CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Rehabilitation of six HPPs in the Republic of Macedonia (hereafter referred to as the "Project" or the "Project activity")

Version 1.3 (rev.)

Completed on 10/09/2007

A.2. Description of the project activity:

The Project involves the implementation of a package of comprehensive plant-wide rehabilitation measures of the six major hydropower plants (HPP) in the Republic of Macedonia and aims at increasing generation capacity, efficiency and reliability of hydropower generation and enhancing the ability of rehabilitated hydropower plants to provide critical electricity supply during peak times and for frequency regulation. The plants covered by the Project are HPP Vrutok (150MW), HPP Raven (19.2MW), HPP Vrben (12.8 MW), HPP Globocica (42MW), HPP Spilje (84MW) and HPP Tikves (92MW). The Project is expected to result in approximately 200,334 tCO2e/yr of emission reductions through the substitution of electricity generated by thermal power plants connected to the Macedonian grid with the additional electric energy generated by the rehabilitated hydropower plants.

Electricity generation capacity of the Macedonian grid without the Project is 1,431 MW. The majority of this electricity (more than 70%) is supplied by four lignite-fired thermal power plants, namely the plants in the Bitola power complex and Oslomej TPP. The rest of the electricity is supplied by HPPs. TPP Negotino is on a cold stand-by, but can be immediately put into operation if necessary to meet extra power demand.The oldest hydro units to be rehabilitated under the Project were commissioned in the late 50s of the 20th century. Although they will not be obsolete for many years to come, they will continue to run at increasingly lower efficiency levels. Therefore, it is desirable to increase the plants' efficiency and reliability and to produce the maximum amount of power from the available water resources.

HPP Vrutok is the largest hydropower generation plant in Macedonia with four 37.5 MW generation units. Units A and B were installed in 1957, while units C and D in 1973. The rehabilitation measures involve design, production, testing and installation of four new Pelton turbine runners, rehabilitation of the thrust and guide bearings, rehabilitation of the inlet butterfly valves and accessories, rehabilitation of siphon isolating valves, installation of a new cooling system, installation of an ovation system and stateof- the-art digital high voltage and low voltage system, overhaul of the 220kV, 110 kV and 35 kV substations' switchgear and control gear, and rehabilitation of the Mavrovo dam bottom outlet.

HPP Raven has three units with rated generation capacity of 6.4 MW each. The first two units (A and B) were installed in 1957 and the the last unit (C) was installed in 1973. The rehabilitation measures involve design, production, testing and installation of three new Francis turbines, rehabilitation of the inlet valves and turbine governors of all three units, revitalization, improvement of insulation and capacity increase of the three generators, installation of a new cooling system, and installation of new excitation system, an ovation system and state-of-the-art digital high voltage and low voltage system.

HPP Vrben has two generation units with rated generation capacity of 6.4 MW. Unit A was put into operation in 1957, while unit B in 1973. The rehabilitation measures involve rehabilitation of the turbine governors and inlet valves of both units, installation of a new cooling system, overhaul of the generators and excitation systems, and installation of an ovation system and state-of-the-art digital high voltage and low voltage system.

HPP Spilje has three generation units installed with generating capacity of 28 MW each. The units commenced operation in 1969. The measures cover rehabilitation of governor controls of hydraulic pressure units and turbine governors, installation of new excitation system, installation of an ovation system and state-of-the-art digital high voltage and low voltage system, and overhaul of the 110 kV substations' switchgear and control gear.

HPP Globocica has two generation units (A and B) installed in 1965. Each unit has rated generation capacity of 21 MW. The rehabilitation measures involve rehabilitation of the turbine governors, installation of new excitation system, installation of an ovation system and state-of-the-art digital high voltage and low voltage system, and overhaul of the 110 kV and 35 kV substations' switchgear and control gear.

HPP Tikves has four generation units with rated capacity of 24.2 MW each. Units A and B were put into operation in 1967 and units C and D in 1980. The rehabilitation measures involve design production testing and installation of four new Francis turbines, rehabilitation of the turbine governors, design and installation of new generators and new excitation system of units A and B, installation of an ovation system and state-of-the-art digital high voltage and low voltage system, and overhaul of the 110 kV substations' switchgear and control gear.

Besides the above described measures, as part of the Project all six hydropower plants were connected to a central control system which allowed their more secure and reliable control and operation. Thus, the Project represents the first of its kind overall rehabilitation of the existing hydropower plants in Macedonia leading to an increase of generation efficiency as well as to hydropower system reliability improvement. It is expected that as a result of the implementation of the Project, the output of the rehabilitated plants will increase by up to 200 GWh/year.

The Project brings a number of sustainable development benefits to Macedonia.

Net environmental benefit

The project implementation leads to an increase in the renewable electricity generation capacity of the Macedonian grid and a reduction in the emission of SO2, NOx and CO2 from the thermal plants, which would have to be operated in the absence of the Project.

Net contribution to economic development

The Project has strong economic effects because it reduces the dependence of Macedonia on imported fossil fuels and has a positive impact on the trade balance of the country. The Project is expected to generate significant foreign currency inflow and will diminish Macedonia's exposure to exchange rate fluctuations.

Improvement in social conditions

The Project's implementation creates a number of new jobs both for highly skilled engineers and construction workers from different ethnic backgrounds and helps partially alleviate the unemployment problems in Macedonia. The Project contributes to the increase of reliability and availability of power supply service by enhancing the ability of the rehabilitated hydropower plants to provide critical electricity supply during peak times and for frequency control.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of Macedonia (host)	Elektrani na Makedonija (ELEM)	No
Japan	Mitsubishi UFJ Securities Co., Ltd.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Republic of Macedonia

A.4.1.2. Region/State/Province etc.:

Rehabilitated Plant	*Municipalities*
HPP Raven	Gostivar
HPP Vrtok	Gostivar
HPP Vrben	Mavrovo I Rostusa
HPP Spilje	Debar
HPP Globocica	Struga
HPP Tikves	Kavadarci

A.4.1.3. City/Town/Community etc:

Rehabilitated Plant	*River*	*Address*
HPP Raven	Mavrovska River	HPP Raven, selo Raven
HPP Vrtok	Mavrovska River	HPP Vrutok, selo Vrutok
HPP Vrben	Gorna Radika River	HPP Vrben, selo Vrben
HPP Spilje	Crni Drim River	HPP Spilje, Debar
HPP Globocica	Crni Drim River	HPP Globocica, Struga
HPP Tikves	Crna River	HPP Tikvesh, Kavadarci

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

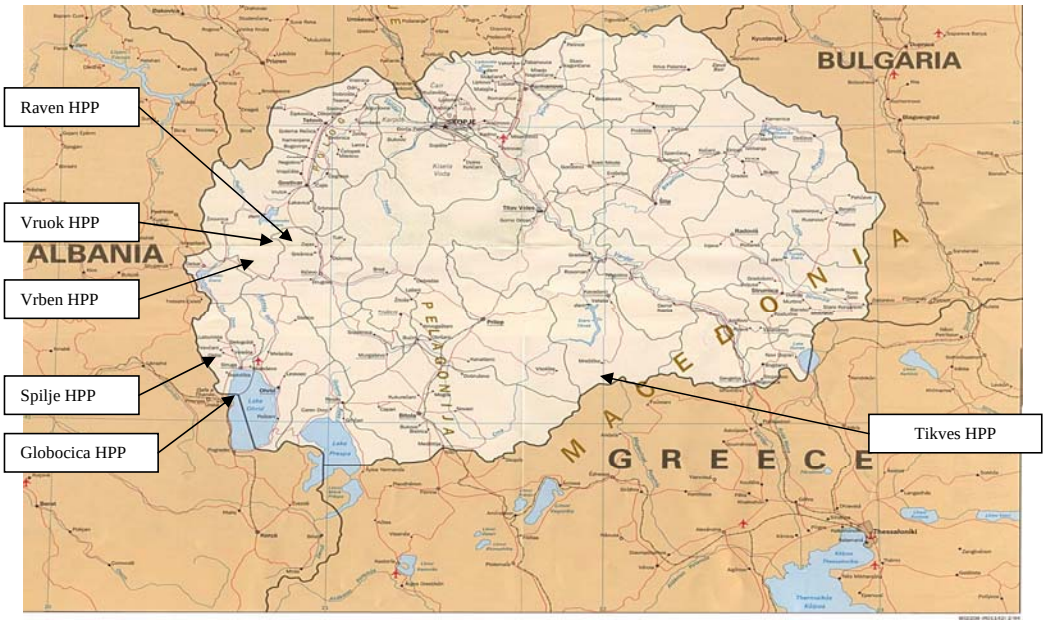

Figure A-1. Project sites

The coordinates of each plant are provided below:

HPP Raven	41°46' N	20°51' E
HPP Vrtok	41°46' N	20°50' E
HPP Vrben	41°42' N	20°43' E
HPP Spilje	41°29' N	20°30' E
HPP Globocica	41°23' N	20°35' E
HPP Tikves	41°24 'N	21°56' E

A.4.2. Category(ies) of project activity:

1. Energy industries (renewable - / non-renewable sources)

A.4.3. Technology to be employed by the project activity:

The Project is carried out in five packages entailing the replacement and rehabilitation of 1) turbine runners, turbine governors, inlet valves and thrust and guide bearings, 2) new butterfly valves, control systems and cooling systems, 3) generators, static excitation systems and voltage regulators, 4) control systems, protection and LV auxiliaries, and 5) substations' switch yards and switch gear.

Most of the equipment will be imported from abroad and meets the highest international standards for environmentally safe and sound technology. Major equipment suppliers are from Slovenia, Argentina, Croatia, Poland and Sweden. The Project will also include special training for the operation of the new systems and equipment and will result in significant transfer of know-how.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO_2e
Year 1	200,132
Year 2	200,132
Year 3	200,132
Year 4	200,132
Year 5	200,132
Year 6	200,132
Year 7	200,132
Total estimated reductions (tonnes of CO_2e)	1,400,924
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	200,132

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A.4.5. Public funding of the project activity:

The Project does not involve public funding and does not result into diversion of ODA.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

The following methodologies are applied:

ACM0002, ver. 6 Consolidated baseline methodology for grid-connected electricity generation from renewable sources

Tool for assessment and demonstration of additionality, ver. 3

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

The Project meets all applicability conditions of ACM0002, ver. 6.

1) Applies to electricity capacity editions from run-of-river hydro power plants; hydropower projects with existing reservoirs where the volume of the reservoir is not increased.

The Project is a rehabilitation of existing hydro power plants. The Project activity does not involve increase in the volume of the reservoirs.

2) The methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuel.

The Project does not involve switching from fossil fuels to renewable energy at the Project site.

3) The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available.

The geographic and system boundaries of the Macedonian grid are clearly identified and information on grid characteristics is available.

B.3. Description of the sources and gases included in the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Power generation by fossil fuel fired grid power plants	CO_2	YES	Major emission source.
		CH_4	NO	Conservative.
		N_2O	NO	Conservative.
Project Activity	Additional power generation by rehabilitated hydro power plants	CO_2	NO	This is a hydropower project.
		CH_4	NO	This is a hydropower project with no increase in reservoir size.
		N_2O	NO	This is hydropower project.

Table B-1. Sources and gases included in the project boundary

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The Project activity involves the retrofit of existing electricity generation facilities. In the absence of the Project, the hydro power plants are expected to continue to provide electricity to the grid at historical average levels ($EG_{historical}$) for at least 20 more years with regular maintenance measures. Usually these maintenance costs are estimated to be less than 10% of the electricity generated.

The technical lifetime of a typical hydropower plant is estimated to be between 50 and 100 years[1]. Hydropower plants in Macedonia are not an exception and are also characterized by a long technical lifetime. For example, one of the oldest plants in Macedonia, Matka HPP, has been in operation since 1938 and still operates well, although with lower efficiency than a modern hydropower plant. The plant personnel has developed a special maintenance and operation plan that involves partial annual maintenance measures, complete check-up and maintenance of the turbine equipment at intervals of at most five years and of electric equipments at most every ten years. This overall maintenance and operation plan and the extremely high level of expertise of the plant personnel have allowed the plant to continue uninterrupted operation up to the present.

It has to be emphasized that this is not an isolated example but common practice in Macedonia. Similar regular maintenance measures have been carried out in each hydropower plant in the country, including the six Project plants. The results of the regular support and maintenance measures are reflected in the performance data of the hydropower plants in Macedonia, including the project plants, none of which has ever been decommissioned due to the end of their technical lifetime. Another important fact to emphasize is that most other existing hydropower plants in Macedonia are constructed mainly in the 50s and 60s of the 20th century, when much more advanced technology than the technology used by Matka HPP was available. Therefore, these plants should perform at least as well as the Matka HPP and can continue operation with regular maintenance for at least the same time Matka has operated up to now. Thus, it is conservative to assume that the technical lifetime of a typical hydropower plant in Macedonia is at least equal to the current lifetime of the Matka power plant, or 70 years without rehabilitation and with regular maintenance measures. As the oldest units were put into operation in 1957, the date when the facilities covered by the Project will be retrofitted in the absence of the CDM activity is determined to be $DATE_{BaselineRetrofit}$ = 01/01/2027. Therefore, the baseline electricity generation equals the average historical electricity generation during the first crediting period.

$$EG_{baseline} = EG_{historical}$$

In accordance with ACM0002, the baseline electricity generation is calculated as the annual generation average based on a five-year annual generation data for the Project plants prior to the start of the plant rehabilitation. The average annual power generation by the Project plants in the period 1996 – 2000 is 1,121.7 GWh. Detailed data is provided in Annex 3.

All power generation above the baseline levels ($EG_{baseline}$) would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin calculation.

[1] Jefferson W. Tester, E. M. Drake, M. J. Driscoll. M.W. Golay and W.A. Peters. 2005. *Sustainable Energy: Choosing Among Options*, Cambridge, MA: MIT Press, p. 536

The baseline emission factor (EF_y) is calculated as the combined margin (CM), consisting of a combination of the operating margin (OM) and the build margin (BM). Due to the lack of readily available dispatch data, the operating margin will be calculated using the Simple OM method. Macedonian grid meets the requirements for applying the Simple OM method because total electricity generation by low cost/must-run resources is approximately 20% in the past five years, which is less than the 50% benchmark for Simple OM specified in ACM0002. Detailed data is provided in Annex 3.

Based on the above assumptions, CM is estimated to be 0.980 tCO_2/MWh.[2]

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Data for baseline determination	Value	Unit
$EG_{historical}$	1,121.68	GWh
CM	0.980	tCO_2e/MWh

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B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

Project additionality is determined using version 3 of the Tool for demonstration and assessment of additionality.

The following steps are utilized to demonstrate Project additionality:

STEP 1 – Identification of alternatives to the project activity consistent with current laws and regulations
STEP 3 – Barrier analysis
STEP 4 – Common practice analysis

STEP 1 – Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

The following alternatives are identified[3]:

A1: The proposed Project activity is implemented and rehabilitated hydro units produce an increased amount of electricity for sale to the Macedonian grid during peak times. *(The Project activity without CDM)*

A2: Plants connected to the Macedonian grid will supply additional electricity. (*Continuation of current practices*)

[2] Plant specific data for the calculation of the CEF is confidential and is not publicly available in Macedonia. As per ACM0002, ver. 6, footnote 4, 2), the PDD contains only the resultant carbon emission factor and the corresponding list of power plants. (Please refer to Annex 3.) The data for CEF calculation is provided to the DOE for verification.

[3] Macedonian grid has excess generation capacity, which is not presently used. The country also has limited financial resources that prevent the construction of new peak generation capacities. Therefore, construction of new fossil-fuel-fired power plants or hydro power plants is not included in the list of project alternatives.

Sub-step 1b. Consistency with mandatory laws and regulations:

All the alternatives are in compliance with mandatory legislation and regulations.

STEP 3 – Barrier Analysis

Sub-step 3a. Identify barriers that would prevent the implementation of the proposed CDM project activity:

A number of insurmountable barriers prevent the implementation of Alternative A1 on a BAU basis.

Barriers to Alternative A1

- Barriers due to the prevailing practice

The Project is the first of its kind project in Macedonia for overall and comprehensive plant-wide rehabilitation of the hydropower generation system. Although partial rehabilitation was conducted at some hydropower units in Macedonia in order to improve the efficiency of hydropower generation under changed hydraulic conditions, these measures have only had limited effect on the hydrogenation system in the country. The Project not only improves the generation efficiency of the existing hydropower plants in Macedonia, but also it increases the reliability and security of hydropower generation system and enhances the ability of the rehabilitated power plants to provide electricity during peak hours and for frequency control. Although other comprehensive hydropower plant rehabilitation projects have been studied[4], they have not been implemented yet. Due to the high degree of uncertainty associated with the output of hydro rehabilitation in general and the Project in particular, the Project was not considered an option for the expansion of the generation capacity of the country and was not included in the power development study of Macedonia[5].

- Investment Barriers

Banking institutions in Macedonia do not have the capacity to finance implementation of large-scale infrastructure projects. The available financing per project is usually limited to 2 million USD, much less than the investment required for the Project (41 mil USD). A working paper by IMF[6] describes in details the inability of the banking system of Macedonia to finance large infrastructure projects due to its fragility, lack of reforms in the banking sector and the large share of non-performing assets hold by large Macedonian banks. In this environment ESM (the predecessor of ELEM[7]) had to look for borrowing opportunities from international investors or lending institutions.

[4] Electric Power Company of Macedonia. 2001. *Development Plan for Construction, Rehabilitation and Modernization of Production, Transmission and Distribution Facilities in the period 2001-2005-2010-2015 (Summary),* Skopje: ESM

[5] Electric Power Company of Macedonia. April 2000. *Least-Cost Expansion Planning Studies, Final Report – Volume II – Main Report*, Skopje: ESM, p. 1-8 ~1-11

[6] Paulo Drummond. 2000. *Former Yugoslav Republic of Macedonia: Banking Soundness and Recent Lessons*, Aug. 2000, WP/00/145. IMF

[7] ELEM was formed as a result of restructuring of ESM in 2005 and emerged as the national power generation company.

Although ESM (ELEM) is the national power company of Macedonia, it has been making only a small operating profit and often there are years when it sustained a loss[8]. In addition, most of ESM (ELEM)'s revenue is denominated in local currency (denar), thus exposing the company to exchange rate fluctuations in case of foreign currency borrowing. This is further aggravated by the fact that Macedonia had no credit rating[9], preventing ESM from accessing low interest international financing. Under the combination of these three conditions, successful repayment of a foreign currency denominated loan is deemed infeasible for ELEM without additional support.

Macedonia became a party to the UNFCCC in 1998 and ratification of the Kyoto Protocol was expected to follow soon. Although there was little general understanding about the Kyoto Protocol in Macedonia at that time, ESM through its international contacts gained knowledge about the potential opportunities offered by emissions trading. Appendix 1 shows that the Kyoto Protocol had impact on ESMs decision to proceed further with the Project, because the company was aware that the Project qualified for the financial assistance of the Kyoto Protocol due to the significant emission reductions of CO_2 it could achieve.

However, the registration of the Project under the CDM was delayed due to the unstable geopolitical conditions in Macedonia, aggravated by the influx of Kosovo refugees as well as by the outbreak of the war conflict in Macedonia. In the following years the situation in the country gradually stabilized, which enabled Macedonia to become a party to the Kyoto Protocol on November 18, 2004. ELEM decided to proceed with the CDM registration when the Macedonian DNA was eventually established in June 2006 and to submit the Project for validation shortly after the rules for CDM project approval were confirmed in February 2007 as part of the National Strategy for Kyoto Protocol Implementation in Macedonia.

Although there was a delay in the registration of the Project, regular contacts have been kept with major participants in the Kyoto Protocol process. ESM staff continued to advocate the fast implementation of the Kyoto Protocol in Macedonia and the CDM opportunities in the country. This is exemplified by presentations made by ESM management at meetings with foreign partners as well as at international conferences, like a UNIDO conference in Vienna in October 2004. This presentation introduced among others several potential CDM projects in Macedonia, including the Project[10].

It is expected that the registration of the Project will significantly contribute to the CDM capacity building in Macedonia, will help improve the investment opportunities in the area of renewable energy and will set a welcome precedent for other emission reduction projects.

Sub-step 3b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed activity):

[8] This situation has continued up to the present. For example, a statement of the IMF mission to Macedonia from February 2007 recommends to the government to develop "a comprehensive action plan to restore the financial viability of the energy sector". (http://www.imf.org/external/np/ms/2007/020507.htm

[9] Macedonia received credit rating for the first time in its history on July 29, 2004 by Standards & Poor (BB with a positive outlook). (http://www.finance.gov.mk/gb/news/mf_cr_juli2004.pdf)

[10] http://www.unido.org/file-storage/download/?file_id=29434

None of the identified barriers prevents the implementation of alternative A2. There is sufficient installed capacity in the Macedonian grid to supply the amount of power generated by the Project. Therefore, the only plausible baseline scenario is alternative A2, continuation of the current practices.

STEP 4 – Common practice analysis

Sub-step 4a – Analyse other activities similar to the proposed project

The Project is the first of its kind in Macedonia. A similar project for comprehensive rehabilitation of seven other HPPs is studied, but has not been implemented yet. New big hydro generation projects have been discussed, but their implementation is also considered feasible only with CDM assistance[11].

Sub-step 4b –Discuss any similar option occurring

Due to the Macedonia's perceived country risks that discourage foreign capital and the shortage of available domestic funds for infrastructure improvement, similar activities are unlikely to be undertaken without the expectations that Project profitability will be augmented by the additional cash flow from the monetization of the CO_2 emission reductions under the CDM.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Baseline emissions

Baseline emissions are calculated with the following formula.

$$BE_y = (EG_y - EG_{baseline}) \times EF_y$$

where:

Parameter	Unit	Description
EG_y	MWh	Net amount of electricity supplied by the Project to the national grid in year y
$EG_{baseline}$	MWh	Baseline generation by the rehabilitated plants, calculated as the average generation by the Project plants in the most recent five years prior to the start of the rehabilitation activities.
EF_y	tCO_2e/MWh	Baseline emission factor calculated as per the steps below.

[11] UNDP. 2007. *National Strategy for Clean Development Mechanisms for the first commitment period of the Kyoto Protocol 2008-2012*, Skopje: UNDP, p.22, p. 26

The baseline emission factor is (EF_y) is calculated as the combined margin, consisting of the combination of operating margin (OM) and build margin (BM) factors calculated as per the steps below. No capacity additions registered as CDM project activities are included in the calculations.

STEP 1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$)

As no dispatch data is available and must-run/low cost resources constitute less than 50% of total grid generation in the past 5 years, Simple OM method is used. The Simple OM factor is calculated for as the generation-weighted average emissions per electricity unit of all generating sources servicing the Macedonian grid, not including the low cost and must-run power plants, for the most recent 3 years (2004-2006). All electricity imported to the Macedonian grid comes from abroad and emission factor of imported electricity is assumed to be 0. Data for fuel consumption and power generation for grid connected plants is used.

$$EF_{OM,y} = \frac{\sum_{y}\sum_{i,j} F_{i,j,y} \times COEF_{i,j,y}}{\sum_{y}\sum_{j} GEN_{j,y}}$$

where

Parameter	Unit	Description
$F_{i,j,y}$	ton	Amount of fuel *i* consumed by relevant power sources *j* in year *y*. Power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid.
$COEF_{i,j,y}$	tCO_2/ton	CO_2 emission coefficient of fuel *i*, taking into account the carbon content of the fuels used by the relevant power sources *j* and the percent of oxidation of the fuel in year *y*.
$GEN_{j,y}$	MWh	Electricity delivered to the grid by power source *j* in year *y*

And

$$COEF_{i,j,y} = NCV_{i,j,y} \times EF_{CO2,i} \times OXID_i$$

where

Parameter	Unit	Description
$NCV_{i,j,y}$	TJ/kt	Net calorific value of fuel *i* used by power source *j* in year y.
$EF_{CO2,i}$	tCO_2/TJ	CO_2 emission coefficient of fuel *i*,
$OXID_i$	%	Default oxidation factor

STEP 2. Calculate the Build Margin emission factor *($EF_{BM,y}$)*

The Build Margin is calculated as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m}}{\sum_{m} GEN_{m}}$$

where

Parameter	Unit	Description
$F_{i,m,y}$	ton	Amount of fuel *i* consumed by relevant power sources *m* in year *y*.
$COEF_{i,m}$	tCO_2/ton	CO_2 emission coefficient of fuel *i*, taking into account the carbon content of the fuels used by the relevant power sources *m*. IPCC 2006 default values used.
GEN_m	MWh	Electricity delivered to the grid by the sample plants *m*.

$EF_{BM,y}$ is calculated *ex-ante* as described in Option 1. The Build Margin emission factor is estimated based on the most recent information available on the five most recently built plants in the Macedonian grid as listed in Annex 3. The sample plants comprise 76% of total electricity generation in Macedonia, which is more than 20% of the total power generation in the country.

STEP 3. Calculate the baseline emission factor EF_y

The Baseline emission factor EF_y is calculated as the weighted average of the operating margin and the build margin. Default weights of 50% are used.

$$EF_y = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$$

where:

Parameter	Unit	Description
w_{OM}	%	Weight of the operating margin. (50%)
$EF_{OM,y}$	tCO_2/MWh	Emission factor of the operating margin.
w_{BM}	%	Weight of the build margin. (50%)
$EF_{BM,y}$	tCO_2/MWh	Emission factor of the build margin.

Leakage

The Project will result into no leakage.

$L_y = 0$

Project emissions

The Project retrofits the existing HPPs and involves no construction of new reservoirs. Therefore, the Project will result into no emissions.

$P_y = 0$

Emission reductions

Emission reductions are calculated with the following formula:

$$ER_y = BE_y - PE_y - L_y$$

where:

Parameter	Unit	Description
BE_y	tCO_2e/MWh	Baseline emissions
PE_y	tCO_2/MWh	Project emissions
L_y	tCO_2e/MWh	Leakage

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**$EG_{historical}$**
Data unit:	GWh
Description:	Baseline power generation
Source of data used:	Electric Power Company of Macedonia, Annual Report 2003, p.16
Value applied:	1,121.68
Justification of the choice of data or description of measurement methods and procedures actually applied :	The calculations are shown in Annex 3.
Any comment:	Calculated as a five-year average generation of the Project plants prior to the start of rehabilitation.

Data / Parameter:	**EF_y**
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor of the grid
Source of data used:	ELEM (internal data); TPP Negotino (www.tecnegotino.com.mk and internal data); Energy Regulatory Commission of Macedonia: *Godisen izvestaj za rabota na regulatornata komisija za energetika na Republika Makedonija vo 2006 godina (Annual Report of the Energy Regulatory Commission of the Republic of Macedonia in 2006)*. Skopje: ERC, p. 26; Statistical Office of Macedonia. 2006. *Statistical Yearbook of the Republic of Macedonia 2006*. Skopje: SOM, p.462 – 463.
Value applied:	0.980
Justification of the choice of data or description of	

書式変更: スペイン語（スペイン-モダン）

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measurement methods and procedures actually applied :	
Any comment:	Calculated as a weighted sum of the operating margin and the build margin.

Data / Parameter:	**$EF_{OM,y}$**
Data unit:	tCO_2/MWh
Description:	Emission factor of the operating margin
Source of data used:	ELEM (internal data); TPP Negotino (www.tecnegotino.com.mk and internal data); Energy Regulatory Commission of Macedonia: *Godisen izvestaj za rabota na regulatornata komisija za energetika na Republika Makedonija vo 2006 godina (Annual Report of the Energy Regulatory Commission of the Republic of Macedonia in 2006)*. Skopje: ERC, p. 26; Statistical Office of Macedonia. 2006. *Statistical Yearbook of the Republic of Macedonia 2006*. Skopje: SOM, p.462 – 463.
Value applied:	0.850
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Calculated as the Simple OM and fixed *ex-ante*.

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Data / Parameter:	**$EF_{BM,y}$**
Data unit:	tCO_2/MWh
Description:	Emission factor of the build margin
Source of data used:	ELEM (internal data)
Value applied:	1.110
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Calculated using Option 1 for BM calculation and fixed *ex-ante*.

Data / Parameter:	$F_{coal,j,y}$
Data unit:	kt
Description:	Amount of lignite consumed in year *y* by power source *j*
Source of data used:	ELEM (internal data)

Value applied:	*Year (y)\ Plant (j)*: TPP Oslomej; TPP Bitola 3; TPP Bitola 2; TPP Bitola 1
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$COEF_{coal,j}$
Data unit:	$tCO_2e/kt_{fossil\ fuel}$
Description:	CO_2 emission coefficient of lignite consumed by power source *j*
Source of data used:	IPCC 2006, v.2, p.1-18~1-24; ELEM internal data for NCV provided by the coal laboratories in Bitola and Oslomej.
Value applied:	*Year (y)\ Plant (j)*: TPP Oslomej; TPP Bitola 3; TPP Bitola 2; TPP Bitola 1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Emission coefficient for lignite. Calculated using country specific net calorific values and IPCC 2006 default values for carbon emission factor and oxidation factor of lignite.
Any comment:	

Data / Parameter:	$EF_{CO2,coal}$
Data unit:	tCO_2e/TJ
Description:	CO_2 emission factor of lignite
Source of data used:	IPCC 2006, v.2, p.1-23
Value applied:	101
Justification of the choice of data or description of measurement methods and procedures actually	Default emission factor of lignite. No local emission factor available.

applied :	
Any comment:	

Data / Parameter:	OX_{coal}
Data unit:	-
Description:	Oxidation factor of lignite
Source of data used:	IPCC 2006, v.2, p.1.23
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	NCV_{coal}
Data unit:	TJ/kt
Description:	Net calorific value of lignite
Source of data used:	ELEM, internal data provided by the coal laboratories in Bitola and Oslomej
Value applied:	*Year (y)\ Plant (j)*: TPP Oslomej; TPP Bitola 3; TPP Bitola 2; TPP Bitola 1
Justification of the choice of data or description of measurement methods and procedures actually applied :	Local net calorific value for lignite
Any comment:	

Data / Parameter:	$F_{mazutj,y}$
Data unit:	kt
Description:	Amount of heavy oil consumed in year *y* by power source *j*
Source of data used:	ELEM (internal data); TPP Negotino (www.tecnegotino.com.mk for 2004 and 2005 and internal data for 2006)

Value applied:	<table><tr><td>*Year (y)\ Plant (j)*</td></tr><tr><td>TPP Oslomej</td></tr><tr><td>TPP Bitola 3</td></tr><tr><td>TPP Bitola 2</td></tr><tr><td>TPP Bitola 1</td></tr><tr><td>TPP Negotino</td></tr></table>
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Heavy fuel oil is used as a start-up and auxiliary fuel at lignite-fired thermal power plants in Macedonia, and as a primary fuel at the Negotino Power Plant.

Data / Parameter:	$COEF_{mazut,j}$
Data unit:	$tCO_2e/kt_{fossil\ fuel}$
Description:	CO_2 emission coefficient of heavy fuel oil consumed by power source *j*
Source of data used:	IPCC 2006, v.2, p.1-18~1-24.
Value applied:	3,126.96
Justification of the choice of data or description of measurement methods and procedures actually applied :	Emission coefficient for heavy fuel oil. Calculated using IPCC 2006 default values for NCV, CO_2 emission factor and oxidation factor of heavy fuel oil. Local values not available.
Any comment:	Heavy fuel oil is used as a start-up and auxiliary fuel at lignite-fired thermal power plants in Macedonia, and as a primary fuel at the Negotino Power Plant.

Data / Parameter:	$EF_{CO2,mazut}$
Data unit:	tCO_2e/TJ
Description:	CO_2 emission factor ofheavy fuel oil
Source of data used:	IPCC 2006, v.2, p.1-23
Value applied:	77.4
Justification of the choice of data or description of measurement methods and procedures actually	Default emission factor of heavy fuel oil. No local emission factor available.

applied :	
Any comment:	Heavy fuel oil is used as a start-up and auxiliary fuel at lignite-fired thermal power plants in Macedonia, and as a primary fuel at the Negotino Power Plant.

Data / Parameter:	OX_{mazut}
Data unit:	-
Description:	Oxidation factor of heavy fuel oil
Source of data used:	IPCC 2006, v.2, p.1-23
Value applied:	1
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Heavy fuel oil is used as a start-up and auxiliary fuel at lignite-fired thermal power plants in Macedonia, and as a primary fuel at the Negotino Power Plant.

Data / Parameter:	NCV_{mazut}
Data unit:	TJ/kt
Description:	Net calorific value of heavy fuel oil
Source of data used:	IPCC 2006, v.2, p.1-18
Value applied:	40.4
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value used. No local value available.
Any comment:	Heavy fuel oil is used as a start-up and auxiliary fuel at lignite-fired thermal power plants in Macedonia, and as a primary fuel at the Negotino Power Plant.

Data / Parameter:	$GEN_{j(coal),y}$
Data unit:	GWh
Description:	Electricity generation by lignite-fired plants in year y
Source of data used:	ELEM (internal data)
Value applied:	

Year (y)\ Plant (j)
TPP Oslomej
TPP Bitola 3
TPP Bitola 2
TPP Bitola 1

Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Used for the calculation of the OM and BM.

Data / Parameter:	$GEN_{j(mazut),y}$
Data unit:	GWh
Description:	Electricity generation by Negotino Thermal Power Plant in year y
Source of data used:	TPP Negotino (internal data for 2006 and www.tecnegotino.com.mk for 2004 and 2005)
Value applied:	*Year (y)\ Plant (j)*: TPP Negotino
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Used for the calculation of the OM.

Data / Parameter:	$GEN_{j\ (hydro),\ y}$
Data unit:	GWh
Description:	Electricity generation by hydropower plants in year y
Source of data used:	ELEM (internal data)
Value applied:	*Plant Name*: HPP Vrutok; HPP Raven; HPP Vreben; HPP Tikves; HPP Spilje; HPP Globocica; HPP Kozjak

Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	$GEN_{j\,(import),y}$
Data unit:	MWh
Description:	Electricity imports to the grid
Source of data used:	Energy Regulatory Commission of Macedonia: *Godisen izvestaj za rabota na regulatornata komisija za energetika na Republika Makedonija vo 2006 godina (Annual Report of the Energy Regulatory Commission of the Republic of Macedonia in 2006).* Skopje: ERC, p. 26 (data for 2005 and 2006); Statistical Office of Macedonia. 2006. *Statistical Yearbook of the Republic of Macedonia 2006.* Skopje: SOM, p.462 – 463 (data for 2004)
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Used for the calculation of the simple OM. As all imports come from abroad, emission factor of import is considered to be 0.

Year	*Electricity import (MWh)*
2004	1,176,198
2005	1,652,704
2006	1,958,345

書式変更: スペイン語（スペイン-モダン）

B.6.3 Ex-ante calculation of emission reductions:

Baseline emissions

The baseline emission factor is calculated following the steps described in ACM0002.

STEP 1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$)

OM CEF is calculated as the Simple OM CEF. The calculations are performed *ex ante* using plant specific data for the grid connected plants[12]. The Simple OM factor is calculated for as the generation-weighted average emissions per electricity unit of all generating sources servicing the Macedonian grid,

[12] ACM0002 ver.6, Footnote 4, Option 2

not including the low cost and must-run power plants, for the most recent 3 years (2004-2006). Data for each year is provided in Annex 3.

$$EF_{OM} = \frac{\sum_{y}\sum_{i,j} F_{i,j,y} \times COEF_{i,j,y}}{\sum_{y}\sum_{j} GEN_{j,y}}$$

$$= \frac{\sum_{y}(\sum_{j} F_{coal,j,y} \times COEF_{coal,j} + \sum_{j} F_{mazut,j,y} \times COEF_{mazut,j,y})}{\sum_{y}(\sum_{j} GEN_{j(coal),y} + \sum_{j} GEN_{j(mazut),y} + \sum_{j} GEN_{j(import),y})}$$

$$EF_{OM} = 0.850 tCO_2 / MWh$$

Based on the above calculations, the Simple OM is estimated to be ***0.850 tCO_2e/MWh***.

削除: 2

STEP 2. Calculate the Build Margin emission factor *($EF_{BM,y}$)*

The Build Margin emission factor *($EF_{BM,y}$)* is estimated *ex-ante*, based on the generation data for 2006 for the five most recently built power plants in Macedonia. These plants constitute 76% of the total generation in Macedonia, which is more that 20% required in ACM0002. Data for the Build Margin calculation is presented in the table below.

Power plant name	Type of fuel	Share in total power generation (%)	Year of commissioning
HPP Kozjak	-	2.8	2004
TPP Oslomej	coal	5.6	1989
TPP Bitola 3	coal	21.7	1988
TPP Bitola 2	coal	22.9	1984
TPP Bitola 1	coal	23.0	1982

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,2006} \times COEF_{i,m}}{\sum_{m} GEN_{m}}$$

$$EF_{BM} = 1.110 tCO_2e / MWh$$

The Build Margin emission factor is estimated to be ***1.110 tCO_2e/MWh***.

STEP 3. Calculate the baseline emission factor *EF_y*

$$EF_y = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y}$$
$$EF_y = 0.5 \times 0.850 tCO_2 / MWh + 0.5 \times 1.110 tCO_2 / MWh$$
$$EF_y = 0.980 tCO_2 / MWh$$

Therefore the carbon emission factor of the Macedonian grid is estimated to be ***0.980tCO₂/MWh***.

削除: *1*

Based on the above results, baseline emissions are calculated as shown below:

$$BE_y = (EG_y - EG_{baseline}) \times EF_y$$
$$BE_y = (1{,}325{,}887 MWh - 1{,}121{,}680 MWh) \times 0.980 tCO_2 e / MWh$$
$$BE_y = 200{,}132 tCO_2 e$$

Leakage

The Project will result into no leakage.

$L_y = 0$

Project emissions

The Project will result into no project emissions, as the Project does not involve construction of a new reservoir.

$P_y = 0$

Emission reductions

Emission reductions are calculated with the following formula:

$$ER_y = BE_y - PE_y - L_y$$
$$ER_y = 200{,}132 tCO_2 - 0 tCO_2 - 0 tCO_2$$
$$ER_y = 200{,}132 tCO_2$$

B.6.4 Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emissions (tons of CO_2e)	Estimation of baseline emissions (tons of CO_2e)	Estimation of leakage (tons of CO_2e)	Emission Reductions (tCO_2e)
Year 1	0	200,132	0	200,132
Year 2	0	200,132	0	200,132
Year 3	0	200,132	0	200,132
Year 4	0	200,132	0	200,132

削除: 2007
削除: 334
削除: 200,334
削除: 2008
削除: 334
削除: 200,334
削除: 2009
削除: 334
削除: 200,334
削除: 2010
削除: 334
削除: 200,334

Year 5	0	200,132	0	200,132
Year 6	0	200,132	0	200,132
Year 7	0	200,132	0	200,132
Total (tons of CO_2)	**0**	**1,400,924**	**0**	**1,400,924**

削除: 2011
削除: 334
削除: 200,334
削除: 2012
削除: 334
削除: 200,334
削除: 2013
削除: 334
削除: 200,334
削除: 2,338
削除: 1,402,338

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Net amount of electricity supplied to the grid by the project plants
Source of data to be used:	ELEM
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,325,887
Description of measurement methods and procedures to be applied:	Calculated as the difference between electricity supplied to the grid by project plants ($EG_{export,y}$) and import of electricity from the grid for in-house consumption ($EG_{import,y}$) in year y. $$EG_y = EG_{export,y} - EG_{import,y}$$
QA/QC procedures to be applied:	Crosschecked with electricity sale receipts.
Any comment:	Under the existing arrangements between ELEM and the transmission and distribution companies, ELEM gets paid only for the net electricity exported to the grid. This requires constant monitoring of electricity imports and exports.

Data / Parameter:	**$EG_{export,y}$**
Data unit:	MWh
Description:	Electricity exported to the grid by the Project plants in year y
Source of data to be used:	ELEM
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1,325,887
Description of measurement methods and procedures to be applied:	The data will be directly monitored at each plant.

QA/QC procedures to be applied:	Crosschecked with electricity sales receipts.
Any comment:	The data will be monitored by electric meters.

Data / Parameter:	**$EG_{import,y}$**
Data unit:	MWh
Description:	Import of electricty from the grid.
Source of data to be used:	ELEM
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	The data will be directly monitored at each plant.
QA/QC procedures to be applied:	Crosschecked with sales receipts.
Any comment:	The data will be monitored by electric meters.

B.7.2 Description of the monitoring plan:

Management Structure of CDM in ELEM

In order to meet the CDM monitoring and reporting requirements outlined above, ELEM will appoint CDM Coordinators at each plant reporting directly to the plant's manager. All the data will be stored in the central data base and managed by a CDM Central Coordinator in the Investment and Development Department. The coordinator will supervise the following activities:

- Data collection and instrument calibration by ELEM's Technical department;
- Consolidation of results from various plants on a monthly basis by the ELEM's Production Department; and
- Preparation of emission reduction and monitoring reports for the purpose of verification by ELEM's Investment and Development Department.

The CDM Central Coordinator will also be responsible to ensure that data has been collected as per the requirements of this PDD and contains no errors.

Monitoring equipment and quality control

Experts using standard methods will install all monitoring equipment. Once installed, this equipment will be calibrated to the highest international standards and regularly maintained by the Project Staff. ISO 9001 and ISO 14001 are adopted by ELEM and will guarantee precision of monitoring. Any irregularities

or problems with the equipment will be reported to the Technical Department and rectified as soon as possible.

ELEM will train the power plant personnel to operate the equipment and to record all the data necessary for monitoring the Project activity as specified in the monitoring plan. This data will be directly used for calculation of project emissions. Measurement records, and other records will be used to ensure consistency.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

The application of the baseline and monitoring methodology was completed on 10/09/2007.

Name of person/entity determining the baseline:
Clean Energy Finance Committee
Mitsubishi UFJ Securities Co. Ltd.
Tokyo, Japan
Email: arnaoudov-vladislav@sc.mufg.jp
Tel: (81-3) 6213-6382
Fax: (81-3) 6213-6175

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

08/01/2001

C.1.2. Expected operational lifetime of the project activity:

40 years

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

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

15/05/2008

削除: 0/03

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

Not applicable.

C.2.2.1. Starting date:

>>

C.2.2.2. Length:

>>

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

In accordance with art. 24 of the Law on Environment of Macedonia, hydropower rehabilitation projects are not required to prepare an environment impact assessment study, but only short reports on the environmental impact. ELEM prepared reports on the environmental impact of each of the plants covered by the project and submitted them for review to the Directorate of Environment to the Ministry of Environment and Physical Planning. The reports were approved on September 6, 2007.

The Project has significant environmental benefits. It is expected to improve the efficiency of the Macedonian power system, decrease the combustion of lignite and heavy fuel oil (the main fuels in Macedonia), increase the hydropower production capacity and therefore lower CO_2 and SO_x emissions.

The Project does not involve any civil works, and does not lead to any air pollution. Noise pollution is negligible and within the internationally accepted standards. All old equipment replaced as part of the Project consists of non-toxic and non-radioactive metals, mainly steel and pig iron, and is recycled in accordance with the Macedonian national requirements. Old lubricants are recycled by the special facility adjacent to TPP Negotino.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Environmental impacts are not considered significant.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

The Stakeholders' consultation was conducted in the period for May 14th to June 13th, 2007 and included:

1) Internet-based public consultation on ELEM's website
2) Consultation through the bulletin boards of the seven municipalities located closest to the Project sites.

As part of the Internet-based consultation, Project description was posted on ELEM's website (www.elem.com.mk) in English and Macedonian, and stakeholders were invited to submit their comments by e-mail, fax or ordinary mail. (Please refer to figure E-1.) The text of the public information is provided in Appendix 2.

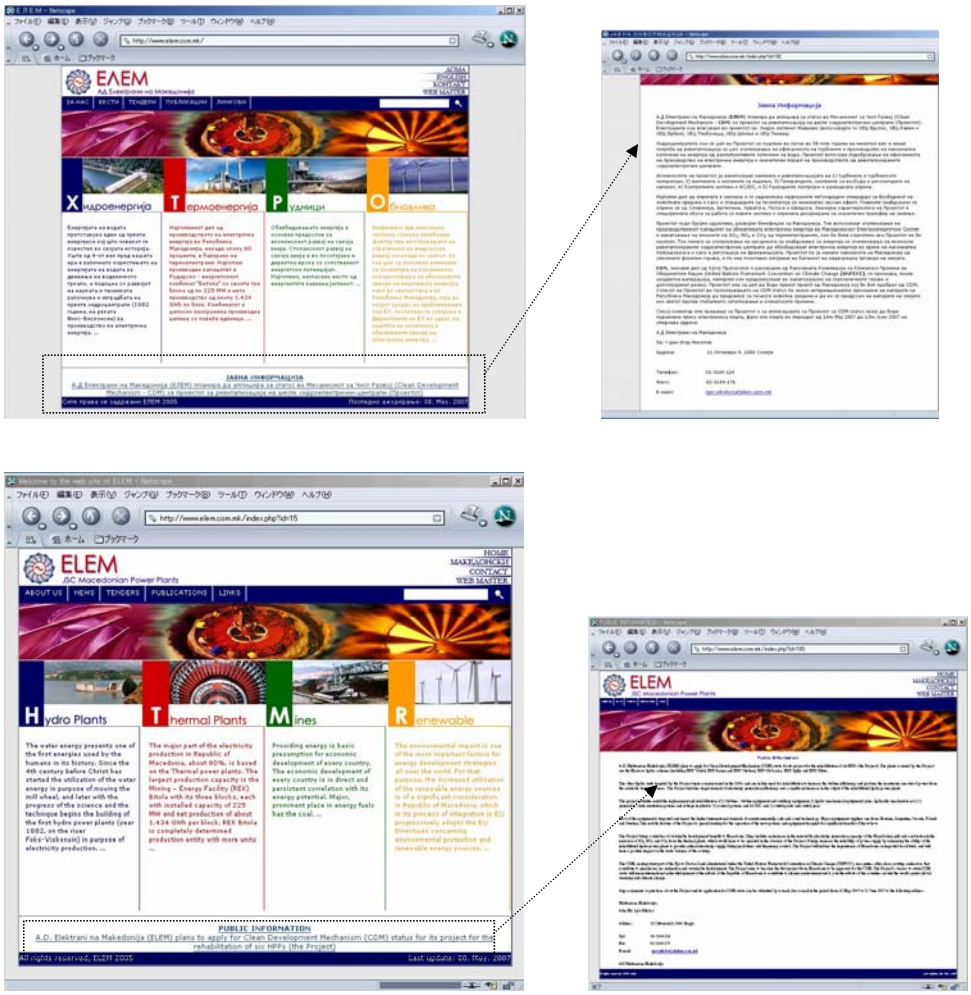

Figure E-1 Internet Announcement

In order to guarantee that the participation in the public consultation of residents in the areas that are closest to the project sites, the same project information was posted on the bulletin boards in the municipal offices of the following municipalities located closest to the Project sites:

1.Centar Zupa
2.Debar
3.Gostivar
4.Mavrovo i Rostuse
5.Struga
6.Vrapciste
7.Kavadarci

Announcements through the municipal office notice board are the traditional way for providing public information to local residents in the mountainous regions where the Project sites are located. As the seven closest municipalities have a diverse ethnic background, the public information was provided in Macedonian, and in Albanian where it has the status of a second official regional language. Photographs of the posted announcements are provided in figures E-2 to E-8 below. The stakeholders could send their comments through e-mail, fax or mail in the period May 14th, 2007 – June 13th, 2007.

Figure E-2 Centar Zupa

Figure E-3 Debar

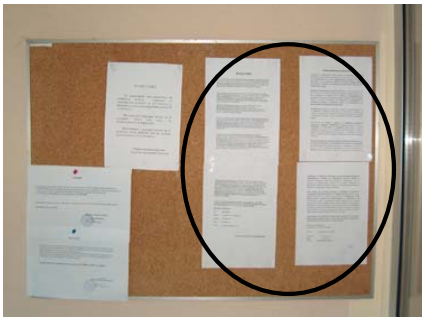

Figure E-4 Gostivar

Figure E-5 Mavrovo i Rostusa

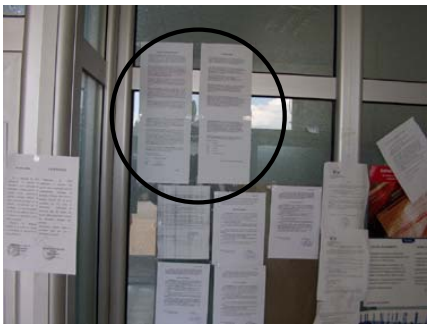

Figure E-6 Struga

Figure E-7 Vrapciste

Figure E-8 Kavadarci

E.2. Summary of the comments received:

Three comments were received during the stakeholders' consultation. The comments were positive and supported ELEM's initiative to implement environmentally friendly projects. The comments are summarized below:

1) The Project supports the integration of Macedonia with the EU and international community. Macedonia should be involved in more similar activities.
2) Further information was required regarding the exact contribution of the Project to the improvement of environmental quality, as well as about the overall effect of greenhouse gases.
3) One participant expressed his support to the fact that implementation of the Project promotes ethnical and age diversity.

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

Detailed answers were sent to the participants who have put up questions during the stakeholders' consultation. No requests for further clarifications were received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Elektrani na Makedonija (ELEM)
Street/P.O.Box:	11. Oktomvri, 9
Building:	
City:	Skopje
State/Region:	
Postfix/ZIP:	1000
Country:	Republic of Macedonia
Telephone:	+389-2-3149-114
FAX:	+389-2-3149-176
E-Mail:	igor.nikolov@elem.com.mk
URL:	www.elem.com.mk
Represented by:	
Title:	Responsible for renewable energy
Salutation:	Mr.
Last Name:	Nikolov
Middle Name:	
First Name:	Igor
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Mitsubishi UFJ Securities Co., Ltd.
Street/P.O.Box:	2-4-1 Marunouchi, Chiyoda-ku
Building:	26th Floor, Marunouchi Building
City:	Tokyo
State/Region:	
Postfix/ZIP:	100-6317
Country:	JAPAN
Telephone:	+81-3-6213-6382
FAX:	+81-3-6213-6175
E-Mail:	arnaoudov-vladislav@sc.mufg.jp
URL:	www.sc.mufg.jp
Represented by:	
Title:	CDM/JI Consultant
Salutation:	Mr.
Last Name:	Arnaoudov
Middle Name:	
First Name:	Vladislav
Department:	Clean Energy Finance Committee

Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The Project does not involve public funding and does not result into diversion of ODA.

Annex 3

BASELINE INFORMATION

1. Historic electricity generation by the power plants[13,14]

Year	Vrutok (GWh)	Raven (GWh)	Vreben (GWh)	Globocica (GWh)	Tikves (GWh)	Spilje (GWh)	Total (GWh)
1996	425.4	49.9	45.5	229.6	180.3	352.9	1,283.6
1997	378.8	44.3	37.1	191.6	140.7	297.6	1,090.1
1998	264.9	31.1	40.4	182.0	153.3	283.9	955.6
1999	421.7	50.3	40.3	225.0	161.6	332.4	1,231.3
2000	376.8	43.2	31.4	178.2	128.3	289.9	1,047.8
Average historical	*373.5*	*43.8*	*38.9*	*201.3*	*152.8*	*311.3*	*1,121.7*
2006	**422.9**	**48.3**	**34.4**	**231.9**	**226.7**	**362.2**	**1,325.9**

2. Data for the operating margin calculation.

Year 2004

Power plant type
TPP Oslomej
TPP Bitola 3
TPP Bitola 2
TPP Bitola 1
TPP Negotino
HPP Vrutok
HPP Raven
HPP Vreben
HPP Tikves
HPP Spilje
HPP Globocica
HPP Kozjak
Import

Year 2005

Power plant type
TPP Oslomej
TPP Bitola 3
TPP Bitola 2
TPP Bitola 1

[13] Electric Power Company of Macedonia. 2003. *Annual Report 2003*. Skopje: ESM, p.16 (data for 1996 - 2000)
[14] ELEM internal data (2006)

TPP Negotino
HPP Vrutok
HPP Raven
HPP Vreben
HPP Tikves
HPP Spilje
HPP Globocica
HPP Kozjak
Import

Year 2006

Power plant type
TPP Oslomej
TPP Bitola 3
TPP Bitola 2
TPP Bitola 1
TPP Negotino
HPP Vrutok
HPP Raven
HPP Vreben
HPP Tikves
HPP Spilje
HPP Globocica
HPP Kozjak
Import

3. Data for the Build margin calculation[15].

Year 2006

Power plant name	Type of fuel	Share in total power generation (%)	Year of commissioning
HPP Kozjak	-	2.8%	2004
TPP Oslomej	coal	5.6%	1989
TPP Bitola 3	coal	21.7%	1988
TPP Bitola 2	coal	22.9%	1984
TPP Bitola 1	coal	23.0%	1982

[15] ELEM internal data

4. Share of Low cost/Must Run generation in total power generation in the period (2002-2006)

Year	2002	2003	2004	2005	2006
Share of Hydropower Generation (%)	13.4%	21.8%	21.9%	21.2%	23.5%

Annex 4

MONITORING INFORMATION

No additional monitoring information is included in this section.

Appendix 1.

Evidence that Project has seriously considered the incentives from the CDM prior to the start of Project construction.

The management of ESM was aware of the financial benefits of the CDM and seriously intended to incorporate them in the overall project financing prior to the start of the Project construction. The official views of the company are presented in the slides attached below (see Figure AN-1), which are part of a presentation made in July 1999 by the ESM management during a visit to the UK National Grid. Due to the reform in ESM leading to the establishment of four completely new companies (ESM, ELEM, MEPSO and TEC Negotino), the reallocation of the headquarters and privatization of ESM Distribucija and the associated restructuring of the archives of the ESM that took place in the period 2004-2005, minutes of meeting and the other official documents related to the decision to proceed with the Kyoto Protocol flexible mechanisms prior to the start of Project could not be located. However, the attached document in Figure AN-1 is considered to completely reflect the views of the management of the company at that time, as this is a document especially prepared for international partners of ESM.

The presentation[16] provides a brief introduction of the overall activities of ESM as well as the investment projects in the area of transmission and generation considered during that period. The Kyoto Protocol Mechanisms are identified as one of the potential sources of project financing for the Project as well as for other power generation projects in the country.

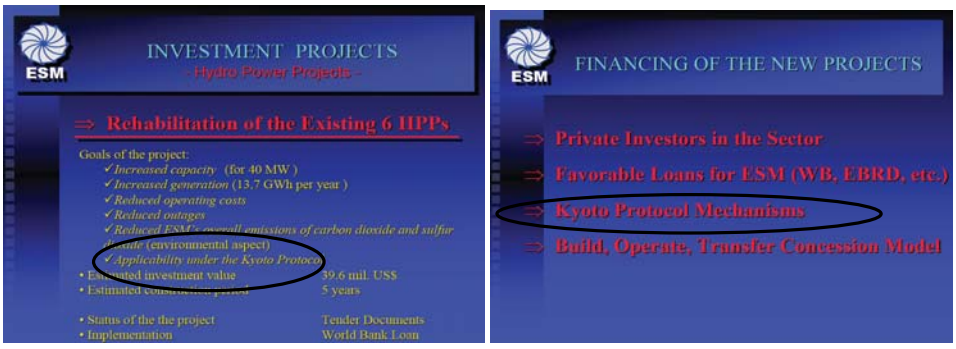

Figure AN-1

Thanks to the efforts and vision of the ESM management, Macedonia had the potential of becoming one of the first countries hosting CDM projects, if it had not been for the political turmoil that significantly delayed the registration of the Project. However, promotion of the CDM has continued during the following years and presentations emphasising the possibility for applying for CDM assistance were

[16] The complete text presentation is provided to the validator, but as it contains company sensitive information, only the relevant slides are attached to the PDD.

made at a number of conferences as exemplified in the slide from a presentation made at a UNIDO organized CDM seminar in Vienna organized in October 2004. (See figure AN-2)

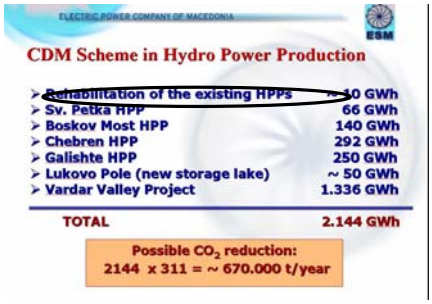

Figure AN-2

It is expected that the registration of the Project as a CDM activity will have an important capacity building role in the country and will become recognition of the efforts of Macedonia to join the international efforts to combat climate change.

Appendix 2.

Text of the Public Consultation Document

Public Information

Elektrani na Makedonija (ELEM) plans to apply for Clean Development Mechanism (CDM) status for its project for the rehabilitation of six HPPs (the Project). The plants covered by the Project are the Mavrovo hydro scheme (including HPP Vrutok, HPP Raven and HPP Vreben), HPP Globocica, HPP Spilje and HPP Tikves.

The oldest hydro units targeted by the Project were commissioned in the 1950s and are in dire need for rehabilitation to increase the turbine efficiency and produce the maximum amount of power from the available water resources. The Project involves improvement of electricity generation efficiency and a significant increase in the output of the rehabilitated hydropower plants.

The project activities entail the replacement and rehabilitation of 1) turbines and turbine generators, 2) valves and cooling systems, 3) generators, static extension systems and voltage regulators, 4) control systems and AC/DC, and 5) switch yards and switch gear.

Most of the equipment is imported and meets the highest international standards for environmentally safe and sound technology. Major equipment suppliers are from Slovenia, Argentina, Croatia, Poland and Sweden. One notable feature of the Project is special training for the operation of the new systems and equipment designed for significant transfer of know-how.

The Project brings a number of sustainable development benefits to Macedonia. They include an increase in the renewable electricity generation capacity of the Macedonian grid and a reduction in the emission of SO_2, NO_x and CO_2 from the thermal plants, which would have to be operated in the absence of the Project. It helps increase the reliability of power supply by enhancing the ability of the rehabilitated hydropower plants to provide critical electricity supply during peak times and frequency control. The Project reduces the dependence of Macedonia on imported fossil fuels, and has a positive impact on the trade balance of the country.

The CDM, an important part of the Kyoto Protocol and administered under the United Nations Framework Convention on Climate Change (UNFCCC), recognizes, after close scrutiny, endeavors that contribute to greenhouse gas mitigation and sustainable development. The Project aims to become the first project from Macedonia to be approved for the CDM. The Project's success to attain CDM status will mean international acknowledgement of the efforts of the Republic of Macedonia to contribute to cleaner environment and to join the efforts of the countries around the world against global warming and climate change.

Any comments or questions about the Project and its application for CDM status can be submitted by e-mail, fax or mail in the period from 09 May 2007 to 08 June 2007 to the following address:

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Attn: Igor Nikolov

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ELEM