**PROJECT DESIGN DOCUMENT FORM
FOR CDM PROJECT ACTIVITIES (F-CDM-PDD)
Version 04.1**

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Chorokhi Hydro Power Plant Project
Version number of the PDD	07
Completion date of the PDD	30 January 2014
Project participant(s)	Achar Energy 2007 Ltd. Co.
Host Party(ies)	Georgia
Sectoral scope and selected methodology(ies)	01 - ACM0002, ver. 13.0.0
Estimated amount of annual average GHG emission reductions	284,042 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The project of Achar Energy 2007 Ltd. Co. (hereafter referred to as "**Achar Energy**"), **Chorokhi Hydro Power Plant Project** (hereafter referred to as the "Project" or "**Chorokhi HPP**"), is a Greenfield hydro power project and located on Chorokhi river, in Batumi city of Georgia. Total installed capacity of Chorokhi HPP is planned to be around 113 MW and expected annual electricity generation amount is 517.88 GWh. Estimated annual emission reduction amount is by project activity generation is 284,042 tCO_2e.

Chorokhi HPP involves 3 weirs and 3 power units in cascade system on same river. These are Kırnati Weir and HPP, Khelvachauri I Weir and HPP, Khelvachauri II Weir and HPP. Installed power, annual estimated electricity generation amount, reservoir surface area in full level and power density for each power units is given in Table 1.

Table 1 Power Units and Power Density Calculation for Project Activity

Chorokhi HPP Power Units	Installed Capacity (MW)	Annual Electricity Generation (GWh/yr)	Reservoir Area in Full Level (m^2)	Power Density (W/m^2)
Kırnati	35.039	146.88	539,746	64.92
Khelvachauri-I	42.808	205.36	905,800	47.26
Khelvachauri-II	35.028	165.64	1,085,333	32.27
TOTAL	**112.875**	**517.88**		

Preliminary studies and licence tasks started in 2011. Construction of the power plants is planned to start in 2012 and by beginning of 2014, project activity is planned to start operation.

Technology to be implemented for the project activity (hydro power generation) is one of the mature and most experienced power generation technology. Project developer has contracted a Chinese company (Zhejiang Fuchunjiang Hydropower Equipment Co., Ltd) for power generation set (turbines&generators). Thus technology of the project activity will be transferred from non-Annex I country.

Project will be connected to the Georgian grid. According to study prepared by Econ, Georgia need to have hydropower plants and increase electricity generation especially during winter and autumn seasons in order to decrease import amount and thermal power plant generation[1]. Therefore, electricity generation with proposed project activity will decreases the amount of electricity to be generated by thermal power plants and by this way, reduce CO_2 emissions. Detail information on baseline is provided in section B.4.

The project will help Georgia to stimulate and commercialise the use of grid connected renewable energy technologies and markets via private investments. Furthermore, the project will demonstrate the viability of private hydro power plants which can support improved energy security, improved air quality, alternative sustainable energy futures, improved local livelihoods and sustainable renewable energy industry development. The specific goals of the project are to:

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[1] See: http://www.investingeorgia.org/uploads/file/The%20electricity%20sector%20in%20Georgia%20-%20A%20risk%20assessment%20ECON%20final.pdf, page 12

- reduce greenhouse gas emissions in Georgia compared to the business-as-usual scenario;
- help to stimulate the growth of the private hydro power industry in Georgia;
- create local employment during the construction and the operation phase of power plant;
- reduce other pollutants resulting from power generation industry in Georgia, compared to a business-as-usual scenario;
- help to reduce Georgia's increasing energy deficit during autumn and summer seasons;
- and differentiate the electricity generation mix and reduce import dependency.

Other than the objective of climate change mitigation through significant reduction in greenhouse gas (GHG) emissions, the project has been carried out to provide social and economic contribution to the region in a sustainable way. The benefits that will be gained by the realization of the project compared to the business-as-usual scenario can be summarized under four main indicators:

Environmental
The project activity will replace the grid electricity, which is constituted of different fuel sources causing greenhouse gas emissions. By replacing in the consumption of these fuels, it contributes to conservation of water, soil, flora and faunas and transfers these natural resources and also the additional supply of these primary energy sources to the future generations. In the absence of the project activity, an equivalent amount of electricity would have been generated from the power plants connected to the grid, majority of which are based on fossil fuels. Thus, the project is replacing the greenhouse gas emissions (CO_2, CH_4) and other pollutants (SO_X, NO_X, particulate matters) occurring from extraction, processing, transportation and burning of fossil-fuels for power generation connected to the national grid.

Economical
Firstly, the project will help to accelerate the growth of the private hydro power industry and stimulate the designation and production of renewable energy technologies in Georgia. Then, other entrepreneurs irrespective of sector will be encouraged to invest in hydro power projects. It will also assist to reduce Georgia's increasing energy deficit and diversify the electricity generation mix while reducing import dependency.

Social
Local employment will be enhanced by all project activities during construction and operation of hydro power plant. As a result, local poverty and unemployment will be partially eliminated by increased job opportunities and project business activities. Construction materials for the foundations, cables and other auxiliary equipment will preferentially be sourced locally. Moreover as contribution of the project to welfare of the region, the quality of the electricity consumed in the region will be increased by local electricity production, which also contributes decreasing of distribution losses.

A.2. Location of project activity

A.2.1. Host Party(ies)

Georgia

A.2.2. Region/State/Province etc.

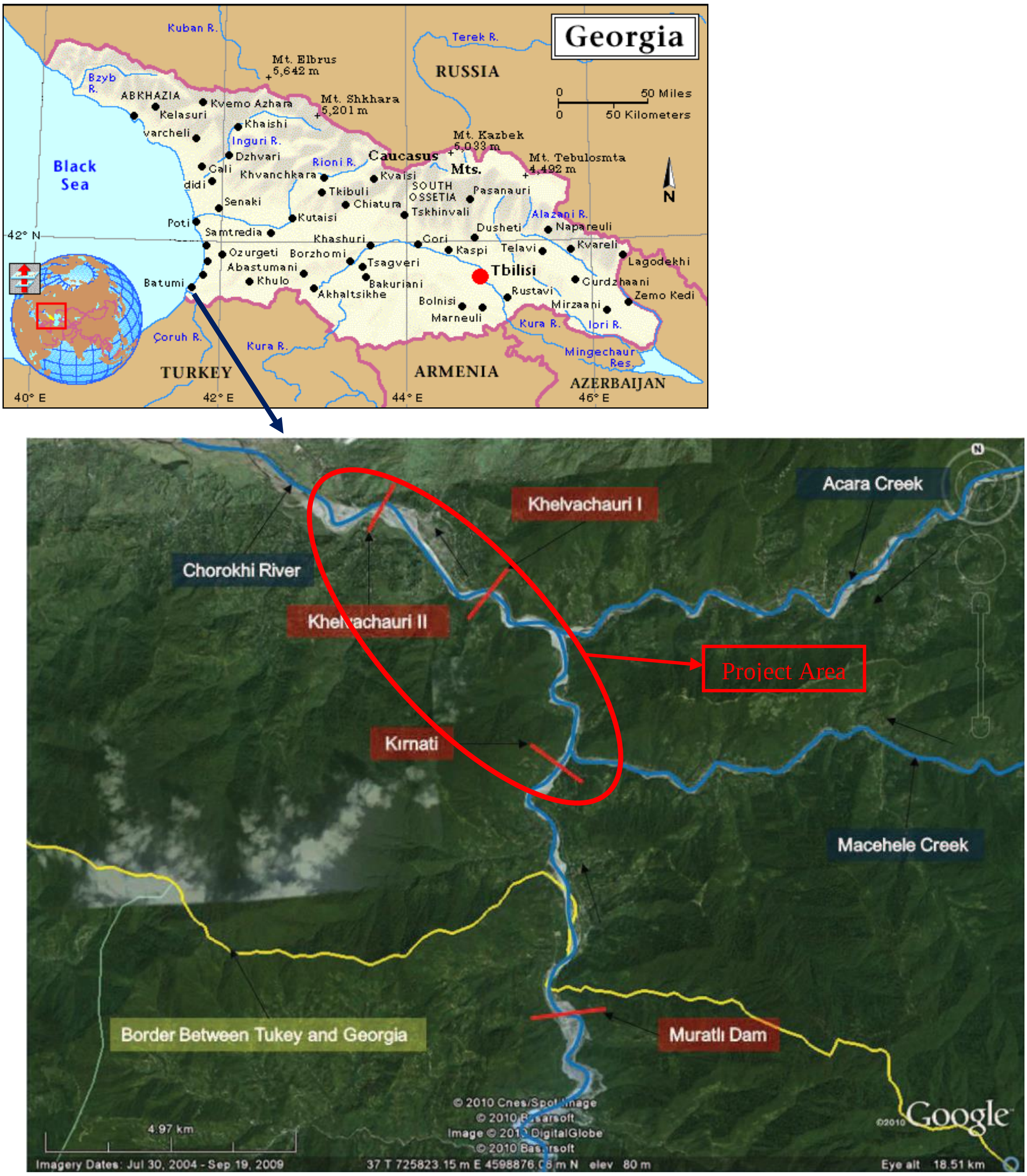
Project area is in Batumi province in Adjara Autonomous Republic of Georgia.

A.2.3. City/Town/Community etc.

The project is located in Khelvachauri town and Kırnati village in Batumi province.

A.2.4. Physical/Geographical location

The main water resource of project is Chorokhi River. The River, rising within the borders of Turkey, conjoins many tributaries before leaving the country borders around Muratlı town of Borçka District and enters the borders of Georgia. After conjoining Macehele and Acara rivers in Georgian borders, it flows into the Black Sea around the province of Batumi. İnguri, Rioni and Kodori Rivers are the main water resources of Kohilda Plain while Kartli Plain has Kura River and tributaries as the main water resource in Georgia, which is a rich territory in terms of river resources. Location of the project is given below in the Map 1.



Map 1: Project area showing location of power units

Table 2: Geographical coordinates of weirs and powerhouses of project activity

Power Units	Latitude (N)	Longitude (E)
Kırnati Weir and Power House	41° 30' 57"	41° 42' 55"
Khelvachauri-I Weir and Power House	41° 33' 2"	41° 41' 51"

Khelvachauri-II Weir and Power House	41° 34' 6"	41° 40' 23"

A.3. Technologies and/or measures

The proposed project activity is a green-field hydro power project, including three power units. Detail characteristics for each power units are given in Table 3. Total installed capacity of Chorokhi HPP is 112.875 MW and total estimated annual electricity generation amount is 517.88 GWh.

The hydro electric power plants grid connection will be from 154 kV substation located near Kırnati power unit. Output of Kırnati unit will be connected via cables to the GSU transformer at the HV substation. Khelvachauri I and II will be connected via 34.5 kV OHL to the HV substation. Grid connection diagram of project activity is given in Figure 3.

Table 3 Characteristics of power units in Chorokhi HPP

		Kırnati HPP	**Khelvachauri-I HPP**	**Khelvachauri-II HPP**
Project Main Characteristics	**Gross Head**	11 m	11 m	9
	Net Head	10.45 m	10.45 m	8.55 m
	Design Flow	375.6 m^3/s	458.8 m^3/s	458.9 m^3/s
	Total Installed Power	35.039 MW	42.808 MW	35.028 MW
	Power Density	64.92 W/m^2	47.26 W/m^2	32.27 W/m^2
	Power Generation	146,880 MWh/year	205,360 MWh/year	165,640 MWh/year
Weir (Regulator)	**Type**	Concrete	Concrete	Concrete
	Crest Length	240 m	223 m	225 m
	Crest Elevation	54.5 m	42.5 m	32.5 m
	Reservoir Area in Crest Elevation	539,746 m^2	905,800 m^2	1,085,333 m^2
	Thalweg Elevation	41 m	30 m	21 m
Water Intake Structure	**Location**	Right Bank	Right Bank	Right Bank
	Number of Gates	5	6	6
	Gate Dimensions (WxL)	9.0 m x 8.20 m	9.0 m x 8.20 m	9.4 m x 8.20 m
	Sill Elevation	44 m	31.5 m	23.5 m
Spillway Structure	**Location**	Left Bank	Left Bank	Left Bank
	Type	Radial Gated	Radial Gated	Radial Gated
	Crest Length	39.2 m	48 m	60 m
	Number of Gates	4	4	5
	Gate Dimensions (WxL)	9.80 m x 11.0 m	12.0 m x 11.0 m	12.0 m x 9.0 m
Power Plant Building	**Dimensions (WxL)**	33.70 m x 64.0 m	33.70 m x 76.5 m	33.70 m x 76.5 m
Turbine	**Type**	Bulb	Bulb	Bulb
	Unit Number and Power	4 x 8,396 kW + 1 x 1,455 kW	5 x 8,209 kW + 1 x 1,763 kW	5 x 6,717 kW + 1 x 1,443 kW
	Unit Discharge Rate	4 x 90 m^3/s + 1 x 15.6 m^3/s	5 x 88 m^3/s + 1 x 18.9 m^3/s	5 x 88 m^3/s + 1 x 18.9 m^3/s
Generator	**Type**	3-phase, synchronised, AC	3-phase, synchronised, AC	3-phase, synchronised, AC
	Total Generator Power	41,224 kVA	50,364 kVA	41,207 kVA

	Unit Number and Power	4 x 9,878 + 1 x 1,712 kVA	5 x 9,658 + 1 x 2,074 kVA	5 x 7,902 + 1 x 1,697 kVA
	Nominal Voltage	6.3 kV	6.3 kV	6.3 kV
	Frequency	50 hz	50 hz	50 hz
	Synchronic Rotation Frequency	142.9+ 333.3 rpm	142.9+ 300.0 rpm	130.4+ 272.7 rpm
Transmission Line	**Type**	2 x 795 MCM	795 MCM	795 MCM
	Line Voltage	154 kV	34.5 kV	34.5 kV
	Connection Point	Batumi Substation of GNERC (national TSO)	Batumi Substation of GNERC (national TSO)	Batumi Substation of GNERC (national TSO)
	Length	6 km	4.5 km	7 km

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Georgia (host)	Achar Energy 2007 Ltd. Co. (private entity)	No

A.5. Public funding of project activity

The project activity doesn´t receive public funding from Parties included in Annex I of the Convention.

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

For the determination of the baseline, the official methodology ACM0002 version 13.0.0, "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"[2], is applied, using conservative options and data as presented in the following section. This methodology refers to four Tools, which are:

1. Tool to calculate the emission factor for an electricity system (version 03.0.0);
2. Tool for the demonstration and assessment of additionality (version 07.0.0);
3. Combined tool to identify the baseline scenario and demonstrate additionality (version 05.0.0);
4. Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02).

For baseline calculation the first tool, for additionality assessment the second tool is used. As third tool is the combination of the first and second tool, it is not used. Since no project emission or leakage calculation is required for hydro power projects fourth tool is not used, either.

B.2. Applicability of methodology

The choice of methodology ACM0002 version 13.0.0 is justified as the proposed project activity meets its all applicability criteria which are also given below:

- Chorokhi HPP is a grid-connected renewable power generation project activity that is the installation of a new hydro power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant);
- The proposed project activity results in new three reservoirs and the power density of all three power plant units, as per definitions given in the project emissions section, is greater than 4 W/m^2.The proposed project activity is a grid-connected hydropower project which is connected to a national power grid of Georgia.
- The project does not involve switching from fossil fuels to renewable energy at the site of the project activity.

"Tool to calculate the emission factor for an electricity system (version 03.0.0)" is applicable to the project activity because:

- the proposed project activity substitutes grid electricity, i.e. project activity supplies electricity to the Georgian grid (page 2, paragraph 3)
- the project electricity system is *not* located partially or totally in an Annex I country, as project activity will be connected to the Georgian grid, a non-Annex I country (page 2, last paragraph).

"Tool for the demonstration and assessment of additionality (version 07.0.0)" is applicable to the project activity because according to the ACM0002 (page 5) *"The additionality of the project activity shall be demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the Board, which is available on the UNFCCC CDM website."*

The project activity corresponds to the criteria described above thus; ACM0002 methodology and identified methodological tools provided in Section B.1 are applicable to the project activity.

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[2] ACM0002 version 13.0.0:
(http://cdm.unfccc.int/filestorage/D/Y/P/DYPFI935XBG274NWH6O8CM1KEZR0VU/EB67_repan13_ACM0002_ver13.0.0.pdf?t=VTR8bWY2bXV1fDAFsp3ftCkwGWKw4gDB27tW)

B.3. Project boundary

The project uses hydro energy to produce electricity. Kinetic power of the hydro is converted to electrical energy, which then will be transferred to the Georgian grid. Electricity to be generated and fed in to Georgian grid will be sold to the users or traders in Georgia and exported to Turkey. A general operation diagram of the project is given in Figure 1.

Although the project owner plans to export some share of the generated electricity to Turkey[3], due to following reasons, Turkish grid is not included in project boundary and project electricity system for emission factor calculation:

- As given in Table 3 (section A.3) the project will be connected to the Batumi substation via two high voltage transmission lines, which is being operated by Georgian Grid Operator (GNERC). This means that, all the electricity to be generated will be fed into Georgian grid. In case of export, this will not be via a direct line from the power plant to Turkey, but via existing interconnection line and using mixed electricity (with calculated emission factor). Thus, physically exported electricity will not be directly from the power plant, but Georgian grid.

- According to paragraph 10-f) of *Tool to calculate the emission factor for an electricity system* (paragraph 17) the Connected electricity system is defined as below:
  *"***Connected electricity system -** *is an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint, and/or the transmission capacity of the transmission line(s) that is connecting electricity systems is less than 10 per cent of the installed capacity either of the project electricity system or of the connected electricity system, whichever is smaller;*

  There is one 220 kV transmission line (interconnection line) between Turkey and Georgia currently having import-export capacity up to 150 MW[4] and being operated under isolated region principle. Turkey's overall installed capacity by end of 2012 is 57,059.4 MW[5] and thus 10% of this becomes 5,705.94 MW. Georgian installed capacity is 3,168 MW[6] and 10% becomes 316.8 MW. As transmission capacity of interconnection line (150 MW) between Turkey and Georgia is less than 10% of Georgian installed capacity (316.8 MW), the Turkish grid shall be considered as connected electricity system and not be considered within the project electricity system, for the purpose of emission factor calculation.

[3] Please refer to section B.5 for further information.
[4] See Net Transfer Capacity Announcement of TEIAS for Interconnection Lines (page 3): http://www.teias.gov.tr/Dosyalar/NetTransferKapasiteleri.doc
[5] See: http://www.teias.gov.tr/yukdagitim/kuruluguc.xls (cell C18)
[6] Please refer to Appendix-4 of this PDD.

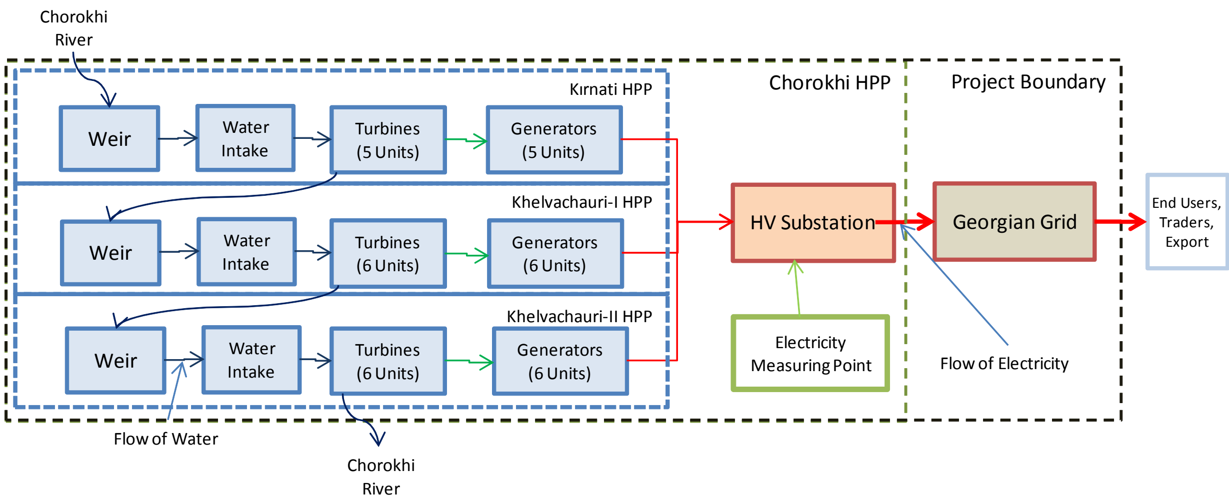

Figure 1: Operation diagram of Chorokhi HPP and boundary of project activity

Based on the above operation diagram, the baseline and project activity related greenhouse gases which are considered in baseline calculation is given below, in Table 4:

Table 4: Emissions sources included in or excluded from the project boundary

Source		GHGs	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	*Main emission source*: Fossil fuels fired for electricity generation cause CO_2 emissions. It is included to baseline calculation to find the displaced amount by the project activity.
		CH_4	No	*Minor emission sources*: Even though there may be some CH_4 and N_2O emissions during electricity generation, these emissions are negligible and not included in baseline calculation to be conservative and comply with Table-1 of the methodology (page 5).
		N_2O	No	
Project Activity	For hydro power plants, emissions of CH_4 from the reservoir(s)	CO_2	No	*Minor emission source. The project will employ diesel motor as back-up power for only emergency purposes. Emission from back-up generators can be neglected according to ACM0002 (page 6).*
		CH_4	No	The project is grid-connected electricity generation from renewable sources, and the power density of the power units in proposed project activity are 64.92 W/m^2, 47.26 W/m^2, 32.27 W/m^2 respectively and each of them is greater than 10 W/m^2. Therefore project emission is considered as zero according to ACM0002.
		N_2O	No	*Minor emission source*

B.4. Establishment and description of baseline scenario

The baseline scenario is identified according to the "Baseline Methodology Procedure" of ACM0002 ver.13.0.0 (page 4). The project activity is installation of a new grid-connected hydro power project

including 3 power units and is not modification/retrofit of an existing grid-connected power plant. So, first identification of this procedure is selected for proposed project activity, which is described as:

> *"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system".*

The baseline scenario is that the electricity delivered to the Georgian grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

Georgia is one of the countries rich of hydro resources in the world. The high watery of rivers, canyon types and high slopes of channels make their hydro electric potential very high. Net hydro energy resources of main 319 large, medium and small rivers constitute approximately 140 billion kWh. The technical potential is 80–85 TWh, and economically effective potential, which depends on many factors (existence of other energy sources, fuel costs and etc.) constitutes 40–50 TWh through different estimations[7].

However, in 2006 the total rated capacity of working hydro power plants was around 2,600 MW and rated generation was approximately 10 TWh, which was only 20–25 % from economically effective potential.

In 2006, thermal electricity generation constituted approximately 27% of total electricity supply, hydro around 64% and imports around 9%. The hydro share in generation was 72-85% in the period 2000-5, but fell substantially in 2006 due to rehabilitation work on Enguri HPP. Electricity generation amount by sources in Georgia from 200 to 2006 is given in below, Figure 2.

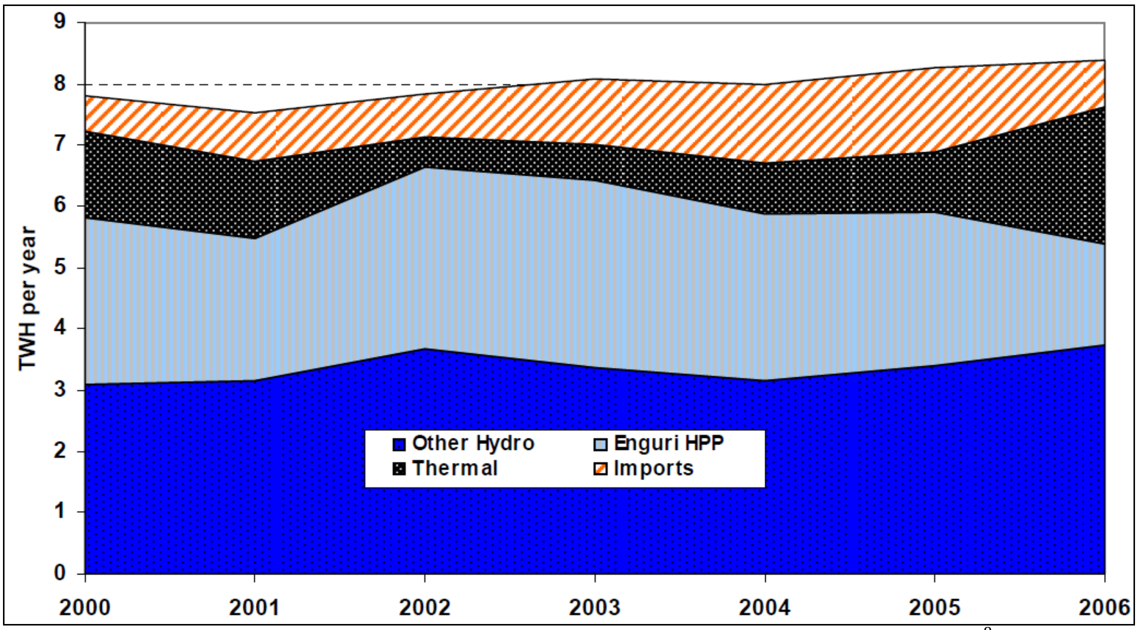

Figure 2: Electricity Generation by Sources for years of 2000-2006[8]

[7] See: http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf (page 2)
[8] See: http://www.investingeorgia.org/uploads/file/The%20electricity%20sector%20in%20Georgia%20-%20A%20risk%20assessment%20ECON%20final.pdf (page 10)

In order to become more energy independent, Georgia needs to add additional capacity to generate hydropower in the autumn and winter months to replace natural gas fired electricity generation. This would favour developments that are able to store energy (dams), or which possess a regular flow of water throughout the year as project activity. Shifting electricity generation from natural gas will reduce emission generation from baseline

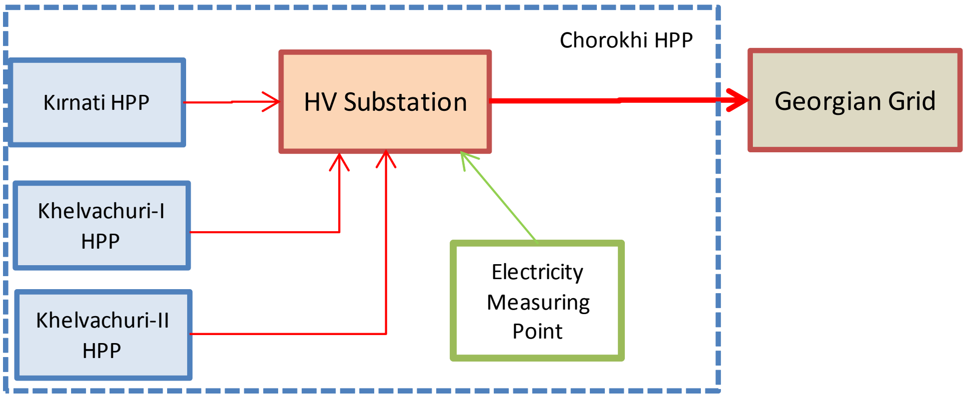

Figure 3: Grid Connection Diagram of Project Activity

B.5. Demonstration of additionality

For the explanation of how and why the project activity leads to emission reductions that are additional to what would have occurred in the absence of the project activity the "Tool for the demonstration and assessment of Additionality version 07.0.0" (Additionality Tool)[9], which defines a step-wise approach, is applied to the proposed project.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

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

Paragraph 4 of version 07.0.0 of the Additionality Tool states: "Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity." Therefore, two scenarios will be considered in the analysis:

1) The proposed project undertaken without the CDM,
2) Continuation of the current situation. In this case, the proposed project will not be constructed and the power will be solely supplied from the Georgian national grid.

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

Project activity is consistent with below main laws and rules:

1) Law on Electricity and Natural Gas[10].
2) Law on Protection of Environment
3) Rules of Licensing and Activity Control in the Electricity, Natural Gas and Water Sector[11]

[9] See, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf
[10] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7271

4) Regulation on Licence and Permits

Other laws and regulations regarding environment and social aspects are given in section D.2. Alternative of the project activity, which is the continuation of current situation is "do-nothing" alternative, therefore there are no applicable laws and regulations for this alternative.

CDM Consideration

CDM early consideration and the serious actions to secure the CDM status for the project are reflected in the key milestones in the development of the project listed below:

Table 5: Project Implementation Schedule and Early Consideration of CDM

Date (DD/MM/YYYY)	Activity
23/08/2011	Agreement with FutureCamp Turkey for CER development
27/09/2012	Date of Approval of Feasibility Study Report by Georgian Authority
18/11/2011	Agreement with DOE (RINA Services S.p.a) for validation
25/11/2011	Letter of Endorsement from Georgian DNA
04/01/2012	Date of granting Environmental Impact Assessment Positive Decision
11/01/2012	Listing of the project on UNFCCC website for Prior Consideration of CDM
25/01/2012	Submission of the project documents for Global Stakeholder comments on UNFCCC website
16/03/2012	Date of Agreement with Electromechanical Equipment Supplier (Project Start Date)
05/04/2012	Date of Agreement with Construction Subcontractor
20/04/2012	Start date of construction activities
31/12/2014	Planned start date of commercial operation

Aforementioned project implementation schedule shows us that Achar Energy started to consideration of CER from the beginning of the project implementation and CER Revenue has decisive impact on decision of proceeding to the project.

In the following, the investment analysis is applied to clearly demonstrate that the project activity is unlikely to be financially/economically attractive without the revenue from the sale of CERs.

Step 2. Investment analysis

Sub-step 2a: Determine appropriate analysis method

With the help of the investment analysis it shall be demonstrated that the proposed project activity is not economically or financially feasible without the revenue from the sale of CERs.

As a result of Sub-step 1a above, there is no alternative project activity for a comparison of the attractiveness of investment. Also, CDM related income is not the only economic benefits of the project activity as it generates revenue from electricity sale. Thus, neither Simple Cost Analysis, nor Investment Comparison Analysis is applicable and the benchmark analysis shall be applied to the project activity.

Sub-step 2b: Option III: Benchmark analysis

[11] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7274

As a common means to evaluate the attractiveness of investment projects and compare them with possible alternatives, the IRR (Internal Rate of Return) shall be used.

Identification of Benchmark:

According to the "Guidelines on the Assessment of Investment Analysis" version 5[12], for the selection of appropriate benchmarks, in cases of projects which could be developed by an entity other than the project participant, the benchmark should be based on parameters that are standard in the market. If so, the cost of equity can be determined by selecting the values provided in Appendix A of the referred guidelines.

For the proposed project, the category according to the sectored scopes used under the CDM is Group I: Energy Industry in Georgia, therefore the default value for the expected return on equity calculated after taxes is *12.9%.* This value is expressed in percentages in real terms, as the IRR calculation of the project activity, which was also carried out in real terms.

Sub-step 2c: Calculation and comparison of the IRR

The equity IRR (after tax) of Chorokhi HPP is calculated on the basis of expected cash flows (investment, operating costs and revenues from electricity sale), as used in the financial analysis for the feasibility assessment of the project. The parameters and values used for the IRR calculation are available to DOE during validation. Brief project financial characteristics of the proposed project activity are given in Table 6.

Table 6: Brief Project Financial Characteristics

Characteristics	Value	Unit	Reference
Installed Power	112.875	*MW*	*Updated Feasibility Study of Downstream Chorokhi HEPPs in Georgia prepared by Fichtner GmbH & Co. KG on October 2011 (FSR)*
Annual Electricity Generation	517,880	*GWh/yr*	*FSR*
Transmission Loss Factor[13]	1.44%	*N/A*	*Three year average of Turkish grid transmission losses. Applied to the only the portion of electricity to be exported to Turkey*
Average Electricity Selling Price	61.20	*USD/MWh*	*FSR*[14]
Total Project Cost[15] **Kırnati HPP** **Khelvachuri-I HPP** **Khelvachuri-II HPP**	214,280,896 60,275,113 81,386,512 72,619,271	*USD*	*FSR*
Operational Duration	20	*yrs*	*Guidelines on Investment Analysis*
Annual Operating Cost **O&M Cost**	2,365,569 1,703,064	*USD/yr*	*Total* *FSR*

[12] See, http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf (Appendix)

[13] Average of 2008-2010 transmission loss rates: (http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2010/front%20page%202010-%C3%A7i%C3%A7ek%20kitap/uretim%20tuketim(22-45)/33(84-10).xls, column T

[14] Weighted average of electricity to be sold in Georgia and exported to Turkey.

[15] 18% VAT is included, but financing cost during construction is not included.

System Usage Cost[16]	662,505		*EPDK*
USD/TL Exchange Rate	1.500	*N/A*	*FSR*
VAT Rate	18%	*N/A*	*Invest in Georgia*[17]
Corporate Tax Rate	15%	*N/A*	*Invest in Georgia*
Financing Conditions			
Debt / Investment Cost Ratio	40%	*N/A*	*From financing conditions of similar project in Turkey*[18].
Grace Period	3	*yrs*	
Debt Payment Period	7	*yrs*	
Interest Rate	7%	*N/A*	

According to the Guidelines for Investment Analysis, 20 yrs of operation life time is appropriate to make financial analysis. Thus financial cash flow analysis has performed for 20 yrs operation years and resulting IRR without CER revenue is stated in below table.

Table 7: Equity IRR value for project activity (after tax)

Period	IRR
20 years	10.04%

Thus benchmark, which is 12.9%, clearly exceeds the resulting equity IRR and rendering the project activity economically unattractive.

Sub-step 2d: Sensitivity analysis

The most important parameters of financial analysis for which sensitivity analysis is performed are:

a. Electricity Price
b. Investment Cost
c. Energy Yield Amount
d. Operating Cost

CER Revenue is not considered for sensitivity analysis.

While the main parameter determining the income of the project is the electricity sales price, a variation of the accordant value shall demonstrate the reliability of the IRR calculation Electricity price (EP) is varied with +/-10% from 61.20 USD/MWh, which is the estimated average electricity price.

The investment cost, energy yield and operating cost parameters are also varied with +/- 10%. The worst, base and best-case results for each parameter variation are given below, in Table 8 and Figure 4.

Table 8: Equity IRR results according to different parameters (for other parameters 61.2 USD/MWh EP is applied)

Parameter	Electricity Price			Investment Cost			Energy Yield			Operating Cost		
Variance	**-10%**	**0%**	**10%**	**-10%**	**0%**	**10%**	**-10%**	**0%**	**10%**	**-10%**	**0%**	**10%**
IRRs	8.27%	10.04%	11.76%	11.92%	10.04%	8.46%	8.27%	10.04%	11.76%	10.17%	10.04%	9.90%

[16] See: http://www.epdk.gov.tr/documents/elektrik/tarife/iletim/ELK_TARIFE_ILETIM_2913.zip ((2913.doc, Bölge: 115 = 14,258.94+414.48 TL). Applied only to the part of electricity generation to be exported to Turkey.
[17] See: http://www.investmentguide.ge/index.php?lang_id=ENG&sec_id=197
[18] See: http://www.alarko.com.tr/eng/haber.asp?ID=1383

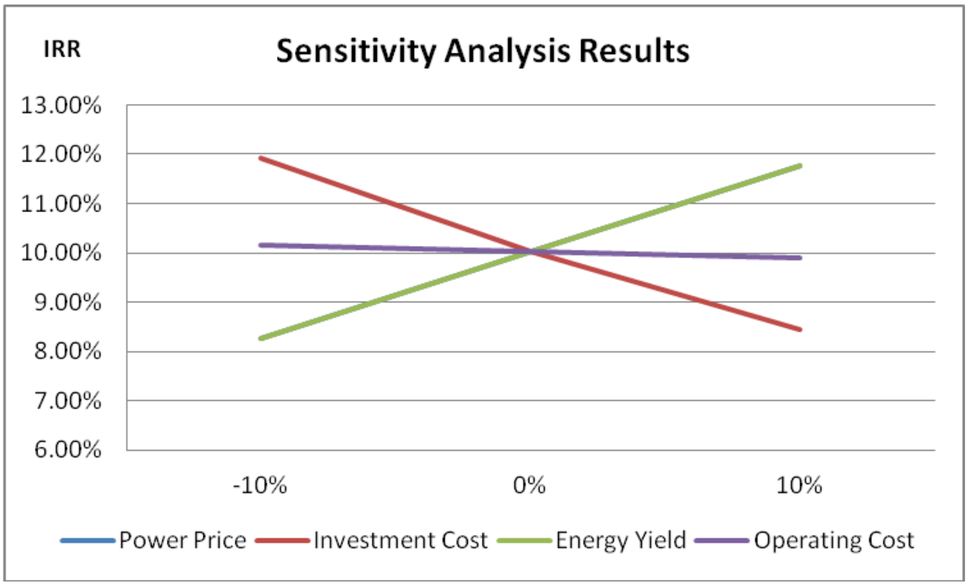

Figure 4 Sensitivity Analysis Results without CER revenue (Equity IRRs, after tax)

Assessments of parameters used for financial analysis and justifications for variations applied to these parameters for sensitivity analyses are provided below:

a. Electricity Price

There is no clear price indication for electricity to be generated by project activity. The share of electricity to be sold in Georgia has a fixed tariff[19]. But for electricity which is planned to be exported to Turkey, there is neither guarantee for export nor guarantee for selling price. Electricity can only be imported to Turkey via wholesale or retail companies having licence from EPDK[20] and electricity purchase agreement between this company and project owner depends on bilateral negotiations. In FSR it is assumed that large share of electricity will be exported to Turkey with 70 USD/MWh price. Weighted average of electricity price, hence, becomes 61.20 USD/MWh.

To exceed benchmark, base price electricity shall increase more than 16.8%. As base price is a weighted average price, and Georgian portion is fixed, it corresponds around 24.5% increase in price of electricity (87.2 USD/MWh) to be exported to Turkey. This is too high and unrealistic for such risky project for which even there is no guarantee for exporting to Turkey, as wholesale companies needs to enter tender process if more than one wholesale companies would like to import electricity via same interconnected lines,in accordance to Regulation on Import and Export of Electricity[21]. In addition to that, according to the report of Electricity Market Regulatory Authority (EMRA), average electricity price for DUY in 2011 (most recent year for during investment decision date, which is 16.03.2012) is 125.86 TL/MWh[22], which corresponds to 75.14 USD/MWh with average USD/TL parity in 2011 (1.675 TL)[23]. Thus we can conclude that16.8% increase in electricity price is not realistic.

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[19] Due to confidentially reasons only available to DOE.
[20] See: http://www.epdk.org.tr/documents/elektrik/mevzuat/yonetmelik/elektrik/ithalat_ihracat/Elk_Ynt_ithalat_ihracat_SonHali.doc (Article-2)
[21] See: http://epdk.org.tr/documents/elektrik/mevzuat/yonetmelik/elektrik/ithalat_ihracat/Elk_Ynt_ithalat_ihracat_SonHali.doc (Article 8-(4), page 7)
[22] See: http://www.epdk.org.tr/documents/elektrik/rapor_yayin/ElektrikPiyasasiRaporu2011.pdf (page 24)
[23] See: http://hazine.gov.tr/File/?path=ROOT%2fDocuments%2fEkonomik+ve+Sekt%c3%b6rel+G%c3%b6stergeler%2ffiyatlar.xls, sheet VII.5, USD/TL average of 2011)

b. Investment Cost

The total investment cost was estimated by an expert firm, Fichtner GmbH & Co. KG, an experienced consultant for feasibility analysis of hydro power projects. The estimated total investment for the proposed project activity is 1.66 Million USD/MW (VAT excluded), which is around 17% lower than minimum unit cost of range published by International Energy Agency (IEA) which is 2-3 Million USD/MW[24]. Moreover VAT excluded investment cost used in financial analysis (187.8 Million USD) is lower than the costs accepted by Ministry of Energy for the project activity, which is 196 Million USD[25] in total.

Hydro power projects have many uncertainties and investment risks, as such kind of projects necessitate usage of significant lands subject to expropriation. To exceed benchmark, investment cost shall decrease more than 14.5%. As the investment cost used in financial analysis is already conservative, having more than 14.5% decrease is not realistic, considering also cost increase risk due to expropriation of lands and geological conditions of project site.

c. Energy Yield Amount

The expected power generation of the proposed project is calculated by an independent qualified and expert consultancy firm (Fichtner) in the FSR, based on long term flow measurements on the Chorokhi river and other close rivers. FSR is also submitted to Georgian government to get permission. Therefore, the energy yield amount is in line with both options below specified of the EB Guidelines for the reporting and validation of plant load factors (EB 48 Annex 11): (a) provided to the government while applying the project activity for implementation approval, and (b) determined by a third party contracted by the project participants.

Energy yield amount (517.88 GWh/yr) corresponds to 52.4% capacity utilization rate. This is already 10% more than average rate of new hydro power projects (47%)[26] for which MoU signed with Georgian government. To exceed benchmark, energy yield shall increase more than 16.8%. While energy yield is already more than average and 10% increase is already considered in sensitivity analysis, 16.8% increase in energy yield is not realistic.

d. O&M cost

The O&M costs were estimated by Fichtner. As given in Table 6, total O&M cost is calculated to be 2,365,569 USD/yr. This amount corresponds to 4.57 USD/MWh (with 517,880 MWh energy yield) unit cost. Comparing with study of IEA[27], unit operation cost for project activity is around 10% less than minimum unit cost of range, which is 5-20 USD/MWh.

Even 50% decrease in O&M costs doesn't lead IRR higher than benchmark (12.9%). For such a large project more than 50% decrease in O&M cost is not rational.

Conclusion

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[24] See: http://www.iea.org/publications/freepublications/publication/Hydropower_Essentials.pdf (page 2, Table-1, category 3)

[25] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7472 (Power plants with no 1,2 and 3)

[26] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7472 (Average of total generation and total installed capacity = 8812*1000 MWh / 2139 MW / 8760 hours = 47%)

[27] See: http://www.iea.org/publications/freepublications/publication/Hydropower_Essentials.pdf (page 2, 'O&M Costs', paragraph 2)

The financial analysis shows that the project is not the financially feasible without the revenue of CERs, and the sensitivity analysis demonstrates that it is unlikely to be financially attractive compared to the benchmark under any reasonable/realistic variations for financial parameters. However, CER revenues will improve the financial feasibility of the proposed project.

In conclusion, the project is not financially feasible without the revenue of CERs. Therefore, the analysis proceeds to Step 4.

Step 4: Common Practice Analysis

According to tool, if the proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section above proceed to Sub-step 4a; otherwise, proceed to Sub-step 4b.

Being a Greenfield and grid connected hydro power plant project, project activity applies the measure (ii) stated in definitions part of the Tool, which is also given below:

(ii) Switch of technology with or without change of energy source including energy efficiency improvement as well as use of renewable energies (example: energy efficiency improvements, power generation based on
renewable energy);

Thus Sub-step 4a of Tool shall be applied for Common Practice analysis.

Sub-step 4a. The proposed CDM project activity(ies) applies measure(s) that are listed in the definitions section above

The latest version of the "Guidelines on common practice" (Guidelines) available on the UNFCCC website shall be applied. Latest version of the Guidelines is version 02.0[28].

According to Guidelines, firstly applicable geographical area shall be chosen. The entire host country was chosen as the applicable geographical area.

Step 1: Calculate applicable capacity or output range as +/-50% of the total design capacity or output of the proposed project activity

All power plants serving the electricity system of Georgia are given in Annex-3[29]. The proposed project activity has the installed capacity of 112.875 MW. So applicable output range as +/-50% of the capacity of the proposed project activity is 56.44 MW and 169.32 MW.

Step 2: Identify similar projects (both CDM and non-CDM) which fulfil all of the following conditions:

(a) The projects are located in the applicable geographical area;

Projects within the Georgia are to be considered.

(b) The projects apply the same measure as the proposed project activity;

Projects applying "switch of technology with or without change of energy source (power generation based on renewable energy)" are to be considered,

[28] See: http://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid44.pdf
[29] See: http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf (Table-A1)

(c) The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity;

Power plant projects using hydro power energy are to be considered

(d) The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant;

Only power plants which are producing electricity are to be considered.

(e) The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1;

Power plants having installed capacity in the range of +-50% capacity of project activity (56.44 MW-169.32 MW) are to be considered,

(f) The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.

As the project activity is under construction, the projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation are to be considered.

Identified similar project fulfilling all of the above criteria are given in Table 9 below. None of these plants are registered as CDM project or undergoing validation for CDM.

Table 9 List of power plants having capacity between +-50% of project capacity

No	Power Plant	Start Up Date	Type	Rated Capacity (MW)	Built By State/Private
1	Khrami-1	1947	Hydro	113	State
2	Gumathesi	1956	Hydro	67	State
3	Dzevrulhesi	1956	Hydro	60	State
4	Lajanurhesi	1960	Hydro	112	State
5	Khrami II	1963	Hydro	110	State
6	Zhinvalhesi	1985	Hydro	130	State

Georgia was a part of Soviet Union before 1992 and until this year, all power plants were built by central government as a consequence of central planning principal. On the other hand, proposed project activity will be built by a private company (Achar Energy).

Step 3: Identify and note N_{all}

None of the similar projects identified in Step 2, is registered CDM projects, project activities submitted for registration, nor project activities undergoing validation.

Thus N_{all} is 6.

Step 4: Identify and note N_{diff}

All of the similar projects identified in Step 2 Table 9 are applied technologies that are different to the technology applied in the proposed project activity, as the project activity will be invested by private company and subject to significant investment risks (as demonstrated by investment analysis above) while all identified similar projects are built by State[30]. Private investments in liberal economies have subject to different investment climates. For private investments, all financial risks are taken by private owners, but for state investments state takes the financial risks. Thus, being a private investment, proposed project activity is applying different technology comparing with identified similar projects considering paragraph 4-d)-(ii) and (iv) of Guidelines, which is also given below:

*4. **Different technologies** are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed clean development mechanism (CDM) project activity and applicable geographical area):*

(d) Investment climate on the date of the investment decision, inter alia:

(i) Access to technology;

(ii) Subsidies or other financial flows;

Projects are to be funded by state budget vs private equity with own investment risk for state and private investments, respectively.

(iii) Promotional policies;

(iv) Legal regulations;

Regulated vs deregulated market rules for state and private investments, respectively.

Thus N_{diff} is also 6.

Step 5: Calculate $F = 1 - N_{diff}/N_{all}$

$F = 1 - N_{diff}/N_{all} = 1 - 6/6 = 0$ and $N_{all} - N_{diff} = 6 – 6 = 0$

The proposed project activity is a common practice within a sector in the applicable geographical area if the factor F is greater than 0.2 and N_{all}-N_{diff} is greater than 3.

As $F = 0 < 0.2$ and $N_{all} - N_{diff} = 0 < 3$, the proposed project activity is not common practice.

The result of investment analysis and common practice analysis demonstrate that the project activity is not financially attractive and is not common practice, therefore additional.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

[30] See: http://www.investingeorgia.org/uploads/file/The%20electricity%20sector%20in%20Georgia%20-%20A%20risk%20assessment%20ECON%20final.pdf (page 1, paragraph 3)

Baseline scenario is identified and described in B.4. Emission reductions due to project activity will be calculated according to *"Tool to calculate the emission factor for an electricity system"* (Tool)[31] as indicated in ACM0002 ver. 13.0.0.

A brief explanation of this methodology is given in Tool as (page 2):

> *"This methodological tool determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM). The operating margin refers to a cohort of power plants that reflect the existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin refers to a cohort of power units that reflect the type of power units whose construction would be affected by the proposed CDM project activity*".

Corresponding formulations and calculations of CM factor and emission reductions are shown in B.6.3

B.6.2. Data and parameters fixed ex ante

Data / Parameter	**$EG_{m,y}$, $EG_{k,y}$**
Unit	**MWh**
Description	Net quantity of electricity generated and delivered to the grid by power unit *m* or *k* in year *y*.
Source of data	Grid Emission Factor Study of Ministry of Environment Protection and Natural Resources of Georgia (MoEP - DNA of Georgia) based on information submitted by Ministry of Energy of Georgia (http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf page 4 and Annex)
Value(s) applied	See Table 11, Table 14 and Table 18
Choice of data or Measurement methods and procedures	MoEP and Ministry of Energy are the main bodies responsible from electricity statistics in Georgia.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	**$FC_{i,y}$**
Unit	Mass or volume unit
Description	Fuels consumed by thermal power plants for electricity generation in the years of 2004, 2005 and 2006
Source of data	Grid Emission Factor Study of Ministry of Environment Protection and Natural Resources of Georgia (MoEP - DNA of Georgia) based on information submitted by Ministry of Energy of Georgia (http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf page 5)
Value(s) applied	See Table 12
Choice of data or Measurement	MoEP and Ministry of Energy are the main bodies responsible from electricity

[31] See, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v3.0.0.pdf (version 03.0.0)

methods and procedures	statistics in Georgia.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	**$NCV_{i,y}$**
Unit	TJ/million m3
Description	Net Calorific Value of natural gas used by thermal power plants in the years of 2004, 2004 and 2006
Source of data	Grid Emission Factor Study of Ministry of Environment Protection and Natural Resources of Georgia (MoEP - DNA of Georgia) based on information submitted by Ministry of Energy of Georgia (http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf page 5)
Value(s) applied	See Table 12
Choice of data or Measurement methods and procedures	MoEP and Ministry of Energy are the main bodies responsible from electricity statistics in Georgia.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	**Sample Group for BM emission factor**
Unit	Name of the plants, MW capacities, fuel types, annual electricity generations and dates of commissioning.
Description	Publicly available official information for the most recent power plants which compromise 20% of total generation
Source of data	Grid Emission Factor Study of Ministry of Environment Protection and Natural Resources of Georgia (MoEP - DNA of Georgia) based on information submitted by Ministry of Energy of Georgia (http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf Annex Table 1)
Value(s) applied	See Table 18
Choice of data or Measurement methods and procedures	MoEP and Ministry of Energy are the main bodies responsible from electricity statistics in Georgia.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	**$EF_{CO2,m,i,y}$**
Unit	tCO_2/GJ
Description	Emission factor for fuel type *i* (natural gas)
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the IPCC Guidelines on National GHG Inventories. http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value(s) applied	See Table 12 and Table 14
Choice of data or	

Measurement methods and procedures	No plant specific and national emission factor data was available in Georgia. So, IPCC default data is used. For Natural gas 54.3 tCO2/TJ value used as suggested in Grid factor emission calculation tool. http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf page 1.23)
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$\eta_{m,y}$
Unit	%
Description	Average energy conversion efficiency of power unit m in year y
Source of data	Annex I the "Tool to calculate the emission factor for an electricity system"
Value(s) applied	See Table 14
Choice of data or Measurement methods and procedures	There is no plant specific energy efficiency rates or data from grid operator of Georgia for thermal power plants in sample group to calculate BM emission factor. Therefore default values given in Annex-1 of "Tool to calculate the emission factor for an electricity system" version 03.0.0 is used for BM calculation. There are two natural gas fired thermal power plants in sample group. They are "AES Mtkvari" and "Energy Invest" Gas turbine-1. Both of them are open cycle power plants (For AES Mtkvari see: http://weg.ge/index.php?option=com_content&task=view&id=64 and for "Energy Invest" Gas turbine-1 see http://www.energyinvest.ge/main.php?who=gas&action=12&lang=eng). As AES Mtkvari is built before the year of 2000 (1990) 30% and as "Energy Invest" Gas turbine-1 is built after 2000 (2006) 39.5% energy efficiency rates are used for BM calculation in accordance with the Annex-1 of the Tool.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$EF_{grid,CM,y}$
Unit	tCO_2/MWh
Description	Combined margin CO2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"
Source of data	Average of $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ emission factors as per the "Tool to calculate the emission factor for an electricity system".
Value(s) applied	0.54847 tCO_2/MWh
Choice of data or Measurement methods and procedures	See section B.6.3 for calculation of the parameter.
Purpose of data	Calculation of annual GHG emission reduction amount
Additional comment	As ex-ante option selected, the parameter will not be monitored as per the "Tool to calculate the emission factor for an electricity system".

B.6.3. Ex ante calculation of emission reductions

Stepwise approach of "*Tool to calculate the emission factor for an electricity system*" version 03.0.0 (Tool)[32] is used to find this combined margin (emission coefficient) as described below:

Step 1. Identify the relevant electric power system

The relevant electricity system for calculation of emission factor for Georgia is the Georgian electricity grid. The Georgian grid is the 'project electricity system'[33] and covers all the plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints. The power plants included in the grid are assessed in the later steps to calculate the operating margin, the build margin leading to calculation of the combined margin.

As suggested in the Emission Factor Tool (page 3): '*if the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used*'. In case of Georgian – the DNA of Georgia has provided not only the delineation of the grid but also the calculation of grid emission factor for Georgia[34]. This guidance from the DNA of Georgia been applied to determine the emission factor of Georgia.

There is no information about interconnected transmission capacity investments which enable significant increases in imported electricity. Thus, for BM calculation transmission capacity is not considered.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)

According to Tool project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

> **Option I:** Only grid power plants are included in the calculation.
> **Option II:** Both grid power plants and off-grid power plants are included

For this project **Option I** is chosen.

Step 3: Select a method to determine the operating margin (OM)

$EF_{grid,OM,y}$ should be calculated based on one of the four following methods:

(a) Simple operating margin, or
(b) Simple adjusted operating margin, or
(c) Dispatch Data Analysis operating margin, or
(d) Average operating margin.

Any of the four methods can be used, however, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

[32] See, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v3.0.0.pdf

[33] For further explanation on project electricity system identification, please refer to section B.3

[34] See, http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf

The Georgian electricity mix does not comprise nuclear energy. Also there is no obvious indication that coal is used as must run resources. Therefore, the only low cost resource in Georgia, which is also considered as must-run, is Hydro power plants. Electricity generation amount by resources from 2002 to 2006 is given in Table 10[35].

Table 10: Share of Low Cost Resource (LCR) Production 2002-2006 (Production in MWh)

Source	2002	2003	2004	2005	2006	Averaged
Generation from Hydro power plants						
(MWh)	6,652.10	6,420.70	5,893.10	5,920.30	5,292.90	**6,035.80**
Share, %	*85.8*	*80.3*	*73.7*	*71.5*	*64.8*	***75.2***
Generation from Thermal power plants						
(MWh)	467.9	587.9	813.2	958.4	2103.8	**986.7**
Share, %	*6*	*7.4*	*10.2*	*11.6*	*25.7*	***12.2***
Import	635.1	988.6	1,288.20	1,398.60	777	**1,017.50**
Share, %	*8.2*	*12.4*	*16.1*	*16.9*	*9.5*	***12.6***
Total (MWh)	**7,755.10**	**7,997.20**	**7,994.50**	**8,277.40**	**8,173.70**	**8,040.00**

As average share of low cost resources for the last five years is more than 50% (75.2%), the simple OM method is not applicable to calculate the operating margin emission factor (EFgrid,OM,y). Thus baseline emission factor was calculated using Simple adjusted OM method.

For the simple adjusted OM, the emissions factor can be calculated using either of the two following data vintages:

- **Ex ante option:** A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, or
- **Ex post option:** The year, in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

The **ex-ante option is selected for Simple adjusted OM method**, with the most recent data for the baseline calculation stemming from the years 2004 to 2006.

<u>Step 4.</u> Calculate the operating margin emission factor according to the selected method

The simple adjusted OM emission factor ($EF_{grid,OM\text{-}adj,y}$) is a variation of the simple OM, where the power plants/units (including imports) are separated in low-cost/must-run power sources (*k*) and other power sources (m). As under Option A of the simple OM, it is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OM-adj,y} = (1-\lambda_y)x\frac{\sum_m EG_{m,y} x EF_{EL,m,y}}{\sum_m EG_{m,y}} + \lambda_y x \frac{\sum_k EG_{k,y} x EF_{EL,k,y}}{\sum_k EG_{k,y}}$$

Where:

$EF_{grid,OM-adj,y}$	=	Simple adjusted operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
Λ_y	=	Factor expressing the percentage of time when low-cost/must-run power

[35] See: http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf (page 5)

		units are on the margin in year *y*
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EG_{k,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit k in year y (MWh)
$NCV_{i,y}$	=	Net calorific value (of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{EL,m,y}$	=	CO2 emission factor of power unit m in year y (tCO_2/MWh)
$EG_{EL,k,y}$	=	CO2 emission factor of power unit k in year y (tCO_2/MWh)
M	=	All grid power units serving the grid in year y except low-cost/must-run power units
K	=	All low-cost/must run grid power units serving the grid in year y
y	=	The relevant year as per the data vintage chosen in Step 3

According to Tool, $EF_{EL,m,y}$, $EF_{EL,k,y}$, $EG_{m,y}$ and $EG_{k,y}$ should be determined using the same procedures as those for the parameters $EF_{EL,m,y}$ and $EG_{m,y}$ in **Option A** of the simple OM method above.

Net electricity imports must be considered low-cost/must-run units *k*. Because low-cost/must run sources in Georgia are only Hydro PPs with zero emissions, second part of above formulation becomes 0 (zero). As also $EF_{EL,m,y}$ and $EG_{m,y}$ will be calculated in accordance with Simple OM, above formulation becomes:

$$EF_{grid,OM\text{-}adj,y} = (1-\lambda_y) \times EF_{grid,OMsimple,y}$$

Option A - Calculation based on average efficiency and electricity generation of each plant

Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} x EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	=	All power units serving the grid in year y except low-cost/must-run power units
y	=	The relevant year as per the data vintage chosen in Step 3

In Georgia, there is only natural gas fired power plants and hydro power plants. As hydro power plants are considered as low-cost/must-run power units, only natural gas fired power plants are taken into account for calculation.

Determination of $EF_{EL,m,y}$

Option A1 is selected to determine the emission factor of each power unit *m*. According to this option, if for a power unit m data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} x NCV_{i,y} x EF_{CO2,i,y}}{EG_{m,y}} \qquad \textbf{(1)}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type i consumed by power unit m in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
EG_y	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
M	=	All power units serving the grid in year y except low-cost/must-run power units
i	=	All fossil fuel types combusted in power unit m in year y
y	=	The relevant year as per the data vintage chosen in Step 3

Because only natural gas is used for the electricity generation in Georgia, index *i* is cancelled. According to document published by Georgian DNA, $NCV_{i,y}$ values were provided by the Ministry of Energy of Georgia. For $EF_{CO2,i,y}$ there is no plant specific, or national values. Therefore, IPCC default value at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories[36], is used for natural gas fired power units. This factor is 54.3 tCO_2/TJ.

Determination of $EG_{m,y}$

For grid power plants, $EG_{m,y}$ should be determined as per the provisions in the monitoring tables. As ex-ante option is chosen, most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation, shall be used. As available electricity generation amount for each power units *m* is for the years between 2004-2006, these values are used in the calculation. According to Tool, net electricity imports must be considered low-cost/must-run units *k* (page 21). Therefore, electricity import amounts are not included in $EG_{m,y}$ calculation.

Table 11 Electricity generation amount of thermal power plants in the years of 2004-2006

Name of Power Unit	2004	2005	2006
Tbilsresi	21.5	292.1	663.9
AES Mtkvari	791.7	666.3	1,149.40
“Energy Invest” Gas-turbine-1	0	0	290.4
Total	**813.2**	**958.4**	**2,103.7**

Table 12 Simple OM Calculation for the years of 2004-2006

Natural Gas Consumption for Each Thermal Power Plant (x1000 m^3)	2004	2005	2006

[36] See: http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf (page 1.24)

Tbilsresi	9,755	108,909	248,731
AES Mtkvari	248,873	206,712	349,820
“Energy Invest” Gas-turbine-1	0	0	91,676
Total (x1000 m^3)	**258,628**	**315,621**	**690,227**
NCV (kcal/m^3)	8,039	8,041	8,045
NCV [Tj/(1000m^3)]	0.03366	0.03367	0.03368
$EF_{CO2,natural\ gas}$ (tCO_2/Tj)	54.3	54.3	54.3
$EF_{grid,OMsimple,\ y}$ (tCO_2/MWh)	**0.58125**	**0.60202**	**0.60009**

Calculation of λ_y

The parameter λ_y is defined as follows:

$$\lambda_y\,(\%) = \frac{\text{Number of hours low - cost / must - run sources are on the margin in year y}}{\text{8760 hours per year}}$$

Lambda (λ_y) should be calculated as follows:

Step (i) Plot a load duration curve. Chronological load data for each hour of year for electricity system of Georgia were ranked from highest to lowest and load duration curves were plotted for years 2004-2006 (see *Figures 4-6*). Revised data (excel spreadsheets) were provided by the Ministry of Energy of Georgia.

Step (ii) Organize Data by Generation Sources: Revised data for annual generation (in MWh) from low-cost/must run resources (HPPs) have been collected and total annual generation from low-cost/must run resources (i.e. $\Sigma_k EG_{k,y}$) have been calculated (see Table 10). Relevant revised data (excel spreadsheets) were provided by the Ministry of Energy of Georgia as stated in the study of Georgian DNA[37].

Step (iii) Fill the load duration curve. A horizontal line across the load duration curve was plotted such that the area under the curve (as an illustration dashed area on Figure 5) equals the total generation (in MWh) from low-cost/must-run power plants/units (i.e. $\Sigma_k EG_{k,y}$).

Step (iv) Determine the “Number of hours for which low-cost/must-run sources are on the margin in year y” First, the intersection of the horizontal line plotted in step (iii) and the load duration curve plotted in step (i) was located. The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin. If the lines do not intersect, then one may conclude that low cost/must-run sources do not appear on the margin and λy is equal to zero. Lambda (λy) is the calculated number of hours divided by 8760 (in leap-year by 8784). Relevant diagrams for years 2004-2006 are given on Figures 4-6, and calculated $EF_{Adjusted\ Simple\ OM}$ in Table 13.

In determining λ_y only grid power units (and no off-grid power plants) are considered. λ parameter was calculated as $\lambda = X / T$, where X is the number of hours for which low-cost/must-run sources (hydro power plants) are on the margin, T is number of hours in year.

[37] See: http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf (page 6)

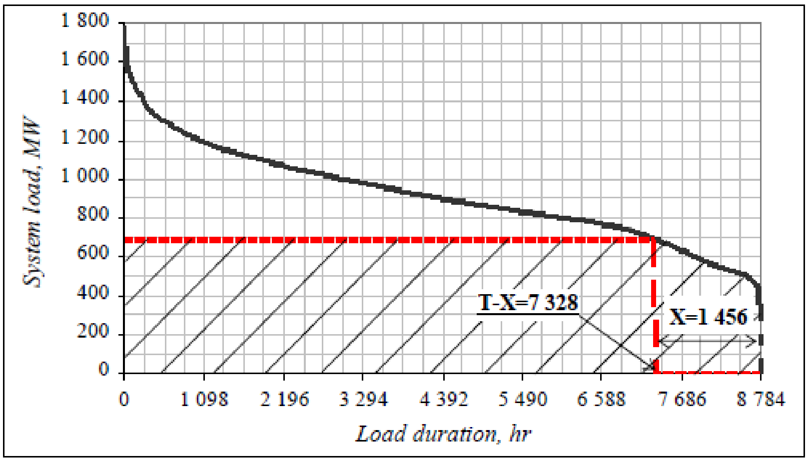

Figure 5 Load duration curve for the Georgian electricity system for year 2004

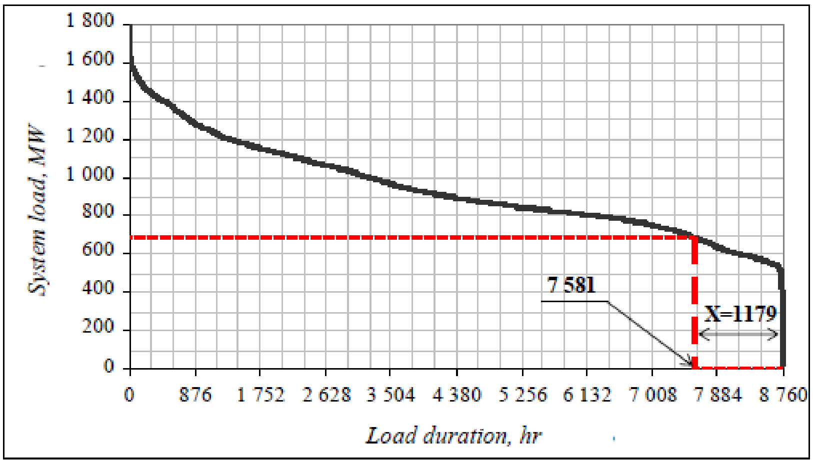

Figure 6 Load duration curve for the Georgian electricity system for year 2005

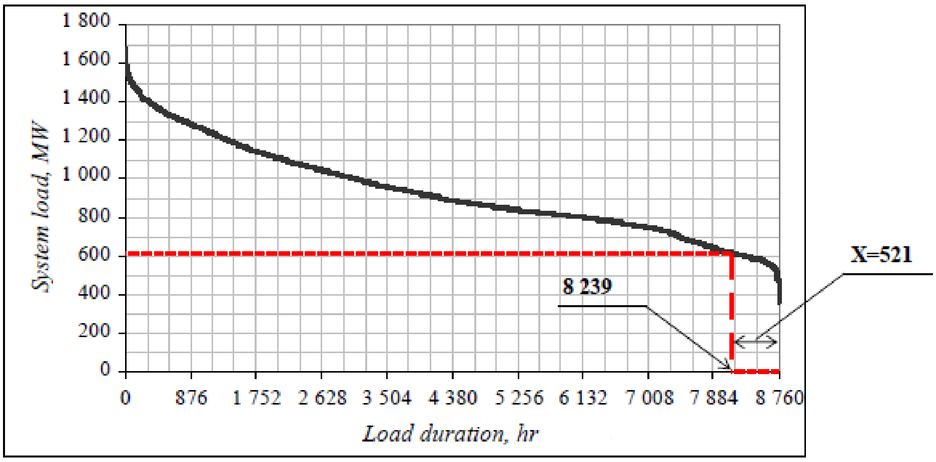

Figure 7 Load duration curve for the Georgian electricity system for year 2006

Calculation of λ and Operating Margin emission factor is given in Table 13.

Table 13 Adjusted OM Emission Factor Calculation

	2004	2005	2006
X (hours)	1,456	1,179	521
λ (X/8760)	0.16621	0.13459	0.05947

1-λ	0.83379	0.86541	0.94053
$EF_{Simple\ OM,y}$ (tCO_2/MWh)	**0.58125**	**0.60202**	**0.60009**
$EF_{grid,OM-Adj,y}$ (tCO_2/MWh)	**0.48464**	**0.52100**	**0.56440**
EG_y (MWh)	813.2	958.4	2103.7
Total of 3 years - EG_y (MWh)	3,875.3		
$EF_{grid,OM-Adj}$ (tCO_2/MWh)	**0.53693**		

Therefore, calculated 3-years average Simple Adjusted Operating Margin emission factor ($EF_{grid,OM-Adj}$) for Georgia grid is **0.53693 (tCO_2/MWh).**

<u>*Step 5:*</u> *Calculate the build margin (BM) emission factor*

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

For BM emission factor calculation **Option 1** is chosen.

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

The Tool has provided a step-wise approach to identify sample group of power units *m* used to calculate the build margin emission factor.

Build Margin calculations are performed with the sample group of power unit *m* consisting of either:

(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

All power plants in operation by 2006 is given in Annex-3. Total electricity generation in 2006 is 7,396,739 MWh and 20% of this generation is 1,479,348 MWh. Total electricity generation of last five power plants in operation is 444,643 MWh which is lower than 20% total generation in 2006. Generation amount of latest 6 power plants in operation is 1,594,092 MWh which is more than 20% of total generation in 2006. Therefore option (b) above, is used to identify sample group for calculation of BM emission factor.

Around latest 6 power plants, two of them are put in operation less than 10 years ago. Other four power plants are put in operation more than 10 years ago. On the other hand, there is no registered CDM project by 2006 in Georgia. Thus all latest 6 power plants are included in sample group ($SET_{sample\text{-}CDM\text{->}10yrs}$) to reach electricity generation amount which is more than 20% of total generation in 2006.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} x EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(2)}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which power generation data is available

The CO2 emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance in Step 4 (a) for the simple OM, using options A1, A2 or A3, using for *y* the most recent historical year for which electricity generation data is available, and using for *m* the power units included in the build margin.

According to Tool (page 17), if the power units included in the build margin *m* correspond to the sample group $SET_{sample\text{-}CDM\text{->}10yrs}$, then, as a conservative approach, only option A2 from guidance in Step 4 (a) can be used and the default values provided in Annex 1 shall be used to determine the parameter $\eta_{m,y}$.

As identified sample group is $SET_{sample\text{-}CDM\text{->}10yrs}$, option A2 for the simple OM calculation shall be used to calculate BM emission factor.

In *Option A2* of Simple OM method, the formulation of emission factor is given below:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} x 3.6}{\eta_{m,y}} \quad \textbf{(3)}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	All power units serving the grid in year *y* except low-cost/must-run power Unit
y	=	Three most recent years for which data is available at the time of submission of the PDD to the DOE for validation

BM emission factor calculation and resulted BM factor is given in Table 14. There are only natural gas and hydro power plants in sample group. Since no official emission factor for natural gas are available,

lower confidence default values of IPCC Guidelines are applied for EF_{CO2}. For efficiency figures Annex-1 of the Tool is used. Both natural gas fired power plants are using open cycle technology.

Table 14 BM Emission Factor Calculation

Name of the Plant in Sample Group	**Date of Operation**	**Fuel Type**	**Electricity Generation in 2006 (MWh)**	**Effective CO2 emission factor (tCO_2/TJ)**	**Average Efficiency ($\eta_{m,y}$)**	**CO2 Emission (tCO_2)**
AES Mtkvari[38]	1990	Natural Gas	1,149,449	54.3	30.00%	748,981
Intsobahesi	1993	Hydro	2,265	0.0	0.00%	0
JSC “Kindzmarauli”	2001	Hydro	2,561	0.0	0.00%	0
Munleik Georgia	2002	Hydro	22,172	0.0	0.00%	0
Khadorhesi	2004	Hydro	127,201	0.0	0.00%	0
“Energy Invest” Gas turbine-1[39]	2006	Natural Gas	290,444	54.3	39.50%	143,737
Total			**1,594,092**			**892,718**
$EF_{grid,BM}$ (tCO_2/MWh)	**0.56002**					

Therefore, calculated Build Margin emission factor ($EF_{grid,BM}$) for Georgia grid is **0.56002 (tCO_2/MWh).**

<u>Step 6 :</u> Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

The weighted average CM method (option A) is used for CM emission factor calculation.

(a) Weighted average CM

The combined margin emission factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM} \qquad \textbf{(4)}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

According to the Tool for hydro power generation project activities: w_{OM} = 0.5 and w_{BM} = 0.5. Then:

$$\boldsymbol{EF_{grid,CM,y} = 0.53693\ tCO_2/MWh * 0.5 + 0.56002\ tCO_2/MWh * 0.5 = 0.54847\ tCO_2/MWh}$$

[38] Single cycle (open cycle) power plant: http://weg.ge/index.php?option=com_content&task=view&id=64 (para. 4)
[39] Single cycle (open cycle) power plant: http://www.energyinvest.ge/main.php?who=gas&action=12&lang=eng (para. 3)

➔ $EF_{grid,CM,y}$ = **0.54847 tCO_2/MWh**

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \qquad \textbf{(5)}$$

Where:
ER_y = Emission reductions in year *y* (t CO_2e/yr).
BE_y = Baseline emissions in year *y* (t CO_2e/yr).
PE_y = Project emissions in year *y* (t CO_2e/yr).

Project emissions

Project emissions are calculated as follows:

$$PEy = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PEy = Project emissions in year y (tCO_2e/yr)
$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO_2/yr)
$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e/yr)
$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year y (tCO_2e/yr)

$PE_{FF,y}$ is zero as there will be no fossil fuel consumption to generate electricity and $PE_{GP,y}$ is zero as the project is not a geothermal project activity.

In order to calculate project emissions from water reservoir of the plant, power density should be calculated. The power density of the project activity (PD) is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

PD = Power density of the project activity
Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity
Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For the new hydro power plants, this value is zero
A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity when reservoir is full (m^2)
A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

As the project activity is not extension of another project, Cap_{BL} and A_{BL} are zero, then

PD = $\underline{Cap_{PJ}}$

A_{PJ}

Proposed project activity includes three power units. Power density calculation of these power plants are given in below Table 15. According to the tool (page 7, equation 4), for the projects having power density more than 10 W/m^2 threshold is zero. As power density for all power units are more than 10 W/m^2, $PE_{HP,y}$ and the project emission (PE_y) is zero.

Table 15 Power density calculation for each power units in proposed project activity

Chorokhi HPP Power Units	**Installed Capacity (MW) - Cap_{PJ}**	**Reservoir Area in Full Level (m^2) - A_{PJ}**	**Power Density (W/m^2) - Cap_{PJ}/A_{PJ}**
Kırnati	35.039	539,746	64.92
Khelvachauri-I	42.808	905,800	47.26
Khelvachauri-II	35.028	1,085,333	32.27

Then: $ER_y = BE_y$

Baseline emissions

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$ **(6)**

Where:

BE_y = Baseline emissions in year *y* (tCO_2/yr).

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EF_{grid,CM,y}$ = Combined margin CO2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO2/MWh)

The project activity is the installation of a new grid-connected renewable power plant at a site where no renewable power plant was operated prior to the implementation of the project activity.

Then:

$EG_{PJ,y} = EG_{facility,y}$

Where:

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)

$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

$ER_y = BE_y = EG_{PJ,y} \times EF_{grid,CM,y} = EG_{facility,y} \times EF_{grid,CM,y}$ = 517,880 MWh/year *x* 0.54847 tCO_2/MWh = 284,042 tCO_2/year

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2015	284,042	0	0	284,042
2016	284,042	0	0	284,042
2017	284,042	0	0	284,042
2018	284,042	0	0	284,042
2019	284,042	0	0	284,042
2020	284,042	0	0	284,042
2021	284,042	0	0	284,042
Total	**1,988,294**	**0**	**0**	**1,988,294**
Total number of crediting years	**7 (renewable)**			
Annual average over the crediting period	**284,042**	**0**	**0**	**284,042**

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	**$EG_{facility,y}$**
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant to the grid in year *y*
Source of data	On site measurement
Value(s) applied	**517,880 MWh/year** Chorokhi HPP Power Units / Annual Electricity Generation (MWh/yr): Kırnati: 146,880 Khelvachauri-I: 205,360 Khelvachauri-II: 165,640 **TOTAL: 517,880**
Measurement methods and procedures	• Regarding the electricity meters: two meters will be placed (one main and one reserve) at the HV substation. These meters are sealed by GNERC and intervention by project proponent is not possible. The fact that two meters are installed in a redundant manner keeps the uncertainty level of the only parameter for baseline calculation low. High data quality of this parameter is not only in the interest of the emission reduction monitoring, but paramount for the business relation between the plant operator and the electricity buyers. • Net electricity generation amount will be measured hourly and recorded monthly. • Since the meters are reading electricity supplied to the system and withdrawn from the system separately, the net electricity amount supplied to the grid will be

Chorokhi HPP Power Units	Annual Electricity Generation (MWh/yr)
Kırnati	146,880
Khelvachauri-I	205,360
Khelvachauri-II	165,640
TOTAL	**517,880**

	calculated by electricity supplied minus electricity withdrawn which will be taken from monthly settlement notifications.
Monitoring frequency	Yearly
QA/QC procedures	Quality assurance of the metering devices is ensured by the mandatory annual calibration process performed by the State Electric System and the Commercial Operator. This ensures the accuracy of the metering devices. In addition to that, meters to employed will be from 0.5s classes ensuring the error level of the metering will not exceed 0.5% To ensure that metering equipment cannot be tampered with, it is initially certified by the State Standardization Organization and is checked on a regular basis by three parties: State Electric System, Commercial Operator of the National Electricity Network. The meters are stamped by both parties and they cannot be opened or manipulated by any single party. Cross check measurement results with records for sold electricity.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$\mathbf{Cap}_{PJ}$
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site
Value(s) applied	<table><tr><th>Chorokhi HPP Power Units</th><th>Installed Capacity (MW)</th></tr><tr><td>Kırnati</td><td>35.039</td></tr><tr><td>Khelvachauri-I</td><td>42.808</td></tr><tr><td>Khelvachauri-II</td><td>35.028</td></tr></table>
Measurement methods and procedures	Determined in accordance with the nameplates supplied by the manufacturer.
Monitoring frequency	Yearly
QA/QC procedures	-
Purpose of data	Calculation of Project Emission
Additional comment	-

Data / Parameter	$\mathbf{A}_{PJ}$
Unit	m^2
Description	Area of the Kırnati, Khelvachauri-I and Khelvachauri-II reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data	Project site
Value(s) applied	<table><tr><th>Chorokhi HPP Power Units</th><th>Reservoir Area in Full Level (m^2)</th></tr><tr><td>Kırnati</td><td>539,746</td></tr><tr><td>Khelvachauri-I</td><td>905,800</td></tr></table>

	Khelva hauri-II: 1,085,333
Measurement methods and procedures	Measurement will be done by a third party (engineering consultant of Achar) via topographical maps.
Monitoring frequency	Yearly
QA/QC procedures	-
Purpose of data	Calculation of Project Emission
Additional comment	Monitoring will be done yearly.

B.7.2. Sampling plan

Data and parameters described in the monitoring plan are to be measured by appropriate methods as provided in the section B.7.1. Therefore no sampling plan is needed.

B.7.3. Other elements of monitoring plan

As the necessary baseline emission factors are all defined ex ante (Operating and Built Margin, see baseline description), the most important information to be monitored is the amount of electricity fed into the grid by Chorokhi HPP. This value will be monitored continuously by redundant metering devices which provide the data for the monthly invoicing.

A basic connection diagram for Chorokhi HPP, including position of the meters is given in section A.4.3

The collected data will be kept by Achar Energy during the crediting period and until two years after the last issuance of CERs for the Chorokhi HPP activity for that crediting period.

Given a data vintage based on ex ante monitoring and selection of a renewable 7 year crediting period, the Combined Margin will be recalculated at any renewal of the crediting period using the valid baseline methodology.

Internal audit and maintenance of monitoring equipment

Since the load on each generator will be provided to the Commercial Operator of the National Electricity Network, the Commercial Operator of the National Electricity Network will proceed to inspection as soon as the anomaly is detected in measurements. The irregularity will also be observed by the chief operators at Chorokhi HPP as technicians will be responsible to keep metering records every day and submit to the plant manager daily with information on daily electricity generation and withdrawn from grid. Daily metering records will be kept with hard copies in folders and will be signed daily by technicians keeping the records. By this procedure, any problem or anomaly with metering equipments can be diagnosed in early hours of occurrences and necessary actions can be taken to fix the problems.

The Chorokhi HPP can also request an inspection from the Commercial Operator of the National Electricity Network or the Georgian State Electric System. On the site, one of the two organizations in charge of inspection, will report to Chorokhi HPP which measures need to be taken to manage the damage to the meters. Meters are re-calibrated after the inspection.

Operational and Management Structure

For the operation of Chorokhi HPP, below hierarchy is planned:

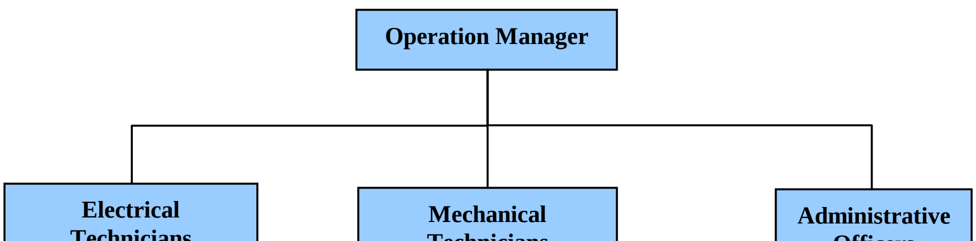

Figure 8: Operation and Management diagram

Table 16: Descriptions of Jobs and Responsibilities in Chorokhi HPP

Job Name	Job Description	Graduation Level	Staff Quantity
Electrical Technicians	Measuring the electricity generation through the proper methods and instruments. Data storing and reporting to Operational Manager and Grid Operator.	Technician high school (electricity division)	3 person/shift (2 shifts/day)
Mechanical Technicians	Making periodical and failure maintenances programmes and activities. Following and fulfilling the guarantee procedures.	Technician high school (electricity or mechanical division)	3 person/shift (2 shifts/day) for each power unit
Security Officers	Securing power plant operation		2 person/shift (2 shifts/day) for each power unit.

Staff quantity given in above Table 16 (total 24) subject to change as the project is early phase of implementation.

At the end of each monitoring period, which is planned to generally last one year, from the monthly meter reading records the net electricity generation amounts as calculated by electricity supplied to the grid minus withdrawn from the system, will be added up to the yearly net electricity generation and result data will be multiplied with the combined margin emission factor with the help of an excel spread sheet that also contains the combined margin calculation.

The project will not involve other emissions sources which are not foreseen by the methodology and which contribute by more than 1% of the emission reduction amount. Project will employ one back-up diesel generator to each power plant in the project activity but emission from these generators will be low as they will be utilized only during the emergency cases. Also, the emissions from back-up generators can be neglected according to methodology (ACM0002, page 6).

Thus, the complete baseline approach is always transparent and traceable. For the elaboration and quality assurance of the monitoring report, FutureCamp Türkiye, an expert in the project mechanisms who already supported in the project design, is assigned. However, in order to continue improving the monitoring procedures and therefore also the future monitoring reports, internal quality check shall be fulfilled by FutureCamp Türkiye. The monitoring reports are checked and in cases of mistakes and inconsistencies in the monitoring report, revisions with improvements shall be done. Furthermore, external year verification assures that the emission reductions calculations are transparent and traceable.

The outlined operation and management structure for the Chorokhi HPP will ensure:

(i) Smooth data collection for the CDM project activity

(ii) Timely calibration of the monitoring equipment

(iii) Enduring data collection and data archiving for CDM project activity.

Because of the data acquisition and management and quality assurance procedures that are anyway in place, no additional procedures have to be established for the monitoring plan. Dedicated emergency procedures are not provided, as there is no possibility of overstating emission reductions due to emergency cases.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

The project activity begins in 16/03/2012, the date of agreement between Achar Energy and electromechanical equipment provider.

C.1.2. Expected operational lifetime of project activity

50 years and 0 (zero) months[40].

C.2. Crediting period of project activity

C.2.1. Type of crediting period

Renewable crediting period

C.2.2. Start date of crediting period

31/12/2014 or the date of registration whichever is later.

C.2.3. Length of crediting period

7 years, 0 months.

[40] See IEA Report: http://www.iea.org/publications/freepublications/publication/Hydropower_Essentials.pdf (page 2, 'Lifetime')

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

A comprehensive Environmental and Social Impact Assessment Report has been performed for the project activity in accordance with Georgian regulations and EBRD (European Bank for Reconstruction and Development). Complete report is available to DOE. The remarks provided in Conclusions section of the report are listed below:

1. Three-step, riverbed type HPP cascade construction is planned. Therefore, arrangement of diversion systems (diversion tunnel, diversion channel, distribution yank, pressure pipelines, etc) is not required, which reduces impact on natural and social environments;

2. Low (10-11 m) and average value (areas of surface mirrors – 0.46, 0.88 and 0.90 km2) reservoirs arrangement is planned. Also fish-passages arrangement is planned for all three dam;

3. No significant changes in tailrace of reservoirs are expected;

4. HPP cascades will operate using discharge water from Muratli HPP and also rivers – Acharistskali and Machakhelastskali natural flow (is Acharistskali HPP project will be implemented, then – on regulated water of Acharistskali). Project flow of Kirnati will be 360 m3/sec, and Khelvachauri I and II – 440 m3/sec;

5. Calculation of sanitary/ecological flow in the tailraces of dam were conducted considering 10% of 95% average annual flow of the riv. Chorokhi, which is 14.1 m3/sec for Kirnati HPP dam and 18.9 m3/sec for Khelvachauri I and II. If we consider, that designed dams are channel type, withdraw of the ecological flow will be permanently available;

6. Ecological flow withdraw from the designed dams on the river Chorokhi will depend on the ecological flows passed out from the Muratli HPP and HPPs cascade on river Acharistskali, which requires the coordinated work of as mentioned HPPs as well as the HPPs (Bikhcha, Derineri and others) existing above Muratli HPP;

7. Considering that construction works will be held on a big distance from settlements, impact from air quality deterioration will be insignificant, which is confirmed by relevant studies;

8. According to the analogue given in the report, the warm-house gases emissions will not be significant on the designed reservoirs operation phase, according to the materials of conducted calculations;

9. Impact cause by noise distribution will be insignificant. Impact if expected on wildlife near construction sites, but it will be of temporal nature and animals/birds will come back to their natural locations after construction works are finished;

10. Power units of project HPPs (power house and substation) will be located near reservoir in riverbed and therefore will have insignificant impact on biological environment;

11. No mitigation measures are required for influence of electric field, due to big distance between settlements and power units;

12. No increase of traffic flows are expected, since intensity of traffic in influence zone is low;

13. No global climate changes are expected during reservoir operations, and small local climate changes are expected near reservoirs (relative increase of humidity);

14. Project HPPs will not have significant impact on dynamics of coastline development, since Machakhelistskali and Acharistskali have a very small role in sediment transportation, and Chorokhistskali does not transport sediments anymore;

15. To prevent flooding of cemetery in Erge and highway arrangement of reinforced-concrete dam is planned, which will significantly reduce impact risks on social environment;

16. From cultural heritage only pier of Khertvisi bridge is in influence area, part of which will be covered with water of two reservoirs;

17. Implementation of this project will cause positive impacts, such as:
    - Creation of temporary and permanent work places for local population;
    - Activation of local business sector (manufacturing of construction materials, food production, trade, services, etc), which will create additional work places;
    - Rehabilitation of existing roads;
    - Development of socio-economics in Khelvachauri municipality and Autonomous Republic of Adjara.

River Chorokhi is trans-boundary river, small part of the river downstream flows on the territory of Georgia (approximately 26 km long from the confluence), the main part of the flow is located on the territory of Turkey. Accordingly, the risk of trans-boundary impact during the project implementation is minimal. From the possible indirect impact types, significant deterioration of river Chorokhi water quality can be considered. Distribution of contaminated sea water in the Turkish territorial waters is less possible.

D.2. Environmental impact assessment

Georgian legislation comprises the Constitution, environmental laws, international agreements, subordinate legislation, normative acts, presidential orders and governmental decrees, ministerial orders, instructions and regulations. Georgia is signatory of a number of international conventions. Environmental and social laws/regulations in Georgia, related with proposed project activity are listed in below table:

Table 17 Environmental Laws and Regulations of Georgia

Year	Law / Regulation
1994	on Soil Protection (amend.1997, 2002)
1994	on protection of plants from harmful organisms
1996	on System of Protected Areas (amend.2003, 2004, 2005, 2006, 2007)
1996	on Protection of Environment (amend 2000, 2003, 2007)
1996	on ownership of agricultural lands
1997	on Wildlife (amend.2001, 2003, 2004)
1997	on Tourism and Recreation
1997	on Water (amend.2003, 2004, 2005, 2006)
1997	on compensations for consumption of Agricultural Lands for Non-agricultural Purposes
1998	on Hazardous Chemicals (amend. 2006,2007)
1999	on State Complex Expertise and Approval of Construction Projects

1999	on Protection of Ambient Air (amend. 2000, 2007)
1999	Forestry Code of Georgia (amend. 2000 2001, 2003, 2005, 2006)
1999	on Seizure of Property Rights for Necessary Public Needs
2005	on Red List and Red Book of Georgia (amend.2006)
2005	on Licenses and Permits
2005	on Fire Safety
2005	on Privatization of State-owned Agricultural Land
2007	on Cultural Heritage
2007	on Status of Protected Areas
2007	on Ecological Examination
2007	on Environmental Impact Permit
2007	on Public Health
2007	on Entitlement of Ownership Rights to Lands Possessed (Employed) by Physical and Legal Persons of Private Law

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

Firs cycle of the meetings with the stakeholders were held on 20-21 July, 2011 within the ESIA of construction and operation phases of the HPP cascade on river Chorokhi. The meetings were organized by the company "Gamma Consulting", which executed the ESIA for the "Achar Energy 2007" which is the implementer of the planned activities. Attending the meetings were:

- Suleyman Tasci – manager of the "Achar Energy 2007" Ltd.;
- Sofio Varshalomidze – PR specialist of "Achar Energy 2007" Ltd.;
- Vakhtang Gvakharia – director of "Gamma Consulting" Ltd.;
- Juguli Akhvlediani – a project manager of "Gamma Consulting" Ltd.;
- Mariam Otten – PR specialist of "Gamma Consulting" Ltd.;
- Nini Tskvitishvili – expert biologist of "Gamma Consulting" Ltd.

Attorneys of the Khelvachauri municipality and local communities were also attending all of the meetings.
According to the preliminary published and coordinated with the local authorities' scheme, statement about the appointment of the preliminary meeting with the stakeholders was published in the 15-20 July, 2011 issue of the newspaper "Achara". In addition, population was warned verbally by the community representatives. Meetings were held:

- In village Maradidi (population of villages Maradidi and Kirnati);
- In village Machakhlis Piri (population of villages Machakhlis Piri and Mirveti);
- In village Erge (population of villages Erge and Acharistskali);
- In municipality of Khelvachauri (population of Khelvachauri and community of Makho).

Booklets including brief information about the planned activities and project related significant negative and positive impacts were given to the population and stakeholders during the meetings. Also, complete contact information of PR responsible person and printed copies of the Stakeholder Engagement Plan.

After that, representative of "Gamma Consulting" Ltd. would have introduced presentation material to the audience, which reflected the content of the project and expected, project related environmental and social impacts, as well as the goals and objectives of Scoping Report and Stakeholder Engagement Plan. After the speech, usually, discussions were held, which was question-answer procedure. However, it should be noted, that despite the fact that vast majority of the public understands the construction and operation project of HPP cascade on the river Chorokhi, many are also worried about the region ecological problem solutions, the threat of climate change, hydrological regime change of the river, risk of landslide process activation, conditions of the historical monuments and other issues.

All the problematic issues, opinion or suggestion raised by the stakeholders has been recorded with audio-technology and will be considered during the preparation process of the preliminary report of the ESIA.

This document represents the report of the meetings and sessions conducted within the procedure of public discussions. Remarks and proposals from the public and stakeholders and the comments made by the specialists of "Achar Energy 2007" Ltd and "Gamma Consulting" Ltd during the meetings, as well as attendance lists and meeting describing pictures are attached to this document.

E.2. Summary of comments received

Comments received during each meeting held and replies of project owner are given below:

1) 21.07.2011. Khelvachauri municipality, village Maradidi – meeting with the local population

Meeting/ Session Location	№	Note – The content of the proposal	Reply
Village Maradidi	1	What will be the dam height at Kirnati?	According to the pre-project solutions, height of Kirnati HPP dam would not be higher than 10-11 m.
	2	What will be the flooded area?	Reservoir's water mirror surface will be approximately 0.46 km^2
	3	Will the lands owned by the population be flooded?	Yes, the reservoir water will flood the lands owned by population and also the parts of the lands owned by the municipality. Currently, the lands under the flood risk are being identified and we will present you the detailed information about the owners on the next meeting.
	4	When will construction begin?	Construction will be able to begin in spring 2012, before the preparatory works will be conducted.
	5	Whether advisable is water-mirror appearance in this region, which is already too dump? The climate will not change?	It is knows, that reservoir exploitation may provoke the activation of the landslide processes. If we consider, that villages of Didachara community are highly sensitive in terms of landslide processes, there is a risk of worsening the situation. Proceeding from this, the issue requires a detailed examination. Decision about the project implementation will be based on engineering geological report. Assessment of the possible negative impact on the climate conditions is the subject of ESIA and the appropriate calculations will be fulfilled. It can be said in advance, that the water mirror surface areas will be small and therefore a significant climate changes are not expected.
	6	How Chorokhi will pass the sediments?	As it is known, due to the HPPs impact, which are located on the territory of Turkey, river Chorokhi practically does not import the solid sediments on the territory of Georgia. Accordingly, designed dam on the river Chorokhi would not have a significant importance in terms of slid sediment transportation interruption. However, washing sluices are designed on the dam, which will open during the flood and pass the sediments accumulated in the reservoir with full capacity.
	7	Power generation will take place at the site, or how it is planned?	According to the project, Kirnati HPP is the canal type and the HPP building will be located behind the dam, so that the diversion system arrangement is not needed.
	8	How many families are expected to be resettled?	According to the materials of preliminary study, we think that there will be no problem of physical resettlement (resettlement of the families). As for the land issues impact is certainly expected and supposedly flooded lands are being identified now days, after completion of this, individual negotiations will be held with every owner.
	9	How do you determine compensation?	Land and real estate (including perennial crops) price will be determined according to the tariffs set by Georgian Legislation. Pre-defined and real market prices will be considered during individual agreements with the population.
	10	Where the approach road will pass and if the road is going to be expanded?	Arrangement of the approach road to the dam of Kirnati HPP is planned from the village Maradidi. The road widening-reconstruction works will start from the central highway, which is a profitable option for village as well. The road widening will be needed on the territory of village, which on the some sections will be associated with the use of the privately owned lands. Such issues will be solved by individual negotiations with the land owners.
	11	When the land related issues will be determined?	Full identification of lands needed for HPP cascade construction will be completed by the end of September and then starts individual negotiations with the land owners.
	12	What will be the width of the road?	The carriageway width will be 5-6 m.
	13	Will the local population be employed?	According to the social policy of company "Achar Energy 2007", absolute majority of the employed personnel will be local population. Only highly qualified specialists will be invited, who can not be found locally.
	14	Will there be benefits for the village?	The electricity tariff is determined by Georgian National Energy Regulatory Commission and this issue can not be solved by "Achar Energy 2007" Ltd. But, according to the company's social policy, it will take an active part in implementation of the socio-economic programs within the villages under project influence are.
	15	If the water will inundate, what will happen?	Designed dams and dams existing on Turkish territories are minimizing the risks of flood, but if the water will flood anyway, sluices designed on the Kirnati dam will ensure free flow of the catastrophic water cost.
	16	The climate has already changed and nothing is growing in the garden and we would not be able to grow anything when the HPP will be made.	Climate change researches within the HPPs cascade impact zone is conducted by a group of specialists. Research materials will provide current climate baseline, as well as the possible climate changes associated with the exploitation of the HPPs cascade. According to the preliminary research results, it can be said, that current climate baseline in the study area may be connected to the global climate change. If we consider, that water mirror surfaces of the designed dams will be small areas, significant impact on the local climate conditions is not expected.

	17	Environment change will be very large. A request, that everything to be studied in advance.	As we have already mentioned, experts of the company "Gamma Consulting" and invited specialists are working in the project influence zone, which are studying the background conditions of the physical, biological and socio-economical environment and environmental and social risk assessment related to the project implementation.
	18	The river Gremi flows in the village, which is the tributary of the Chorokhi. The big request from population is to strengthen the bank. Comes out of the river-bed during the water abounding and floods the village.	Your proposal will certainly be considered and river Gremi bank strengthening works will be included in the project documentation.

List of participants to the meeting in Maradidi village on 21/07/2011

№	Name, Surname	Organization and Job Title
1	Zakariadze Levan	Builder
2	Chelidze Zurabi	Pensioner
3		Pensioner
4	Sukonnikovi Temuri	Unemployed
5		Pensioner
6	Saparidze Irma	Unemployed
7	Zakariadze Omari	Builder, Unemployed
8		Unemployed
9	Malakmadze Bichiko	Unemployed
10	Svanidze Nugzari	Unemployed
11	Gorgoshadze Iasha	Unemployed
12	Goguadze Nuri	Driver
13	Goguadze Remzi	Builder
14	Diasamidze Zurabi	Unemployed
15	Zaqaradze Amirani	Pensioner
16	Zaqaradze Badri	Firefighter
17	Malakmadze Suliko	Unemployed
18	Beridze Muhamedi	Unemployed
19	Svanidze Jambuli	Driver
20	Beridze Malkhazi	Firefighter
21	Beridze Murmani	Unemployed
22	Sukolnikovi Vakhtangi	Unemployed
23	Beridze Merabi	Unemployed



Figure 9 Photos from meeting in Maradidi village.

2) 21.07.2011. Khelvachauri municipality, village Machakhlis Piri – meeting with the local population

Meeting/Session Location	№	Note – The content of the proposal	Reply
Village Machakhlis Piri	1	On what level will the water rise?	Khelvachauri 1 HPP reservoir maximum water level will be 41 m from the sea level. Flood of the territories of village Machakhlis Piri is not expected, significant part of the territories of village Mirveti, existing on the left bank of river Chorokhi, will be covered with water.
	2	The tarrif should not be changed?	The electricity tariff is determined by Georgian National Energy Regulatory Commission and this issue can not be solved by "Achar Energy 2007" Ltd.
	3	We are interested in height of the dams.	Khelvachauri 1 HPP dam height will be approximately 10 m.
	4	Would not the road be flooded?	According to the pre-project solutions, road flooding is not expected.
	5	These HPPs are built by state or private entity?	HPPs cascade construction project is being implemented by a private investment. Also, participation of the international financial organizations is planned.
	6	Who will be compensated and how?	Compensations will be paid to those private and legal persons whose lands and real estate will be damaged or lost during the project implementation. Land and real estate (including perennial crops) price will be determined according to the tariffs set by Georgian Legislation. Pre-defined and real market prices will be considered during individual agreements with the population.
	7	Registration of agricultural lands and personal plots is suspended already two years. In this case, how do we get compensation?	According to the environmental and social policy of the international financial organizations (WB, EBRD, EFC), compensation will be paid to all the property which is used by a person and which is the source of living for this person. According to the policy of these organizations, compensation will be paid for the unregistered lands, if the owner proves that it is the source of his income. Georgian Legislation does not consider the compensation for the unregistered lands.
	8	Find out the issue of the village Mirveti. It is below and will be flooded for sure.	As we have mentioned, part of village Mirveti territory (mostly rural-agricultural lands) will be covered with the reservoir water of Khelvachauri 1 HPP. Flood zone boundaries will be specified simultaneously to the project parameters specification, reservoir's alienation line and then we will know
			whose lands will be the subject of procurement.
	9	Are we threatened with flooding during the inundation?	Designed dams on river Achariskali and dams existing on Turkish territories are minimizing the risks of flood, but if the water will flood anyway, sluices designed on the Khelvachauri 1 HPP dam will ensure free flow of the catastrophic water cost.
	10	The reservoir will affect on the climate and harvest.	If we consider, that water mirror surfaces of the designed dams will be small areas, significant impact on the local climate conditions is not expected. Climate change researches within the HPPs cascade impact zone is conducted by a group of specialists. Research materials will provide current climate baseline, as well as the possible climate changes associated with the exploitation of the HPPs cascade.

List of participants to the meeting in Machakhlis Piri village on 21/07/2011

№	Name, Surname	Organization and Job Title
1	Sandro Mutidze	LEPL. School teacher of village Maradidi
2	Dariko Tsitladze	Housewife
3	Nodari Didmanidze	Pensioner
4	Nadim Didmanidze	Member of the Khelvachauri Council
5	Tengiz Didmanidze	Driver
6	Akhmed Diasamidze	Entrepreneur
7	Jemali Didmanidze	Entrepreneur
8	Temuri Didmanidze	Unemployed
9	Vladimer Lomadze	Unemployed
10	Ushangi Didmanidze	Unemployed
11	Ruslan Lomidze	Entrepreneur
12	Suliko Didmanidze	LEPL. School teacher of village Maradidi
13	Ramaz Didmanidze	Unemployed
14	Almaskhan Didmanidze	Student
15	Irakli Didmanidze	Unemployed
16	Beglar Didmanidze	Unemployed
17	Mamuka Didmanidze	Unemployed
18	Iago Cherkezishvili	Unemployed
19	Romeo Didmanidze	Student
20	Tamaz Didmanidze	Theologist
21	Nodar Zakaradze	
22	Aslan Gabitadze	

Figure 10 Photos from meeting in Machakhlis Piri village.

3) 21.07.2011. Khelvachauri municipality, village Erge – meeting with the local population

№	Note – The content of the proposal	Reply
1	What is the principle of the compensation issue?	Compensations will be paid to those private and legal persons whose lands and real estate will be damaged or lost during the project implementation. Land and real estate (including perennial crops) price will be determined according to the tariffs set by Georgian Legislation. Pre-defined and real market prices will be considered during individual agreements with the population.
2	When will be the information about the lands specified?	Full identification of lands that is needed to be purchased will be completed by the end of September and preparatory work for land acquisition will start in October.
3	Will the information about the HPPs construction published in the internet?	All material was published on the web site of "Achar Energy 2007". Address is given in the booklets provided to you and in Stakeholder Engagement Plan.
4	The lands are no longer registered to the population, despite the fact, that measuring is conducted and we have the discs, the process has stopped for unknown reasons.	Georgian Legislation does not consider the compensation for the unregistered lands. According to the environmental and social policy of the international financial organizations (WB, EBRD, EFC), compensation will be paid to all the property which is used by a person and which is the source of living for this person. Company "Achar Energy 2007", will help population to register their lands and then purchase them, according to its social policy. But all of you have to take into account one important condition, that the company will purchase only those plots which were used by population for rural-agricultural or commercial purposes for years and is their living source.
5	If we would not register the lands, what will happen then?	Company "Achar Energy 2007", will help population to register their lands and then purchase them, according to its social policy.
6	If the HPP will be arranged at Makho bridge, are we threatened with resettlement in this case?	According to the preliminary design solutions, residential homes should not be involved in the zone flooded by reservoir water. This issue will be specified after preparation of final version of the project documentation and will be presented to you during the next meeting.
7	We live on farming and if the climate will change due to the reservoir and we would not be able to harvest, who and how will compensate us?	If we consider, that water mirror surfaces of the designed dams will be small areas, significant impact on the local climate conditions is not expected. We will be able to provide detailed information after completion of the researches processing during the ESIA.
8	We approve the construction, but our terms should be taken into account.	Today's meeting serves for introduction of your opinions and suggestions, which will certainly be considered in the ESIA report, and later in the project documentation.
9	How much will the reservoir cover?	Reservoir's water mirror surface will be approximately 0.9 km^2
10	Will there be the protection line or fencing?	Reservoir perimeter fencing or protective line arrangement practice is not accepted in any country of the world and will not be used in this case either.
11	Will the local workers be used?	According to the social policy of company "Achar Energy 2007", absolute majority of the employed personnel will be local population. Only highly qualified specialists will be invited, who can not be found locally.
12	When the HPP will be constructed here – mandarin would not grow, the climate has changed significantly after the HPPs were constructed on the territory of Turkey. The worst will happen to us after this construction.	As we have already mentioned, group of specialist of "Gamma Consulting" works for preparation of conclusion on possible climate changes associated with the project implementation. According to the materials of preliminary study, impact on climate conditions due to the reservoirs existing on the territory of Turkey, is very noticeable. Designed reservoirs will have a small area of water mirror surface and therefore the impact would not be significant. Detailed information will be provided to you on the next meeting, when the studies are completed and the final conclusion is made.

List of participants to the meeting in Erge village on 21/07/2011

№	Name, Surname	Organization and Job Title
1	Kupradze Jujuna	Housewife
2	Diasamidze Nestani	Housewife
3	Goradze Darejan	Housewife
4	Gvianidze Nugzar	Attorney of village Erge
5	Goradze Nargizi	Housewife
6	Bolkvadze Vardo	Housewife
7	Bolkvadze Tengiz	
8	Goradze Amiran	Pensioner
9	Goradze Mikheil	Unemployed
10	Tsintsadze Nugzar	Unemployed
11	Gogitidze Tamaz	Unemployed
12	Goradze Nugzar	Pensioner
13	Kokobinadze Mindia	Unemployed
14	Kokobinadze Kamil	Individual Entrepreneur
15	Bolkvadze Davit	Individual Entrepreneur
16	Goradze Badri	Pensioner
17	Goradze Rostom	Pensioner
18	Zakaradze Malkhazi	Unemployed
19	Kokobinadze Jujuna	Pensioner
20	Kokobinadze Dariko	Pensioner
21	Goradze Romani	Unemployed


Figure 11 Photos from meeting in Erge village.

4) 21.07.2011. Khelvachauri Municipality – Meeting with the local authorities and population

№	Note – The content of the proposal	Reply
1	How will be ensured the information of the population? What means will be used?	All information about the project and all documentation prepared during the ESIA process will be published on the web site of the company "Achar Energy 2007". Printed and electronic version of the ESIA Report is available in the administration building of Khelvachauri municipality and in office of the company "Achar Energy 2007". Web site address, office address of the company "Achar Energy 2007" and the contact information of the PR specialist (Sofio Varshalomidze) is provided in the booklets given to you and in the Stakeholder Engagement Plan. The best way to inform the population is the meetings. Repeatedly meeting is planned by the end of the October, on this meeting we will provide you with accurate information on issues you are interested in.
2	Is arrangement of the round tables, meetings with the NGOs and other similar events planned?	Such meetings will certainly be held in process of the ESIA.
3	Totally, what is the designed capacity of the HPPs?	According to the preliminary design solutions, total capacity of the HPPs cascade will be 105,7 MW.
4	Various methods of power generation is known. What are the advantages of the dam method? We already have significant experience related to the ecology, how protected will we be in this case? Is not it better to use wind energy? If it is intended by economic point of view?	Comparative characteristics of the alternative energy sources will be provided in the ESIA Report and advantages and disadvantages of all sources will be discussed. I can already tell you, that there is no alternative source for energy generation, which would not have a negative impact on the environment (including wind and solar energy usage cases). Hydro energy is the most accepted and approved version among the renewable energy sources. Canal type HPP proposed by the project, is an acceptable option with the environmental point of view, which is confirmed according to the feasibility substantiation.
5	Is there calculation of what will Georgian budget get from operation of these HPPs?	According to the memorandum concluded with the Georgian government, 40% of the generated electricity will be delivered to the Georgian energy system, with local prices. In addition, the budget will receive significant additional income in form of the taxes.
6	You have presented the list of the impacts. Can you describe, what will be the deterioration and improvement of the natural and social environment in percents, according to these paragraphs? Will this	Today we have presented information on all types of impacts (positive, negative), which may have place in process of project implementation. ESIA provides a detailed study of all types of the impact, analysis and
	be studied and justified and will this be more specific and justified?	forecasts the quality of possible changes of physical, biological and social environment.
7	Our country is now focused on tourism and HPP construction will change the climate, the pressure and disease risks will increase, mosquito will appear, will be evaporation and etc. Would this construction interfere the development of the tourism policy?	Considering the small are of reservoir water mirror surface, we should not expect a significant climate changes. In case of reservoir coastline improvement and development of relevant infrastructure, reservoirs may be used for recreation purposes.
8	How much will be the flooded area?	Total water mirror surface of all three HPP will be approximately 2.24 km^2.
9	Will the construction touch the roads? Will the local roads and village approach roads be damaged?	Only one section of central highway will be the subject of flooding, including the cemetery of village Erge. But the dam construction is proposed by the project, which excludes the risk of flooding od the road and cemetery. Part of the road of village Mirveti will be flooded, for which the company "Achar Energy 2007" will prepare a new road project and provide its construction.

List of participants to the meeting in Khelvachuri Municipality on 21/07/2011

№	Name, Surname	Organization and Job Title
1	Irakli Surmanidze	Khelvachauri municipality, Deputy governor
2	Guram Saparidze	Khelvachauri municipality, Deputy governor
3	Jaba Abuladze	Khelvachauri municipality, Assistant governor
4	Gurami Mutidze	Khelvachauri region, village Makho
5	Zurabi Mutidze	Khelvachauri region, village Makho
6	Mikheil Mchedlishvili	Khelvachauri region, village Simoneti
7	Genadi Komakhidze	Khelvachauri region, village Simoneti
8	Genadi Kalandadze	
9	Merabi Mutidze	Khelvachauri region, village Makho
10	Guladi Kalandadze	
11	Amiran Khajishvili	Khelvachauri region, village Simoneti
12	Murman Tetradze	Khelvachauri region, village Simoneti
13	Roland Khajishvili	Khelvachauri region, village Simoneti
14	Nugzar Mchedlishvili	Khelvachauri region, village Simoneti
15	Merab Gurgenidze	Khelvachauri region, village Khelvachauri
16	Tamaz Lortkipanidze	
17	Nugzar Dzneladze	
18	Suliko Mikeladze	Municipal Council member
19	Enver Davitashvili	Attorney of village Makho
20	Omar Kalandadze	Khelvachauri region, village Makho
21	Givi Gorgoshadze	Khelvachauri region, village Simoneti
22	Roland Khajishvili	Khelvachauri region, village Simoneti
23	Jujuna Khajishvili	Attorney of village Simoneti

Figure 12 Photos from meeting with the local authorities and population in Khelvachauri municipality.

E.3. Report on consideration of comments received

All of the comments are considered by project developer and replied as shown in section E.2.

When the comments are analyzed, it will be seen that main concern of local people are on impact of the project on their lands, and agricultural activities. Project developer ensured local people with proper compensation of lands to be remained under water after project implementation. It is also mentioned that, according to studies performed, there will be no impact of the project on climate of the region; therefore any negative impact on agricultural production is not anticipated. Some comments were about the impact of project on existing roads. Project developer mentioned that some parts of the roads may be flooded but Achar Energy will build new roads or repair damaged ones properly. There were many comments on employment opportunity due to project activity and project developer ensured them as most of the people for project construction and operation will be employed from close settlements.

Any relevant comments were taken into consideration during project planning. A comprehensive ESIA (Environmental and Social Impact Assessment) report is prepared to properly evaluate any impact of the project to the environment and take measures to mitigate any possible negative ones.

SECTION F. Approval and authorization

For the project activity Letter of Approval is received from the DNA of Georgia, the Ministry of Environment Protection, on 01 May 2012. The Letter of Approval is provided below:

საქართველოს გარემოს დაცვის მინისტრი

MINISTER OF ENVIRONMENT PROTECTION OF GEORGIA

KA030150327292512

საქართველო, 0114 თბილისი, გ. გულუას ქ. N6; ტელ:2727200, 2727220, ფაქსი:2727237; www.moe.gov.ge
6 G. Gulua Str. 0114, Tbilisi, Georgia, Tel:(+995 32) 2727200, 2727220, Fax:2727237; www.moe.gov.ge

 # 1300 **01 / მაისი / 2012 წ.**

To: Mr. Kakha Sharabidze
Authorised Representative
Achar Energy 2007 Ltd.
172 Varshanidze street , Batumi, Georgia

Letter of Approval

for "Chorokhi Hydro Power Plant Project" (the "project")

As Authorized Representative of the Designated National Authority (DNA) of Georgia for the Clean Development Mechanism (CDM) under the Kyoto Protocol of the United Nations Framework Convention on Climate Change I hereby confirm that:

(i) Georgia has accessed to the Kyoto Protocol on 16th June 1999;
(ii) Georgia participates voluntary in the CDM;
(iii) The Project will assist Georgia in achieving sustainable development;
(iv) The DNA will cooperate with the Project Participant and the CDM Executive Board to facilitate the CDM process and give assistance, where necessary, for the issuance and transfer of Certified Emission Reductions (CERs) to the Project Participant.

As authorised representative of the Designated National Authority of Georgia for the Clean Development Mechanism under the Kyoto Protocol I authorize **Achar energy 2007 Ltd.** to participate in the CDM project activity **"Chorokhi Hydro Power Plant Project"** as Project Participant.

As such I acknowledge their right, title and interest in all of the greenhouse gas emission reduction generated by the project (and any CERs which are created as a result of the project).

With this letter I approve on behalf of Georgia the project **"Chorokhi Hydro Power Plant Project"** as a Clean Development Mechanism project for the purpose of article 12 of the Kyoto Protocol.

Sincerely,

Acting Minister Gocha Mamatsashvili

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Appendix 1: Contact information of project participants

Organization name	Achar Energy 2007 Ltd. Co.
Street/P.O. Box	M. Varshanizde St.
Building	No: 172
City	BATUMI
State/Region	
Postcode	
Country	GEORGIA
Telephone	
Fax	
E-mail	info@acharenergy.com
Website	
Contact person	Bahadır Uyanık
Title	Project Manager
Salutation	Mr.
Last name	Uyanık
Middle name	Bahadır
First name	Yasin
Department	
Mobile	
Direct fax	0090 216 544 24 04
Direct tel.	0090 216 544 24 00
Personal e-mail	bahadir.uyanik@iltekiletisim.com

Appendix 2: Affirmation regarding public funding

No public funding is used for the project activity.

Appendix 3: Applicability of selected methodology

No additional information other than given in B.2.

Appendix 4: Further background information on ex ante calculation of emission reductions

Table 18 Power plants serving the electricity system of Georgia by end of 2006

No	Power Plant	Start Up Date	Type	Rated Capacity (MW)	Annual Generation (MWh)
1	Zahesi	1927	Hydro	36.8	158,984
2	Abashahesi	1928	Hydro	1.8	1,789
3	Rionhesi	1933	Hydro	48	290,473
4	Dashbashhesi	1936	Hydro	1.26	5,948
5	Atshesi	1937	Hydro	16	70,946
6	Kekhvihesi	1941	Hydro	0.98	400
7	Alazanhesi	1942	Hydro	4.8	5,329
8	Khrami-1	1947	Hydro	113	334,691
9	Chitakhevhesi	1949	Hydro	21	106,833
10	Khertvisihesi	1950	Hydro	0.3	608
11	Mashaverahesi	1951	Hydro	0.6	300
12	Tiriponhesi	1951	Hydro	3	3,001
13	Kazbegihesi	1951	Hydro	0.3	452
14	Tetrikhevhesi	1952	Hydro	13.6	28,345
15	Satskhenisihesi	1952	Hydro	14	44,887
16	Kabalihesi	1953	Hydro	1.5	836
17	Martkopihesi	1953	Hydro	3.86	5,989
18	Ortachalhesi	1954	Hydro	18	88,574
19	Shaorhesi	1955	Hydro	38.4	67,029
20	Gumathesi	1956	Hydro	67	220,228
21	Dzevrulhesi	1956	Hydro	60	84,326
22	Machakhelahesi	1956	Hydro	1.4	6,438
23	Bzhuzhahesi	1957	Hydro	12	46,834
24	Squrhesi	1958	Hydro	1	1,460
25	Lajanurhesi	1960	Hydro	112	274,695
26	Misaktsieli-Ento	1961	Hydro	2.7	4,737
27	Khrami II	1963	Hydro	110	118,204
28	Sionhesi	1964	Hydro	9.14	28,211
29	Tbilsresi	1965	Thermal	150	663,910
30	Ritseulahesi	1967	Hydro	9.05	24,114
31	Chkhorhesi	1967	Hydro	5.35	6,071
32	Vardnili-I	1971	Hydro	220	344,477
33	Engurhesi	1978	Hydro	1300	1,652,111
34	Zhinvalhesi	1985	Hydro	130	390,355
35	Vartsikhehesi	1987	Hydro	184	721,062
36	AES Mtkvari	1990	Thermal	300	1,149,449

37	Intsobahesi	1993	Hydro	1.7	2,265
38	JSC "Kindzmarauli"	2001	Hydro	1.5	2,561
39	Munleik Georgia	2002	Hydro	20	22,172
40	Khadorhesi	2004	Hydro	24	127,201
41	"Energy Invest" Gas turbine-1	2006	Thermal	110	290,444
TOTAL				**3,168**	**7,396,739**

Total Generation Amount of Last 5 Power Plants	444,643
20% of Total Generation	1,479,348
Sample Group Generating More than 20% of Total Generation (Total generation of last 6 power plants)	1,594,092

Appendix 5: Further background information on monitoring plan

No additional information other than given in B.7

Appendix 6: Summary of post registration changes

Not applicable

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History of the document

Version	Date	Nature of revision
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b.
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03	EB 25, Annex 15 26 July 2006	
02	EB 14, Annex 06b 14 June 2004	
01	EB 05, Paragraph 12 03 August 2002	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		