260,000	100%
(2) Front-end fee	300,000	100%
(3) Interest Rate Cap or Interest Rate Collar premium	0	
(4) Interest during construction	9,440,000	100%
<b>Total</b>	<b>120,000,000</b>	

18. Overhead costs incurred by Yuanshen for preparing, implementing, and managing project activities will be financed by the MOF subsidy and follow the government's fiduciary requirements. The total MOF subsidy is set currently at RMB5.5/Wp to cover both the overhead costs incurred by Yuanshen as well as the installed capacity wattage per each contract. Yuanshen and the government are currently working on determining an appropriate rate/amount per watt for the reimbursed overhead costs. Once agreed, this amount (expressed in RMB/Wp) will be deducted from the MOF subsidy to cover these overheads. Thus, any remaining contract amount not covered by the MOF subsidy will be financed by the Bank loan.

19. Yuanshen will sign the equipment and installation contract with the supplier/contractor, following the acceptable procurement procedures. The contract amount will be expressed in the unit price multiplies the installed capacity. Once the supplier/contractor completes the agreed minimum amount installed capacity, Yuanshen will carry out the acceptance check (Yanshou). If the capacity is acceptable, Yuanshen will request the disbursement of the Bank loan based on the completed capacity. There could be multiple disbursement requests for each contract. The amount financed by the Bank is calculated as: installed capacity \* (unit price – (RMB5.5/Wp –



RMB0.93/Wp))<sup>6</sup>. In order to better reflect this arrangement, the following table will be used when Yuanshen submits the withdrawal applications.

<b>Supplier</b>	<b>Contract number</b>	<b>Contract unit price RMB/(Wp)</b>	<b>The unit price after subsidy for disbursement</b>	<b>Installed capacity in this application (Wp)</b>	<b>Amount financed by the WB</b>	<b>Cumulative disbursed amount after this application</b>

20. While the contracts between Yuanshen and the schools will continue for 15-20 years after the installation of the PV systems, the Bank can only finance expenditures incurred during project implementation. As such, it was agreed that maintenance costs would be financed from counterpart funds. Since maintenance has already been included in two previously signed contracts, Yuanshen and the PMO will deduct the maintenance amount when submitting withdrawal applications to the Bank for these two contracts.

21. **Retroactive Financing.** Retroactive financing of up to \$24 million would be available for eligible expenditures incurred on and after June 30, 2012. Retroactive financing will be processed according to the requirements specified in the Loan Agreement and Project Agreement.

***Procurement***

22. **Capacity Assessment.** The principal risk identified in the procurement capacity and risk assessment was the inadequate experience of Yuanshen Company staff with procurement under Bank financed projects (the PMO already has some experience with Bank procurement). Mitigation measures include the following four actions: (a) training has been provided to procurement staff of Yuanshen Company and the PMO during project preparation; (b) procurement training will be provided to all project procurement staff periodically during project implementation in accordance with the procurement training plan prepared by the PMO; (c) Procurement management arrangements acceptable to the Bank has been prepared by Yuanshen as a chapter of the Project Implementation and Operations Manual to standardize project procurement procedures and provide guidance to project staff with responsibility for procurement; and (d) a procurement agent with experience in World Bank procurement procedures has been recruited by Yuanshen Company and the PMO to assist with the planning and implementation of procurement activities. The overall procurement risk is considered ‘moderate’.

23. **Applicable Guidelines.** Procurement will be carried out in accordance with the “*Guidelines: Procurement of Goods, Works and Non-Consulting Services under IBRD Loans*”

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<sup>6</sup> The formula is calculated based on the current subsidy level, which is subject to regular review of government subsidies and disbursement status during project implementation.

and IDA Credits & Grants by World Bank Borrowers” dated January 2011; the “Guidelines: Selection and Employment of Consultants by World Bank Borrowers” dated January 2011; and the provisions stipulated in the Loan Agreement. National Competitive Bidding (NCB) shall be carried out in accordance with the *Law on Tendering and Bidding of the People’s Republic of China* promulgated by Order of the President of the People’s Republic of China on August 30, 1999 subject to the modifications stipulated in the Loan Agreement in order to ensure consistency with World Bank Procurement Guidelines.

24. **PV System Supply & Installation and Goods Procurement.** PV system supply and installation (100 MW) would be procured under the project. Individual PV systems would range from 50 kW to 200 kW and procurement would be conducted through International Competitive Bidding (ICB) and NCB as well as Shopping. Non-consulting services contracts (outreach and dissemination activities) would be procured for the purpose of raising public awareness on energy efficiency.

25. **Procurement Plan.** A Procurement Plan (PP) for the first 18 months of project implementation, acceptable to the Bank, has been prepared and consolidated by the PMO for World Bank review. It will be available in the project files and on the World Bank’s external website. The PP will be updated annually or as required to reflect implementation needs and improvements in institutional capacity.

26. **Frequency of Procurement Supervision.** Procurement supervision would be carried out once a year. Procurement post reviews will be carried out by the World Bank every 12 months. The procurement post review sampling ratio will be 1 out of 10 contracts.

27. **Thresholds for Procurement Methods and Prior Review.** Procurement methods and prior-review thresholds are indicated in the table below. No works or consultants’ services will be financed out of the loan.

**Table A3-1: Thresholds for Procurement Methods and Prior Review**

<b>Expenditure Category</b>	<b>Contract Value Threshold (US\$)</b>	<b>Procurement Method</b>	<b>Prior Review Threshold (US\$)</b>
1. Goods and Non-Consulting Services	≥3,000,000	ICB	All
	<3,000,000	NCB	≥3,000,000 and identified in the Procurement Plan
	<100,000	Shopping	1st Contract
	None	Direct Contracting (small value contracts for Public Awareness)	All

<b>Expenditure Category</b>	<b>Contract Value Threshold (US\$)</b>	<b>Procurement Method</b>	<b>Prior Review Threshold (US\$)</b>
2. Supply and Installation of Equipment	≥25,000,000	ICB	All ≥15,000,000 and identified in the Procurement Plan
	<25,000,000	NCB	
	<200,000	Shopping	1st Contract

28. **Retroactive Financing.** Table A3-2 below lists the contracts for PV system installation that are expected to be procured under retroactive financing. All contracts to be financed through retroactive financing will be subject to prior review.

**Table A3-2: Contracts to be procured under Retroactive Financing**

<b>Reference Number</b>	<b>Description</b>	<b>Procurement Method</b>	<b>Domestic Preference (Yes/No)</b>	<b>Review by Bank (Prior / Post)</b>
SS(RE)-G2011-01	Design, supply, installation and operation services of rooftop PV systems (first batch)	NCB	No	Prior
SS(RE)-G2011-02	Design, supply, installation and operation services of rooftop PV systems (second batch)	NCB	No	Prior

***Environmental and Social (including safeguards)***

29. Rooftop PV system installation and operation will have limited environmental, safety and health impacts. The PV systems will only be installed on the roofs of existing buildings, without any land acquisition and resettlement, therefore, only *OP 4.01 Environment Assessment* is triggered. Main potential environmental impacts are health and safety concerns during PV system operation, as well as potential impacts related to the installation of the systems, such as potential construction nuisances (noise/dust/waste), disturbance of school activities, and construction hazards. These potential impacts are site-specific and are not significant. They can be readily avoided, minimized, and mitigated with good design and sound construction management. The project is a Category B project as per OP4.01.

30. An Environmental Management Plan (EMP), acceptable to the Bank, has been prepared by Beijing Energy and Environmental Development Engineering Ltd. The preparation of the EMP followed national requirements, as well as the World Bank's *OP4.01 Environmental Assessment*

and the International Finance Corporation's *Environment, Health and Safety General Guidelines*. The EMP includes thorough screening of possible environmental impacts and a management plan to avoid, minimize, and mitigate these potential impacts. It also includes a set of standard environmental codes of practice (ECOPs) for common environmental and safety issues met during the installation and operation stages. The ECOPs will be included in the Project Implementation and Operations Manual as a guiding tool for project implementation.

31. Project schools were consulted extensively during the preparation of the EMP. The main health and safety concerns were fully incorporated in the EMP and the ECOP. The EMP was publicly disclosed on the websites of the Beijing Energy Efficiency Center (on September 5, 2012) and the project company, as well as through the World Bank InfoShop (disclosed on September 6, 2012).

32. During project implementation, the PMO and the implementing company (Yuanshen Company) will be responsible for overall environmental management. A Project Implementation and Operations Manual has been developed. It includes the institutional arrangements for environmental management and the ECOP. The ECOP will also be incorporated in the bidding documents/contracts for implementation.

### ***Monitoring & Evaluation (M&E)***

33. Annex 1 provides a detailed description of the performance indicators to be tracked under the project and specifies the source and schedule for data collection. The PMO (with relevant inputs from Yuanshen Company and the Beijing Energy Conservation and Environmental Protection Center) will be responsible for the overall M&E system, including regular data collection to assess progress towards achieving results. It will furnish to the Bank semi-annual progress reports on project implementation by February 15 and August 15 of each year, starting with August 15, 2013. In addition, it will prepare a mid-term review report by February 15, 2016. Based on the recommendations of these reports and the Bank's reviews and comments thereon, the PMO will take actions, satisfactory to the Bank, to address any emerging issues in order to meet the targets set in the results framework.

34. The PMO has prepared a Project Management Manual which specifies clearly the roles and responsibilities of each party concerned during project implementation. It also gives a detailed description of the project processing workflow and procedures. The Manual helps to create a smooth and coordinated environment for project management.

35. In addition, Yuanshen has developed a Project Implementation and Operations Manual which provides a standardized set of technical and safety instructions for the implementation of component 1 under the project. All the contractors are required to strictly follow the guidance provided by the Manual. Yuanshen will also monitor the construction work at various sites by various contractors based on the Manual. The Manual also specifies the selection criteria of participating schools and Yuanshen's responsibilities for operation, maintenance and repair of the solar equipment installed at the participating schools throughout the project operation phase.

**Annex 4: Operational Risk Assessment Framework (ORAF)**  
**CHINA: Beijing Rooftop Solar Photovoltaic Scale-Up (Sunshine Schools) project**

<b>1. Project Stakeholder Risks</b>		<b>Rating</b>	<b>Moderate</b>	
<p><b>Description :</b>  The PDO is aligned both with the GOC and BMG 12<sup>th</sup> Five-Year Plans and GOC and BMG are strongly committed to the project.</p> <p>The Beijing Education Commission is fully involved in the project management structure at various levels. Thus the voices from participating schools are clearly heard and the project is designed in a way that schools and students will be able to enjoy the benefits of the project to the largest extent possible.</p>	<b>Risk Management:</b> Beijing DRC is working on a Government Policy Guideline which requires each district of Beijing to take a quantified responsibility of renewable energy application. After this Guideline is operational, the involvement of the district governments and the schools will be further improved.			
	<b>Resp:</b> Client and Bank	<b>Stage:</b> Both	<b>Due Date :</b>	<b>Status:</b> In progress
<b>2. Implementing Agency Risks (including fiduciary)</b>				
<b>2.1 Capacity</b>		<b>Rating:</b>	<b>Substantial</b>	
<p><b>Description :</b>  The PMO has about 20 years of experience with World Bank financed projects and has competent and committed staff. However, the PMO lacks the specific technical expertise required for project design and implementation.</p> <p>Yuanshen Company, the implementing company for Component 1, has already implemented Bank financed projects in the past 15 years. However, Bank fiduciary and safeguards policies have changed over time. Yuanshen's capacity in coordinating with different government agencies and schools is weak. A Project Management Manual and a Project Implementation and Operations Manual have been developed and will guide project implementation.</p> <p>Counterpart funding for rooftop PV systems relies on government subsidies. Endorsement of the provision for the subsidies has been received.</p>	<b>Risk Management :</b> Technical discussions and training will be provided to the PMO and Yuanshen Company by Bank specialists and consultants. An independent monitoring and evaluation mechanism will be established to provide technical support to the PMO and to oversee project design and implementation. <p>The project will provide capacity building support to municipal agencies, especially to the Beijing Education Commission, District Education Committees and schools.</p> <p>Financial management and procurement training programs will be provided by the Bank to the PMO and the implementing agency to gain adequate knowledge in these fields.</p>			
	<b>Resp:</b> Client and Bank	<b>Stage:</b> Both	<b>Due Date :</b>	<b>Status:</b> In progress
<b>2.2 Governance</b>		<b>Rating:</b>	<b>Low</b>	
<p><b>Description :</b>  The project management and decision making structure is already in place. The institutional arrangements and the roles and responsibilities of the different agencies have now been clearly identified.</p>	<b>Risk Management :</b>			
	<b>Resp:</b> Client	<b>Stage:</b> Both	<b>Due Date :</b>	<b>Status:</b> In progress

<b>3. Project Risks</b>			
<b>3.1. Design</b>	<b>Rating:</b>	<b>Substantial</b>	
<p><b>Description :</b> It will be the first project of its kind in China for large scale distributed solar PV generation in public facilities, particularly in schools. However, technologies for rooftop PV installation and generation are already mature.</p> <p>Project design is complex: (a) large number of schools is involved in the project; (b) need to customize the design for each school; and (c) the installation work is permitted on weekends or holidays.</p> <p>A project Implementation and Operations Manual has been developed by Yuanshen to standardize the technical requirements for construction at various sites. Yuanshen has implemented rooftop PV system installation with one school using their own funds to gain lessons and experience for future operation.</p>	<p><b>Risk Management :</b> In addition, rooftop PV system of 5MW capacity will be installed in selected schools with retroactive financing in order to gain more experience for future large scale construction.</p> <p>WB specialists and consultants will work closely with the PMO and the implementing agency on a comprehensive and detailed project implementation plan.</p>		
	<b>Resp:</b> Client and Bank	<b>Stage:</b> Both	<b>Due Date :</b>
<b>3.2. Social &amp; Environmental</b>	<b>Rating:</b>	<b>Low</b>	
<p><b>Description :</b> <u>Environmental:</u> The proposed project will have limited environmental impacts during the installation and operation of rooftop PV facilities, with main concerns for safety issues. The EMP incorporates: (a) generic environmental specifications to guide the installation of rooftop PV systems, and (b) safety management rules for operation. The Project Implementation and Operations Manual provide safety instructions to all contractors for the installation phase.</p> <p><u>Social:</u> Most of the works related to the project will be conducted within the selected existing schools and other educational institutions.</p>	<p><b>Risk Management :</b> Sufficient training and guidance will be provided to the PMO and to the EIA Consultant throughout project preparation and implementation.</p> <p>A “Target School Participation Outline” will be used for school survey before the design is finalized for each school.</p>		
	<b>Resp:</b> Client and Bank	<b>Stage:</b> Both	<b>Due Date :</b>
<b>3.3. Program &amp; Donor</b>	<b>Rating:</b>	<b>Moderate</b>	
<p><b>Description :</b> Part of the technical assistance is financed from the proposed GEF supported Urban-Scale Building Energy Efficiency and Renewable Energy Project, which is managed by the Ministry of Housing and Urban-Rural Development. As there are multi stakeholders involved in this project, efficient coordination among all parties concerned will be important.</p>	<p><b>Risk Management :</b> The Bank will ensure close coordination among multi stakeholders on technical assistance activities.</p>		
	<b>Resp:</b> Client and Bank	<b>Stage:</b> Both	<b>Due Date :</b>

<b>3.4. Delivery Monitoring &amp; Sustainability</b>	<b>Rating:</b>	<b>Substantial</b>		
<b>Description :</b> Quality of PV installation and other relevant works may not be up to standards. Capacity for construction management may not be strong enough and capacity for identifying and fixing implementation problems may be weak.  Inadequate human and financial resources to operate and maintain the facilities and equipment after the RESCO contracts between Yuanshen and the schools end and the facilities are handed over to the schools. The capacity building component includes actions to address project sustainability.	<b>Risk Management :</b> Under the guidance of the PLG, the PMO will monitor and mitigate the risks identified in project implementation.  Bank supervision will focus on sustainability issues.  Schools will negotiate new contracts with Yuanshen or select other service providers to maintain the rooftop PV systems after the RESCO contracts end.			
	<b>Resp:</b> Client and Bank	<b>Stage:</b> Both	<b>Due Date :</b>	<b>Status:</b> In progress
<b>3.5. Other (Optional)</b>	<b>Rating:</b>			
<b>Description :</b>	<b>Risk Management :</b>			
	<b>Resp:</b>	<b>Stage:</b>	<b>Due Date :</b>	<b>Status:</b>
<b>3.6. Other (Optional)</b>	<b>Rating:</b>			
<b>Description :</b>	<b>Risk Management :</b>			
	<b>Resp:</b>	<b>Stage:</b>	<b>Due Date :</b>	<b>Status:</b>
<b>4. Overall Risk Rating: Substantial</b>				
<b>Comments:</b> (1) The involvement of the senior leadership representatives from all relevant agencies in the leading group and in the PMO will facilitate cross-sectoral coordination at various levels; (2) The Project Implementation and Operations Manual and the Project Management Manual list standard technical requirements during construction at various sites and standardize relevant workflow and procedures; (3) Initial design may need significant revision at the time of construction, and bidding documents need to take this into consideration to avoid contract variations.				

## Annex 5: Implementation Support Plan

### Strategy and Approach for Implementation Support

1. This annex lays out the key activities that the Bank will implement to appropriately mitigate the risks identified during project implementation. It will focus on the key risks defined in the ORAF and will strive to provide the client with the most effective implementation support. Under the proposed project, the key risks revolve around the project design and the implementing agency's lack of adequate capacity in the effective execution of the project's physical construction, procurement, financial management, safeguards management, and monitoring and evaluation activities.

2. **Technical Support.** The Bank provided technical expertise during project preparation and will continue to provide extensive technical support to the PMO and the implementing agency to effectively monitor and implement the project activities according to the Project Management Manual and the Project Implementation and Operations Manual. The Bank will also provide training and technical assistance activities in implementing the technical designs during project implementation.

3. **Procurement.** Procurement implementation support would include:

- Facilitation of a multi-stage training program targeting procurement staff in the PMO and the implementing agency to help them fully understand Bank procurement guidelines;
- Review of procurement documents and timely provision of feedback on the results of prior and post reviews to the parties concerned;
- Monitoring procurement progress against the agreed Procurement Plan.

4. **Financial Management.** Project financial management will be reviewed and evaluated on a regular basis by the Bank's financial management specialist. S/he will join supervision missions and will review the implementation of the Financial Management Manual. The specialist will also provide technical support to the project implementing agency and help with timely resolution of potential financial management issues and any issues identified by the auditors. The review and monitoring will include the evaluation of the adequacy of the financial management arrangements in place, disbursement processes, on-lending arrangements, counterpart fund allocations, and document filing systems.

5. **Environmental and Social Safeguards.** Bank environmental and social development experts will provide guidance to the project implementing agency on addressing relevant issues that arise during project implementation.

### Implementation Support Plan

6. Most Bank staff working on the project is based in the World Bank Beijing Office. This would ensure rapid and effective response to the Borrower's needs for implementation support. Washington-based staff and international consultants would bring global experience to the project. Formal supervision and field visits covering all aspects of project implementation will be carried out semi-annually during the early stage of project implementation, complemented by occasional visits by small missions on an as-needed basis. Estimated inputs from different specialists at different stages of project implementation are outlined below.



7. **Financial Management.** The supervision strategy for this project is based on its Financial Management (FM) risk rating, which will be evaluated on a regular basis by the FM specialist in line with the FM Manual, and in consultation with the relevant task team leader. Training will be provided by the Bank before the commencement of project implementation. The Bank team will also help the project identify bottleneck issues and address these issues in a timely manner.

**Table A5-1: Project Implementation Support Input Requirements**

<i>Time</i>	<i>Focus</i>	<i>Skills Needed</i>	<i>Resource Estimate</i>	<i>Partner Role</i>
<i>First twelve months</i>	<ul style="list-style-type: none"> <li>• Team and project leadership</li> <li>• Project design and technical supervision</li> <li>• FM &amp; Procurement</li> <li>• Capacity building</li> </ul>	<ul style="list-style-type: none"> <li>• Technical</li> <li>• FM</li> <li>• Procurement</li> </ul>	6-7 staff, 2 trips per staff	NA
<i>12-48 months</i>	<ul style="list-style-type: none"> <li>• Project implementation and supervision</li> <li>• FM &amp; Procurement</li> <li>• M &amp; E</li> </ul>	<ul style="list-style-type: none"> <li>• Technical</li> <li>• Safeguards</li> <li>• FM</li> <li>• Procurement</li> </ul>	6-7 staff, 2 trips per staff annually	NA
<i>Other</i>				

**Table A5-2: Skills Mix Required**

<i>Skills Needed</i>	<i>Number of Staff Weeks</i>	<i>Number of Trips</i>	<i>Comments</i>
Task Team Leader	4 SWs during the first year and 3 SWs annually in the following years	Two	Country office based
Energy specialist	4 SWs during the first year and 3 SWs annually in the following years	Two	Country office based
Energy specialist	4 SWs during the first year and 3 SWs annually in the following years	Two	International staff (Washington based)
Infrastructure specialist	3 SWs during the first year and 2 SWs annually in the following years	Two	International staff (Washington based)
Environmental safeguards specialist	2 SWs during the first year and 1 SWs annually in the following years	Field trips as required	Country office based
Social safeguards specialist	1 SW annually	Field trips as required	Country office based
FM specialist	1 SW annually	Field trips as required	Country office based
Procurement specialist	3 SWs annually	Field trips as required	Country office based

## Annex 6: Economic and Financial Analysis

### A. Economic Analysis

1. **Project Objectives and Brief Description of Project Components.** The project aims to promote the use of renewable energy by installing 100 MW of distributed rooftop PV systems in about 800 schools and other educational institutions in Beijing Municipality. This will be achieved through supporting a rooftop PV demonstration program in about 800 schools and other educational institutions in Beijing Municipality that uses RESCO business model, pilots two-way metering in selected schools, and supports development of institutional capacity, which enables policies and educational programs for renewable energy deployment in the city.
2. **Economic Benefits and Costs Identified.** The economic benefits and costs of the project are identified and quantified to the extent possible. Economic benefits include consumer satisfaction (via consumption of the electricity generated), avoided environmental and health costs (both global and local) owing to providing electricity by clean solar power instead of thermal power in Beijing, and the benefits of demonstrative and educational effects provided by the project. Economic costs include the capital investment for the installation of rooftop PV systems and operation and maintenance (O&M) costs.

#### **General Assumptions and Methods Used**

3. The economic benefits and costs are monetized at the constant price of the base year 2011 and are net of taxes, subsidies, and other transfers. The analysis assumes that the prices of goods and wages are determined in market conditions and close to shadow prices used in the economic analysis. Therefore, there is no adjustment or conversion in market prices for shadow prices.
4. The project duration (the period of analysis) is set at 25 years starting from 2013, which includes 5 years of construction and 20 years of operation. The project is a public investment aiming to promote a new renewable energy solution in schools and provide public goods such as electricity consumption utilities of school students and faculty, global and local pollution emission reduction, and demonstrative and educational effects in a long run. A discount rate of 5 percent is used in estimating present values in the analysis.
5. The cost-benefit analysis approach is used to quantitatively examine the economic viability of the investments. The economic benefit of electricity consumption was valued based on the concept of the consumers' willingness-to-pay for the electricity generated by the rooftop PV systems. Environmental and health benefits are owing to the project's providing electricity by clean solar power instead of thermal power which otherwise will burn coal and emit local air pollutants and CO<sub>2</sub>. Both global and local environmental benefits from CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>x</sub>, and TSP emission reduction were quantified so were the benefits of demonstrative and educational effects provided by the project.
6. A sensitivity analysis was conducted to test the robustness of the results of the cost-benefit analyses. Key parameters and assumptions used in the economic analysis are listed in Table A6-1.

**Table A6-1: Parameters and assumptions in the economic analysis**

Items	Parameters/Assumptions
Project life	25 years
Construction period	5 years
Operation period	20 years
Discount rate	5%
Electricity tariffs in Beijing	Promotional tariff for electricity generated by solar power: 1.00 yuan /kWh; regular tariff for commercial entities: 0.80; discounted tariffs for schools: 0.50
National average coal consumption by thermal power unit	333 g/kWh
CO <sub>2</sub> emission factor in north China	0.9 t CO <sub>2</sub> /MWh
SO <sub>2</sub> emission factor in north China	0.0077 t SO <sub>2</sub> /MWh
NO <sub>x</sub> emission factor in north China	0.004 t NO <sub>x</sub> /MWh
TSP emission factor in north China	0.4 kg TSP/MWh
Global environmental benefit per ton of CO <sub>2</sub> reduced	US\$15 /t CO <sub>2</sub>
Local environmental benefit per ton of SO <sub>2</sub> reduced*	US\$379 /t SO <sub>2</sub>
Global environmental benefit per ton of NO <sub>x</sub> reduced*	US\$269 /t NO <sub>x</sub>
Global environmental benefit per ton of TSP reduced*	US\$5801 /t TSP
Exchange rate	US\$1 =6.29 yuan RMB

\* Source: World Bank, 2007, the Cost of Pollution in China.

### Project baseline and alternatives

7. The project analysis includes the non-project scenario and alternative technical options. In the non-project scenario, the current electricity distribution system would continue to be used in schools. The electricity consumed by schools would be generated by coal-fired power plants. The technical options considered in the analysis include types of PV panels, school selection, metering, and grid connection.

### Cost-Benefit Analysis

8. *Economic benefits.* In Beijing, 99 percent of the electricity of the grid is generated by thermal power plants. Coal production and consumption poses significant costs to the local and global environment and the public. In particular, coal burning for power generation emits local air pollutants such as SO<sub>2</sub>, NO<sub>x</sub>, total suspended particulates (TSP) and greenhouse gases such as

CO<sub>2</sub>. To estimate global benefits of CO<sub>2</sub> reduction, the information about the “social cost of carbon” (SCC) and the carbon price in CDM projects were considered. SCC is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services. According to a study done by an Interagency Working Group of the U.S. Government under Executive Order 12866, annual average SCC is measured at \$31/tCO<sub>2</sub> from 2017 to 2037 at a discount rate of 3 percent and at \$9 at a discount rate of 5 percent. For the economic benefit analysis for this project, the global environmental cost of US\$15 per ton of CO<sub>2</sub> was assumed and a baseline emission factor for northern China of 0.9 tCO<sub>2</sub>/MWh was used. The World Bank 2007 report “Cost of Pollution in China” presented the emission factor and unit cost of SO<sub>2</sub>, NO<sub>x</sub> and TSP which were shown in the table above and applied in estimating local environmental benefits of local pollution emission reduction. The economic benefit analysis indicated a present value of global environmental benefits is RMB 114 million and a present value of local environmental benefits is RMB 54 million.

9. The benefits of electricity consumption by schools were quantified using the concept of the willingness-to-pay (WTP), which can help capture the total electricity consumption utility of consumers. With no willingness-to-pay survey done for the project, literature data on WTP values for the premium that consumers are willing to pay for renewable energy sources (RES) on top of their normal electricity bill (rather than the full value) was reviewed. Because these WTP values are measured as a lump sum for a certain length of time rather than as a value per kWh of electricity, the assumption was made that the WTP value for one kWh of electricity consumed is equal to the regular tariff in Beijing, which is 0.80 yuan/kWh, over years. Since the electricity prices in China are expected to continue to increase, this represents a conservative estimate of the average WTP value that puts the estimated economic benefit of electricity consumption at a lower end of a possible range. Its present value estimated in the analysis is RMB 1.02 billion.

10. In non-project scenario, there would be electricity loss in power transmission from power plant to end-user. The distributed PV systems would avoid the loss. Economic benefits from avoided transmission loss were also estimated approximately at 5 percent of total electricity generated. The present value of the saving is RMB 54 million.

11. The project will also have substantial demonstrative value for renewable energy deployment in more schools and other institutions in other cities outside Beijing and beyond the project construction period. Such benefits include cost reduction owing to increased production of the solar PV for more schools and positive environmental externalities like global and local air pollution reduction through the replication of the roof-top systems in schools beyond Beijing. To capture some of the benefits, it is assumed that, inspired by the demonstration project, there would be 300 schools adopting the roof-top solar PV system (with an annual new generation capacity of 30 MWp) every year from 2015 to 2024 in surrounding cities and the unit cost of the system (currently at 12 yuan/Wp) would gradually decrease by 15 percent from 2018 to 2024 because of increased production and economies of scale. The present value of the demonstrative benefit is about RMB 313 million.

12. The other benefit which the analysis tried to capture is the educational benefits. The students (and their parents) have a willingness to pay for a better opportunity for scientific studies. The roof-top solar PV systems installed by the project in schools will be used for students to get the first hand experiences with solar power in their science classes or after-school programs. In Beijing, the government provides RMB 100 Yuan per student (or RMB 200 million in total) each year for the in- and after-school science programs. It was assumed that 10 percent (i.e., 10 yuan per student) would be the students' willingness to pay for using the solar PV systems each year. The present value of the benefit is about RMB 70 million.

13. **Economic costs.** The total capital investment is 1,423.0 million RMB. O&M cost is RMB 2.08 million per year during operation.

14. **Results of the cost-benefit analysis.** The aggregated results of the analysis under the scenario including the electricity consumption benefit to consumers are summarized in the table below. It shows that the economic internal rate of return (EIRR) of the project is 8.78 percent in real term, its net present value (NPV) is RMB 419.1 million and the benefit-cost ratio (BCR) is 1.33.

**Table A6-2: Results of the cost-benefit analysis**

Unit: million Yuan RMB	PV (5%)	2013	2015	2017	2019	2020	2024	2025	2030	2037
Electricity consumption (WTP)	1078.7	4.8	71.9	89.6	92.6	91.6	87.9	87.0	82.3	75.7
Global environmental benefits	114.0	0.5	7.6	9.5	9.8	9.7	9.3	9.2	8.7	8.0
Local environment benefits	53.6	0.2	3.6	4.4	4.6	4.5	4.4	4.3	4.1	3.8
Avoided transmission loss	53.9	0.2	3.6	4.5	4.6	4.6	4.4	4.3	4.1	3.8
Demo and replication benefits	313.1	0.0	4.4	13.1	39.8	62.1	97.6	0.0	0.0	0.0
Educational benefits	70.3	0.5	7.5	9.5	10.0	10.0	10.0	0.0	0.0	0.0
<b>Benefit Subtotal</b>	<b>1683.6</b>	<b>6.3</b>	<b>98.5</b>	<b>130.5</b>	<b>161.4</b>	<b>182.6</b>	<b>213.5</b>	<b>104.8</b>	<b>99.2</b>	<b>91.3</b>
Capital investment	1242.9	480.1	205.8	68.6						
O&M	21.6	0.4	1.4	1.6	1.7	1.7	1.7	1.7	1.7	1.7
<b>Cost Subtotal</b>	<b>1264.5</b>	<b>480.5</b>	<b>207.1</b>	<b>70.2</b>	<b>1.7</b>	<b>1.7</b>	<b>1.7</b>	<b>1.7</b>	<b>1.7</b>	<b>1.7</b>
Net benefit flow	419.1	(474.2)	(108.6)	60.3	159.6	180.9	211.8	103.1	97.5	89.6
EIRR	8.78%									
ENPV (IC=5%)	419.1									
B/C ratio	1.33									

15. A sensitivity analysis shows that the EIRR will drop to 7.32 percent if the estimated benefit decreases by 10 percent. But if there were 400 more schools each year and a 20 percent cost reduction in the estimation of the demonstrative benefit, the EIRR would go up to 10.33 percent. Considering that the project aims to increase the share of renewable energy in Beijing's schools, the EIRR can be considered economically acceptable.

16. **Affordability and impact on the poor.** The project will install PV systems in schools and other educational institutions in Beijing Municipality and support institutional capacity building. The level of electricity tariff paid by the schools would not increase after the project (at a minimum). It therefore will not cause any additional burden on the public including the poor.

## **B. Financial Analysis**

17. A financial analysis was conducted at the municipal level, project level, and entity level to assess respectively the certainty of counterpart funds, the profitability of the project, and the financial viability of the project company.

18. ***Financial Analysis at the Municipal Level.*** The project will be jointly financed by the Ministry of Finance (MOF) and the Beijing Municipal Government (BMG). In 2009, MOF launched the Golden Sun Program to support the installation of distributed PV generation, including rooftop PV systems in urban areas. The total MOF subsidy for the project will amount to RMB 562.5 million (39 percent of the total project investment cost). The BMG would provide a RMB1.0/Wp subsidy to rooftop PV systems for 3 consecutive years. The total subsidy from the BMG would be RMB 300 million, of which 42 percent or RMB 125.2 million will be used to subsidize the investment cost of the project, accounting for 9 percent of the total project investment cost. The remaining 58 percent or RMB174.8 million will be used to support the operation and maintenance (O&M) of the project.

19. ***Financial Analysis at the Project Level.*** The revenues of the project include tariff revenues paid by project schools and the subsidy provided by the BMG. After installation of the PV systems, the BMG will provide subsidy to Yuanshen. With 42 percent of BMG's subsidy used to cover project investment cost, the remaining 58 percent of BMG's subsidy will be used to cover O&M costs. Since July 2012, the power tariff for schools is RMB0.5053/kWh currently. The project schools will pay Yuanshen for the solar PV electricity it consumes on a monthly basis. It is assumed that the power tariff will not be adjusted during the life of the project. It is estimated that the power consumed by the schools from PV systems is about 100 GWh.

20. The O&M costs include the expenses for cleaning the PV systems, data transfer, bank services, and Yuanshen's management of the project. The major assumption of O&M costs are as follows:

- Cleaning PV systems. Yuanshen will pay each school with RMB1,000 per year for employing workers of project schools to clean dust and make minimum maintenance of PV systems.
- Data transfer. It is assumed that 40 percent of project schools are located in the remote area of Beijing Municipality and these project schools will use general packet radio service (GPRS) to transfer the amount of power generated by the PV systems and consumed by the project schools to Beijing Energy Conservation and Environmental Protection Center (BECEPC). Every month, Yuanshen will pay RMB30.00 to the company which provides GPRS service. The remaining 60 percent of the project schools will use their campus networks to transmit data to BECEPC or other places. These data transferred by campus networks are free.
- Bank services. Each month, the project schools will remit their power tariff to Yuanshen through local banks. These remittances will be paid by Yuanshen at RMB5.00 every month for each school.

- Yuanshen' management. Yuanshen has designated several staff to take care of the construction and implementation of the project. Yuanshen' management cost includes the salary of these staff members and their overhead.

21. A calculation of the financial internal rate of return (FIRR) of the project determined the FIRR to be negative, although the weighted average cost of capital (WACC) of the project is about 1.02 percent. The net present value (NPV) of the project at WACC is also a negative figure and the project is not profitable. Detailed information on the project financial analysis is available in the project files.

22. Sensitivity analyses were carried out. Because the project is not financially profitable, switching values of capital costs, maintenance costs, and revenues that would make the FIRR of the project fall to the cut-off rate were calculated. The FIRR of the project would fall to the cut-off rate, if:

- The investment cost is reduced by 13%;
- The O&M cost is reduced by 83% over the life of the project;
- The tariff revenue is increased by 18% over the life of the project; and
- The investment cost is reduced by 10% whilst the tariff revenue is increased by 10% over the life of the project.

23. The sensitivity analysis indicated that the most effective way to make the project profitable would be the synthetic action by reducing 10 percent of the investment cost and increasing 10 percent of the tariff revenues.

24. ***Financial Analysis at the Entity Level.*** Yuanshen Company is responsible for the implementation of Component 1 of the project. Before the project, Yuanshen had invested in Bayi Middle School to build 0.139 MW of PV systems. A financial analysis of Yuanshen's PV business, including both Bank financed and non Bank financed PV business, was carried out. The financial resources of the project investment made by Yuanshen include subsidies from the MOF and the BMG, and the Bank loan. Yuanshen has the responsibility to pay the debt service of the project. The revenues of Yuanshen's PV business will come from the tariff paid by the project schools and the subsidy provided by the BMG. The O&M costs include the expenses for cleaning the PV systems, data transfer, bank services, and Yuanshen's management of the project.

25. In addition to the assumptions used for the project financial analysis, the following assumptions were also used for Yuanshen's financial analysis:

- MOF's subsidy will be recorded as long term account payable, which will be used to write off the depreciation of the PV systems in order to reduce the operating cost of the PV systems.
- BMG's subsidy can be divided into two parts. The first part about RMB125.2 million will be used for project investment, which will be used to write off the depreciation of the PV systems. The second part about RMB174.8 million will be used as subsidy revenue to cover the O&M costs.

- The Bank loan is about US\$120 million, of which US\$9.7 million will be used to finance the interest during the implementation and front-end fee. The interest rate of the Bank loan is 2.23 percent and the repayment period is about 20 years after 5 years of grace period.
- The depreciation rate is about 5.94 percent and the amortization rate is about 6.25 percent.
- The account receivable is 5 percent of tariff revenue generated by PV system.
- Yuanshen will enter into contracts with project schools. According to the contracts, the PV systems of first phase of the project schools will be transferred to the project schools in 15 years after the installation of the PV system. The PV systems of the second phase of the project schools will be transferred to the project schools in 20 years after the installation of the PV system. Along with the transfer of PV system, Yuanshen also transfers its O&M obligation to the project schools.

26. Based on this information, the pro forma financial statements of Yuanshen from 2013 to 2037 were prepared. According to these financial statements, the EBITDAs of Yuanshen's PV business are always positive. Taking into account the large amount of depreciation, the net profits of Yuanshen's PV business become negative from 2023 to 2029. Yuanshen's PV business runs at a deficit. The operating cash flows of Yuanshen's PV business are always positive. This enables Yuanshen to have capacity to cover its cost of PV business. There are 8 years that the cost recovery rates are less than 1. However, the debt service coverage ratios are not so good. From the 3<sup>rd</sup> year of repayment of the Bank loan, DSCRs are below 1. Table A6-3 summarizes the financial performance of Yuanshen.

27. To help Yunshen reduce its investment cost and O&M costs, and increase its tariff revenues, financial covenants are set up which require that CRR is not less than 1 and DSCR is not less than 1.1. Detailed information of Yuanshen's financial analysis is available in the project files.



**Table A6-3: Financial performance of Beijing Yuanshen Energy Saving Technology Company Limited**

RMB thousand	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
<b>Income Statement</b>																									
Operating Revenue	3,179	21,223	45,113	53,697	56,166	58,605	58,000	57,396	56,792	56,188	55,584	54,979	54,375	53,771	53,167	49,861	49,288	48,716	48,144	47,571	32,538	12,864	5,483	3,013	44,709
Government Subsidies	139	139	10,435	85,000	60,000	25,000	10,000	5,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operating Expenses	1,582	6,987	13,707	16,151	16,987	17,767	17,733	17,699	17,666	17,632	17,257	15,267	12,632	11,647	11,294	10,385	10,353	10,321	10,289	10,257	9,415	5,996	2,500	1,230	3,185
EBITDA	1,736	14,376	41,841	122,547	99,179	65,838	50,267	44,697	39,126	38,556	38,326	39,712	41,743	42,124	41,873	39,475	38,935	38,395	37,854	37,314	23,122	6,868	2,983	1,783	41,524
Depreciation	0	0	0	0	0	0	0	0	0	1,883	83,978	83,978	83,978	83,978	82,151	78,480	78,480	55,076	21,994	9,441	4,760	0	0	0	0
EBIT	1,736	14,376	41,841	122,547	99,179	65,838	50,267	44,697	39,126	36,673	-45,651	-44,265	-42,235	-41,854	-40,279	-39,005	-39,545	-16,682	15,861	27,873	18,363	6,868	2,983	1,783	41,524
Financial Expenses	1,110	1,170	60	0	0	14,982	14,214	13,446	12,677	11,909	11,141	10,372	9,604	8,836	8,067	7,299	6,531	5,762	4,994	4,226	3,457	2,689	1,921	1,152	384
EBT	626	13,206	41,781	122,547	99,179	50,855	36,053	31,251	26,449	24,764	-56,792	-54,638	-51,839	-50,690	-48,346	-46,304	-46,076	-22,444	10,867	23,647	14,905	4,179	1,062	630	41,139
Income Tax	94	1,981	6,267	18,382	14,877	7,628	5,408	4,688	3,967	3,715	0	0	0	0	0	0	0	0	1,630	3,547	2,236	627	159	95	6,171
Net-Profit	532	11,225	35,513	104,165	84,302	43,227	30,645	26,563	22,482	21,049	-56,792	-54,638	-51,839	-50,690	-48,346	-46,304	-46,076	-22,444	9,237	20,100	12,669	3,552	903	536	34,968
<b>Cash Flow Statement</b>																									
Operations	1,483	11,493	34,379	103,735	84,178	58,087	44,889	40,039	35,189	34,872	38,357	39,743	41,773	42,154	41,903	44,571	38,964	38,423	36,253	33,795	21,638	7,225	3,193	1,812	33,268
Investments	-322,707	-304,834	-21,901	-34,090	-51,871	8,250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Financing	322,667	293,681	110,558	29,421	21,116	-62,417	-61,649	-60,881	-60,112	-59,344	-57,894	-53,213	-47,242	-44,572	-43,165	-41,754	-40,985	-40,217	-39,449	-38,680	-37,912	-37,144	-36,375	-35,607	-34,839
Cash Change	1,443	340	123,036	99,066	53,423	3,920	-16,760	-20,841	-24,923	-24,472	-19,537	-13,471	-5,469	-2,418	-1,262	2,817	-2,022	-1,794	-3,196	-4,885	-16,274	-29,918	-33,182	-33,795	-1,571
Ending Cash Balance	1,443	1,783	124,819	223,885	277,308	281,228	264,468	243,627	218,704	194,232	174,694	161,224	155,755	153,337	152,075	154,893	152,871	151,077	147,882	142,997	126,724	96,805	63,623	29,828	28,257
<b>Balance Sheet</b>																									
<b>Asset</b>																									
Current Asset	1,602	2,844	127,075	226,570	280,116	284,158	267,369	246,497	221,544	197,041	177,474	163,973	158,474	156,026	154,733	157,386	155,335	153,513	150,289	145,376	128,350	97,448	63,897	29,978	30,493
Net Fixed Asset	454,036	947,169	1,079,406	1,073,966	1,065,202	988,306	911,410	834,514	757,618	680,722	603,826	526,930	450,034	373,138	298,068	214,657	142,949	93,155	74,251	66,642	62,823	44,368	18,356	8,845	5,652
Other Assets	28,470	61,770	77,904	86,897	95,814	88,733	81,651	74,569	67,488	60,406	53,324	46,243	39,161	32,079	24,998	13,296	6,525	1,242	-1,848	-3,679	-4,620	-4,620	-4,620	-4,620	-4,620
Total	484,108	1,011,783	1,284,384	1,387,432	1,441,132	1,361,197	1,260,429	1,155,580	1,046,649	938,169	834,624	737,146	647,669	561,243	477,800	385,339	304,809	247,910	222,693	208,338	186,553	137,196	77,633	34,203	31,525
<b>Liabilities and Owner's Equity</b>																									
Current Liabilities	82,261	94,690	101,917	96,602	90,696	77,716	64,735	51,755	38,774	25,794	13,495	5,109	1,925	643	-0	0	0	0	0	0	0	0	0	0	0
Long-Term Liabilities	385,457	889,478	1,119,339	1,123,537	1,098,842	988,660	870,228	751,796	633,364	516,815	482,361	447,907	413,452	378,998	344,543	310,089	275,635	241,180	206,726	172,272	137,817	103,363	68,909	34,454	0
Owners' Equity	16,389	27,614	63,128	167,293	251,594	294,821	325,466	352,030	374,511	395,560	338,768	284,130	232,292	181,602	133,256	75,250	29,174	6,730	15,966	36,067	48,736	33,833	8,724	-251	31,525
Total	484,108	1,011,783	1,284,384	1,387,432	1,441,132	1,361,197	1,260,429	1,155,580	1,046,649	938,169	834,624	737,146	647,669	561,243	477,800	385,339	304,809	247,910	222,693	208,338	186,553	137,196	77,633	34,203	31,525
<b>Ratios</b>																									
Debt Repayment	1,110	38,170	2,060	0	0	49,437	48,668	47,900	47,132	46,363	45,595	44,827	44,058	43,290	42,522	41,754	40,985	40,217	39,449	38,680	37,912	37,144	36,375	35,607	34,839
CRR	1.23	2.62	4.03	8.59	6.84	2.55	2.13	2.00	1.87	1.79	0.49	0.50	0.51	0.51	0.52	0.52	0.52	0.68	1.29	1.99	1.85	1.48	1.24	1.26	12.52
DSCR	1.56	0.38	20.31	-	-	1.33	1.03	0.93	0.83	0.83	0.84	0.89	0.95	0.97	0.98	0.95	0.95	0.95	0.96	0.96	0.61	0.18	0.08	0.05	1.19