e7 Bhutan Micro Hydro Power CDM Project

Project Design Document

Rev. 02

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e7 Fund For Sustainable Energy Development

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A. General description of project activity

A.1 Title of the project activity:

e7 Bhutan Micro Hydro Power CDM Project

A.2. Description of the project activity:

The purpose of the "e7 Bhutan Micro Hydro Power CDM Project" is to reduce GHG emissions and to contribute to the sustainable development of the community by constructing a hydroelectric power station with a power generation capacity of 70kW in an unelectrified Chendebji village where it is otherwise very hard to construct hydroelectric power station. This purpose well meets the mission of the e7 (see A.3.) which is to play an active role in global electricity issues and to promote sustainable development.

Plans to provide the power grid extension in unelectrified remote locations are not feasible taking into account the geographical conditions surrounding Chendebji village characterized with high mountains of various altitudes as well as the cost efficiency. Therefore, the development of hydropower is essential for electrification of these remote locations.

The electrification of Chendebji village with hydropower leads to the reduction of greenhouse gases emitted from the burning of fossil fuel (kerosene) and natural woods. The baseline scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of this project activity is to electrify the village by diesel power generation. Therefore, it is assumed that the electrification of Chendebji village with hydropower will reduce the greenhouse gas emission from the diesel power generation.

In this project, hot water is planned to be provided for the villagers of Chendebji village by using the surplus electricity which will be generated because of a little demand at the first stage of the electrification. The villagers welcome using the hot water for washing and bathing because it will reduce the load of housework and increase welfare as well as this initiative is expected to reduce dependence on fuelwood for heating water.

In addition, the communication equipment is scheduled to be set up for the remote monitoring of generated electricity, the education and the revitalization of local economies. This project contributes to improve the villager's health and daily convenience.

This project contributes not only to reduce the greenhouse gas emissions but also to sustainable development of the Chendebji village because of many positive effects shown in Table 1. Implementing this project well accords with the purpose of CDM.

Table 1. Benefits from the e7 Bhutan Micro Hydro Power CDM Project

Health	●Being able to use electric cooking appliances (reduction in smoke inhalation from fuelwood and kerosene) ●Spending sanitary and healthy life by easy access to washing and bathing
Agricultural productivity	●Spending less time on gathering fuelwood and food preparation, which lead to the increase of time allocated to farm work
Economic Development	●Allowing more time particularly for women for farm work and/or other income generation works (cottage industries, small enterprises) through the usage of lighting and electric appliances ●Carrying out E-commerce by internet
Education	●Enhancing introduction of new electricity-driven learning tools (television, computers, etc.) and lighting, which enables adult education during the evening hours ●Receiving education through satellite broadcasting
Medical	●Enabling to use vaccine refrigerators, tele-medicine capabilities, and other electric medical devices
Environment	●Decreasing deforestation, land erosion by reducing fuelwood consumption ●Decreasing emissions from baseline diesel power generation (alternative to micro hydro power generation) and fuel transportation
Demographics / long-term	●Decreasing infant mortality rate, increasing life-expectancy, and diminishing migration to urban areas, etc.

A.3. Project participants:

This project is conducted by *e7 Fund For Sustainable Energy Development* as one of the e7 activities and *Royal Government of Bhutan*.

e7, comprised of nine leading electricity companies from G7 countries, was formed in 1992 with the vision of examining and co-operating on major global electricity-related issues, with an emphasis on the global environment and sustainable energy development. The current members of the e7 are; American Electric Power (USA), Electricite de France (France), Enel (Italy), Hydro-Quebec (Canada), The Kansai Electric Power, Co., Inc. (Japan), Ontario Power Generation (Canada), RWE (Germany), Scottish Power (UK), and Tokyo Electric Power Company (Japan). United together in the e7, these companies have identified the common goal to "play an active role in protecting the global environment, and in promoting the efficient generation and use of electricity."

○***e7 Fund For Sustainable Energy Development***

e7 Fund For Sustainable Energy Development was created in 1998 to help assemble funding from both the e7 and external donors to finance the implementation of selected e7 projects that promote sustainable energy development and/or reduce greenhouse gas emissions. The e7 Fund For Sustainable Energy Development is a non-profit institution recognized by the United Nations Economic and Social Council as a Non-Governmental Organization (NGO) with special consultative status. Information regarding the representative of e7 Fund For Sustainable Energy Development is as follows;

Andrew Mitchell, Mr.
Executive Direcor, e7 Fund For Sustainable Energy Development
(Address)
22-30 Avenue de Wagram, Paris, 75382, France
Tel : +44 141 636 4513
Fax: +44 141 636 4577
E-Mail : andrew.mitchell@scottishpower.com

<Contact Information>
(Contact Person)
Takao Shiraishi, Mr.
Project leader, The Kansai Electric Power, Co., Inc.

Hirofumi Kazuno, Mr.
Specialist responsible for baseline and monitoring methodologies, The Kansai Electric Power, Co., Inc.
(Specialist responsible for baseline and monitoring methodologies was changed Toru Yamanaka to Hirofumi Kazuno as of July 5,2004)

(Host Country)
○***Kingdom of Bhutan***
Jigme, Mr.
Program Officer
National Environment Commission Secretariat
Royal Government of Bhutan

Sonam Tshering, Mr.
Director General
Department of Energy
Ministry of Trade & Industry
Royal Government of Bhutan

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1 Host country Party(ies):

Kingdom of Bhutan
Kingdom of Bhutan (Capital: Thimphu) is an inland country between India and China (Tibet) located on the south slope of the east Himalayas (Lat. 26° 45'～28° 10'N., Long.88° 45'～92° 10'E.). It has an area of 46,500 km^2 stretching 300km from east to west and 170km from north to south.

Fig 1. Location of Kingdom of Bhutan

A.4.1.2 Region/State/Province etc.:

Trongsa District

A.4.1.3 City/Town/Community etc:

Chendebji Village

Tangsibji Block

Fig 2. Overview of the village

A.4.1.4 Detailed description of the physical location, including information allowing the unique identification of this project activity *(max one page)*:

Chendebji village is almost in the center of Kingdom of Bhutan; located about 2,500m above sea level in the west of Trongsa District (Lat. 27° 29' N., Long. 90° 20' E.). In this area, there is a junction of the Chendebji River with its branch, the Lamchela River. The Chendebji River flows down south east while being mixed with many other rivers.

Chendebji village is located about 150km east of Thimphu, or the capital of Kingdom of Bhutan (about eight-hour-drive by car) in the area where rainy season lasts from May to September and snow season from December to February. Although the village is faced with a main road leading to Thimphu, the Chendebji River running between the village and the road prevents access by vehicle which makes the village isolated.

People in the unelectrified Chendebji village is using firewoods for cooking and heating, and kerosene for lighting. A lot of major towns in Kingdom of Bhutan have already been electrified and people living there can use lighting appliances, rice cookers, TVs and so on. People living in the Chendebji village, on the other hand, are eager to carry out electrification of their village in order to use electrical appliances. It is considered that the electrification of the village promotes to reduce the housework of women, improve health condition of village people and to expand studying and social activity time at night etc.

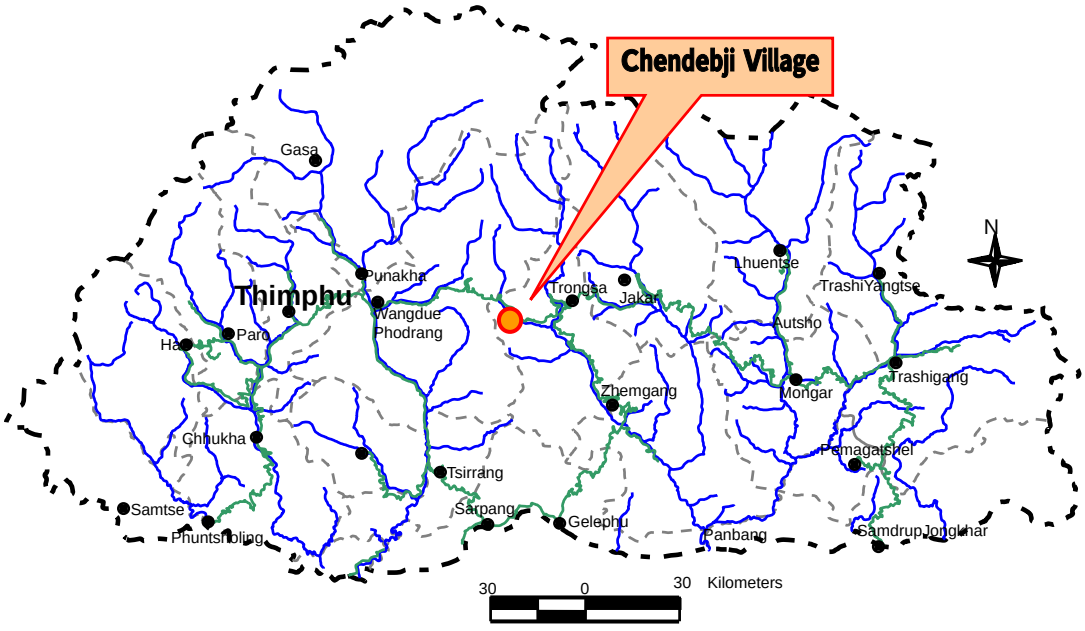

Fig 3. Location of the Chendebji Village

A.4.2 Type and category(ies) and technology of project activity

Type and Category of project activity

TypeI- Renewable Energy Projects
I.A. Electricity Generation by the User

This project electrifies the non-electrified Chendebji village, which has not been connected to the power grid and is not planning to connect to the power grid in the near future, by constructing hydro power (categorized under renewable energy) station. Hence, this project is considered to be classified under the Category IA.

Technologies of project activity

The micro hydro power station is constructed to electrify remote locations in response to the increasing desire for the electrification among the villagers of the Chendebji village. Considering the potential electricity demand for the village and capable amount of the river flow used effectively for the hydro power station, it was decided to design output capacity to be 70kW, which clears the 15MW criteria for the Small Scale CDM project.

(Electric power generation technology)

Based on a major premise that the hydro power station is mainly operated by local people and cost-effectiveness of each type of turbines, both cross flow turbines and reversible pump turbines are two good candidates for this project. Those two turbines have characteristics of relatively simple structures, easy operation and maintenance. Taking into account of these advantageous engineering aspects of easy operation and maintenance, which have been generally learned and experienced through installation in Bhutan, the cross flow turbines is selected in this project. Since this is the first hydro power project in Chendebji village which is operated by local people, they can receive benefits from learning and experiencing the operation of environmentally-friendly hydro power technology.

Table 2 shows the main elements of the specification of the turbine and the generator.

Table 2: Specification of the main facilities of the project

Plant output (kW)		70
Effective head (m)		50
Maximum operating water (m^3/s)		0.2
Turbine	Type	Cross-flow turbine
	Inlet valve	Sluice valve
Generator	Type	Horizontal shaft, revolving-field type, three-phase synchronous generator
	Rated voltage (V)	400
	Rated power factor	0.8 lagging
	Frequency (Hz)	50

(Transmission and distribution line)

Two transmission/distribution lines will be installed from the power house to Chendebji village and to the farthest, Chendebji Chorten, or a temple. Generated power is directly distributed to Chendebji village as the same voltage at the outlet of the generator through the single circuit of the 230V/400V three-phase four-wire type. On the other hand, power voltage will be raised from 400V to 11kV by a transformer installed at the point near the road where the transmission/distribution line crosses the river from the power house, and

then sent to Chendebji Chorten via the single circuit of the11kV three-phase three-wire type transmission line that goes along the road.

The power will be distributed to each facility and household via the single-phase 230V branch line that is diverged from the distribution line. Total length of the 230V/400V distribution line is expected to be about 3.01km while that of the 11kV distribution line is about 1.36km. A watt-hour meter will be provided to each facility and household to measure the consumed electric energy.
Taking into account durability of wood and other factors, we decided to use steel spliced pole in this project. Regarding the electric wires, the stranded type steel cored aluminum bare conductor, or Aluminum Conductor Steel Reinforced (ACSR), which is common in Bhutan will be used for the 11kV transmission line. For the 230/400V distribution line, taking into account the request from the Bhutan government in view of environmental protection, insulated strand cable, or Aerial Bundled Conductor (ABC), will be used.

(Operation and maintenance)
There are 27 hydro power stations in Bhutan and the Bhutan Power Corporation (BPC) owns all 23 mini and micro hydro power stations except Lingzhi and large stations such as Chukha, Kurichhu, and Basochhu. The BPC runs the electric power business including power generation and distribution.

e7 will supervise to construct the hydro power plant in Chendebji Village and will be responsible for the construction. In addition, e7 will register the project as an UNFCCC-CDM project activity in accordance with the UNFCCC procedure. After the completion of the construction, while the Department of Energy (DoE) on behalf of the Royal Government of Bhutan will be the owner of the project, the Local Community (Trongsa District Administration and Chendebji Village) will undertake the operation and maintenance as well as management and monitoring of the data of the power generated from the power plant. The monitoring of the project will be done under the direct technical guidance of the DoE. The e7 will implement necessary training regarding the implementation of the monitoring.

One villager in the Chendebji Village will be employed as a local operator of power plant, who is fully responsible for the operation including routine operation, monitoring of the electric power generated, patrol and inspections at the micro hydropower station. The selected person will be fully responsible for the operation of the power station after going through professional education by the e7. The local operator will check deposits in the weir and settling basin, and clean up the dust screen as and when necessary. The operator will also conduct a visual check of the entire penstock monthly. In addition, he or she will clean up settled sediments as necessary to facilitate smooth operation of the power station.

In case of any accidents or troubles, that will interrupt normal operation of the power station, the local operator will take first-aid actions while immediately requesting the BPC to repair and modify the troubled part. The BPC will subsequently send repair engineers and necessary parts later to recover the part.

(Information and Communication Technology)
This project intends to utilize the micro hydropower station not only for the electrification program for remote locations but also for Information and Communication Technology (ICT) implementation for the purposes of education, tele-medicines, internet

communications, and small enterprises development (e-commerce). ICT equipment are expected to be installed and transferred to villagers in this project by the e7.

A.4.3 Brief statement on how anthropogenic emissions of greenhouse gases (GHGs) by sources are to be reduced by the proposed CDM project activity:

This project is to construct a run-of-river micro hydro power station newly, which does not emit GHG.

The electrification of the Chendebji village is not included in "9th Five Year Plan (2002-2007) of Bhutan" . Because of its geological severeness, difficulties in access, and lack of domestic resources for investments in national projects, it is very difficult to invest and construct small-scale hydro power stations in local remote areas by the Royal government of Bhutan. Therefore, in almost all of the villages, which have already constructed small-scale hydro power stations, the constructions have been supported by various kinds of foreign official assistance. These realities demonstrate that the small-scale hydropower project is not profitable and feasible in the Chendebji village and it would not be electrified without this project. This project activity would not have occurred anyway because this project is not financially viable without e7 finance for the purpose of implementing CDM project and acquiring credits.

The baseline scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of this project activity is to electrify the village by diesel power generation. Electrification by the diesel power generation is a method generally used by the remote electrification project and is cited as an appropriate method in the "Appendix B of the simplified modalities and procedures for small-scale CDM project activities."

Since the newly built run-of-river micro hydropower generation emits no GHGs, all GHGs which would have been emitted from the diesel power generation can be considered to be reduced. A default value of CO2 emission coefficient from diesel generation units is 0.9kg-CO2/kWh, which is cited in the "Appendix B of the simplified modalities and procedures for small-scale CDM project activities." Based on an assumption that the capacity factor of the hydroelectric power station is 95%, which is calculated based on the operation hours that excludes maintenance periods, annual total electric power produced adds up to 582.54MWh. Therefore, the amount of emission reduction becomes 524t-CO2/year.

A.4.4 Public funding of the project activity:

Public funding, such as grants from official development funds, are not involved in this project.

A.4.5 Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

e7 Fund For Sustainable Energy Development has not implemented same-kind hydro power project in Kingdom of Bhutan. Therefore this project is not a debundled component of a larger project activity.

B. Baseline methodology

B.1 Title and reference of the project category applicable to the project activity:

TYPE I – Renewable energy project
I.A. Electricity generation by the user
Energy Baseline (b) Option 2

B.2 Project category applicable to the project activity:

This project electrifies the non-electrified Chendebji village, which has not been connected to the power grid, by constructing a hydro power (categorized under renewable energy) station. Hence, this project is considered to be categorized under the "Category IA."

In this project, electricity is not generated at each household but only in the hydroelectric power plant. Therefore, option 2 is selected and used.

B.3 Description of how the anthropogenic GHG emissions by sources are reduced below those that would have occurred in the absence of the proposed CDM project activity *(i.e. explanation of how and why this project is additional and therefore not identical with the baseline scenario)*

The electrification of the Chendebji village is not included in "9th Five Year Plan (2002-2007) of Bhutan". Because of its geological severeness, difficulties in access, and lack of domestic resources for investments in national projects, it is very difficult to invest and construct small-scale hydro power stations in local remote areas by the Royal government of Bhutan. Therefore, in almost all of the villages, which have already constructed small-scale hydro power stations, the constructions have been supported by various kinds of foreign official assistance. These realities demonstrate that the small-scale hydropower project is not profitable and feasible in the Chendebji village and it would not be electrified without this project. This project activity would not have occurred anyway because this project is not financially viable without e7 finance for the purpose of implementing CDM project and acquiring credits.

The energy baseline scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of this project activity is to electrify the village by diesel power generation. Electrification by the diesel power generation is a method generally used by the remote electrification project since its initial construction cost is low, installation is easy, and operation requires no special expertise. It is also cited as an appropriate method in the "Appendix B of the simplified modalities and procedures for small-scale CDM project activities."

Because the newly built hydropower generation of the run-of-river type does not emit greenhouse gases at all, it can be considered that all greenhouse gases emitted from the diesel power generation can be reduced.
As the renewable energy technology in this project is not equipment transferred from another activity, leakage calculation is not required.

B.4 Description of the project boundary for the project activity:

"Appendix B of the simplified modalities and procedures for small-scale CDM project activities." shows the definition of the project boundary as "*The physical, geographical site of the generating unit and the equipment that uses the electricity produced delineates the project boundary*".

According to this definition, the project boundary is set to 'the generating unit' such as the main building of the newly installed Chendebji hydro power station, water intake, penstock, the transmission/distribution equipment, and 'the equipment that uses the electricity produced' such as the hot water supply equipment as a settlement for community.

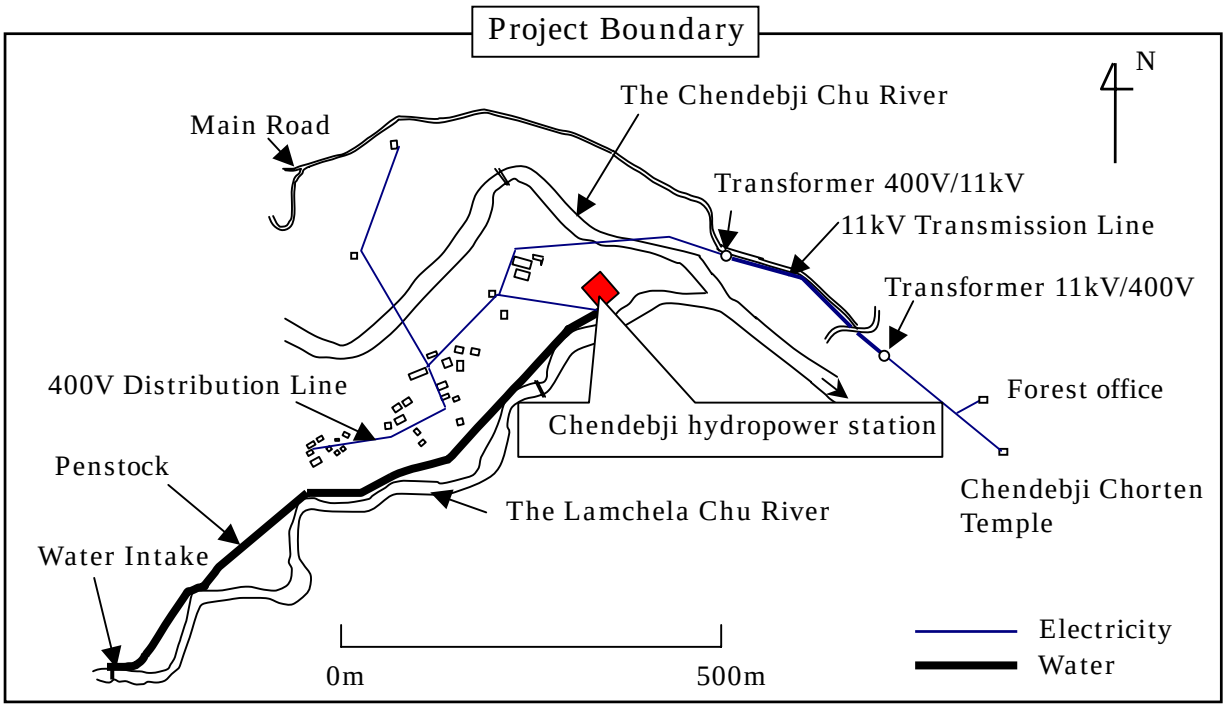

Fig 4. Project Area

B.5 Details of the baseline and its development:

B.5.1 Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities:

If this project does not exist, considering initial construction cost and easiness of its installation and operation as a remote electrification project, electrification by the diesel can be considered to occur. Since this newly built run-of-river micro hydropower generation does not emit GHGs in operating, GHGs would have been emitted by the assumingly set up diesel power generation without this project. Amount of GHGs emission from the diesel power generation is calculated with using a default value of CO2 emission coefficient from diesel power generation units, 0.9kg-CO2/kWh.

B.5.2 Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

25/04/2003

B.5.3 Name of person/entity determining the baseline:

The Kansai Electric Power Co., Inc.

(Contact Person)
Hirofumi Kazuno, Mr.
(Specialist responsible for baseline and monitoring methodologies)

C. Duration of the project activity and crediting period

C.1 Duration of the project activity:

C.1.1 Starting date of the project activity:

Construction work of the hydroelectric power station is planned to start on July 2004. Operation of the station is planned to start on May 2005. CER is to be issued in 2005 and afterwards.

C.1.2 Expected operational lifetime of the project activity: *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*

25y

C.2 Choice of the crediting period and related information:

C.2.1 Renewable crediting period *(at most seven (7) years per crediting period)*

C.2.1.1 Starting date of the first crediting period *(DD/MM/YYYY)*:

01/05/2005

C.2.1.2 Length of the first crediting period *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*:

7 y

C.2.2 Fixed crediting period *(at most ten (10) years)*:

C.2.2.1 Starting date *(DD/MM/YYYY)*:

C.2.2.2 Length (max 10 years): *(in years and months, e.g. two years and four months would be shown as: 2y-4m.)*

N/A

D. Monitoring methodology and plan

D.1 Name and reference of approved methodology applied to the project activity:

Type IA
Monitoring (b)
"Metering the electricity generated by all systems or a sample thereof"

The monitoring method of this project is based on the method articulated in the "Appendix B of the simplified modalities and procedures for small-scale CDM project activities"

D.2 Justification of the choice of the methodology and why it is applicable to the project activity:

Since this project is a newly built run-of-river micro hydropower generation, there occurs no emissions of greenhouse gases through its operation by nature.

For the monitoring, the data of total amount of power produced by the plant as gross power output will be monitored. Since the amount of the electric power which is used for the generation equipment, power supply for the gauge, is negligible (less than 1%), it is sufficient to collect data of gross output.

In collecting data of the electricity produced for the monitoring at the power station, using watt-hour-meters is the most appropriate method to meet the requirement of accuracy, comparability, completeness, and validity.

The data monitored will be recorded on papers per day and the data consolidated after every month will be reported to DoE via the Local Community (Trongsa District Administration and Chendebji Village) per month by the local operator. The operator is to receive appropriate education necessary for the monitoring before the start of the operation of the plant. e7 will also supervise the monitoring of the data of the power produced by the plant during the first 2 years after the start of its operation.

The watt-hour-meters used for the monitoring in this project is the same type of the meters which have been generally used at power stations in Bhutan. BPC will implement the maintenance and correction of meters periodically in the same way as carried out at other hydropower plants in Bhutan. The BPC has already implemented the maintenance and correction at power plants in Bhutan and therefore has enough knowledges and experiences regarding the maintenance and correction of the meters.

In case of any accidents or troubles, the BPC will repair and fix the troubled part promptly.

In addition, it is planned to set up communication equipment that can monitor data concerning power generation of the plant site at remote place, and the plant operational condition will be also confirmed by checking these data.

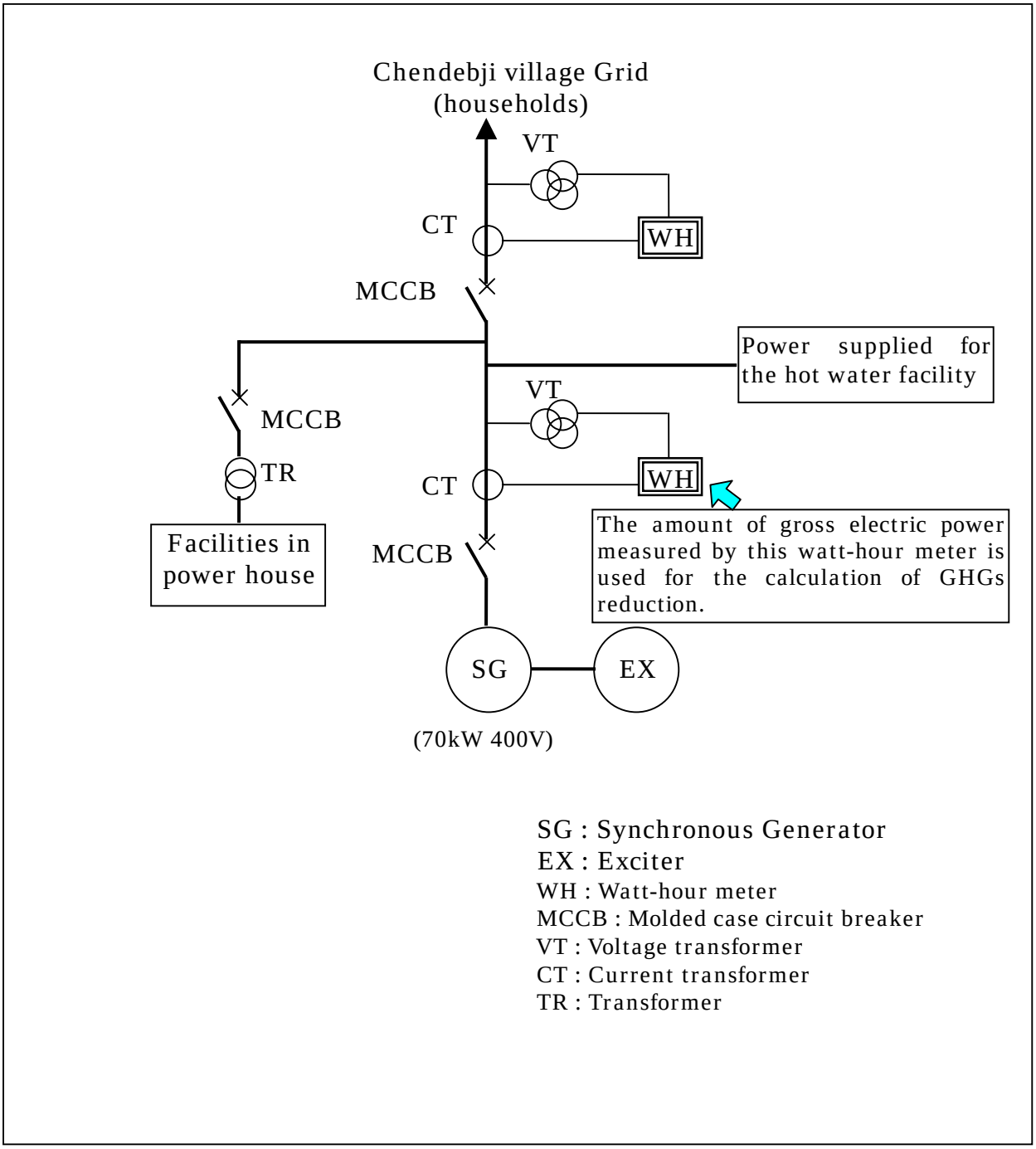

Fig 5. Single Line Diagram-Generator, Main & Control Circuits

D.3 Data to be monitored:

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1.	Electricity-Generated(Gross)	-	kWh	m	Once in a day by hand/ electronic	100%	Paper/ electronic	9 years	

D.4 Name of person/entity determining the monitoring methodology:
(Please provide contact information and indicate if the person/entity is also a project participant listed in annex 1 of this document.)

The Kansai Electric Power Co., Inc.

(Contact Person)
Hirofumi Kazuno, Mr.
Specialist responsible for baseline and monitoring methodologies,

E. Calculation of GHG emission reductions by sources

E.1 Formulae used:

E.1.1 Selected formulae as provided in appendix B:

The baseline scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the project activity is to construct the diesel power station, which is cited as reasonable in the "Appendix B of the simplified modalities and procedures for small-scale CDM project activities."

TYPE IA
(b) Option 2:
$EB = \Sigma iOi /(1 - l)$

Where

EB = annual energy baseline in kWh per year

Σi = the sum over the group of "i" renewable energy technologies (e.g. solar home systems, solar pumps) implemented as part of the project.

Oi = the estimated annual output of the renewable energy technologies of the group of "i" renewable energy technologies installed (in kWh per year)

l = average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programmes or distribution companies in isolated areas, expressed as a fraction.

Since ***Oi*** is the data of total amount of power produced by the plant as gross power output will be monitored, ***l*** is calculated as "***l = 0***". This leads to conservative calculation.

Since the run-of-river micro hydropower generation emits no GHGs, all GHGs emitted from the diesel power generation which would have been installed without this project, can be considered to be reduced. As suggested in the "Appendix B," IPCC default value from diesel generation units, or 0.9kg-CO2/kWh (Type IA), is used for the calculation of baseline emission.

As the renewable energy technology in this project is not equipment transferred from another activity, leakage calculation is not required.

E.1.2 Description of formulae when not provided in appendix B:

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary: *(for each gas, source, formulae/algorithm, emissions in units of CO2 equivalent)*

N/A

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities *(for each gas, source, formulae/algorithm, emissions in units of CO2 equivalent)*

N/A

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the project activity emissions:

N/A

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHG's in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities: *(for each gas, source, formulea/algorithm, emissions in units of CO2 equivalent)*

N/A

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

N/A

E.2 Table providing values obtained when applying formulae above:

	Electricity	Emission Factor	CO2 Emission Reduction
Ex-ante	582.54 [MWh]	0.9	524 [t-CO2]
Ex-post	Data to be monitored	0.9	Calculated according to the data monitored

Based on an assumption that the capacity factor of the hydroelectric power station is 95%, which is calculated based on the operation hours that excludes maintenance periods and periods which have not enough water for generation, annual total electric power produced adds up to 582.54MWh(E_B =582.54MWh/year). Amount of CO2 emission reduction which is calculated according to annual total electric power produced multiplied by IPCC default value of the diesel generation units, or 0.9kg-CO2/kWh, is 524t-CO2 per year.

(582.54MWh/year x 0.9 kg-CO2/kWh =524t-CO2/year)

The actual GHG emission reduction is calculated by using *Ex-post* data monitored. Since annual total electric power produced by the hydroelectric power fluctuates according to annual precipitation of each year, it is more accurate to use *Ex-post* data monitored for the calculation.

F. Environmental impacts

F.1 If required by the host Party, documentation on the analysis of the environmental impacts of the project activity: *(if applicable, please provide a short summary and attach documentation)*

Environmental impacts assessment has already been implemented according to the assessment method on the project implementation stipulated on "Royal Government of Bhutan, Environmental Assessment Act 2000, Environment Assessment Process Manual" under the guidance of National Environment Commission (NEC) (See Annex 4).

According to the results of the assessment, the environmental impacts caused by this project can be considered to be small in general since all necessary countermeasures to decrease the impacts are to be implemented. "Environmental Clearance" which is necessary for the implementation of a project has already been issued by the NEC on behalf of Royal Government of Bhutan (See Annex 5).

e7 Fund's countermeasure against the indicated points by the NEC listed in the "Environmental Clearance" has been submitted to the NEC, and was approved by the Royal Government of Bhutan as appropriate environmental countermeasures against possible environmental impact during the implementation of this project.

Although the environmental impact caused by the installation of the hydropower station can be considered to be limited, e7 is planning to implement the following activities as monitoring periodically during the first 2 years after the construction of the power station.

- Measurement of the water flow at the intake on the river;
- Analysis of the socio economic condition of the villagers after the electrification;
- Analysis of the impact of the flow reduction upon the presence of brown trouts.

G. Stakeholders comments

G.1 Brief description of the process by which comments by local stakeholders have been invited and compiled:

Explanation of this project and the interview were done to the Chendebji villagers during the Feasibility Study period. A workshop was held for explaining this project to the officials from DoE and NEC etc. Further, a public consultation session was held with the representatives from the village. The detail of the result of the session is as follows.

< Interview to the villagers>

Date: November 9-12, 2002

Interviewee: Villagers from 26 households

< Workshop >

Date: July 16, 2003

Interviewee: 7 person from DoE, 3 person from NEC, 1 person from Ministry of Finance, 2 person from Bhutan Power Corporation, and 2 person from Bhutan Telecom.

< Public consultation >

Date: July 19, 2003

Participants: Villagers from about 30 households out of 42 including a substitute of the village chief as an official representative of the Chendebji village, one person from NEC, one person from DoE, and one person from District Administration, Trongsa.

G.2 Summary of the comments received:

<Interview result >

As a result of the interviews to the villagers of the Chendebji village, it has become clear that they have been eager for the village electrification and have had no negative opinions for the project. Results of the interview regarding expected usage of the electricity and the positive effects of the electrification by the Chendebji villagers are as follows,

Table 3. Expected usage of the electricity in the Chendebji village.

Classification	Item
Public Facilities	TV set
	Lighting appliance
	Video tape recorder
Home Appliances	Rice cooker
	Electric pots
	Radio and cassette recorder
	Lighting appliance
	Other appliances including TV set, refrigerators and heater

<Workshop>

The officials from the DoE and NEC etc., or the government agencies of the Royal Government of Bhutan, at the workshop were also supporting this CDM project.

Mr. Karma Nyedrup, NEC, however, commented the following three points.

- It is necessary for the e7 to consider to take possible countermeasures for material transportation because there is a possibility that the environment is destroyed by constructing the temporary road for the transportation.
- It is necessary for the e7 to confirm where to put the sand dug up for the temporary road.
- It is necessary for the e7 to implement the environmental impact assessment related to this project according to NEC regulations.

Various questions and answers were exchanged among the participants and the following major details were given:

- Concerning possible electric power demand in the village and whether this variable had been taken into account in determining electric power demand, it was explained that the situation in Rukupji had been used as an example of electric power demand after electrification.
- Concerning possible flood damage to the facilities, the villagers confirmed that the area chosen for the power house is safe from flooding.
- Pipe size has been calculated to allow for loss due to friction caused by rust over the entire length of the project (more than 20 years).
- Sediment accumulation: the caretaker will open the flushing gate if necessary to ensure removal of sediment.
- Detailed information was provided on river flow after the construction.

< Public consultation session in the Chendebji village >

NEC explained the outline of the project and the impacts by implementing this project to the villagers at the public consultation session. Villagers from about 30 households out of 42 households were participated in the Public consultation. A substitute of the village chief participated in the consultation as the representative of the village, and would explain later the contents of the consultation to the villagers who could not have attended the consultation. The main points of the explanation were as follows;

- There is little possibility to influence the ambient environment of the village during construction and operation of the micro hydropower station.
- Electrification of the Chendebji village provides the community good influence on many aspects such as “Health”, “Agricultural productivity”, ”Economic development”, and “Environment”.
- It is necessary to move the fence of the school.
- Flour mill might not be operated during snow season because of lack of water flow.

The villagers were eager for the village electrification in general and there were no negative opinions heard from the villagers for the electrification plan at all. The e7 agreed with the villagers, DoE, NEC where to put the sand dug up for the temporary road and to move the fence of the school. During the consultation session, it became clear that the flour mill had not been in operation any more.

G.3 Report on how due account was taken of any comments received:

All comments from the villagers and officials from the DoE and NEC etc. are supportive for this project. Comments received from the villagers were considered and were included in the “Environmental Clearance” issued by NEC. e7 Fund’s appropriate countermeasure against the indicated points by the NEC listed in the “Environmental Clearance” has been submitted to NEC, and was approved by the Royal Government of Bhutan as appropriate environmental countermeasures against possible environmental impact during the implementation of this project. Since we obtained consensus with all stakeholders on this project, it can be judged that there is no need for further specific response for the comments.

Annex 1

CONTACT INFORMATION FOR PARTICIPANTS IN THE PROJECT ACTIVITY

(Please repeat table as needed)

(Contact Person of Annex I Country)

Organization:	The Kansai Electric Power Co., Inc
Street/P.O.Box:	3-6-16 Nakanoshima Kita-ku
Building:	
City:	Osaka
State/Region:	Osaka Prefecture
Postfix/ZIP:	530-8270
Country:	Japan
Telephone:	+81-6-6441-9430
FAX:	+81-6-6441-8598
E-Mail:	shiraisi@kepco.co.jp
URL:	www.kepco.co.jp
Represented by:	
Title:	General Manager
Salutation:	-
Last Name:	Shiraishi
Middle Name:	-
First Name:	Takao
Department:	International Network Group, Corporate Planning Department
Mobile:	+81-80-5303-7490
Direct FAX:	+81-6-6441-8598
Direct tel:	+81-80-5303-7490
Personal E-Mail:	shiraisi@kepco.co.jp

(Contact Person of Annex I Country)

Organization:	The Kansai Electric Power Co., Inc
Street/P.O.Box:	3-6-16 Nakanoshima Kita-ku
Building:	
City:	Osaka
State/Region:	Osaka Prefecture
Postfix/ZIP:	530-8270
Country:	Japan
Telephone:	+81-6-6441-8821 (Ext:3232)
FAX:	+81-6-6441-3549
E-Mail:	kazuno.hirofumi@b4.kepco.co.jp
URL:	www.kepco.co.jp
Represented by:	
Title:	Manager
Salutation:	-
Last Name:	Kazuno
Middle Name:	-
First Name:	Hirofumi
Department:	Office of environmental Considerations
Mobile:	
Direct FAX:	+81-6-6441-3549
Direct tel:	+81-6-7501-0143
Personal E-Mail:	kazuno.hirofumi @b4.kepco.co.jp

(Contact Person of Annex I Country)

Organization:	e7 Fund For Sustainable Energy Development
Street/P.O.Box:	22-30 Avenue de Wagram
Building:	
City:	Paris
State/Region:	
Postfix/ZIP:	75382
Country:	France
Telephone:	+44 141 636 4513
FAX:	+44 141 636 4577
E-Mail:	andrew.mitchell@scottishpower.com
URL:	
Represented by:	
Title:	Executive Direcor
Salutation:	--
Last Name:	Mitchell
Middle Name:	--
First Name:	Andrew
Department:	
Mobile:	--
Direct FAX:	+44 141 636 4577
Direct tel:	+44 141 636 4513
Personal E-Mail:	andrew.mitchell@scottishpower.com (Asst: lesley.hoggan@scottishpower.com)

(Contact Person of Host Country)

Organization:	National Environment Commission Secretariat
Street/P.O.Box:	
Building:	
City:	Thimphu
State/Region:	
Postfix/ZIP:	
Country:	Kingdom of Bhutan
Telephone:	+975-2-323384
FAX:	+975-2-323385
E-Mail:	Jigme@nec.gov.bt
URL:	
Represented by:	
Title:	Program Officer
Salutation:	
Last Name:	
Middle Name:	
First Name:	Jigme
Department:	
Mobile:	
Direct FAX:	+975-2-323385
Direct tel:	+975-2-323384
Personal E-Mail:	Jigme@nec.gov.bt

(Contact Person of Host Country)

Organization:	Ministry of Trade & Industry
Street/P.O.Box:	
Building:	
City:	Thimphu
State/Region:	
Postfix/ZIP:	
Country:	Kingdom of Bhutan
Telephone:	+975-2-323555/322505
FAX:	+975-2-328278/324735
E-Mail:	sting@druknet.bt
URL:	
Represented by:	
Title:	Director General
Salutation:	
Last Name:	Tshering
Middle Name:	
First Name:	Sonam
Department:	Department of Energy
Mobile:	
Direct FAX:	+975-2-328278/324735
Direct tel:	+975-2-323555/322505
Personal E-Mail:	

Annex 2
INFORMATION REGARDING PUBLIC FUNDING

Public funding, such as grants from official development funds, are not involved in this project.

Annex 3
Letter from Royal Government of Bhutan

དཔལ་ལྡན་འབྲུག་གཞུང་།
རྒྱལ་ཡོངས་མཐའ་འཁོར་གནས་སྟངས་ལྷན་ཚོགས་ཡིག་ཚང་།

ROYAL GOVERNMENT OF BHUTAN
NATIONAL ENVIRONMENT COMMISSION SECRETARIAT

NEC/PCD/CDM/2004/ 6634 27th February 2004

Dear Dasho,

Subject: Approval of the Chendebji Micro Hydro Project as a pilot Clean Development Mechanism Project

I am pleased to convey to you that the 221st session of the Coordination Committee Meeting of the Council of Ministers have approved the Chendebji Micro Hydro Project as a pilot Clean Development Mechanism Project. Please find attached a copy of the approval from the Cabinet Secretariat.

With kind regards,

Yours sincerely,

Nado Rinchhen
Deputy Minister

Dasho Karma Dorji,
Secretary,
Ministry of Trade and Industry,
Thimphu

cc Mr. Sonam Tshering, Director, Department of Energy
Mr. Karma Tshering, CDM focal person, Department of Energy

NECS, PO Box 466, Thimphu, Bhutan
Telephone (975-2) 323384/325856/324323/326993 Fax (975-2) 323385
Email addresses:
AFS
adminnec@druknet.net.bt
Technical Division
EIA Section: eianec@druknet.net.bt
RMS Section: rmnec@druknet.net.bt
ICO section: curnec@druknet.net.bt
Policy Coordination Division
Policy Analysis Section: ppdnec@druknet.net.bt
Legal Section: legalnec@druknet.net.bt

དཔལ་ལྡན་འབྲུག་གཞུང་།

ROYAL GOVERNMENT OF BHUTAN ཕྱོགས་བསྒྲུབ་རྩོལ་གནས་ཚད།

Cabinet Secretariat
Trashichhu Dzong
Thimphu: Bhutan

COM/03/04/ 571

24 February 2004

Hon'ble Dy. Minister
NEC Secretariat
Thimphu

SUB: CLEAN DEVELOPMENT MECHANISM PROJECT

REF: HON'BLE NEC CHAIRMAN'S NOTE SUBMITTED VIDE MoWHS/39/786 DATED FEBRUARY 9, 2004

Hon'ble *Dasho*,

We are pleased to convey that the Royal Government has approved the Chendebji Micro Hydro Project as a Clean Development Mechanism Project.

The Government has further approved the proposal for sharing of the Certified Emissions Reduction Credits between the Royal Government and the e7 Fund on 50:50 basis, and for renegotiation after two years time, the transaction costs related to the CDM procedures which will be borne by e7 for an initial period of two years.

This has reference to the 221st session of the Coordination Commitee Meeting of the Council of Ministers held on February 10, 2004.

With my respects.

NATIONAL ENVIRONMENT COMMISSION
Received 25/02/04

Yours faithfully,

(Sherub Tenzin)
SECREATRY

Copy to:
1. Hon'ble Chairman, Council of Ministers, for kind information.
2. Hon'ble Chairman, NEC, C/o MoWHS, for kind information.
3. Secretary, Ministry of Trade & Industry, for kind information.

1) For the cabinet file
2) copy given to [illegible]
25-2-04

Trashichhu Dzong, Thimphu, P.O. Box No. 1011 Tel. +975-2-321435 (Secretary) 321436, 321437
Fax +975-2-321438 E-mail : netsuf@druknet.net.bt

Annex 4
Procedure for Project Assessment

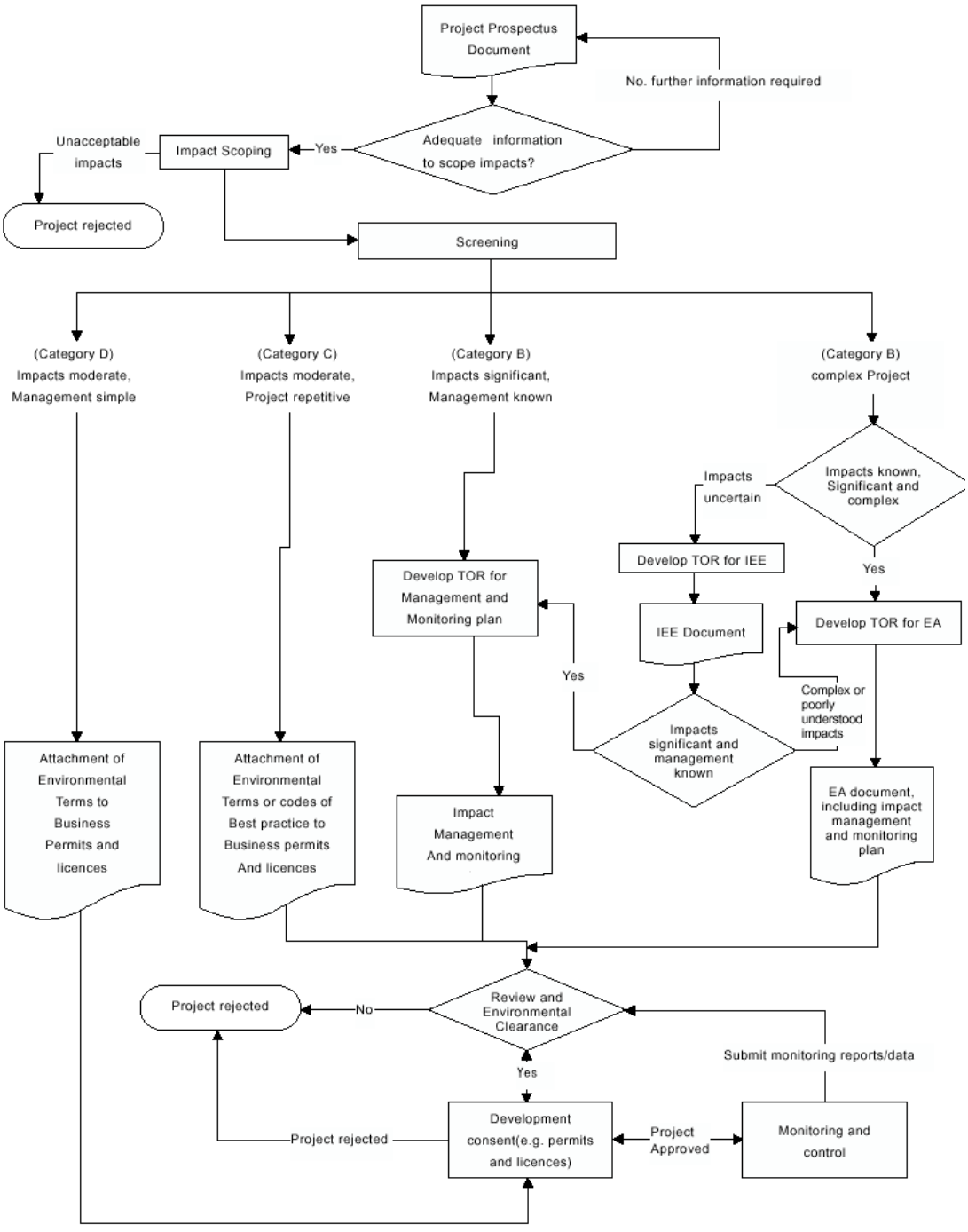

Figure 1-1 Procedure for Project Assessment

Annex 5

Environmental Clearance

FROM : PCD-DOE FAX NO. : 009752324735 Dec. 18 2003 01:29PM P1

To:

Snd Attn:

Mr. Takao Shiraishi

རྒྱལ་ཡོངས་མཐའ་འཁོར་གནས་སྟངས་ལྷན་ཚོགས་ཡིག་ཚང་།

ROYAL GOVERNMENT OF BHUTAN

NATIONAL ENVIRONMENT COMMISSION SECRETARIAT

NEC/EA/DOE/389/2003/ /6216

25 November 2003

Sir,

Subject: Environmental Clearance for Construction of 70 kW Micro Hydro Power in Chendebji village, under Trongsa Dzongkhag

The National Environment Commission Secretariat issues the environmental clearance for construction of 70 kW e7 CDM Micro Hydro Power Plant in Chendebji village under Trongsa Dzongkhag with the following environmental terms and conditions:

1. The decision to issue environmental clearance is based on the information submitted to the NECS vide letter No. DoE/PCD/E7(CDM)/2002-03/26 dated July 17, 2003 and the additional information submitted vide letter No. DOE/PCD/E7(CDM)/2003-04/271 dated 7 Nov. 2003.
2. The construction activities must be done in accordance with the Land Act, 1979, Forest and Nature Conservation Act, 1995, Environmental Assessment Act, 2000 and the Electricity Act, 2001.
3. Construction activities shall not obstruct/hamper the usage of existing trails by the villagers.
4. The excavated materials shall be deposited in designated areas only.
5. The existing stream shall be protected from construction debris/materials falling into it.
6. The project water intake shall not deprive drinking water and other water resources of the villagers.
7. The temporary access road, after completion of the project must be reclaimed to its original state.
8. Construction of the temporary road shall be done using backhoe tractor and Excavator
9. The excavated material, particularly, from the construction of temporary road – topsoil – must be stored in designated areas only. The deposited topsoil shall be protected from rain and wind. The topsoil must be reused in restoring the temporary road.
10. The generation of dust from the construction activities shall be suppressed by spraying water at least twice a day.
11. Construction of water intake shall not be done during the spawning season of the ~~brown trout.~~ fishes
12. The Department of Energy (DoE) is responsible for directing the contractor for provision of proper sanitation facilities to the workforce employed at the project site.
13. The DoE must submit a separate application for construction of transmission lines to the NECS for clearance.
14. The contractors must ensure that occupational health and safety measures

NECS, PO Box 466, Thimphu, Bhutan

Telephone. (975-2) 323384/325856/324323/326993 Fax. (975-2) 323385

Email addresses:

AFD
[illegible]

Technical Division
EA Section: [illegible]
EMS Section: [illegible]
ICD Section: [illegible]

Policy Coordination Division
Policy Analysis Section: [illegible]
Legal Section: [illegible]

Annex 5
Environmental Clearance

implemented at all times during construction of the project.

15. Visual impact due to the project construction must be minimized by not uprooting/cutting trees unnecessarily, within or outside the construction areas and also by planting trees after project activity completion in consultation with the nearest Forest Office.
16. The clearance holder shall submit detailed implementation measures prior to the initiation of the construction activities.
17. It is the responsibility of the DoE to conduct routine environmental monitoring and maintain records.
18. Should any dispute arise due to the implementation of these activities, the project proponent is responsible for resolving it amicably; and
19. Should the applicant violate any of the aforementioned condition, this Environmental Clearance shall be revoked without any liability on the part of the NECS.

This Environmental Clearance is valid for **Eighteen (18)** months from the date of issue.

Date of Issue: 24 November 2003.

Sincerely,

Head
Technical Division

To
Karma Tshering
Executive Engineer & e7 Project Manager
Planning & Coordination Division
Department of Energy
Ministry of Trade and Industry
Thimphu

CC:

1. The Director, Department of Forest, Thimphu.
2. Dasho Dzongdag, Dzongkhag Adm., Trongsa.
3. The Director, Department of Roads, Thimphu.