CHOROKHI HYDRO POWER PLANT PROJECT

Document Prepared By Lifenerji Ltd. Şti.

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1 PROJECT DETAILS

1.1 Summary Description of the Project

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 **98.731 MWe** and expected annual electricity generation amount is **410.8 GWh**. Generated electricity will be fed into Georgian grid and to a portion of the electricity will be exported to Turkey. Thus in this PD baseline scenarios and two emission factors for both Georgia and Turkey are defined and additionality for both countries is demonstrated. Estimated annual emission reduction amounts by project activity for both Georgia and Turkey are **225,312 tCO_2e** and **197,933 tCO_2e.**

Chorokhi HPP involves 2 weirs and 2 power units in cascade system on same river. These are Kırnati Weir and HPP and Khelvachauri I 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 (MWe)	Annual Electricity Generation (GWh/yr)	Reservoir Area in Full Level (m^2)[1]	Power Density (W/m^2)
Kırnati	51.251[2]	204[3]	530,000	94.96
Khelvachauri-I	47.48[4]	206.8[5]	900,000	52.76
TOTAL	**98.731**	**410.8**		

Preliminary studies and licence tasks started in 2011. Construction of the power plants is planned to start in 2012 and by February of 2017, 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

[1] See; Khelvachauri HPP FSR, page 7-3
[2] See; Kırnati HPP FSR, page 1-1
[3] See; Kırnati HPP FSR, page 9-1
[4] See; Khelvachauri HPP FSR, page 1-1
[5] See; Khelvachauri HPP FSR, page 9-1

power plant generation . 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 2.4.

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:

- 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.

1.2 Sectoral Scope and Project Type

The project applies CDM EB-approved methodologies and tools in their latest version. The CDM program is a VCS approved program.

The respective sectoral scope is scope 1: "Energy Industry – Renewable/Non-renewable Sources".

1.3 Project Proponent

Organization name	Achar Energy 2007 Ltd. Co.
Contact person	Bahadır Uyanık
Title	Project Manager
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1.4 Other Entities Involved in the Project

Organization name	Lifenerji Ltd. Şti
Role in the project	Carbon Project Consultant
Contact person	Engin Mert
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1.5 Project Start Date

01.02.2017 (expected) will be the date on which the project began generating GHG emission reductions or removals and project start date.. As per the VCS Standard, the project start date is the date on which the project began generating GHG emission reductions or removals. Thus project start date is line with the VCS standard.

1.6 Project Crediting Period

A two times renewable crediting period of 10 years 0 month shall apply. First verifiable emission reductions shall be achieved in February 2017. Thus the first crediting period shall last from 1st of February 2017 until 31st of January 2027.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	x
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)	
	For Georgia	For Turkey
2017[6]	206,536	181,439

[6] Start date: 01.02.2017
End date: 31.01.2027

2018	225,312	197,933
2019	225,312	197,933
2020	225,312	197,933
2021	225,312	197,933
2022	225,312	197,933
2023	225,312	197,933
2024	225,312	197,933
2025	225,312	197,933
2026	225,312	197,933
2027[7]	18,776	16,494
Total estimated ERs	2,253,120	1,979,330
Total number of crediting years	10	
Average annual ERs	225,312	197,933

1.8 Description of the Project Activity

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 1. Total installed capacity of Chorokhi HPP is 98.731 MWe and total estimated annual electricity generation amount is 410.8 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 will be connected via 34.5 kV OHL to the HV substation. Grid connection diagram of project activity is given in **Figure 1**.

Table 2: Technical details of the plant

		Kırnati [8] HPP	**Khelvachauri-I HPP[9]**
Project Main Characteristics	**Gross Head**	15m	12 m
	Net Head	14.51 m	11.365 m
	Design Flow	375.6 m^3/s	108.9 m^3/s
	Total Installed Power	51.251 MWe	47.48 MWe
	Power Density	96.7 W/m^2	52.76 W/m^2
	Power Generation	204 GWh/year	206.8 GWh/year
Weir	**Type**	Concrete	Concrete

[7] Start date: 01.02.2017
End date: 01.01.2027
[8] See; Kırnati HPP FSR, page 1-6
[9] See; Khelvachauri HPP FSR, page 1-6

(Regulator)	**Crest Elevation**	60.30 m	44 m
	Reservoir Area in Crest Elevation	530,000 m^2	900,000 m^2
	Thalweg Elevation	41 m	31 m
Water Intake Structure	**Location**	Right Bank	Right Bank
	Number of Gates	5	6
	Gate Dimensions (WxL)	10.00 m x 8.00 m	10.00 m x 8.00 m
	Sill Elevation	41 m	30 m
Spillway Structure	**Location**	Left Bank	Left Bank
	Type	Controlled with Gates	Controlled with Gates
	Number of Gates	4	5
	Gate Dimensions (WxL)	12.00 m x 14.50 m	18.00 m x 12.00 m
Power Plant Building	**Dimensions (WxL)**	48.4 m x 100 m	48.4 m x 100.0 m
Turbine	**Type**	Bulb	Bulb
	Unit Number and Power	4 x 12,076 kW + 1 x 2,024 kW	5 x 9,100 kW + 1 x 1,980 kW
	Unit Discharge Rate	4 x 90 m^3/s + 1 x 15.6 m^3/s	5 x 90 m^3/s + 1 x 18.9 m^3/s
Generator	**Type**	3-phase, synchronised, AC	3-phase, synchronised, AC
	Total Generator Power	57,353 kVA	55,829 kVA
	Unit Number and Power	4 x 13.818 + 1 x 2.263 kVA	5 x 10,700 + 1 x 2,329 kVA
	Nominal Voltage	6.3 kV	6.3 kV
	Frequency	50 hz	50 hz
	Synchronous Speed	166.7 rpm	150.0+ 300.0 rpm
Transmission Line	**Type**	1272 MCM	1431 MCM
	Line Voltage	110 kV	110 kV
	Connection Point	Batumi Substation of GNERC (national TSO)	Batumi Substation of GNERC (national TSO)
	Length	5 km	12 km

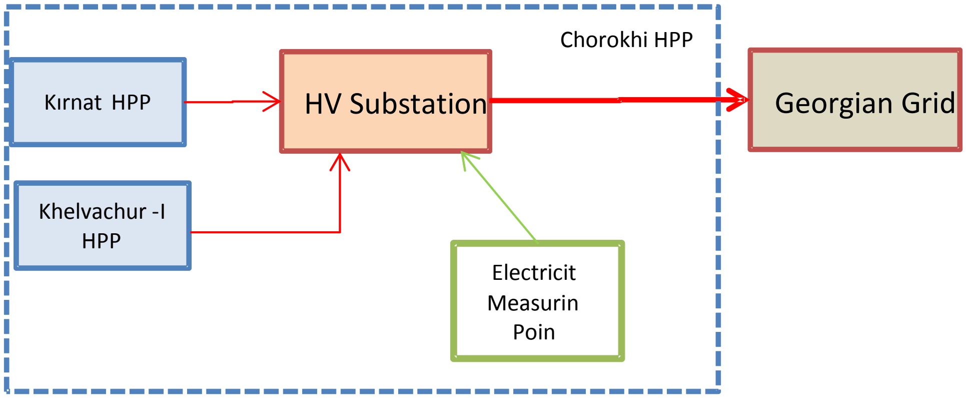

Figure 1: Grid Connection Diagram of Project Activity

Operational lifetime of the project is estimated from the report of International Energy Agency.[10] .In the report it is stated that operational lifetime of the projects are from 50 to 100 years. In order to be conservative 50 years of operational lifetime is assumed for the project.

Turbine technical lifetime of the project is calculated as 36 years by using the 'Tool to determine the remaining lifetime of equipment''11. In the tool it is said that lifetime for the Hydro Turbines is 150000 hours. In order to determine operational life time of the HPP firstly capacity factor of the HPP should be calculated because HPP will not be in operation for whole year. By dividing annual generation (410,800 MWh/year) to the installed capacity (98.731 MWe), the operation time in a year will be found which is 4160.8 h/year. Finally dividing lifetime of the equipment (150000 hours) to the operational time per year, life time of the equipment will be found in terms of year which is 36.05. Thus operational life time of the hydro turbines will be found as 36 years.

1.9 Project Location

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

[10] See, http://www.iea.org/publications/freepublications/publication/Hydropower_Essentials.pdf ; page 2 lifetime section
[11] See, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-10-v1.pdf

Map 1: Location of the plant

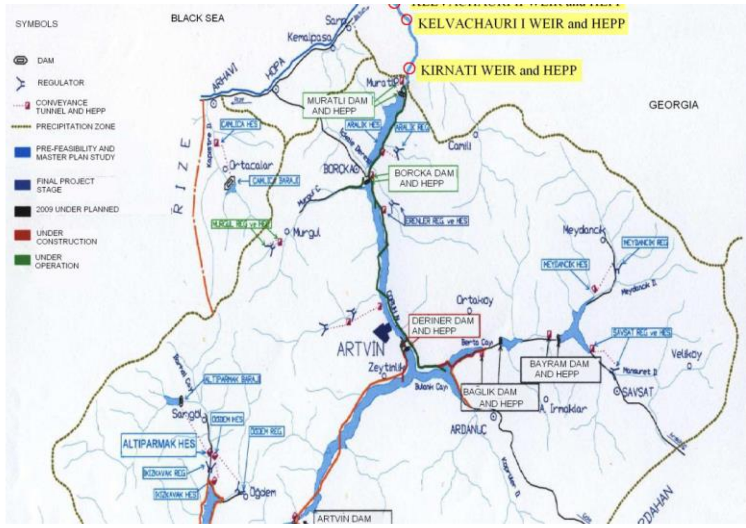

Table 3: Coordinates of the plant

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"

1.10 Conditions Prior to Project Initiation

As the project activity is a greenfield project, the conditions prior to the project initiation is the continuation of the current situation, i.e. the equivalent amount of energy would have been produced by other grid-connected units, which is explained under the Section 2.4 (Baseline Scenario.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

Project activity is consistent with below main laws and rules:
1) Law on Electricity and Natural Gas[12].
2) Law on Protection of Environment
3) Rules of Licensing and Activity Control in the Electricity, Natural Gas and Water Sector[13]
4) Regulation on Licence and Permits

[12] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7271
[13] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7274

1.12 Ownership and Other Programs

1.12.1 Right of Use

Achar Energy is the owner of Chorokhi HPP. Related evidence is given under the Annex.

1.12.2 Emissions Trading Programs and Other Binding Limits

Not applicable: The project activity is neither included in an emissions trading program nor does it take place in a jurisdiction or sector in which binding limits are established on GHG emissions.

1.12.3 Other Forms of Environmental Credit

Not applicable.

1.12.4 Participation under Other GHG Programs

The Project has not been registered or seeking registration under other GHG programs.

1.12.5 Projects Rejected by Other GHG Programs

Chorokhi HPP (http://cdm.unfccc.int/Projects/DB/RINA1356641431.9/view) is rejected by CDM EB due to partially exporting generated electricity to Turkey, which is an Annex-I country. (http://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20140516103401646/Reg_rule43.pdf).

1.13 Additional Information Relevant to the Project

Eligibility Criteria

This is not a grouped project.

Leakage Management

Not applicable.

Commercially Sensitive Information

There is no commercially sensitive information that needs to be excluded from the public version of the VCS PD to be displayed on the VCS Project Database

Further Information

Not applicable.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

For the determination of the baseline, the official methodology ACM0002 version 16.0.0, "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"[14], 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 04.0.0);
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.

2.2 Applicability of Methodology

The choice of methodology ACM0002 version 16.0.0 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 two 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 04.0.0)" 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).

[14] ACM0002 version 16.0.0: https://cdm.unfccc.int/filestorage/0/X/6/0X6IERWMG92J7V3B8OTKFSL1QZH5PA/EB81_repan09_ACM0002_ver16.0_clean.pdf?t=a2J8bnN1cnI2fDCIUazmIlELtim-mL61GiVc

"Tool for the demonstration and assessment of additionality (version 07.0.0)" is applicable to the project activity because according to the ACM0002 (page 12) *"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 2.1 are applicable to the project activity.

2.3 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 2.

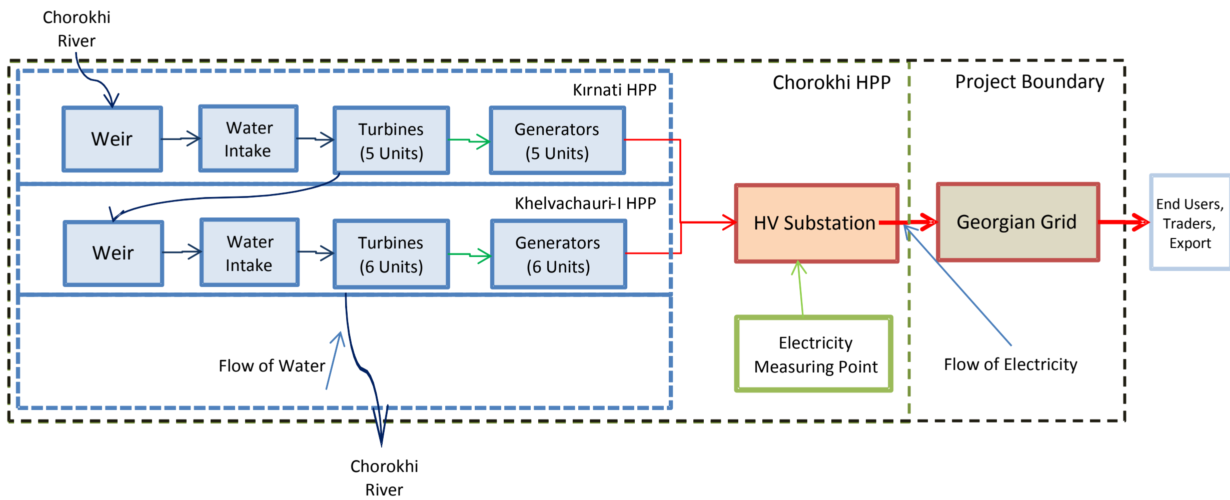

Figure 2: Boundary of project activity

Source		Gas	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	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 94.96 W/m^2 and 52.76 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*

2.4 Baseline Scenario

Generated electricity will be fed into Georgian grid and to be exported to Turkey. Thus in this PD baseline scenarios are defined for both countries.

For Georgia:

The baseline scenario is identified according to the "Baseline Methodology Procedure" of ACM0002 ver.16.0.0 (page 10). The project activity is installation of a new grid-connected hydro power project including 2 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[15].

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 3.

[15] See: http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf (page 2)

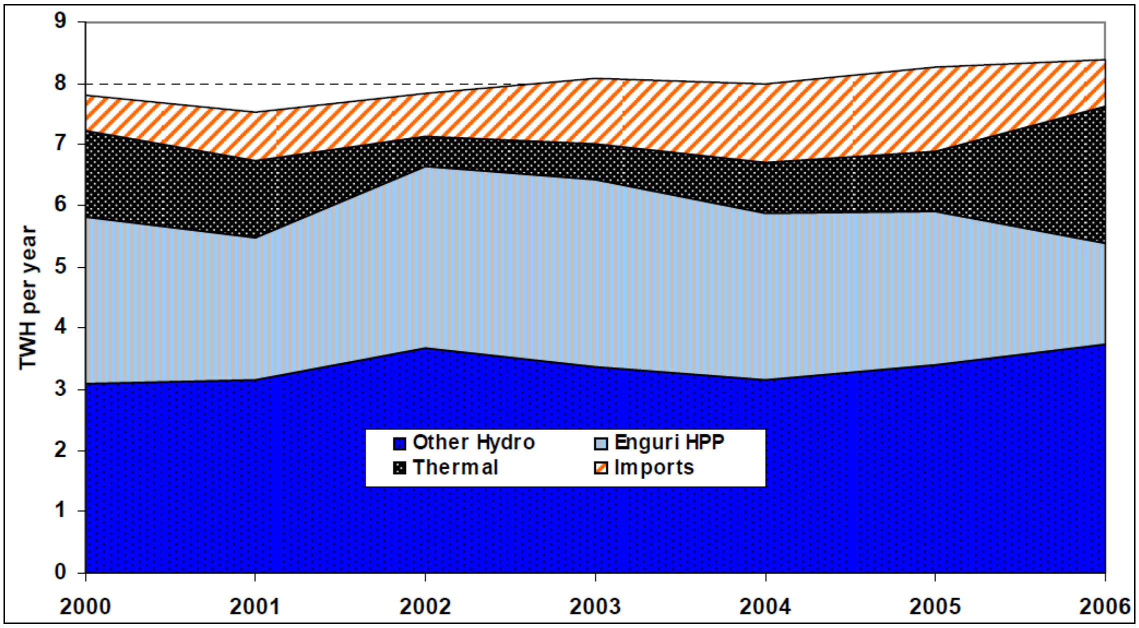

Figure 3: Electricity Generation by Sources for years of 2000-2006[16]

Conclusion for Georgia:

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

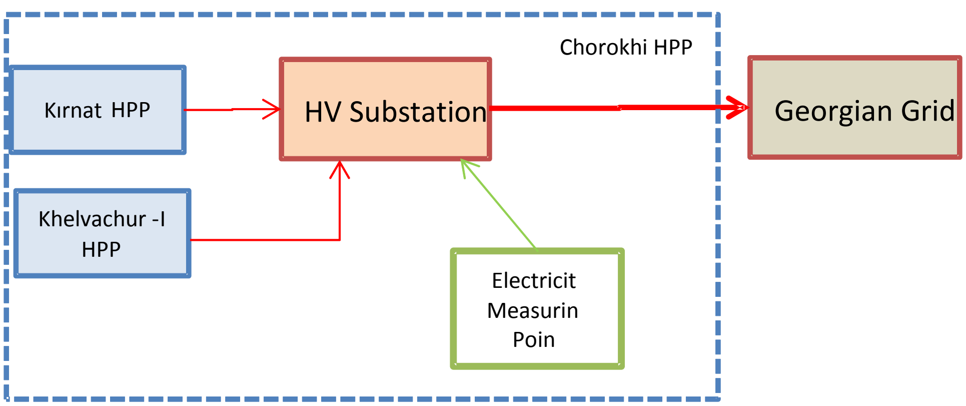

Figure 4: Grid Connection Diagram of Project Activity

[16] See: http://www.investingeorgia.org/uploads/file/The%20electricity%20sector%20in%20Georgia%20-%20A%20risk%20assessment%20ECON%20final.pdf (page 10)

For Turkey:

The baseline scenario is identified according to the "Baseline Methodology Procedure" of ACM0002 ver.16.0.0 (page 10). The project activity is installation of a new grid-connected hydro power project including 2 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 Turkey 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.

Demand for electricity in Turkey is growing rapidly with average 6.27%[17] for previous ten years. TEİAŞ, who is responsible from the grid reliability has prepared an electricity demand projection for next ten years period (2013-2022) for Turkey and announced on November 2013, given in Table 4 and Figure 5, reflecting the continuation of current demand growth[18].

Table 4: Low and High Demand Projection Scenarios for Ten Years Period (TWh)

Scenarios	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
High Scenario	258.14	278.96	301.3	320.47	340.71	362.1	384.67	408.5	430.51	453.56
Low Scenario	253.77	265.78	278.16	289.33	300.39	314.85	330.44	346.51	362.13	378

[17] See, http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2013.pdf (page 6, Table 1)

[18] See, http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2013.pdf (page 18-19, Table 7 for High and Table 8 for Low Scenarios)

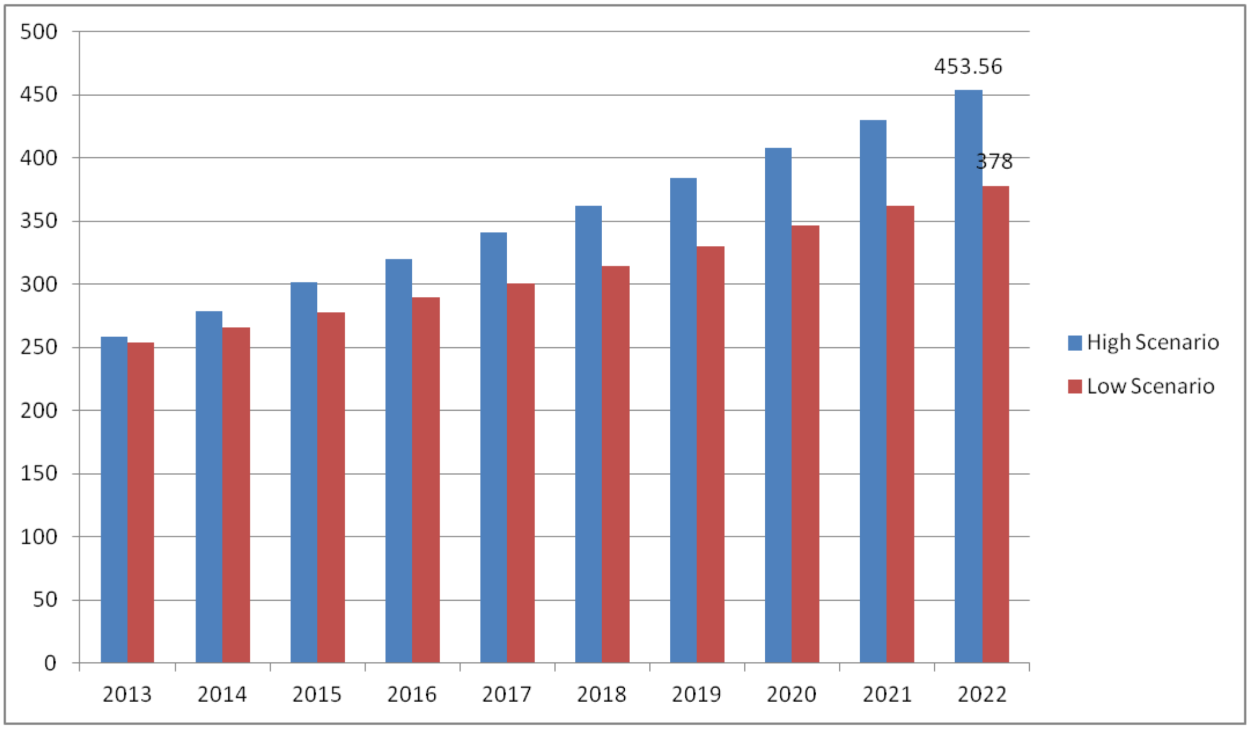

Figure 5: Electricity Demand Projections for Ten Years

In this projection, electricity supplies are also forecasted taking into account all power plants, which are operational, under construction and newly licensed. Generation projection based on project generation is given in:

Table 5: Projection of Total Generation Capacity by Fuel Types (TWh)[19]

YEARS	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**SHARE IN 2017 (%)**
LIGNITE	52,712	52,715	52,939	56,143	60,470	61,870	*14.55%*
HARDCOAL	3,967	3,967	3,967	4,969	7,020	8,070	*1.90%*
IMPORTED COAL	26,827	26,827	26,786	29,697	33,356	42,567	*10.01%*
NATURAL GAS	149,344	166,022	177,262	180,853	186,092	187,249	*44.02%*
GEOTHERMAL	1,184	1,294	1,702	2,206	2,410	2,410	*0.57%*
FUEL OIL	9,604	9,604	9,604	9,604	10,009	10,414	*2.45%*
DIESEL	148	148	148	148	148	148	*0.03%*
NUCLEER	0	0	0	0	0	0	*0.00%*
OTHER	1,373	1,373	1,373	1,373	1,373	1,373	*0.32%*
THERMAL TOTAL	245,157	261,948	273,780	284,991	300,879	314,102	*73.85%*
BIOGAS+WASTE	1,136	1,260	1,404	1,481	1,538	1,538	*0.36%*
HYDRO	62,413	66,805	80,483	87,269	96,097	98,335	*23.12%*
WIND	7,950	8,153	8,677	9,724	10,902	11,356	*2.67%*
TOTAL	**316,657**	**338,166**	**364,344**	**383,465**	**409,416**	**425,331**	***100.0%***

[19] See, http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2013.pdf (page 44, Table 26)

According to the 5-year projection it is clear that fossil fuels will remain the main sources for electricity generation (73.85 % in 2017). Natural gas will continue to dominate the market. Hydro will account for 23.12% of the mix whereas all non-hydro renewable combined (geothermal/biogas/waste/wind) will only account for 3.03% of all electricity generation. This projection is consistent with continuing fossil fuel dependent characteristics of Turkish electricity sector, which is illustrated in **Figure 6**. The share of fossil fuels in the mix has been continuously increasing since the 1970s, reaching 71.6% in 2013.

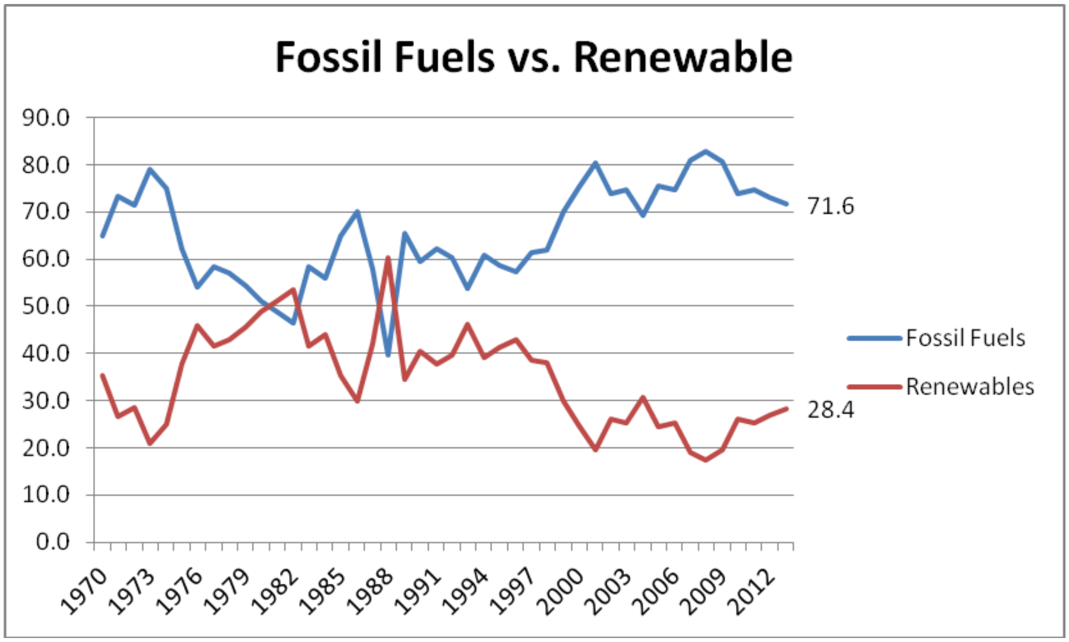

Figure 6: Fossil Fuels and Renewable in Turkish Electricity Mix (1970-2013)[20]

Conclusion for Turkey:

In the shed of above analysis for the baseline scenario (continuation of current situation) it can be concluded that:

- **Conclusion-1:** Energy demand in Turkey has been increasing with significant rates since ten years, and it is expected to continue at least for next five years.

- **Conclusion-2:** Even all operational plants, construction phase plants and licensed ones are taken into account lack of supply is projected after five operational years[21]. So, there is significant need for electricity generation investments to satisfy demand, which means electricity to be generated by the project activity would otherwise be generated by new power plants to avoid power shortage in coming years.

[20] See, http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2013/uretim%20tuketim(23-47)/38.xls

[21] See, http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2013.pdf (page 72)

- **Conclusion-3:** Fossil fuels will hold the dominance in generation mix till the end of 2021 with 73.85% share. Hydro included renewable will remain low with 23.12% share and non-hydro energy contribution will stay negligible with only 3.03% of total share by the end of that period. This also shows that most of new capacity additions will be fossil fuel fired power plants.

The combination of aforementioned trends indicates that if Chorokhi HPP would not be built, power from a new grid-connected thermal plant would be the most likely scenario.

2.5 Additionality

Additionality is demonstrated for both Georgia and Turkey.

For Georgia;

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)[22], 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 VER,
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[23].
2) Law on Protection of Environment

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

3) Rules of Licensing and Activity Control in the Electricity, Natural Gas and Water Sector[24]
4) Regulation on Licence and Permits

Other laws and regulations regarding environment and social aspects are given in section 5. 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.

Prior Consideration of VER

Table 6: Project Implementation Schedule and Early Consideration of VER

Date (DD/MM/YYYY)	Activity
23/08/2011	Agreement with FutureCamp Turkey for CER development [25]
27/09/2012	Date of Approval of Feasibility Study Report by Georgian Authority
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 (Investment Decision Date)
05/04/2012	Date of Agreement with Construction Subcontractor
20/04/2012	Start date of construction activities
12/01/2015	Agreement with DOE (RINA Services S.p.a) for validation under the VCS
01/02/2017	Planned start date of commercial operation

Listing of the project on UNFCCC website for Prior Consideration of CDM could be seen as the prior consideration of VER. Date of equipment agreement with electromechanical equipment supplier shall be set as the investment decision date according to decision of EB41[26]

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 VERs.

[24] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7274
[25] Agreement with Futurecamp Turkey was transferred to Lifenerji Ltd. Şti. With the confirmation of PO, FutureCamp Turkey and Lifenerji Ltd. Şti.
[26] See: http://cdm.unfccc.int/EB/041/eb41rep.pdf (paragraph 67)

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 VERs.

As a result of Sub-step 1a above, there is no alternative project activity for a comparison of the attractiveness of investment. Also, VER 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

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[27], 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.

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

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 7.

Table 7: Brief Project Financial Characteristics

Characteristics	Value	Unit	Reference
Installed Power	98.731	*MWe*	*FSR*
Annual Electricity Generation	410.8	*GWh/yr*	*FSR*
Transmission Loss Factor[28]	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	48	*USD/MWh*	*National Legislations*[29]
Total Project Cost[30] **Kırnati HPP** **Khelvachuri-I HPP**	193,288,338 103,324,199 89,964,138	*USD*	*FSR*
Operational Duration	20	*yrs*	*Guidelines on Investment Analysis*
Annual Operating Cost **O&M Cost** **System Usage Cost**[31]	2,218,466 1,421,145 797,321	*USD/yr*	*Total* *FSR* *EPDK*
USD/TL Exchange Rate	1.800	*N/A*	*FSR*
VAT Rate	18%	*N/A*	*Invest in Georgia*[32]
Corporate Tax Rate	15%	*N/A*	*Invest in Georgia*
Financing Conditions **Debt / Investment Cost Ratio** **Grace Period** **Debt Payment Period** **Interest Rate**	 40% 3 7 7%	 *N/A* *yrs* *yrs* *N/A*	*From financing conditions of similar project in Turkey*[33]*.*

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 VER revenue is stated in below table.

Table 8: Equity IRR value for project activity (after tax)

[28] 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

[29] Provided to the DOE

[30] 18% VAT is included, but financing cost during construction is not included.

[31] 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.

[32] See: http://www.investmentguide.ge/index.php?lang_id=ENG&sec_id=197

[33] See: http://www.alarko.com.tr/eng/haber.asp?ID=1383

Period	IRR
20 years (only Georgia scenario)	3.93%

Thus benchmark, which is 12.9%, clearly exceeds the resulting equity IRR and rendering the project activity economically unattractive. (For selecting only Georgia or Turkey scenario please choose the right values in the excel sheet page "Input cell b20" and "Operating cost cell a9")

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

VER Revenue is not considered for sensitivity analysis.

The power price, 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 9.

Table 9: Equity IRR results according to different parameters

Parameter	Electricity Price			Investment Cost			Energy Yield			Operating Cost		
Variance	-10%	0%	10%	-10%	0%	10%	-10%	0%	10%	-10%	0%	10%
IRRs	2.57%	3.93%	5.21%	4.55%	3.93%	3.36%	2.57%	3.93%	5.21%	4.08%	3.93%	3.78%

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

a. Electricity Price

To exceed benchmark, base price electricity shall increase more than 76%. Since the share of electricity to be sold in Georgia has a fixed tariff [34], IRR is unlikely to exceed the benchmark value.

b. Investment Cost

[34] Due to confidentially reasons only available to DOE.

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 1.74 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[35]. Moreover VAT excluded investment cost used in financial analysis (170 Million USD) is lower than the costs accepted by Ministry of Energy for the project activity, which is 196 Million USD[36] 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 80%. As the investment cost used in financial analysis is already conservative, having more than 80% 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 (410.8 GWh/yr) corresponds to 47.9% capacity utilization rate. This is already 10% more than average rate of new hydro power projects (47%)[37] for which MoU signed with Georgian government. To exceed benchmark, energy yield shall increase more than 76%. While energy yield is already more than average and 10% increase is already considered in sensitivity analysis, 76% increase in energy yield is not realistic.

d. O&M cost

The O&M costs were estimated by Fichtner. As given in Table 7, total O&M cost is 1,421,145 USD/yr. This amount corresponds to 3.46 USD/MWh (with 410,800 MWh energy yield) unit cost. Comparing with study of IEA[38], unit operation cost for project activity is around 10% less than minimum unit cost of range, which is 5-20 USD/MWh.

[35] See: http://www.iea.org/publications/freepublications/publication/Hydropower_Essentials.pdf (page 2, Table-1, category 3)
[36] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7472 (Power plants with no 1,2 and 3)
[37] 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%)
[38] See: http://www.iea.org/publications/freepublications/publication/Hydropower_Essentials.pdf (page 2, 'O&M Costs', paragraph 2)

Even 100% decrease in O&M costs doesn't lead IRR higher than benchmark (12.9%).

Conclusion

The financial analysis shows that the project is not the financially feasible without the revenue of VERs, 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, VER revenues will improve the financial feasibility of the proposed project.

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

Step 4: Common Practice Analysis

According to tool, if the proposed VER 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[39].

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

[39] See: http://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid44.pdf

All power plants serving the electricity system of Georgia are given in Annex-3[40]. The proposed project activity has the installed capacity of 98.731 MWe. So applicable output range as +/-50% of the capacity of the proposed project activity is 49.4 MW and 148.1 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,

(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 (49.4 MW-148.1MW) 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 10 below. None of these plants are registered as CDM project or undergoing validation for CDM.

[40] See: http://moe.gov.ge/files/PDF%20%20qartuli/Updated_Baseline_EF_2004-2006_24_July_2012.pdf (Table-A1)

Table 10 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 VER 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 10 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[41]. 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,

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

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.

For Turkey;

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 Baseline Methodology refers to the consolidated "Tool for the demonstration and assessment of additionality"[42] version 7.0.0 (Tool), which defines a step-wise approach to be 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

To identify the realistic and credible alternative scenario(s) for project participants, scenarios in the Tool are assessed:

a) The proposed project activity undertaken without being registered as a VER project activity

This alternative is realistic and credible as Chorokhi HPP may undertake project activity if it sees no risk for project and/or if the project turns out to be financially attractive without VER credit income. However, investments analyze shows that the project is not economically feasible without VER credit income. Detail information is given in Step-3.

b) Other realistic and credible alternative scenario(s) to the proposed VER project activity scenario that deliver electricity with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology;

The project activity is power generation activity without any greenhouse gas emission harnessing the energy of the hydro. Being a private entity, Achar doesn't have to invest power investments even proposed project activity. Also, since Chorokhi has a license only for hydro power investment and since in the proposed project area there is no wind or other sources for electricity generation, other project activities delivering same electricity in the same project area is *not* realistic for project participant.

c) Continuation of the current situation, i.e. Chorokhi HPP is not built

The decision in favour or against a project investment depends on the expected revenues and risks, like for every other private investment. Investment decisions other than Chorokhi HPP are independent from the question whether Chorokhi HPP is built or not. This alternative is also realistic and credible.

[42] Version 6, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf (page 4)

According to baseline scenario there is a need for energy investment to satisfy increasing demand and if the Chorokhi HPP is not built, the same amount of energy will be supplied by other private investors to the grid. Forecasts shows that electricity supplied in the absence of Chorokhi HPP will be mainly based on fossil fuels as the projections for the year of 2017 forecasts 73.85% share for fossil fuels in the energy mix.
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In the absence of the project the power will be produced by new and existing power plants in accordance with the baseline in ACM0002 version 16
Outcome of Step 1.a: Therefore, two realistic and credible alternative scenarios are identified for the project activity:

a) The proposed project activity undertaken without being registered as a VER project activity.

b) Continuation of the current situation, i.e. Chorokhi HPP is not built.

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[43].
2) Law on Protection of Environment
3) Rules of Licensing and Activity Control in the Electricity, Natural Gas and Water Sector[44]
4) Regulation on Licence and Permits

Other laws and regulations regarding environment and social aspects are given in section 5. 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.

Prior Consideration of VER

Table 11: Project Implementation Schedule and Early Consideration of VER

Date (DD/MM/YYYY)	Activity
23/08/2011	Agreement with FutureCamp Turkey for CER development [45]
27/09/2012	Date of Approval of Feasibility Study Report by Georgian Authority
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

[43] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7271
[44] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7274
[45] Agreement with Futurecamp Turkey was transferred to Lifenerji Ltd. Şti. With the confirmation of PO, FutureCamp Turkey and Lifenerji Ltd. Şti.

	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 (Investment Decision Date)
05/04/2012	Date of Agreement with Construction Subcontractor
20/04/2012	Start date of construction activities
12/01/2015	Agreement with DOE (RINA Services S.p.a) for validation under the VCS
01/02/2017	Planned start date of commercial operation

Listing of the project on UNFCCC website for Prior Consideration of CDM could be seen as the prior consideration of VER. Date of equipment agreement with electromechanical equipment supplier shall be set as the investment decision date according to decision of EB41[46]

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 VERs.

Step 2. Investment analysis

"Guidelines on the assessment of investment analysis[47]" version 5 is taken into account when applying this step.

Applied tool: "Tool for the demonstration and assessment of additionality version 7.0.0"

Sub-step 2a: Determine Appropriate Analysis Method

Three options can be applied for the investment analysis: the simple cost analysis, the investment comparison analysis and the benchmark analysis.

- Option I: Simple cost analysis
- Option II: Investment comparison analysis
- Option III: Benchmark analysis

The simple cost analysis is not applicable for the proposed project because the project activity will have revenue (from electricity sales) other than VER related income. The investment comparison analysis is also not applicable for the proposed project because the baseline scenario, providing the same annual electricity output by the Turkish National Grid, is not an investment project.

To conclude, the benchmark analysis will be used to identify whether the financial indicators (Equity
IRR in this case) of the proposed project is better than relevant benchmark value.

[46] See: http://cdm.unfccc.int/EB/041/eb41rep.pdf (paragraph 67)
[47] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

Sub-step 2b: Option III: Benchmark analysis

While applying the Benchmark Analysis, Option III, the Equity IRR is selected as the financial indicator for the demonstration of the additionality of the project as permitted in the additionality tool.

Benchmark rate is calculated in line with "Tool for the demonstration and assessment of additionality" (v.7) According to the Tool, benchmark can be derived from 'Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds'. As a banker view, according to Worldbank loan appraisal document[48], threshold equity IRR for wind power investments (i.e. required returns of equity for wind power plant investors) in Turkey is 15%.

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 12.

Table 12: Brief Project Financial Characteristics

Characteristics	Value	Unit	Reference
Installed Power	98.731	*MWe*	*FSR*
Annual Electricity Generation	410.8	*GWh/yr*	*FSR*
Transmission Loss Factor[49]	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	73	*USD/MWh*	*National Legislations*[50]
Total Project Cost[51] **Kırnati HPP** **Khelvachuri-I HPP**	193,288,338 103,324,199 89,964,138	*USD*	*FSR*
Operational Duration	20	*yrs*	*Guidelines on Investment Analysis*
Annual Operating Cost **O&M Cost**	2,218,466 1,421,145	*USD/yr*	*Total* *FSR*

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48 Worldbank - Project Appraisal Document on a IBRD Loan and a Proposed Loan from Clean Technology Fund to TSKB and TKB with the Guarantee of Turkey, May 2009 (http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2009/05/11/000333037_20090511030724/Rendered/PDF/468080PAD0P112101Official0Use0Only1.pdf page 80, paragraph 29 and page 81, Table 11.5. In order to access to the file, copy and paste the complete link to the web browser.)

49 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

50 See; http://www.epdk.gov.tr/documents/elektrik/mevzuat/kanun/Elk_Kanun_Yek_Kanun.doc , page 9 Table I

51 18% VAT is included, but financing cost during construction is not included.

System Usage Cost[52]	797,321		*EPDK*
USD/TL Exchange Rate	1.800	*N/A*	*FSR*
VAT Rate	18%	*N/A*	*Invest in Georgia*[53]
Corporate Tax Rate	15%	*N/A*	*Invest in Georgia*
Financing Conditions **Debt / Investment Cost Ratio** **Grace Period** **Debt Payment Period** **Interest Rate**	 40% 3 7 7%	 *N/A* *yrs* *yrs* *N/A*	*From financing conditions of similar project in Turkey*[54]*.*

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 VER revenue is stated in below table.

Table 13: Equity IRR value for project activity (after tax)

Period	IRR
20 years (only Turkey scenario)	10.25%

Thus benchmark, which is 15%, clearly exceeds the resulting equity IRR and rendering the project activity economically unattractive. (For selecting only Georgia or Turkey scenario please choose the right values in the excel sheet page “Input cell b20” and “Operating cost cell a9”)

Sub-step 2d: Sensitivity analysis

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

e. Electricity Price
f. Investment Cost
g. Energy Yield Amount
h. Operating Cost

VER Revenue is not considered for sensitivity analysis.

The power price, 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 14**.

Table 14: Equity IRR results according to different parameters

[52] 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.
[53] See: http://www.investmentguide.ge/index.php?lang_id=ENG&sec_id=197
[54] See: http://www.alarko.com.tr/eng/haber.asp?ID=1383

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%

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

a. Electricity Price

To exceed benchmark, base price electricity shall increase more than 28%. Since the share of electricity to be sold in Turkey has a fixed tariff, IRR is unlikely to exceed the benchmark value.

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 1.74 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[55]. Moreover VAT excluded investment cost used in financial analysis (170 Million USD) is lower than the costs accepted by Ministry of Energy for the project activity, which is 196 Million USD[56] 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 39%. As the investment cost used in financial analysis is already conservative, having more than 39% 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.

[55] See: http://www.iea.org/publications/freepublications/publication/Hydropower_Essentials.pdf (page 2, Table-1, category 3)
[56] See: http://www.menr.gov.ge/common/get_doc.aspx?doc_id=7472 (Power plants with no 1,2 and 3)

Energy yield amount (410.8 GWh/yr) corresponds to 47.9% capacity utilization rate. This is already 10% more than average rate of new hydro power projects (47%)[57] for which MoU signed with Georgian government. To exceed benchmark, energy yield shall increase more than 28%. While energy yield is already more than average and 10% increase is already considered in sensitivity analysis, 28% increase in energy yield is not realistic.

d. O&M cost

Even 100% decrease in O&M costs doesn't lead IRR higher than benchmark (15%).

Conclusion

The financial analysis shows that the project is not the financially feasible without the revenue of VERs, 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, VER revenues will improve the financial feasibility of the proposed project.

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

Step 4: Common Practice Analysis

According to tool, if the proposed 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

[57] 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%)

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[58].

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

The proposed project activity has the installed capacity of 98.731 MWe. So applicable output range as +/-50% of the capacity of the proposed project activity is 49.4 MW and 148.1 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;

For this scenario projects within the Turkey 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,

(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 (49.4 MW-148.1 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.

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[58] See: http://cdm.unfccc.int/Reference/Guidclarif/meth/meth_guid44.pdf

Since the project is submitted to the stakeholder consideration for CDM in 2012, plant which are in operational in 2012 is considered for common practice.

Identified similar project fulfilling all of the above criteria are given in Table 15 below. None of these plants are registered as VER project or undergoing validation for VER.

Table 15 List of power plants having capacity between +-50% of project capacity

No	Power Plant	Type	Rated Capacity (MW)	Financial Situation
1	ADIGÜZEL	Hydro	62	EÜAŞ
2	ASLANTAŞ	Hydro	138	EÜAŞ
3	AKKÖPRÜ	Hydro	115	EÜAŞ
4	DEMİRKÖPRÜ	Hydro	69	EÜAŞ
5	DERBENT	Hydro	56.4	EÜAŞ
6	DİCLE	Hydro	110	EÜAŞ
7	DOĞANKENT	Hydro	74.5	EÜAŞ
8	HİRFANLI	Hydro	128	EÜAŞ
9	KAPULUKAYA	Hydro	54	EÜAŞ
10	KESİKKÖPRÜ	Hydro	76	EÜAŞ
11	KILIÇKAYA	Hydro	120	EÜAŞ
12	KÖKLÜCE	Hydro	90	EÜAŞ
13	KRALKIZI	Hydro	94.5	EÜAŞ
14	KÜRTÜN	Hydro	85	EÜAŞ
15	MENZELET	Hydro	124	EÜAŞ
16	MURATLI	Hydro	115	EÜAŞ
17	SUAT UĞURLU	Hydro	69	EÜAŞ
18	TORUL	Hydro	103.2	EÜAŞ
19	SEYHAN I	Hydro	60	EÜAŞ
20	KADINCIK I	Hydro	70	EÜAŞ
21	KADINCIK II	Hydro	56	EÜAŞ
22	ŞANLI URFA	Hydro	51	EÜAŞ
23	KOVADA-II(BATIÇİM EN.)	Hydro	51.2	İHD
24	ÇAMLICA (AYEN ENERJİ)	Hydro	84	YİD
25	YAMULA	Hydro	100	YİD
26	AKKÖY ENERJİ (AKKÖY I	Hydro	101.9	Private

	HES)			
27	SEYRANTEPE HES (SEYRANTEPE BARAJI)	Hydro	56.8	Private
28	EŞEN-I (GÖLTAŞ)	Hydro	60	Private
29	HACININOĞLU HES (ENERJİ-SA)	Hydro	142.3	Private

Step 3: Identify and note N_{all}

Thus N_{all} is 29.

Step 4: Identify and note N_{diff}

Financial flow of the project can be seen as different technology according to the tool. For instance 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 EÜAŞ (state), İHD (transfer of operational rights), and YİD (built operate transfer) are seem as different financial flow types. All projects under these catogories are considered as different technologies.
Thus N_{diff} is 25.

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

$F = 1- N_{diff}/N_{all} = 1 - 25/29 = 0.1379$ and $N_{all} - N_{diff} = 29 – 25 = 4$

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, 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.

2.6 Methodology Deviations

Not applicable.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

For Georgia;
Stepwise approach of "*Tool to calculate the emission factor for an electricity system*" version 04.0.0 (Tool)[59] 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'[60] 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[61]. 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:

[59] See, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf

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

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

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.

<u>Step 3:</u> 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.

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 16[62].

Table 16: 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:

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

- **Ex ante option:** A 3-year generation-weighted average, based on the most recent data available at the time of submission of the VCS-PD 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 ($EF_{grid,OM-adj,y}$) 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:

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

Where:

$EF_{grid,OM-adj,y}$	=	Simple adjusted operating margin CO2 emission factor in year *y* (tCO_2/MWh)
Λy	=	Factor expressing the percentage of time when low-cost/must-run power 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[63], 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 VCS-PD 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 17 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 18 Simple OM Calculation for the years of 2004-2006

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

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

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 16). Relevant revised data (excel spreadsheets) were provided by the Ministry of Energy of Georgia as stated in the study of Georgian DNA[64].

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 7) 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 7-9, and calculated $EF_{Adjusted\ Simple\ OM}$ in
Table 19.

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.

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

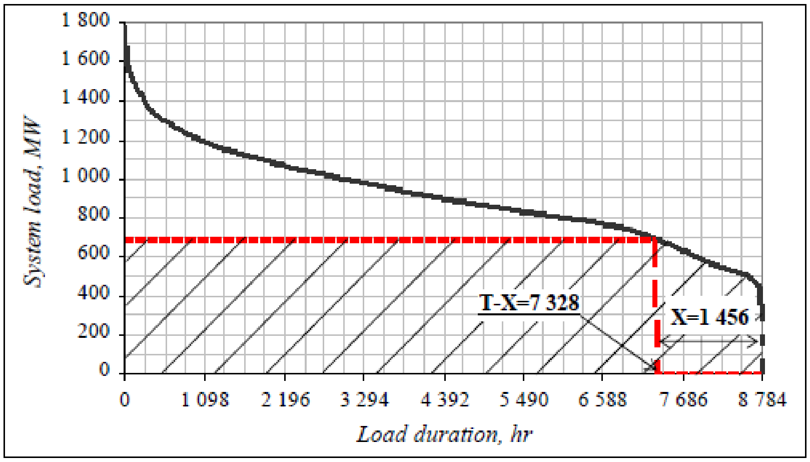

Figure 7 Load duration curve for the Georgian electricity system for year 2004

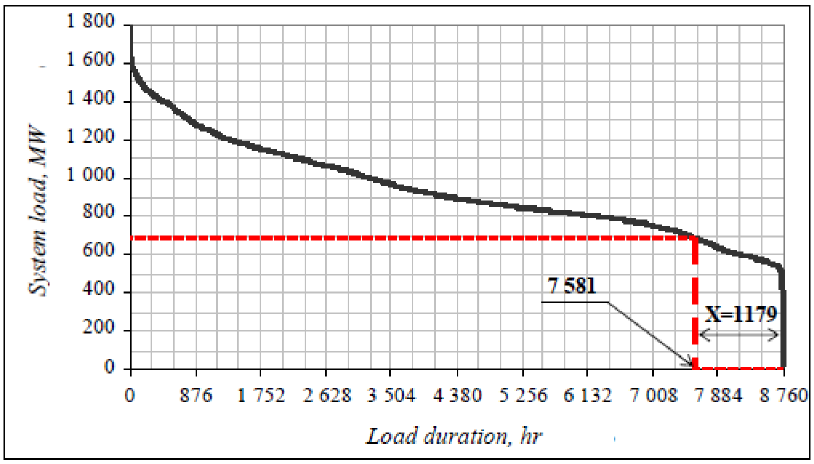

Figure 8 Load duration curve for the Georgian electricity system for year 2005

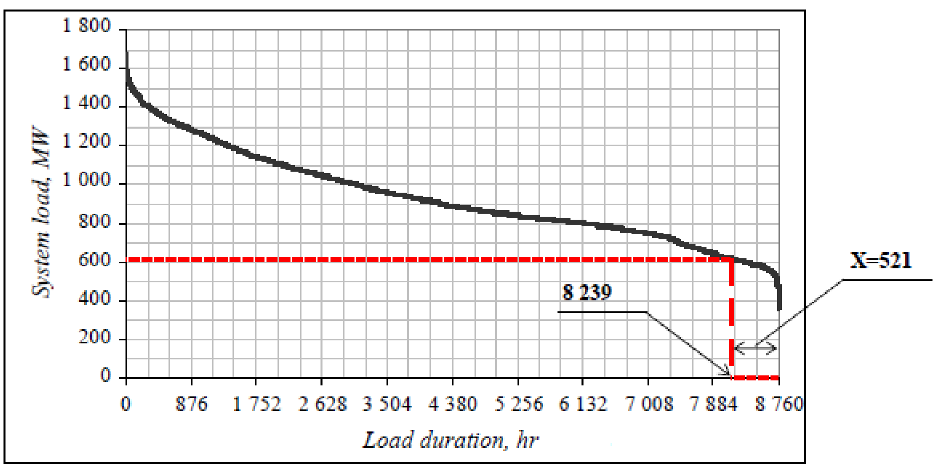

Figure 9 Load duration curve for the Georgian electricity system for year 2006

Calculation of λ and Operating Margin emission factor is given in Table 19.

Table 19 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 VCS-PD 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-2. 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:

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

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:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} x3.6}{\eta_{m,y}} \quad \textbf{(3)}$$

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 20. 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 20 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[65]	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[66]	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).**

Step 6 : 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

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

(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:

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

➔ **$EF_{grid,CM,y}$ = 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).

For Turkey;

Stepwise approach of „*Tool to calculate the emission factor for an electricity system*" version 04.0.0 [67] is used to find this combined margin (emission coefficient) as described below:

Step 1. Identify the relevant electric systems

[67] See, http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf

There are 21 regional distribution regions in Turkey but no regional transmission system is defined. In Article 20 of License Regulation it is stated that:

"*TEIAS shall be in charge of all transmission activities to be performed over the existing transmission facilities and those to be constructed as well as the activities pertaining to the operation of **national transmission system** via the National Load Dispatch Center and the regional load dispatch centers connected to this center and the operation of Market Financial Reconciliation Center*[68]".

As it can be understood from this phrase, only one transmission system, which is national transmission system is defined and only TEİAŞ is in the charge of all transmission system related activities. Moreover, a communication with representative of TEIAS, which indicates that: "*There are not significant transmission constraints in the national grid system which is preventing dispatch of already connected power plants*" is submitted to the DOE. Therefore, the national grid is used as electric power system for project activity. The national grid of Turkey is connected to the electricity systems of neighboring countries. Complying with the rules of the tool, the emission factor for imports from neighboring countries is considered 0 (zero) tCO_2/MWh for determining the OM.

There is no information about interconnected transmission capacity investments, as TEİAŞ, who operates the grid, also didn't take into account imports-exports for electricity capacity projections.[69] Because of that, 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)*

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

(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM.

[68] See, http://www.ongurergan.av.tr/en-EN/mevzuat/Electric%20Market%20Licensing%20Regulation.doc (page 21)
[69] See, http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2013.pdf

The Simple Operating Margin (OM) emission factor ($EF_{grid, OM, y}$) is calculated as the generation weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all the generating plants serving the system, excluding low-cost/must-run power plants. As electricity generation from solar and low cost biomass facilities is insignificant and there are no nuclear plants in Turkey, the only low cost /must run plants considered are hydroelectric, wind and geothermal facilities.

The Turkish 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 resources in Turkey, which are considered as must-run, are Hydro, Renewable and Waste, Geothermal and Wind (according to statistics of TEİAŞ).

Table 21: Share of Low Cost Resource (LCR) Production 2009-2013 (Production in GWh)[70]

	2009	2010	2011	2012	2013
Gross production	194,812.9	211,207.7	229,395.1	239,496.8	240,153.95
TOTAL LCR Production	38,229.6	55,837.6	58,226.0	65,345.8	69,512.70
Hydro	35,958.4	51,795.5	52,338.6	57,865.0	59,420.47
Renewable and Waste	340.1	457.5	469.2	720.7	1,171.20
Geothermal and Wind	1,931.1	3,584.6	5,418.2	6,760.1	8,921.04
Share of LCRs	19.62%	26.44%	25.38%	27.28%	28.95%
Average of last five years			**25.53%**		

As average share of low cost resources for the last five years is far below 50% (25.53%), the Simple OM method is applicable to calculate the operating margin emission factor ($EF_{grid,OM,y}$)

For the Simple OM method, 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 VCS-PD 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 OM method, with the most recent data for the baseline calculation stemming from the years 2011 to 2013.

***Step 4.* Calculate the operating margin emission factor according to the selected method**

[70] See: www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2013/uretim%20tuketim(23-47)/37(06-13).xls

The Simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants. The calculation of the simple OM emission factor can be based on:

- net electricity generation and corresponding CO_2 emission factor of each power unit (Option A), or
- total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (Option B).

Option B is chosen to calculate the Simple OM, as there is no power plant specific data available. Renewable power generation is considered as low-cost power source and amount of electricity supplied to the grid by these sources is known.

Where Option B is used, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants, and based on the fuel type(s) and total fuel consumption of the project electricity system, as per formula in the tool:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} x NCV_{i,y} x EF_{CO2,i,y}}{EG_y}$$

(1)

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$	=	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	=	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_y	=	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost / must-run power plants / units, in year y (MWh)
i	=	All fossil fuel types combusted in power sources in the project electricity system in year y
y	=	three most recent years for which data is available at the time of submission of the PDD to the DOE for validation

For the calculation of the OM the consumption amount and heating values of the fuels for each sources used for the years 2011, 2012 and 2013, is taken from the TEİAŞ annual statistics, which holds data on annual fuel consumption by fuel types as well as electricity generation amounts by sources and electricity imports. All the data needed for the calculation, including the emission factors and net calorific values (NCVs), are provided in separate excel sheet. Total CO_2 emission due to electricity generation in Turkey for the years of 2011, 2012 and 2013 are given in Table 22.

Table 22: CO_2 emissions from electricity production 2011-2013 ($ktCO_2$)

	2011	2012	2013
CO_2-Emmissions	109,963	110,931	104,840

Table 23 presents the gross electricity production data by all the relevant energy sources. Low-cost/must run resources like hydro, wind, geothermic and biomass do not emit fossil CO_2 and thus are not taken into account in calculations.

Table 23: Gross electricity production by fossil energy sources 2011-2013 (GWh)[71]

Energy Source	2011	2012	2013
Natural Gas	**104,047.6**	**104,499.2**	**105,116.3**
Lignite	**38,870.4**	**34,688.9**	**30,262**
Coal	**27,347.5**	**33,324.2**	**33,524**
Fuel Oil	**900.5**	**981.3**	**1,192.5**
Motor Oil	**3.1**	**657.4**	**546.4**
Naphtha	**0.0**	**0.0**	**0.0**
LPG	**0.0**	**0.0**	**0.0**
Total fossil fuels	**171,169.1**	**174,151.0**	**170,641.2**

Above table shows gross data, but EG_y in the above described formula means electricity delivered to the grid, i.e. net generation, the following table shall help to derive net data by calculating the net/gross proportion on the basis of overall gross and net production numbers.

Table 24: Net/gross electricity production 2011-2013 (GWh)[72]

	2011	2012	2013
Gross Production	**229,395.10**	**239,496.80**	**240,153.95**
Net Production	**217,557.70**	**227,707.30**	**228,977.00**
Relation	**94.84%**	**95.08%**	**95.35%**

Multiplying these overall gross/net relation percentages with the fossil fuels generation amount does in fact mean an approximation. However this is a conservative approximation as the consumption of plant auxiliaries of fossil power plants is higher than for the plants that are not included in the baseline calculation. In the end this would lead to a lower net electricity generation and therefore to a higher OM emission factor and higher emission reductions.

Table 25 shows the resulting net data for fossil fuel generation and adds electricity imports.

[71]See; www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2013/uretim%20tuketim(23-47)/37(06-13).xls

[72] For Net Production See, www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2013/uretim%20tuketim(23-47)/34(84-13).xls

Table 25: Electricity supplied to the grid, relevant for OM (GWh)

	2011	2012	2013
Net El. Prod. by fossil fuels	**162,336.3**	**165,578.2**	**162,699.4**
Electricity Import	**4,555.8**	**5,826.7**	**7,429.4**
Electricity supplied to grid by relevant sources	**166,892.1**	**171,404.9**	**170,128.8**

Electricity import is added to the domestic supply in order to fulfill the Baseline Methodology requirements. Imports from connected electricity systems located in other countries are weighted with an emission factor of 0 (zero) tCO_2/MWh.

The last step is to calculate $EF_{grid,OMsimple,y}$:

Table 26: Calculation of Weighted $EF_{grid,OMsimple,y}$ ($ktCO_2/GWh$)

	2011	2012	2013
CO_2-Emmissions ($ktCO_2$)	109,963	110,931	104,840
Net Electricity Supplied to Grid by relevant sources (GWh)	**166,892.1**	**171,404.9**	**170,128.8**
$EF_{grid,OMsimple,y}$ ($ktCO_2/GWh$)	0.6589	0.6472	0.6162
3-year Generation Weighted Average $EF_{grid,OMsimple,y}$ ($ktCO_2/GWh$)	0.6407		

➔ **$EF_{grid,OMsimple,y}$ = 0.6407 ($ktCO_2/GWh$)**

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

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 VCS-PD 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.

Again, the project proponents can chose between two options according to the calculation tool: calculate the BM ex-ante based on the latest available data or update the BM each year ex post. Option 1, the ex-ante approach, is again chosen.

The sample group of power units *m* used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above. The last plant of the sample group is built in 2010 and until the end of the 2012 which is the latest year for official statistics published for plants put in operation. VER plants are excluded from sample group. While identifying the sample group dismantled, revised, retrofits are not included. Only new capacity additions (power plants / units) are taken into account. All power plants in operation by 2012 are given in Annex.

Total electricity generation in 2013 is **240,153.953**GWh and 20% of this generation is **48,030.8** ($AEG_{SET->20\%}$) GWh. Total electricity generation of last five power plants in operation is 369 GWh ($AEG_{SET-5-units}$) which is lower than 20% total generation in 2013. Since $AEG_{SET->2\%0}$ is bigger than $AEG_{SET-5-units}$, $SET_{->20\%}$ is chosen as SET_{sample}. Also in the sample group there is no power plant started supply electricity to grid more than 10 years ago, steps d, e and f are ignored

Sample group for BM emission factor is given the Annex. The derivation of the values presented in Table 27.

Table 27 : Sample group generation for BM emission factor calculation (GWh)

Energy Source	2011	2012	2013
Natural Gas	104,047.6	104,499.2	105,116.3
Lignite	38,870.4	34,688.9	30,262
Coal	27,347.5	33,324.2	33,524
Fuel Oil	900.5	981.3	1,192.5
Motor Oil	3.1	657.4	546.4
Naphtha	0.0	0.0	0.0
LPG	0.0	0.0	0.0
Total fossil fuels	**171,169.1**	**174,151.0**	**170,641.2**

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

Because of only fuel types and electricity generation data are available for the sample group, *Option B2* of Simple OM method is used to calculate emission factor. The formulation of emission factor is given below:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} x3.6}{\eta_{m,y}} \quad \textbf{(3)}$$

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 (%)
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 the Table 28. For BM factor calculation, since no official emission factors for different fuel types are available, lower confidence default values of IPCC Guidelines are applied.

Table 28: BM emission factor calculation using equation (2) and (3)

Energy Source	**Sample Group Total Generation (GWh)**	**Effective CO_2 emission factor (tCO_2/TJ)**	**Average Efficiency ($\eta_{m,y}$)**	**CO_2 Emission ($ktCO_2$)**
Natural Gas	**23,411.4**	54.3	60.00%	7,627.4
Lignite	**40.0**	90.9	50.00%	26.2
Coal	**12,533.0**	89.5	50.00%	8,076.3
Fuel Oil	**701.2**	72.6	46.00%	398.4
Hydro	**12,421.2**	0.0	0.00%	0.0
Renewables	**829.4**	0.0	0.00%	0.0
Total	**49,936.2**			**16,128.3**
$EF_{grid,BM,y}$ (tCO_2/MWh)	**0.3230**			

➔ **$EF_{grid,BM,y}$ = 0.3230 tCO_2/MWh**

<u>Step 6.</u> Calculate the combined margin emission factor

The calculation of the combined margin (CM) emission factor (*EFgrid,CM,y*) is based on one of the following methods:
(a) Weighted average CM; or
(b) Simplified CM.

The combined margin emission factor is calculated by using weighted average CM as per tool formula below:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM}$$

(5)

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 wind power generation project activities: w_{OM} = 0.5 and w_{BM} = 0.5. Then:

$EF_{grid,CM,y}$ = 0.6407 tCO2/MWh * 0.5 + 0.3230 tCO2/MWh * 0.5

= 0.4818 tCO2/MWh

➔ **$EF_{grid,CM,y}$=0.4818 tCO_2/MWh**

Emission reductions are calculated as follows:

$ER_y = BE_y - PE_y - LE_y$ **(5)**

Where:
ER_y = Emission reductions in year *y* (t CO_2/yr).
BE_y = Baseline emissions in year *y* (t CO_2/yr).
PE_y = Project emissions in year *y* (t CO_2/yr).
LE_y = Leakage emissions in year *y* (t CO_2/yr).

3.2 Project Emissions

Project emissions are calculated as follows:

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

Where:

PE_y = 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

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

Proposed project activity includes three power units. Power density calculation of these power plants are given in below **Error! Reference source not found.**. 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.

Chorokhi HPP Power Units	Installed Capacity (MW)	Reservoir Area in Full Level (m^2)	Power Density (W/m^2)
Kırnati	51.251	530,000	96.7
Khelvachauri-I	47.480	900,000	52.76

Then: $ER_y = BE_y$

3.3 Leakage

No leakage emissions are considered.

3.4 Net GHG Emission Reductions and Removals

Year	Estimated baseline emissions or removals (tCO_2e)		Estimated project emissions or removals (tCO_2e)		Estimated leakage emissions (tCO_2e)		Estimated net GHG emission reductions or removals (tCO_2e)	
	For Georgia	For Turkey	For Georgia	For Turkey	For Georgia	For Turkey	For Georgia	For Turkey
2017	206,536	181,439	0	0	0	0	206,536	181,439
2018	225,312	197,933	0	0	0	0	225,312	197,933
2019	225,312	197,933	0	0	0	0	225,312	197,933
2020	225,312	197,933	0	0	0	0	225,312	197,933
2021	225,312	197,933	0	0	0	0	225,312	197,933
2022	225,312	197,933	0	0	0	0	225,312	197,933
2023	225,312	197,933	0	0	0	0	225,312	197,933
2024	225,312	197,933	0	0	0	0	225,312	197,933
2025	225,312	197,933	0	0	0	0	225,312	197,933
2026	225,312	197,933					225,312	197,933
2027	18,776	16,494	0	0	0	0	225,312	197,933
Total	2,253,120	1,979,330	0	0	0	0	2,253,120	1,979,330

4 MONITORING

4.1 Data and Parameters Available at Validation

For Georgia;

Data / Parameter	**$EG_{m,y}$, $EG_{k,y}$**
Data 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 applied:	See Table 17, Table 20 and Table 31
Justification of choice of data or description of measurement methods and procedures applied	MoEP and Ministry of Energy are the main bodies responsible from electricity statistics in Georgia.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	**$FC_{i,y}$**
Data 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 applied:	See Table 18
Justification of choice of data or description of measurement methods and procedures applied	MoEP and Ministry of Energy are the main bodies responsible from electricity statistics in Georgia.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	**$NCV_{i,y}$**
Data 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 applied:	See Table 18
Justification of choice of data or description of measurement methods and procedures applied	MoEP and Ministry of Energy are the main bodies responsible from electricity statistics in Georgia.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	**Sample Group for BM emission factor**
Data 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 applied:	See Table 31
Justification of choice of data or description of measurement methods and procedures applied	MoEP and Ministry of Energy are the main bodies responsible from electricity statistics in Georgia.
Purpose of Data	Calculation of baseline emissions
Comments	-

Data / Parameter	$\mathbf{EF_{CO2,m,i,y}}$
Data 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 applied:	See Table 18 and Table 20

Justification of choice of data or description of measurement methods and procedures applied	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
Comments	-

Data / Parameter	$\eta_{m,y}$
Data 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 applied:	See Table 20
Justification of choice of data or description of measurement methods and procedures applied	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 04.0.0 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
Comments	-

Data / Parameter	**$EF_{grid,CM,y}$**
Data 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 applied:	0.54847 tCO_2/MWh
Justification of choice of data or description of measurement methods and procedures applied	See section 3.1 for calculation of the parameter.
Purpose of Data	Calculation of annual GHG emission reduction amount
Comments	As ex-ante option selected, the parameter will not be monitored as per the "Tool to calculate the emission factor for an electricity system".

For Turkey;

Data / Parameter	**$EG_{m,y}$, $EG_{k,y}$**
Data 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	Turkish Electricity Transmission Company (TEIAS), Annual Development of Electricity Generation- Consumption and Losses in Turkey (1984-2013) TEIAS, see http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2013/uretim%20tuketim(23-47)/34(84-13).xls
Value applied:	See Table 24 and Table 25
Justification of choice of data or description of measurement methods and procedures applied	Table 24 is used to find relation between the gross and net electricity delivered to the grid by fossil fuel fired power plants Import and Export data is used to find total net electricity fed into the grid in the years of 2011, 2012 and 2013. TEIAS is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Purpose of Data	Data used for emission reduction calculation
Comments	

Data / Parameter	**$FC_{i,y}$**
Data unit	Mass or volume unit
Description	Fuels consumed for electricity generation in the years of 2011, 2012 and 2013
Source of data	Annual Development of Fuels Consumed In Thermal Power Plants In Turkey by The Electric Utilities, TEİAŞ. See: http://www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2013/yak%C4%B1t48-53/49.xls
Value applied:	See **Table 33**
Justification of choice of data or description of measurement methods and procedures applied	TEİAŞ is the national electricity transmission company, which makes available the official data of all power plants in Turkey.
Purpose of Data	Data used for emission reduction calculation
Comments	

Data / Parameter	**$NCV_{i,y}$**
Data unit	TJ/million m3
Description	Net Calorific Value of fuel types in the years of 2011, 2012 and 2013
Source of data	Calculated by using HVi,y to FCi,y as Net Calorific Values of fuel types are not directly available in Turkey.
Value applied:	See Table 34, Table 32, Table 33
Justification of choice of data or description of measurement methods and procedures applied	TEİAŞ is the national electricity transmission company, which makes available the official data of power plants in Turkey. Calculation of NCVs from national HVi,y and FCi,y data is preferred to default IPCC data as these are more reliable.
Purpose of Data	
Comments	

Data / Parameter	**Sample Group for BM emission factor**
Data unit	Name of the plants, MW capacities, fuel types, annual electricity

	generations and dates of commissioning.
Description	Most recent power plants which compromise 20% of total generation
Source of data	Annual Development Of Fuels Consumed In Thermal Power Plants In Turkey By The Electric Utilities, TEIAS: http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2011.pdf http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2012.pdf http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2013.pdf
Value applied:	See Table 36
Justification of choice of data or description of measurement methods and procedures applied	TEIAS is the national electricity transmission company, which makes available the official data of all power plants in Turkey. The latest data available during PDD preparation was for 2012 please find information as: http://www.teias.gov.tr/YayinRapor/APK/projeksiyon/KAPASITEPROJEKSIYONU2013.pdf
Purpose of Data	
Comments	

Data / Parameter	**$EF_{CO2,m,i,y}$**
Data unit	tCO_2/GJ
Description	Emission factor for fuel type I
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 applied:	See Table 35
Justification of choice of data or description of measurement methods and procedures applied	No plant specific and national emission factor data is available in Turkey. So, IPCC default data is used.

Purpose of Data	
Comments	

Data / Parameter	**$\eta_{m,y}$**
Data 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"(v.4)
Value applied:	See Table 28
Justification of choice of data or description of measurement methods and procedures applied	For efficiency rates of Coal and Lignite Power Plants See Annex-1 of the Tool (highest rate is applied to be conservative) For Natural Gas and Oil plants efficiencies, default value given in the tool is applied: http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf
Purpose of Data	
Comments	

Data / Parameter	**$EF_{grid,CM,y}$**
Data 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 applied:	0.4818 tCO_2/MWh
Justification of choice of data or description of measurement methods and procedures applied	See section 3.1for calculation of the parameter.
Purpose of Data	Calculation of annual GHG emission reduction amount

Comments	As ex-ante option selected, the parameter will not be monitored as per the "Tool to calculate the emission factor for an electricity system".

4.2 Data and Parameters Monitored

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Data / Parameter	$EG_{facility,y,Georgia}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant to the Georgian grid in year *y*
Source of data	On site measurement
Description of measurement methods and procedures to be applied	• 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. Electricity imported to the Georgian grid will be calculated by subtracting data monitored at the HV substation (total electricity generation) from data monitored at the Batumi TM (electricity sold to Turkey).
Frequency of monitoring/recording	Continuous measurement and at least monthly recording
Value applied:	**410,800 MWh/year**
Monitoring equipment	Electricity Meter.
QA/QC procedures to be applied	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
Calculation method	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 calculated by electricity supplied minus electricity withdrawn which will be taken from monthly settlement notifications.
Comments	-

Data / Parameter	$EG_{facility,y,\ Turkey}$
Data unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant to the Turkish grid in year *y*
Source of data	On site measurement
Description of measurement methods and procedures to be applied	• Electricity, which will be sold to Turkey, will be transferred via Akhatlsikhe back to back converter station to the Batumi TM. A meter will be installed for the monitoring of electricity sold to Turkey at the Batumi TM. Net electricity sold to Turkey will be calculated after the deduction of transmission losses.
Frequency of monitoring/recording	Continuous measurement and at least monthly recording
Value applied:	**410,800 MWh/year**
Monitoring equipment	Electricity Meter.
QA/QC procedures to be applied	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
Calculation method	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 calculated by electricity supplied minus electricity withdrawn which will be taken from monthly settlement notifications.
Comments	-

Data / Parameter	**Cap_{PJ}**
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity
Source of data	Project site
Description of measurement methods and procedures to be applied	-
Frequency of monitoring/recording	Yearly
Value applied:	98.731 MWm
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of Project Emission
Calculation method	-
Comments	-

Data / Parameter	**A_{PJ}**
Data unit	m^2
Description	Area of the Kırnati, Khelvachauri-I 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
Description of measurement methods and procedures to be applied	Measurement will be done by a third party (engineering consultant of Achar) via topographical maps.
Frequency of monitoring/recording	Yearly
Value applied:	**900000 m2 +530000 m2**
Monitoring equipment	-
QA/QC procedures to be applied	-
Purpose of data	Calculation of Project Emission
Calculation method	Calculation of Project Emission
Comments	Monitoring will be done yearly.

4.3 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. Electricity imported to the Turkish grid will be monitored by the meter installed at the Batumi TM. Electricity imported to the Georgian grid will be calculated by subtracting data monitored at the HV substation (total electricity generation) from data monitored at the Batumi TM (electricity sold to Turkey).These values 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:

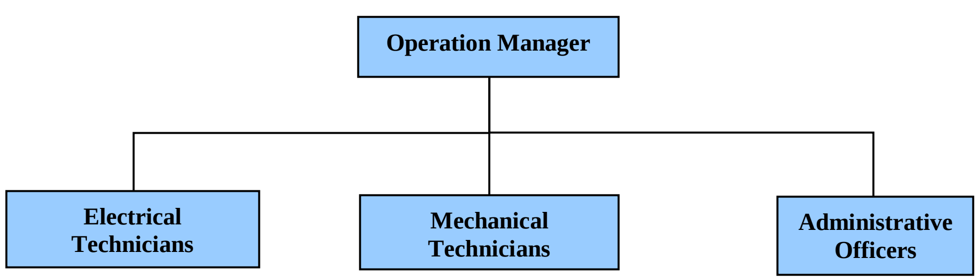

Figure 10: Operation and Management diagram

Table 29: 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 29 (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 12).

Thus, the complete baseline approach is always transparent and traceable. For the elaboration and quality assurance of the monitoring report, Lifenerji Ltd. Şti., 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 Lifenerji Ltd. Şti.. 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 VCS project activity
(ii) Timely calibration of the monitoring equipment
(iii) Enduring data collection and data archiving for VCS 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.

5 ENVIRONMENTAL IMPACT

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.

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 30 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

6 STAKEHOLDER COMMENTS

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.

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 11 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 12 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 13 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 14 Photos from meeting with the local authorities and population in Khelvachauri municipality.

All of the comments are considered by project developer and replied.

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.

APPENDIX I: <PROOF OF OWNERSHİP>

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

APPENDIX II: < FURTHER BACKGROUND INFORMATION >

Table 31 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

Calculation of Total CO_2 from OM Power Plants:

Table 32[73]: $HV_{i,y}$ (Heating Values for Fossil Fuels for Electricity Generation (TCal)

Energy Sources	2011	2012	2013
Hard Coal+Imported Coal	57,567	71,270	68,785
Lignite	107,210	93,587	81,676
Fuel Oil	5.280	5.625	5,837
Diesel Oil	155	1.884	1,363
LPG	0	0	0
Naphta	0	0	0
Natural Gas	202,064	203,766	203,244

Table 33: $FC_{i,y}$ (Fuel Consumptions for Fossil Fuels for Electricity Generation (million m^3 for Natural Gas and ton for others)[74]

Energy Sources	2011	2012	2013
Hard Coal+Imported Coal	10,574,434	12,258,462	12,105,930
Lignite	61,507,310	55,742,463	47,120,306
Fuel Oil	531,608	564.796	573,534
Diesel Oil	15,047	176.379	129,359
LPG	0	0	0
Naphta	0	0	0
Natural Gas	22,804,587	23,090,121	22,909,746

1	**Tcal**	**=**	**4.1868**	**TJ**

[73] See; www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2013/yak%C4%B1t48-53/51.xls

[74] See; www.teias.gov.tr/T%C3%BCrkiyeElektrik%C4%B0statistikleri/istatistik2013/yak%C4%B1t48-53/49.xls

Table 34: $NCV_{i,y}$ (Average Net Calorific Values for Fossil Fuels for Electricity Generation (TJ/million m^3 for Natural Gas and TJ/kton for others) and EF_i (Emission Factor of Fossil Fuels)

Energy Sources	NCVi 2011 (TJ/Gg)	NCVi 2012 (TJ/Gg)	NCVi 2013 (TJ/Gg)	EFCO2, I (kg/TJ)
Hard Coal+Imported Coal	22.79	22.34	23.79	*89.50*
Lignite	7.30	7.03	7.26	*90.90*
Fuel Oil	41.58	41.70	42.61	*72.60*
Diesel Oil	43.15	44.71	0.00	*72.60*
LPG	0.00	0.00	0.00	*61.60*
Naphta	0.00	0.00	0.00	*69.30*
Natural Gas	37.10	36.95	37.14	*54.30*

Table 35: CO_2 Emission by each Fossil Fuels Types (ktCO_2e)

Energy Sources	2011	2012	2013
Hard Coal+Imported Coal	21,572	26,706	25,775
Lignite	40,802	35,617	31,084
Fuel Oil	1,605	1,710	1,774
Diesel Oil	47	573	0
Lpg	0	0	0
Naphta	0	0	0
Natural Gas	45,938	46,325	46,206
TOTAL	**109,963**	**110,931**	**104,840**

Table 36: Power plants serving the electricity system of Turkey

No	Information to clearly identify the Plant (Name of the Plant)	Date of Commissioning	Capacity in MW	Fuel Type	Annual Generation (GWh)
1	Eren Enerji (Addition)	2010	600.0	Imported coal	4006.00
2	Eren Enerji (Addition)	2010	600.0	Imported coal	4006.00
3	MARMARA PAMUKLU MENS. SN.TİC.A.Ş. (Addition)	2010	26.2	Natural Gas	203.76
4	Aliağa Çakmaktepe Enerji A.Ş.(Aliağa/İZMİR) (Addition)	2010	69.8	Natural Gas	556.00
5	FRİTOLAY GIDA SAN.VE TİC. AŞ. (Addition)	2010	0.3	Biogas	2.40
6	Sönmez Enerji Üretim (Uşak) (Addition)	2010	2.6	Natural Gas	19.77
7	Ak-Enerji (Uşak OSB)	2010	- 15.2	Liqued Fuel + N.Gas	0.00
8	Ak-Enerji (DG+N) (Deba-Denizli)	2010	- 15.6	Liqued Fuel + N.Gas	0.00
9	Polyplex Europa Polyester Film	2010		Natural Gas	61.00

			7.8		
10	ALTEK ALARKO Elektrik Santralleri	2010	21.9	Natural Gas	151.36
11	Aksa Enerji (Demirtaş/Bursa)	2010	- 1.1	Natural Gas	0.00
12	RASA ENERJİ (VAN) (Addition)	2010	10.1	Natural Gas	64.41
13	SİLOPİ ELEKTRİK ÜRETİM A.Ş.(ESENBOĞA)	2010	- 44.8	Fuel Oil	0.00
14	International Hospital Istanbul	2010	0.8	Natural Gas	6.00
15	Tuzla Jeotermal	2010	7.5	Geothermal	0.00
16	Menderes Jeotermal Dora-2	2010	9.5	Geothermal	0.00
17	Selimoğlu Reg. Ve Hes	2010	8.0	Hydro (run of river)	0.00
18	Kulp IV HES	2010	12.3	Hydro (run of river)	46.00
19	Cindere HES (Denizli) (Addition)	2010	9.1	Hydro (With Dam)	28.29
20	Bayburt Hes	2010	14.6	Hydro (run of river)	51.00
21	UZUNÇAYIR HES (Tunceli) (Addition)	2010	27.3	Hydro (With Dam)	105.00
22	Alakır Hes.	2010	2.1	Hydro (run of river)	6.00
23	Peta Müh. En. (Mursal II Hes.)	2010	4.5	Hydro (run of river)	19.00
24	Asa Enerji (Kale Reg. Ve Hes.)	2010	9.6	Hydro (run of river)	0.00
25	Hetaş Hacısalihoğlu (Yıldızlı Hes)	2010	1.2	Hydro (run of river)	5.00
26	Doğubay Elektrik (Sarımehmet Hes)	2010	3.1	Hydro (run of river)	10.00
27	Nuryol Enerji (Defne Reg. Ve hes.)	2010	7.2	Hydro (run of river)	22.00
28	ÖZGÜR ELEKTRİK (AZMAK I REG.VE HES)	2010	5.9	Hydro (run of river)	0.00
29	Birim Hidr. Üretim A.Ş. (Erfelek Hes)	2010	3.2	Hydro (run of river)	19.00
30	Beytek El. Ür. A.Ş. (Çataloluk Hes.)	2010	9.5	Hydro (run of river)	0.00
31	Nisan E. Mekanik En. (Başak Reg. Hes.)	2010	6.9	Hydro (run of river)	22.00
32	UZUNÇAYIR HES (Tunceli) (Addition)	2010	27.3	Hydro (With Dam)	105.00
33	Fırtına Elektrik Üretim A.Ş. (Sümer Hes)	2010	21.6	Hydro (run of river)	70.00
34	KAR-EN Karadeniz El. A.Ş. Aralık Hes	2010	12.4	Hydro (run of river)	0.00
35	Birim Hidr. Üretim A.Ş. (Erfelek Hes)	2010	3.2	Hydro (run of river)	19.00
36	Karadeniz El. Üret. (Uzundere-1 Hes)	2010	62.2	Hydro (run of river)	165.00
37	Akım Enerji (Cevizli Reg. Ve Hes.)	2010	91.4	Hydro (run of river)	330.00
38	Çakıt Hes. (Çakıt Enerji)	2010	20.2	Hydro (run of river)	0.00
39	Ceyhan Hes. (Oşkan Hes.) (Enova En.)	2010		Hydro (run of river)	98.00

			23.9		
40	Erenler Reg. Ve Hes. (BME Bir. Müt. En.)	2010	45.0	Hydro (run of river)	85.00
41	Paşa Reg. Ve Hes (Özgür Elektrik)	2010	8.7	Hydro (run of river)	0.00
42	Güzelçay-I-II Hes (İlk Elektrik Enerji)	2010	8.1	Hydro (run of river)	0.00
43	Kale Reg. Ve Hes (Kale Enerji Ür.)	2010	34.1	Hydro (run of river)	116.00
44	Erikli-Akocak Reg. Ve Hes	2010	82.5	Hydro (run of river)	0.00
45	Çamlıkaya Reg. Ve Hes	2010	5.6	Hydro (run of river)	19.00
46	Dinar Hes. (Elda Elekrik Üretim)	2010	4.4	Hydro (run of river)	15.00
47	Damlapınar Hes. (Cenay Elektrik Üretim)	2010	16.4	Hydro (run of river)	0.00
48	Dim Hes (Diler Elektrik Üretim)	2010	38.3	Hydro (run of river)	123.00
49	ÖZGÜR ELEKTRİK (AZMAK I REG.VE HES)	2010	5.9	Hydro (run of river)	0.00
50	Kirpilik Reg. Ve Hes (Özgür Elektrik)	2010	6.2	Hydro (run of river)	22.00
51	Yavuz Reg. Ve Hes (Masat Enerji)	2010	22.5	Hydro (run of river)	83.00
52	Kayabükü Reg. Ve Hes (Elite Elektrik)	2010	14.6	Hydro (run of river)	0.00
53	Gök Reg. Ve Hes (Gök Enerji El. San.)	2010	10.0	Hydro (run of river)	43.00
54	Bulam Reg. Ve Hes (MEM Enerji ELK.)	2010	7.0	Hydro (run of river)	0.00
55	Karşıyaka HES (Akua Enerji Üret.)	2010	1.6	Hydro (run of river)	8.00
56	Ceyhan Hes. (Berkman Hes) (Enova En.)	2010	25.2	Hydro (run of river)	103.00
57	Güdül I Reg. Ve HES (Yaşam Enerji)	2010	2.4	Hydro (run of river)	14.00
58	Tektuğ Elektrik (Andırın Hes)	2010	40.5	Hydro (run of river)	106.00
59	Selen Elektrik (Kepezkaya Hes)	2010	28.0	Hydro (run of river)	0.00
60	REŞADİYE 2 HES (TURKON MNG ELEKT.)	2010	26.1	Hydro (run of river)	0.00
61	Kozan Hes (Ser-Er Enerji)	2010	4.0	Hydro (run of river)	9.00
62	Kahraman Reg. Ve Hes (Katırcıoğlu)	2010	1.4	Hydro (run of river)	6.00
63	Narinkale Reg. Ve Hes (EBD Enerji)	2010	3.1	Hydro (run of river)	10.00
64	Erenköy Reg. Ve Hes (Türkerler)	2010	21.5	Hydro (run of river)	87.00
65	Kahta I HES (Erdemyıldız Elektrik Üretim)	2010	7.1	Hydro (run of river)	35.00
66	Azmak II Reg. Ve Hes	2010	- 18.1	Hydro (run of river)	0.00
67	Ulubat Kuvvet Tüneli ve Hes	2010	97.0	Hydro (With Dam)	372.00
68	REŞADİYE 1 HES (TURKON MNG ELEKT.)	2010	15.7	Hydro (run of river)	0.00
69	Egemen 1 HES (Enersis Elektrik)	2010		Hydro (run of river)	0.00

			19.9		
70	Sabunsuyu II HES (Ang Enerji Elk.)	2010	7.4	Hydro (run of river)	21.00
71	Burç Bendi ve Hes (Akkur Enerji)	2010	27.3	Hydro (run of river)	113.00
72	Murgul Bakır (Ç.kaya) (Addition)	2010	19.6	Hydro (run of river)	40.50
73	Güzelçay II Hes (İlk Elektrik Enerji) (Addition)	2010	5.0	Hydro (run of river)	0.00
74	REŞADİYE 1 HES (TURKON MNG ELEKT.)	2010	15.7	Hydro (run of river)	0.00
75	Egemen 1 HES (Enersis Elektrik)	2010	8.8	Hydro (run of river)	0.00
76	Yedigöze HES (Yedigöze Elektrik)	2010	155.3	Hydro (With Dam)	474.00
77	Umut III Reg. Ve HES (Nisan Elek.)	2010	12.0	Hydro (run of river)	26.00
78	FEKE 2 Barajı ve HES (Nisan Elek.)	2010	69.3	Hydro (With Dam)	223.00
79	Egemen 1B HES (Enersis Elektrik)	2010	11.1	Hydro (run of river)	0.00
80	Kalkandere Reg. Ve Yokuşlu HES.	2010	14.5	Hydro (run of river)	63.00
81	ROTOR ELEKTRİK (OSMANİYE RES)	2010	55.0	Wind	0.00
82	Asmakinsan (Bandırma 3 RES)	2010	24.0	Wind	0.00
83	Soma Enerji Üretim (Soma Res)	2010	34.2	Wind	0.00
84	Deniz Elektrik (Sebenoba Res)	2010	10.0	Wind	0.00
85	Akdeniz Elektrik (Mersin Res)	2010	33.0	Wind	0.00
86	Boreas Enerji (Boreas I Enez Res)	2010	15.0	Wind	0.00
87	Bergama Res En. Ür. A.Ş. Aliağa Res	2010	90.0	Wind	0.00
88	Bakras En. Elek. Ür. A.Ş. Şenbük Res	2010	15.0	Wind	0.00
89	ALİZE ENERJİ (KELTEPE RES)	2010	1.8	Wind	0.00
90	ROTOR ELEKTRİK (Gökçedağ Res)	2010	22.5	Wind	0.00
91	MAZI-3 RES ELEKT.ÜR. A.Ş. (MAZI-3 RES)	2010	7.5	Wind	0.00
92	BORASKO ENERJİ (BANDIRMA RES)	2010	12.0	Wind	0.00
93	Ziyaret Res (Ziyaret Res Elektirk)	2010	35.0	Wind	0.00
94	Soma Res (Bilgin Rüzgar San. En. Ür.)	2010	90.0	Wind	0.00
95	Belen ELEKTRİK BELEN Res (Addition)	2010	6.0	Wind	0.00
96	ÜtOPYA ELEKTRİK (DÜZOVA RES) (Addition)	2010	15.0	Wind	0.00
97	Kuyucak Res (Alize Enerji Ür.)	2010	25.6	Wind	0.00
98	Sares Res (Garet Enerji Üretim)	2010	15.0	Wind	0.00
99	Turguttepe Res (Sabaş Elektrik Ür.)	2010		Wind	0.00

			22.0		
100	AKIM ENERJİ BAŞPINAR (SÜPER FİLM)	2011	25.3	Natural Gas	177.00
101	AKSA AKRİLİK (İTHAL KÖM.+D.G)	2011	25.0	Natural Gas	189.08
102	AKSA ENERJİ (Antalya)	2011	600.0	Natural Gas	3600.00
103	ALİAĞA ÇAKMAKTEPE ENERJİ (İlave)	2011	139.7	Natural Gas	1051.60
104	BEKİRLİ TES (İÇDAŞ ELEKTRİK EN.)	2011	600.0	Imported coal	4320.00
105	BOLU BELEDİYESİ ÇÖP TOP. TES. BİYOGAZ	2011	1.1	Landfill Gas	0.00
106	BOSEN ENERJİ ELEKTRİK ÜRETİM AŞ.	2011	93.0	Natural Gas	698.49
107	CENGİZ ÇİFT YAKITLI K.Ç.E.S.	2011	131.3	Natural Gas	985.00
108	CENGİZ ENERJİ SAN.VE TİC.A.Ş.	2011	35.0	Natural Gas	281.29
109	CEV ENERJİ ÜRETİM(GAZİANTEP ÇÖP BİOGAZ)	2011	5.7	Landfill Gas	0.00
110	FRAPORT IC İÇTAŞ ANTALYA HAVALİMANI	2011	8.0	Natural Gas	64.00
111	GLOBAL ENERJİ (PELİTLİK)	2011	4.0	Natural Gas	29.91
112	GORDİON AVM (REDEVCO ÜÇ EMLAK)	2011	2.0	Natural Gas	15.00
113	GOREN-1 (GAZİANTEP ORGANİZE SAN.)	2011	48.7	Natural Gas	277.00
114	GÜLLE ENERJİ(Çorlu) (İlave)	2011	3.9	Natural Gas	17.97
115	HASIRCI TEKSTİL TİC. VE SAN. LTD. ŞTİ.	2011	2.0	Natural Gas	15.00
116	HG ENERJİ ELEKTRİK ÜRET. SAN.TİC. A.Ş.	2011	52.4	Natural Gas	366.00
117	ISPARTA MENSUCAT (Isparta)	2011	4.3	Natural Gas	33.00
118	ITC ADANA ENERJİ ÜRETİM (İlave)	2011	1.4	Landfill Gas	0.00
119	ITC-KA EN. (ASLIM BİYOKÜTLE) KONYA	2011	5.7	Landfill Gas	0.00
120	ITC-KA ENERJİ (SİNCAN) (İlave)	2011	1.4	Landfill Gas	0.00
121	ITC-KA ENERJİ MAMAK KATI ATIK TOP.	2011	2.8	Landfill Gas	0.00
122	İSTANBUL SABİHA GÖKÇEN UL.AR. HAV.	2011	4.0	Natural Gas	32.00
123	KARKEY (SİLOPİ 1)	2011	100.4	Fuel Oil	701.15
124	KAYSERİ KATI ATIK DEPONİ SAHASI	2011	1.6	Landfill Gas	0.00
125	KNAUF İNŞ. VE YAPI ELEMANLARI SN.	2011	1.6	Natural Gas	12.00
126	LOKMAN HEKİM ENGÜRÜ SAĞ.(SİNCAN)	2011	0.5	Natural Gas	4.00
127	MARDİN-KIZILTEPE (AKSA ENERJİ)	2011	32.1	Natural Gas	225.00
128	NUH ENERJİ EL. ÜRT.A.Ş. (ENERJİ SANT.-2)	2011	120.0	Natural Gas	900.00
129	ODAŞ DOĞALGAZ KÇS (ODAŞ ELEKTRİK)	2011		Natural Gas	415.00

			55.0		
130	POLYPLEX EUROPA POLYESTER FİLM	2011	3.9	Natural Gas	30.70
131	SAMSUN TEKKEKÖY EN. SAN. (AKSA EN.)	2011	131.3	Natural Gas	980.00
132	SAMUR HALI A.Ş.	2011	4.3	Natural Gas	33.00
133	SARAY HALI A.Ş.	2011	4.3	Natural Gas	33.00
134	TEKİRDAĞ-ÇORLU TEKS.TES.(NİL ÖRME)	2011	2.7	Natural Gas	21.00
135	TİRENDA TİRE ENERJİ ÜRETİM A.Ş.	2011	58.4	Natural Gas	410.00
136	YENİ UŞAK ENERJİ ELEKTRİK SANTRALI	2011	8.7	Natural Gas	65.00
137	ZORLU ENERJİ (B.Karıştıran)	2011	7.2	Natural Gas	54.07
138	ŞANLIURFA OSB (RASA ENERJİ ÜR. A.Ş.)	2011	116.8	Natural Gas	800.00
139	AYDIN/GERMENCİK JEOTERMAL	2011	20.0	Geothermal	150.00
140	ÇEŞMEBAŞI REG. VE HES (GİMAK EN.)	2011	8.2	Hydro (run of river)	39.00
141	ÇUKURÇAYI HES (AYDEMİR ELEKTRİK ÜR.)	2011	1.8	Hydro (run of river)	8.00
142	DARCA HES (BÜKOR ELEKTRİK ÜRETİM)	2011	8.9	Hydro (run of river)	0.00
143	DERME (KAYSERİ VE CİVARI ENERJİ)	2011	4.5	Hydro (run of river)	14.00
144	DURU 2 REG. VE HES (DURUCASU ELEK.)	2011	4.5	Hydro (run of river)	22.00
145	ERENKÖY REG. VE HES (NEHİR ENERJİ)	2011	21.5	Hydro (run of river)	87.00
146	ERKENEK (KAYSERİ VE CİVARI ENERJİ)	2011	0.3	Hydro (run of river)	0.00
147	EŞEN-1 HES (GÖLTAŞ ENERJİ ELEKTRİK)	2011	60.0	Hydro (run of river)	240.00
148	GİRLEVİK (BOYDAK ENERJİ)	2011	3.0	Hydro (run of river)	21.00
149	GÖKMEN REG. VE HES (SU-GÜCÜ ELEKT.)	2011	2.9	Hydro (run of river)	13.00
150	HACININOĞLU HES (ENERJİ-SA ENERJİ)	2011	142.3	Hydro (run of river)	360.00
151	HAKKARİ (Otluca) (NAS ENERJİ A.Ş.)	2011	1.3	Hydro (run of river)	6.00
152	HASANLAR	2011	9.4	Hydro (run of river)	39.00
153	HASANLAR HES (DÜZCE ENERJİ BİRLİĞİ)	2011	4.7	Hydro (run of river)	0.00
154	İNCİRLİ REG. VE HES (LASKAR ENERJİ)	2011	25.2	Hydro (run of river)	126.00
155	KALKANDERE REG. VE YOKUŞLU HES	2011	23.4	Hydro (run of river)	0.00
156	KARASU 4-2 HES (İDEAL ENERJİ ÜRETİMİ)	2011	10.4	Hydro (run of river)	0.00
157	KARASU 4-3 HES (İDEAL ENERJİ ÜRETİMİ)	2011	4.6	Hydro (run of river)	0.00
158	KARASU 5 HES (İDEAL ENERJİ ÜRETİMİ)	2011	4.1	Hydro (run of river)	0.00
159	KARASU I HES (İDEAL ENERJİ ÜRETİMİ)	2011		Hydro (run of river)	0.00

			3.8		
160	KARASU II HES (İDEAL ENERJİ ÜRETİMİ)	2011	3.1	Hydro (run of river)	13.00
161	KAZANKAYA REG. VE İNCESU HES (AKSA)	2011	15.0	Hydro (run of river)	48.00
162	KESME REG. VE HES (KIVANÇ ENERJİ)	2011	4.6	Hydro (run of river)	16.00
163	KIRAN HES (ARSAN ENERJİ A.Ş.)	2011	9.7	Hydro (run of river)	0.00
164	KORUKÖY HES (AKAR ENERJİ SAN. TİC.)	2011	3.0	Hydro (run of river)	22.00
165	KOVADA-I (BATIÇİM ENERJİ ELEKTRİK)	2011	51.2	Hydro (run of river)	36.20
166	KOVADA-II (BATIÇİM ENERJİ ELEKTRİK)	2011	8.3	Hydro (run of river)	4.10
167	KOZDERE HES (ADO MADENCİLİK ELKT.)	2011	3.1	Hydro (run of river)	0.00
168	KÖYOBASI HES (ŞİRİKOĞLU ELEKTRİK)	2011	1.1	Hydro (run of river)	5.00
169	KULP I HES (YILDIZLAR ENERJİ ELK.ÜR.)	2011	22.9	Hydro (run of river)	78.00
170	KUMKÖY HES (AES-IC İÇTAŞ ENERJİ)	2011	17.5	Hydro (run of river)	98.00
171	AKSU REG. VE HES (KALEN ENERJİ)	2011	5.2	Hydro (run of river)	16.00
172	ALKUMRU BARAJI VE HES (LİMAK HİD.)	2011	261.3	Hydro (run of river)	828.00
173	AYRANCILAR HES (MURADİYE ELEKTRİK)	2011	32.1	Hydro (run of river)	0.00
174	BALKONDU I HES (BTA ELEKTRİK ENERJİ)	2011	9.2	Hydro (run of river)	33.00
175	BAYRAMHACILI BARAJI VE HES	2011	47.0	Hydro (run of river)	175.00
176	BERDAN	2011	10.2	Hydro (run of river)	47.20
177	BOĞUNTU HES (BEYOBASI ENERJİ)	2011	3.8	Hydro (run of river)	17.00
178	CEVHER I-II REG. VE HES (ÖZCEVHER EN.)	2011	16.4	Hydro (run of river)	0.00
179	ÇAKIRMAN REG. VE HES (YUSAKA EN.)	2011	7.0	Hydro (run of river)	22.00
180	ÇAMLIKAYA REG.VE HES (ÇAMLIKAYA EN)	2011	2.8	Hydro (run of river)	0.80
181	ÇANAKÇI HES (CAN ENERJİ ENTEGRE)	2011	9.3	Hydro (run of river)	39.00
182	MENGE BARAJI VE HES (ENERJİSA ENERJİ)	2011	44.7	Hydro (run of river)	0.00
183	MOLU ENERJİ (Zamantı-Bahçelik HES)	2011	4.2	Hydro (run of river)	30.00
184	MURATLI REG. VE HES (ARMAHES EL.)	2011	26.7	Hydro (run of river)	94.00
185	NARİNKALE REG. VE HES (EBD ENERJİ)	2011	30.4	Hydro (run of river)	108.00
186	OTLUCA I HES (BEYOBASI ENERJİ ÜR.)	2011	37.5	Hydro (run of river)	0.00
187	OTLUCA II HES (BEYOBASI ENERJİ ÜR.)	2011	6.4	Hydro (run of river)	0.00
188	ÖREN REG. VE HES (ÇELİKLER ELEKTRİK)	2011	6.6	Hydro (run of river)	16.00
189	POYRAZ HES (YEŞİL ENERJİ ELEKTRİK)	2011		Hydro (run of river)	10.00

			2.7		
190	SARAÇBENDİ HES (ÇAMLICA ELEKTRİK)	2011	25.5	Hydro (run of river)	0.00
191	SARIKAVAK HES (ESER ENERJİ YAT. AŞ.)	2011	8.1	Hydro (run of river)	0.00
192	SAYAN HES (KAREL ELEKTRİK ÜRETİM)	2011	14.9	Hydro (run of river)	0.00
193	SEFAKÖY HES (PURE ENERJİ ÜRETİM AŞ.)	2011	33.1	Hydro (run of river)	0.00
194	DAREN HES ELEKTRİK (SEYRANTEPE)	2011	49.7	Hydro (run of river)	181.13
195	SIZIR (KAYSERİ VE CİVARI EL. T.A.Ş)	2011	5.8	Hydro (run of river)	46.00
196	SÖĞÜTLÜKAYA (POSOF III) HES	2011	6.1	Hydro (run of river)	31.00
197	TEFEN HES (AKSU MADENCİLİK SAN.)	2011	33.0	Hydro (run of river)	141.00
198	TUZTAŞI HES (GÜRÜZ ELEKTRİK ÜR.)	2011	1.6	Hydro (run of river)	10.00
199	ÜZÜMLÜ HES (AKGÜN ENERJİ ÜRETİM)	2011	11.4	Hydro (run of river)	41.00
200	YAMAÇ HES (YAMAÇ ENERJİ ÜRETİM A.Ş.)	2011	5.5	Hydro (run of river)	0.00
201	YAPISAN (KARICA REG. ve DARICA I HES)	2011	13.3	Hydro (run of river)	0.00
202	YAPRAK II HES (NİSAN ELEKTROMEK.)	2011	10.8	Hydro (run of river)	32.00
203	YAŞIL HES (YAŞIL ENERJİ ELEKTRİK)	2011	3.8	Hydro (run of river)	15.00
204	YEDİGÖL REG. VE HES (YEDİGÖL HİDR.)	2011	21.9	Hydro (run of river)	77.00
205	YEDİGÖZE HES (YEDİGÖZE ELEK.) (İlave)	2011	155.3	Hydro (run of river)	425.00
206	SARES RES (GARET ENERJİ ÜRETİM)	2011	7.5	Wind	0.00
207	SEYİTALİ RES (DORUK ENERJİ ELEKTRİK)	2011	30.0	Wind	0.00
208	SOMA RES (SOMA ENERJİ) (İlave)	2011	36.9	Wind	0.00
209	SUSURLUK RES (ALANTEK ENERJİ ÜRET.)	2011	45.0	Wind	0.00
210	ŞAH RES (GALATA WİND ENERJİ LTD. ŞTİ)	2011	93.0	Wind	0.00
211	TURGUTTEPE RES (SABAŞ ELEKTRİK)	2011	2.0	Wind	0.00
212	ZİYARET RES (ZİYARET RES ELEKTRİK)	2011	22.5	Wind	0.00
213	AKRES (AKHİSAR RÜZGAR EN. ELEKT.)	2011	43.8	Wind	0.00
214	AYVACIK RES (AYRES AYVACIK RÜZG.)	2011	5.0	Wind	0.00
215	BAKİ ELEKTRİK ŞAMLI RÜZGAR (İlave)	2011	24.0	Wind	0.00
216	ÇANAKKALE RES (ENERJİ-SA ENERJİ)	2011	29.2	Wind	0.00
217	ÇATALTEPE RES (ALİZE ENERJİ ELEKTRİK)	2011	16.0	Wind	0.00
218	İNNORES ELEKTRİK YUNTDAĞ RÜZGAR	2011	10.0	Wind	0.00
219	KİLLİK RES (PEM ENERJİ A.Ş.)	2011		Wind	0.00

			40.0		
220	ACARSOY TERMİK KOM.ÇEV.SANT. (ACARSOY EN.)	2012	50.0	Natural Gas	375.00
221	AFYON DGKÇ (DEDELİ DOĞALGAZ ELEKTRİK ÜR.)	2012	126.1	Natural Gas	945.00
222	AGE DOĞALGAZ KOM. ÇEV. SANT. (AGE DENİZLİ)	2012	141.0	Natural Gas	1057.00
223	AKDENİZ KİMYA SAN. VE TİC. A.Ş.	2012	4.0	Natural Gas	30.00
224	AKKÖPRÜ (DALAMAN)	2012	115.0	Hydro (run of river)	176.00
225	AKKÖY II HES (AKKÖY ENERJİ A.Ş.)	2012	229.7	Hydro (run of river)	508.00
226	AKKÖY-ESPİYE HES (KONİ İNŞAAT SAN. A.Ş.)	2012	8.9	Hydro (run of river)	40.00
227	AKSA AKRİLİK KİMYA SAN. A.Ş. (İTHAL KÖM.+D.G)	2012	42.5	Natural Gas	298.00
228	AKSU RES (AKSU TEMİZ ENERJİ ELEKTRİK ÜRETİM)	2012	72.0	Wind	0.00
229	ALABALIK REG. VE HES SANTRALI I-II (DARBOĞAZ ELK. ÜR. SAN.)	2012	13.8	Hydro (run of river)	0.00
230	ALES DOĞALGAZ KOM. ÇEV. SANT. (ALES ELEKT.)	2012	49.0	Natural Gas	370.00
231	ALPASLAN I (ELEKTRİK ÜRETİM A.Ş.)	2012	80.0	Hydro (run of river)	0.00
232	ALTINYILDIZ MENSUCAT VE KONF. FAB. (Tekirdağ)	2012	5.5	Natural Gas	38.00
233	ANAK HES (KOR-EN KORKUTELİ ELEK. ÜRET. SAN.)	2012	3.8	Hydro (run of river)	9.00
234	ARAKLI-1 REG. VE HES(YÜCEYURT ENERJİ ÜRETİM)	2012	13.1	Hydro (run of river)	0.00
235	ARCA HES (GÜRSU TEMİZ ENERJİ ÜRETİM A.Ş.)	2012	5.5	Hydro (run of river)	0.00
236	AREL ENERJİ BİYOKÜTLE TESİSİ (AREL ÇEVRE)	2012	2.4	Biomass	0.00
237	ARPA REG. VE HES (MCK ELEKTRİK ÜRETİM A.Ş.)	2012	32.4	Hydro (run of river)	44.00
238	ASAŞ ALÜMİNYUM SANAYİ VE TİCARET A.Ş.	2012	8.6	Natural Gas	65.00
239	ATAKÖY (ZORLU DOĞAL ELEKTRİK ÜRETİMİ A.Ş.)	2012	5.5	Hydro (run of river)	11.00
240	AVCILAR HES (AVCILAR ENERJİ ELEKTRİK ÜRET.)	2012	16.7	Hydro (run of river)	28.00
241	AYANCIK HES (İLK ELEKTRİK ENERJİ ÜRETİMİ SN.)	2012	15.6	Hydro (run of river)	37.00
242	AYRANCILAR HES (MURADİYE ELEKTRİK ÜRETİM)	2012	9.3	Hydro (run of river)	0.00
243	BAĞIŞTAŞ II HES (AKDENİZLİ ELEKTRİK ÜRETİM)	2012	32.4	Hydro (run of river)	69.00
244	BALIKESİR RES (BARES ELEKTRİK ÜRETİM A.Ş.)	2012	30.3	Wind	0.00
245	BALIKESİR RES (ENERJİSA ENERJİ ÜRETİM A.Ş.)	2012	82.5	Wind	0.00
246	BALKUSAN BARAJI VE HES 1 NOLU SANT. (KAREN)	2012	13.0	Hydro (run of river)	0.00
247	BALKUSAN BARAJI VE HES 2 NOLU SANT. (KAREN)	2012	25.0	Hydro (run of river)	0.00
248	BALSUYU MENSUCAT SAN. VE TİC. A.Ş.	2012	9.7	Natural Gas	68.00
249	BAMEN KOJENERASYON	2012		Natural Gas	14.00

	(BAŞYAZICIOĞLU TEKSTİL)		2.1		
250	BANDIRMA RES (YAPISAN ELEKTRİK ÜRETİM A.Ş.)	2012	5.0	Wind	0.00
251	BANGAL REG. VE KUŞLUK HES (KUDRET ENERJİ)	2012	17.0	Hydro (run of river)	32.00
252	BEKTEMUR HES (DİZ-EP ELEKTRİK ÜRETİM LTD.)	2012	3.5	Hydro (run of river)	11.00
253	BEREKET ENERJİ ÜRETİM A.Ş. (BİOGAZ)	2012	0.6	Biogas	5.00
254	BEYKÖY (ZORLU DOĞAL ELEKTRİK ÜRETİMİ A.Ş.)	2012	16.8	Hydro (run of river)	87.00
255	BEYPİ BEYPAZARI TARIMSAL ÜRETİM PZ. SN. A.Ş.	2012	8.6	Natural Gas	63.00
256	BİLECİK DOĞALGAZ ÇS. (TEKNO DOĞALGAZ ÇEV.)	2012	25.8	Natural Gas	190.00
257	BİLECİK DOĞALGAZ KÇS. (DEDELİ DOĞALGAZ EL.)	2012	126.1	Natural Gas	945.00
258	BİLKUR TEKSTİL BOYA TİC. A.Ş.	2012	2.0	Natural Gas	14.00
259	BİNATOM ELEKTRİK ÜRETİM A.Ş. (Emet/KÜTAHYA)	2012	10.4	Natural Gas	78.00
260	BİS ENERJİ(Sanayi/ Bursa)	2012	48.0	Natural Gas	361.00
261	BOSEN ENERJİ ELEKTRİK ÜRETİM AŞ.(Bursa)	2012	27.9	Natural Gas	210.00
262	BOYABAT BARAJI VE HES (BOYABAT ELEKTRİK)	2012	513.0	Hydro (run of river)	830.00
263	BOZYAKA RES (KARDEMİR HADDECİLİK VE ELEKT.)	2012	12.0	Wind	32.00
264	BÜYÜKDÜZ HES (AYEN ENERJİ A.Ş.)	2012	68.9	Hydro (run of river)	192.00
265	CAN 1 HES (HED ELEKTRİK ÜRETİM A.Ş.)	2012	1.8	Hydro (run of river)	6.00
266	CEYHAN HES (BERKMAN HES) (ENOVA EN ÜRET.)	2012	12.6	Hydro (run of river)	31.00
267	CUNİŞ REG. VE HES (RİNERJİ RİZE ELEKTRİK ÜR.)	2012	8.4	Hydro (run of river)	21.00
268	ÇAĞLAYAN HES (ÇAĞLAYAN HES ENERJİ ÜRETİM)	2012	6.0	Hydro (run of river)	12.00
269	ÇARŞAMBA HES (ÇARŞAMBA ENERJİ ELEKTRİK)	2012	11.3	Hydro (run of river)	36.00
270	ÇILDIR (ZORLU DOĞAL ELEKTRİK ÜRETİMİ A.Ş.)	2012	15.4	Natural Gas	20.00
271	ÇINAR-1 HES (AYCAN ENERJİ ÜRETİM TİC. VE SN.)	2012	9.3	Hydro (run of river)	19.00
272	ÇUKURÇAYI HES (AYDEMİR ELEKTRİK ÜRETİM A.Ş.)	2012	1.8	Hydro (run of river)	2.00
273	DAĞPAZARI RES (ENERJİSA ENERJİ ÜRETİM A.Ş.)	2012	39.0	Wind	0.00
274	DEMİRCİLER HES (PAK ENERJİ ÜRETİMİ SAN.)	2012	8.4	Hydro (run of river)	0.00
275	DENİZ JEOTERMAL (MAREN MARAŞ ELEKTRİK)	2012	24.0	Geothermal	0.00
276	DENİZLİ JEOTERMAL (ZORLU DOĞAL ELEK. ÜR.A.Ş.)	2012	15.0	Geothermal	105.00
277	DİNAR RES (OLGU ENERJİ YATIRIM ÜRETİM)	2012	16.1	Wind	51.00
278	DOĞANKAYA HES (MAR-EN ENERJİ ÜRET. TİC.)	2012	20.6	Hydro (run of river)	56.00
279	DUMLU HES (DUMLU ENERJİ ELEKTRİK	2012		Hydro (run of river)	5.00

	ÜRETİM)		4.0		
280	DURMAZLAR MAKİNA SANAYİ VE TİCARET A.Ş.	2012	1.3	Natural Gas	10.00
281	DURUM GIDA TERMİK KOJEN. SANT. (DURUM GIDA)	2012	3.6	Natural Gas	29.00
282	EGE SERAMİK ENERJİ SANTRALI	2012	13.1	Natural Gas	90.00
283	EGER HES (EGER ELEKTRİK ÜRETİM LTD. ŞTİ.)	2012	1.9	Hydro (run of river)	6.00
284	EKİM BİYOGAZ (EKİM GRUP ELEKTRİK ÜRETİM)	2012	1.2	Biogas	10.00
285	ENERJİ-SA (ÇANAKKALE)	2012	0.9	Wind	0.00
286	ENERJİ-SA (KÖSEKÖY)	2012	120.0	Natural Gas	930.00
287	ENERJİ-SA (MERSİN)	2012	1.4	Natural Gas	11.00
288	ERDEMİR(F.O+K.G+Y.F.G+DG)(Ereğli-Zonguldak)	2012	53.9	Natural Gas	355.00
289	EREN ENERJİ ELEKTRİK ÜRETİM A.Ş.	2012	30.0	Imported coal	195.00
290	ERİK HES (ELEKTRİK ÜRETİM A.Ş.)	2012	6.5	Hydro (run of river)	21.00
291	ERMENEK (ELEKTRİK ÜRETİM A.Ş.)	2012	302.4	Hydro (run of river)	1187.00
292	ERZURUM MEYDAN AVM (REDEVKO BİR EMLAK)	2012	2.4	Natural Gas	16.00
293	ES ES ESKİŞEHİR ENERJİ SAN. VE TİC. A.Ş.	2012	2.0	Biogas	15.00
294	ESENDURAK HES (MERAL ELEKTRİK ÜRETİM)	2012	9.3	Hydro (run of river)	0.00
295	FEKE 1 HES (AKKUR ENERJİ ÜRETİM TİC. VE SAN.)	2012	29.4	Hydro (run of river)	0.00
296	FEKE 2 BARAJI VE HES (AKKUR ENERJİ ÜRETİM)	2012	69.3	Hydro (run of river)	0.00
297	FINDIK I HES (ADV ELEKTRİK ÜRETİM LTD. ŞTİ.)	2012	11.3	Hydro (run of river)	27.00
298	GOODYEAR (İzmit/Köseköy)	2012	5.2	LPG	35.00
299	GÖKGEDİK HES (UHUD ENERJİ ÜRETİM TİC.)	2012	24.3	Hydro (run of river)	75.00
300	GÖKNUR GIDA MAD. EN. İM. İT. İH. TİC. VE SAN. AŞ.	2012	1.6	Imported coal	6.00
301	GÜDÜL 2 HES (YAŞAM ENERJİ ELEKTRİK ÜRETİM)	2012	4.9	Hydro (run of river)	15.00
302	GÜLLÜBAĞ BARAJI VE HES (SENENERJİ ENERJİ)	2012	96.0	Hydro (run of river)	280.00
303	GÜNAYDIN RES (MANRES ELEKTRİK ÜRETİM A.Ş.)	2012	10.0	Wind	0.00
304	GÜNDER REG. VE HES (ARIK ENERJİ ÜRETİM A.Ş.)	2012	28.2	Hydro (run of river)	0.00
305	GÜRTEKS İPLİK SANAYİ VE TİCARET A.Ş.	2012	6.7	Natural Gas	53.00
306	HATİPOĞLU PLASTİK YAPI ELEMANLARI SAN.	2012	2.0	Natural Gas	14.00
307	HORU REG. VE HES (MARAŞ ENERJİ YATIRIM SN.)	2012	8.5	Hydro (run of river)	25.00
308	HORYAN HES (HORYAN ENERJİ A.Ş.)	2012	5.7	Hydro (run of river)	15.00
309	ITC ADANA ENERJİ ÜRETİM (ADANA	2012		Waste	35.00

	BİOKÜTLE SNT)		4.2		
310	ITC BURSA ENERJİ ÜRETİM SAN. VE TİC. A.Ş.	2012	9.8	Waste	37.00
311	İKİZDERE (ZORLU DOĞAL ELEKTRİK ÜRETİMİ A.Ş.)	2012	18.6	Hydro (run of river)	100.00
312	İNNORES ELEKTRİK YUNTDAĞ RÜZGAR (Aliağa-İZMİR)	2012	5.0	Wind	0.00
313	İŞBİRLİĞİ ENERJİ ÜRETİM SAN. VE TİC. A.Ş.	2012	19.5	Natural Gas	146.00
314	İZAYDAŞ (İZMİT ÇÖP)(Köseköy)	2012	0.3	Waste	2.00
315	İZMİR BÜYÜK EFES OTELİ KOJENERASYON TES.	2012	1.2	Natural Gas	9.00
316	JTI TORBALI KOJENERASYON SANTR. (JTI TÜTÜN)	2012	4.0	Natural Gas	30.00
317	KARADAĞ RES (GARET ENERJİ ÜRETİM)	2012	10.0	Wind	0.00
318	KARTALKAYA HES (SIR ENERJİ ÜRETİM SAN.)	2012	8.0	Hydro (run of river)	15.00
319	KAYADÜZÜ RES (BAKTEPE ENERJİ A.Ş.)	2012	39.0	Wind	0.00
320	KAYAKÖPRÜ 2 HES (ARSAN ENERJİ A.Ş.)	2012	10.2	Hydro (run of river)	36.00
321	KAYSERİ KATI ATIK DEPONİ SAHASI (HER ENERJİ)	2012	1.4	Waste	10.00
322	KESKİNOĞLU TAVUKÇULUK VE DAMIZLIK İŞLET.	2012	6.0	Natural Gas	45.00
323	KILAVUZLU HES (ELEKTRİK ÜRETİM A.Ş.)	2012	40.5	Hydro (run of river)	150.00
324	KIRIKDAĞ HES (ÖZENİR ENERJİ ELEKTRİK ÜRET.)	2012	16.9	Hydro (run of river)	40.00
325	KIVANÇ TEKSTİL SAN.ve TİC.A.Ş.	2012	2.1	Natural Gas	11.00
326	KOCAELİ ÇÖP BİYOGAZ (LFG) (KÖRFEZ ENERJİ)	2012	2.3	Waste	18.00
327	KOZBEYLİ RES (DOĞAL ENERJİ ELEKTRİK ÜRETİM)	2012	20.0	Wind	60.00
328	KOZDERE HES (ADO MADENCİLİK ELEKTRİK ÜR.)	2012	6.1	Hydro (run of river)	5.00
329	KÖKNAR HES (AYCAN ENERJİ ÜRETİM TİC.)	2012	8.0	Hydro (run of river)	15.00
330	KUZGUN (ZORLU DOĞAL ELEKTRİK ÜRETİMİ A.Ş.)	2012	20.9	Hydro (run of river)	0.00
331	KÜÇÜKER TEKSTİL SAN. VE TİC. A.Ş.	2012	5.0	Lignite	40.00
332	KÜRCE REG. VE HES (DEDEGÖL ENERJİ)	2012	12.0	Hydro (run of river)	36.00
333	MENGE BARAJI VE HES (ENERJİSA ENERJİ)	2012	44.7	Hydro (run of river)	58.00
334	MERCAN (ZORLU DOĞAL ELEKTRİK ÜRETİMİ A.Ş.)	2012	20.4	Hydro (run of river)	78.00
335	METRİSTEPE RES (CAN ENERJİ ENTEGRE ELEKT.)	2012	39.0	Wind	0.00
336	MİDİLLİ REG. VE HES (MASAT ENERJİ ELEKTRİK)	2012	20.9	Hydro (run of river)	45.00
337	MURAT I-II REG. VE HES (MURAT HES ENERJİ EL.)	2012	35.6	Hydro (run of river)	107.00
338	MURATLI REG. VE HES (ARMAHES ELEKTRİK ÜR.)	2012	11.0	Hydro (run of river)	17.00
339	MURSAL I HES (PETA MÜHENDİSLİK	2012		Hydro (run of river)	13.00

	ENERJİ)		4.2		
340	MUTLU MAKARNACILIK SANAYİ VE TİCARET A.Ş.)	2012	2.0	Natural Gas	18.00
341	NAKSAN ENERJİ ELEKTRİK ÜRETİM A.Ş.	2012	16.0	Natural Gas	120.00
342	NİKSAR HES (NİKSAR ENERJİ ÜRETİM LTD. ŞTİ.)	2012	40.2	Hydro (run of river)	140.00
343	ODAŞ DOĞALGAZ KÇS (ODAŞ ELEKTRİK ÜRETİM)	2012	128.2	Natural Gas	450.00
344	OFİM ENERJİ SANTRALI (OSTİM FİNANS VE İŞ MER.)	2012	2.1	Natural Gas	16.00
345	ORTADOĞU ENERJİ (KÖMÜRCÜODA) (Şile/İSTANBUL)	2012	2.8	Waste	17.00
346	ORTADOĞU ENERJİ (ODA YERİ) (Eyüp/İSTANBUL)	2012	4.1	Waste	22.00
347	ÖREN REG. VE HES (ÇELİKLER ELEKTRİK ÜRETİM)	2012	19.9	Hydro (run of river)	12.00
348	ÖZMAYA SANAYİ A.Ş.	2012	5.4	Hydro (run of river)	40.00
349	PAMUKOVA YEN. EN. VE ELEK. ÜR. A.Ş.	2012	1.4	Waste	0.00
350	PANCAR ELEKTRİK ÜRETİM A.Ş.	2012	34.9	Natural Gas	731.00
351	PAPART HES (ELİTE ELEKTRİK ÜRETİM)	2012	26.6	Hydro (run of river)	80.00
352	PİSA TEKSTİL VE BOYA FABRİKALARI (İstanbul)	2012	1.0	Natural Gas	7.00
353	POLAT HES (ELESTAŞ ELEKTRİK ÜRETİM A.Ş.)	2012	6.6	Hydro (run of river)	20.00
354	POYRAZ RES (POYRAZ ENERJİ ELEKTRİK ÜRETİM)	2012	50.0	Wind	0.00
355	SAMSUN AVDAN KATI ATIK (SAMSUN AVDAN EN.)	2012	2.4	Waste	18.00
356	SAMURLU RES (DOĞAL ENERJİ ELEKTRİK ÜRET.)	2012	22.0	Hydro (run of river)	60.00
357	SARIHIDIR HES (MOLU ENERJİ ÜRETİM A.Ş.)	2012	6.0	Hydro (run of river)	18.00
358	SELÇUK İPLİK SAN. VE TİC. A.Ş.	2012	8.6	Natural Gas	65.00
359	SELVA GIDA SAN. A.Ş.	2012	1.7	Natural Gas	14.00
360	SEYRANTEPE HES (SEYRANTEPE ELEKT. ÜRET.)	2012	56.8	Hydro (run of river)	161.00
361	SEZER BİO ENERJİ (KALEMİRLER ENERJİ ELEKTR.)	2012	0.5	Waste	4.00
362	SIRAKONAKLAR HES (2M ENERJİ ÜRETİM A.Ş.)	2012	18.0	Hydro (run of river)	39.00
363	SİNEM JEOTERMAL (MAREN MARAŞ ELEKTRİK)	2012	24.0	Geothermal	191.00
364	SODA SANAYİ A.Ş. (Mersin)	2012	252.2	Natural Gas	1765.00
365	SOMA RES (SOMA ENERJİ ELEKTRİK ÜRETİM A.Ş.)	2012	24.0	Wind	0.00
366	SÖKE-ÇATALBÜK RES (ABK ENERJİ ELEKTRİK)	2012	18.0	Wind	0.00
367	SÖKE-ÇATALBÜK RES (ABK ENERJİ ELEKTRİK)	2012	12.0	Wind	0.00
368	SULUKÖY HES (DU ELEKTRİK ÜRETİM A.Ş.)	2012	6.9	Hydro (run of river)	18.00
369	ŞANLIURFA OSB (RASA ENERJİ ÜRETİM	2012		Natural Gas	82.00

	A.Ş.)		11.7		
370	ŞENKÖY RES (EOLOS RÜZGAR ENERJİSİ ÜRETİM)	2012	26.0	Wind	0.00
371	ŞİFRİN REG. VE HES (BOMONTİ ELK. MÜH. MÜŞ.)	2012	6.7	Hydro (run of river)	10.00
372	TELEME REG. VE HES (TAYEN ELEKTRİK ÜRET.)	2012	1.6	Hydro (run of river)	6.00
373	TELLİ I-II HES (FALANJ ENERJİ ELEKTRİK ÜRET.)	2012	8.7	Hydro (run of river)	18.00
374	TERCAN (ZORLU DOĞAL ELEKTRİK ÜRETİMİ A.Ş.)	2012	15.0	Hydro (run of river)	28.00
375	TRAKYA YENİŞEHİR CAM SAN. A.Ş.	2012	6.0	Biogas	45.00
376	TUĞRA REG. VE HES (VİRA ELEKTRİK ÜRETİM A.Ş.)	2012	4.9	Hydro (run of river)	10.00
377	TUNA HES (NİSAN ELEKTROMEKANİK ENERJİ)	2012	37.2	Hydro (run of river)	0.00
378	TUZKÖY HES (BATEN ENERJİ ÜRETİMİ A.Ş.)	2012	8.4	Hydro (run of river)	0.00
379	TUZLAKÖY-SERGE REG. VE HES (TUYAT ELEKT.)	2012	7.1	Hydro (run of river)	0.00
380	UMUT I REG. VE HES (NİSAN ELEKTROMEKANİK)	2012	5.8	Hydro (run of river)	0.00
381	ÜÇKAYA HES (ŞİRİKÇİOĞLU ELEKTRİK ÜRETİM A.Ş.)	2012	1.0	Hydro (run of river)	3.00
382	VİZARA REG. VE HES (ÖZTÜRK ELEKT. ÜRET. LTD.)	2012	8.6	Hydro (run of river)	0.00
383	YAĞMUR REG. VE HES (BT BORDO ELK. ÜR.)	2012	8.9	Hydro (run of river)	0.00
384	YAMANLI III KAPS. GÖKKAYA HES (MEM ENERJİ)	2012	28.5	Hydro (run of river)	0.00
385	YAMANLI III KAPS. HİMMETLİ HES (MEM ENERJİ)	2012	27.0	Hydro (run of river)	0.00
386	YAVUZ HES (AREM ENERJİ ÜRETİM A.Ş.)	2012	5.8	Hydro (run of river)	0.00
387	YEDİSU HES (ÖZALTIN ENERJİ ÜRETİM VE İNŞAAT)	2012	22.7	Hydro (run of river)	41.00
388	YENİ UŞAK ENERJİ ELEKTRİK SANTRALI	2012	9.7	Natural Gas	62.00
389	YILDIRIM HES (BAYBURT ENERJİ ÜRETİM VE TİC.)	2012	10.7	Hydro (run of river)	22.00
390	YOKUŞLU KALKANDERE HES (SANKO ENERJİ)	2012	5.2	Hydro (run of river)	0.00
391	YONGAPAN (KASTAMONU ENTEGRE)(D.İskelesi)	2012	15.0	Natural Gas	90.00
392	ZORLU ENERJİ (B.Karıştıran)	2012	25.7	Natural Gas	195.00
393	YAĞMUR REG. VE HES (BT BORDO ELK. ÜR.)	2012	8.9	Hydro (run of river)	0.00
394	YAMANLI III KAPS. GÖKKAYA HES (MEM ENERJİ)	2012	28.5	Hydro (run of river)	0.00
395	YAMANLI III KAPS. HİMMETLİ HES (MEM ENERJİ)	2012	27.0	Hydro (run of river)	0.00
396	YAVUZ HES (AREM ENERJİ ÜRETİM A.Ş.)	2012	5.8	Hydro (run of river)	0.00
397	YEDİSU HES (ÖZALTIN ENERJİ ÜRETİM VE İNŞAAT)	2012	22.7	Hydro (run of river)	41.00
398	YENİ UŞAK ENERJİ ELEKTRİK SANTRALI	2012	9.7	Natural Gas	62.00
399	YILDIRIM HES (BAYBURT ENERJİ ÜRETİM	2012		Hydro (run of river)	22.00

	VE TİC.)		10.7		
400	YOKUŞLU KALKANDERE HES (SANKO ENERJİ)	2012	5.2	Hydro (run of river)	0.00
401	YONGAPAN (KASTAMONU ENTEGRE)(D.İskelesi)	2012	15.0	Natural Gas	90.00
402	ZORLU ENERJİ (B.Karıştıran)	2012	25.7	Natural Gas	195.00