Final Evaluation of

"Promoting Clean Electric Buses for the Beijing Olympics (CEBBO)" Project

A GEF/UNDP Medium-Size Project

PROJECT EVALUATION REPORT

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July 2009

LIST OF ACRONYMS AND ABBREVIATIONS

BJMILP	Beijing Municipal Institute of Labor Protection
BMG	Beijing Municipal Government
BOCOG	Beijing Organizing Committee of the Olympic Games
BOG	Beijing Olympic Games
BTG	Beijing Transport Group
CDBs	Conventional Diesel Buses
CEBBO	China: Promoting Clean Electric Buses for the Beijing Olympics
CH_4	Methane
CNG	Compressed natural gas
CO	Carbon monoxide
CO_2	Carbon dioxide
ELPI	Electrical Low Pressure Impactor
EPB	Beijing Municipal Environmental Protection Bureau
FCB	Fuel Cell Bus
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GPS	Global positioning system
ICE	Internal combustion engine
kwh	Kilowatt-hour
LEBs	Li-Ion Battery-Powered Electric Buses
LFA	Logical Framework Analysis
MFB	Municipal Financial Bureau
MOF	Ministry of Finance
MOST	Ministry of Science and Technology
MSP	Medium-Size Project
MSTC	Municipal Science and Technology Commission
NDIR	Non-destructive infrared
NDRC	National Development and Reform Commission
NDUV	Non-destructive ultraviolet
NO_2	Nitrogen dioxide
NOx	Nitric oxides
NPD	National Project Director
PM	Particulate matter
PMO	Project Management Office
ProDoc	Project Document
PSC	Project Steering Committee
SCR	Selective catalytic reduction
SO_2	Sulfur dioxide
TOR	Terms of Reference
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

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EXECUTIVE SUMMARY

The project being evaluated, titled as Promoting Clean Electric Buses for the Beijing Olympics (CEBBO) Project, used the Olympics as an opportunity to showcase the Global Environmental Facility's (GEF's) contribution to addressing global environmental challenges and the Chinese efforts in greening the Olympics and improving environmental quality of Beijing. The project demonstrated the use of the electric buses (E-Buses) powered solely by Li-ion batteries and set the program for continued use buses to transport passengers after the Olympics.

Aside from the publicity and awareness value of the Project, it has significantly included the technical, E-Bus operation, noise evaluation, emission evaluation and environmental impact information to guide the future activities and program for the E-Bus program of Beijing, other cities and China as a whole, that can be shared to other interested countries through United Nations Development Programme (UNDP) and GEF.

The context of the E-Bus Program is anchored on the expected direct global environmental benefits of project include avoidance of greenhouse gas emissions from the operation of the E-Buses during their lifetime. Through the demonstration of the electric buses and a focused outreach program, the project is expected to raise the public awareness about the GEF, climate change, and global environmental issues.

The Results Framework or the Planning Matrix derived from the project design and Logical Framework Analysis of the CEBBO Project at the outset provided a very important guide in the project understanding and implementation.

The success of this project depended on the timely implementation of the project activities since the holding of the Beijing Olympics is on a fixed schedule. With the successful closing of the Beijing Olympic Games and the basic tasks of the project have been completed, the project final evaluation is being carried out to assess the implementation effectiveness of the project.

As indicated in the Evaluation Terms of Reference (TOR), the evaluation involved component level and project level analyses by evaluating the project implementation effectiveness, according to the Electric Buses operating conditions and transport situation for the Beijing Olympics. The exercise includes assessing project effectiveness, implementation efficiency, organization capacity, achievements gained when building the cooperative relations between the parties, the sustainability of the project, as well as the contributions and effects brought by the implementation of the project for development of clean transport modes in Beijing. The performance measurement indicators and targets used in the project monitoring system were also reviewed if they are aligned to achieve desired project outcomes. A qualitative and quantitative analysis and evaluation on social, environmental and economic impact of the project, investigating the project effect on reducing Greenhouse Gas (GHG) emissions were also done.

The Evaluation Team reviewed the project documents and reports to understand the project objectives, historical developments, institutional and management mechanisms, activities and status of accomplishments. It also conducted a series of meetings with the major participants to the CEBBO Project and related activities and conducted interviews.

Key Findings on Activities/ Outputs

Procurement and Operation of the E-Buses

Beijing Public Transport Holdings, Ltd. purchased four (4) fully Li-ion battery-powered Electric Buses (LEB) from the GEF/UNDP support and 46 others from their own co-financing inputs to make the total of 50 LEBs available for the CEBBO Project. The buses were commissioned into use for the Beijing Olympic Games (BOG) in the Olympic Village as planned. The Battery Charging facility was also established to serve the 50 LEBs. Charging can be carried out on each bus for 10 batteries. Eighty (80) sets at 10 batteries each or 800 batteries are stocked for the operation of the 50 LEBs. Current charging time is 2.5 to 3 hours for each battery. Total battery cost is at RMB 500,000 per vehicle. The Team noted that the batteries are being rented for the CEBBO Project at RMB 4 per kilowatt-hour (kwh) following an agreed rental mechanism.

The LEBs are easier to maintain compared to the conventional diesel and compressed natural gas (CNG) buses. Reliability is observed to be higher for LEBs.

GHG Emission Potentials

For the GHG (CO_2) emission reduction potentials in line with GEF goals, the project reviewed the assumptions placed in the GEF Project Document (ProDoc). The Evaluation Team verified the calculation methodology and estimated the achievements of the project in terms of expected environmental outcomes. Battery disposal issues were identified that need to be resolved and programmed in the future activities to support the LEB wider usage.

Publicity

The scale and reach of the Beijing Olympics were a great opportunity for the promotion of clean and green transportation technologies. The 50 LEBs continue to provide service to the public on bus lines after the Olympics. The awareness drive for clean energy transport modes using LEBs was greatly enhanced by the social impacts that were brought about by the project which included high standard of bus service for the public. The bus service was free of charge during the Olympic period. Economics of the LEBs, however, cannot be established fully and conclusively with the CEBBO Project which is more of a demonstration and promotion project involving grants and subsidies as part of the developmental approach.

Project Management

Project management was done through a Project Management Office (PMO) headed by the National Project Director designated from the main executing agency, the Beijing Municipal Environmental Protection Bureau.

Project Outcomes and Impacts

The CEBBO Project aimed at supporting the promotional activities that look at market development and commercialization of LEBs in the long term. It also supported the efforts of Beijing Municipal Government to invest for 46 LEBs and a charging station.

The CEBBO Project helped to create a need for scaled-up operation of LEB systems, i.e. 50 buses and a station with the function of charging and first class maintenance. Innovative battery renting mechanism to ensure low risk and liability for a bus company and optimized battery management were identified to be important issues that should be studied further regarding the LEB viability.

The CEBBO project provided an active contribution to showcase LEBs as the project provides 4 out of 50 buses which operated for the Beijing Olympics public. It also contributed to policy impact and organizational development for the LEB program institutionalization. In the Beijing Transportation Development Plan (2004-2020), it was stated that the development of electric vehicle is to be encouraged. The Beijing Municipal Government is developing the application plan of new energy buses over the next few years. Beijing Public Transport Holdings, Ltd. will implement it in accordance with the requirements of the government. Beijing is planning to further promote LEBs and other environmental friendly vehicles.

The results of the Exhaust Emissions Evaluation and the Noise Evaluation provided very good database for programming the technical environmental aspects of the LEB Program which will provide basis for other clean energy initiatives of the China Government such as the Fuel Cell Buses, CNG buses, etc.

CONCLUSIONS

1. On the overall, the expected key outputs and outcomes of the CEBBO Project were accomplished with **Highly Satisfactory** level of performance. The purchase of the LEBs and the installation of the Recharging Station met the objectives through various inputs and very active cooperation and participation of all the partners. It has placed the LEBs in the forefront of the transport policy and plan of China in the next 3 years to come. It has gained the wide publicity mileage not only for Beijing but also for China and UNDP/GEF as a whole in the national and international levels.
2. The project has been executed successfully according to project plans in meeting the agreed targets and outcomes which included:
    a. Improved awareness of the athletes, media, and the public of the Chinese efforts for a Green Olympics
    b. Improved air quality at the Olympics venues and surroundings
    c. Enhanced image of Beijing both nationally and internationally
    d. Enhanced public image of GEF as a global entity to support environmentally sustainable development
    e. Enhanced public awareness about the GEF, climate change and clean vehicle technologies in China.
3. The project has been highly effective in project implementation considering the short timelines and strict government standards.
4. On the overall, the Project is highly efficient in making use of available resources from the different partners which derived maximum advantage on a “win-win” situation under a highly cooperative undertaking.
5. The CEBBO Implementing Group is well equipped and has been very well organized and motivated to pursue the project goals and could be a very good organizational foundation in institutionalizing the LEB program for China as a whole.
6. The Project is well designed and conceptualized based on the agreed promotional objectives. There were questions from the public, however,

regarding the economics and cost of the technology at present, although the project, being predominantly a promotional and demonstration initiative, did not focus on these issues. The GHG reduction potential projections in the ProDoc may have been limited by the assumptions made and therefore have also been reviewed by the Team considering current local situations and actual power generation mix in the grid.

7. The CEBBO Project has basically been a technology adoption, publicity and promotion project. And also being a Medium-Size Project (MSP) is therefore not expected to result in major reduction of green house gas emissions or removal of barriers to clean energy bus development. The instant impact of the project is on the exhaust emission and noise pollution reduction within the point of use of the buses. On the national level, the immediate impact of the project is on the inclusion of the LEBs in government mass transport policy within the five-year plan in the major cities of China. The long term impact of the LEBs as an environmental solution will definitely come as more LEBs are commercialized in China and in other countries as exports of locally produced LEBs.
8. There has been very good working relationships and coordination among the partners and stakeholders leading to successful project implementation. There is no doubt that very strong organizational capacity achieved by the Project will become the solid foundation towards the long term institutional arrangements that will be required in establishing the national LEB program of China.
9. As determined by the CEBBO project formulation at the outset, the key risk factors identified that could affect the sustainability of the LEB initiatives at the country and Beijing Municipal Government levels have been met. On this basis, the Evaluation Team believes that the project is sustainable and could become the basis of the post-project program-led market development and commercialization of the LEBs in China in the future. Judging from the commitments of China government in its development plans, the Team is convinced that the China Government believes in the viability of the LEB and other clean energy technology and is prepared to support the requirements of the development program.
10. The CEBBO reports and other documentations and interviews indicated a long list of achievements and outputs. As far as the main objective of the CEBBO Project is concerned, this Evaluation identifies the major project outcomes which were achieved Highly Satisfactorily as expected in the Project.
11. As designed, the Project proved to have very good interrelationships among project components and activities leading to common goal as seen in the overall success of the CEBBO Project.

Regarding best practices and lessons learned, the Team noted that despite the challenges on making effective coordination to produce results within critical schedules, the project as a whole was able to deal with high profile, sensitive and multi-sectoral activities at the highly visible Beijing Olympics through effective management and follow-through. Indeed, the best practice that can be cited is having an MSP-scale of activities to derive large scale impact with far-reaching promotional value and scope.

Recommendations

The following points are being recommended by the Evaluation Team:

1. The experience achieved by the CEBBO Project can be exhibited in similar regional and world events such as the Shanghai World Expo 2010.

2. The government should sustain its support to include a recharging station in the Beijing Development Plan.
3. The government should develop further the needed policy guidelines and more incentives on the technology development and cost reduction to encourage the use of economical and clean transport modes including more LEBs being a very promising alternative clean transportation scheme.
4. Public awareness of LEBs should be continued and further increased including the support technical and operational improvements.
5. To achieve better economics, the necessary continuing improvements (in which some were already adopted) should include:

    - Innovative battery renting mechanism to ensure low risk and liability for a bus company and optimized battery management (*already adopted*)
    - Battery monitoring system for buses on service based on mobile network communication to improve further the reliability. (*already adopted*)
    - New invention on battery charging process, i.e. use a robot to switch batteries instead of charging them on the bus to save time and space for charging process. (*already adopted*)
    - Research on the characters/lifespan of current battery and new battery material to extend the capacity and
    - Reduction of the cost of new charging station.

Final Evaluation of "Promoting Clean Electric Buses for the Beijing Olympics (CEBBO)" Project

1. INTRODUCTION

Background

The Promoting Clean Electric Buses for the Beijing Olympics (CEBBO) Project or also referred to herein as the Project, used the Olympics as an opportunity to showcase the GEF's contribution to addressing global environmental challenges and the Chinese efforts in greening the Olympics and improving environmental quality of Beijing. The Project demonstrated the use of the electric buses (E-Buses) powered solely by Li-ion batteries and set the program for continued use buses to transport passengers after the Olympics.

Context of the E-Bus Program

The expected direct global environmental benefits of project include avoidance of greenhouse gas emissions from the operation of the E-Buses during the Olympics and in their lifetime. In its contextual design, at the outset, it was expected that through demonstration during the Olympics, development and deployment of clean vehicle technologies would accelerate in China, resulting in further reduction of greenhouse gas emissions. The indirect global environmental benefits of the project will be achieved through the outreach program by raising the awareness of the athletes, the media, and other participants to the Olympics and the general public about climate change and other global environmental issues as well as options to reduce the human impact on the environment.

2. DESCRIPTION OF THE E-BUS PROGRAM

Developmental Logic Theory

With the GEF incremental support to the China initiative, awareness about global environmental issues, sustainable urban transport, and clean vehicle technologies in a high profile event like the Olympic Games will be significantly promoted. The Olympic Games presents a useful venue and a rare opportunity for the GEF to showcase its achievements to the world through this project.

As designed, the direct value-added of this GEF project was the procurement of four buses and additional publicity that the GEF would bring about clean and low-carbon technology, and about global climate change and local environmental issues. More importantly, the Project was expected to demonstrate that the international community supports China in hosting a Green Olympics. Through the demonstration of the electric buses and a focused outreach program, the project was also expected to raise the public awareness about the GEF, climate change, and global environmental issues, which would not be achieved without this project.

Results Framework

The Logical Framework Analysis (LFA) which is found in Section II of the CEBBO Project Document (ProDoc) provided the project planning matrix that includes project strategy, goal, objectives, components, activities, outcomes, success indicators, baseline assumptions, targets, means of gauging success and critical assumptions a E-Bus Project.

Brief Description

The XXIX Olympic Games was held in Beijing in August 2008. As the host of the Olympic Games, the Municipal Government of Beijing has committed itself to hosting a "Green, Scientific and Humanistic Olympic Games" in order to achieve the goal of harmonious development of society, economy and nature. Minimizing the environmental footprint and maintaining good local air quality in particular are key components for the concept of a Green Olympics. The GEF community has been working very actively to protect the global environment while improving the local environmental quality and the livelihood of the people. The project aimed at demonstrating the use of electric buses powered solely by Li-Ion batteries during the Olympics as an opportunity to showcase the GEF's contribution to addressing the global environmental challenges and the Chinese efforts in greening the Olympics and improving environmental quality of Beijing.

The Project involved the implementation of several activities that make up two major project components:

1. Procurement, Operation and Maintenance of Li-Ion Battery-Powered Electric Buses
2. Outreach of the GEF and Green Olympics

Project Expected Results

According to the Project Document, the Project is expected to bring about CO_2 emission reduction of about 112 tons during the 30 days of Beijing Olympics. It is expected to bring about the following outcomes:

1. Improved awareness of the athletes, media, and the public of the Chinese efforts for a Green Olympics
2. Improved air quality at the Olympics venues and surroundings
3. Enhanced image of Beijing both nationally and internationally
4. Enhanced public image of GEF as a global entity to support environmentally sustainable development
5. Enhanced public awareness about the GEF, climate change and clean vehicle technologies in China.

CEBBO Project Organization

The Project organization is mainly composed of the following:

- *Implementing Agency*: UNDP China supervises the project independently on behalf of the GEF and to manage the disbursement of the GEF funds for the project.
- *Project Steering Committee*: A Project Steering Committee (PSC) was formed to give advice and make decisions on key implementation issues. The PSC is

composed of : China GEF Secretariat, UNDP China, Ministry of Finance (MOF) and the Beijing Municipal Government (BMG)

- *Project Leading Group*:
- *Project Management Office (PMO)*: PMO is responsible for routine project management, intensifying of communications and coordination among the institutions undertaking the activities on various topics, for supervising and managing the implementation of the project together with UNDP and for engaging in the daily management.
- *National Project Director (NPD):* The NPD Is in-charge of the project in behalf of all the Chinese partners and ensures that the outputs of the project comply with what are stated in the Project Document; supervises the implementation process; and ensuring that the activities are completed on time, and in coordination with other relevant government departments and stakeholders.

The project organizational set-up is shown in **Fig. 1.**

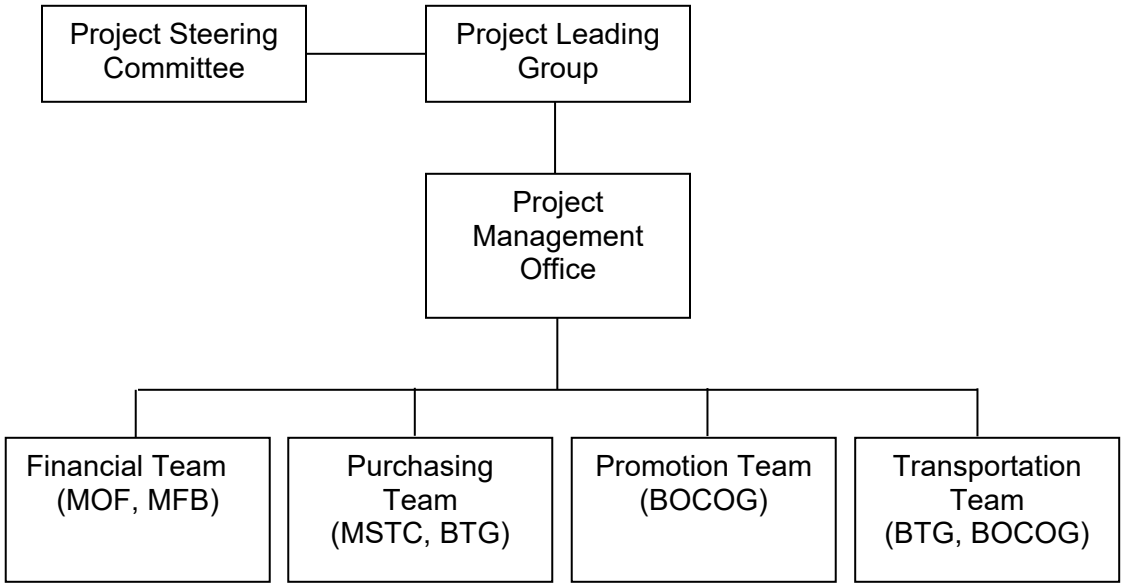

Fig. 1. CEBBO Project Organizational Set-Up

External Factors Likely to Affect Success

The success of this project depended on the timely implementation of the project activities since the holding of the Beijing Olympics is on fixed schedule. This required that special care be given to the procurement of vehicles to ensure timely delivery and operation during the Games according to project implementation plans. A secondary risk is the Li-ion battery technology used to power the buses, since the technology has not been applied on a commercial basis. Finally, smooth coordination between the various departments of the Beijing Municipal Government, the bus manufacturers and operators, the Beijing Organizing Committee of the Olympic Games (BOCOG), and other stakeholders needs to be ensured.

3. PURPOSE OF THE EVALUATION

With the successful closing of the Beijing Olympic Games and the basic tasks of the project have been completed, the project final evaluation is being carried out to assess the implementation effectiveness of the project.

The objective of the final external evaluation is to assess the implementation effectiveness, the organizing capacity and the relationship building effectiveness of the CEBBO Project. At the same time, the final evaluation should assess the social, environmental and economic impact of the project and sum up the implementation experience of the project, which could help relative department put forward the proposals and measures for the further development of the electric buses.

4. SCOPE OF EVALUATION

As required by the Evaluation Terms of Reference (TOR) in **Annex A** the evaluation involved component level and project level analyses.

The following were assessed:

1. Evaluating the project implementation effectiveness, according to the Beijing Olympics Electric Buses operating conditions, including assessing project effectiveness, implementation efficiency, organization capacity, achievements gained when building the cooperative relations between the parties, the sustainability of the project, the as well as the contributions and effects brought by the implementation of the project for development of Beijing electric buses. Whether there is effective relationship and communication between/among components so that data, information, lessons learned, best practices and outputs are shared efficiently, including cross-cutting issues.

2. Whether the performance measurement indicators and targets used in the project monitoring system are specific, measurable, achievable, reasonable and time-bounded to achieve desired project outcomes. A qualitative and quantitative analysis and evaluation on social, environmental and economic impact of the project, investigating the project effect on reducing GHG emissions.

3. Whether the use of consultants has been successful in achieving component outputs.

The extent of the evaluation task and findings depended largely on the nature and extent of information provided to the Evaluation Team.

5. EVALUATION APPROACH AND METHODOLOGY

The Final Evaluation Team reviewed the project documents and reports to be well versed as to the project objectives, historical developments, institutional and management mechanisms, activities and status of accomplishments. Information will be gathered through document review, group and individual interviews and site visits.

The Evaluation Team conducted a series of meetings with the major participants to the CEBBO Project and conducted interviews with the public. Before the evaluation mission was completed, the Team presented the initial findings of the assessment prior to the submission of the draft Final Report.

The Program of Activities of the Evaluation can be seen in **Annex B** and the Project Evaluation Participants List is seen in **Annex C.**

6. FINDINGS

6.1. Implementation Experience

6.1.1. *Key Activities/ Outputs*

- Procurement and Operation of the E-Buses

Beijing Public Transport Holdings, Ltd. purchased four (4) pure Li-ion battery-Electric Buses (LEB) from the GEF/UNDP support and 46 others as their co-financing inputs. The planned procurement of a total of 50 LEBs was realized.

A series of strict inspection and test operation was carried out prior to operations. The buses were commissioned into use for the Beijing Olympic Games (BOG) in the Olympic Village as scheduled.

The battery charging and exchange station for the 50 LEBs was constructed and operationalized using local engineers in a 5,000 sq. meter-lot near the village.

On the operations side, the following were done as planned in *Activity 1.1:* Operation of Electric Buses at the Olympic Games Venues and Surroundings. The following are Operational information and data for the period July 20, 2008 to July 4, 2009, or about a year of operation:

Operational Statistics

1. The 50 LEBs were put into operation including the 4 funded by GEF/UNDP with a total distance traveled of 1,628,513 kilometers (km) for the said period.

2. Average distance traveled per vehicle is 32,570 km. with the highest one at 38,960 km. and lowest at 20,156 km., respectively.

3. Total electricity consumption is 2,086,630 kWh for the period which includes the consumption to operate the on-vehicle air conditioners.

4. Currently, the 50 E-Buses operate on two regular routes, Route 81 and 84, serving city residents, which have 11 kilometers and 25 kilometers, respectively, for one way trip, and 248 and 183 trips each day on each route with 8,400 and 9,600 passengers averagely served per day, respectively. the following were observed:

    a. 11 kilometers and 25 kilometers, respectively, of one way trip,
    b. 248 and 183 trips each day, respectively, and

c. 8,400 and 9,600 passengers averagely served per day, respectively.

5. So far, there was no failure records, neither major malfunctions nor complaints reported.

Battery Charging

The battery charging station consists of two (2) charging lines with one set on-vehicle charging port (i.e. using a line port available for vehicle charging without loading and unloading the batteries). Charging can be carried out on each bus for 10 batteries. Eighty (80) sets at 10 batteries each or 800 batteries are stocked for the operation of the 50 LEBs. The charging station is located in a 5,000-square-meter lot in the vicinity of the Olympic Village. The operational and cost data related to the battery were observed, as follows:

1. Maximum traveling distances is at 130 km (or 65 km in radius) with fully-charged battery and with air-conditioning (AC) unit operating for all the time during the trip.
2. Current charging time is 2.5 to 3 hours for each battery,
3. Current battery exchange time averaged at 7 minutes, which can still possibly be reduced to 5 minutes.
4. The on-vehicle charging takes longer charging time as expected.
5. Battery economic life time data is not yet available since it is still around one year in operation, but it is expected to last for 3 years at minimum as told by the battery manufacturer based on the current battery conditions.
6. Total battery cost is at RMB 500,000 per vehicle, however, the batteries are being rented for the CEBBO Project at RMB 4 per kwh.
7. The capital investment of one charging station is at RMB 30 million.

Maintenance

The following were observed:

1. The LEBs are easier to maintain compared to the conventional diesel and CNG buses
2. Maintenance costs for LEBs are higher than the conventional buses for the parts replacement, but almost the same in terms of labor fees
3. Reliability is observed to be higher for LEBs.
4. Maintenance requirement is normally for every 5,000 kilometers. During the Olympics, maintenance was done every 2,000 km, thus, improving reliability.

Riding Comfort

1. The passengers and drivers declared that LEBs are more comfortable.
2. Driving is smoother at acceleration and cruising.
3. The battery-powered prime mover is quieter in operation.

Battery disposal

1. Battery case being able reused
2. Lithium material is fully recycled
3. Carbon powder recycled
4. Aluminum components recycled

Overall economics of operation

The information on economics of LEB operation is believed to have been submitted to the government when the subsidy on fare rates for the 50 LEBs was justified. However, such information was not available to the Team during the evaluation, so that the evaluation of economic aspect of the project lacks data support.

GHG Emission Reduction Potentials

For the GHG (in terms of CO_2) emission reduction potentials, the project reviewed the assumptions placed in the GEF Project Document (ProDoc) and revalidated the emission factor. For instance, the emission factor assumed in the ProDoc was 1.067 kg CO_2/kWh based on mainly grid coal generation and the national average energy efficiency. Thus, the GHG calculation used by this Evaluation's assumed a weighted emission factor that was based on 80% coal-based grid generation (with 20% using wind power from Guanting field in Beijing) and higher energy efficiency achieved in Beijing. The updating on GHG calculation resulted to the emission factor of 0.65 kg CO_2/kWh.

Therefore, based on the above observations, all tasks indicated in *Component 1* have been completed at **Highly Satisfactory**[1] rating.

- Publicity

The UNDP/GEF Logos that were placed on the LEBs strategically boosted the publicity mileage for UNDP and GEF as well for China in their environmental mission and accomplishments.

High visibility and impact were achieved in the international press conference held in July 2008 in conjunction with the Beijing Olympics opening. Multimedia resources were employed to gain wider reach.

Public service ads broadcasted environmental awareness and protection on mobile television on vast majority of city buses.

A series of leaflets, mementos and brochures were distributed in the Olympic Village, schools communities, streets and other public places to make more and more people aware of the usefulness of electric vehicles and the global environmental issues.

The 50 LEBs continue to provide service to the public on bus lines after the Olympics.

The TV program "Green Olympics: Ecological City" was shown during Olympic Games and had been reported as completed during the Evaluation meeting.

[1] **Note on Rating:**

Highly Satisfactory (HS)	Project is expected to achieve fully or exceed its objective. The project can be presented as "good practice."
Satisfactory (S)	Project is expected to achieve mostly its objective.
Marginally Satisfactory (MS)	Project is expected to achieve partially its objective.
Unsatisfactory (U)	Project is not expected to achieve its objective.

Activity 2.1 described that the GEF/UNDP logo shall be displayed on the electric buses throughout the life for at least the 4 GEF/UNDP LEBs. The LOGO of GEF,UNDP and ”Green Olympics” was designed together and displayed on the electric buses, but after the Olympics, all the logos concerning the Olympics must be removed as provided by the guidelines of the Organizing Committee of the Olympic Games including the GEF/UNDP logos. The Evaluation Team suggests that this issue be taken up by the UNDP Country Office in China with the project implementors if the provisions of this activity will be followed.

- Evaluation and Monitoring

The following were monitored and evaluated during and after the Beijing Olympics:

1. Exhaust emissions monitoring;
2. Noise monitoring and
3. Questionnaires survey of the passengers of LEBs.

Project monitoring and evaluation were completed for the duration of the Olympics and continued measurements and evaluation to complete the assessment up to the end of July 2009, which is the project completion.

The 50 LEBs fulfilled the transport requirements in the Olympic Games for the Media Village and Athletes villages as planned.

The goal of safe and reliable operation was achieved with zero breakdown fault and outage. From the end of the Olympic games up to May 2009, the 50 LEBs had traveled 1,073,500 km, consumed 1,239,300 kwh and carried 835,000 passengers.

- Project Management

- Project management was done through a Project Management Office headed by the National Project Director designated from the main executing agency, the Beijing Municipal Environmental Protection Bureau. The activity is still ongoing up to project closure by end of July 2009.

6.1.2. ***Other Outputs***

The Evaluation noted additional Project Outputs regarding the reduction of other pollutants, especially toxic ones viz., PM, NOx, etc.

6.1.3. ***Accomplishments***

The following assessment of accomplishments was based on the CEBBO project Document (ProDoc) consisting of two parts: accomplishments on the project targets and the achievements on the project impacts. The results are shown in the tables below.

- Performance measurement indicators and targets

Table 1 presents the accomplishments on the different components and activities of the CEBBO project.

Table 1. Performance Measurement Indicators and Targets

Project Strategy	Target	Actual	Assessment of Achievement
Component 1: Procurement, operation and maintenance of Li-ion Electric Buses			
Outcome 1.1 Athletes, media, and the public made aware of the Chinese efforts for a Green Olympics	• One (1) high visibility event in the inauguration of LEB's	• Press Conference of UNDP GEF Promoting Clean Electric Buses for the BOG held on July 31, 2008	• *Achieved more than the expected turnout*
	• Fifty (50) mobile television presentations and free flyers in the buses	• The TV program "Green Olympics: Ecological exhibited during the BOG and reported accomplished during the Evaluation.	• *Achieved*
	• 200 km-trip/day per LEB during the BOG	• 209 km-trip/day	• *Achieved* as explained below in **Note on Achievement.**
Outcome 1.2 Improved air quality at the Olympic venues and surroundings	257 days in 2008 (counted for small part achievement)	274 days in 2008	*Achieved 106% of Target*
Outcome 1.3 Enhanced image of Beijing	Nationally and internationally recognized efforts of Beijing in environmental protection, its adoption of increasingly strict vehicle emission standards, and the increased use of low GHG emitting transport technologies	In conjunction with successful Beijing Olympics, the CEBBO Project gained national and international recognition	*Achieved more than expectation*
Component 2: Outreach of the GEF and Green Olympics			
Outcome 2.1 Enhanced public image of the GEF as a global entity to support environmentally sustainable development	Improved level of awareness and increased visibility of the GEF	Greatly improved level of awareness and increased visibility of the GEF	*Achieved*

Outcome 2.2 Increased public awareness about the GEF, climate change and clean vehicle technologies	Improved level of public awareness about GEF, climate change and clean vehicle technologies	Greatly improved level of public awareness about GEF, climate change and clean vehicle technologies	*Achieved*

Notes on Achievement:

Outcome 1.1 Target 3: According to data from the Beijing Public Transportation Co., the 50 LEBs had the total mileage of 131,300 km during Olympic period, i.e. from August 8 to September 19, 2008, or the opening and closing dates. With the total of 50 days service period, it turned out to be 209 km-trip per day for the 4 LEBs for which the target is 200 km-trip per day.

- Qualitative and Quantitative Analysis and Evaluation on Impacts of the Project

Table 2 presents the achievement on the impacts of the project. In summary, the project impact achievement is **Highly Satisfactory.**

Table 2. Qualitative and Quantitative Analysis and Evaluation on impacts of the CEBBO Project

Project Strategy	Target	Actual	Assessment of Achievement
GOAL: Reduction of the growth rate of GHG emission in the transport sector	At least **2** tons of CO2 emission reduction per Li-on battery-powered electric bus (LEB). In total for 50 LEBs, about **111.6** tons CO2 emission reduction	2.306 tons CO2 emission reduction per LEB during the whole operation distance of 6,000 km In total for 50 LEBs, about **115.3** tons CO2 emission reduction	*Achieved more than 100% of Target* (Computation seen in **Annex D.**)
OBJECTIVE: Fully supported Chinese efforts in greening the 2008 Olympic Games in Beijing through the demonstration of Li-on battery powered electric buses	50 LEBs during the month of XXIX BOG	50 LEBs	*Achieved*

6.2. Project Outcomes and Impacts

6.2.1. Social

1. High standard of bus service for all

   The LEBs used in Olympic Village and Media Village helped the athletes, officials, media staff and service staff to commute between facilities. They

were provided timely, safe, quiet, clean, odorless, comfortable, and pleasant experience with no accident or shutdown.

The design of the LEBs for the Paralympics made the disabled athletes, officials, media staff easy to use them. The special design includes low deck board, electric retractable slope for wheelchair users, ten seats facing the passage in front of the bus, and an open space for wheelchairs facing the rear gate with safety belt available. These designs will continue help the children, the elders, the disables, the pregnant women and others passengers when the 50 LEBs serve as the normal buses after the Olympic period.

2. Free and low ticket prices

   The bus service was free of charge during the Olympic period. After that, when LEBs were serving for the normal buses, the low charge policy for public transportation that Beijing Municipal Government has adopted in recent years made more residents and visitors especially those with low income choose to use public transportation more.

   The ticket prices for LEBs are the same to normal buses which are 1 RMB for single ticket, 0.4 RMB for normal prepaid card user, 0.2 RMB for student prepaid card user, free for the elders over 65 years old upon presenting a certificate or ID card. These prices are the same whatever stops the passenger takes.

   These prices are believed to be far below the running cost of all kinds of buses, even more obvious for LEBs. The operational statistics shows that around 6 RMB cost per passenger were estimated for only electricity fee and battery rent after promotional Olympic period when the 50 LEBs served as normal buses.

3. A good example to show the determination of Beijing to sustainable transportation and clean air

   The LEBs, together with other high profile activities, have shown that Beijing will and can try its best to achieve the desired environmental goals when given the responsibility during the Olympics and Paralympics.

4. Very satisfactory riding experience

   Almost all the passengers as well as the bus drivers interviewed during the questionnaire survey were very satisfied with the LEBs,. They gave the remarks based on the more comfortable and quiet riding/driving, and no tailpipe emissions on the road that annoy pedestrians.

6.2.2. Economics

1. Economics of the LEBs cannot be established fully and conclusively with the CEBBO Project alone which is more of a demonstration and promotion project

The CEBBO Project aimed at demonstration and laying the field for supporting the commercialization of LEBs in the long term. It also supported the efforts of Beijing Municipal Government to invest for 50 LEBs and a charging station. The effort was not mainly aiming to gain direct economic benefits as the bus service was free while investment and running costs are higher than that of diesel bus. The running cost was roughly estimated during the Evaluation. It should be mentioned that the Beijing Public Transportation Holding, Ltd. is a public-owned company and have huge amount of subsidies from the local government every year. The subsidies include the investment for new buses, facilities such as the charging station for LEBs and operating cost, personnel cost, among others.

The procurement of LEB and infrastructure buildup is still costly, while they use state-of-the-art technologies and provide more convenience.

The power cost of LEB, which consumes 1.1-1.4 kWh electricity per km (electricity cost is about 4.6 RMB/kWh, including the expense of battery renting), has an operation cost of 5.0-6.5 RMB/km. To the contrast, the diesel bus fuel consumption rate is 0.4 l/km (diesel price is about 5.5 RMB/l), so its operational cost is about 2.2 RMB/km.

The CEBBO Project helped to create a need for scaled-up operation of LEB system, i.e. 50 buses and a station with the function of charging and first class maintenance. This is valuable for improvement/innovation of technical, management, and commercial aspect towards establishing the LEB market hat will make the LEB economical and commercial.

Thus, to achieve better economics, the necessary improvements include:

1. Innovative battery renting mechanism to ensure low risk and liability for a bus company and optimized battery management.

2. Battery monitoring system for buses on service based on mobile network communication.

3. New invention or innovation on battery charging process, i.e. use a robot to switch batteries instead of charging them on the bus to save time and space for charging process. The process is being optimized to make battery switch even faster, from about 6 min to 5 min. This will allow more buses to be supported by a single charging station.

4. Research on the characters/lifespan of current battery and new battery material to extend the capacity and lifespan which are the bottlenecks for long line and heavy duty bus service.

5. Through the interview with stakeholders, it was found that they believe the cost of new charging station for the new plan of 50 more LEBs will be significantly lower than the current one.

The Evaluation Team noted that first three (3) improvements have been adopted and are in different stages of implementation.

2. Improvement on the E-Bus industrial chain

Besides the cost reduction and technical/management improvements, the industrial chain for LEBs has been built and made stronger as the result of the current project. The industrial chain includes LEB running team of the Public Transportation Group Co., the battery producer, renter and charging station operator -- the MGL Company, the bus producer and fixing/maintenance service provider, the producer of the battery exchange robot mechanism and other equipments in the charging station, the designer of the LEB and the supporting system, and so on. The CEBBO project and its four (4) LEBs provided an active contribution and many promotional activities that made possible for all the 50 LEBs to have a system and program which have enlarged the impact and multiplier effect on the social benefits and other requirements for launching and sustaining an LEB program.

6.2.3. Policy

1. Policy and decision-making before the Olympic period were focusing on showcasing the commitment for clean air.

In the Beijing Transportation Development Plan (2004-2020), development of electric vehicle is to be encouraged. The successful result of the current LEB fleet encourages Beijing Municipal Government to put LEB in the list of further sustainable transportation promotion policy. The Beijing Municipal Government is developing the application plan of new energy buses over the next few years and Beijing Public Transport Holdings, Ltd. will implement in accordance with the requirements of the government. The 15th phases air pollution control program of Beijing sets priority on LEB, hybrid vehicles, CNG vehicles, and trolleybus for city bus and other public service sectors when purchasing new vehicles.

2. Beijing is planning to further promote LEBs and other environmental friendly vehicles.

The Beijing Municipal Government has decided to subsidize 860 Hybrid bus, additional 50 LEBs, and a certain number of CNG buses in 2009-2012. In 2009, the Beijing Municipal Government has issued an order for another 50 LEBs which are into preparation stage for production and 860 hybrid buses to Beijing Public Transport Holding, Ltd. In order to meet the power recharging of the additional new 50 LEBs, the Beijing Municipal government has arranged for the original charging station’s reconstruction and expansion to increase its capacity. Because of the success of the CEBBO project demonstration, the government policy on LEBs together with other transport alternatives has become firmer and progressive.

3. Potentials for better policy framework.

Difficulties were discussed during the group interview in the evaluation. The major one is the difficulty for choosing sites for LEB charging stations since they are not included in city development planning. This fact shows the significance of a forward-looking urban comprehensive sustainable transportation planning in the city level. This could be a further step to

promote vehicles using new fuels which need special infrastructures to operate. The LEB and Fuel Cell Bus (FCB) are two examples.

6.2.4. Environmental

LEBs contribute directly to local air quality

As suggested in the ProDoc Logical Framework, the indicator of number of blue sky days was adopted. There were 274 blue sky days in 2008, 17 days more than the target (257 days) set by the stakeholders of the project. It should be noted that this improvement can be attributed to a combination of many initiatives, such as vehicle utilization reduction, the use of alternative fuels, clean energy transport technologies (LEBs is just but one among several options), etc., and of many factors, including meteorological, which all contributed to this observation.

Local Air Quality Impact

By only using the batteries for power supply that result to no direct tailpipe emissions and particulate matter, LEBs contribute directly to the local air quality improvement, especially at the point of use such as in the Olympic venues and surroundings. Internal combustion engine (ICE) buses, whether using diesel or natural gas, are annoying pollution sources to people. The development of LEBs is strongly supported by most passengers according the results of the questionnaire survey done for the project. The local air quality impact contributed by LEBs, however, is still limited by the yet small market at this early stage of technology introduction in China.

In 2008, the annual average concentrations of inhalable pollutants which include particulate matter (PM 10), nitrogen dioxide (NO_2), carbon monoxide (CO) and sulfur dioxide (SO_2) were registered to be 0.122 microgram per cubic meter (mg/m^3), 0.049 mg/m^3, 1.4 mg/m^3 and 0.036 mg/m^3, respectively. Compared to those in 2007, the annual average concentrations of PM_{10}, NO_2, CO and SO_2 decreased by 26.1%, 30.9%, 46.2% and 43.8%, respectively. Except for PM10, the said annual average concentrations of the other three pollutants met the national air quality standards.

In line with the project objectives, these parameters were also reckoned for the period of the Beijing Olympic Games (Aug. 8 to Aug. 24) or a total of 17 days. Qualitatively, there were ten (10) days out of the 17 days which posted *excellent* air quality while the other 7 days achieved *good* air quality. It was concluded that the actual air quality measurements met the national standards set throughout the BOG. Quantitatively, when compared to the same period in 2007, the ambient concentrations of PM_{10}, NO_2, CO and SO_2 decreased by 53.7%, 57.4%, 42.9% and 46.7%, respectively.

Same measurement procedures were done during the Beijing Paralympics Games (which was 12 days for the period September 6 to September 17). Two (2) days out of the 12 days achieved *excellent* air quality and the other 10 days achieved *good* air quality. It was also concluded that the air quality likewise met the set national standards throughout this particular period of the Paralympics Games. Compared to the same period in 2007, the ambient

concentrations of PM_{10}, NO_2, CO and SO_2 decreased by 57.2%, 53.4%, 44.1% and 47.8%, respectively.

With these observations, the Evaluation Team affirms that there is very good reason to conclude that the deliberate usage of clean transport technologies including LEBs, has a very good local air quality impact.

Greenhouse Gas (GHG) Emission Reduction

Fuel-based GHGs also contribute to environmental degradation. ICE buses, whether using diesel or natural gas, emit GHG emissions including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). In 2008, there were 9,357 diesel buses of the *China 3* standard (which is a state-determined standard); 5,239 *China 4* diesel buses and 4,144 compressed natural gas (CNG) buses running on the road. The total number of these buses accounts for more than 90% of the total buses operated in Beijing. Since *China 3* diesel buses dominated the bus population, the Team used it as the baseline to estimate GHG emission reduction assuming that the 50 LEBs were introduced as an alternative.

The average fuel consumption of *China 3* diesel buses in Beijing which have been tested on-road by the Beijing Municipal Research Institute of Environmental Protection and Beijing Institute of Technology, is 0.449 liter/km. Taking this average value and assuming that all the carbon from the burned diesel fuel is converted to CO_2 (as CO and HC emissions of diesel engine are very low), the CO_2 emission of a *China 3* diesel bus is 1.197 kg/km. For the whole operation distance of 6,000 km set in the ProDoc, a *China 3* diesel bus is estimated to emit 7.179 tons of CO_2.

Inherently, LEBs emit no GHG emissions directly. However, the generation of electricity which powers LEBs emits GHG, mostly CO_2 emission. Since the power generation comes from a variety of energy sources, such as coal-fired plants, hydro-electric plants, nuclear plants, wind energy and solar energy, the mix proportion of electricity from coal-fired power plants and other alternative energies determines the amount of CO_2 emission per kWh of electricity. During the period of the BOG, 20% of the electricity used at Olympic venues came from the wind power located in Guanting field of Beijing. At the national level, hydroelectric, nuclear and other alternative energies account for about 19% of the total power supply mix.

Therefore, the grid percentage of 0.8 attributed for coal-fired power is used to calculate the CO_2 emission per kWh of electricity, which is 0.650 kg/kWh. Integrating the average power consumption of LEB (1.25 kWh/km, based on 1.1 kWh/km without air conditioning and 1.4 kWh/km with air conditioning), a LEB emitted 0.812 kg CO_2/km. For the whole operation distance of 6,000 km, a LEB emitted 4.873 tons CO_2, which is 2.306 tons CO_2 less than a *China 3* diesel bus. For the entire fleet of 50 LEBs, 115.3 tons CO_2 were reduced during the whole operation distance of 300,000 km.

Based on the above calculation, the resulting actual GHG reduction met the target set in the ProDoc Logical Framework, i.e., “At least 2 tons CO_2 emission reduction per LEB. In total, (this is) about 111.6 tons CO_2 emission

reduction". The said actual measurement as estimated in the foregoing calculations indicates the reduction contributed by LEB to the mitigation of GHG emissions in the transportation sector.

Additionally, the introduction of LEBs reduced other GHGs such as CH_4 or N_2O emissions compared to CNG buses or *China 4* diesel buses. Existing test indicates that CNG buses emit considerable CH_4 emissions, which has a global warming potential (GWP) 21 times that of CO_2. *China 4* diesel buses that use selective catalytic reduction (SCR) technology to reduce NOx emission emit more N_2O emission, which has a GWP 310 times that of CO_2, than diesel buses without SCR.

6.2.5. Exhaust Emissions Evaluation

Regarding local air quality improvement, eight buses running on the roads of Beijing, including two *China 3* diesel buses, two *China 4* diesel buses and 4 CNG buses, were tested by the Beijing Municipal Research Institute of Environmental Protection and Beijing Institute of Technology to evaluate the exhaust emission reduction of LEBs. The testing included the activities listed below.

1. The exhaust emissions testing consisted of the following:

On-line measurement of gaseous pollutants from buses in Beijing, using gaseous pollutant analyzer of SemTech of American Sensors' Inc. was used.

Real-time measurement of the number and mass concentration of the fine particulate emission from the buses, using Electrical Low Pressure Impactor (ELPI) of Dekati Company for diesel vehicles using China 3 and China 4 emission standards. For comparison, CNG buses were also included as test vehicles.

2. The exhaust emissions monitoring system included the following components:

    - Portable/integrating exhaust emission analytic system; NDIR analyzer (CO/ CO_2); NDUV analyzer (NO/NO_2); HFID analyses (THC);
    - Electrochemical sensor of O_2 measurement
    - Environmental sensor of temperature, ambient pressure and humidity;
    - Exhaust emission flow meter;
    - Interface of vehicle operating parameter;
    - Global positioning system (GPS); and
    - Second-by-second measurement of the emission of particulate matters.

The exhaust emission reductions of 50 LEBs based on comparative vehicles are given in **Table 3**. With inherently zero tailpipe emissions, the 50 LEBs reduced considerable amount of $PM_{2.5}$, NOx, HC and CO emissions locally. As a kind of toxic pollutant, $PM_{2.5}$ would bring serious damage to the human health, especially respiratory system and cardiovascular tissue. NOx and HC emissions are key precursors of ozone, which forms by a chemical reaction

between NOx and volatile organic compounds (VOC, similar to HC excluding methane) in the presence of sunlight. High level of ozone would affect people with lung disease, children, older adults, and athletes. CO enters the bloodstream through the lungs and binds to hemoglobin, the substance in blood that carries oxygen to cells. It actually reduces the amount of oxygen reaching the body's organs and tissues.

Table 3. Results of Emission Reduction Testing

Emission Reductions of LEBs based on Comparative Vehicles During the BOG, in Kilograms（kg）For 50 buses				
Comparative Vehicle	**CO**	**HC**	**NOx**	**$PM_{2.5}$**
Diesel Bus (*China 3*)	1,056	21	1,853	41
Diesel Bus (*China 4*)	188	5	1,447	13
CNG Bus	1,357	211	2,275	3

From the end of the BOG up to May 31,2009 in Kilograms（kg）For 50 buses				
Comparative Vehicle	**CO**	**HC**	**NOx**	**$PM_{2.5}$**
Diesel Bus (*China 3*)	8,630	169	15,153	336
Diesel Bus (*China 4*)	1,540	40	11,833	105
CNG Bus	11,092	1,724	18,597	22

Note:

1. Only local emissions are considered in this table. There is no tailpipe emissions from LEB.
2. The 1st period is around BOG, lasting about 2 months; the 2nd period is from the end of BOG to May 31, 2009;
3. Based on the on-road testing data, the operation of 50 LEBs reduced local emissions of CO, HC, NOx and PM of different amounts compared to *China 3* diesel buses, *China 4* diesel buses and CNG buses, which are given in this table. Generally speaking, more than 90% of the HC emissions from CNG bus is methane, which is also GHG and of 21 times the global warming potential of CO_2.

In addition, the number of $PM_{2.5}$ emission is not given in the table above. More and more scientific research discovered that the ultra-fine particles (less than 100 nm in size) emitted by diesel buses could be more dangerous to the human health. While the ultra-fine particles only account for a small part in the total mass of $PM_{2.5}$, they dominate the total number of fine particles. The emission rate of ultra-fine particle number from the diesel buses reached the order of magnitude at 100 billion per second. The operation of 50 LEBs also cut the emissions of trillions of ultra-fine particles locally.

6.2.6. Noise Monitoring

1. Monitoring methods included:

    a. Monitoring on the bus line
    b. Selecting testing lines and monitoring the noise emission of single bus at different running conditions
    c. Installing noise monitoring equipments and analyzing the noise level from engines and emissions of different buses
2. Types of test vehicles monitored included: Diesel Bus (*China 3* emission standard), Diesel Bus (*China 4* emission standard), CNG Bus, Trolley bus, and LEBs.
3. Equipment used include: Noise analyzer B&K 2250 and Noise analyzer BSWA801

Results of Noise Monitoring

1. Noise level evaluated

    - Noise level measured following the related national standard procedures by Beijing Municipal Institute of Labor Protection (BJMILP)
    - Overall lowest noise level compared to conventional buses, in terms of acceleration, cruising at 30 and 50 km/hr
    - Lowest noise level measured from a roadside monitoring point on E-Bus operation at 30 and 50 km/hr

2. Results

    - The monitoring results of the actual operation lines indicate that the noise of LEBs is the lowest.
    - The monitoring results of specific lines at different running conditions indicate that the noise levels of LEBs are the lowest of the diesel buses.
    - The noise level of LEBs is 6.9 dB at the maximum lower when compared to the 3 other types of buses with the same running conditions.

6.2.7. Questionnaires Survey

1. The investigating agency was the Beijing Municipal Research Institute of Environmental Protection on June 15, 2009 at the Line 84 of the LEBs.

2. The survey results led to the following observations:
    - Almost all passengers supported the development of the LEBs
    - Almost all passengers felt the LEBs have low noise level.
    - Most passengers think that LEBs is more comfortable than the other types of buses.
    - Most passengers consider LEB moving more smoothly.

6.2.8. Organizational

1. The organizational approach for the CEBBO Project is well-founded and backed up by the tripartite agreement which provided the legal basis and role definition of participants for the project. This strength led the project to become successful in meeting its goals.

2. The project organizational set-up became the launching pad for cooperative undertaking among the relevant agencies involved which was sustained to become the basis for the post-project LEB program organizational structure not only for Beijing but also for the country..

3. For instance at the beginning, the Ministry of Finance and Beijing Finance Bureau signed a grant agreement for the funds; while the Beijing Finance Bureau and Beijing Environmental Protection Bureau have signed a re-transfer agreement to ensure the proper use of the project funds.

4. The oneness of purpose and unified direction among the institutions involved, viz., the Beijing Environmental Protection Bureau, Beijing Financial Bureau, the Beijing Municipal Science and Technology Commission, the Beijing Public Transport Holdings, Ltd. and the Beijing Organizing Committee for the Games of XXIX Olympiad, united everyone to accomplish the tasks within the agreed timeframe. As they contributed resources and efforts, the whole project organization made them possible to push forward the activities and necessary inputs towards achieving the goals of the CEBBO project. As such, the organizational impact of the project is seen already in the organizational structure that is adopted by the Beijing Municipal Government as it pursues its LEB program. Further, this set up provides now the basis for a countrywide organizational structure for the national E-Bus Program.

6.3. Assessment of the Project Design

6.3.1. Country Ownership

The CEBBO Project has definitely played a big role in putting together the efforts in the development of an E-Bus Program in Beijing that has big municipal as well as country-level significance.

The Project has successfully demonstrated the use of E-Buses powered by Li-ion batteries during the Olympics and has laid the developmental groundwork for the LEB Program of China. As an added impact of the China country initiative, the Project provided a great opportunity to showcase UNDP's and GEF's contribution to addressing global environmental challenges along side the Chinese initiatives in pursuing for the world a Green Olympics and improving environmental quality in Beijing.

Aside from this Project undertaking, the Team noted the initiatives such as MOST establishing a "Special Project of Electric Vehicles for Hi-Tech Olympic Game" in the electric vehicle projects in the 10th and 11th Five-Year Plan and necessary scientific research and technical resources and Beijing Municipal Government counterpart in the development and demonstration of E-Buses for the Olympic games and thereafter.

6.3.2. Project Conceptualization and Design

The Team used the Project Identification Form (PIF) submitted for project entry and the CEBBO Project Document (PIMS No. 4039) as the basis for evaluating the project formulation during the development of the concept and as it was interpreted for implementation as stated in various documents and reports.

- *Was there clear identification of the problem being addressed and effective conceptualization of the approach?*

  The Team affirms this. The CEBBO Project has been designed to address the issue of transport pollution in big cities and saw the application and replication of the use of E-Buses as one of the effective means of controlling GHG emissions in the transport sector. It was also conceived to elevate the impact level not only at the municipal and country level but also at the international and global levels by riding on the Green Olympics concept and clean energy awareness strategy. The technical as well as the promotional aspects were combined to address the identified project purpose and strategic approach.

- *Were the project objectives and outputs stated specifically and clearly in terms of verifiable performance indicators?*

  Likewise, the Team sees that the Project was clearly defined and timeframe well established to coincide with the Beijing Olympics and scale of publicity. The project development process identified a baseline for which the objectives and targets were reckoned with as stated in the CEBBO Project Logical Framework Analysis (LFA) with its outcome-output-activities structures and verifiable performance indicators.

  The expected outcome of bringing about an equivalent of 112 tons of CO2 emission during the 30-day Beijing Olympic Games is clear with the methodology of calculation explained in the project annexes. Aside from this result, however, the stated outcomes on publicity and awareness goals were clearly stated though difficult to measure. These will just be based on observations, responses to surveys and judgments by experts.

- *Was the relationship among the objectives, outputs and activities logically articulated?*

  The project documents and reports clearly articulated the project objectives, outputs, strategy and activities. As it was designed for world level impact, the project built on MOST's and the Beijing Municipal Government's efforts to promote E-Buses in China and promote the LEBs as a means of achieving a world level Green Olympics. The ultimate goal of the project to contribute in reducing the growth rate of GHG in China transport sector has been demonstrated successfully in using LEBs. To realize the purpose and objectives, the project components and related activities, viz., (1) Procurement, Operation and

Maintenance of Li-Ion Battery-Powered E-Buses and (2) Outreach of the GEF and Green Olympics, were logically-arranged and sufficient to meet the project goals within the timeframe of the Olympics as articulated in the LFA and other project documents for a Medium-Size Project of GEF/UNDP.

Therefore, the project design is objectively-stated enough and justifiable considering the need for promotion and publicity that can be achieved by riding on the national and international reach and relevance of the BOG to promote the Green and environmental consciousness with the use of clean energy buses.

6.3.3. Partners and Stakeholders Identification and Participation

The Project involved close coordination among the project Partners, UNDP China as the GEF Implementing Agency, and other institutions implementing related sustainable transport projects and activities for the Beijing Olympics. The main Partners were judiciously identified and actively involved in activities directly related to the CEBBO project purpose. They include: the Ministry of Finance, the Beijing Municipal Government, and the Beijing Organizing Committee of the Olympic Games. Other stakeholders/participants included design institutes and manufacturers of the E-Buses and Li-Ion batteries and the Beijing Transport Holding Company which operated and maintained the buses. The Team observed that the partnership and stakeholder arrangements proved to be a “win-win” situation for every participant and partner.

Aside from the technical and operational arrangements, the following critical arrangements on financial management and monitoring and evaluation and related activities done by the major partners contributed also significantly to the success of the project:

a. Financial Management

As a member of the Project Management Group, according to the division of work, the Beijing Municipal Financial Bureau completed the following tasks:

- Applied for the project coordinating with the Ministry of Finance, UNDP and other departments
- Approved the asset transfer and re-transfer agreements
- Applied for opening of a RMB special account and account management
- Reviewed project applications for funds and allocate grant funds.
- Reported the use of funds in accordance with UNDP guidelines

b. Monitoring and Evaluation

The partner organizations that participated in the activities of Monitoring and Evaluation of Component 2 include the following: 1. Beijing Municipal Research Institute of Environmental Protection; 2.

Beijing Public Transport Holding, Ltd.; 3. Beijing Institute of Technology, National Professional Auto Emission Test Laboratory; 4. Department of Environmental Science and Engineering, Tsinghua University; 5. Beijing Municipal Institute of Labor Protection; and the Air Monitor Science and Technology Instrument Co., Ltd. (Beijing) .

The Team also gathered information on the status and direction of the MOST project on Demonstration of Fuel Cell Buses (FCBs) in Beijing which was also funded by GEF. The Team observed the fact that China's clean energy bus program is rationally approached by considering different options towards long term benefits. The FCBs and the E-Buses are part of the overall national sustainable transport program of China.

6.4. Assessment of Project Implementation

6.4.1. Implementation Approach

The implementation approach of this Medium Size Project, as reaffirmed by the CEBBO Project Management Group, has been considered by the Evaluation Team as responsive to the needs and capacity of the Lead Agency and the Participating partners towards the pursuit of the LEB demonstration goals in the midst of a high profile and wide coverage of the Beijing Olympics. This also led to the overall success of the CEBBO Project.

6.4.2. Partnership Strategy

The partnership strategy has proven to be very strong in drawing the maximum support and resources from the different participating institutions and agencies which were bound together by common goals, complementing capabilities and the Beijing Olympic spirit that goes beyond the project level to national and international agenda.

6.4.3. Financial Planning and Delivery of Co-Financing Inputs

The Team's task is not only to check if the financial plan has been followed but how it was spent per main budget item. The Team was provided with data on the overall status of project expenditure vis-à-vis the budget and did not go through the rigor of detailed accounting of the sub-items. The Team was informed that the Project has been audited and reports were submitted to proper authorities applying accepted government procedures.

The Team evaluated the system and the corresponding official financial arrangements which the Team believes are covered by sufficient controls, authorities and accountability as described below for the GER and co-financing portions of the project resources.

GEF Funds

The legal basis for the financial management for the CEBBO Project was provided by the tripartite agreement on July 14, 2008. The transfer agreement between the international department of the Ministry of Finance and the Beijing Municipal Financial Bureau made possible the entry of the

GEF funds to the government accountability system. For the funds to be available at the implementation level, the Beijing Municipal Financial Bureau and the Beijing Municipal Environmental Protection Bureau signed a re-transfer agreement as another accountability scheme for the GEF funds.

To strengthen financial management and facilitate the cash flow and payments as part of the transfer agreement, a special RMB account was opened in the Beijing Municipal Financial Bureau for the project. In view of the critical delivery timelines and short implementation periods, it is noted that the expense and payments system was further facilitated by a reimbursement practice where the Beijing Municipal Environmental Financial Bureau advances for the purchase of project inputs and services which are later on replenished by the Beijing Financial Bureau. As a result, the delivery of inputs and services are timely and effective.

The GEF grant funds of USD 1 million (RMB 6.81 million at 6.81 exchange rate) for the project were provided to the UNDP as the Implementing Agency on August 28, 2008. The Beijing Municipal Finance Bureau transferred separate funds in the amount of RMB 4,767,000 for Component 1 which is the purchase of four (4) LEBs to the Beijing Public Transport Holding, Ltd. and RMB 953,400 for Component 2 or the publicity activities early December 2008.

Co-Financing

The co-financing for the 46 LEBs and a host of many support activities and leadership participation are key factors of the magnitude of success of the CEBBO Project.

The amount of co-financing provided by the Government of China and the partners has exceeded much beyond the planned amounts in the PRODOC as originally envisioned. The inputs for the other components are observed to be very significant but are not reported to be included in the summary of financial status.

At present, the balance of funds for remaining ongoing activities of Component 3 (Evaluation activities) is 612,900 RMB and of Component 4 (Project Management) is 476,700 RMB or a total amount of RMB 1,089,600 (excluding interest earnings). The summary of financial status as of July 2009, is shown in **Table 4**. The actual balance amounts vary with the budget and do not correspond to the budget figures as planned due to changes in exchange rates and interests. The figures were taken from the report of the Beijing Municipal Financial Bureau in RMBs. The exchange rate assumed here was 6.7 RMB per USD.

Table 4. Planned Budget and Actual Expenditure of the CEBBO Project as of July 1, 2009, in USD

Project Components	GEF			Co-Financing		
	Planned	**Actual**	**Balance[a]**	**Planned**	**Actual**	**Remarks**
1. E-Bus Procurement and Operation	700,000	700,000	0	12,300,000	12,450,000	Actual 101% budget
2. Publicity	140,000	140,000	0		Very Significant	Not reported
3. Evaluation	90,000	(on-going)	91,477[b]		Very Significant	Not reported
4. Project Management	70,000	(on-going)	71,149[b]		Very Significant	Not reported
Totals, in USD	**1,000,000**	**840,000**	**162,626[a]**	**12,300,000**	**12,450,000**	
RMB	*6,810,000*		*1,089,600*			

[a] The actual balance amounts vary with the budget and do not correspond to the budget figures as planned due to changes in exchange rates and interests. The figures were taken from the report of the Beijing Municipal Financial Bureau in RMBs.
[b] The exchange rate assumed here was 6.7 RMB per USD.

The actual total co-financing inputs are very significant (though unquantified) which reflects the highly cooperative and effective partnership strategy among the project participants.

6.4.4. Effectiveness of Executing Agency and Implementing Partners

The Team observed that the Executing Agency and Implementing Partners were very effective in the implementation of the project which was based on very strong leadership and organizational capacities.

Beijing Municipal Government/Beijing Environmental Protection Bureau

- EPB leadership organized a strong team to do the major project tasks leading to the successful implementation of the activities and realization of targets
- EPB was able to mobilize the necessary co-financing to meet the bigger portion of the investment

Implementing Partners

The implementing partners were able to seize the opportunity of combining promotion of the LEBs with the national and international prominence of the Olympic Games and therefore gaining the extra publicity and promotional advantage for the Green image

6.4.5. Assessment of Sub/Contracts and Consultants

The main tasks that were supposed to be sub contracted and the actual entities hired to do the work included the following:

- Promotional Campaign on Climate Change and Clean Vehicle technologies (2 months)
  - HUASHI Digital Mobile Television Ltd.
  - Beijing Jinghaitonglian Company

- Air Quality Monitoring (4 months)
  - Air Monitor Science & Technology Instrument Co., Ltd.(Beijing)
  - Beijing Environmental Monitoring Center

- Public Relations for GEF-supported Green Olympics (2.5 months)
  - Beijing Public Transit Advertisement Ltd.
  - HUASHI Digital Mobile Television Ltd.

The professional services that were supposed to be contracted as consultancy contracts and the actual consultants hired to the tasks included the following:

- Clean Vehicle Expert (International)
  - National Lab of Auto Performance and Emission Test

- Air Quality Expert (Local)
  - Air Monitor Science & Technology Instrument Co., Ltd.(Beijing)

- Clean Vehicle Expert (Local)
  - Meng Gu Li Battery Manufacture of Beijing Guo An Corp.

The hiring of subcontractors and consultants were pursued considering the Project's very tight timeline and the lead time needed in looking for and bidding the services using the normal procedures.

The Evaluation Team verified the status of work by the above contractors through the interview with the CEBBO PMO and the reports (in Chinese language) submitted by the different contractors. Based on the materials provided, the Team observed that all the contractors have met their contract requirements in terms of targets, budgets and schedule and therefore have fulfilled their tasks which altogether contributed also to the overall success of the Project.

6.5. Issues, Concerns and Action Points on Next Steps

The Evaluation Team did not find significant issues directly related to the CEBBO Project implementation that were not acted upon or pending that affected the successful execution of the project.

The issues that could be mentioned at this point relate mostly on the direction of future work regarding the following topics of interest and are therefore included and addressed in the Evaluation recommendations:

1. Need for further showcasing of the LEB technology and application towards increased public awareness in order to develop the market for LEB and its commercialization
2. Need for increased capacity for recharging stations
3. Identification of next steps for government support and focus on subsidies and incentives
4. Identification and provision for technical and operational improvements on battery technology, charging process, renting mechanisms, cost reduction, etc.

7. CONCLUSIONS, BEST PRACTICES AND LESSONS LEARNED

7.1. Conclusions on Project Results and Design

7.1.1. Project Accomplishment

On the overall, the expected key outputs and outcomes of the CEBBO Project were accomplished with **Highly Satisfactory** level of performance. The purchase of the LEBs and the installation of the Recharging Station met the objectives through various inputs and very active cooperation and participation of all the partners. It has placed the LEBs in the forefront of the transport policy and plan of China in the next 3 years to come. It has gained the wide publicity mileage not only for Beijing but also for China and UNDP/GEF as a whole in the national and international levels.

7.1.2. Project Execution

The project has been executed successfully according to project plans in meeting the agreed targets and outcomes which included the following:

a. Improved awareness of the athletes, media, and the public of the Chinese efforts for a Green Olympics
b. Improved air quality at the Olympics venues and surroundings
c. Enhanced image of Beijing both nationally and internationally
d. Enhanced public image of GEF as a global entity to support environmentally sustainable development
e. Enhanced public awareness about the GEF, climate change and clean vehicle technologies in China.

7.1.3. Project Effectiveness

The project has been highly effective in project implementation considering the short timelines and strict government standards.

7.1.4. Implementation Efficiency

On the overall, the Project is highly efficient in making use of available resources from the different partners which derived maximum advantage

7.1.5. Organization Capacity

The CEBBO Implementing Group is well equipped and has been very well organized and motivated to pursue the project goals

7.1.6. Project Design

The Project is well designed and conceptualized but could however be improved in terms of economic and GHG potential projections considering current local situations.

7.1.7. Project Impacts

The CEBBO Project has basically been a technology adoption, publicity and promotion project. And also being an MSP is therefore not expected to result in major reduction of green house gas emissions or removal of barriers to clean energy bus

development. The instant impact of the project is on the exhaust emission and noise pollution reduction within the point of use of the buses. On the national level, the immediate impact of the project is on the government mass transport policy of including the LEBs within the five-year plan in the major cities of China. The long term impact of the LEBs as an environmental solution will definitely come as more LEBs are commercialized in China and in other countries as exports of locally produced LEBs

7.1.8. Achievements Gained when building the cooperative relations among the parties

There has been very good working relationships and coordination among the partners and stakeholders leading to successful project implementation and likewise towards the long term institutional arrangements that will be required by the LEB program of China.

7.1.9. Sustainability of the Project

As determined by the CEBBO project formulation at the outset, the key factors that could affect the sustainability of the LEB country and Beijing Municipal Government initiatives are the following:

a. Adequate maintenance of the new buses and battery charging infrastructure
b. Modified regulatory framework promoting project goals.
c. Incorporation of sustainable energy-integrated transport practices in the transport planning process.

On this basis, the Evaluation Team believes that the project is sustainable and could become the basis of the post-project program-led commercialization of the LEBs in China in the future as the market is developed. The following were observed by the Team to contribute to the LEB project/program sustainability:

- China government is convinced of the viability of the LEB and other clean energy technology and is prepared to support the requirements of the development program
- China government has launched a new national program to include the acquisition and operation of 10,000 clean energy buses including LEBs and hybrid buses for ten (10) cities for the period of 2009 to 2012.
- There are emerging and promising battery technologies which will be more efficient and power-intensive.

7.1.10. Outcome contributions and effects brought about by the implementation of the Project development of Beijing Electric buses

The CEBBO reports and other documentations and interviews indicated a long list of achievements and outputs. As far as the main objective of the CEBBO Project is concerned, this Evaluation identifies the following major project outcomes which were achieved Highly Satisfactorily as expected in the Project:

- Improved awareness by the general public in the vicinity and outside through the multimedia in conjunction with the global event particularly on clean energy buses
- Improved local air quality in Olympic venues and surroundings

- Enhanced image of Beijing as a whole in the national and international levels
- Enhanced image of UNDP/GEF in their role in sustainable environmental development
- Enhanced public awareness on GEF, climate change and clean energy buses.

7.1.11. Whether there is effective relationship and communication between/among components

As designed, the Project proved to have very good interrelationships among project components and activities leading to common goal as seen in the overall success of the CEBBO Project.

7.2. Best Practices and Lessons Learned

Despite the challenges on making effective coordination to produce results within critical schedules, the project management office was able to deal with high profile, sensitive and multi-sectoral activities through effective management and follow-through. Indeed, the best practice that can be cited is having an MSP-scale of activities to derive large scale impact with far-reaching promotional value and scope.

8. RECOMMENDATIONS

The following points are recommended by the Evaluation Team:

1. The experience achieved by the CEBBO Project can be exhibited in similar regional and world events such as the Shanghai World Expo 2010.
2. The government should sustain its support to include a recharging station in the Beijing Development Plan.
3. The government should develop further the needed policy guidelines and more incentives on the technology development and cost reduction to encourage the use of economical and clean transport modes including more LEBs being a very promising alternative clean transportation scheme.
4. Public awareness of LEBs should be continued and further increased including the support technical and operational improvements.
5. To achieve better economics for future LEBs, the necessary continuing improvements (with some already adopted for implementation) should include:

    a. Innovative battery renting mechanism to ensure low risk and liability for a bus company and optimized battery management (*already adopted*).
    b. Battery monitoring system for buses on service based on mobile network communication to improve further the reliability (*already adopted*).
    c. New invention on battery charging process, i.e. use a robot to switch batteries instead of charging them on the bus to save time and space for charging process (*already adopted*).
    d. Research on the characters/lifespan of current battery and new battery material to extend the capacity and
    e. Reduction of the cost of new charging station.

ANNEXES

Annex A - CEBBO Project Evaluation Terms of Reference

Annex B - Program of Activities of the Evaluation

Annex C - CEBBO Project Evaluation Participants List

Annex D - Computation of the Reduction of GHG Emissions

Annex A. CEBBO Project Evaluation Terms of Reference

UNITED NATIONS DEVELOPMENT PROGRAMME

Name of Project: China: Promoting Clean Electric Buses for the Beijing Olympics (CEBBO)

Terms of Reference for the External Evaluation

1. Project Introduction

The XXIX Olympic Games will be held in Beijing in August 2008. As the host of the Olympic Games, the municipal government of Beijing has committed itself to hosting a "Green, Scientific, and Humanistic Olympic Games" in order to achieve the goal of harmonious development of society, economy and nature. Minimizing the environmental footprint and maintaining good local air quality in particular are key components for the concept of a Green Olympics.

The project will demonstrate the use of LEBs (and FCBs) as effective means of controlling GHG emissions from the transport sector in China. The results of this project will contribute to enhancing the policy and technology promotion initiatives of the government to mitigate climate change, as well as in strengthening vehicle pollution control, promoting clean transport vehicles, improving urban transport environment and controlling vehicle exhaust emissions.

The project will involve the implementation of several activities that make up 2 major components: (1) Procurement, Operation and Maintenance of Li Ion Battery-Powered Electric Buses; and, (2) Outreach of the GEF and Green Olympics.

With the successful closing of the Beijing Olympic Games, the basic established tasks of the project have been completed, the project final evaluation will be carried out to assess the implementation effectiveness of the project.

2. Objectives of the Final External Evaluation

The objective of the final external evaluation is to assess the implementation effectiveness, the organizing capacity and the relationship building effectiveness of “Promoting Clean Electric Buses for the Beijing Olympics (CEBBO)" project. At the same time, the final evaluation should assess the social, environmental and economic impact of the project and sum up the implementation experience of the project, which could help relative department put forward the proposals and measures for the further development of the electric buses.

As defined in the GEF Monitoring and Evaluation (M&E) Policy, an evaluation is a systematic and impartial assessment of an activity, project, program, strategy, policy, sector, focal area or other topics. It aims at determining the relevance, impact, effectiveness, efficiency and sustainability of the interventions and contributions of the involved partners. An evaluation should provide evidence-based information that is credible, reliable and useful, enabling the timely incorporation of findings, recommendations and lessons into the decision-making processes.

3. Scope of the Evaluation

The evaluation will involve analysis at two levels: component level and project level.

The following shall be assessed:

1. Evaluating the project implementation effectiveness, according to the Beijing Olympics Electric Buses operating conditions, including assessing project effectiveness, implementation efficiency, organization capacity, achievements gained when building the cooperative relations between the parties, the sustainability of the project, the as well as the contributions and effects brought by the implementation of the project for development of Beijing electric buses. Whether there is effective relationship and communication between/among components so that data, information, lessons learned, best practices and outputs are shared efficiently, including cross-cutting issues.

2. Whether the performance measurement indicators and targets used in the project monitoring system are specific, measurable, achievable, reasonable and time-bounded to achieve desired project outcomes. A qualitative and quantitative analysis and evaluation on social, environmental and economic impact of the project, investigating the project effect on reducing GHG emissions.

3. Whether the use of consultants has been successful in achieving component outputs.

4. Evaluation Methodology

The Final Evaluation Team is expected to become well versed as to the project objectives, historical developments, institutional and management mechanisms, activities and status of accomplishments. Information will be gathered through document review, group and individual interviews and site visits. Review relevant project documents and reports will be based on the following sources of information: review of documents related to the Project and structured interviews with knowledgeable parties

The Evaluation Team will conduct an opening meeting with the National Project Director (NPD), Project Management Office (PMO), Beijing Public Transit Group , Beijing Science Commission , and Beijing EPB to be followed by an “exit” interview to discuss the findings of the assessment prior to the submission of the draft Final Report.

Prior to engagement and visiting the PMO, the Evaluation Team shall receive all the relevant documents including at least:

- CEBBO Project Document and Project Brief
- Inception Report
- Annual Work and Financial Plans

The Evaluation Team should at least interview the following people:

- National Project Director
- PMO Director
- National Chief Technical Advisor
- Project Administrative Officer
- Project Financial Officer

- PSC Members
- UNDP Country Office in __China___ in-charge of the __CEBBO__ Project

5. Evaluation Team

The Evaluation Team will be composed of one International Lead Consultant and two National Consultants. The Team is expected to combine international standards of evaluation expertise, excellent knowledge of the EE and Climate Change projects and national context of EE project.

At the minimum, the members of the Final Evaluation Team shall have the following professional background and responsibilities:

A. International Lead Consultant （one or two person）

Budget：US$4,000

Numbers of working days: About 5 days

Coming to China: 1 time

Location: Beijing

Profile

- Post-Graduate in Transportation or Renewable Energy.
- Minimum of ten years accumulated and recognized experience in renewable energy and clean transportation projects
- Minimum of five years of project evaluation and/or implementation experience in the result-based management framework, adaptive management and UNDP or GEF Monitoring and Evaluation Policy
- Familiarity in similar country or regional situations relevant to that of the ___China_____
- Experience with multilateral and bilateral supported EE/RE and climate change projects
- Comprehensive knowledge of international EE/RE industry best practices
- Very good report writing skills in English

Responsibilities

- Documentation of the review
- Leading the Final Evaluation Team in planning, conducting and reporting on the evaluation.
- Deciding on division of labor within the Team and ensuring timeliness of reports
- Use of best practice evaluation methodologies in conducting the evaluation
- Leading presentation of the draft evaluation findings and recommendations in-country

- Conducting the debriefing for the UNDP Country Office in __China___ and __EUEEP_____ Project Management
- Leading the drafting and finalization of the Final External Evaluation Report

B. National Consultant (two persons)

Budget：US$3,000 for each person

Numbers of working days: About 10 days for each person

Location: Beijing

Profile

- Post-graduate in renewable energy or transportation, or college degree in said areas with at least ten years of project development and implementation.
- A minimum of five years of project management experience in EE/RE or related climate change projects
- EE/RE and climate change training and technical experience
- Knowledge of EE/RE industry and projects
- Multilateral and bilateral funded project development and implementation
- Familiarity with ___clean transportation____ national development policies, programs and projects

Responsibilities

- Documentation review and data gathering
- Contributing to the development of the evaluation plan and methodology
- Conducting those elements of the evaluation determined by the International Lead Consultant
- Contributing to presentation of the evaluation findings and recommendations at the evaluation wrap-up meeting
- Contributing to the drafting and finalization of the evaluation report.

The members of the Team must be independent from both the policy-making process and the delivery and management of the UNDP/GEF assistance. Therefore, candidates who had any direct involvement with the design and implementation of the __CEBBO__ Project will not be considered.

6. Evaluation Schedule and Deliverables

The evaluation will commence in __**-june-2009_____. An evaluation report will be produced after 10 days, highlighting important observations, analysis of information and key conclusions including its recommendations.

The report will be initially shared with the __CEBBO__ PMO to solicit comments or clarifications and will be presented to the UNDP Country Office (CO) in _China__ for further deliberations. Consequently, the final evaluation Report (in three copies) will be made and submitted to the UNDP CO with a copy furnished to the __CEBBO_ PMO.

There will be two main deliverables:

- Final Review evaluation report, including an executive summary, fulfilling the evaluation requirements set out in this Terms of Reference (TOR). The final report is to be cleared and accepted by UNDP CO in __China__ before final payment. The final report (including executive summary, but excluding annexes) should not exceed 50 pages.
- A power-point presentation of the findings of the evaluation. Depending upon the complexity of the evaluation findings, UNDP CO in __China_____ may consider organizing a half-day stakeholders meeting at which to make a presentation to the partners and stakeholders.

Annex B - Program of Activities of the Evaluation

China: Promoting Clean Electric Buses for the Beijing Olympics (CEBBO)

External Evaluation
Plan of Activities

Venue	Time	Activity/Agenda	Entities/Persons Involved
22 June – July 1			
Home base/Internet		**Pre-Mission Admin Preparation, Contracting, Travel and Document Review** • Administrative Requirements, Contracts and Communications • Travel documentation, Visa and Ticketing • Coordination on Evaluation Schedules and Site Visits/ Meetings via Internet • Review of Project Documents and Progress Reports (e-copies to be provided) • Data Gathering on Financial Outlook vs. Expected Outputs as of end of Project (with suggested format)	UNDP China CEBBO Project PMO Evaluation Team: Rogelio Z. Aldover Wei Guo Liu Xin Jingnan Hu
2 – 3 July (Thurs - Fri)			
(To be arranged in nearby Hotel as venue)	5 pm, Fri, 3 July (for Organizational/ Planning Meeting)	• Arrival of Evaluation Team Members • Team Organizational/Planning Meeting • Confirmation of Evaluation Plan, Task Assignments and Reporting • Confirmation of Meetings with Agencies and Groups and list of Interviews with Resource persons involved in the **CEBBO** Project	Evaluation Team
4 - 5 July (Sat - Sun)			
Home base/Hotel	open	• Initial Assessment and Analysis of Performance in Respective Assigned Areas by Team Members • Preparation of Talking Points for meetings with Agencies and Groups involved in CEBBO Project (submission by e-mail)	Evaluation Team
6 July (Mon)			
Meeting Hall,	9:30 – 11:00	**Project Evaluation Briefing and**	

Venue	Time	Activity/Agenda	Entities/Persons Involved
Yulong Hotel, Beijing		**Accomplishment Report** • Introduction • Briefing on Highlights of the CEBBO Project • Video on Promotional Activities • Evaluation Terms of Reference and Expectations • Presentation on CEBBO Project background, objectives, activities and accomplishments • Finalization of the Evaluation Program and Logistics/Transportation Requirement • Evaluation Report format and outline indicating assignment of members	National Project Director (NPD); PMO Director Beijing Public Transit Group; Beijing Science Commission; CEBBO Project PMO Evaluation Team
Function Room, Yulong Hotel, Beijing	1:00 – 4:00 pm	Evaluation Team Coordination Meeting and Synthesis of initial findings	Evaluation Team
		7 July (Tues)	
Beijing Bus Company Headquarters	9:00 a.m. – 5 p.m.	Discussions with Beijing Bus Company on the Project Implementation Field Investigation and interview with Bus Operators/Drivers	
		8 July (Wed)	
Charging Station, Olympic Village	9:00 – 12:00 am	Meeting with local E-bus and battery suppliers	Evaluation Team
UNDP Country Office	3:00 – 3:30 p.m.	Meeting with UND=P	Evaluation Team
Ministry of Science and Technology (MOST)	4:00 – 5:00 p.m.	Meeting with Ministry of Science and Technology (MOST) regarding related project on Fuel Cell Buses	Evaluation Team
Via Internet	Evening	Submission of draft reports by Team Members according to assignments in Evaluation Report Outline	Evaluation Team
		9 July (Thurs)	
Yulong Hotel, Beijing	a.m.	Evaluation Team Coordination Meeting for preparation of Draft Evaluation Report and Presentation Materials	Evaluation Team
Meeting Hall, Yulong Hotel,	3:00 p.m.	**Presentation of Evaluation Report**	Rogelio Z. Aldover Team Head

Venue	Time	Activity/Agenda	Entities/Persons Involved
Beijing			
10 July (Fri)			
		Departure of Rogelio Z. Aldover	
10 – 13 July (Fri – Mon)			
Home base		Consolidation of the CEBBO Project Evaluation Report by integrating all inputs and the comments during the Presentation of initial Evaluation Report findings	Rogelio Z. Aldover Team Head
14 July (Tues)			
Via Internet	3:00 pm	Submission of the Evaluation Report via Internet	Rogelio Z. Aldover Team Head
17 July (Fri)			
Via Internet		CEBBO PMO and UNDP Feedback and Comments on the Evaluation Report	UNDP China CO, CEBBO Project PMO
21 July (Tues)			
Via Internet		Submission of the Evaluation Report	Rogelio Z. Aldover Team Head
28 July (Tues)			
Via Internet		Submission of Final Comments on the Evaluation Report	UNDP country Office and CEBBO PMO
30 July (Thurs)			
Via Internet		Submission of the Final Version of the CEBBO Evaluation Report	Rogelio Z. Aldover Team Head
Closure			

Annex C. CEBBO Project Evaluation Participants List

NAME	Organization/Agency	Telephone
	CEBBO Participating Agencies	
Guoqing Zhang	Beijing Municipal Financial Bureau	68423841
Jining Bao	Beijing Municipal Financial Bureau	13641243623
Xiaoting Fan	Beijing Municipal Financial Bureau	13811754689
Mengmei Zheng	Beijing Municipal Environmental Protection Bureau	13661261611
Dingwei Zheng	Beijing Municipal Environmental Protection Bureau	13651320042
Xiang Shen	Beijing Municipal Science and Technology Committee	13701107769
Jianke Yu	Former Environment Department of Beijing Organizing Committee of the Olympic Games	13911991612
Yongzhi Wu	Beijing Transit Group	15901069556
Hong Wang	Beijing Environmental Protection Education & Communications Center	13501347985
Gang Tian	Beijing Municipal Research Institute of Environmental Protection	13901114513
Gang Li	Beijing Municipal Research Institute of Environmental Protection	13701398242
Shoubin Fan	Beijing Municipal Research Institute of Environmental Protection	13810706367
	UNDP Country Office	
Shijun Liu	Programme Manager, Energy and Environment Team UNDP China Country Office	
	CEBBO Project Evaluation Team	
Rogelio Aldover	Consultant and Team Leader	
Wei Guo	Consultant *(Technical, E-Bus Operation and Noise Evaluation)*	
Xin Liu / Xin Hu	Consultant (*Social, Economic and Policy Impact)*	
Jingnan Hu	Consultant (*Emission Evaluation and Environmental Impact)*	

Annex D - Computation of the Reduction of GHG Emissions

The Promoting Clean Electric Buses for the Beijing Olympics (CEBBO) Project is aimed to demonstrate the utilization of Li-ion battery powered electric buses (LEBs) as an alternative transport mode to achieve GHG emission reduction, specifically CO_2, in the transport sector. The direct CO_2 emission reduction comes from the operation of 50 LEBs serving athletes, media people and the general public within the BOG venues and surroundings. The 50 LEBs carried out the transport service that were supposed to be provided by conventional diesel buses, so the CO_2 emission reduction is estimated based on the following assumptions,

1. Fifty (50) Li-ion battery powered electric buses were purchased and formed part of the bus fleet that was being used in the Olympic Games venues and surroundings during and after the XXIX Beijing Olympic Games. The operation distance of each LEB in the estimation of CO_2 emission reduction is 6,000 kilometers, as used in the ProDoc.

2. The Li-ion battery powered buses are alternative to previously planned utilization of the same number of conventional diesel buses (CDBs) for the Olympic Games bus fleet. Since in 2008, *China 3* diesel buses dominated the bus fleet running on the roads of Beijing, the Evaluation Team used it as the baseline to estimate GHG emission reduction.

3. The Li-ion battery powered buses do not produce CO_2 at the point of operation, but the production of electricity that supplied the power to LEBs has CO_2 emissions. Calculations are based on the CO_2 emission factor of the grid electricity used in the Olympic Games venues and surroundings. Since the grid is fed by 80% coal-fired power plants, which have an average CO_2 emission factor of 0.812 kg/kWh in the general area of Beijing, and 20% wind power from Guanting field in Beijing that has no CO_2 emissions, the integrated CO_2 emission factor is 0.812*80% + 0*20% ＝ 0.650 kg/kWh..

CO_2 Emissions from CDBs

On-road emissions testing of *China 3* diesel buses in Beijing by the Beijing Municipal Research Institute of Environmental Protection and Beijing Institute of Technology showed that their diesel fuel consumption rate varied from 0.35 lit/km to 0.50 lit/km. Taking the average of 0.45 lit/km, the CO_2 emission factor of a China 3 diesel bus is about 1.197 kg/km. For the operation distance of 6000 km during and after the XXIX BOG, one China 3 diesel bus emitted 7.179 tons CO_2. For the entire CDB fleet, the total CO_2 emissions are 359.0 tons.

CO_2 Emissions from LEBs

According to the data from Beijing Public Transport Holdings Ltd, the Li-ion battery-powered electric buses (LEBs) that were used in the project have an average power consumption of 1.25 kWh/km, based on 1.1 kWh/km without air conditioning and 1.4 kWh/km with air conditioning. Integrating the CO_2 emission factor of 0.650 kg/kWh, a LEB emitted 0.812 kg CO_2/km. For the whole operation distance of 6,000 km during and after the XXIX BOG, one LEB emitted 4.87 tons CO_2. And for the entire LEB fleet, the total CO_2 emissions are 243.6 tons.

Direct CO_2 emission reduction

For the operation distance of 6,000 km during and after the XXIX BOG, the alternative of deploying LEBs instead of CDBs achieved about 2.306 tons CO_2 emission reduction per LEB. For the entire fleet of 50 LEBs, 115.3 tons CO_2 were reduced during the whole operation distance of 300,000 km. These met the target set in the ProDoc Logical Framework, i.e., "*At least 2 tons CO_2 emission reduction per Li-ion battery powered electric bus (LEB), in total, about 111.6 tons CO_2 emission reduction*". In not so meager amounts, the project directly contributed to the mitigation of GHG emissions in the transportation sector.