

The project consigned by the Ministry of the Environment in 2004

# CDM/JI Feasibility Studies

Wind Power Project in Mondul Kiri Province, Cambodia

## Summary Report

March 2005

Marubeni Corporation

(1) Basic elements related to implementation of the Project

General description of the proposed project and background of the proposal

The Project aims to implement as a small-scale project for renewable energy development using wind and solar power in the highlands of Mondul Kiri Province (the Province), Cambodia.

Last year our company proposed a rubber tree afforestation project in Mondul Kiri Province as CDM project, where feasibility study (F/S) was conducted this year. In order to implement the afforestation project, we consider that electrification of the project region with no access to electricity is indispensable. This is the reason why we proposed a project for renewable energy development using wind and solar power as a small-scale project. This Project places importance on contributing to sustainable development in local communities and improving the quality of local people's lives.

Outline of the host country

Kingdom of Cambodia,

Capital city	:Phnom Penh
Planar dimension	:181,035 km <sup>2</sup>
Population	:11.7 million (1999)
Population growth rate	:3.0%
Adult workforce ( Male )	:47%
( Female )	:53%
Gross domestic product	:US\$ 3,289million (1999)
GDP growth rate	:4%
GDP per person (nominal )	:US\$ 300 (1999)
Main industry	:clothing and shoes
Major export	:clothing and shoes
Major import	:gasoline, factory machines
Inflation rate	:9% (1999)

Total rate of foreign investment: US\$479 million (1998)

(The source of information: Ministry of Economy and Finance, Kingdom of Cambodia)

Schedule of the feasibility study

-July 2004:	prior consultation with counterparts in the host country
-July to December 2004:	feasibility study
-September 2004:	the first site visit
-November 2004:	the second site visit and a pilot hybrid system
- November2004:	submission of an interim report and a Product Design Document (PDD) draft
-January 2005:	collection of the data from the pilot hybrid system
-February 2005:	analysis of the data collected Revision of the PDD draft

Policies and situations of CDM/JI such as criteria to accept CDM/JI and the state of DNA establishment in the host country

The government of Cambodia seems to be making very active approaches by the facts that it ratified the Kyoto Protocol in August 2002 and established an official DNA in July 2004 in Climate Change Office (the Ministry of Environment), which is listed on UNFCCC website. Moreover, Cambodia has so far been very active for CDM, holding seminars and workshops on CDM through international organizations such as IGES and conducting capacity-building, and so forth. This Project helps Japan acquire CERs (Certified Emission Reductions), DNA and the Ministry of Technology and Resources support the Project because it will make contributions to sustainable development of Mondul Kiri Province by giving the following advantages:

- Advantages for Mondul Kiri Province
  - More chances of employment in local communities
  - Development of local industries
  - Continued development
  - Technology transfer
  - Improvement of living standards

Organization of the present study (Japan, the host country, and others )

Japan: The General Environmental Technos Co., Ltd. (Providing overall advisory for drafting a PDD)

The host country: The Ministry of Technology and Resources (cooperating with a F/S and providing information on the Project site)

## (2) Proposal of the Project

### Detail contents of the Project

115 small hybrid power systems (10-20kW each) using wind and solar power with a total capacity of 1.4 MW are to be constructed in 21 communes and 90 villages in Mondul Kiri Province.

### Project boundary, proof of additionality, and baseline identification

#### 1) Project boundary

The Project boundary can be described as villages (power generation facilities, distribution facilities, and houses that receive transmitted electricity) that use electricity produced by the newly introduced hybrid facilities, and then a bundle of these sub-boundaries can be recognized as the project boundary.

#### 2) Additionality

The barriers demonstrated below that prevent this project from being implemented proves additionality of this CDM project.

- Investment barriers: This project has substantially low profitability and the project site is located in the most underdeveloped remote areas in Cambodia.
- Technical barriers: Cambodia has not experienced this newest technology (a hybrid system comprising a vertical-sail-axle-type wind turbine generator and a photovoltaic generator) and lacks in experience in implementing and maintaining the technology.

#### 3) Baseline identification

The Project qualifies as a small-scale CDM project because 1.4 MW planned capacity of renewable energy generators is less than 15 MW threshold required to be qualified as a small-scale CDM project and there exist the barriers mentioned above. As this Project falls onto the project category Type I.A. (Renewable Energy Projects/Electricity generation by the user) according to the guidelines for the small-scale CDM project activities, it is assumed that electricity generating by diesel is the most feasible baseline scenario (this produces more GHG emissions than this CDM Project scenario).

### GHG reductions (or CO<sub>2</sub> absorption) and leakage due to the Project activity

- GHG emission reductions by this Project calculated under the present assumptions (1.4MW for the total installed capacity, 20% for the load factor, the default value 20% for distribution losses, the default value 0.9kgCO<sub>2</sub>e/kW for emission coefficient of diesel generation units) are estimated at 2,759tCO<sub>2</sub>/y.
- This Project comprises the renewable technology of wind and solar power generation (newly introduced equipment), and there is no need to consider leakage.

#### Monitoring plan

The monitoring methodology for project type I.A. (Renewable Energy Projects and Electricity generation by the user) is applicable. In other words, the actual amount of electricity generated by the hybrid generation facilities constructed in villages of the Project boundary is measured and recorded electronically, and the total recorded data is monitored as the actual amount of electricity for the entire Project.

Environmental impact/other indirect impact (including results of risk analysis in case of afforestation )

- This project introduces small hybrid generation facilities (10-20kW) using wind and solar power to each village, and environmental impacts such as noise, vibration, discharged water, effluent gas and so on are not expected.
- The pilot hybrid system was introduced on trial in Pu Tru village in November 2004. Two months later, in January 2005, we revisited the village and directly confirmed that no particular environmental impact had occurred so far.

#### Stakeholders comments

- We visited Pu Tru village (two villages, the upper and lower sides of the highlands) on September 1<sup>st</sup> and interviewed a family. As the result, we found that they desire for indoor lighting in schools in their villages and information from the outside by the TV and the radio.
- In the second mission to the Project site in November, a seminar was held with 6 delegates from 3 villages including Pu Tru village. In the seminar, there was a request that children need electric light to study at night because they now use oil lamps with empty cans that might trigger fire on strongly windy days. There was a comment that information from the outside by the TV is especially desirable, but if it charges them for electricity charges, indoor light is acceptable.

#### (3) Towards implementation of the Project

##### Organization of the Project (Japan, the host country, and others)

- In Japan, the Project will be implemented by private companies (including participants in the rubber tree afforestation CDM project) with financial aid from the Japanese government (the Ministry of the Environment).
- In the host country, introduction of power generation facilities and the initial management are consigned to the implementation entity of the rubber tree afforestation project for the moment. In the future, the facilities are financially supported by private power producers in local areas.

##### Financial plan for the Project

For the IRR of the Project to be positive within durable years (15 years), it is necessary to keep the initial cost less than 300 million yen and electricity rates around US\$0.10/kWh, not free of charge as originally assumed. Since it is almost impossible to receive financial loan from banking institutions due to this low IRR in Cambodia, all the initial cost of this Project will be procured with capital funds. In addition, when revenue from CERs is considered, IRR (calculated for 15 years) of this Project is 0.29% at the rate of US\$5/CER and is raised only to 1.25% even at the rate of US\$10/CER. Therefore, the subsidy from the Ministry of the Environment or the Ministry of Economy, Trade and Industry will be necessary to realize the Project. In this case, if the subsidy is one third of the initial investment (300 million yen), IRR rises to 5.00% without revenue of CERs. If one half of the initial investment is subsidized, this value reaches 9.87%. Furthermore, adding revenue from CERs to this subsidy, IRR of this Project is expected to exceed 10% even after the costs of verification and certification of CERs are deducted.

##### Cost-effectiveness

GHG emission reductions realized by the Project are estimated at 2,759tCO<sub>2</sub> per year and 57,939tCO<sub>2</sub> for 21 years. Consequently, cost-benefit performance of CO<sub>2</sub> emission reductions by the Project eventually results in 8,096 yen/tCO<sub>2</sub> for the total cost (approximately 4.69 million yen) of

the Project including the management cost in 21 years of the crediting period.

Outlook and problems to overcome for implementation of the Project

- Because it is the most promising that this Project is implemented together with the rubber tree afforestation CDM project, which F/S was conducted for last year and now is under consideration for implementation.
- Because expected IRR of this Project indicates very low value of around 1 % even with CERs, how much profitability is improved by a CDM project alone should be examined in association with electricity rates.
- We should examine closely the possible impact on the electrification of local communities with no access to the electricity to date.
- In this Project, batteries containing lead that may cause environmental pollution are incorporated in the electricity power generation units. A recovering and recycling system of old batteries exhausted in a few years should be established as a local business if possible.
- This project focuses on wind and solar power as renewable energy. However, it became clear through the feasibility study with site visits that there exist a number of villages available for micro-hydro projects and biomass projects (using livestock excreta). CDM projects utilizing all kinds of renewable energy available in the area should be developed eventually.

(4) Validation/Determination (in case the process is taken)

Description of validation (Determination) or desk review

N/A

Process of communication with OE

N/A