JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE PROJECTS
Version 01.1 - in effect as of: 27 October 2006

CONTENTS

SECTION A. General description of the small-scale project

A.1. Title of the small-scale project:

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Project title: Small Hydropower Station SHPS „Potochnitsa"
Version: 6.0
Date: 06/02/2008

A.2. Description of the small-scale project:

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The proposed project for a Small Hydro-power station SHPS „Potochnitsa" (called SHPS „Potochnitsa" or the Project further herein) is implemented by the company FINAUTO LTD. - Sofia.

The Project contemplates the construction of a small run-of-the-river power station. Due to its proximity to Stouden Kladenets Dam, about 3,5km, it will operate in a mode subordinate to HPS Stouden Kladenets built on the dam. SHPS „Potochnitsa" will operate in compliance with the dispatch schedule of the Electric Power System (EPS) dam discharge and processing of waters passing through it for generation of electric power.

A.2.1 Water Economy Analysis

Currently, the developed discharge of Stouden Kladenets SHPS is 120m^3/s. Dam waters are processed through four 30m^3/s Francis turbines. The following conclusions can be drawn from the existing data bases on dam discharges and water volumes processed through Stouden Kladenets HPS from its commissioning in 1958 till the beginning of 2006:

- The mean annual volumes run through for the whole period of operation of Stouden Kladenets HPS were1372.0 x 10^6 m^3/year;
- The mean annual volumes of ecological water continuously released into the river bed downstream of the dam constitute 0,93% of the afflux thereby creating a very good environment for the ecosystems downstream of the dam;
- At the same time, the mean annual volumes let through the sluice over that period are 116.$10^6$$m^3$, without their utilization for power generation which shows that the development of Stouden Kladenets HPS has proven lower than the optimal possibilities of the river in that sector;

In addition to operating in the subordinate mode following the operation of Stouden Kladenets HPS, the Project will process water from r. Krumovitsa with place of confluence about 2km upstream of the weir of the prospective power station. A hydrology study report was developed on the mouth of r. Krumovitsa establishing the hydrological parameters of the river as well as the flood discharges and water volumes that are to pass through SHPS „Potochnitsa"[1].

A.2.2 Determining the Development of SHPS „Potochnitsa"

A water economy analysis was prepared in order to determine the development of the Project taking into account the initial conditions described above.

[1]Feasibility study of SHPS "Potochnitsa" Project

Initially, the so-called "balance method" was applied to the analysis, where the afflux from Stouden Kladenets HPS was integrated with that of the river Krumovitsa and, on that basis, an averaged permanence curve of discharge upstream of the weir of SHPS „Potochnitsa" was elaborated.

It was found out, however, that the operation schedule of Stouden Kladenets HPS was variable and unpredictable in time, depending solely on the operation of the EPS that, in its turn, was controlled by the Central Dispatching Unit of NEK who quite frequently varied the operating parameters of the hydro-power cascade. With a view to the above said, the following development plan is adopted:

- For the water passing through the dam – the same development in relation to discharge as that at Stouden Kladenets HPS;
- For the water from r. Krumovitsa – development based on the standard water-economy analysis.

Currently, a project is starting for extension of Stouden Kladenets HPS with installation of an additional 5 hydropower unit with 16MW rated capacity. That reconstruction will permit an increase of the developed discharge from 120m^3/s to 160m^3/s, so that the overflow water volumes can be accommodated.

The water economy study of r. Krumovitsa came to the conclusion that the optimal development of the river water would be 10m^3/s.

In conclusion, as a result of the studies carried out it was finally decided that the developed discharge of HPS Potochnitsa should be 170m^3/s, as a sum of the developed discharge from Stouden Kladenets HPS - 160m^3/s and the optimal development of the water from r. Krumovitsa – 10m^3/s [2].

A.2.3 Description of the Project Activities[2]

The design developed discharge 170m^3/s was confirmed by Water Use Permit No. 301074/24.10.2005 issued by the Basin Directorate of the East Aegean Region (BDEAR) with headquarters in Plovdiv, within the Ministry of Environment and Water (MoEW). FINAUTO applied for amendment of Water Use Permit due to alteration in final project technical design. Amendment of Water Use Permit No. 301074/27.06.2007 is issued by BDEAR, with the same water discharge characteristics but it is envisage the final project design. On the basis of the Amendment Water Use Permit the total installed capacity of SHPS „Potochnitsa" - 9,38MW, was determined.

The total storage reservoir of the Project will be 1'640'000m^3, and the ponded areas will be 53'000m^2. Thus, the estimated energy density of the hydropower project will be equivalent to 176,98W/m^2.

The purpose of the Project is to utilize, as far as possible, the existing hydrological resources between the two existing large integrated hydropower works consisting of dams with hydropower stations, for electricity generation. The Project is intended to produce about 27,301GWh/a electric power per annum[3].

Besides, the Project will generate emission reduction units (ERU) as a Joint Implementation Project. That will be realized because, during operation of the hydropower station, primarily in a mode of parallel operation of Dolna Arda Hydro-Power Cascade, part of marginal coal-fired power units electricity generation in the EPS will be replaced. It is expected that the annual average reduction of GHG emissions from EPS calculated as ERU's, will be 23'522÷23'970 tCO_2 per annum.

[2] Feasibility study of SHPS "Potochnitsa"- Application 1: Water Economy Analysis;
[3] Final Technical Specification of SHPS "Potochnitsa" Project

A.2.4 Economic and Environmental Benefits from performance of the Project as a Contribution to the Local Sustainable Development

The implementation of the SHPS Potochnitsa Project will help to achieve economic and environmental benefits to the Haskovo District and will contribute to the local sustainable development of the region as a renewable energy source (RES). The following arguments can be cites as specific benefits to the sustainable development:

- Utilize, as fully as possible, the available hydrological resources for production of electric power from RES, thus creating conditions for sustainable development and sustainable power generation;
- Improve the investment opportunities in a definitely poor farming region, thus improving the local economy;
- Diversify and improve the mix of generating capacities, and more particularly, those of RES utilizing capacities that are capable of meeting the steadily growing energy demand in the country, and thence, reduce the dependence on coal-fired capacities;
- Reduce pollution with noxious gases and dust (SO_2, NO_x, TSP), including greenhouse gases resulting from combustion of coal for power generation through their replacement by electricity supply from RES;
- Increase the opportunities for reduction of unemployment in the region by employment of about 100 workers during the construction phase, and about 20 employees during the operation of the SHPS;
- Part of the equipment and all building materials for the needs of the site will be produced in this country, thus assisting the sustainable development of local economy.

A.3. Project participants:
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Table No. 1

Name of Party involved	Private and/or public entity(ies) project participants	Does the party involved wish to be considered as project participant
Republic of Bulgaria (Host Party)	Project proponent: FINAUTO LTD.	Yes
Republic of France	Project EPC contractor and equipment supplier: MECAMIDI	No
Kingdom of Denmark	ERUs buyer: Danish Carbon	No

A.4. Technical description of the small-scale project:

A.4.1. Location of the small-scale project:
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A.4.1.1. Host Party(ies):
>>
Republic of Bulgaria

A.4.1.2. Region/State/Province etc.:
>>
Haskovo District

A.4.1.3. City/Town/Community etc.:
>>
Village of Dolno Cherkovishte, Stambolovo Municipality

A.4.1.4. Detail of physical location, including information allowing the unique identification of the small-scale project:
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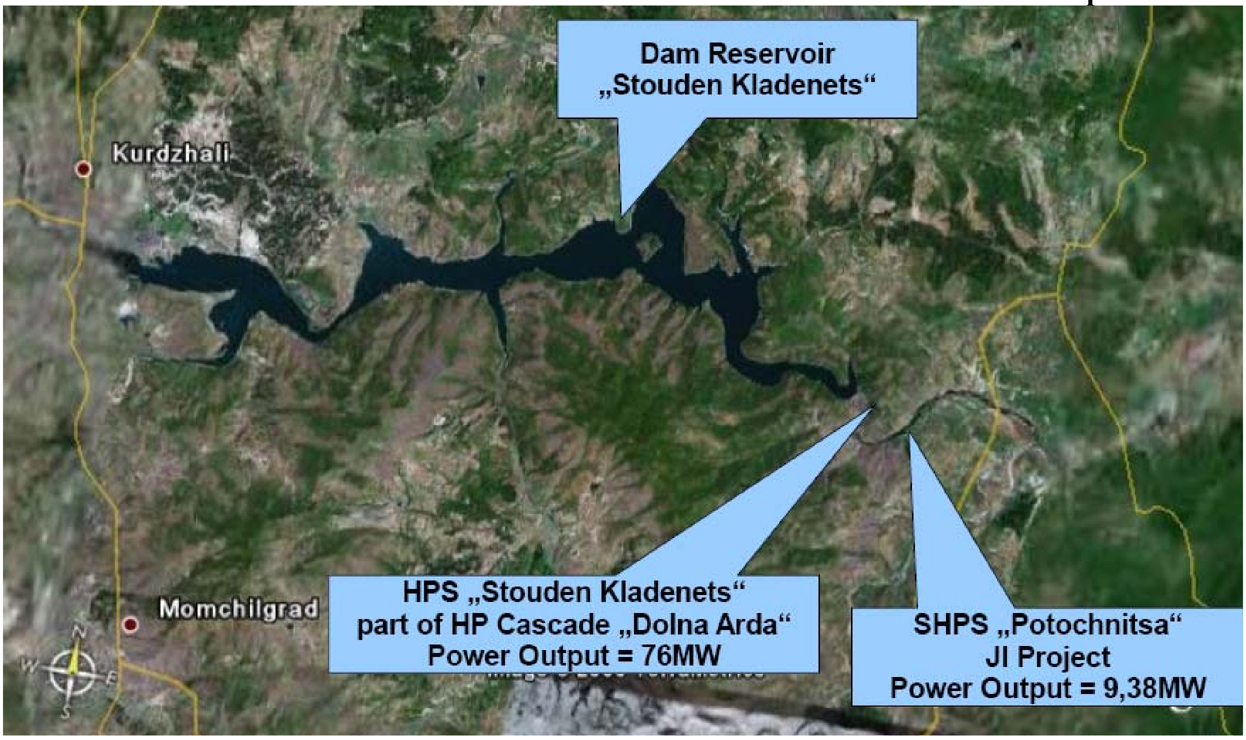
The coordinates of the prospective small-scale Project site are:

- Longitude 23^0 39’ 53,05”E;
- Latitude 41^0 36’ 45,93”N.

SHPS „Potochnitsa” will be located 3,5km away downstream of Stouden Kladenets HPS along the course of the river of Arda and 2km downstream of the mouth of r. Krumovitsa. The Project will be implemented on a site on the territory of the village of Dolno Cherkovishte and is situated 350m away from the bridge across the river of the road Krumovgrad - Tunkovo.

The location of SHPS "Potochnitsa" is presented in Map No. 1

Map No. 1



A.4.2. Small-scale project type(s) and category(ies):

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The Joint Implementation Supervisory Committee (JISC) developed, provisions for small-scale (SSC) projects as defined in paragraph 6 (c) of decision 17/CP.7, as appropriate.

In accordance with paragraph 2 (f) of decision 10/CMP.1, referring to paragraph 6 (c) of decision 17/CP.7[4], three types of JI SSC projects are defined. Type I JI SSC projects refer to "Renewable energy projects with a maximum output capacity equivalent of up to 15 megawatts (MW) (or an appropriate equivalent)". JI SSC projects have to conform to one of the SSC project categories approved by the Executive Board of the CDM7 or an additional SSC project category approved by the JISC.

According to the categorization of the above provisions the Project type and category are as follows:

Type I: Renewable energy project with maximum output capacity of 9,38MW
Category I.D: Power generation for EPS by RES
Subcategory: Hydropower[5]

The Project consists of a small hydropower station with 2 (two) hydro-power units with Kaplan type turbines and hydro-generators, and 4,69MW capacity of each unit. The total installed capacity of SHPS „Potochnitsa" is 9,38MW which is less than the restrictive capacity 15MW of small-scale JI project activities. The power is generated by water which is a renewable energy source and the production is free of greenhouse gases. The generated electric power will be delivered to the transmission network of the country.

[4] JI Guidelines: http://ji.unfccc.int/CritBasMon ; http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf
[5] http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

A.4.3. Technology(ies) to be employed, or measures, operations or actions to be implemented by the small-scale project:

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A.4.3.1 Project Layout and Physical Boundaries

SHPS Potochnitsa was designed in conformity with the classical dam plan using the pressure head created by the river barrage for power generation. The Project diagram is compact and includes the following main facilities:

- Overflow dam with segment gates to maintain an upstream at the elevation 151,80 m;
- Station building with turbines situated coaxially with the overflow dam;
- Auxiliary dams at different places to protect the land regarding the upstream level;
- Stilling basin downstream of the power station and the overflow bays;
- Guiding walls downstream of the stilling basin;
- Administrative building;
- Fish pass to protect environment, with fish scale, hurtle down flow, in-draft flow for a ecological minimum flow of 5,6 m^3/s
- Electrics and automation (transformers, outdoor switchyard (OS) 20kV, auxiliary electrical installation, earthing and automatics)

A.4.3.2 Substantiation and technical parameters of the main hydro-power facilities [3]

1.) Dam.

According to the topology and the geology, it was designed a weight dam. This dam is completed by 3 segment gates width 14m height 6,2m, with on the upper a regulation flap height 1,6m. Each gate evacuates 870 m^3/s and for a total of water evacuated of 2'610 m^3/s which corresponds to a millenary flood. This value is particularly conservative to protect the site against the flooding, normally in Europe for such construction. The reference flow to evacuate is more or less in reference with a 2 or 3 centuries flood and not millenary. The three regulation flaps (one per gate) permit to evacuate instantly the additional flow in case of emergency stop due for example to a break on the grid. These flaps are sized to evacuate 180 m^3/s in a short time.

2.) Auxiliary dams

The dam at the level 151,80m creates a small lake which fulfills the river bed. In some places, it is necessary to provide small dams since 1,5 m up to 3 m to protect the land against the flood. These different dams are designed as weight dams

3.) Fish pass

To preserve the environment system of the river, a system of fish pass is provided with three components:

- A fish scale witch permits to the fishes to go upstream the river with a flow of 0,5 m^3/s
- A penstock to create an in-draft flow to attract the fishes with a flow of 2 m^3/s
- An hurtle down flow of 3,1 m^3/s to permit to young fishes to go downstream avoiding the turbine flow

4.) Building power house

The power house is built on the left bank which is the natural bed of the river. By this way, the hydraulic flow is favored increasing the efficiency and minimizing the consequence on the natural flowing of the river. A particular attention will be required to provide architecture in accordance with the local uses.

5.) Intakes facilities

There is a grid at the intake to protect the turbines against heavy materials with a space between bars of 7 cm. An automatic trash rack installed above permits to clean the grid. A set of insulation gates permits to isolate the turbines for repairs and maintenance.

6.) Two Kaplan double regulation Groups

After studies of different variants and due to the particular regime of this power plant, we decided to equip a flow of 170 m^3/s. The power plant is situated just after a big dam and a power plant called Student Kladenetz. As this power plant is a peak power plant, it is necessary to be available to accept the total flow of this power plant which is, including the ecologic flow, about 160 m^3/s plus an additional river Krumitza situated between Studen Kladenetz dam and the power plant for a total flow of 170 m^3/s.

According to the geological survey, on the left bank, there is a thick layer of alluvial deposit (between 8 up to 10m) which obliges to dig deeply in any case to base hydraulic constructions. In these conditions, it is more economical to install two bigger and deeper turbines instead of three smaller turbines.

Due to the regulation operated by the big power plant upstream which is a peak power plant, there is no problem to operate the minimal flow with these turbines.

6.1) Turbines characteristics, (type: KDRLB3800)

- Number of group - 2
- Net head - 7 meters
- Flow per turbine - 85 m^3/s
- Minimal flow per turbine - 17 m^3/s
- Apparent power at the shaft - 5193 kW
- Electrical power at the generator - 4690 kW
- Total installed power - 9380 kW

By means of a gearbox (rpm accelerator), located between the turbine and the generator, the rotation speed of the turbine impeller is transformed into higher synchronized rotation speed of the generator shaft.

6.2) Hydro-generators, (type: LSA58US55-8P)

The hydro-generators are synchronized, 3-phase, brushless, for horizontal mounting and has the following technical data:

- Voltage – 690V
- Frequency – 50Hz;
- Rated rotation speed – 750rpm;
- Apparent ostensibly power – 5770kVA;
- Rated power – 4690kW;
- Protection – IP23;
- Isolation class – F.

The hydro-generators are fitted with integrated excitation controlled by an electronic card supplied with the process control computer, capable of monitoring the operating voltage and regulation of cosφ. The generator protection is of the digital relay type. The components of medium tension are designed as ABB or SCHNEIDER equipment. Process automation at the SHPS is provided by 3 double-faced control boards. The control and command is based on three PLC SIEMENS S7-300, one per group and one for auxiliaries.

One of the boards controls the operating parameters of the individual facilities. The other two boards control the operating parameters of the individual hydropower units. A common process-control computer controls the station operation.

The local and remote control is assumed by industrial PC Window XP system with touch screen to operate into the power plant with the best efficiency.

It is possible also with password to visualize and operate in remote mode the power plant through Internet network from any place.

For the electrical part, it is a modern system with all components in accordance with European standards according to IEC standard.[3]

A.4.3.3 Choise of main equipment, project design and turbine manufacture

1.) EPC contractor of the project is the company MECAMIDI. The detailed project design is also carry out of the same firm. Since the beginning of there activities MECAMIDI has been turbine manufacture. Nowadays the French company has been developing more extensively entire hydroelectric power stations from 200kW up to 100MW. By this means MECAMIDI has become one of global leaders in this range of hydropower facilities with more than 500 HPS installed around the world. Please see the company web site for more reference: < http://www.mecamidi.com/ >

2.) Kaplan type turbines are not manufacture in the host country. Thus, they are few examples in the country for application of this technology and all of these HPS are situated after dam reservoirs. These HPS are fitted with Kaplan turbines from abroad and all are imported from the former Soviet Union and the former Czechoslovakia.

3.) The Kaplan turbines of MECAMIDI are in compliance with all international standards of International Elecrtrotechnique Commission (IEC) concerning manufacture, testing and control systems equipment of Kaplan turbines.
The list of applicable IEC standards are submitted with the PDD and are shown on file
< Standard reference hydro-turbines MECAMIDI.pdf >

4.) The project technology utilize Kaplan type water turbine. There are no other suitable hydropower turbines for run-of-the-river low falls except this type of turbine.

5.) Pelton and Francis type water turbines are the other well develop hydro turbines, but they are not applicable for this project, because of the required water falls for there application which is higher than 10 meters.

6.) The Kaplan turbines are fitted for low falls, from 1.30 m to 30 m of fall height. The entry of water could be regulated by mobile blades of the distributor placed upstream of the wheel of the turbine, and by the pales which angle is modified by a mechanism inside the shaft.

7.) Therefore Kaplan turbines are the only one type of hydro-turbine suitable for this project and could not be substituted by other new technology based on primary hydro energy sources within the project period.

[3]Final Technical Specification of SHPS “Potochnitsa” Project

A.4.4. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed small-scale project, including why the emission reductions would not occur in the absence of the proposed small-scale project, taking into account national and/or sectoral policies and circumstances:

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The proposed small-scale project for construction of SHPS „Potochnitsa" will generate approximately 27,301GWh/a[3] electric power per year using the hydropower potential of the river of Arda.

The power generated by the Project will be supplied to the national power system, and in that manner it will contribute directly to reduction of the output of marginal coal-fired power units in the EPS. Therefore, with the operation of SHPS „Potochnitsa" the GHG emissions that would be generated by the replaced power units at Thermal Power Plants would be reduced. Keeping in mind the above-mentioned facts the reductions of GHG emissions were calculated on the basis of the combined marginal method.

It should be also noted that, without the revenues from sale of ERU's, the Project is not financially lucrative. In these circumstances, the Project investor will face financial obstacles to implementation of the Project. Development of the Project as a Joint Implementation one, however, will permit to report reduction of the GHG emissions, and in that case the generated ERU's will be additional.

Besides, no reduction emissions would be achieved if the Project is not implemented due to financial and technical reasons and obstacles as listed here below:

- The Project implementation costs, as a specific indicator per installed kilowatt, are considerably higher than those for construction of conventional power units fired with fossil fuels;
- Due to the lack of experience in crediting of RES, the local banks do not consider such projects attractive and refuse to credit them;
- Besides, the Bulgarian commercial banks avoid offering long-term credit for such small energy projects since they consider them highly risky;
- SHPS „Potochnitsa" is considered a project hard to implement from technical point of view due to the need for construction of an overflow dam consisting of ten overflow bays shutting by means of radial gates.

Notwithstanding that the state policy in the energy sector favors the development of RES, their implementation is not a priority, because of the high cost per installed kilowatt, their relatively low utilization rate in hours, and the small power output. In that situation, the Project is optional to the EPS because it is not included in the list of capacities to be constructed according to the annual plan for least-cost development of the energy sector.

[3] Final Technical Specification of SHPS "Potochnitsa" Project

A.4.4.1. Estimated amount of emission reductions over the crediting period:

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In accordance with the approved methodology AMS-I.D/Version 12, 07 October 2007 [5] and applying it to SHPS „Potochnitsa", the Project will generate *ex-ante* calculated mean emission reduction of 23'522tonnesCO_2 per annum for the report period 2008-2012.

The planned development of the energy sector envisages construction and commissioning of new RES capacities increasing over the years. That will result in gradual reduction of the EPS Compound Emission Factor which will be reflected in the reduction of GHG emissions in the System.

Provided that Bulgaria concludes an agreement with the Buyer country of carbon credits from the Project, for purchase of ERU, and their transfer from the register of the Seller country to the register of the Buyer country is legitimated for the next 5-year report period from 2013 till 2017 the generation of ERU by the Project may be carried further.

The annual emission reductions due to implementation of the SHPS Potochnitsa Project are presented in Table No. 2.

Table No. 2

Year	**Annual estimation of emission reductions in tonnes of CO2e**
2008	0'000
2009	13'910
2010	23'970
2011	23'615
2012	23'533
Total crediting period 2008÷2012	**85'030**
Annual average	23'522

Note: The quantity of ERU's generated by the Project is different for each year and varies with the future generated and measured net generated electric power at HPS Potochnitsa and with the EPS Compound Emission Factor that will be determined *ex-post* during the report period.

[5] http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

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

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The Project participants declare that the small-scale project activities for construction and operation of SHPS „Potochnitsa" are not a de-bundled component of a larger project. It is also declared that there is no approved small-scale JI or request for final approval of another small-scale JI project with the following characteristics:

- With the same Project participants;
- Project with registration of the last 2 years; and
- Within the same project category and with the same technology; and
- With design boundaries within 1km from the design boundaries of the proposed project in the point of closest proximity between them.

A.5. Project approval by the Parties involved:

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According to paragraph 20 of the JI guidelines[4], a "Party involved in an Article 6 project shall inform the secretariat of:

- Its designated focal point for approving projects pursuant to Article 6, paragraph 1 (a);
- Its national guidelines and procedures for approving Article 6 projects, including the consideration of stakeholders' comments, as well as monitoring and verification".

Paragraph 31 of the JI guidelines stipulates that project participants shall submit to an AIE a PDD that contains all information needed for the determination of whether the project has been approved by the Parties involved.

This approval by the Parties involved should be unconditional and in writing and shall be attached to the JI PDD at the latest before the final determination report is made publicly available.

Such written approval constitutes the authorization by a designated focal point of a specific legal entity to participate in the specific JI project. The approval will covers the requirements of paragraphs 29 and 31 (a) of the JI guidelines[4].

[4] http://ji.unfccc.int/CritBasMon

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

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According to Decision 10/CMP.1 paragraph 4 (a)[4], the participants in JI projects may apply Baseline and Monitoring methodologies approved by the CDM Executive Board.

Therefore, the approved CDM baseline methodology for small-scale project activities AMS-I.D./Version 12, 07 October 2007: „Grid connected renewable electricity generation”[5] can be used for this project.

The grounds for applicability of the AMS-I.D. methodology to this small-scale JI project activity are as follows:

- The Project is of a hydropower type, one of the several RES project types where the use of that methodology is allowed;
- The total installed capacity of SHPS „Potochnitsa” is 9,38 MW which is within the permissible limits 15MW of the chosen methodology for small-scale project activities;
- The methodology is applicable to RES projects that will deliver electric power to the country's power transmission network;
- The design energy density calculated by dividing the installed power generation capacity by the pond volume area of the Project is equivalent to 176,98 W/m^2. That energy density is much higher than 10MW/m^2 which, according to the requirements of the CDM Executive Board, is the minimum value above which that of the Project should be. Therefore, the use of the approved methodology (AMS-I.D.) is possible and the design emissions from the pond volume may be neglected since they are insignificant and slightingly low.

The AMS-I.D. methodology characterizes the project activity baseline for SHPS „Potochnitsa” in the following manner:

"For all other systems, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kgCO2e/kWh) calculated in a transparent and conservative manner as:

a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002 / Version 06, Sectorial Scope:01, 19 May 2006[6]. Any of the four procedures to calculate the operating margin can be chosen but the restrictions to use the Simple OM and the Average OM calculations must be considered

OR

b) The weighted average emissions (in kg CO2equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

According to the method used for Operating Margin calculation in the ACM 00002 methodology, two approaches are possible:

- (*ex-ante*) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission, if or,
- The year in which project generation occurs, if ($EF_{OM,y}$) is updated based on *ex-post* monitoring.

[4] http://ji.unfccc.int/CritBasMon
[5] http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html
[6]http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

The second approach was chosen as more reliable and conservative to determine and calculate more accurately the Operating Margin keeping in mind the last trends and development prospects of the country's EPS.

The spatial boundaries of the Project overlap with the country's EPS, because SHPS Potochnitsa will be connected to the common 110kV power transmission network of the country. Having in mind that circumstance, the multi-project approach was selected to develop the Baseline Methodology. For the purpose of creating the Baseline Scenario and determining the Compound Margin Emission Factor (EF_y) of the system, a probabilistic forecast of the EPS power and energy balance was developed for the minimum and maximum Power Demand Forecast. The monthly and annual energy balance of EPS will be updated in the *ex-post* monitoring in order to determine the up-to-date EF_y that will be used to determine the actual emission reduction levels.

The baseline of JI project is the scenario that reasonably represents the development and relevant GHG emission rates of Bulgarian Electricity Power System (EPS). The scenario is including all power plants in EPS with power output over 25MW.

In the Baseline Scenario the GHG emissions generate by operation of EPS would occur in absence of the proposed project. In the Project Scenario small part of GHG emissions of EPC would be avoided i.e. reduced due, to the JI project power generation.

Baseline scenario is the one prescribed in ACM0002 for project activities that do not modify or retrofit an existing electricity generation facility, i.e. "electricity delivered to the grid by the project 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 grid emission factor".

For the purpose of determining the emission factors from energy balances, the power units within the EPS with capacities exceeding $10MW_{el}$ were divided in four categories:

- Operation Margin Power Units;
- Build Margin Power Units;
- Low-cost Power Units;
- Must-run Power Units.

According to Methodology ACM0002, the Baseline Emission Factor (EF_y) is calculated as a Combined Margin Emission Factor consisting of the combination of Operating Margin (EF_{OM}) and Build Margin Emission Factors (EF_{BM}) which are weighed 50% to 50%.

For determination of EF_{OM}, ACM0002 proposed using of one of the following 4 methods:

1. Dispatch Data Analysis ($EF_{OM\_Dispatch\_Data y,}$);
2. Simple ($EF_{OM,simple,y}$);
3. Simple adjusted ($EF_{OM,\_simple\_adjusted,y}$);
4. Average OM_EF ($EF_{OM\_average}$).

Methodology ACM0002 require as first methodological choice to implement Dispatch Data Analysis for determination of $EF_{OM,y}$. Detailed dispatch data couldn't be provided and this method is not applicable.

Second proposed method is Simple OM which could be used when low-cost/must-run power units constitute less than 50% of the total power generation of EPS. This condition is fulfilled and the method could be and is utilized for calculation of OM emission factor.

The third method - Simple Adjusted OM – is specifying of Simple OM method, because of consideration additionally of hour numbers per year for which low-cost & must-run power units are operating on the margin. This method is also applicable because detailed operational data for the power plants and annuals load duration curves are available of the EPS. Implementation of this method gives the opportunity for determination of all power units operating at the margin.

The forth method is Average OM and could be implemented only when low-cost and must-run (LC&MR) power units constitute more than 50% of power generation in EPS and specific datasets for applying Simple and Simple Adjusted OM are not available. LC&MR power units constitute less than 50% of EPS total power generation and information data to apply Simple and Simple Adjusted OM methods are available. Therefore Average OM method isn't allowed for implementation.

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants

Simple Adjusted OM emission factor ($EF_{OM,simple\ adjusted,y}$) is a variation on the previous method, where the power sources (including imports) are separated in low-cost/must-run power sources (*k*) and other power sources (*j*).

For all power units falling within the Operation Margin, the weighted average emission factor of (EF_{OM}), was calculated as presented in Table No. 3

Table No. 3

Simple Adjusted Operation Margin Emission Factor					
	2008	**2009**	**2010**	**2011**	**2012**
Minimum Power Demand Forecast	0,892	0,953	0,929	0,919	0,915
Maximum Power Demand Forecast	0,891	0,932	0,921	0,911	0,909

Emission factor ($EF_{OM,y}$), from the maximum Power Demand Forecast for the country was used in the further calculations since it is smaller, and therefore more conservative, in order to avoid overestimation of the forecast emission reduction quantities.

Build Margin emission factor (**$EF_{BM,y}$**) is calculate as the generation-weighted average emission factor (tCO2/MWh) of a sample group (m) of power plants consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation in (MWh) and that have been built most recently. Project participants could use from these two options that sample group that comprises the larger annual generation.

Project participants shall choose between one of the following two options in PDD.

Option I. Calculation of Build Margin emission factor ($EF_{BM,y}$) *ex-ante* based on the most recent information available on plants already built for sample group (m) at the time of PDD submission.

Option II. For the first crediting period, the Build Margin emission factor ($EF_{BM,y}$) must be updated annually *ex-post* for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, ($EF_{BM,y}$) should be calculated *ex-ante*, as described in option 1.

It is consider that the group of five power plants build more recently or EPS power generation additions of 20% will revise during the crediting period, therefore the second option with updated annually ex-post BM emission factor for the specific year is chosen.

The condition to opt between sample group of the five power plants and power plant capacity additions in the electricity system that comprise 20% of the system generation in MWh that have been built most recently is observe and the bigger power generation is taken for calculation of BM emission factor.

The calculated weighted average Build Margin for the years from 2008 till 2012 is presented in Table No. 4

Table No. 4

Build Margin Emission Factor					
	2008	**2009**	**2010**	**2011**	**2012**
Minimum Power Demand Forecast	0,855	0,853	0,850	0,833	0,825
Maximum Power Demand Forecast	0,850	0,845	0,835	0,819	0,815

In further calculations of the Build Margin, the emission factor EF_{BM} of the maximum Power Demand Forecast for the country was used as more conservative.

The Compound Emission Factor, in accordance with the ACM0002 methodology, is calculated as the weighted average emission factor EF_y, between the Operation Margin and Build Margin emission factors in kgCO2e/kWh. Here, that is based on the assumption that the JI Project will most probably have an impact on the operation of the existing and new power units in the short term (marginal operating cost), as well as in the delay of implementation of new capacities in the long term (marginal build costs). That is corroborated by the Integrated Resource Planning Program used as a model for the forecast of EPS energy balance, and reliably determines the power units in the Build Margin and in the Operation Margin.

The results of Baseline Compound Emission Factor calculations are presented in Table No. 5.

Table No. 5

Baseline Emission Factor with Simple Adjusted Operation Margin EF					
	2008	**2009**	**2010**	**2011**	**2012**
Minimum Power Demand Forecast	0,874	0,894	0,889	0,876	0,870
Maximum Power Demand Forecast	0,871	0,888	0,878	0,865	0,862

The further calculations of Project emission reductions are based upon the Baseline Compound Emission Factor for maximum Power Demand Forecast in the EPS. These are the lowest values, and therefore, the most conservative from the viewpoint of avoiding overestimation of the generated ERUs.

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the small-scale project:

>>

The prescribed rules of UNFCCC of the simplified modalities and procedures aim at establishing the additional nature of the Project according Attachment A to "**Appendix B** of the simplified modalities and procedures for small-scale CDM project activities", Version 06, September 30, 2005[6], where various restrictions are considered. At least one of these restrictions has to be identified as one as a result of which the Project would not be implemented in any case.

Appendix B requires the Project proponents to prove the correctness of additionality with explanation of the project activities and emission reductions in the light of the restrictions preventing them. It is for the purpose of overcoming these barriers that the Project is proposed as a small-scale JI Project. In that connection, the project proponents have identified the following project implementation restrictions:

1.) Investment restrictions.

The total investments for implementation of the small-scale Project are estimated at €8'065'000. Of these, €5'150'000 is needed for supply of the equipment and radial gates of the weir. This part of the investment will be covered by means of a financial commodity loan and constitutes (64%) of the total investment. In these circumstances, the Entrepreneur shall raise the rest of the investment (36%) from its own funds.

In Bulgaria, it is considered advisable for energy projects to have equity to debt capital relationship of the order of 20% to 80%, so that the project can be attractive to the investor. In this case the Project requires a large share of equity investment and that is a very serious financial barrier to its implementation.

With its registration as a JI Project and securing of revenues from ERU sales, the Project is going to be much more profitable to the potential investors and, in that case, the banks will be far more willing to grant loans for implementation of the Project.

2.) Technological restrictions

The Project will be implemented in complicated geological conditions. The bank slopes at the sites are severely eroded, and lateral support walls have to be built in the area of the whole overflow dam, as well as in the area downstream of the hydropower station from the beginning of the stilling sector to about 30m downstream of the bridge of the Krumovgrad -Tunkovo road. The walls will consist of metal mesh pockets filled with stone and reinforced with cement, to ensure protection of the banks against erosion.

The ten overflow courses of the weir upstream of the hydropower station will be closed with back-support radial gates. These radial gates are sophisticated and expensive facilities. Besides, they require automation of the hydraulic open/close drive for letting through the high water from the river.

Building of the overflow dam and protection of the river banks considerably increase the project cost, constituting 38% of the total investments, and are therefore, technological barriers to implementation of the Project.

[6] http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

3.) Prevailing practice

An analysis of the country's electric power capacities that provide the power and energy balance of the EPS would bring to the finding that about 85% of the electricity output is generated by the Nuclear Power Plant and Thermal Power Plants. The four large hydro-power cascades consisting of dams and related diversion-type HPS of NEK EAD generate 8%÷12% of the total electricity in the country. In such conditions, the share of RES, mainly small hydro-power stations, is between 2% and 4% of the annual power generation within the EPS[7].

Viewed retrospectively, the large hydro-power stations in the EPS have been built by the state and for the present moment, it is the only party interested in the construction of large HPS with the related dams. The development of SHPS and other RES power capacities has been left to private investors. That means in practice that the RES projects will have to be developed in completely market conditions without depending on any financial support from the state.

The situation is due to the fact that the country is in a state of monetary board and cannot undertake any financial guarantees except those under the Energy Law provision that obligates NEK and the power distributors to off-take the whole quantity of power generated by RES. In order to keep in pace with the increasing power demand trend in the country, the least-cost planning of EPS stakes on an energy policy giving priority to the most advantageous construction of large power generating nuclear and thermal capacities.

All that shows that construction of SHPS and the other RES, is not a prevailing practice in Bulgaria and the energy sector will continue to rely on the large nuclear and coal-fired power capacities to meet the power demand in the country.

4.) Conclusions

1.) The analysis of different restrictions and barriers shows that the Project is facing a number of difficulties and obstacles to its implementation. Since it is comparatively small and financially unattractive, the Project does not fit into the least-cost EPS planning, and is not, therefore, present in the basic EPS development scenario.

2.) In these circumstances, without a financial support from the carbon credit sales revenues, as a JI Project, it can be stated that the Project is not economically beneficial. It is assumed that the additional financing through ERU's will provide 8÷10% of the overall project investment. That circumstance will improve the financial parameters of the Project and will also enhance the banks' and entrepreneurs' confidence in it.

3.) The current practice in the country with respect to the energy policy is to lay the emphasis on electricity generation by thermal power plants, nuclear power plants and large hydro-power stations which, together with the difficulties of RES funding and the technological barriers shows that the SHPS Potochnitsa Project is facing substantial difficulties from implementation point of view. Thus, the Project is considered additional and is not included in the basic EPS development scenario in the process of least-cost planning.

[7] Bulgarian Power Sector least-cost Development Plan. Please see NEK's web site: http://www.nek.bg/tender/nek_mr-info-04.11.2004-ENG.pdf

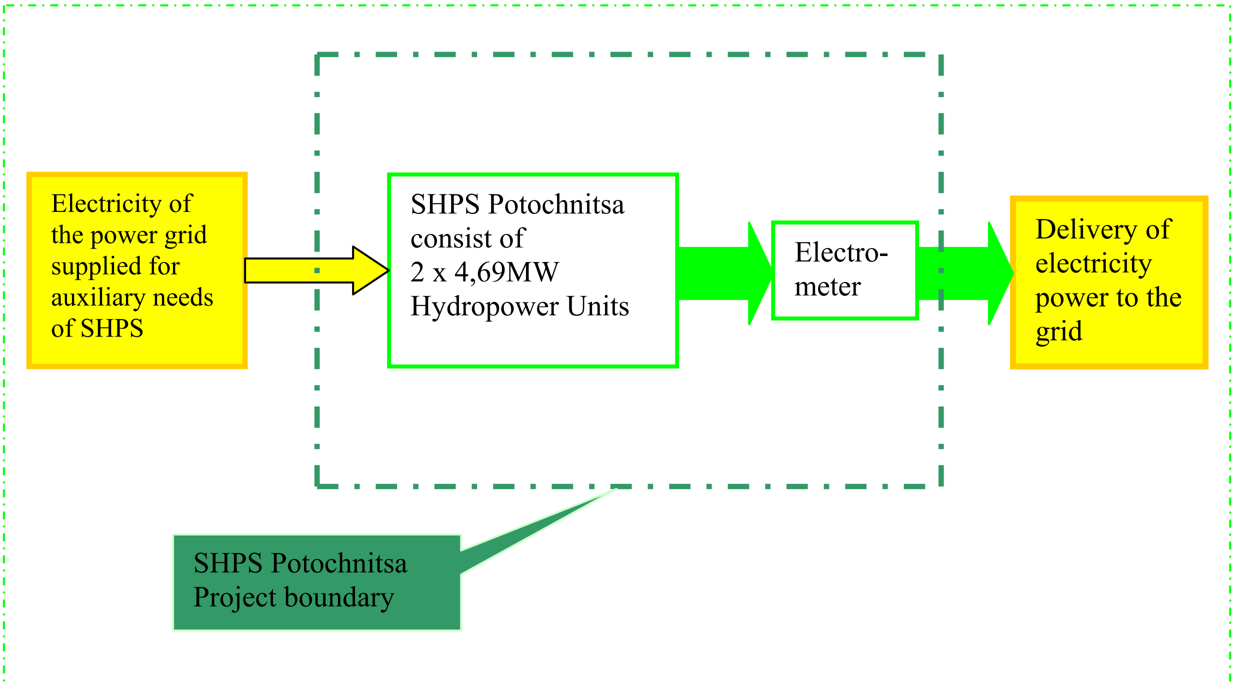
B.3. Description of how the definition of the project boundary is applied to the small-scale project:

>>

The Project boundaries specified in Appendix B[8] of simplified modalities and procedures are defined as the physical and geographic site of RES.

According to Appendix B of the simplified modalities and procedures Project boundary is: "The project boundary shall be limited to the physical project activity. Project activities that displace energy supplied by external sources shall earn certified emission reductions (CER's) for the emission reductions associated with the reduced supply of energy by those external sources."

The system boundary of the proposed SHPS Potochnitsa Project is defined as the overall EPS of the country. The baseline project boundary includes the Project and all other power plants connected to the power transmission network of the country. The project boundary is expressed in the following Flowchart No1.



Flowchart No1: Project Boundary

[8] This appendix has been developed in accordance with the simplified modalities and procedures for small-scale CDM project activities (contained in annex II to decision 21/CP.8. Please see document FCCC/CP/2002/7/Add.3) and it constitutes appendix B to that document. For the full text of the annex II to decision 21/CP.8, please see reference/documents section on UNFCCC CDM web site http://unfccc.int/cdm).

Off-site emission are according to the project boundary, are shown in Table No. 6 below:

Table No. 6

Off-site emissions			
Current situation	**Project Implementation**	**Direct/indirect**	**Include/exclude**
Baseline CO_2 emission of electricity power grid		Direct	Include
	CO_2 emission of electricity gird for auxiliary needs	Direct	Included but are negligible small
	CO_2 avoided emission of project electricity generation feed to the power grid	Indirect	Include

Remark: GHG emission related with construction activities and transport delivery of materials, and equipment during construction process are neglected, because they are very small and negligible compare to the project emissions reduction and it is impossible to monitor them.

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

>>

In conformity with Part B.2 of this PDD, the project activity is generation of electric power for the EPS which consists of nuclear, thermal and hydro-power generating capacities. Therefore, the applicable baseline methodology is like that described in Appendix B of indicative simplified baseline and monitoring. This methodology defines the baseline by multiplying the kWh produced by RES by the baseline emission factor measured in kgCO2e/kWh. The baseline is assessed using the method specified in Paragraph 9 of Type I.D in Appendix B, option (a) which is presented in full in item B.2 of the present document.

Date of completion of the third Baseline Version (DD/MM/YYYY):
29/11/2007

Name of the Baseline author:
Christo Schwabski

Legal entity determining the Baseline:
Econia Ltd.

Address: 22 Bogatitsa st. , 1421 Sofia, Bulgaria
Telephone: +359 2 9263 445; Mobile: +3592 889 635 262
e-mail: schwabski@mail.orbitel.bg

The legal entity is not any of the Project Participants indicated in Annex 1 of this document.

SECTION C. Duration of the small-scale project / crediting period

C.1. Starting date of the small-scale project:

>>

01/04/2009 (April 1st, 2009)

C.2. Expected operational lifetime of the small-scale project:

>>

30 years (360 months)

C.3. Length of the crediting period:

>>

The Project Participants propose the years 2009÷2012 inclusive as credit period. This means 3 years and 9 months or totally 45 months crediting period and with a starting date on April 1st 2009.

On provision that an Agreement is signed between Denmark and Bulgaria for transfer of carbon credits between the registers of the two countries for a further five-year period 2013÷2017 the generation of carbon credits by the Project may be continued.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

>>

According to Decision 10/CMP.1 paragraph 4 (a), the JI Project Participants may apply Baseline and Monitoring Methodologies approved by the CDM Executive Board. Therefore, the approved CDM Monitoring methodology for small-scale projects AMS-I.D./Version 12, 07 October 2007: „Grid connected renewable electricity generation” may be used in this Project.

The monitoring methodology used for the Project is described in „Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories”. The monitoring methodology is entitled: AMS-I.D. Monitoring methodology “Grid connected renewable electricity generation” (Version 12, 07 October 2007)

This monitoring methodology will be used jointly with the selected baseline methodology “AMS-I.D. Grid connected renewable electricity generation”. SHPS Potochnitsa Project is a small-scale one and will be connected to the EPS grid.

Therefore, the choice of monitoring methodology of the Project is confirmed as justified.

D.2. Data to be monitored:

>>

The monitoring will consist in continuous measurement of the net electric power generated by Potochnitsa SHPS. The monthly value of net electric power from the power plant will be recorded on an electronic medium and will be entered in a special log book for that purpose. The measured quantities of electric power will be rechecked by means of the invoiced amounts of electric power from the project of Company’s power transmission operator.

Hour dispatching of the two marginal power units in the EPS will be performed by NEK. Technical data required for calculation of the Baseline Emission Factor will be received from the respective thermal power plants whose power units have been marginal for a month's time. These data will be re-checked by NEK for succession, uncertainties and errors on the basis of the element composition of the fuel burned and the technical and cost indicators of thermal power plants for the respective month.

On the basis of verified technical data and the hours per month for which power units have operated in the EPS at the highest (marginal) operating costs, NEK will calculate the CO_2 Baseline Emission Factor.

The Project monitoring team on the basis of net quantities of power generated by SHPS Potochnitsa and the baseline emission factor for the respective month will calculate the reduction of emissions by the Project in Emission Reduction Units measured in tones of saved CO_2.

A similar description of the data to be measured, collected, computed and archived during Project monitoring is presented in Table No.7.

Table No. 7

I.D. number	Data variable	Source of data	Data unit	Measured calculated or estimated	Recording frequency	Proportion of data to be monitored	How will the data be archieved (electronic/ paper)	For how long is archived data to be kept	Comment
1.EG_M	Electricity supplied to the grid by the project	Measured and verified against sales data	MWh	Measured	monthly	100%	Electronic and paper	During the crediting period and plus 2 years	Electricity supplied by the project activity to the grid. Double check by receipt of sales
2. MU_H	Hours of the first 2 Marginal Units (MU) of EPS	Power Units merit order and software estimation of the 2 MUs	Hours	Estimated by software	hourly	100%	Electronic and paper	During the crediting period and plus 2 years	If the 1 MU is launch during the hour the second one will be use as MU
3. EF_Mi	Emission Factor of power unit serving at the margin	Actual data reported by the marginal TPP	tCO2/ MWh	Measured and calculated	monthly	100%	Electronic and paper	During the crediting period and plus 2 years	Fuel characteristics will be analysis and measured - Carbon content, LHV and Carbon unoxidized. The EF will be calculated
4. EF_{Mg}	Emission Factor of the grid	1. Power Units serving at the margin for determined hours - $Hours_i$ 2.Marginal Units EF_Mi	tCO2/ MWh	Calculated	monthly	100%	Electronic and paper	During the crediting period and plus 2 years	$EF_M grid = \Sigma H_i * EF_M i / H_M$ Hi – hours at the margin H_M – total monthly hours
5. ERU monthly	Emission Reduction Units per month	Project, marginal TPPs and NEK	tCO2	Calculated	monthly	100%	Electronic and paper	During the crediting period and plus 2 years	$ERU_{tCO2M} = EG_M * EF_M$
6. ERU annually	Emission Reduction Units per year	Project, marginal TPPs and NEK	tCO2	Calculated	monthly	100%	Electronic and paper	During the crediting period and plus 2 years	$ERU_{tCO2A} = \Sigma ERU_{tCO2M} i$ where: I =1-12, are the months during year of crediting period

D.3. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

<table>
<tr><td colspan="3">Table No. 8</td></tr>
<tr><th>Data (Indicate table and ID number)</th><th>Uncertainty level of data (High/Medium/Low)</th><th>Explain QC/QA procedures planned for these data, or why such procedures are not necessary</th></tr>
<tr><td>1.EG_M</td><td>Low</td><td>1.) Electric meters will be maintained in good repair and subjected annually to testing and calibration in conformity with the technical requirements for measurement accuracy assurance.

2.) The monthly invoices for electricity sold to the Grid Operator will be used in monitoring the performance of Project electric meters.

3.) Measurements methods, there accuracy and procedures, the type of electric meters, applied calibration procedures are according to “Bulgarian Electricity Metering Rules” (BEMR) published by State Energy and Water Regulatory Commission (SEWRC). Please see the web site: http://www.dker.bg/papers_en.htm

4.) According to Article 28 (1) of BEMR “The commercial metering of active and reactive industrial electricity shall be implemented by three-element electrometers at distribution lines with voltage 110 kV and higher.

5.) According to BEMR the electricity metering system of SHPS must be in compliance with following requirements:
<table>
<tr><th>Accuracy of the different elements of the metering system</th><th>Current % of the rated current</th><th>Capacity factor</th><th>Error Limit in %</th></tr>
<tr><td>Electrometer for active energy type 0.2 S</td><td>5 % to 20 %</td><td>1</td><td>± 0.4%</td></tr>
<tr><td>Current transformer type 0.2 S</td><td>1 % to 5 %</td><td>1</td><td>± 0.6 %</td></tr>
<tr><td>Voltage transformer type 0.2</td><td>20 % to 120%</td><td>0.5 inductive to 0.8 capacitive</td><td>±0.93%</td></tr>
</table>
</td></tr>
<tr><td>2. MU_H</td><td>Low</td><td>1.) The software for monitoring the hours during which power units have operated at the margin will check the</td></tr>
</table>

		operating units every hour against the merit order dispatching of the units. 2.) No QC/QA procedures are required for such assessment
3. $EF_{M}i$	1.) Low 2.) Medium	1.) At TPP's, wherever there are installed gas analyzers for direct determining of CO_2 emissions, the emission factor per hour is received from the data logger of the measuring system. Depending on the electricity generated by the power unit, the weighted average emission factor of the marginal power unit is calculated for the respective month. Once in a year, the gas analyzer and data logger are subjected to mandatory testing and calibration outside the TPP beside the regular calibration and testing of the instruments in compliance with the manufacturer's instructions. 2.) At TPP's without gas analyzers the monthly emission factor is calculated on the basis of a procedure according to which the needed data will be obtained from the averaged monthly determination of the technical parameters of a TPP together with the data from analyses of the element composition of the fuels used. NEK will exercise quality control of the technical data from the TPP and will verify them by computation from the fuel analysis. A second data verification will be done on the basis of direct gas measurements carried out by the Regional Inspectorate of Environment and Water.
4. EF_{Mg} 5. ERU monthly 6. ERU annually	Low	Used for direct calculation of emission reduction. No QC/QA procedures are required for these data.

D.4. Brief description of the operational and management structure that will be applied in implementing the monitoring plan:

>>

EPC Agreement with the Purchaser makes the necessary provisions for training of operation staff. Current maintenance needs are according to EPC Agreement and are describe below:

1.) The duration of the guarantee period is 24 months for parts and labour as from the date of the provisional equipment acceptance.

2.) If, during the guarantee period, the equipment or parts of the equipment are found to be defective, or continuously demonstrates failures that can be attributed to defective design or workmanship, or does not meet the contractual specifications, EPC contractor shall, following a written notification from the Purchaser , remedy the defects, or failures within a reasonable time.

3.) After the end of the guarantee period, the Supplier undertakes to make available to the Purchaser, at the latter's request and expenses, After Sales Service (ASS), comprising the supply of spare parts and repairs of whatever nature, relative to the equipment supplied for a minimum period of 10 years.

4.) The EPC contractor will inform the Purchaser annually of any technological innovations concerning the equipment it has purchased.

5.) The EPC contractor will arrange initial comprehensive training of necessary operation and current maintenance staff in order to guarantee proper operation of SHPS Potochnitsa.

The firm FINAUTO is planning to set up a JI Project Team who will be in charge of the Monitoring. The team members will be trained in the JI Project concept as well as in performance of the Monitoring Plan. The Team staff will allocate among themselves the assignments for collection, compiling, and calculation of the required data under the monitoring plan.

The monitoring archive will be checked weekly, and presented and analyzed with the Team Leader. Once a month, the Team will review and check the project activities of the previous month, will verify the collected data and the respective estimated Project emission reductions.

The monitoring reports will be prepared in conformity with the approved procedures of the JI Project, and will be acceptable for auditing by a third party in manner and structure. The annual monitoring reports will be submitted to AIE for validation and for the purpose of certification.

D.5. Name of person(s)/entity(ies) establishing the monitoring plan:

>>

Name of the person – developer of the Monitoring Methodology:
Christo Schwabski

Legal entity determining the Monitoring Plan:
Econia Ltd.

Address: 22 Bogatitsa st., 1421 Sofia, Bulgaria
Telephone: +359 2 9263 445; Mobile: +3592 889 635 262
e-mail: schwabski@mail.orbitel.bg

The person and legal entity indicated here above are not among the Project participants listed in Annex 1 of the present document.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions and formulae used in the estimation:

>>

It is planned to build SHPS Potochnitsa as a run-of-the-river power station. The total pond volume of the Project will be 1’640’000m^3, and the pond areas will be 53’000m^2. In these circumstances the calculated energy density of the hydro-power project is equivalent to 176,98W/m^2.

According to the definition of energy density, when it is higher than 10W/m^2, the design emissions from the water equalizer may be neglected and are not identified with anthropogenic emissions from sources of GHGs within the project boundary.

Therefore, there are no anthropogenic emission formulae applicable to the Project within its boundaries.

E.2. Estimated leakage and formulae used in the estimation, if applicable:

>>

The Project proponent has not found any emissions of anthropogenic GHGs from sources outside the Project boundary that are significant, measurable, or can be accounted for by the project implementation activities. Therefore, there is no leakage that can be considered as resulting from the Project.

According to Paragraph 8 of Appendix B of the modalities for small-scale CDM projects, the Project proponent confirms that the process equipment to be used on the Project has not be transferred from or used by another project. Therefore, no leakage calculations are required.

E.3. Sum of E.1. and E.2.:

>>

The sum of emissions due to project activity and leakage is zero.

Therefore, the total project activity emissions are also zero.

E.4. Estimated baseline emissions and formulae used in the estimation:

>>

Citation of Item 10 wording of Methodology AMS I.D is as follows:

" In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, where the existing and new units share the use of common and limited renewable resources (e.g. stream-flow, reservoir capacity, biomass residues), the potential for the project activity to reduce the amount of renewable resource available to, and thus electricity generation by, existing units must be considered in the determination of baseline emissions, project emissions, and/or leakage, as relevant"

For project activities that involve the addition of new generation units (e.g. turbines) at an existing facility, the increase in electricity production associated with the project (EGy in MWh/ year) should be calculated as follows:

EGy = TEy – WTEy

Where:
***TEy** - is the total electricity produced in year y by all units, existing and new project units;*
***WTEy** - is the estimated electricity that would have been produced by existing units (installed before the project activity) in year y in the absence of the project activity, where…."*

SHPS Potochnitsa is completely new JI project, therefore the above mentioned item 10 in the methodology is considered not relevant, by the reason of non-existing power units in the project boundary.

According to the procedures of the approved methodology ACM0002, the calculations and Baseline determination have to be done in a transparent and conservative manner.

As presented in Paragraph B.2, the baseline emissions are defined by multiplying the MWh of electric power produced by RES by an emission factor measured in tCO2e/MWh. The Baseline emissions, according to the calculations described, are expressed by the following equation:

$$BEm_y = EG_y * EF_{grid} \quad [tCO_2e] \qquad (1)$$

where:
BEm_y – the baseline emissions in tCO_2e;
EG_y – electric power generated per month by the Project, in MWh;
EF_{grid} – emission factor (rate) of EPS in tCO_2e/MWh.

The EPS emission factor is calculated as the weighted average between the emission factor of the Simple Operation Margin and the Build Margin emission factor which is expressed by the following equation:

$$EF_{grid} = ½ *EF\_OM + ½ *EF\_BM \quad [tCO_2e/MWh] \qquad (2)$$

The Operation Margin emission factor is calculated depending on the direct emissions from power units operating at the margin and the respective electricity output of such units. The equation whereby EF_OM is expressed is given below:

$$EF\_OM = \frac{\sum_{i=1}^{n} EmCO_{2i}}{\sum_{i=1}^{n} EG_i} \quad [tCO_2e/MWh] \qquad (3)$$

where:
EF_OM –Operation Margin emission factor;
$EmCO_{2i}$ - forecast CO_2 emissions for the respective year from the i-th power unit operating at the Operation Margin in the EPS measured in tCO_2e, calculated by Formula (4);
EG_i – forecast electricity output for the respective year from the i-th power unit operating at the Operation Margin in the EPS measured in *MWh*.

The forecast electricity output from power units was obtained on the basis of the Least-Cost Development Plan (LCDP) of the Bulgarian EPS. An Integrated Resource Planning computer model was used in the LCDP elaboration process. The US Company Electric Power Software is developer of the software, named IRP Manager. Since 1995 the model has been used for long-term least-cost planning in the energy sector by NEK - EAD.

The forecasts were developed on the basis of the minimum and maximum power demand forecasts. Respectively, two annual series were obtained for forecast power generation under the two power demand scenarios. All emission estimates were performed in accordance with the maximum and minimum forecasts. After that, the forecast with lowest emission factors was selected as more conservative and with a view to avoiding overestimation of the forecast emission reductions.

The forecast CO_2 emissions for the respective year from the i-th power unit are expressed by the following equation:

$$EmCO2_i = \frac{CC_j * EI_i * (100 - Unoxid_i) * 44}{LCV * 10^7 * 12} \quad [tonnesCO_2e] \qquad (4)$$

where:
CC_j – annual average carbon content in the j-th fuel in %;
EI_i – the annual amount of energy input in the i-th power unit in GJ/a, calculated by Formula (5);
U_{noxidi} – annual average unburnt carbon content at the i-th power unit, total in fuel residues – slag and ash in %;
LCV – annual average net calorific value of "as-received" fuel in GJ/Mg for coal and fuel oil, and in MJ/Nm^3 for natural gas.

The annual amount of energy input in the i-th power unit in GJ/a is expressed by the equation:

$$EI_i = EG_i * GHR_i \quad [GJ/a] \qquad (5)$$

where:
EGi – forecast annual electricity output by the i-th power unit in GWh/a;
GHR_i – gross Heat Rate of fossil fuel at the i-th power unit in kJ/kWh.

The Build Margin emission factor is calculated depending on the direct emissions from power units operating at the Build Margin, and the respective electricity output by such units. The equation whereby EF_OM is expressed is given below:

$$EF\_BM = \frac{\sum_{j=1}^{n} EmCO_{2j}}{\sum_{j=1}^{n} EG_j} \quad [tCO_2e/MWh] \qquad (6)$$

where:
EF_OM –Operation Margin emission factor;
Em_{CO2j} - forecast CO_2 emissions for the respective year from the j-th power unit operating at the Build Margin in the EPS, measured in tCO_2e, calculated by Formula (4);
EG_j – the forecast annual electricity output for the respective year by the j-th power unit operating at the Operation Margin in the EPS, measured in *MWh*.

The detailed calculations of baseline emissions and corresponding emission rates are on Excel file:
<SHPS Potochnitsa Baseline Calculations 29Nov2007.xls>

The summary findings of Baseline calculations are shown in Annex 2 of PDD.

E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

>>

Reduction in *EmRy* emissions due to project activities during the report period is expressed by the following equation:

$$EmRy = BEm_y - EmP_y - EmL_y \ [\text{tonnes}CO_2e] \quad (7)$$

where:

BEm_y – annual baseline emissions;

EmPy – annual design emissions by project activities equal to zero, as per item E.3.

Therefore the annual reduction of the project emission is equal to the baseline emission for the respective year:

$$EmRy = BEm_y \ [\text{tonnesCO2e}] \quad (8)$$

E.6. Table providing values obtained when applying formulae above:

>>

Detailed calculations of emissions and the related emission rates are given in spreadsheets by years from 2008 till 2012 inclusive in file < SHPS Potochnitsa Baseline Calculations 20Sep2007.xls> to the present PDD.

The results of baseline emission calculations corresponding to project emission reductions are presented in Table No.9.

Table No. 9

Year	Project Power Generation	Simple Adjusted OM_EF	Build Margin EF	Compound Margin EF	Baseline Emission	CO_2 Emission Reduction
	MWh	tCO_2/MWh			tCO_2	
2008	00'000	0,891	0,850	0,871	0'000	0'000
2009	9'581	0,932	0,845	0,888	13'910	13'910
2010	27'301	0,921	0,835	0,878	23,970	23,970
2011	27'301	0,911	0,819	0,865	23'615	23'615
2012	27'301	0,909	0,815	0,862	23'533	23'533
2008-2012	**91'184**	**0,9128**	**0,8328**	**0,8728**	**85'030**	**85'030**

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

>>

On the grounds of Art.93, Paragraph 5 of the Environmental Protection Act (EPA), the Information Required for Estimation of the Need for EIA was presented to the Haskovo Regional Inspectorate of Environment and Water (RIEW).

That information is in substance a preliminary environmental assessment and presents written documents prepared by the Project proponent in conformity with Appendix No.2 to Art.6 of the Regulation on the Conditions and Procedure of EIA of Investment Proposals for Construction, Activities and Technologies.

The documentation presented for the purpose of assessing the need for analysis of Project environmental impact contains:

1. Characteristics of the investment proposal:
   a. Summary of the proposal. Proving the need for the investment proposal.
   b. Relation to other activities, existing and approved by a structural or another type of plan.
   c. Details on considered alternatives.
   d. Site location, inclusive of area required for temporary works during construction.
   e. Description of the main processes and their capacity.
   f. Plan of the new road infrastructure and modification of the existing one.
   g. Program of project activities, inclusive of construction, operation and the phases of closing down, restoration and subsequent use.
   h. Proposed methods of construction. Natural resources to be used during construction and operation.
   i. Types and quantities of waste expected to be generated and method of treatment.
   j. Information on considered measures for mitigation of the harmful environmental impacts.
   k. Other activities related to the investment proposal – extraction of building materials and treatment of sewerage effluent.

2. Investment proposal location:
   a. Plan, maps and photos showing the Project boundaries and providing information on the physical, natural and anthropogenic characteristics as well as elements of the National Ecological Network situated in its vicinity.
   b. Sensitive territories, inclusive of sensitive zones, vulnerable zones, protected zones, sanitary protection zones and National Ecological Network.
   c. Information on considered alternative Project locations.

3. Characteristics of potential environmental impacts in consequence of Project implementation:
   a. Impacts on the free air, atmosphere, water, soil, bowels of the earth, landscape, natural landmarks, mineral diversity, biological diversity and the protected territories of the monuments of culture.
   b. Impacts on the people and human health from different hazardous energy sources – noise, vibrations, radiation.
   c. Impact upon elements of the National Ecological Network including those situated in the Project vicinity.

d. Type of impacts – direct, indirect, secondary, cumulative, short-, medium- and long-term, permanent and temporary, positive and negative.
e. Probability of impact occurrence and impact scope – geographic region.
f. Impact duration, frequency and reversibility.
g. Measures to be included in the Project and related to prevention, mitigation or compensation of significant adverse environmental impacts.

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

>>
With Decision No.XA-46-ПР/2005, the Regional Inspectorate of Environment and Water - Haskovo finds that it is not necessary to perform any Project EIA. It means that the environmental assessment of the Project contained in the written documentation is sufficient to assess the environmental impact during the construction of SHPS Potochnitsa and during Project operation.

At the same time, that Decision permits implementation of the Project as a completely lawful from environmental protection point of view.

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

>>

1. Notification of stakeholders

Notification of local stakeholders and feedback of their opinions and recommendations for the Project were carried out in conformity with the legislation regulating environmental protection. The procedures of notification and assessment of the need for EIA are described in Chapter Two of the Regulation on the Conditions and Procedure of EIA of Investment Proposals for Construction, Activities and Technologies adopted by Council of Ministers Ordinance No.59 / 07.03.2003.

In accordance with these procedures, by its letter of January 2005 FINAUTO Company informed RIEW – Haskovo on whose territory SHPS Potochnitsa will be located, of its project investment proposal. Simultaneously with notification of the competent authority, the Project proponent informed, by letter Incoming Ref. No.53-00-81, dated 18.03.2005. to the mayors of the municipalities concerned – Stambolovo and Krumovgrad, and to the mayors' offices in the villages of Dolno Cherkovishte, Rabovo (within Stambolovo Municipality) and Oreshari, Moryantsi and Potochnitsa (within Krumovgrad Municipality) of FINAUTO's investment intent to build the run-of-the-river SHPS Potochnitsa. In that letter, in accordance with the EPA and the abovementioned Regulation, written positions were requested from the municipalities and villages concerned with the Project implementation.

With its Letter Ref. No. 73/13.03.2005 to the Director of RIEW – Haskovo, the Project proponent presented the Information Required for Estimation of the Need for Project EIA.

On the grounds of Art.4 Paragraph 2 of the Regulation, FINAUTO informed the residents of Stambolovo and Krumovgrad Municipalities of its intention to implement the Project by an announcement in the local newspapers „NOVINAR YUG" and „New Life" published in the towns of Kirdzhali and Haskovo and distributed all over Haskovo District.

All positions, opinions and recommendations concerning the Project were sent to the competent authority, in this case – RIEW - Haskovo, to be taken into account in the Decision on the need for EIA and, in that manner, the prerequisites were established for either obtaining a permit for further development of the Project or its rejection due to inadequate environmental conformity.

2. Summary of the comments received:

The comments, remarks and additional requirements towards the Project from the environmental protection point of view in the process of its implementation and operation are summarized below:

1.) The Project will produce electric power using a RES – the energy potential of the river which is an activity preferential in Bulgaria since the latter joined the Kyoto Protocol that was approved by an Act of Parliament of 16.05.2005, thereby becoming mandatory.

2.) Only areas within the river bed are affected by ponding after construction of the dam.

3.) Implementation of the proposal will not necessitate any change in the existing road infrastructure or construction of a new one.

4.) The new SHPS will be fully automated.

5.) During Project operation, there will be no sources of adverse physical factors: noise, vibrations and harmful radiation.

6.) The solid run-off-river drift and bottom silt – will be transported mainly while high waves are passing. The integrated works facilities designed for letting through the flood water will also ensure transportation of the solid run-off in conditions of conformity with the transportation mode of the natural river stream.

7.) Operation of SHPS Potochnitsa does not involve any risk of water pollution, and the water downstream of the turbines will have higher oxygen content.

8.) The Project does not affect any territories or habitats protected by law, existing monuments of culture and territories of specific sanitary status.

9.) The detailed design shall include construction and maintenance of a fish passage that will prevent interruption of fish migration and movement.

10.) The Project does not create any risk of significant water pollution provided that the equipment operation requirements are met and pollution by oils or lubricants is not allowed.

11.) Refueling and lubricant replacement shall be done outside the boundaries of the hydropower facility.

12.) A contract shall be concluded with a company holding a permit or registration under Art.12 of the Waste Management Act (WMA) published in State Gazette No. 86/30.09.2003г. for delivery of waste generated in the process of construction.

13.) Wastes generated during construction and operation shall be collected and transferred to an operating registered waste disposal site.

14.) Construction waste shall be treated in conformity with Art.18 of the WMA.

15.) Municipal waste shall be treated in conformity with Art.16, paragraph 1 and paragraph 2 of the WMA.

16.) Hazardous waste shall be treated in conformity with the WMA and the related secondary legislation.

17.) An Emergency Action Plan shall be elaborated.

18.) Before implementation of the investment proposal, a procedure for obtaining water use permit shall be carried out in accordance with the provisions of Chapter IV of the Water Act published in State Gazette No. 67 / 1999.

19.) The Project does not involve any risk to health or environment.

20.) No written or verbal objections against the Project have been received at the mayors' offices in the Krumovgrad and Stambolovo municipalities.

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

1.) Report on item 9 of the Comments:
The construction part of the detailed design of SHPS Potochnitsa includes construction of a fish passage going round the power station.

In order to let through the fish migrating to the river of Krumovitsa during the reproduction period, a fish passage version was selected in the form of a free channel with dimensions: width W = 2m; length L = 1200m; river floor elevation in the beginning of the fish passage – 147,50, rift in the gully; outfall elevation - 142,00 downstream of the bridge and rise H = 5,00m. The floor and walls of the channel will be partly in the natural ground and partly concreted. In order to provide near to nature conditions for the migrating fish, it is planned to cover the concreted sectors of the walls and floor with material taken from the river.

The envisaged slope of the channel (5m at about 900m), will ensure flow velocity about 1,0 ÷ 1,3m/sec, which migrating fish can overcome without problems. In order to regulate the flow rate of water released through the fish passage channel, an automatic outlet will be made in the weir, and then the quantity of water required for fish migration will be let through, while maintaining a permanent top water level irrespective of the influx. For overall protection of the facility, construction of a fence and permanent security monitoring by devices at Potochnitsa HPS and at the fish passage are envisaged.

2.) Report on item 12 of the Comments:
A contract will be concluded with the holder of a permit under Art.12 of the Waste Management Act for transfer of the waste generated during construction after a contract has been concluded with the contractor of the site construction works.

3.) Report on item 13 of the Comments:
The waste generated during construction and operation will be collected and transported to the operating dump site indicated by the mayor’s office of Stambolovo municipality.

4.) Report on item 15 of the Comments:
The municipal waste will be treated in conformity with Art.16 Paragraph 1 of WMA with the existing waste management organization on the territory of Stambolovo municipality.

5.) Report on item 17 of the Comments:
Together with the detailed design of SHPS Potochnitsa, an Emergency Action Plan was drawn up taking into account the possibility of natural disasters including floods, earthquake, etc.

6.) Report on item 18 of the Comments:
The procedure of obtaining a water use permit in compliance with the Water Act was carried out.
Water Use Permit No. 301074 / 21.10.2005г. was received from the MoEW Basin Directorate of the East Aegean Region with central office in the city of Plovdiv.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE CALCULATIONS

1.) Default IPCC values from the *IPCC 1996 Revised Guidelines and the IPCC Good Practice Guidance* for net calorific values and corresponding carbon emission factors for fuels are use for justification of plant-specific values.

2.) Specific Carbon Emission Factor (CEF) justification compared with Revised 1996 IPCC Guidelines default values are shown in the following Table No10.

Item	Parameter / Power Plant / Unit	Fuel	Net Caorific Value GJ/Mg MJ/m3	Fuel Carbon Content %	Plant Spec. CEF calculated t C/TJ	Revised 1966 IPCC default value t C/TJ	Fraction of Carbon OXIDi %	r. 1996 IPCC default value OXIDi %
01	TPP Bobov dol	lignite	9,58	26,2	27,35	27,60	1,93	2,00
02	TPP Varna	antracite	24,12	64,25	26,64	26,80	4,70	2,00
03	TPP Rousse East (Unit #4)	antracite	24,18	64,5	26,67	26,80	3,83	2,00
04	TPP Maritsa #3	lignite	10,38	23,765	22,89	27,60	2,64	2,00
05	TPP Lukoil	residual oil	40,2	84,00	20,90	21,10	1,00	1,00
06	TPP Brikel	lignite	9,650	18,65	19,33	27,60	1,86	2,00
07	TPP Deven	bit.coal	25,55	65,50	25,64	25,80	4,00	2,00
08	TPP Republika	lignite	8,02	11,82	14,74	27,60	3,88	2,00
09	TPP Sliven	subbit. coal	14,47	26,20	18,11	26,20	3,60	2,00
10	TPP Sviloza	antracite	23,46	62,12	26,48	26,80	1,83	2,00
11	TPP Vidahim	antracite	22,24	60,12	27,03	26,80	3,46	2,00
13	TPP Maritsa East 2 (Units #1-#4, 150MW)	lignite	6,47	16,70	25,81	27,60	2,39	2,00
14	TPP Maritsa East 2 (Units #5-#8, 200MW)	lignite	6,47	16,70	25,81	27,60	2,49	2,00
15	TPP Maritsa East #3	lignite	6,562	16,70	25,45	27,60	2,92	2,00
16	TPP Maritsa East #1	lignite	6,489	17,20	26,51	27,60	2,00	2,00
17	IPP GT's	natural gas	33,3	48,00	14,41	15,3 (dry)	0,50	0,50
18	TPP Kremikovtsi	bitumen	27,65	60,50	21,88	22,00	1,00	1,00
19	TPP Rousse East (Unit #1,2,5,6,7)	antracite	25,17	65,80	26,14	26,80	2,58	2,00
20	DHP Vratsa	natural gas	33,36	48,00	14,39	15,3 (dry)	0,50	0,50
21	DHP Sofia East	natural gas	33,36	48,00	14,39	15,3 (dry)	0,50	0,50
22	DHP Sofia	natural gas	33,54	48,00	14,31	15,3 (dry)	0,50	0,50
23	DHP Pleven	natural gas	33,49	48,00	14,33	15,3 (dry)	0,50	0,50
24	DHP Plovdiv North	natural gas	33,40	48,00	14,37	15,3 (dry)	0,50	0,50
25	DHP Shoumen	natural gas	33,53	48,00	14,32	15,3 (dry)	0,50	0,50
26	DHP Gabrovo	subbit. coal	26,50	63,00	23,77	26,20	8,40	2,00

Table No 10: Specific Carbon Emission Factor

The equation for calculation of Carbon Emission Factor of generating source utilizing specific fuel is present as follows:

$$CEF_i = \frac{C_{FC} * 10}{NCV_i} \quad (\text{tC/TJ})$$

Where:

CEF_i is carbon emission factor for specific fossil fuel fired in combustion installation in (tC/TJ);
C_{FC} is carbon fossil fuel content in (%)
NCV_i is net calorific value of fossil fuel (in a mass or volume unit) in (GJ/Mg or MJ/m^3)

3.) Justification is made for carbon emission factors and fuel oxidation factors between calculated plant specific values and default IPCC values. Comparison between findings and default values could express as follows:

3.1) plant specific carbon emission factors *CEFi* are lower than IPCC default values. Thus, *CEFi* are consider conservative, because lead to lower emission rates.

3.2) plant specific fuel oxidation factors *OXIDi* are higher than IPCC default values. Therefore, *OXIDi* are conservative, because express lower *COEFi*.

3.3) Specific plant emission coefficient *COEFi*, is lower than 2006 IPCC default values and that lead to lower emissions reductions. Thus emission coefficient *COEFi* is conservative i.e. lowest and is expressed with the equation:

$$COEF_i = \frac{NCV_i * CEF_i * (100 - OXID_i) * (44/12)}{100}$$

4.) Justification of data variables utilize in the baseline calculations

<table>
<tr><td>ID Number</td><td>No.2 (according to spreadsheet with Baseline emission calculations)</td></tr>
<tr><td>Parameter</td><td>$GEN_{y,(i,j,k)}$</td></tr>
<tr><td>Data unit</td><td>$GW_{el}h$</td></tr>
<tr><td>Description</td><td>Power Plant electricity power generation</td></tr>
<tr><td>Data Source</td><td>Data are taken of Central Dispatch Unit SCADA system for the dispatchable power units and of annual power plants reports for non-dispatchable power plants</td></tr>
<tr><td>Measurement</td><td>Measurements methods, there accuracy and procedures, the type of electric meters, applied calibration procedures are according to “Bulgarian Electricity Metering Rules” (BEMR) published by State Energy and Water Regulatory Commission. Please see the link: http://www.dker.bg/papers_en.htm

According to Article 28 (1) of BEMR “The commercial metering of active and reactive industrial electricity shall be implemented by three-element electrometers at distribution lines with voltage 110 kV and higher.”
The electricity metering system must be in compliance with following requirements:

<table>
<tr><th>Accuracy of the different elements of the metering system</th><th>Current
% of the rated current</th><th>Capacity factor</th><th>Error Limit in %</th></tr>
<tr><td>Electrometer for active energy type 0.2 S</td><td>5 % to 20 %</td><td>1</td><td>± 0.4%</td></tr>
<tr><td>Current transformer type 0.2 S</td><td>1 % to 5 %</td><td>1</td><td>± 0.6 %</td></tr>
<tr><td>Voltage transformer type 0.2</td><td>20 % to 120%</td><td>0,5 inductive to 0,8 capacitive</td><td>±0.93%</td></tr>
</table></td></tr>
<tr><td>Comments</td><td>The data for non-dispatchable power plants are double-checked through SCADA output data for regional grid feed in power and the annual reports of these power plants.</td></tr>
</table>

ID Number	*No. 3*
Parameter	*GHR_y*
Data unit	*kJ/kWh*
Description	*Power Unit(s) or Plant - Gross Heat Rate*
Data Source	*Thermal Power Plants monthly records*
Measurement	*Direct method is consisting of measuring fuel incoming in power plant or power unit(s). Division of fuel mass or volume unit to power generation give gross heat rate of the combustion system.*
Comments	*Double check of these data is applied with indirect power balance method for coal fired power plants. The lowest number of the two methods is taken for further calculations as conservative data.*

ID Number	*No.5*
Parameter	*NCVy*
Data unit	*mass unit: (GJ/tonne) & volume unit (MJ/m^3)*
Description	*Fuel Net Calorific Value (Lower Heating Value)*
Data Source	*Power plants annual reports*
Measurement	*for coal – adiabatic calorimeter is applied* *for liquid and gas fuel - the supplier fuel specification are adopted*
Comments	*Double check of the data is applied with fuel specifications bases for specific thermal power plants.* *In case of excess of base fuel specs the lowest number is accept which lead to lower emissions and thus is conservative.*

ID Number	*No. 6*
Parameter	*CCi*
Data unit	*%*
Description	*Carbon content in specific fuel*
Data Source	*Power plants annual reports*
Measurement	*for coal: Monthly chemical analysis is applied.* *for liquid and gas fuel: supplier specs are used.*
Comments	*Double check is applied with fuel bases specifications comparison. The lowest number is accepted in aim to be conservative, because it lead to lower emissions*

ID Number	*No. 9*
Parameter	*$OXID_i$*
Data unit	*%*
Description	*Un oxidized part in post- combustion residues*
Data Source	*Power plants annual reports*
Measurement	*for coal: Monthly chemical analysis of un oxidized carbon in combustion residues – fly ash and slag.* *For liquid and gas fuel revised 1966 IPCC Guidelines default values for un oxidized carbon are applied.*
Comments	*Combustion analysis equation is applied to estimate the sum of chemical and mechanical losses which are determine chemical tests and are in percentage of fuel on oxidized part.*

ID Number	*No. 15*
Parameter	*PGL_y*
Data unit	*%*
Description	*Power grid technological losses*
Data Source	*EPSO Central Dispatch Unit and Regional Dispatch Units of power distribution companies*
Measurement	*National Dispatch Unit SCADA and Regional Dispatch Units SCADA*
Comments	*Power grid technological losses are calculated from the difference between electricity power for distribution and actual power demand, divided to power for distribution, multiply by hundred. The result number is in percentage.*

5.) Two baseline scenarios with emission calculations are develop according to the Minimum and Maximum demand forecast of EPS. The Maximum demand scenario is chosen because it lead to lower emission rates, thus is consider conservative. Justification is made in reference to file < SHPS Potochnitsa Baseline Calculations 29Nov2007> with calculations of baseline emission factor (*EFy*).

The Baseline Calculations were performed in the form of spreadsheets by years for the period 2008-2012. The results of Baseline calculations are presented in following Table No. 11

Parameter		Demand	Unit \ Year	2 008	2 009	2 010	2 011	2 012
System Total Power Generation	Σ GENy	Minimum	GWh/a	40 280	39 921	42 855	44 262	44 352
		Maximum	GWh/a	41 042	40 756	43 817	45 272	45 392
Ratio Build Margin Power Geneneration		Minimum	GWh/GWh	22,56%	24,90%	28,06%	28,98%	29,83%
versus EPC total Power Generation		Maximum	GWh/GWh	22,83%	25,18%	28,37%	29,44%	30,43%
Ratio LC&MR power Plants versus		Minimum	GWh/GWh	48,30%	48,77%	46,01%	44,91%	43,44%
EPC total power generation		Maximum	GWh/GWh	48,10%	48,16%	45,52%	44,35%	42,83%
Simple OM emission factor	EF_{OM_sim}	Minimum	tCO2/MWh	0,892	0,935	0,929	0,919	0,915
		Maximum	tCO2/MWh	0,891	0,932	0,921	0,911	0,909
Simple Adjusted OM emission factor	$EF_{OM\_sim\_adj}$	Minimum	tCO2/MWh	0,892	0,935	0,929	0,919	0,915
		Maximum	tCO2/MWh	0,891	0,932	0,921	0,911	0,909
Build Margin Emission Factor	EF_{BM}	Minimum	tCO2/MWh	0,855	0,853	0,850	0,833	0,825
		Maximum	tCO2/MWh	0,850	0,845	0,835	0,819	0,815
Combined Margin Emission Factor	$CM_{\_BEF}$							
Combined Margin emission factor		Minimum	tCO2/MWh	0,874	0,894	0,889	0,876	0,870
with Simple OM emission factor	$CM\_EF_{OM\ sim}$	Maximum	tCO2/MWh	0,871	0,888	0,878	0,865	0,862
Combined Margin emission factor with		Minimum	tCO2/MWh	0,874	0,894	0,889	0,876	0,870
Simple Adjusted OM emission factor	$CM\_EF_{OM\ sim\ adj}$	Maximum	tCO2/MWh	0,871	0,888	0,878	0,865	0,862
Combined Margin emission factor		Minimum	tCO2/MWh	0,694	0,693	0,701	0,695	0,689
with Average OM emission factor	$CM\_EF_{AV\ OM}$	Maximum	tCO2/MWh	0,693	0,691	0,694	0,688	0,685
Power Grid Emission Factor of								
JI Projects generating electricity	$EF_{GEN,y}$		tCO2/MWh	0,871	0,888	0,878	0,865	0,862
Power Grid T&D losses			%	13,43%	13,56%	11,91%	11,08%	11,47%
Power Grid Emission Factor of								
JI projects with savings of electricity			tCO2/MWh	0,988	1,009	0,983	0,961	0,960

Table No. 11: Baseline Calculations

Annex 3
Project Financial Analysis

As proposed in Methodology ACM0002, the additionality of the proposed project is demonstrated and assessed by "Tool for the demonstration and assessment of additionality" (version 04) EB 36. The assessment steps are as follows:

Step 0: Preliminary screening based on the starting data of the project activity
The proposed project is not above described type of project starting before the date of approval and account emission reduction prior to the start of the crediting period.

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 alternatives are construction of other SHPS. In fact there are no other project of implemented low fall run-of-the-river SHPS in Bulgaria. The reason for this situation is that low falls run-of-the-river SHPS are more investment expansive and with lower efficiency in comparison of all other type SHPS.

The study published by NEK "Small Hydro Power Stations – Investments for the future" reports that about 700 points have been identified where there are technical potential for the construction of SHPSs.

Despite of these facts, a very limited number of SHPSs have been commissioned and no one low fall run-of-the-river SHPS in the past few years. The reason is lack of experience with development of SHPS. Project developers have little experience in implementing such projects which are connect to the national power grid. Therefore, small scale hydro power projects are considered risky by the banks, despite of the good potential as energy source. The small marginal share of small hydro power energy sources in the national power grid reflects the high risk for these project types.

Sub-step 1b. Enforcement of applicable laws and regulation
The new Energy Act is built upon the 2002 Energy Strategy[9] of Bulgaria in accordance with the requirements of the European Union Directives on electricity and natural gas. Energy Act general purpose is to create conditions for the establishment of a competitive energy market, lower the costs of energy supplied to the public, to promote the sustainable development of renewable energy sources (RES) and the co-generations for efficiency combined cycle generation of electricity and heat. The Chapter 11 / Articles 157-163/ of the Energy Act especially promotes the electricity produced from RES and high efficiency combined heat and power (CHP) plants.

The main promotion is that the public suppliers and distributors of energy are obligated to buy all produced from RES and CHP quantity of energy on preferential and regulated prices till coming in force of the green certificates system. The last amendments of Energy Act are from September 2006. The major additions in the Act are positive for the development of RES and CHP in the country:

- The first one is in Article 4, point 11 are amend with wording that every 4 years the Ministry of Economy and Energy (MEE) is obligated to analyze the national potential of high efficiency CHP and RES and to estimate the increasing of their share in the consumption of electricity in the country in accordance with the national indicative purpose the share to reach 11 % in 2010.

[9] **Energy Strategy of Bulgaria.** Please see the web site of Ministry of Economy and Energy: (www.doe.bg/download/energiina_strategia/Energy_strategy-Eng2.doc

- The second one is connected with the validity term of the preferential prices. To this moment the preferential prices were validity to come in force of the green certificates, but now this connection drops out. The electricity distributors are obligated to sign long term contract with the RES and CHP producers. The validity term is minimum 12 years from the each project's start of operation, and the level of the preferential price to 31.12.2022 will be defined with a special Regulation of the State Energy and Water Regulatory Commission (SEWRC) of Bulgaria.

In positive relation with the Energy Act about the development of RES and high efficiency CHP is the Energy Efficiency Law adopted from Bulgarian Parliament in February 2004.

The usage of Renewable Energy Sources (RES) is stated as a major policy direction in the last edition of the Energy Law 2003. This Law stimulates the usage of RES by means of a main source for sustainable development of the electricity production in Bulgaria. This necessity was developed, because of the fact, that most of the primary energy sources used in the country are imported, as well as the low usage of the high-potential of RES.

The Project is a contribution to the development of RES in Bulgaria. It is a step for the achievement of the Bulgarian Government strategies and programs and of the European Community requirements for an increase of the electricity produced by RES from 4,8 % in 2003 to 11 % in 2010. Considering this, Bulgaria is far behind European Union, where it is forecasted that in 2010 the electricity produced by RES will reach 22 % from the total quantity of produced electricity.

Step 2. Investment analysis
The purpose of investment analysis is to determine whether the proposed project activity is economically or financially less attractive than other alternatives without the revenue from the sale of Emission Reduction Units (ERUs). To conduct the investment analysis, following substeps are used:

Sub-step 2a. Determine appropriate analysis method
The *Tools for the Demonstration and Assessment of Additionality* recommends three analysis methods, including simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III).

The proposed project generates financial and economic benefits through the sales of electricity other than JI related income therefore the simple cost analysis (Option I) could not be taken. And the investment comparison analysis (Option II) is only applicable to projects where alternatives should be similar investment projects. The proposed Potochnitsa project is the first implementation in Bulgaria of low fall run-of-the-river hydro-power technology. The proposed project will adopt Caplan turbine type and with implement full automation of operation processes. Project economy analysis, concluded that the hydrology situation of proposed project makes it a unique small hydro power station. So Option II is not an appropriate one either. The proposed project will use benchmark analysis method based on the consideration that benchmark IRR and project total investment IRR are both available.

Sub-step 2b. Option III. Apply benchmark Analysis
Small Hydropower projects are considered financially attractive only when there Financial IRR is the range of 10 to 12%. Thus, 11% should be applied as the benchmark IRR of this project.

Sub-step 2c. Calculation and comparison of financial indicators
1) Basic parameters for calculation of financial indicators
Based on project design documentation, basic parameters for calculation of financial indicators are as follows:
Installed Capacity: 9,38 MW

Net power output: 27,3012 GWh/a
Project Lifetime: 30 years
Total investment: EUR 8’065’000
SHPS Electricity Power Tariff: 43,56 EUR/MWh (excluding VAT)
Crediting period: 3,5 years(42 months in total)
Expected ERU’s Price: 6,75ERU/tCO2e

2) Comparison of IRR for the proposed project and the financial benchmark
In accordance with benchmark analysis (Option III), if the financial indicators of the proposed project, such as the project IRR, are lower than the benchmark, the proposed project is not considered to be financially attractive. Project financial analysis is performed in 3 scenarios:

- Scenario I: “Business as usual”. The project is developing without revenue of ERU’s;
- Scenario II: “as JI project”. The project is developing as JI with revenue of ERU’s in the crediting period 2008-2012.
- Scenario III: “ERU’s after 2012”. The project is developing as JI with revenue of ERU’s in the crediting period 2008-2012 and for next 5 years crediting period 2013-2017.

Project financial is elaborated on Excel file: < FinCalc JI Project SHPS Potochnitsa 27Sep2007.xls >

The results of financial analysis are presented in the following summary Table No. 12

Table No.12

Scenario	Project IRR	NPV	Pay-back period
	30 years	30 years	years
	%	EUR 000'	number
Business as Usual Project Development	10,74%	4 218	13
Project Development as JI	11,24%	4 561	12
Project Development as JI and selling additional carbon credits in the period 2013÷2017	12,13%	5 266	11

Project financial calculations show the project IRR of the proposed Potochnitsa hydropower project with and without the revenue of ERU’s. Without the revenue of ERU’s, the project IRR is 10,74% which is lower than financial benchmark. Thus the proposed project is not considered to be financially attractive. However, taking into account the JI revenues, the project IRR is 10,24%, which is a little bit higher than the financial benchmark. Therefore the JI revenues enable the project to overcome the investment barrier and demonstrate the additionality of the proposed project.

Sub-step 2d. Sensitivity analysis
The sensitivity analysis explain whether the conclusion regarding financial attractiveness is robust to reasonable variations in the critical assumptions.
The following key parameters have been selected as sensitive indicators to test the financial attractiveness for the proposed project.

- Total investments;
- O&M costs;
- Electricity Power Tariff

.
The effect of changes in total investments, O&M costs and electricity price is examined on the internal return rate (IRR). It is assumed that these three parameters change within the range between (-20% ÷

+20%), then the outcomes of IRR sensitivities are presented in the following tables considering the three scenarios.

Table No13

Scenario I BaU	30 years operation						
Sensitivity of project IRR to key financial parameters in Scenario I BaU							
Financial Parameter	-20%	-10%	-5%	0%	5%	10%	20%
Total investment	14,06%	12,22%	11,44%	10,74%	10,09%	9,49%	8,44%
Total O&M Costs	11,33%	11,04%	10,89%	10,74%	10,58%	10,43%	10,11%
Electricity Power Tariff	7,77%	9,58%	10,46%	10,74%	12,99%	13,04%	14,73%

Table No14

Scenario II as JI Project	30 years operation						
Sensitivity of project IRR to key financial parameters in Scenario II as JI project							
Financial Parameter	-20%	-10%	-5%	0%	5%	10%	20%
Total investment	14,79%	12,83%	11,99%	11,24%	10,55%	9,92%	8,81%
Total O&M Costs	11,85%	11,55%	11,39%	11,24%	11,08%	10,92%	10,60%
Electricity Power Tariff	8,21%	10,06%	10,96%	11,24%	12,73%	13,60%	15,33%

Table No15

Scenario III ERU's after 2012	30 years operation						
Sensitivity of project IRR to key financial parameters in Scenario III ERU's after 2012							
Financial Parameter	-20%	-10%	-5%	0%	5%	10%	20%
Total investment	15,93%	13,83%	12,94%	12,13%	11,40%	10,72%	9,53%
Total O&M Costs	12,74%	12,44%	12,29%	12,13%	11,97%	11,81%	11,48%
Electricty Power Tariff	9,08%	10,94%	11,85%	12,13%	13,63%	14,50%	16,24%

It can be seen from above tables that the project IRR would fluctuate in a certain range with the three parameters, while those ranges are different. O&M cost gives the minimum effects on project IRR, which make it fluctuate from 10,11% to 11,33%. The total investment of the project affects IRR somehow more serious than O&M costs (fluctuate from 8,44% to 14,06%), so it could be considered sensitive.

The electricity power tariff changes would bring significant impacts on the economic performance of the proposed project. Higher electricity power price could result in a good financial improvement. This sensitivity analysis is based on the reasonable assumption that the electricity power price would fluctuate between the -20%-+20% of its determined price by Bulgarian SEWRC. The IRR changes from 7,77% to 14,73%, which would exceed the benchmark value.

In conclusion, electricity power tariff is considered as the key parameter affecting the project IRR. And according to the sensitivity analysis, it is believed that the project would not be economic attractive even when the electricity price varies of the reasonable price. Therefore, the proposed project needs the supporting from JI to make it financially attractive.

Step 4. Common practice analysis
The existing common practice is identify and discuss through the following sub-steps:

Sub-step 4a. Analyze other activities similar to the proposed project activity:

The country is comparatively poor of water resources about 1600 - 2000 m^3 annual water quantities per capita of the population. Thanks to the mountainous character of part of the country territory, the theoretically estimated hydro energy potential comes up to 26 billion kWh during a year with average water flow. The potential which can be technically processed is about 57% of the theoretical potential and is estimated to 15 billion kWh. The 125 HPSs which are currently in operation process about 33% of the technical potential. Together with the PSHPPs their share constitutes 23% of the installed capacities in the country and 5-8% of the electricity generation.

During the last 20 years the real generation has been reduced by 30-40% compared to the expected generation according to the design. That has resulted from the dry years on the Balkan Peninsula and in the whole world, as well as from the deviation of large water masses for water supply, irrigation and environmental purposes.

At present there are 87 operating big hydropower plants in Bulgaria with total installed capacity of 2830 MW. The locations of the hydropower sites show that 143 MW are concentrated in country Northern part and 2691 MW – in the Southern part of the country.

Over 90% of the built up capacities are located below large water reservoirs which allows the best utilization of the river flow with regard to the electric power needs in the country.

Over 88% of the current operating hydropower capacities are focused in the four big hydropower complexes: Belmeken- Sestrimo- Chaira Hydropower Cascade, Vacha Cascade, Dolna Arda Cascade and Batak Cascade. The table below shows the energy indices that are most typical of these four hydropower complexes:

Table 16

Cascade/ HPP	In operation since	Total volume of the water reservoirs	Number of turbines (pumps)	Capacity	Generation (consumption)
	year	mln. m3		MW	GWh/ year
Belmeken-Sestrimo-Chaira Cascade		137		1599	1092
Chaira PSHPP	1999		4 turbines-F	864	456
			(4 pumps)	788	(586)
Belmeken HPP/PSHPP	1976		5 turbines- P	375	306
			(2 pumps)	104	(175)
Sestrimo HPP	1974		2 turbines-P	240	221
Momina Klissoura HPP	1974		2 turbines-F	120	109
Vacha Cascade		500		401	543
Teshel HPP	1972		2 turbines-F	60	102
Devin HPP	1984		2 turbines-F	80	70

Vacha HPP/PSHPP	1975		3 turbines-F	160	168
			(1 pumps)	45	(71)
Krichim HPP	1973		2 turbines-F	76	165
Vacha I HPP	1933		4 turbines-F	14	22
Vacha II HPP	1972		2 turbines-F	6,6	16
Arda Cascade		812		270	481
Kardjali HPP	1964		4 turbines-F	106	115
Stouden Kladenets HPP	1958		4 турбини-F	60	190
Ivailovgrad HPP	1965		3 turbines-K	104	176
Batak Cascade		361		231	605
Batak HPP	1957		4 turbiens-P	40	127
Peshtera HPP	1959		5 turbines-P	125	340
Aleko HPP	1959		3 turbiens-F	66	138
TOTAL FOR THE FOUR CASCADES:				2501	2721

Problems related to the operation of the Bulgarian HPPs.
As a result of the durable climatic changes that have been observed and the lower quantities of rainfalls on the territory of the country, the flow of the big Bulgarian rivers is getting reduced compared to the flow 15-20 years ago. Under the conditions of reduced river flow, the deviation from the planned utilization, respectively from the power generation, has reached 15-25% in the Bulgarian HPSs in the last years.

The condition of the mechanical and electrical equipment is another reason for reducing the power generation in the HPSs. A great deal of the operating plants were built 30 years ago, and in many cases 50 years ago. In the last years rehabilitation was done to some of the large Bulgarian HPSs and as a result of that the operational parameters of these plants were considerably improved. The remaining part of the operating HPSs can be characterized by lower efficiency indices of the main hydro mechanical equipment and lower power generation resulting from that.

The deviation of considerable water masses for other purposes / irrigation, water supply, etc./ is also one of the main reasons for the reduced power generation. Due to that reason the electric power not generated by the big HPPs during the last 10 years has reached 300 – 400 GWh/ year.

Restructuring and rehabilitation of the existing hydropower projects.
The rehabilitations fulfilments will achieve the following:

- improvement of the facilities' operational parameters
- extension of the facilities' operational life by 25-30 years
- reaching of the modern technical standards in the hydropower plants' running.

The rehabilitation programme is focused on the sites forming the four largest hydropower complexes in the country.

Belmeken-Sestrimo-Chaira hydropower cascade.
By the commissioning of Chaira PSHPP the total generating capacity of Belmeken –Sestrimo-Chaira Hydropower Complex has reached 1599 MW. The main parameters of the separate hydropower plants are shown in the table below:

Table 17

№	Parameter	Belmeken HPS/ PSHPP	Sestrimo HPS	Momina Klissoura HPS	Chaira PSHPP
1.	Installed capacity - generating mode [MW] - pumping mode [MW]	 375,0 104,0	 240,0 –	 120,0 –	 864,0 788,0
2.	Planned annual power generation/ consumption - generating mode [GWh] - pumping mode [GWh]	 556,00 222,00	 421,00 –	 198,00 –	 1180,00 1575,00
3.	Number of units	5	2	2	4
4.	Type of units	“Pelton”	“Pelton”	“Francis”	“Francis” (reverse type)

The first three hydropower plants (“Belmeken”, “Sestrimo” и “Momina Klissoura”) have been in operation since 1974 /1976.

The first two units in Chaira PSHPP were commissioned in 1995, and in August 1999 units 3 and 4 were put in operation by which the plant has reached its full capacity.

With installed capacity of approximately 1600 MW Belmeken – Sestrimo-Chaira Cascade is undoubtedly the most important hydropower complex in Bulgaria. That also determines the priorities of this cascade for the implementation of the rehabilitation programme of the biggest hydropower projects.

The rehabilitation works in Belmeken HPP/PSHPP, Sestrimo HPP and Momina Klissoura HPP were completed by October 2000. The financing was ensured by the NEK own funds and a loan granted by the World Bank. The complex programme for the cascade rehabilitation was completed in 2000.

Batak hydropower cascade.

The Batak Cascade was built in the period 1951 - 1959 and it is the first hydropower cascade in Bulgaria. The power generation comes from three HPSs located in the upper river valley of Maritsa r. and having the following main parameters presented in following table:

Table 18

№	Index	Batak HPS	Peshtera HPS	Aleko HPS
1.	Installed capacity [MW]	40,0	128,0	64,8
2.	Planned annual power generation [GWh]	167,7	440,7	202,0
3.	Number of units	4	5	3
4.	Types of units	“Pelton”	“Pelton”	“Francis”

At present a rehabilitation programme is being implemented for the facilities of the Batak Cascade with financing from FOFEA (The Swiss Ministry of Foreign Economic Relations/ . The rehabilitation works on Peshtera HPS , on Batak HPS and on Aleko HPS are completed, and the HPSs of the cascade are commission.

Construction and commissioning of new hydropower projects.
The Least Cost Development Plan foresees the construction of the following new hydropower projects until the year 2020:

Dolna Arda cascade rehabilitation project
The Arda River is one of the biggest Bulgarian rivers. Along its middle and lower streams, three hydropower plants have been built below the dams having the same name: Kardjali, Studen Kladenets and Ivailovgrad. The total installed capacity of the three HPPs is 270 MW at annual power generation of 440 GWh.

Nowadays rehabilitation project is implemented at Dolna Arda cascade as JI Project. The project envisage rehabilitation of all hydropower units in the cascade and build up of additional Unit 5 in Studen Kladenets HPS. The total project investment costs are estimated to EUR 64,4Mil.

Gorna Arda Cascade Project
The Gorna Arda Cascade Project envisages along the upper stream of the river the construction of three new dams with hydropower plants located below them. The total installed capacity of the new power plants is 170MW and the annual power generation is 454 GWh. Along with its electric power importance, this project will also have a significant social contribution, since a lot of working labour will be employed for its construction in a region of high unemployment rate.

All necessary investigations, including engineering and geological research, topographic studies, have been done for these new hydropower cascade, as well as the type and the parameters of the main facilities have been optimized. Quantity and value accounts are made up. The total investments for Gorna Arda cascade construction and commissioning is estimate to EUR 320mil.

Vacha hydropower cascade project
The project consist of Vacha cascade HPS's rehabilitation and Tsankov kamak hydropower project The Tsankov Kamak Hydropower project is located on another big Bulgarian river - Vacha. At present, there are 6 hydropower stations built up and commissioned, with total installed capacity of 446 MW and annual power generation of 543 GWh. The project envisages for the new plant, which will be located along the middle stream of the river to be with 80MW capacity and average annual power generation of 186 GWh.

Recently the project is in civil construction works. According to the time schedule Tsankov kamak project will be commission in mid of 2009. The rehabilitation of existing HPS at the cascade is already accomplished. Vacha Cascade Project is developed and implement as JI Project. The total investment project costs are estimated to EUR 220Mil.

Yadenitsa reservoir project.
By the commissioning of Chaira PSHPP, the power system has got a powerful and modern plant. At the increased requirements for ensuring a safe, reliable and economic electric power supply at certain admitted deviation limits concerning voltage and frequency, the Chaira PSHPP functions are expanding compared to the initially accepted ones. In that sense the role of the plant is becoming very important for:

- the total system regulation of the load schedule at optimal structure of the generating capacities;

- increasing of the system reliability and cheapness by ensuring an even regime in the NPP and TPP day and night;
- quick and flexible back-up of the system with possibility for keeping the load in case of shut down the large single capacity in EPS.

For the realization of the above main additional functions of Chaira PSHPP, it is necessary that the volume of the lower compensating basin of Chaira PSHPP is increased.

Yadenitsa Water Reservoir Project envisages for this dam to be built up at the level of Chaira Dam and to be connected to the latter by a joining pressure water way. The so formed system of interconnected vessels will allow a gravitated transfer of waters from one compensating basin to another, which in fact means increasing of the volume of the lower compensating basin of Chaira PSHPP.

For this project, as well as for the previous projects, NEK by its own funds has carried out a considerable part of the preliminary works, mainly for the deviation of an existing forest way, as well as forming the project sites at both sides of the reverse pressure tunnel and the road connections to them for a good access to them.

The technical project and the tender documents are already worked out, as well as the procedures for terrain expropriation.

Sub-step 4b. Discuss any similar options that are occuring

The study published by NEK "Small Hydropower Plants – Investments for the future"[10] reports that about 700 spots have been identified where there are technical potential for the construction of small run-on-the river HPSs, and there are over 100 attractive spots for the construction of SHPSs below existing irrigation or water supply reservoirs. However detailed technical and economic analyses have been completed for only few small HPSs, and a very limited number of plants have been realized in past years, most of them under a Joint Implementation scheme.

The main reason why most of the identified small HPSs were not implemented is that they are still seeking financing and the sector is not attracting private investment due to the large initial investments costs and the relatively long period of return.

A considerable part of the initialized hydropower potential in Bulgaria can be put to a useful purpose by means of the construction of small hydropower stations. There are such good opportunities along the valleys of two considerably big Bulgarian rivers - Iskar and Strouma.

The studies carried out so far show that 46 small hydropower stations with a total capacity of 133 MW and annual generation of 711 GWh can be built up along the Iskar river.

The investigations along the Strouma river show that there are good technical possibilities for the construction of 27 low head falls power stations with a total capacity of 59 MW and annual production of 238 MW.

[10] http://www.nek.bg/cgi-bin/index.cgi?l=2&d=1211

The data for the installed hydropower capacities utilizing Kaplan turbines against the total amount installed hydropower capacities in the country is only 4,19%. Additional data is that from installed hydropower output of 136,24MW with Kaplan turbines in the country only 2% are in SHPS. The main reasons for this situation with Kaplan turbine utilization in Bulgaria are as follows:

- relatively larger investments compared with the other SHPS equipped with Francis and Pelton turbines;
- relatively lower efficiency of Kaplan turbines compared with Francis and Pelton turbines;
- there is no turbine manufacture in Bulgaria which produce Kaplan turbines.

In these circumstances, there aren't similar new projects developments in the country for hydropower electricity generation with implementation of Kaplan turbines observed and commonly carried out.

However there are two JI projects in Bulgaria which have sub-projects utilizing Kaplan turbines.

The first JI project is "Pool of Small Hydro Power Stations and Wind Energy Parks Project"[11]. This project includes 14 SHPSs but only 3 of them are equipped with Kaplan turbines. Financial analysis of these sub-projects is made but only final results are presented. The parallel at the financial findings of the two projects is presented in following table.

Table No.19

JI Project	Small Hydropower Station	Output	Pay back period	Project IRR	
				BaU	With ERUs
		MW	years	%	
Potochnitsa	Potochnitsa	9,38	12	10,74	11,24
Pool of SHPS&WEP	1. Zverino	3,008	10	8,9	n.a.
	2. Luti brod	0,732	9	10,8	n.a.
	3. Lobosh	1,62	9	11,7	n.a.

Notwithstanding poorly data there are three outcomes which show clearly the sub-projects in the JI project Pool are more financially attractive than SHPS Potochnitsa:

1.) The accept calculation time period in financial analysis for the Pool sub-projects is 11 years in comparison with 30 years for SHPS Potochnitsa which correspond to operation time of the main equipment and is more accurate. This stipulation give lower figure for the JI project IRR, which should be much higher if operation and calculation period is considered not less than 20 years.
2.) The pay back periods of sub-projects in the Pool are lower than of SHPS Potochnitsa, which clearly indicate that these projects are more profitable.
3.) The Project IRR with the additional financing input of ERU revenue was not indicate in the JI Pool sub-projects which is not transparent and don't present what is the additional financial indices of JI.

[11] http://ji.unfccc.int/JI_Projects/Verification/PDD/index.html

The second JI project which utilizes only Kaplan turbines is "Sreden Iskar Cascade HPP Portfolio Project"[11]. The project consists of construction and commissioning of 9 run-of-the-river SHPS with total installed capacity of 25,62MW in the valley of Iskar river.

The portfolio project will be finance and supported of EBRD. In this circumstances it could be deem that the financial conditions of this project are more preferable than these of SHPS Potochnitsa which is finance by a local bank – the branch in Sofia of UniCredito Bank.

Unfortunately in the PDD of Sreden Iskar Cascade project there are not financial analysis or financial parameters, thus no comparison could not be made with Potochnitsa Project. The essential differences between the two projects are that Sreden iskar cascade last SHPS will be final commission in 2011 and the SHPSs in the cascade are relatively smaller than Potochnitsa Project.

Conclusions:

1.) Similar projects utilizing Kaplan turbines are not widely presented in Bulgarian hydropower sector and new HPS with similar equipment could not be seem to be widespread in near future.
2.) There are essential distinctions between the project activity and the similar project activities explained in the above analysis.
3.) Sub-steps 4a and 4b of common practice analysis are satisfied and reasonably explained why SHPS Potochnitsa is additional:

Annex 4

Republic of Bulgaria

MINISTRY OF ENVIRONMENT AND WATER

To Whom It May Concerns:

LETTER OF SUPPORT

The Ministry of Environment and Water supports in principle the proposed project idea

Proposal number/date	/10.04.2006
Title	"Construction and exploitation /operation/ of Hydro Power Plant "Potochnitsa"
Location	"Arda" River, Town of Potochnitsa, Haskovo District,
Supplier	"Finauto" Ltd

and confirms that it falls within the scope of Joint Implementation projects under the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

The Ministry of Environment and Water will consider granting formal approval of the Joint Implementation project according to the Bulgarian procedures, decisions of the Joint Implementation Supervisory Committee and under the following conditions:

- sufficient amount of allowances is available for electricity production and electricity demand reduction projects in the Joint Implementation set aside in the approved by the European Commission National Allocation Plan;
- submission of a Project Designed Document, validated by an Independent Entity;
- the buyer of the emission reduction generated by the project is a country that has signed a Memorandum/Agreement on cooperation under Article 6 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change with the Republic of Bulgaria;
- the assessment of the project by the Steering Committee established for this purpose, and according to the Bulgarian criteria is positive.

May, 2006
Sofia, Bulgaria
Jordan Dardov
Deputy Minister of Environment and Water