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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Refurbishment of Enguri Hydro Power Plant, Georgia. Version 1, completed in June 2007

A.2. Description of the project activity:

Enguri Hydro Power Plant (HPP) is the largest hydropower plant connected to the Georgian power grid. Located at the Enguri river, it consists of the 272 m high Enguri Arch Dam, a 16km long head-pressure tunnel and the Enguri Power House with five generating units, with five Francis turbines installed, giving 1300 MW of total installed capacity (260MW each) and expected total annual electricity output of GWh 4,430. The capacity of Enguri reservoir is 1.1 billion m^3.

Since the original commissioning of Enguri HPP (1978-1980), four generating units (out of five) have been operating at relatively low efficiency (230 MW each) and in the regime of frequent emergency shut-downs. The fifth unit (Unit #3) was completely shutdown in 1993 due to damage to the mechanical parts and faulty initial design. Planning for the rehabilitation of Enguri power units started in 1998-99 thanks to the financial and technical support of the European Bank for Reconstruction and Development (EBRD) and the European Commission. The aim of the rehabilitation is correcting certain inadequacies of initial soviet design and construction in an attempt to increase output potential and reliability.

The full-scale rehabilitation of Enguri includes the rehabilitation of five generating units (Unit #1, #2, #3, #4, #5); improvements to the dam structure and reduction in leakages from the high pressure pipeline; repair of the water gates at the dam site; and completion of the grouting work at the dam galleries and pressure tunnel. Enguhresi Ltd is the fully state-owned company in charge of operating and maintaining Enguri HPP.

Between 2001 and 2007, the following financing sources for the overall rehabilitation project (incliding units rehabilitation and all other works) were identified. Total EBRD loan equals USD 48.7 million (or EUR 36.34 million given the exchange rate of June 2007) and total European Commission grant equal to EUR 11.3 million. The Government of Georgia has pledged to contribute a total of USD 12.9 million to the overall project to co-finance the overall project, however this will be fully used to cover only local taxes associated with imports of new equipment and execution of the project. Therefore these resources could not be used to co-finance the project itself. The Government of Georgia and Enguhresi Ltd plan to obtain part of the necessary financial resources from the sale of CERs and thus the revenues from CERs are essential for the financial viability of this CDM project activity.

The status and specific conditions of each generating unit are described as follows:

- **Unit #3.** The rehabilitation of Unit #3 was considered of high priority, given the fact that it was completely shut down in 1993. The cost for rehabilitating Unit #3 as well as designing the rehabilitation of all the remaining units was EUR 7,236,456 and USD 1,797,189 (or a total of USD 11,651,678 given June 2007 exchange rates). These costs were entirely covered by the EBRD, the European Commission and the Government of Georgia (the latter covered only the local tax charges associated with imports of equipment and execution of the project). The construction works on Unit #3 initiated in 2003 and were completed at the beginning of 2006. Unit #3 is **not included** in the scope of the proposed CDM project activity.

- **Unit #2**. The costs of rehabilitating Unit #2 (including auxiliary equipment) are EUR 6,992,932 and USD 1,470,146 (or a total of USD 10,993,965 given June 2007 exchange rates). The EBRD, European Commission and the Government of Georgia pledged to cover the costs of rehabilitation of this unit. However, the Government of Georgia was co-financing only taxes. The continuous devaluation of US$/EUR exchange rate over the past four years negatively affected the available finances, because when the US dollars were lent (pledged) by EBRD in 2002 they were sufficient to cover the contract costs mainly quoted in euros. By beginning of 2007, Enguhresi Ltd found itself short of USD 897,902 for the completion of Unit #2. Since the contract with the engineering company was already signed, Enguhresi was forced to use the needed resources from the financing initially allocated by EBRD and European Commission to other Enguri units. The anticipation of revenues stemming from the sale of Certified Emission Reductions was a key factor for Enguhresi in the decision-making process. In fact, Enguhresi was aware of the financing pledged by EBRD and European Commission for the Units 1, 4 and 5 and could already gauge the overall size of the financing shortfall without the CER revenues. The rehabilitation of Unit #2 was initiated in mid 2006 and is due to be completed at the end of July 2007. For the above-mentioned reasons the upgrade of Unit #2 **is included** in the scope of the proposed CDM project activity.
- **Unit #4.** The cost of rehabilitating Unit #4 is EUR 4,195,050 and USD 1,442,929 (or a total of USD 7,156,117 given June 2007 exchange rates). These costs are to be partly covered by finance provided by EBRD and the European Commission and partly by revenues from Certified Emission Reductions. The rehabilitation works will begin in August 2007 and are expected to be concluded by end of August 2008. The upgrade of Unit #4 **is included** in the scope of the proposed CDM project activity.
- **Unit #1.** The cost of rehabilitating Unit #1 is EUR 4,908,210 and 1,688,227 (or a total of USD 8,363,392 given June 2007 exchange rates). These costs are to be partly covered by finance provided by EBRD and the European Commission and partly by revenues from Certified Emission Reductions. The rehabilitation works will begin in October 2008 and are expected to be concluded by end of March 2010. The start date of the rehabilitation of Unit 1 is delayed compared to the initial planning because of a technical problem with the turbine of Unit #1 which was discovered by mid 2006. In particular, when planning for the rehabilitation time-schedule on the turbine, the contracted engineers found that the turbine of Unit #1 is of slightly different design. Although its rehabilitation will take similar time as of the rest of the units, due to a different design it is impossible to start with the rehabilitation of the generator itself until the turbine works are completed and the turbine is inserted back into the pit. This problem unfortunately causes the overall rehabilitation schedule for the last unit to be delayed exactly by the time required to complete the repair works on turbine #1 (five months). The upgrade of Unit #1 **is included** in the scope of the proposed CDM project activity.
- **Unit #5.** The cost of rehabilitating Unit #5 is EUR 4,908,210 and 1,688,227 (or a total of USD 8,363,392 given June 2007 exchange rates). These costs are to be partly covered by finance provided by EBRD and the European Commission and partly by revenues from Certified Emission Reductions. The rehabilitation works will begin in April 2010 and are expected to be concluded by end of August 2011. The upgrade of Unit #5 **is included** in the scope of the proposed CDM project activity.

The upgrade of Unit #2, Unit #4, Unit #1 and Unit #5 under the Enguri HPP Rehabilitation Project is the proposed project activity under the Clean Development Mechanism. Thus, the project boundary includes the project site that is actually rehabilitated under the CDM project activity and it corresponds to the Unit # 2, Unit # 4, Unit # 1 and Unit # 5 of the Enguri hydro power plant.

The ultimate goals of the CDM project are to:

- increase the reliability of the Enguri Hydro Power Plant,
- increase its operating capacity by 160 MW (40 MW per unit)
- considerably increase the capacity factor of the plant (i.e. the number of full load operating hours).
- considerably reduce leakage in the dam and the pressure tunnel in order to lead to a more efficient use of the hydro resource of the existing reservoir (which will not change).

The proposed CDM project activity will allow Enguri HPP to produce more electricity without the need to construct an additional power plant. The CDM project will reduce the need to use electricity based on fossil fuel combustion. The overall reduction of GHG during the crediting period is estimated at an average of **234,257** tonnes of CO2 equivalent (CO2e) per year or **2,342,577 tonnes of CO2e** over a ten year crediting period (January 2008 – December 2017), by offsetting more carbon-intensive electricity production from the Georgian electric grid.

Contribution to Sustainable Development
According to the project participants, this project contributes to sustainable development in Georgia. Specifically, the project contributes as follows to the three aspects of sustainable development: economic, environmental and social aspects:

<u>*Economic aspects*</u>

- *Sustainable technology transfer*: Internationally renown engineering firms (Voiht Siemens, Stucky, Electrowatt-Econo and Electricite de France) are involved in this project and modern technology is transferred to Georgia. In addition, the performance of contracted companies and correctness of the chosen design have now been proven at the completed Unit # 3 of the Enguri HPP
- *Effect on the region*: The project is implemented in the Gali region, which is a relatively rural and economically disadvantaged region of Georgia.
- *Employment generation*: New employment is created during construction works at Enguri HPP.
- *Project's effect on other ongoing sectoral programs and plans*: The project will help Georgia to achieve the target set by the Georgian Ministry of Energy of "ensuring energy security through the re-equipment of existing power capacity and construction of new facilities" (Main Directions of the State Power Sector of Georgia). The electricity supplied by Enguri HPP is of primary importance for Georgia. In fact, electricity supplied by Enguri HPP contributed to 30% of total Georgian electricity production in 1988, rising to 45% in 1995 and down to 36% in 2005 (Source: Energy Balance of Georgia Power Sector, Ministry of Energy, Georgia). In addition, the project allows to diversify the sources of electricity generation and decreases dependence on imported natural gas from Russia, especially in a period of increasing export gas prices. Considering that Georgia's energy sector is heavily dependent on importing gas to supplement hydro-power during electricity shortfalls (which constitutes the largest item in the country's import bill), reduction of gas imports will have a significant positive effect on the weak Balance of Payments of Georgia.

<u>*Environmental aspects*</u>

- *Substitution of fossil fuels*: The project will substitute the power plants on the margin of the electricity system in Georgia. These are hydro power plants and thermal power plants running on natural gas.

- *Air quality*: The project can reduce over 230,000 tCO_2 per year. In addition, the project will reduce local pollutant emissions (NO_x, SO_2, VOCs) associated with electricity generation in Georgia, with positive health impacts for the local population
- *Water quality*: The existing water reservoir will not be increased. Water resources will be used more efficiently. Although, waste oil was stored on site and the river and drainage water were contaminated with oil, after Phase 1 of the Rehabilitation Project, secondary oil has been treated in the regeneration plant for refining and reuse
- *Impact on land resources*: No contamination of soil was detected during the inspection period.
- *Contribution to environmental conventions*: The project will contribute to meet the Kyoto Protocol goals and the Millennium Development goals (poverty reduction, energy security, environmental benefits)

Social aspects

- *Stakeholders contributions:* A stakeholder consultation was organised specifically for this project in Tbilisi on 12 March 2007. The further publication of the PDD and relative documents of this project on the websites of the chosen Designated Operational Entity and the UNFCCCC website will be essential to receive further comments on this project. All comments received will be taken into account by the Project Participants.
- *Availability of better living conditions*: The project contributes to increased safety of the region surrounding the dam structure. As mentioned above, the project generally contributes to increased energy security in the country.
- *Development of intellectual capacity*: The introduction of updated technology and training of local employees will contribute to Georgian intellectual capacity
- *Political issues*: The project contributes to a more politically stable situation at the border with Abkhazia, as the dam structure and the power station are situated in different regions of Georgia. Despite the extremely difficult political situation, Phase 1 of the Enguri project has been the only concrete joint initiative undertaken by both Abkhazian and Georgian communities. The severe tension between the two communities can be improved thanks to the cooperative nature of this CDM project.

A.3. Project participants:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
UK or Netherlands (to be determined)	EBRD	No
Georgia (host)	Engurhesi Ltd.	Yes

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

Enguri Hydro Power Plant is located in the Gali Region of Abkhazia, near to the north-east coast of the Black Sea.

A.4.1.1. Host Party(ies):

Georgia

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

Gali Region of Abkhazia

A.4.1.3. City/Town/Community etc:

The water reservoir of Enguri HPP is located deep in the gorge, along the flow of the river Enguri, at a distance of 5 km from the settlement of Jvari. The power house is situated 15 km from the dam, on territory of the village of Saberio. The CDM project will take place at the power house, near the town of Saberio

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

Latitude: 42° 65’ 30’’ N
Longitude: 41° 93’ 50’’ E
Elevation: 256 m

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

This CDM project correspond to a project within the Sectoral Scope Number 1: Energy Industries (renewable -/ non-renewable sources).

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

Technologies to be employed relate to the rehabilitation of hydro power plants. The rehabilitation and upgrade of each power plant unit includes the following technical activities: upgrading of generators, voltage regulator and excitation systems, low voltage equipment/accessories, unit control, protection, monitoring systems, speed governors, spherical valve operating mechanisms, supply of mandatory spare parts for each rehabilitated units, rehabilitation of common AC and DC auxiliaries, 10kV cables and transformers, drainage system and compressed air system.

The engineering and construction company involved in the project is a major international firm, Voigt Siemens (Germany) which works on the basis of a turnkey performance based contract with Engurhesi Ltd. The contracted company in charge of the rehabilitation work of all the units at Enguri. In addition, Stucky (Switzerland), Electrowatt-Econo (Switzerland), and Electricite de France (France) form a consortium of companies in charge of the supervision of the rehabilitation work and acting as independent engineers. The companies are world-renown engineering, power and construction firms that apply state of the art technology. The excellent performance of the contracted companies as well as the correctness of the design chosen for the rehabilitation of all Enguri units have now been proven. In fact, one Enguri unit (Unit # 3) has already been rehabilitated and successfully commissioned.

The engineering, construction and supervision contracts signed by Enguhresi Ltd and the above-mentioned firms include training of local employees at Enguri HPP. Project participants are particularly keen on the project covering an extensive training programme for the employees of Enguri HPP to ensure that the rehabilitated assets are used in an optimal way. Notably in the past, due to the civil unrest in the Abkhazian region, several experienced operational staff at Enguri have been forced to leave and many have not returned. It is therefore expected that this training will contribute to increased professionalism among electricity sector workers in Georgia. Thus this CDM project will contribute to the transfer of environmentally safe and sound technology and know-how to Georgia.

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

Total annual emission reductions from the electricity generated by the project are estimated as **234,257** tonnes of CO2 equivalent (CO2e) per year or **2,342,577 tonnes of CO2e** over a ten year crediting period from January 2008 to December 2017.

Years	Annual Estimation of Emission Reductions in tCO2e
Half Year 1) January 2008- December 2008	92,319
Full Year 1) January 2009- December 2009	138,478
Full Year 2) January 2010- December 2010	190,407
Full Year 3) January 2011- December 2011	259,646
Full Year 4) January 2012- December 2012	276,956
Full Year 5) January 2013- December 2013	276,956
Full Year 6) January 2014- December 2014	276,956

Full Year 7) January 2015- December 2015	276,956
Full Year 8) January 2016- December 2016	276,956
Full Year 9) January 2017- December 2017	276,945
Total estimated reductions (tCO2e)	2,342,577
Total number of crediting years	10
Annual average of estimated reductions over the crediting period	234,257

A.4.5. Public funding of the project activity:

EBRD is providing a loan to Engurhesi Ltd. for the rehabilitation works at the Enguri HPP. EBRD does not claim any compensation in the form of certified emission reductions (CERs) for the repayment of the loan. EBRD funding does not result in a diversion of official development assistance.
In addition the European Commission provides a grant to Engurhesi Ltd. for the rehabilitation works at the Enguri HPP. The European Commission states that this grant does not constitute diversion of official development assistance funds.

SECTION B. Application of a baseline and monitoring methodology

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

Version 06 of ACM0002 Consolidated baseline methodology for grid-connected electricity generation from renewable sources.
Version 02 of the Tool for the demonstration and assessment of additionality.

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

ACM0002 is applicable to grid-connected renewable power generation project activities under the following conditions:

- *Applies to electricity capacity additions from:*
    - *Run-of-river hydro power plants; hydro power projects with existing reservoirs where the volume of the reservoir is not increased.*
    - *New hydro electric power projects with reservoirs having power densities (installed power generation capacity divided by the surface area at full reservoir level) greater than 4 W/m2*
    - *Wind sources;*
    - *Geothermal sources;*
    - *Solar sources;*
    - *Wave and tidal sources.*

The refurbishment of Enguri hydro power plant is a renewable power generation project activity connected to the Georgian power grid. The project includes an existing reservoir of 1.1 billion m^3 whose volume will not be increased during or after the project implementation. This information is stated in the "Enguri Dam and Hydroelectric Power station, Georgia. Feasibility study for rehabilitation. Part 1. Technical and economic studies" dated February 1998.

- *This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;*

The refurbishment of Enguri hydro power plant does not involve switching from fossil fuels to renewable energy at the site.

- *The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available; and*

The boundaries for the Georgian grid system are clearly identified and information of the characteristics of the Georgian grid is available and presented in the following sections.

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

Emission sources

As per the ACM0002 methodology *"For the baseline determination, project participants shall only account CO2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity."* The spatial extent of the project boundary includes the project site that is actually rehabilitated (which corresponds to Units # 2, #4, #1 and #5 of the Enguri HPP) and all the plants connected physically to the electricity system that the CDM project power plant is connected to.

Under the project scenario there are no sources of CO_2, CH_4 and N_2O from within the project boundary. In fact, the Enguri Rehabilitation project is not a new hydroelectric project with reservoirs, and thus the project boundary does not need to include the reservoir area. Due to this CDM project the reservoir area will not increase.

Baseline	Source	Gas	Included?	Justification/explanation
	No sources	CO2	Yes	
		CH4	No	
		N20	No	
Project Activity	No sources	CO2	No	
		CH4	No	
		N20	No	

In addition, no CO_2 emissions from transportation or project construction are to be accounted and therefore no leakage is accounted for in this project activity. In addition, since the reservoir is not modified by the proposed project activity, no sources of methane (from decay of flora/fauna in the reservoir) are accounted for in this project activity.

Spatial extent of the project boundary

As per the ACM0002 methodology *"The **spatial** extent of the project boundary includes the project site and all power plants connected physically to the electricity system that the CDM project power plant is connected to.*

*For the purpose of determining the build margin (BM) and operating margin (OM) emission factor, as described below, a (regional) **project electricity system** is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints".*

As the Georgian DNA has not specifically defined the spatial extent of the project electricity system in which power plants can be dispatched without significant transmission constraints, the whole Georgian electricity grid was defined in this PDD as the project electricity system.

In addition, the imports of electricity from Russia and Armenia were included in the spatial extent of the project boundary for the purposes of calculation of the operating margin (OM), as requested by the ACM002 methodology.

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

Calculation of the emission factor of the Georgian grid (EF_y)

Version 06 of ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable sources” states that
The baseline emission factor (EFy) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps. Calculations for this combined margin must be based on data from an official source (where available) and made publicly available.
The operating margin and the build margin are derived from the data published or obtained from the following organisations:

- Central Electricity Dispatch Center of Georgia supplied Enguhresi Ltd and the Armenian Designated National Authority with a load data spreadsheet of the Georgian electricity system for the years 2006, 2005 and 2004. The data supplied included the hourly load (in MW) of electricity supplied to the Georgian grid and the imports of electricity from other grids to the Georgian grid. The data were sent directly by e-mail to the Carbon Consultant.
- Intergovernmental Panel on Climate Change, “Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories”. Workbook Vol 2. Table 1-2, page 1.6 (http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1wb1.pdf)

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

According to the ACM0002 methodology, the Operating Margin calculation must be based on one of the four following methods:
(a) Simple OM, or
(b) Simple adjusted OM
(c) Dispatch data analysis OM
(d) Average OM.
The simple OM emission factor can be calculated using either of the two following data vintages for years(s) y:

- *Option 1: The full generation-weighted average for the most recent 3 years for which data are available at the time of submission of the PDD*
- *Option 2: The year in which project generation occurs, if emission factor is updated based on ex post monitoring.*

Among the four methods for calculating the OM, the Simple Adjusted OM (method b) is chosen.

- The Dispatch Data Analysis OM cannot be selected because of the unavailability of the detailed dispatch data for the Georgian grid.

- The Simple OM (method a) cannot be applied in Georgia since the low-cost/must run resources (i.e. hydro generation) constitute more than 50% of total grid generation in the average of the five most recent years as shown in the table below. The sources of the data used in the following table are:
  - ✓ For 2002 to 2003: The data is published on the website of the Georgian Ministry of Energy: "Energy Balance" of the power sector of Georgia: Part 1. Analysis and Proposals. The report studies the energy balance of the power sector in Georgia from 1960 to 2006.
  - ✓ For 2004 to 2006 the load data supplied by Ministry of Energy, Georgia (CDM Council).

Year	2002	2003	2004	2005	2006
Percentage of low-cost/must run resources in total generation	92.71%	91.13%	74.46%	71.53%	64.34%
Average of five years	78.85%				

- The Central Electricity Dispatch Center of Georgia has supplied the DNA with the data necessary to plot the Load Duration Curve and estimate the factor lambda for the year 2004, 2005 and 2006 for the Georgian electricity grid. Given the difficulty for the project developer to obtain such a large dataset *ex post* for each year in which electricity generation occurs from the CDM project, the *ex ante* vintage was chosen.

The calculations that quantify the baseline and the carbon emission factor of the Georgian grid are shown in the Section B 6.4 of this PDD, relevant sourcing has also been indicated.

The remainder of this section presents the discussion on the grid-connected facilities that are considered for the calculation of the operating margin and the build margin.

<u>Choice of plants for the operating margin calculation</u>

The table below presents all the plants considered for the calculation of the operating margin for 2004, 2005 and 2006. If hydro, geothermal, wind, low-cost biomass, nuclear and solar generation is excluded, then only four thermal power plants remain in the operating margin: thermal power plants Tbilsresi, Mtkvari, Tbiltetsi for 2005 and 2004. In addition to these existing thermal power plants the CCGT Energy-Invest, is included in the operating margin for 2006, as it entered into operation in 2006.

It must be noted that Tbiltetsi has not been running since 2002. The imports from Russia, Turkey and Armenia are also included in the calculation of the operating margin. It must be noted that since the imported electricity comes from other countries, the emission factor of all the imports was assumed to be 0 tons of CO2 per MWh (as prescribed on page 4 of the ACM0002 methodology).

The power sources included in the operating margin calculation are highlighted in the table below.

Power Plants	Date Commissioned	Fuel Source	Capacity	Generation (2004)	Generation (2005)	Generation (2006)
			MW	GWh	GWh	GWh
Tbilsresi	1965	Natural Gas (dry)	150.0	21.47	292.10	710.43
AES Mtkvari	1990	Natural Gas (dry)	300.0	791.73	666.32	1,218.07
CCGT Energy-Invest	2005	Natural Gas (dry)	50.0	-	-	296.52
Tbiltetsi	1911	Natural Gas (dry)	18.0	-	-	-
Zahesi	1927	Hydro	37.0	167.67	147.86	162.90
Abhesi	1928	Hydro	1.8	3.19	2.82	2.40
Rionhesi	1933	Hydro	48.0	288.80	296.41	291.32

Power Plants	Date Commissioned	Fuel Source	Capacity	Generation (2004)	Generation (2005)	Generation (2006)
			MW	GWh	GWh	GWh
Dashbash	1936	Hydro	1.3	7.33	6.88	5.96
Atsihes	1937	Hydro	16.0	53.61	61.04	72.48
Kekhvihesi	1941	Hydro	1.0	-	-	1.17
Alazanhesi	1942	Hydro	4.8	12.17	15.31	5.49
Khrami-1	1947	Hydro	113.0	238.77	196.97	339.36
Chitakhevhesi	1949	Hydro	21.0	100.43	109.52	108.36
Khertvisihesi	1950	Hydro	0.3	1.08	0.76	0.65
Mashaverahesi	1951	Hydro	0.6	0.23	-	0.45
Tiriponhesi	1951	Hydro	3.0	-	-	3.02
Kazbegihesi	1951	Hydro	0.3	-	-	0.46
Kabalihesi	1953	Hydro	1.5	3.17	1.36	0.87
Martkophesi	1953	Hydro	3.9	3.36	4.65	6.06
Ortachalhesi	1954	Hydro	18.0	81.84	87.40	89.90
Shaorhesi	1955	Hydro	38.0	97.14	109.42	68.02
Tetrikhevhesi	1956	Hydro	14.0	20.04	29.02	29.37
Satskhenisihesi	1956	Hydro	14.0	32.67	43.34	46.19
Gumathesi	1956	Hydro	44.0	210.00	203.07	223.64
Dzevrulhesi	1956	Hydro	80.0	111.69	127.94	85.60
Machakhelahesi	1956	Hydro	1.4	-	3.98	6.90
Squrhesi	1958	Hydro	1.0	1.92	1.72	1.53
Bzhuzhahesi	1958	Hydro	12.0	52.42	61.74	48.81
Lajanurhesi	1960	Hydro	112.0	86.30	125.33	288.89
Misaktsieli-Ento	1961	Hydro	2.7	2.33	4.20	5.41
Khrami-2	1963	Hydro	110.0	3.01	126.61	119.96
Sionhesi	1964	Hydro	9.1	39.47	41.63	29.38
Ritseulahesi	1967	Hydro	6.1	24.22	24.31	24.42
Chkhorhesi	1967	Hydro	5.4	4.36	6.52	6.52
Vardnilhesi	1971	Hydro	220.0	384.22	424.95	347.29
Vartsikhehesi	1976	Hydro	184.0	680.25	674.07	752.03
Engurhesi	1978	Hydro	1,300.0	2,728.12	2,535.24	1,667.51
Zhinvalhesi	1985	Hydro	130.0	437.93	401.66	393.55
Intsobahesi	1993	Hydro	1.7	1.47	2.67	2.27
JSC "Kindzmarauli"	2001	Hydro	1.5	3.45	2.34	3.67
Munleik-Georgia	2002	Hydro	20.0	6.93	4.69	22.37
Khadorhesi	2004	Hydro	24.0	3.15	36.89	131.21
Net imports from Russia, Armenia, Turkey				1,207.60	1,398.64	766.06
Total			**3,120.2**	**7,913.54**	**8,279.38**	**8,386.46**

The Simple Adjusted Operating Margin is calculated in detail in section B.6.3 (Ex-ante calculation of emission reductions) according to formulas stated in Section B.6.1 (Explanation of methodological choices).

The Simple Adjusted Operating Margin ($EF_{OM,\ ssimple\_adjusted,\ y}$) is calculated to be 0.2005 kg CO2/ kWh for 2004; 0.2178 kg CO2/ kWh for 2005 and.0.3930 kg CO2/ kWh for 2006.

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

According to the ACM0002 methodology, the Build Margin calculation must be the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants *m*:

The sample group m consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation. Power plant capacity additions registered as CDM project activities should be excluded from the sample group m. If 20% falls on part capacity of a plant, that plant is included in the calculation.

The build margin emission factor can be calculated using either of the following data vintages for years(s) y:

Option 1: Calculate the Build Margin emission factor $EF_{BM,y}$ ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission.

Option 2: For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated ex-ante, as described in option 1 above.

For the calculation of the build margin the *ex-ante* vintage (Option 1) is chosen, given the availability of data on plants already built at the time of PDD submission. As per the latest expansion plan of the Government of Georgia thermal power plants and hydro plants are expected to be commissioned. However, it is likely that delay in commissioning of the new costly plants may continue for years. Thus, the PDD calculates the baseline's emissions based strictly on the power plants that were in operation by December 2006.

Also according to ACM0002 methodology:

For the purpose of determining the Build Margin (BM) emission factor, as described below, the spatial extent is limited to the project electricity system, except where recent or likely future additions to transmission capacity enable significant increases in imported electricity. In such cases, the transmission capacity may be considered a build margin source, with the emission factor determined as for the OM imports below.

For the calculation of the Build Margin imports from Russia, Armenia and Turkey are excluded given the fact that there are no plans for transmission capacity expansion in Georgia.

Choice of plants for the build margin calculation

As per ACM0002, the build margin was calculated according to the two available methods:

1) The power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. These include: two thermal plants (Mtkvari and CCGT Energy-Invest) and four hydro power plants (Intsobahesi, JSC "Kindzmarauli", Munleik-Georgia and Khadorhesi). The sum of these plants' electricity generation is 1,674 million kWh and it contributes to 21.97% of total Georgian electricity production.
2) The five power plants that have been built most recently are the thermal plant CCGT Energy-Invest and the four hydro plants Intsobahesi, JSC "Kindzmarauli", Munleik-Georgia and Khadorhesi. The sum of these plants electricity generation is 456.04 million kWh and it contributes to 5.98% of total Georgian electricity production.

It results that the First definition (1) of build margin corresponds to the larger electricity contribution in 2006. The choice of plants for the build margin calculation is highlighted in the table below.

Power Plants	Date Commissioned	Fuel Source	Capacity	Generation (2006)	% of Generation Mix	Cumulative % of Generation Mix
			MW	Million kWh	%	%
Tbiltetsi	1911	Natural Gas (dry)	18.0	-	0%	100%
Zahesi	1927	Hydro	37.0	162.90	2%	100%
Abhesi	1928	Hydro	1.8	2.40	0%	98%
Rionhesi	1933	Hydro	48.0	291.32	4%	98%
Dashbash	1936	Hydro	1.3	5.96	0%	94%
Atsihes	1937	Hydro	16.0	72.48	1%	94%
Kekhvihesi	1941	Hydro	1.0	1.17	0%	93%
Alazanhesi	1942	Hydro	4.8	5.49	0%	93%
Khrami-1	1947	Hydro	113.0	339.36	4%	93%
Chitakhevhesi	1949	Hydro	21.0	108.36	1%	88%
Khertvisihesi	1950	Hydro	0.3	0.65	0%	87%
Mashaverahesi	1951	Hydro	0.6	0.45	0%	87%
Tiriponhesi	1951	Hydro	3.0	3.02	0%	87%
Kazbegihesi	1951	Hydro	0.3	0.46	0%	87%
Kabalihesi	1953	Hydro	1.5	0.87	0%	87%
Martkophesi	1953	Hydro	3.9	6.06	0%	87%
Ortachalhesi	1954	Hydro	18.0	89.90	1%	87%
Shaorhesi	1955	Hydro	38.0	68.02	1%	86%
Tetrikhevhesi	1956	Hydro	14.0	29.37	0%	85%
Satskhenisihesi	1956	Hydro	14.0	46.19	1%	84%
Gumathesi	1956	Hydro	44.0	223.64	3%	84%
Dzevrulhesi	1956	Hydro	80.0	85.60	1%	81%
Machakhelahesi	1956	Hydro	1.4	6.90	0%	80%
Squrhesi	1958	Hydro	1.0	1.53	0%	80%
Bzhuzhahesi	1958	Hydro	12.0	48.81	1%	80%
Lajanurhesi	1960	Hydro	112.0	288.89	4%	79%
Misaktsieli-Ento	1961	Hydro	2.7	5.41	0%	75%
Khrami-2	1963	Hydro	110.0	119.96	2%	75%
Sionhesi	1964	Hydro	9.1	29.38	0%	74%
Tbilsresi	1965	Natural Gas (dry)	150.0	710.43	9%	73%
Ritseulahesi	1967	Hydro	6.1	24.42	0%	64%
Chkhorhesi	1967	Hydro	5.4	6.52	0%	64%
Vardnilhesi	1971	Hydro	220.0	347.29	5%	63%
Vartsikhehesi	1976	Hydro	184.0	752.03	10%	59%
Engurhesi	1978	Hydro	1,300.0	1,667.51	22%	49%
Zhinvalhesi	1985	Hydro	130.0	393.55	5%	27%
AES Mtkvari	1990	Natural Gas (dry)	300.0	1,218.07	16%	21.97%
Intsobahesi	1993	Hydro	1.7	2.27	0%	5.98%
JSC "Kindzmarauli"	2001	Hydro	1.5	3.67	0%	6%
Munleik-Georgia	2002	Hydro	20.0	22.37	0%	6%

Power Plants	Date Commissioned	Fuel Source	Capacity	Generation (2006)	% of Generation Mix	Cumulative % of Generation Mix
			MW	Million kWh	%	%
Khadorhesi	2004	Hydro	24.0	131.21	2%	6%
CCGT Energy-Invest	2005	Natural Gas (dry)	50.0	296.52	4%	4%
Total (Excluding Export)			**3120.2**	**7620.40**		

It must be noted that thermal and hydro power plants in Georgia are composed of units that have been commissioned in different years. Since the UNFCCC guidelines refer to the term "plants" in the calculation of the build margin, the year when the last unit of the plant was commissioned is used as the year of commissioning of the whole plant.

The build margin is calculated in detail in Section B.6.3 (Ex-ante calculation of emission reductions) according to the formula stated in Section B.6.1 (Explanation of methodological choices). The Build Margin ($EF_{BM,y}$) is calculated to be **0.4958** kg CO2/ kWh.

STEP 3: Calculate the baseline emission factor EF_y

The baseline emission factor EF_y is calculated as the weighted average of the generation-weighted average of Simple Adjusted Operating Margin emission factor ($EF_{OM, simple\_adjusted, y}$) and the Build Margin emission factor ($EF_{BM,y}$)

The weights applied to the Operating and the Build Margins are 0.5 as requested by the ACM0002 methodology for hydro plants. The baseline emission factor is calculated as follows:

Baseline Emission Factor = 0.5 [(2004 Simple Adjusted Operating Margin x 2004 Generation + 2005 Simple Adjusted Operating Margin x 2005 Generation +2006 Simple Adjusted Operating Margin x 2006 Generation) / (2004 Generation + 2005 Generation + 2006 Generation)] + 0.5 [2006 Build Margin]

Or Baseline Emissions Factor = [0.5 * [(0.2005 * 7913.54 + 0.2178 * 8279.38 + 0.3930 * 8386.46) / (7913.54+8279.38+8386.46)]] + [0.5 * 0.4958]
= 0.3839

The Baseline Final Emission Factor is calculated to be **0.3839** kg CO2e/kWh.

STEP 4. Calculate the baseline emissions

This CDM rehabilitation project is a project activity that retrofits three generation units (Unit # 2, Unit # 4, Unit # 1 and Unit # 5) of Enguri HPP. For such a project activity, the baseline emissions are the following:

In the absence of the CDM project activity, the existing facility would continue to provide electricity to the grid ($EG_{baseline}$, in MWh/year) at historical average levels ($EG_{historical}$, in MWh/year), until the time at which the generation facility would be likely be replaced or retrofitted in the absence of the CDM project activity ($DATE_{BaselineRetrofit}$). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and baseline electricity production ($EG_{baseline}$) is assumed to equal project electricity production (EG_y, in MWh/year), and no emission reductions are assumed to occur.

Where EGhistorical is the average of historical electricity delivered by the existing facility to the grid, spanning all data from the most recent available year (or month, week or other time period) to the time at which the facility was constructed, retrofit, or modified in a manner that significantly affected output (i.e., by 5% or more), expressed in MWh per year.

Thus *EGhistorical* is the level of electricity that would have been generated and inputted into the national grid by the existing facility units, in the absence of the CDM project activity. The *EGhistorical* is the average of historic production levels of existing facility Units #4, #1, #5 between 1981 and 2006. Data were available for the years 1981 to 2005 for the Unit #2. The generation level of Unit #2 in 2006 was zero given the fact that the unit was taken off operation for the purposes of the rehabilitation project. During the historical years considered units have operated normally without any exceptional generation peaks or shortfalls. The data were supplied by Enguhresi Ltd and were recorded in the company accounts. As shown in Section B.6.3. (Step 5) under a baseline scenario the project activity would supply an average of 2,638.6 GWh of electricity per year or an average of 659.6 GWh per Unit.

In order to estimate the point in time *($DATE_{BaselineRetrofit}$)* when the existing equipment would need to be replaced in the absence of the project activity, one of the following approaches has to be taken:
(a) The typical average technical lifetime of the type equipment may be determined and documented, taking into account common practices in the sector and country, e.g. based on industry surveys, statistics, technical literature, etc.
(b) The common practices of the responsible company regarding replacement schedules may be evaluated and documented, e.g. based on historical replacement records for similar equipment.

Given the availability of data Option (a) is chosen. The technical lifetime of a hydropower plant subject to continuous and adequate operational maintenance is over 100 years. The technical lifetime reduces if ordinary maintenance works are not properly conducted, as was the case of Enguri HPP after the collapse of the Soviet Union and the independence of Georgia.

In particular, the technical lifetime of Enguri HPP Units included in the CDM project is analyzed in the document entitled "Enguri Dam and Hydroelectric Power station, Georgia. Feasibility study for rehabilitation. Part 1. Technical and economic studies" dated February 1998 and prepared for the EBRD by the Joint Venture between Elektrowatt Engineering Ltd (Switzerland) and Stucky Ingenieurs Conseils SA (Switzerland). After conducting inspection works in summer 1997 on the technical status of the power plant, the team of engineers concluded that (paraphrase):

- The turbines at Units 2, 4, 1 and 5 have operated for about 65,000 hours and are well capable of another 50,000 to 60,000 hours of operating service before their runners need replacing. Previous general overhauls have taken place every three to four years, but have taken 8 weeks to overcome so it can be assumed that the turbines have never been dismantled fully.
- The electric equipment is in very poor condition as only those repairs necessary for operation or to ensure that the minimum levels of reliability are achieved were carried out.
- The generators at Units 2, 4, 1 and 5 are affected by faulty Soviet design. Temporary repairs to the insulation systems of the generators allowed all serviceable machines to run up to 230 MW each, but are not able to run at full 260 MW capacity because of vibration problems.

It can therefore be assumed that Engurhesi Ltd would continue to operate a similar level of maintenance works as in the past years, which would maintain the effective capacity of each unit at the low level of 230 MW. The expected lifetime of turbines was calculated at the end of 1997 and was equal to 55,000-60,000 hours. Given the historic average capacity factor of 2,638.6 hours of the four units at Enguri HPP (as calculated in Section B.6.3, Step 4) the expected lifetime of the turbines is between 19.2 and 20.9 years. The technical lifetime of the turbines should expire between the beginning of 2017 and the end of 2018, which corresponds to more or less to the entire CDM crediting period chosen. The $DATE_{BaselineRetrofit}$ is thus chosen as the midpoint of the estimated period, or the beginning of 2018.

The baseline emissions are calculated in detail in Section B.6.3 according to formula stated in Section B.6.1. (Explanation of methodological choices). The baseline emissions are represented in the table in section A.4.4 of this document.

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

As per the selected methodology ACM0002, the project proponent is required to establish that the GHG reductions due to the project activity are additional to those that would have occurred in the absence of the Enguri project activity as per the 'Tool for the demonstration and assessment of additionality' Annex-1 to EB 16 Report. Additionality of project activity as described in the selected methodology (ACM0002) is discussed further.

Step 0. Preliminary screening based on the starting date of the project activity

Since Enguhresi Ltd. wishes to have the crediting period starting after the registration of the CDM project activity, this step of the Additionality Tool is not applicable. Nevertheless, the incentives provided by the CERs revenues were seriously taken into consideration by the financier EBRD during the appraisal period of the rehabilitation of Units #2, # 4, #1 and #5. The internal EBRD Memorandum document dated 28 September 2006 and titled "Georgia - Enguri Hydro Power Plant Rehabilitation Project" and subtitled "Attached for consideration and approval by the Board of Directors at its meeting on 7 November 2006 is a Recommendation from the President together with a Report on the above subject" states: "Funds raised through the CDM under the Phase II [of the Enguri HPP Rehabilitation Project] will be used in priority for meeting the Borrower's and Enguhresi's obligations under the Project".

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

In sub-step 1a and 1b, it is required to identify realistic and credible alternative(s) that were available to Enguhresi or similar project developers that provide output or services comparable with the Enguri project activity. These alternatives are required to be in compliance with all applicable legal and regulatory requirements.
We identify the following plausible alternative(s) to the Enguri project activity.

Alternative 1. The proposed project activity undertaken but not as CDM project activity

In this alternative, the refurbishment of Unit # 2, Unit # 4, Unit #1 and Unit #5 of Enguri HPP is undertaken but not as a CDM project activity. Thus, Enguhresi does not receive any revenues from the sale of CERs and relies only on revenues from power sales to repay the loan given by EBRD. This alternative is in compliance with all applicable legal and regulatory requirements

Alternative 2. The refurbishment of Unit # 2, Unit # 4, Unit # 1 and Unit # 5 is not undertaken and capacity additions are implemented elsewhere on the Georgian grid

In this alternative, the refurbishment of Unit # 2, Unit #4, Unit #1 and Unit #5 of Enguri HPP is not undertaken. The capacity of 160 MW is added elsewhere on the Georgian grid in order to meet the increasing electricity demand in Georgia. According to the 2005 Annual Report of the Ministry of Energy of Georgia, the electricity demand in Georgia in 2005 was 8,379 GWh and is expected to rise to around 9,000 GWh in 2007 and 17,360 GWh in 2020. The Georgian Ministry of Energy expects that, with rehabilitation of existing facilities and construction of new facilities, the power sector will add capacity equal to 1,270 MW over the next five years. Much of this will come from rehabilitation of medium and large-scale facilities, however, 70 MW are expected from facilities less than 10 MW in size. Funds have been allocated by the World Bank, EBRD, KfW, JBIC, USAID and other investors for the rehabilitation of existing hydropower resources. The following power plants are currently under construction: Khudoni HPP (246.6 MW x 3); Kobuleti CCGT (72 MW); Namakhvani HPP (210 MW); Tvishi HPP (100 MW); Zhoneti HPP (90 MW); Khador HPP (24 MW). The following small to medium power plants are planned by the Ministry of Energy: Cascade of Neskra HPPs (5 HPPs) – 87.3 MW; Cascade of Chelti HPPs (5 HPPs) – 13 MW; Cascade of Bakhvistskali HPPs (2 HPPs) – 22.3 MW; Cascade of Khrami HPPs (3 HPPs) – 125 MW; Cascade of Gubazeuli HPPs (4 HPPs) – 26.9 MW; Cascade of Chorokhi HPPs (2 HPPs) – 36.8 MW; Cascade of Rioni HPPs (2 HPPs) – 63.6 MW. This alternative is in compliance with all applicable legal and regulatory requirements.

Alternative 3. Continuation of the current situation

In this alternative, the refurbishment of the Unit # 2, Unit # 4, Unit #1 and Unit #5 of Enguri HPP is not implemented and thus contributes nothing to reducing the carbon intensity of the Georgian grid. The growing electricity demand in Georgia is not met through capacity additions in Georgia but through increases in electricity imports. According to the USAID 2006 report "Energy Balance of Georgia Power Sector part 1: balances from 1960 to 2006", the "significant tendency of the modern electricity balance in Georgia is to satisfy the growing demand on electricity not with the increase of local production but with imports". This alternative is in compliance with all applicable legal and regulatory requirements

Step 2. Investment Analysis OR
Step 3. Barrier Analysis

Under the Barrier Analysis it must be demonstrated that the proposed project activity faces barriers that:
(a) Prevent the implementation of this type of proposed project activity; and
(b) Do not prevent the implementation of at least one of the alternatives.

Step 3a. Identify barriers that would prevent the implementation of the proposed project activity

The following barriers are identified for this project activity:

1. ***Investment barriers*:**

   a. **General country risk**

Standard & Poor’s sovereign long term investment rating on both local and foreign currency in Georgia in November 2006 was B+ . The Standard & Poor's rating varies on scale of values between CCC- (the lowest) and AAA+ (the highest). The range between AAA to BBB are investment grade countries, while BB to C are non-investment grade. Georgia is thus still a non-investment grade country according to Standard & Poor's, although the economic condition in Georgia has improved in the past years. The low rating for Georgia is a result of weak external liquidity of the country, high inflation, and substantial infrastructure development needs, in the context of a poor institutional framework and political uncertainty arising from regional conflicts. Thus, due to the history of payment, political instability and credit problems, it will take a long time to repair Georgia’s image for foreign investors. This in turn will exacerbate the problem of lack of local capital for large infrastructural projects such as rehabilitation and construction of new hydro power plants.

b. Lack of capital for rehabilitation of Enguri HPP

The lack of capital is seen as the main barrier, as the following problems exist for existing hydro power plants that want to raise funds from local and foreign banks for rehabilitation purposes:

(a) The interest rates applied to loans in Georgian Lari by Georgian commercial banks to industrial public sector companies were given at a level of 16.9% in September 2006, which is considered very high by Engurhesi (Source: National Bank of Georgia, Bulletin of Monetary and Banking Statistics (January-September, 2006);
(b) The loan terms are generally too short for a long term investment such as the refurbishment of a major power plant resulting in 120 MW capacity addition;
(c) The Georgian banks are too small to provide loans for such a large rehabilitation project;
(d) The loan amounts are too small for international capital markets.

Specifically for Enguri HPP the lack of capital has been a major barrier for the delay in the implementation of the overall Rehabilitation project. The project implementation suffered badly from the lack of funds with no possibility of getting financing from the Georgian Government for the execution of the project. Enguhresi can supply information regarding the financing pledged, the actual financing secured, the cost of rehabilitation of each unit and the current financing deficits for Unit # 2, Unit # 4, Unit #1 and Unit #5 of Enguri HPP.
It appears clear that revenues from the sale of Certified Emissions Reductions are of extreme importance for the timely execution of the overall rehabilitation project.

c. Risks due to level of tariffs

The Georgia National Energy Regulatory Commission (GENRC) regulates long-term tariffs for, among others, State-owned electric power plants. On May 15 of 2006 the GNERC issued revised electricity end - user tariffs in Georgia so as to improve the commercial viability of various operators in the sector. Also, in June 2006, Enguri HPP’s generation tariff was reduced from 2.13 tetri/kWh to 1.187 tetri/kWh (Source: GENRC’s website, www.gnerc.org/www/eng_tariffs.htm). This decision was taken for the following reasons:

(a) Improvement of the Enguri collection rate in the past years from 25% in 2003 to 68.3% in the first half of 2006;
(b) Recognition of efficiency gains following the rehabilitation of the Enguri HPP during Phase 1 of the Rehabilitation project, and

(c) A need to compensate for the ever increasing thermal price in Georgia in light of recent increases of the tariff for gas set by Russia.

Project Proponents expects that the level of tariffs set for Enguri HPP from 2006 onwards should largely cover operation and maintenance costs and debt repayment of Enguhresi. Nevertheless, the three arguments used above by GENRC to justify the decrease in the long-term tariff set for Enguri HPP could gain importance in the coming years. In particular the need to compensate for rising natural gas prices could be exacerbated by international disputes between Georgia and Russia and rising world natural gas prices. GENRC could reduce Enguri HPP's tariffs in the future as it has done in 2006. This could undermine Enguhresi's ability to repay the loan offered by EBRD. On the other hand, CER revenues will partly offset this risk for Enguhresi.

d. Risks due to low collection rates

As shown in the table below, Engurhesi has always been operating at a loss, such loss being mostly from the provision for doubtful receivables, directly related to the low collection rate from large distribution companies, to whom Enguhresi sells its electricity. The collection rate at Enghuresi has improved in recent years, but was still low at 30.6% in 2005 and at 68% in the first half of 2006. With substantial increase in electricity prices for final consumers in 2006 (35% increase for residential customers), it would be challenging for the Government to maintain such level of collection whilst keeping commercial losses under control.

In 1000 US Dollars	2003	2004	2005	2006*
Generation of Electricity in GWh	3,066.10	2,794.47	2,535.24	568.22
Total Billed	26,241.0	30,472.7	29,508.5	6,723.9
Collection	6,493.9	7,830.5	9,039.0	4,593.4
Collection Rate at Enguhresi	24.75%	25.70%	30.63%	68.31%
Net loss for the reporting period	- 3,583.3	- 3,076.8	- 4,560.8	-2,824.3

*Source: Engurhesi Balance Accounts, *2006 figures reflect first half of the year and Enguri was shut down for 3 months due to rehabilitation to high pressure water pipe*

In turn, the collection rate at the level of the large distribution companies has also been low in the recent years, with even a slight declining trend between years 2004 and 2005.

In 1000 Lari	January	Febr.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Totals
Total billed 2005	123,853	71,803	54,399	51,048	44,234	37,367	29,009	16,510	29,560	26,666	35,483	51,416	571,347
Collected as % of Total 2005	15.8%	28.4%	39.6%	38.5%	41.9%	49.3%	64.5%	122.9%	66.1%	75.6%	65.8%	53.3%	56.7%
Total billed 2004	64,710	46,764	40,328	44,196	43,348	35,954	31,230	35,976	37,522	33,163	37,125	30,179	480,495
Collected as % of Total 2004	18.6%	42.2%	45.3%	49.5%	38.5%	40.3%	48.6%	53.0%	66.6%	48.3%	44.8%	28.3%	57.6%

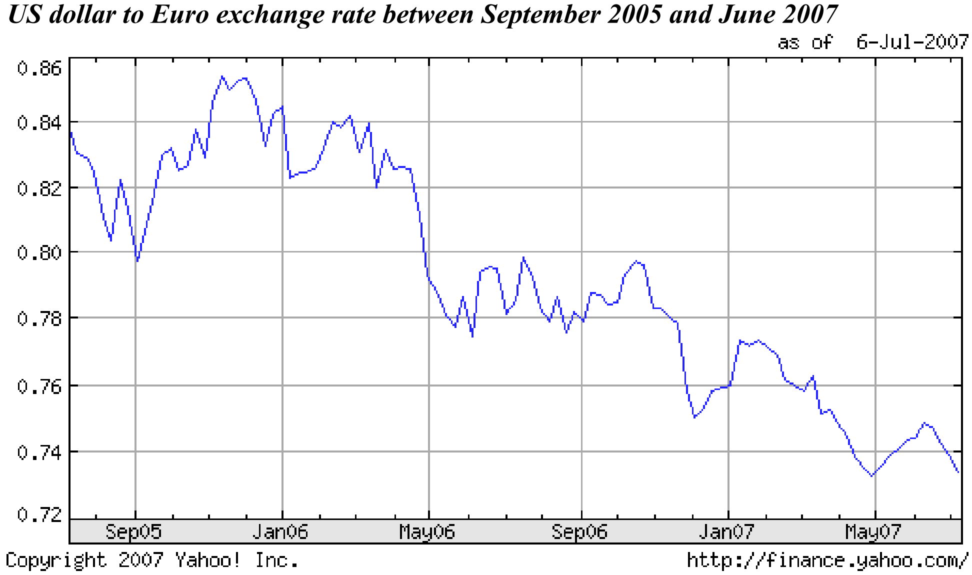
Source: Sum of all total billed and total non collected energy payments from chart on website http://www.minenergy.gov.ge in the section Energy Statistics & Forecasts » Electricity » Combined Collections and Commercial Losses.

Thus, it is as yet unclear whether the Georgian electricity system will soon be immune from non-payment risk. The risk of non-payments for power generators, including Enguhresi, could remain for years to come and revenues from CERs could partly offset this risk.

e. Exchange rate risks

International finance institutions, including EBRD, provide loans to Enguhresi in US dollars. Engurhesi will pay engineering and capital costs to Siemens Voigt (Germany) in Euros. After the rehabilitation project, Enguhresi will receive payments for the electricity generated and will be billed in Georgian Laris. Engurhesi will need to return the loan to EBRD in 7 years and two months in US dollars, without a grace period. The fluctuations in the relative values of these three currencies expose the project activity to considerable investment risk. In particular, since Enguhresi receives electricity payments in Lari, but repays its loan in US dollars, an appreciation of the US dollar compared to the Georgian Lari will reduce Enguhresi's capability to repay the loan. On the other hand, if the US dollar depreciates against the Euro, Enguhresi will face the risk of higher than expected investment costs. This situation is not hypothetical and the depreciation of the US dollar against the Euro was clearly perceived as a major barrier by Enguhresi in the year 2005 and 2006.
The graph below illustrates the depreciation of the US dollar compared to the Euro in the past year.
Several analysts expect that the current trend of depreciation of the US dollar compared to euro will continue or even enhance in the coming years (see for example the article "The falling dollar", The Economist, 30 November 2006). This situation will likely lead to higher than expected investment costs for Enguhresi and the revenues from CDM carbon credits (in euro) will partly offset this risk.

US dollar to Euro exchange rate between September 2005 and June 2007

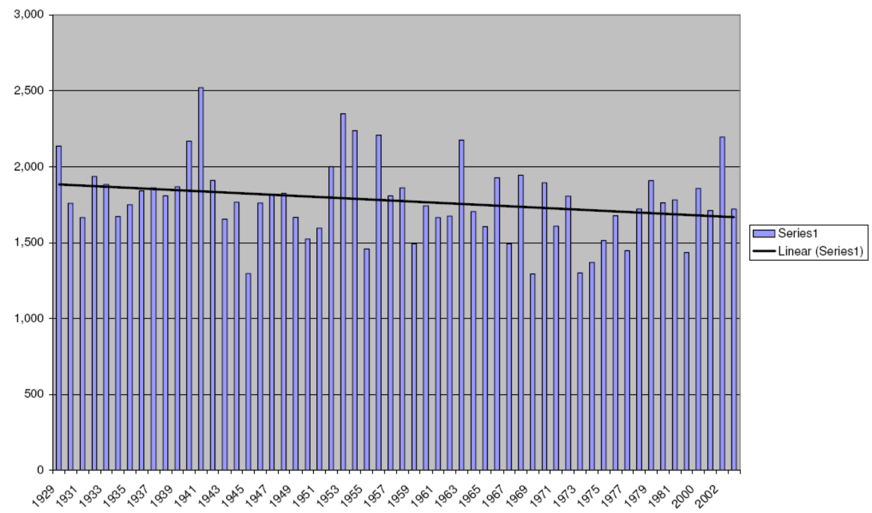


2. *Technological barriers:* The project faces the following barriers related to the specifics of hydro power plants and the structure of the Georgian electricity grid.

a. Hydrology risks:

The USAID 2006 publication "Energy balance of Georgia power sector: analysis and proposals" shows the historic total annual water flow (as simple sums of monthly average m3/sec flows) of the Enguri river at the entrance to the Enguri HPP reservoir. The graph below shows a declining trend in water flow in the past 80 years. This trend is likely to continue due to the expected effects of climate change in the Caucasus region.

Enguri river water flow in 1929-2002 in m3/sec.



Source: USAID 2006, "Energy balance of Georgia power sector: analysis and proposals"

Given the availability of a large reservoir at Enguri HPP, the yearly and not the monthly water flow variability would impact the amount of hydropower production at Enguri HPP. As shown in the table below, water flow variability, measured statistically through standard deviation, increased to 276 m3/sec in recent years (1999-2003) compared to the level of 259 m3/sec in the 1929- 1981 period. It can be reasonably expected that the variability of water flow will be exacerbated by climate change in years to come.

Statistical Characteristics of History of Enguri River Flow Conditions: Averages and Standard Deviations, Data in m3/sec.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Full Year
Monthly Average													
1929-1981	37.16	36.13	49.42	134.23	267.00	306.72	329.15	253.62	148.06	96.55	68.64	48.06	1774.73
1999-2003	39.80	44.00	51.60	159.40	269.40	354.00	327.40	219.40	116.20	87.80	75.00	39.40	1783.40
All Data	37.39	36.81	49.60	136.40	267.21	310.79	329.00	250.67	145.31	95.79	69.19	47.32	1775.48
Monthly Standard Deviation													
1929-1981	9.69	9.54	15.81	41.80	64.02	66.49	57.97	50.20	35.43	36.10	25.66	13.34	259.01
1999-2003	15.01	18.87	30.37	28.32	62.18	69.70	80.24	12.10	39.89	34.82	22.08	12.40	276.24
All Data	10.10	10.63	17.12	41.24	63.33	67.48	59.31	49.03	36.58	35.78	25.26	13.39	257.99

Source: USAID 2006, "Energy balance of Georgia power sector: analysis and proposals"

Climate change is causing and will cause progressively greater variation of temperature and precipitation from historic trends. The precipitation variations due to climate change affect the predictability of hydropower output and relative revenues. The unpredictability of revenue means that investors regard hydropower projects with increased caution and are less likely to invest than they might once have been. (Source: Harrison, Whittington (2002) "Analysing Climate Change Risk in Hydropower Development")

b. Unreliability of the Georgian transmission line:

As stated in the USAID 2006 publication "Energy balance of Georgia power sector: analysis and proposals", most of the Georgian energy producing capacity is hydro power which lies in the west of the country. Most of the load, and most of the fast-reacting thermal capacity, resides in the east. There is presently just one main high voltage transmission line connecting the western and eastern portions of the country, the Imereti Line. If the line is not working properly, then the least cost operation of the dispatch of energy, relying principally on hydro power, is not feasible. This barrier hampers the proposed CDM project activity only indirectly as it increases the overall risk of the Georgian electric system. In addition, this barrier hampers the successful contribution to Georgian electricity supply of the planned new hydro power plants in eastern Georgia, as envisaged under Alternative 2. Alternative 3 is not affected directly by this barrier since import lines connect Georgia from both east and west to other countries (Georgia is connected to Armenia, Turkey and Russia while Abkhazia is connected to Russia).

3. *Other Barriers*

a. Unstable political situation in Abkhazia

The region of Abkhazia remains extremely vulnerable and unstable. The close involvement of the UN peacekeepers and additional security forces provided by the Georgian government for Enguri HPP have slightly improved the situation at the project site. Nevertheless, Georgia's small economy is very dependent on Russia (its leading trading partner and the remittances from Georgians abroad) This dependence is currently exacerbated by political tensions between the two countries and is very likely to continue in the foreseeable future.

b. Issues regarding Enguri HPP ownership

It must be noted that institutional issues regarding Enguri HPP ownership and status are not yet completely solved. Back in 1998, when the plan for a partial rehabilitation of Enguri HPP (Phase 1) was drafted, Enguri HPP belonged to Sakenergo, the State-owned vertically integrated Georgian power utility. In 2001, the Georgia State Electrosystem (GSE) became the legal successor of Sakenergo, owner and operator of most of the thermal generating plants in Georgia. Enguhresi Ltd, a State owned special purpose company was then designated by GSE to own and operate Enguri HPP. With the new power sector organisation, GSE is no longer responsible for hydro power plant activities and the Government of Georgia asked EBRD to provide its loan directly to the Georgian State, which in turn on-lends to Enguhresi Ltd. However, Enguhresi's effective ownership and control over Enguri HPP remains controversial until the final settlement of the dispute between Abkhazian and Georgian communities, given the fact that the Enguri HPP dam is located in Georgian territory while the power plant is in Abkhazian territory.

Step 3b. Show that identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

The following table illustrates how the barriers discussed under step 3a prevent Alternative 1 from happening. Alternative 2 and 3 are affected by the barriers to a lesser extent than the proposed CDM activity. Alternative 3 is chosen as baseline for the proposed project activity, as capacity additions elsewhere on the Georgian grid are less likely to meet increasing electricity demand than electricity imports. This is due to the following main reasons: 1) Under Alternative 2 the Georgian electricity grid would face high investment costs required for the construction of capacity additions, while under Alternative 3 no investment costs are faced; 2) Under Alternative 2, the Georgian electricity grid is affected by transmission line problems; 3) Georgian electricity demand can be met through imports of electricity from Iran, Armenia and Russia. Thus Alternative 3 is the most plausible business as usual course of action. The barriers discussed above would have prevented the proposed project activity, unless it is registered under the CDM framework.

Barriers	**Alternative 1** *Refurbishment of Units 1, 4, 5 but not as CDM*	**Alternative 2** *No refurbishment of Units 1, 4, 5, demand met through capacity additions in Georgia*	**Alternative 3** *Current situation, no refurbishment of Units 1, 4, 5, demand met through imports*
General country risk	Affected	Affected	Affected
Lack of capital	Affected strongly, without incentive provided by CDM refurbishment is very unlikely	Affected less strongly than proposed CDM activity, as smaller scale power plants require less capital investment than Enguri	Not affected
Tariffs risk	Affected strongly, since without CDM revenues tariff risk is not offset, not even partly	Less affected than proposed CDM activity. Tariffs will likely be reduced by GENRC for new capacity additions. Tariffs will likely remain the same for Enguri if it is not rehabilitated.	Less affected than proposed CDM activity. Tariffs will likely remain the same for Enguri if it is not rehabilitated. Tariffs do not affect imported electricity.
Collection rates risk	Affected strongly, since without CDM revenues low collection rate risk is not offset, not even partly	Affected but less than Enguri because distribution companies receiving electricity from new capacity additions are more likely to settle smaller debts before larger ones and Enguri is easily the largest generator	Affected but less than Enguri because distribution companies receiving electricity from existing power stations are more likely to settle smaller debts before larger ones and Enguri is easily the largest generator
Exchange rate risk	Affected strongly, since without CDM revenues exchange risk is not offset, not even partly	Newly built plants may be affected if receiving dollar-based foreign funding and facing expenses in euro.	Not affected
Hydrology risks	Affected	Not affected	Not affected
Transmission line unreliability	Affected	Affected directly	Not affected
Abkhazia unstable politically	Affected	Affected slightly as no works will be implemented at Enguri	Affected slightly as no works will be implemented at Enguri
Enguri HPP ownership	Affected	Affected slightly as no works will be implemented at Enguri	Affected slightly as no works will be implemented at Enguri
Conclusion	*Barriers prevent Alternative 1. Alternative 1 is unviable.*	*Barriers affect Alternative 2 less strongly than proposed CDM activity, but more strongly than Alternative 3*	*Barriers affect Alternative 3 less strongly than proposed CDM activity. Alternative 3 is the baseline.*

Step 4. Common practice analysis

Step 4a and 4b require to evaluate whether any similar options to the project activity are occurring in the same region (i.e. Western Georgia/Abhazia), with similar technology (i.e. refurbishment of some units of a large hydro power plant), with similar scale (i.e. over 100MW capacity additions to a large hydro power plant).
Refurbishments of hydro plants were conducted in Georgia in the past 15 years mainly thanks to international financial institutions' and donor countries' contributions. These refurbishments included: 1) Khrami 1 HPP (113.5 MW) financed by Japanese credit 2) Vartsikhe HPP (184 MW) financed by the German KfW bank 3) Lajanuri HPP (115.8 MW) financed by Japanese credit and Georgian Ministry of Energy (Source: USAID 2006, "Energy balance of Georgia power sector: balances from 1960 to 2006").

Nevertheless, Enguri HPP is an exceptional power plant for many reasons:

1. It is the largest hydropower plant in the Caucasus and in Georgia in terms of installed capacity
2. It is located in a politically very unstable region, which affected severely the Georgian Government's willingness to provide funds for its rehabilitation and the implementation of Phase 1 of the Enguri Rehabilitation project;
3. It was built to operate as peak demand power plant in the Soviet Union but has been operated as base load plant supplying 30% of Georgian electricity.

We therefore conclude that there is no similar option to the proposed project activity and the proposed project activity is not common practice in Georgia.

Step 5. Impact of CDM registration

CDM registration will bring the following benefits to the proposed project activity and will alleviate the following barriers:

- Lack of capital: the CDM component was essential for EBRD when the decision for providing the loan to Enguhresi;
- Tariffs risk: the CDM incentive will offset at least partly the risk of declining energy tariffs set by GENRC, as Enguhresi will receive an additional revenue stream in the form of CERs;
- Collection rates risk: the CDM incentive will at least partly offset the risk of low collection rates of Enguhresi, as Enguhresi will receive an additional revenue stream in the form of CERs;
- Exchange rate risk: CERs will be paid in euro which will at least partly offset the euro-dollar exchange rate risk;

In addition, this is the first proposed hydro power CDM activity in Georgia. The proposed activity will give the right signal to Georgian and international players that CDM is viable in Georgia, resulting in a higher quantum of GHG emissions reductions in the country.

As per the above-mentioned steps the proposed project activity is additional and the GHG emissions are reduced below those that would have occurred in the absence of the CDM project activity.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Section B4 (Description of baseline and its development) describes in detail the methodological choices and determination of the operating margin, build margin and the combined margin.

This section shows the different formula used for the derivation of emission factor of the baseline by developing the 'operating margin' and the 'build margin'. The various formulas applied will be developed from step-1 through step-3. The various variables and their sources are also indicated.

Step 1. ***Calculate the simple adjusted operating margin***

a. Estimation of Net Calorific Value of natural gas (TJ / 1000m^3) for each years 2004 to 2006

Net Calorific value (TJ / 1000 m^3)	=	Net Caloric Value $_{cal}$ (kcal / m^3)	**X**	(4.1688) (1000 KJ / kcal)	X	(1/10^6) (TJ/KJ)

Data Source: Net Caloric Value – Ministry of Energy, Georgia (validated by Georgian CDM Council).

b. Emission factor CO2equ for natural gas (tonnes(t) of CO2/ TJ):

CO2 emissions rate (t CO2/ TJ)	=	Carbon Emission factor (t C / TJ)	**X**	(44/12) (t CO2/t C)

Data Source: Carbon emission factor for natural gas - IPCC

c. Coefficient of CO2 emission from natural gas (t CO2 / 1000 m^3) for each years 2004 to 2006

Coeff. of CO2 emission of natural gas in year *y* (t CO2./ 1000 m^3)	=	Net Calorific Value of natural gas in year *y* (TJ / 1000 m^3)	**X**	Emission factor CO2equ of natural gas in year *y* (t CO2 / TJ)	**X**	OXID in year *y*

Data Source: OXID (Oxidation factor) - IPCC

d. Emissions from each natural gas power plant for years 2004 to 2006 (t CO2):

Emissions of each power plant in year *y* (t CO2)	=	Fuel consumed (1000 m^3)	**X**	Coeff. of CO2 emission of natural gas in year *y* (t CO2 / 1000 m^3)

e. Calculate the simple operating margin for 2006, 2005, 2004:

Simple Operating margin	=	Sum of generation-weighted CO2 emissions from all plants excluding low-cost / must-run kWh serving the grid
(kg CO2/kWh)		(kg Co2/ kWh of all plant excluding low-cost / must-run (including imports) supplying the grid)

Data Source: Ministry of Energy, Georgia (CDM Council).

f. Calculate λ for 2006, 2005, 2004

The factor λ is the number of hours per year for which low-cost/must run resources are on the margin over the total 8760 hours of the year. It is calculated following the following steps:

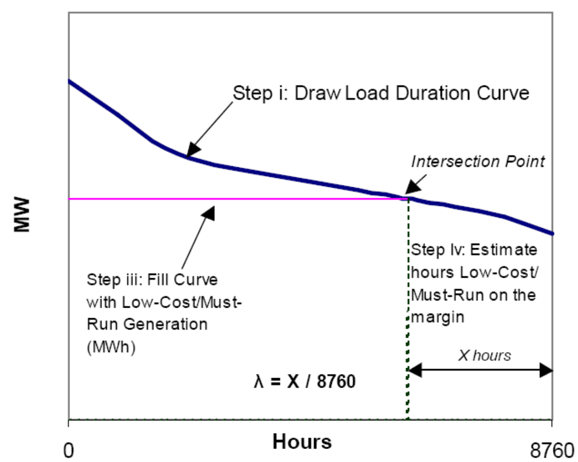
Step i) Plot a Load Duration Curve. Collect chronological load data (typically in MW) for each hour of a year, and sort load data from highest to lowest MW level. Plot MW against 8760 hours in the year in descending order.

Step ii) Organize Data by Generating Sources. Collect data for, and calculate total annual generation (in MWh) from low-cost/must-run resources (i.e. $\sum_k GEN_{k,y}$ *).*

Step iii) Fill Load Duration Curve. Plot a horizontal line across load duration curve such that the area under the curve (MW times hours) equals the total generation (in MWh) from low cost/must-run resources (i.e. $\sum_k GEN_{k,y}$ *).*

Step iv) Determine the "Number of hours per year for which low-cost/must-run sources are on the margin". First, locate the intersection of the horizontal line plotted in step (iii) and the load duration curve plotted in step (i). 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 λ is equal to zero. Lambda (λ) is the calculated number of hours divided by 8760.

For Georgia the low- cost/ must run sources are the hydro power plants which generate electricity to the Georgian grid. The underlying load data of the Georgian electricity grid for 2004, 2005 and 2006 were supplied by the Ministry of Energy, Georgia (CDM Council).



Data Source: Ministry of Energy, Georgia (CDM Council)

g. Apply (1- λ) to the operating margin of 2006, 2005, 2004

Simple adjusted operating margin (kg CO2 equ. / kWh)	=	(1- λ)	**X**	Operating margin (kg Co2 equ. / kWh)

Step 2: Calculate the emission factor of each plant and develop the build margin for 2006

Build Margin (kg CO_2 equ. / kWh)	=	Sum of generation- weighted CO_2 emissions of each plant for every kWh in the grid Generated by the recent 9 plants contributing to 20% of 2006 Georgian electricity production (kg CO_2 / kWh)

Data Source: Ministry of Energy, Georgia (CDM Council)

Step 3: Calculate the baseline emission factor of the grid

Emission factor of the grid= ½ (kg CO_2 equ. / kWh)	Build Margin (kg CO_2 equ. / kWh)	+	Generation-Weighted Average of Simple Adjusted Operating Margins for 2004, 2005 and 2006) (kg CO_2 equ. / kWh)

Note. Alternative weights are not used for hydro power projects.

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

Data / Parameter:	**Carbon emission factor of the grid**
Data unit:	kg CO_2 / kWh
Description:	The weighted average of the generation-weighted average of Simple Adjusted Operating margins for 2004, 2005 and 2006 and the Build margin as for methodology ACM0002.
Source of data used:	• Ministry of Energy, Georgia (CDM Council)
Value applied:	0.3839
Justification of the choice of data or description of measurement methods and procedures actually applied :	The justification for using the simple adjusted operating margin and the methodological choices underlying the calculation of the operating and the build margin are detailed in Section B.4. The calculations are detailed in Section B.6.3.
Any comment:	-

Data / Parameter:	**CO_2 operating margin emission factor of the grid for 2004, 2005 and 2006**
Data unit:	kg CO_2 / kWh
Description:	The Simple Adjusted Operating margin is chosen as for methodology ACM0002.
Source of data used:	• Ministry of Energy, Georgia (CDM Council)
Value applied:	2004: 0.2005 2005: 0.2178 2006: 0.3930
Justification of the choice of data or	The value of the simple operating margin carbon emission factor is calculated based on the operating margin at the time of PDD submission. The justification

description of measurement methods and procedures actually applied :	for using the simple adjusted operating margin is detailed in Section B.4. The calculations are detailed in Section B.6.3.
Any comment:	-

Data / Parameter:	**CO2 build margin emission factor of the grid**
Data unit:	kg CO_2 / kWh
Description:	The Build margin is chosen as for methodology ACM0002.
Source of data used:	• Ministry of Energy, Georgia, CDM Council
Value applied:	0.4958
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of the build margin carbon emission factor is based on the best available data at the time of the PDD validation. They are based on the most recent plants added to the system. The justification for determining the build margin is detailed in Section B.4. The calculations are detailed in and Section B.6.3.
Any comment:	-

Data / Parameter:	**Amount of fossil fuel consumed by each power source / plant**
Data unit:	1000 m^3
Description:	Consumption of natural gas by the available thermal power plants of Mtkvari, Tbilsresi and the CCGT Energy-Invest
Source of data used:	• Ministry of Energy, Georgia (CDM Council)
Value applied:	See Section B.6.3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The actual volume of natural gas consumed by the power plants as reported by the Ministry of Energy, Georgia available at the time of the PDD is used.
Any comment:	

Data / Parameter:	**CO2 emission coefficient of each fuel type**
Data unit:	t C / TJ
Description:	Tonnes of carbon per terajoule. The CO_2 emission coefficient of a fuel type is the carbon content of each fuel type, adjusted by the combustion efficiency factor (or oxidation factor) of 0.995
Source of data used:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Workbook Vol 2. Table 1-2, page 1.6 (http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1wb1.pdf)
Value applied:	Natural gas (dry), adjusted: 15.3 Hydro: 0
Justification of the choice of data or description of measurement methods	Data provided by the IPCC is considered to be authoritative in this field.

and procedures actually applied :	
Any comment:	-

Data / Parameter:	**Electricity generation of each power source / plant**
Data unit:	GWh
Description:	This data variable indicates the level of electricity of a certain power plant that is supplied to the national electricity grid.
Source of data used:	Ministry of Energy, Georgia (CDM Council)
Value applied:	See Section B.4 Step 1 and Section B.6.3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	These were the most accurate data available for 2004 to 2006 generation levels of existing power plants supplying electricity to the Georgian grid. Data were collected and inputted in the calculation table of the adjusted operating margin.
Any comment:	-

Data / Parameter:	**Identification of power source plant for the OM**
Data unit:	Name of plant
Description:	The methodology ACM0002 allows the calculation of operating margin according to four methodologies. The adjusted simple operating margin was chosen for this CDM project.
Source of data used:	Ministry of Energy, Georgia (CDM Council)
Value applied:	CCGT Energy-Invest, Tbilsresi, Mtkvari and Tbiltetsi
Justification of the choice of data or description of measurement methods and procedures actually applied :	The calculation of the adjusted operating margin implies the division of generation sources in low cost must run resources (hydro, geothermal, wind, low-cost biomass, nuclear and solar generation) and other resources. If the low-cost must-run resources are excluded, then only four thermal power plants can be included in the calculation of the adjusted operating margin
Any comment:	-

Data / Parameter:	**Identification of power source plant for the BM**
Data unit:	Name of plant
Description:	The build margin includes either the recent five power plants or recent power plants that have been built more recently and contributed to 20% of electricity generation of a certain year, whichever definition includes the largest generation.
Source of data used:	Ministry of Energy, Georgia (CDM Council)
Value applied:	See Section B.4 Step 2 and Section B.6.3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The names of plants included in the build margin are based on the more recently built plants that contribute 20% of the electricity generated.

Any comment:	

Data / Parameter:	**Fraction of time during which low-cost / must run sources are on the margin**
Data unit:	Hours
Description:	Amount of hours of the year when the low-cost must-run resources are on the margin.
Source of data used:	Ministry of Energy, Georgia (CDM Council)
Value applied:	2004: 1465 2005: 1179 2006: 636
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data variable was calculated as the crossing point of the load Duration Curve and the Low-Cost Must-Run Resources curve, as shown in Section B.6.3.
Any comment:	-

Data / Parameter:	**Electricity imports to the project electricity system in 2004, 2005, 2006**
Data unit:	GWh
Description:	Amount of electricity currently imported from Russia, Turkey and Armenia into the Georgian electric grid
Source of data used:	Ministry of Energy, Georgia (CDM Council)
Value applied:	2004: 1207.602 2005: 1398.639 2006: 766.061
Justification of the choice of data or description of measurement methods and procedures actually applied :	Most accurate data available
Any comment:	These were the most accurate data available for 2006 electricity imports into the Georgian grid. Data were collected and inputted in the calculation table of the adjusted operating margin.

Data / Parameter:	**CO2 emission coefficient of fuels used in connected electricity systems (if imports occur)**
Data unit:	kg CO2e / kWh
Description:	Carbon content of the electricity imported in the Armenian grid
Source of data used:	Methodology ACM0002
Value applied:	0
Justification of the choice of data or description of measurement methods	Since the imported electricity comes from other countries, the emission factor of all the imports was assumed to be 0 tons of CO2 per MWh (as prescribed on page 4 of the ACM0002 methodology).

and procedures actually applied :	
Any comment:	-

Data / Parameter:	Average annual energy supply to grid prior to the upgrade
Data unit:	kWh
Description:	Average level of electricity supplied to the Georgian grid by Enguri HPP's *Unit #4, Unit #1 and Unit #5* in the years 1981 to 2006 and in the years 1981 to 2005 for *Unit #2*
Source of data used:	Georgia Wholesale Electricity Market
Value applied:	See Section B.4 (Description of baseline and its development) Step 4.
Justification of the choice of data or description of measurement methods and procedures actually applied :	To determine the baseline scenario of projects that retrofit or modify an existing facility, as per the methodology ACM0002 a minimum of past 5 years (for which data is available) is required to calculate the level of electricity supplied by the facility. It is also required that during these years the facility should not have been modified in a manner that significantly affected output.
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

Step 1: Calculate the simple adjusted Operating Margin emissions factor ($EF_{OM, simple\_adjusted, y}$)

The operating margin emissions factor ($EF_{OM, y}$) has been calculated using a 3 year data vintage. The table below calculates the relative energy contribution of each of the thermal plant connected to the grid, calculates the emissions for each plant and develops the simple operating margin for 2004, 2005 and 2006.

Parameter	Unit	2004	2005	2006
NCV_{cal}	Kcal / m^3	8,039.00	8,041.44	8,044.73
EF_C	tons of Carbon / TJ	15.30	15.30	15.30
OXID		1.00	1.00	1.00
Heat Content Conversion	Kcal / KJ	4.1868	4.1868	4.1868
NCV	TJ / 1000 m^3	0.03366	0.03367	0.03368
Emission Factor	tons of CO2 / TJ	56.10	56.10	56.10
Coefficient of Emission	tons of CO2 / 1000 m^3	1.8788	1.8793	1.8801
Fuel Consumed by each Thermal Plants:	1000 m^3			
Tbilsresi		9,755.00	108,909.00	232,662.00
AES Mtkvari		248,873.00	206,712.00	349,820.00
CCGT Energy-Invest		-	-	91,676.00
Emissions by each Thermal Plants:	tons of CO2			
Tbilsresi		18,327.26	204,675.56	437,426.35
AES Mtkvari		467,571.43	388,479.33	657,694.36
CCGT Energy-Invest		-	-	172,359.47
Total Emissions	tons of CO2	485,898.69	593,154.89	1,267,480.18

Parameter	Unit	2004	2005	2006
Generation from Other sources to the Grid	GWh	2,020.81	2,357.05	2,991.08
Operating Margin ($EF_{OM,y}$)	kg CO2 equ. / kWh	0.2440	0.2517	0.4238

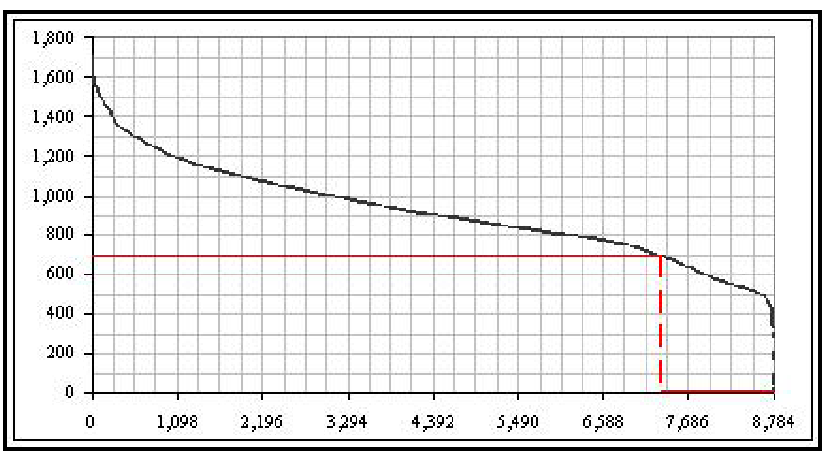
The table below calculates the Lambda factor for the determination of the simple operating margin for the year 2004, 2005 and 2006.

Year	Unit	Description	Value
2004	X	Number of hours low cost/must run resources are on the margin	1456
	λ	λ= X/8760	0.166
	1- λ		0.834
2005	X	Number of hours low cost/must run resources are on the margin	1179
	λ	λ= X/8760	0.135
	1- λ		0.865
2006	X	Number of hours low cost/must run resources are on the margin	636
	λ	λ= X/8760	0.073
	1- λ		0.927

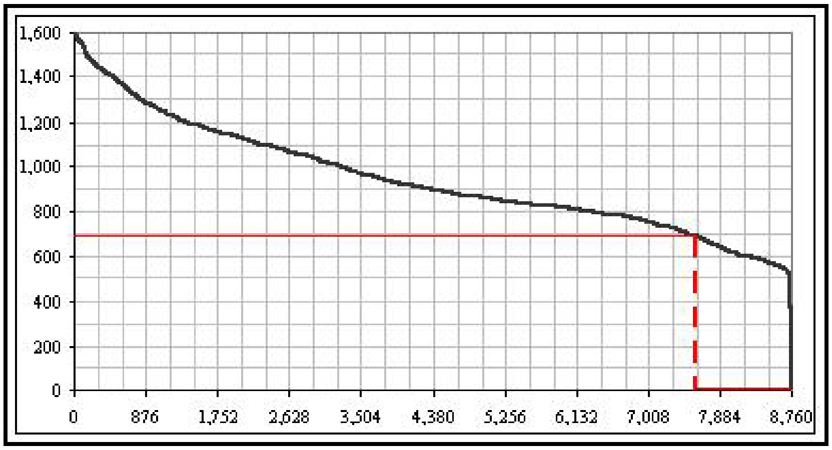
The figure below presents the Load Duration Curve and the Must-run low-cost resources curve determined for the identification of their intersection point. The intersection point indicates the number of hours in the year when the low-cost must-run resources are on the margin in 2004, 2005 and 2006, respectively, on the Georgian grid.

$$EF_{OM,\ simple\_adjusted,\ y} = (1-\lambda)\ \mathbf{X}\ EF_{OM,\ y}$$

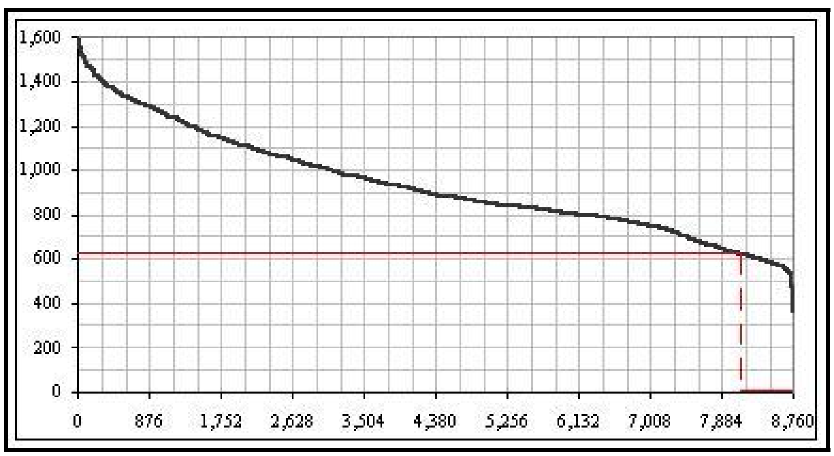
Year	λ	$EF_{OM,y}$	$EF_{OM,simple\_adjusted,y}$
2004	0.166	0.2404	0.2005
2005	0.135	0.2517	0.2178
2006	0.073	0.4238	0.3930



2004 Load Duration Curve and the Must -run Low-cost Resources Curve



2005 Load Duration Curve and the Must -run Low-cost Resources Curve



2006 Load Duration Curve and the Must -run Low-cost Resources Curve

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

The table below calculates the emission factor of each plant included in the build margin and develops the build margin.

Recent Plants in the Build Margin contributing to 20% generation	Capacity	Generation	Emission of CO2
	MW	million kWh	tons of CO2
AES Mtkvari	300.00	1,218.07	657,694.36
Intsobahesi	1.65	2.27	
JSC "Kindzmarauli"	1.50	3.67	
Munleik-Georgia	20.00	22.37	
Khadorhesi	24.00	131.21	
CCGT Energy-Invest	50.00	296.52	172,359.47

Recent Plants in the Build Margin contributing to 20% generation	Capacity	Generation	Emission of CO2
	MW	million kWh	tons of CO2
Total	397.15	1,674.11	830,053.83
Build Margin ($EF_{BM,y}$) (kg CO2 equ. / kWh)			0.495818269

STEP 3: Calculate the Build Margin Baseline Emission Factor (EF_y)

The baseline emission factor EF_y is calculated as the average of the Operating Margin emission factor ($EF_{OM,\,y}$) and the Build Margin emission factor ($EF_{BM,y}$). The table below calculates the emission factor of the grid.

Year	Operating Margin of power sources other than low-cost must run resources ($EF_{OM,\,y}$) (kg CO2 / kWh)	Operating Margin of power sources other than low cost must run resources adjusted with (1- λ) ($EF_{OM,\,simple\ adjusted,\,y}$) (kg CO2 / kWh)	System Generation (GEN_y) (\`000 kWh)	Build Margin ($EF_{BM,\,y}$) (kg CO2/ kWh)	Emission Coefficient for the Grid (EF_y) (kg CO2 / kWh)
2004	0.2404	0.2005	7,913.54		
2005	0.2517	0.2178	8,279.38		
2006	0.4238	0.3930	8,386.46	0.4958	
Generation-Weighted Average of 3 Years			0.2720		
Average of Operating Margin and Build Margin (EF_y)					0.3839

Step 4: <u>Calculate the baseline emissions of the proposed project activity</u>

The table below calculates the average historic output of the CDM project activity. The period from 1981 to 2006 of operation of the Enguri HPP is taken into consideration for the calculation of the average historic output. As shown in the table below, in the baseline scenario, the project activity would generate 2,035 MWh of electricity per year.

Average Historic Output													
Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Unit 1 Electricity Produced (GWh)	480.3	807.4	578.7	474.2	576.4	359.2	646.0	647.5	655.6	683.5	521.4	491.9	707.8
Unit 2 Electricity Produced (GWh)	138.4	721.6	562.3	669.0	458.3	234.1	707.6	546.1	777.8	808.6	628.4	626.6	668.7
Unit 4 Electricity Produced (GWh)	517.0	520.5	387.5	356.5	655.8	506.6	707.2	759.3	1,084.3	954.8	1026	837.0	971.4
Unit 5 Electricity Produced (GWh)	522.2	560.5	587.5	1,003.1	886.7	737.9	837.8	864.5	1,030.1	801.6	825	355.5	560.7
Total Units 1,4,5 Electricity Produced (GWh)	1,657.9	2,609.9	2,116.0	2,502.7	2,577.1	1,837.7	2,898.6	2,817.3	3,547.8	3,248.4	3,000.7	2,311.0	2,908.6
Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Average of each unit
Unit 1 Electricity Produced (GWh)	348.5	676.2	441.3	712.7	598.8	659.2	536.8	449.0	566.5	861.9	936.5	509.7	582.4
Unit 2 Electricity Produced (GWh)	948.4	635.9	377.6	583.6	658.1	504.4	607.1	715.2	798.0	659.6	406.0	0.0	603.5
Unit 4 Electricity Produced (GWh)	1,030.2	536.7	590.1	779.3	339.3	666.0	409.3	819.7	930.2	612.8	683.6	491.2	689.6
Unit 5 Electricity Produced (GWh)	753.0	872.3	700.1	1,060.3	1,087.8	911.5	793.8	1,005.2	772.2	665.0	552.9	639.2	763.0
Total Units 1,4,5 Electricity Produced (GWh)	3,080.2	2,721.1	2,109.1	3,135.9	2,684.1	2,741.1	2,347.1	2,989.0	3,066.9	2,799.2	2,578.9	1,640.1	
Average Historic Output for units 1,2,4,5 (GWh) in years 1981-2006 (2006 data cannot be used for Unit 2 as it was taken off in 2006)	**2,638.6**												
Average Historic Output per Unit (GWh)	**659.6**												
Average capacity factor (hours)	**2,868.0**												

Data Source: Enguhresi balance accounts

Step 5 : <u>Calculation of Emission Reductions (ER_y)</u>

The emission reductions by the project activity during a given year *y* is the difference between Baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y).

$$ER_y = BE_y - PE_y - L_y$$

where the baseline emissions (BE_y in tCO2) are the product of the baseline emissions factor (EF_y in tCO2/MWh) calculated in Step 3, times the electricity supplied by the project activity to the grid (EG_y in MWh) minus the baseline electricity supplied to the grid in the case of modified or retrofit facilities (EG baseline in MWh), as follows:

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

- Project Emissions by sources of GHGs due to the project activity within the project boundary are zero since hydro power is a GHG emission free source of energy.
- Leakage is not applicable as the renewable energy technology used is not equipment transferred from another activity. Therefore, no leakage calculation is required.
- Emission reductions are thus equal to baseline emissions and are calculated in the table below:

Baseline Scenario										
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Available Capacity (MW) Units 1,2,4,5	920.0	920.0	920.0	920.0	920.0	920.0	920.0	920.0	920.0	920.0
Electricity Produced (GWh)	2,638.6	2,638.6	2,638.6	2,638.6	2,638.6	2,638.6	2,638.6	2,638.6	2,638.6	2,638.6
Project Scenario										
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Available Capacity (MW) Units 1,2,4,5	1,000.0	1,000.0	1,040.0	1,080.0	1,080.0	1,080.0	1,080.0	1,080.0	1,080.0	1,080.0
Electricity Produced (GWh) Enguri Plant Units 1,2,4,5	2,879.0	2,999.3	3,134.6	3,314.9	3,360.0	3,360.0	3,360.0	3,360.0	3,360.0	3,360.0
Emissions Reductions										
Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Additional Electricity Produced (GWh)	240.5	360.7	496.0	676.3	721.4	721.4	721.4	721.4	721.4	721.4
Carbon Emission Factor of Georgian Grid (kgCO2/kWh)	0.38390	0.38390	0.38390	0.38390	0.38390	0.38390	0.38390	0.38390	0.38390	0.38390
Certified Emissions Reductions Generated (tCO2)	**92,318.7**	**138,478.1**	**190,407.3**	**259,646.4**	**276,956.1**	**276,956.1**	**276,956.1**	**276,956.1**	**276,956.1**	**276,945.5**
Total Certified Emissions Reductions Generated (tCO2), ten years	**2,342,577**									
Total Certified Emissions Reductions Generated (tCO2), 2008-12	**957,807**									

For the calculation of *EGy* (i.e. the quantity of electricity expected to be generated by the project activity in the project scenario) the following assumptions were taken into account:

- The rehabilitation of units 2, 4, 1, 5 does not occur simultaneously. The rehabilitated Unit 2 is expected to start generating electricity after the rehabilitation process on 1 August 2007 and will claim emissions reductions only from the expected date of registration of the project activity by the CDM Executive Board. The rehabilitated Unit 4 is expected to start generating electricity after the rehabilitation process on 1 September 2008. The rehabilitated Unit 1 is expected to start generating electricity on 1 April 2010. The rehabilitated Unit 5 is expected to start generating electricity on 1 April 2011.

- During the rehabilitation process each unit does not generate any electricity. Thus, while the unit is rehabilitated no additional electricity compared to the baseline scenario can be generated.
- The additional electricity produced due to the project activity *(EGy – EGbaseline)* is calculated pro-rata for the years 2008, 2009, 2010 and 2011 to take into account the fact that the rehabilitated units will begin operation at a given month within the year.

The actual amount of electricity generated by the rehabilitated units of the Enguri HPP will be monitored ex-post at the end of each year and the emissions reductions will be recalculated.

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

The following is a final table detailing the overall emissions reductions of the project activity.

Years	Estimation of Project Emissions in tCO2e	Estimation of Baseline Emissions in tCO2e	Estimation of leakage in tCO2e	Estimation of overall Emissions Reductions in tCO2e
Half Year 1) July 2008-December 2008	0	31,030.3	0	31,030.3
Full Year 1) January 2009-December 2009	0	82,747.5	0	82,747.5
Full Year 2) January 2010-December 2010	0	134,464.7	0	134,464.7
Full Year 3) January 2011-December 2011	0	186,181.9	0	186,181.9
Full Year 4) January 2012-December 2012	0	186,181.9	0	186,181.9
Full Year 5) January 2013-December 2013	0	186,181.9	0	186,181.9
Full Year 6) January 2014-December 2014	0	186,181.9	0	186,181.9
Full Year 7) January 2015-December 2015	0	186,181.9	0	186,181.9
Full Year 8) January 2016-December 2016	0	186,181.9	0	186,181.9
Full Year 9) January 2017-December 2017	0	93,090.9	0	93,090.9
Half Year 10) January 2018-June 2018		0	0	0
Total (tCO2e)	0	1,458,425	0	1,458,425

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	**Electricity supplied annually to the grid by Unit #2**
Data unit:	GWh
Description:	Electricity supplied to the grid by Unit #2. Unit #2 is expected to generate electricity from Augus 2007.
Source of data to be used:	Electricity meter on Unit #2 will measure the electricity inputted in the Georgian grid.
Value of data applied	2008- 2017: 840

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Measurements will be taken every eight hours by a representative of Engurhesi Ltd from an electricity meter fitted to the unit. The metering devices are calibrated annually by the State Standardization Organization.
QA/QC procedures to be applied:	The metering devices are calibrated annually by the State Standardization Organization
Any comment:	

(Copy this table for each data and parameter)	
Data / Parameter:	**Electricity supplied annually to the grid by Unit #4**
Data unit:	GWh
Description:	Electricity supplied to the grid by Unit #4. Unit #4 is expected to generate electricity from July 2008.
Source of data to be used:	Electricity meter on Unit #4 will measure the electricity inputted in the Georgian grid.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2008: 280 (from September 2008) 2009- 2017: 840
Description of measurement methods and procedures to be applied:	Measurements will be taken every eight hours by a representative of Engurhesi Ltd from an electricity meter fitted to the unit. The metering devices are calibrated annually by the State Standardization Organization.
QA/QC procedures to be applied:	The metering devices are calibrated annually by the State Standardization Organization
Any comment:	

(Copy this table for each data and parameter)	
Data / Parameter:	**Electricity supplied annually to the grid by Unit #1**
Data unit:	GWh
Description:	Electricity supplied to the grid by Unit #1. Unit #1 is expected to begin generate electricity from April 2010
Source of data to be used:	Electricity meter on Unit #4 will measure the electricity inputted un the Georgian grid.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2008: 0 electricity metered (but historical baseline value of 659.6 is applied) 2009: 0 electricity metered (but historical baseline value of 659.6 is applied) 2010: 630 metered from 1 April 2010 (the historical baseline value of 165 is assumed that between 1 January and 31 March, i/e/ 3/12 of the average annual historic level of 659.6) 2011-2016: 840

Description of measurement methods and procedures to be applied:	Measurements will be taken every eight hours by a representative of Engurhesi Ltd from an electricity meter fitted to the unit.
QA/QC procedures to be applied:	The metering devices are calibrated annually by the State Standardization Organization
Any comment:	

(Copy this table for each data and parameter)	
Data / Parameter:	**Electricity supplied annually to the grid by Unit #5**
Data unit:	GWh
Description:	Electricity supplied to the grid by Unit #5. Unit #5 is expected to begin generate electricity from April 2011
Source of data to be used:	Electricity meter on Unit #5 will measure the electricity inputted un the Georgian grid.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2008-2010: 0 electricity metered (but historical baseline value of 659.6 is applied) 2011: 630 metered from 1 April 2010 (the historical baseline value of 165 is assumed that between 1 January and 31 March, i/e/ 3/12 of the average annual historic level of 659.6) 2012-2017: 840
Description of measurement methods and procedures to be applied:	Measurements will be taken every eight hours by a representative of Engurhesi Ltd from an electricity meter fitted to the unit.
QA/QC procedures to be applied:	The metering devices are calibrated annually by the State Standardization Organization.
Any comment:	

B.7.2 Description of the monitoring plan:

As stated by the latest version of the monitoring methodology “ACM0002 Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources”, the monitoring of the following is required: “Electricity generation from the proposed project activity”. The other data listed in the methodology should not be monitored for this CDM project activity since the ex-ante method was applied for the calculation of the build margin and the operating margin and since this project is not a new hydro electric power project.

The spatial extent of the monitoring plan will be the physical project site of the CDM project activity, that corresponds to the Unit #2, Unit #4, Unit # 1 and Unit # 5.
Once implemented, the relevant data monitoring report will be submitted to a designated operational entity contracted to verify the emission reductions achieved during the crediting period. Any revisions requiring improved accuracy and/or completeness of information will be justified and will be submitted to a designated operational entity for validation.

The responsibility for taking electricity meter readings lies with the general manager of the project implementation unit at Engurhesi Ltd.

Meter readings are archived three times a day, during the change of shifts of the operating personnel. Quality assurance of the metering devices is ensured by the mandatory annual calibration process performed by the State Standardization Organization. This ensures the accuracy of the metering devices.

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 and Engurhesi Ltd. The meters are stamped by all parties and they cannot be opened or manipulated by any single party.

Actual hourly generation by each source of power contributing to the Georgian grid is recorded by the network administrators. This allows for the records of electricity generated that are taken by Enguri Ltd to be verified against an alternative source. Also, official representatives of State Electric System and Commercial Operator of the National Electricity Network check Enguri's readings on a quarterly basis and compare them with their own records of dispatched electricity to the central network.

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

The final draft of the baseline for the proposed CDM activity was completed in June 2007 by:
Ms. Natalia Gorina
ICF International (Carbon Advisor/Consultant)
Sardinia House
52 Lincoln's Inn Fields
London WC2A 3LZ
Tel. +44 (0) 20 70923014
Fax +44 (0) 20 70923001
E-mail: ngorina@icfi.com

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

January 2008

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

At least 20 years

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

C.2.1. Renewable crediting period

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

>> Not applicable

C.2.1.2. Length of the first crediting period:

>> Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

1 January 2008

C.2.2.2. Length:

10 years, until 31 December 2017

SECTION D. Environmental impacts

>>

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

A clear distinction should be made between the environmental impacts that the construction and commissioning of the Enguri dam and hydro power plant caused and continue to cause and the environmental risks associated with the operation of the plant which will be possible to eliminate or minimise through the rehabilitation of the plant. The rehabilitation of Enguri will not increase the environmental impacts created by the construction and commissioning of the dam. It will, however, enlarge the environmental benefits that Enguri brings by increasing the emissions-free electricity that the plant is able to generate.

Environmental Impact of Construction and Commissioning

The environmental impacts that the construction and commissioning of the Enguri dam and hydro power plant caused and continue to cause are significant and will continue regardless of rehabilitation. These impacts consist of:

- Interrupting the river and potential migration routes of fish
- Change from river to lake conditions
- Loss of approximately 10 km2 of vegetation, mainly forest, during first filling of the reservoir
- Change of the river Enguri discharge downstream of the dam (reduction of flow)
- Change of groundwater conditions in the Enguri floodplain
- Change in sediment load downstream of the dam, with potential effects on the estuary of the river and the nearby Black Sea Coast
- Change of downstream conditions in the river Eristckali and Okumi

- Loss of livelihood of 365 families which have had to be resettled.

Environmental Impact of Rehabilitation

The *Feasibility Study of Rehabilitation Final Report Part II: Environmental Health and Safety Audit,* was produced in February 1998, (which is made available to the Designated Operational Entity) by the European consortium of Electrowatt Engineering Ltd and Stucky SA (Switzerland) as part of the project feasibility study in 1997-98. This Audit reviewed the state of the plant and identified a number of respects in which the Enguri dam and power plant and ancillary installations are either damaging or risk damaging the environment. It also made suggestions for measures that could be taken to eliminate or minimise these risks. The table below summarises the risks and actions described.

Impact / Risk	Remediation/Mitigation Action
Negative visual impact of cranes, cableways and concrete plants abandoned after dam construction	Remove and dispose of properly
Contamination of river and surrounding soil through oil leakages	Inspections of all oil containing structures and appropriate repairs or replacements made. Investigations into possible waste disposal options as waste oil is presently stored on site. Install oil skimmers at the lorry parking area and mechanical workshop.
Acids in water treatment plant	Improve storage and handling of acids
Asbestos	Removal of asbestos in insulation and the store room, at least where damaged, and its replacement with alternative products
Technical waste water	Collection, installation of oil skimmers where necessary, treatment
Domestic waste water	Control / replacement of sewage system, treatment
Solid waste, materials and debris from the power plant	Remove, recycle or dispose of properly
Solid waste from settlement	Collect, dispose of properly

The outline of Enguri Rehabilitation Project including the *Environmental Health and Safety Audit* were duly submitted to the Environmental Ministry of Georgia before its approval by the Parliament of Georgia in 1998. However, no environmental permits were requested for the project because of it is a rehabilitation project and not a new construction.

The Project Implementation Unit of the Enguri Rehabilitation Project prepared a detailed *Project Overview and the Report on Environmental Action Plan* in September 2006 (which is made available to the Designated Operational Entity). The Environmental Action Plan is based on specifications of the International Hydropower Association as well as the World Bank Environmental Assessment and the EU environmental standards, and responds to four broad objectives: 1) Reducing consumption of resources, 2) Reducing the impact on nature, 3) Reducing the carbon intensity of energy production, and 4) Increasing product of service values. In addition, the Environmental Action Plan has taken into consideration the following Environmental and Health & Safety regulating laws of Georgia:

- Laws of Georgia on "Environmental Protection Permits" of 15 October 1996, and "State Ecological Examination" of 15 October 1996, in reference with construction and rehabilitation of Power Plants, Dams and Reservoirs, Hydro-technical Facilities;
- Law of Georgia on "Environmental Protection" of 10 December 1996, in reference with Environmental Audit and Licensing;
- Laws of Georgia on "Healthcare" of 10 December 1997, and "Security of Hazardous Enterprises" of 10 December 1997, in reference with the liability of employers towards the employees for informational provision of and care on professional deceases;
- Law of Georgia on "Management and protection of River banks" of 27 October 2000, in terms of Erosion protection and bank formation;
- Law of Georgia on "Employment" of 28 September 2001, in terms of provision of fair and safe working conditions for the employees;
- Law of Georgia on "Licensing of Geological Activities" of 8 May 2003, in terms of Geophysical, hydro-geological, geo-engineering and geo-ecological activities.

The *Environmental Action Plan* describes the remediation/mitigation actions that have been taken and are planned under two phases of the rehabilitation project as of September 2006. These are summarised in the table below:

Issue	**Implementation status**	**Planned remedial action**
Visual impact	All abandoned cranes, cableways and still structure of the concrete plant were removed.	The former concrete plant near the dam to be demolished
Oil containers of transformers Used oil tanks and oil skimmers Oil-contaminated water	Under the existing scope of the contract on Electro-Mechanical Works with Voith-Siemens all oil immersed transformers located in the underground power house were replaced by the dry (cast resin) type of new transformers. As a general rule, secondary (used) oil is treated in the regeneration plant for refining and reuse. At this stage no old oil tanks and skimmers are in use. Waste oil is kept in the oil tanks.	To protect drainage water from contamination both before and after rehabilitation, it is of highest priority that the company acquires the oil collection cubicle which shall be placed in the lower level drainage pit; Oil tanks and containers: inspect and define measures needed accordingly; Filling station: inspect underground diesel and petrol tanks and define any measures accordingly; As a high priority measure, the mechanical workshop needs to be equipped with oil channeling rout and the skimmer, and floor needs to be concrete-sealed.
Acids (Power House)	No acid source of contamination was detected during the inspection.	
Asbestos (Power House)	Insulation asbestos of Units # 3 and #2 cooling water piping were fully replaced. Buildings and workshops were checked for applied asbestos. No open exposure of such material was detected.	Supply and install neutralization equipment; Insulation asbestos of Unit #1 will be replaced during the rehabilitation of process in 2007. Replacing of all water cooling systems on remaining two un-rehabilitated units are planned to be

		carried out in the Phase II electro-mechanical works.
Waste (Power House and Dam)	All levels of the Plant and the Dam were substantially cleared. Steel and other remnants of old devices from the workshops and maintenance areas have been removed. Old switch-boards, transformers and cubicles of rehabilitated Unites # and 2 have been removed.	Provide waste water treatment plant for residential areas.
Contaminated soil (Power House)	No contamination of soil was detected during the inspection period.	

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

The Parliament of Georgia gave its approval of the Enguri Rehabilitation project in 1998. The environmental impacts of the project are not considered significant and a full environmental impact assessment was not required.

SECTION E. Stakeholders' comments

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

A Stakeholder Consultation meeting was organised specifically for the "Refurbishment of Enguri Hydro Power Plant, Georgia" CDM project activity. Invitations to the Stakeholder Consultation were sent by letter, e-mail or communicated telephonically to 47 potential participants identified among stakeholders that are either impacted by this CDM project or have a direct interest in the CDM project.

The Stakeholder Consultation was held on Monday 12 March 2007, at 14.00 at the Meeting Hall "Salkhino", Metekhi Sheraton Palace Hotel, 20 Telavi street, Tbilisi, 0103, Georgia. The meeting was conducted both in Georgian and English and simultaneous translation was provided. All attendees received a copy of the draft Project Design Document (version of January 2007 in English) and a questionnaire (in Georgian).

Two presenters gave PowerPoint presentations during the meeting as follows:

- 14.00 Presentation by Natalia Gorina, Senior Consultant, ICF International
  - Background on Clean Development Mechanism in Georgia
- 14.30 Presentation by Brendan Quigley, Project Manager for Consortium of International Engineering Consultants for the Enguri Project
  - Current status of implementation of the rehabilitation project
  - Environmental Action Plan at Enguri HPP
- 15.00 Presentation by Natalia Gorina, Senior Consultant, ICF International

- Enguri HPP CDM project: purpose, project description, sustainable development benefits

The presentations were followed by a Question and Answer session.

The following is the list of attendees:

	Name	Surname	Organisation	Position
1	Giorgi	Abulashvili	Energy Efficiency Centre Georgia	Director
2	Alexander	Akhvlediani	Samegrelo-Zemo Svaneti Administration	Deputy Head of Administration
3	Ramin	Bakhturidze	Enguri Hydropower Station	Member of Supervisory Board
4	Nino	Chkhobadze	NGO Environmental League	Director
5	Liana	Garibashvili	Energy Efficiency Centre Georgia	Chief specialist
6	David	Girgvliani	SRF Gamma Consulting	Expert
7	Kety	Gujaraidze	NGO Green Alternative	Project Manager
8	Medea	Inashvili	Ministry of Environment of Georgia	Main Specialist
10	Nana	Janashia	Caucasus environmental NGO network	Director
11	Paata	Janelidze	UNDP GEF KfW Project Promotion of the use renewable energy resources for local energy supply - Georgia	Project Manager
12	Valeri	Kankia	Enguri Hydropower Station	Chairman of Supervisory Board
13	Otar	Kiria	Santsk-Javalcheti Roads Rehabilitation project by MCG	
14	Manana	Kochladze	Georgian environmental NGO	Project Manager
15	Grigol	Lazriev	CDM Georgian DNA	Contact Person
16	Grigol	Matcharadze	Enguri Hydropower Station	Technical Manager PIU
17	Joseph	Melitauri	World Bank mission in Georgia	Operations Officer, Infrastructure & Energy Department
18	Taras	Nijaradze	Basis Bank	Chairman of Supervisory Board
19	Nana	Pirtshelani	Ministry of energy of Georgia	Deputy Director of Policy and international relations Department
20	Mariam	Shotadze	United Nations Development project	Environmental Specialist / EFP
21	Marina	Shvangiradze	Coordinator of Georgia's Second National Communication to the UNFCCC	
22	Rusudan	Simonidze	The Greens Movement of Georgia / Friends of the Earth	Leader
23	Levan	Tavartkiladze	Ekoalliance Association	Director
24	Lia	Todua	Center for Strategic Research and Development of Georgia; Coordinator of Environmental Program	Director
25	Keti	Tsereteli	REC Caucasus	
26	Malkhaz	Tskvitishvili	Enguri Hydropower Station	Project Manager, PIU

27	David	Tvalabeishvili	World Bank mission in Georgia	Carbon Finance Coordinator, Infrastructure & Energy Department

The following questions and comments were made during the Stakeholder Consultation by the attendees (paraphrased and summarised version of the Question and Answer session):

1) Question posed by Marina Shvangiradze, coordinator of the second national communication of Georgia to the UNFCCC: "What is the reliability of the installed technology? Can we be assured that the installed technology is going to be sustainable and will operate successfully over the crediting period of the project?"
Answer given by Brendan Quigley, Project Manager for Consortium of International Engineering Consultants for the Enguri Project:
The Georgian engineering and construction firm Sakhydro was one of the contractors of this project and received training from the Consortium of International Engineering Firms during the first year of operation. The technology transfer resulted to be very successful since Sakhydro did not need any further training from the Consortium.
The turbines are in good state, the generators will be rehabilitated and re-installed. The monitoring and controlling system will ensure the reliability and sustainability of the system in the next 10 years.

2) Question posed by the audience (not clear by whom specifically): "What exact technical parts will be installed at the units included in the CDM project?"
Answer given by Malkhaz Tskvitishvili, Project Manger of the Enguri Rehabilitation Project Implementation Unit.
Turbines are already rehabilitated, while the CDM project will include the rehabilitation of the generators. Within the timeframe of the CDM project a state of the art monitoring and controlling equipment will be installed that will ensure the overall security and safety of the system.

3) Which pieces of equipment are of Soviet (Ukrainian) design and which are of German design?
Answer given by Brendan Quigley. The turbine is of Ukrainian design, while the generators, the monitoring and operation equipment are of German design (supplied by Voiht Siemens).

4) Question posed by George Abulashvili, Director of the Energy Efficiency Center in Georgia and member of the CDM Council in Georgia: "How can the efficient volume of the reservoir be increased withut increasing the surface area covered by the reservoir? "
Answer given by Brendon Quigley: This reservoir is very deep and since Enguri is a high mountain river there is the problem of sedimentation in the reservoir. In order to minimise sedimentation in the reservoir specialist companies are hired and they will be involved in the implementation of a sedimentation action plan (to minimise sedimentation in the reservoir).

5) Question posed by George Abulashvili, Director of the Energy Efficiency Center in Georgia and member of the CDM Council in Georgia: "What are the sources of data used to calculate the carbon emission factor of the Georgian grid? How reliable are these sources? Are they official sources?"
Answer given by Natalia Gorina, Senior Consultant, ICF International
The sources of data used for the calculation of the carbon emission factor of the Georgian grid are indicated on page 10 of the Project Design Document. The most important source of information for the calculation of the emission factor is the Central Electricity Dispatch Center of Georgia which provided

the load data necessary for the calculation of the lambda factor, and thus the adjusted operating margin and the build margin. In addition, internationally recognised data, such as the IPCC factors were used in calculations. It can therefore be concluded that the data sources used are reliable.

6) Question posed by Medea Inashvili, Ministry of Environment: "What is the cost of rehabilitation of the three Enguri generation units?"
Answer given by Malkhaz Tskvitishvili. The cost of rehabilitation is around USD 5 million $ per each unit. USD 45 million were earmarked for Phase 1 and USD 12 million for Phase 2.

7) Question posed by by Medea Inashvili:"How much payment will Enguhresi receive for the CERs stemming from this CDM project?"
Answer given by Natalia Gorina. The payment that Enguhresi will receive from the sale of CERs is still difficult to state given the fact that the CERs price is subject to negotiation. Nevertheless, I can give you a range of prices that were paid by potential carbon buyers in similar transactions. The prices per CERs currently paid are between EUR 5 and EUR 8-9 per ton. Most of available buyers, including the newly created EBRD fund purchase CERs up to 2012 and offer an option to purchase CERs generated after 2012. CERs revenues can be obtained by multiplying the expected volume of this project for 5 years (2008-2012) and the range of CERs prices.

8) Question posed by George Abulashvili: "What is the time schedule for the next steps of the CDM cycle for this project, i.e. when do you expect validation, national approval and CDM registration to occur?"
Answer given by Natalia Gorina. We would like to engage in the next steps of the CDM process as soon as possible and proceed to collecting and preparing the necessary documentation for DNA approval later this month. At the same time an internationally recognised DOE will be selected to proceed to validation. We hope to obtain the registration of the project in 2007 or early 2008 but several factors are not under our control. In any case we try to speed up the CDM process as much as it is possible.

9) Question posed by the audience (not clear by whom specifically): How much electricity produced by Enguri HPP goes to Abhazia?
Answer given by Malkhaz Tskvitishvili: currently the Abhazian side receives 36% of total electricity generated.

10) Question posed by Paata Janelidze, Project Manager of the UNDP GEF KfW Project Promotion of the use renewable energy resources for local energy supply - Georgia. Mr. Janelidze announced that he was very pleased with the quality of the Project Designed Document. He then commented on the issue of additionallity of this CDM project: since the rehabilitation of one unit has already been implemented successfully, there could be some concern in demonstrating the barrier analysis, given the fact that several barriers existed even initially, but still did not prevent the rehabilitation from taking place. Natalia Gorina replied that the major barrier which is present for the CDM project only is the lack of funding for the rehabilitation of Units #2, # 4, #1 and #5.
Mr. Janelidze then asked a clarification question on the data regarding calculation of the heat rate of thermal plants included in the operating margin. Natalia Gorina clarified the issue.

11) Question posed by Marina Shvangiradze, Coordinator of Georgia's Second National Communication to the UNFCCC: "Does this PDD include the monitoring plan? Who will be in charge of monitoring the emissions reductions?"
Answer given by Natalia Gorina. The Project Design Document includes a monitoring plan. The monitoring plan foresees that the electricity produced by the units of the Enguri HPP are metered

according to the methodology ACM0002. The exact person in charge of monitoring at Enguri HPP will be nominated towards the end of the Rehabilitation Project.

12) Comment made by Grigol Lazriev, head of the Georgian Designated National Authority. For the purposes of approval of this CDM project by the Georgian DNA, the ACM0002 methodology needs to be applied in full and the simple adjusted operating margin calculation should be calculated for all three recent years (2006, 2005, 2004) (Note: at the time of the Stakeholder Consultation, only the 2006 load data were available to the Carbon Consultant and only the 2006 adjusted operating margin was calculated).

13) It was then discussed by several attendees what is the most reliable source of information on load data for the purpose of carbon emission factor calculation among the data provided by the Electricity Dispatch Center or the data provided by Georgian Ministry of Energy. It was concluded that the Electricity Dispatch Center supplies the best available data.

E.2. Summary of the comments received:

Eleven answered questionnaires were received. The vast majority of the received questionnaires were completed in Georgian. Questionnaires can be made available to the Designated National Authority and the Designated Operational Entity. The following paragraphs summarise the comments received.

1) *Do you believe that the Enguri Rehabilitation project contributes to sustainable development of Georgia? Why?*

10 out of 11 answered questionnaires believe that the project does contribute to sustainable development, since the project allows the generation of electricity from a renewable source. This project is considered to be of strategic importance for sustainable development of Georgia. The project is very important for Georgia given the fact that Enguri contributes to about 40% of total electricity generation in Georgia. The Enguri HPP is currently running at a less efficient level than it its nominal rate. Thanks to the CDM project, the contribution of Enguri to CO_2- free energy production will increase even further. One answered questionnaire notes that rehabilitating existing capacity avoids the construction of new electricity facilities with further environmental impacts. One answered questionnaire notes that this CDM project is better than the construction of the new Hudoni hydro power plant in Georgia.
One answered questionnaire comments that the sustainable development benefits will be evident only if new modern state of the art technology is transferred to Georgia and if these technologies are adapted successfully to local conditions.

2) *Can you identify any issues or omissions in the Environmental Impact Assessment of the Enguri Rehabilitation Project? Do you think it was conducted in a proper manner?*

Three people believe that since the full Environmental Impact Assessment was not attached to the PDD, they did not have a chance to evaluate the environmental impacts in full. The remaining 8 questionnaires did not foresee any further negative environmental impacts other than those cited in the Environmental

Action Plan. Thus, the CDM project consisting in the rehabilitation of the three generation units itself does not impact the environment any further than the environmental impacts of the preexisting plant.
Several questionnaires underlined the fact that the Environmental Action Plan was conducted in a proper manner. No answered questionnaire noticed any negative environmental impact in connection to the CDM project.

3) *In your opinion, what are the potential negative environmental impacts that were not addressed?*

One answered questionnaire points out that a potential negative environmental impact can stem from potential changes of groundwater conditions in the Enguri floodplain, which could have impacts on the local population of the Samegrelo region. 3 questionnaires left the question blank.
All the remaining questionnaires did not find any negative environmental impacts.

4) *In your opinion, what are the potential negative impacts on the local communities that were not taken into account?*

Only two out of 11 questionnaires answered this question. The remaining 9 questionnaires left this question blank. One questionnaire pointed out the fact that the increased electricity production at Enguri HPP could potentially cause a smaller volume of water discharged downstream from the dam and the power station. This could potentially affect negatively the people living downstream of the river.
One answered questionnaire stated that all the economic and social aspects were well discussed during the presentation and they reflect the reality of the situation of the region.

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

The Environmental Action Plan was sent to those participants that required further information on the environmental aspects of the project. No other comments were received. All the comments given during the Stakeholder Consultation were taken into account in the final version of the Project Design Document.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	European Bank for Reconstruction and Development
Street/P.O.Box:	One Exchange Square
Building:	
City:	London
State/Region:	
Postfix/ZIP:	EC2A 2JN
Country:	United Kingdom
Telephone:	Switchboard: +44 20 7338 6000
FAX:	Central fax: +44 20 7338 6100
E-Mail:	
URL:	www.ebrd.com
Represented by:	
Title:	Principal Carbon Manager
Salutation:	Mr.
Last Name:	van de Ven
Middle Name:	
First Name:	Jan-Willem
Department:	Energy Efficiency and Climate Change Team
Mobile:	+44 7802510619
Direct FAX:	+44 20 73386942
Direct tel:	+ 44 20 7338 7821
Personal E-Mail:	vandevej@ebrd.com

Organization:	Enguhresi Ltd
Street/P.O.Box:	50, Chvchavadze Avenue
Building:	
City:	Tbilisi
State/Region:	
Postfix/ZIP:	
Country:	Georgia
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	Project Manager
Salutation:	Mr.
Last Name:	Tskvitishvili
Middle Name:	
First Name:	Malkhaz
Department:	Project Implementation Unit
Mobile:	

Direct FAX:	(995 32) 29 21 37
Direct tel:	(995 32) 20 40 10
Personal E-Mail:	malkhaz@caucasus.net

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The European Commission provides a grant of EUR 9.4 million to this CDM project. The European Commission confirms that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of the European Commission. The European Commission will not claim any Certified Emission Reductions to be generated by the Enguri HPP Rehabilitation CDM project. These Certified Emission Reductions belong to the Government of Georgia.

Publicly available article on EBRD lending to Enguhresi Ltd and the Georgian government

Power to the people of Georgia

Power cuts were the daily routine in post-Soviet Georgia, with blackouts lasting for as long as two weeks. They became emblematic of the country's precipitous economic decline, played out in degraded living standards in what was once one of the USSR's most prosperous republics.

Households, businesses, hospitals and schools had to make do, or die. On the home front they substituted with often-faulty gas heaters (one of which killed Prime Minister Zurab Zhvania in 2005). Or they financed their own private generators, or paid bribes, in the case of some bigger industrial concerns, to ensure scarce power from the central system was diverted to them.

Since 1997 the EBRD and the European Commission (EC) have been helping to unpick the knots in Georgia's energy supply, in part by investing in the Enguri hydropower station, the country's main power source. It has been a long and torturous road and the job isn't finished yet, but residents can now flick on their light switches in Tbilisi at any time of day and find the electricity is working.

Improvements at Enguri will help Georgia to reduce imports of expensive natural gas used for power generation and improve security of supply by replacing it with renewable domestic hydropower.

Geopolitical power play

Enguri was built in 1978 to provide peak electricity to the then Soviet Union. By the time the Soviet Union disintegrated in 1991, the plant urgently needed rehabilitation following years of zero maintenance. The plant's unit three shut down completely in 1993, robbing the country of 10 per cent of its power supply; other units operated below capacity.

Rehabilitation seemed impossible. The state argued it had no funds. And the plant straddles a disputed internal frontier with Abkhazia, a territory that has long fought for independence from Georgia.

Merab Daritaia is the Chief Engineer of Sakhydroenergomsteri, the state company that built the hydropower plant. He was just 22 years old when he moved to Sokhumi city – in what is now the Abkhazian-controlled zone – to build the Enguri power house.

He remembers that 21,000 people were employed to build the plant. "There I met my wife," says Mr Daritaia. In Sokhumi, his son, Temur, was born.

The plant became his life. He has spent 25 years in the settlement. The memory of watching it decay brings tears to the eyes of a now grey-haired Mr Daritaia.

In 1997, the EBRD agreed to lend the Georgian government $38.75 million to rehabilitate Enguri; the EC offered a grant of €9.4 million. "This was a brave decision as the plant was in a conflict zone," says Mr Daritaia.

The project floundered for a number of years for many reasons including the Abkhazia conflict and difficulties in tendering the project contracts in accordance with EBRD's stringent anti-corruption procurement rules.

At last, Georgian technicians were allowed to enter Abkhazia to repair the power house; in return, the Abkhazians would receive free energy.

Towards the power house

Driving towards the power house, Mr Daritaia feels uncomfortable going through an unofficial checkpoint manned by young Abkhazians. “There have been times when our workers have been kept at gunpoint,” he says, “but I believe that the rehabilitation helped to build a working relationship with the Abkhazians.”
In March 2006, armed guards from elsewhere in the Commonwealth of Independent States were brought to guard the plant on the Abkhazian side. One of them, aged 23, comments that “guards like me are essential to safeguard peace and normal life.”
In the power house, all the equipment is new and carries English rather than Russian trademarks. “Three out of five energy generating units have been restored thanks to the EBRD loan and together they now produce enough to supply a quarter of the country’s needs,” says Malkhaz Tskvitishvili, the Project Manager.
He leads the way into the galleries within the 271-metre-high dam, the world’s highest arch dam, and discusses with Laurent Chabrier, the EBRD banker involved in Enguri, how this loan has changed the plant.
The plant was shut down completely in March 2006 so that rehabilitation could start. Beneath the dam reservoir is a series of huge galleries, one atop the other, containing equipment essential to plant operations. “About 5.3 kilometres of galleries were rehabilitated,” says Mr Tskvitishvili. “They were flooded in water.”
The pressure gallery, 100 metres under the water reservoirs and the riskiest point of the dam site, was rehabilitated. So were the valve chamber, the pressure tunnel and the equipment to monitor geophysical movement that could weaken the dam.

A safer, more dependable dam

“It is now safer to work in the plant,” observes Mr Chabrier. “This project has improved safety in terms of the dam, the workers and the region. Above all, it has brought reliable electricity to Georgia.”
And that is not all. About 140 staff were trained thanks to a Swiss government grant, a road linking the power house with the dam was rebuilt and the workers’ settlements were refurbished in Potskho, the ‘village of the dam’. Five hundred people live there, of whom 300 are rehabilitating the dam.
Jimi Akubardia, one of them, disappears inside the dam every morning at 7am. He is too busy cleaning and dismantling equipment to have time for talk. His parents and grandparents depend on his $380 per month salary.

No power cuts in Tbilisi

“The three power units came back on stream on 14 July 2006,” says Mr Tskvitishvili. The EBRD is now considering extending the loan to cover rehabilitation of the remaining two energy generating units.
“The Enguri hydropower plant is essential to Georgia. It covers 40 per cent of Georgia’s total energy consumption. The state was not strong enough alone to rehabilitate this plant,” says Archil Mamatelashvili, Deputy Minister of Energy. “We needed the EBRD and the EC to raise finance.”
Much has changed since the blackout days. A former Minister of Energy is now in prison, charged with corruption. And the power company will be able to fund its own maintenance programme: 70 per cent of customers now pay for electricity compared to only 30 per cent in 2002.
“Drive around the Georgian capital, Tbilisi, in the evening and you feel you are in a city as brightly lit as Las Vegas,” says Malkhaz Tskvitishvili.
By Marjola Xhunga, communications adviser

14 August 2006
Source: http://www.ebrd.com/new/stories/2006/060822.htm

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

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