Project design document form for small-scale CDM project activities

(Version 06.0)

Complete this form in accordance with the Attachment “Instructions for filling out the project design document form for small-scale CDM project activities” at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Gudauri Small Hydropower
Version number of the PDD	14
Completion date of the PDD	08/04/2016
Project participant(s)	Energo – Aragvi Ltd
Host Party	Georgia
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral scope 1: Energy Industries (renewable-/ non-renewable sources)
Estimated amount of annual average GHG emission reductions	22,891

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>> The proposed project activity involves installation of a new 9.72 MW grid connected hydro power plant developed by Energo-Aragvi Ltd, Gudauri at a site where there was no renewable energy power plant operating prior to the implementation of the project activity. Hence the project is a Greenfield activity. The installation of the proposed capacity of the project is planned to be carried out in two phases-

Stage I consisting of 8.52 MW generating 50.6 GWh/ yr and stage-II consisting of 1.2 MW generating 9.3 GWh/yr. The stage I is expected to get commissioned by December 2012. The stage-II is expected to get commissioned by February 2015 after the successful implementation of the stage-I. The detail of the stage wise implementation is as mentioned below:

Stage	Total Capacity (MW)	Generator Details	Net Generation (GWh/ yr)
I	8.52	(2 x 4.26 MW)	50.6
II	1.2	(1 x 1.2 MW)	9.3

The purpose of Gudauri Project activity is to generate electrical energy by using the hydropower potential of Tetri Aragvi River to meet the demand for electrical energy in the Gudauri region. The proposed project activity being a grid connected project will be designed to feed the total power generated from the project activity after meeting the auxiliary demand and other line losses of the proposed power plant to the National Grid of Georgia via 110 kV transmission line. In absence of the project activity, equivalent units of electricity would have been generated by the fossil fuel dominated grid connected power plants, resulting in CO_2 emissions to the atmosphere. Hydro power being a clean source of energy would not result in any greenhouse gas (GHG) emissions. Thus, the installation of the proposed CDM project activity would result in reduction of GHG emissions that would have otherwise taken place due to generation of electricity in grid connected carbon intensive power plant and contribute to mitigation of global warming.

The net electricity evacuated to the national grid of Georgia from the proposed CDM project activity will be monitored continuously with the help of export-import meter installed at the grid interconnection point. The project aims to reduce 22,891 tCO_2/annum on an average of GHG emissions electricity would have otherwise been generated by the fossil fuel dominated grid connected power plants.

Energo – Aragvi Ltd which is the owner of the project activity believe that the installation of the complete Gudauri scheme is essential for a sustainable development of the Gudauri region, especially to cover the increasing demand for electricity at the Gudauri ski arena and tourist resort and to support the public grid in the whole region. The project activity is likely to have the following benefits:

- Encourage and support the tourist Industry which is economically crucial for the Gudauri region e.g. for skiing and rock climbing
- The project activity would be essential for the development of small industries that could operate in the region of Duscheti if a reliable source of energy is available. As a 110 kV line from Russia supplying with energy has been stopped.
- The development of Industry and tourism will increase employment opportunities for the people in the local areas and contribute to social well being.
- Wood in the forests is being cut in villages and cities for use as firewood. Intensive cutting that mainly takes place around the populated areas has had negative environmental impact reflected in the decrease of potable water resources and weakening the ability of forests of GHG sequestration. Further the risk of erosion is being increased. The project will try to meet the energy demand and contribute to environment sustainability. In the Gudauri region due to the lack of electricity power the people are forced to cut wood in the forest as an alternative energy source.
- The project activity contributes toward environmental sustainability by using renewable resources and not leading any GHG emissions in the environment and not affecting the health of the local population.
- As on the date version 8 of the PDD, the stage I of the proposed project activity is expected to get commissioned by the end of 2012. After the successful implementation of the stage I, the construction for stage II will begin accordingly.

A.2. Location of project activity

A.2.1. Host Party

>>
Georgia

A.2.2. Region/State/Province etc.

>>
Gudauri is located in the north region of Georgia, at the Dusheti District.

A.2.3. City/Town/Community etc.

>>
Gudauri Small Hydropower Project is located close to the Gudauri village.

A.2.4. Physical/Geographical location

>>
The power plants are located in the northern part of Georgia as shown on the map below.

The Gudauri Small Hydropower Project is located upstream the village Kvesheti on the river Tetri Aragvi close to the Gudauri ski resort and Gudauri region. The powerhouse is located at Aragvi river. It is bounded by 42˚26'42" N latitude and 44˚28'52"E longitude.

A.3. Technologies and/or measures

>> **Technology:**

Based on the lengthy and extensive investigation engineering works the Gudauri scheme in total with 9.72 MW installed capacity and 59.9 GWh yearly production will be developed. The whole scheme would significantly support and stabilize the electricity network in the whole region. To

facilitate financial engineering the realization of the total scheme has been divided in two stages-Stage I and Stage II.

Stage I:

The water from the left tributary will be collected by a Tyrolean weir at an elevation 1812.80 m asl and will collect 3.6 m^3/s leading to a sand trap and from there on to a reservoir with 53,463 m^3 volume and a water level of 1800 m asl. At the weir intake a discharge of 0.4 m^3/s residual water will be provided. The water from the right tributary will be collected by a Tyrolean weir at an elevation 1810 m asl and will collect max 2.5 m^3/s leading to a sand trap and from there on to the reservoir with 53,463 m^3 volume and a water level of 1800 m asl. From the reservoir 3.6 m^3/s (design discharge) for turbination will be transferred through a penstock of 5,135 m length and a diameter 1,400 and 1,500 mm.

At the powerhouse two Pelton turbines each with an installed capacity of 4,397 kW including the generator of capacity 4260kW each and electrical equipment as per requirement will be installed. The produced energy will be transferred through a 10 kV transmission line to the substation located in about 1,000 m distance above the powerhouse and there supplied to the 110 kV existing transmission line (national grid of Georgia).

Stage II:

The water will be collected by a Tyrolean weir at an elevation 2,000 m asl and will collect max 1.0 m^3/s leading to a sand trap. From the sand trap the water will be transferred by polyethylene pipes with a diameter of 700 mm and a length of 2,800 m to a daily pondage with a capacity of 5,000 m^3 volume and a water level of 1,975 m asl. From the daily pondage 0.8 m^3/s for turbination will be transferred through a penstock of 350 m length and a diameter 600 mm in steel pipes to the powerhouse located at the reservoir for stage I.

At the powerhouse one Pelton turbine with an installed capacity of 1,200 kW including the generator and electrical equipment as per requirement will be installed. The produced energy will be transferred through a 10 kV transmission line to the powerhouse of stage I.

Summary on the technical data[1]

Stage I

Particulars	Units	Value
Design Discharge	m^3/s	3.6
Turbine Type	kW	4397(Pelton)
Generator	kW	4260
No. of Turbines		2
Net Head	m	240

[1] The technical data has been taken from the Project Design Report Rev.1, page8 prepared for the project on June 2010

Diameter of the Penstock	mm	1500/1400
Average Annual Energy Production	GWh	50.6

Stage II

Particulars	Units	Value
Design Discharge	m³/s	0.8
Turbine Type	kW	1200 (Pelton)
No. of Turbines		1
Net Head	m	167.44
Average Annual Energy Production	GWh	9.3

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Georgia (host)[2]	Energo – Aragvi Ltd	**No**

A.5. Public funding of project activity

>>

There is no public funding involved in this project activity[3].

A.6. Debundling for project activity

>> According to para2 of Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities[4] and para 2 of Annex13, EB54, ”*A proposed small-scale project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity*:

- *With the same project participants;*
- *In the same project category and technology/measure; and*

[2] http://maindb.unfccc.int/public/country.pl?country=GE

[3] A declaration of the no public funding for the project activity has been provided by the PP.

[4] http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf

- *Registered within the previous 2 years; and*
- *Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point."*

Energo-Aragvi Ltd have not registered any small scale CDM project activity within the previous two years or applied to register another small scale CDM project activity whose project boundary is within 1 km of the project boundary of the proposed small scale activity at the closest point in the same project category and technology.

Therefore, the project is not a de bundled component of a large scale project activity. There is no other hydropower scheme in operation or in planning stage at the Gudauri, Tbilisi region.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

>> The proposed project activity falls into:

Project Type: I Renewable energy projects

Project Category: AMS- I.D. Grid connected renewable electricity generation, version 17, valid from June 17, 2011 onwards.[5]

B.2. Project activity eligibility

>> The proposed project activity is a grid-connected hydro power generation project (i.e. renewable power generation project activity) and installs a new power plant at the project site where no renewable power plant was operated prior to the implementation of the project activity (i.e. Greenfield plant). The project activity qualifies under the type I and category I.D. The relevant methodology for the mentioned type and category of small scale methodology is AMS-I.D., version 17.

<u>Justification of the small scale project activity as per technology/measure of AMS I.D/Version 17</u>

The applicability of the project activity under the above methodology is provided in the table below:

Technology/Measure as per AMS I.D/Version 17[6]	Measure of the project activity	Conclusion
This methodology comprises renewable energy generation units, such as	The project activity is a run-of-the-river hydro	The project activity satisfies the applicability

[5] Please refer the link: http://cdm.unfccc.int/UserManagement/FileStorage/V9LRSXKP24Q7YT6HZDUBO3C0ING8AJ

photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass:[6] *Supplying electricity to a national or a regional grid; or* *Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.*	power plant. The generated electricity will be exported to the grid which in absence of the project activity would have been generated by the grid mix consisting of several fossil fired generating units. The project Owner has signed a power purchase contract with ESCO the state owned Electricity System Operator and will supply all electricity via the national grid to ESCO	criterion. No wheeling arrangement is foreseen.
2. Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A) applies is included in Table 2.	The project activity will supply the electricity to the national grid of Georgia.	Project activity will apply AMS-I.D latest revision "grid connected renewable electricity generation ".The project activity satisfies the applicability criterion.
3. This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The project will install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity	The project activity satisfies the applicability criterion. .
4. Hydro power plants with reservoir that satisfy at least one of the following conditions are eligible to apply this	The project activity will be a run-of-the-river	The project activity satisfies the applicability

[6] Refer to EB 23, annex 18 or the definition of renewable biomass.

methodology: *The project activity is implemented in an existing reservoir with no change in the volume of reservoir;* *The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2;* *The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.*	project with two Water intakes and one balance pond necessary for proper operation of the turbines. There is no existing or new reservoir.	criterion.
5. "If the unit added has both renewable and non-renewable components (e.g.. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel[7], the capacity of the entire unit shall not exceed the limit of 15MW."	The unit has only renewable component. Since the project activity generates electricity harnessing hydro-power generating potential, there is no scope of co-firing of fossil fuel. The project activity generates about 9.72 MW which is less than 15 MW.	This eligibility criterion is met by the project activity.
6. "Combined heat and power (co-generation) systems are not eligible under this category."	The project activity does not deal with cogeneration.	This eligibility criterion is not applicable for the project activity under consideration.
7. "In the case of project activities that involve the addition of renewable energy generation units at an existing	The proposed project activity is a Greenfield one. It does not involve	So the criterion is not applicable for the project activity under

[7] Co-fired system uses both fossil and renewable fuels.

renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct[8] from the existing units."	the addition of renewable energy generation units at an existing renewable power generation facility	consideration
8. "In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The project activity is a Greenfield one. So the question of retrofitting does not arise in this case.	The criterion is not applicable.

Applicability

The project activity will involve generation of electricity by using hydro potential which is a form of renewable energy. The power generated by the project activity will help in displacing electricity that would have been supplied by non renewable power generations connected to the grid. Therefore, the project activity meets the applicability conditions of the Baseline Methodology of AMS I.D, Version 17[6], EB 61, Annex 17, Valid from 17 June 11 onwards.

Actual application of the baseline methodology

As the installed capacity of the project activity will be 9.72 MW, which is less than stipulated 15 MW, the project activity falls under the small scale CDM project activity and Baseline calculations for the Emissions factor of the Georgian national grid are done according to Appendix B of the simplified modalities and procedures for small-scale CDM project activities (Type I - Renewable Energy Projects - I.D. 'Grid connected renewable electricity generation'):

"The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kgCO_2e/kWh) calculated in a transparent and conservative manner:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribes in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered,

Or

(b) The weighted average emissions (in kg CO_2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

8 Physically distinct units are those that are capable of generating electricity without the operation of existing units, and that do not directly affect the mechanical, thermal, or electrical characteristics of the existing facility. For example, the addition of a steam turbine to an existing combustion turbine to create a combined cycle unit would not be considered "physically distinct".

Calculations must be based on data from an official source (where available) and made publicly available, the details are provided in Annex 3 – Baseline information.

In order to avoid different result, due to inconsistent data about the Georgian National Grid, the DNA of Georgia decided to calculate an emission factor which can be used by the project developers.

The calculated Emission Factor of the Georgian National Grid provided by the Georgian DNA = 0.3999 t CO_2/MWh[9]. This was the latest available grid emission factor provided by DNA of Georgia at the time of PDD submission for validation process.

This emission factor will be fixed ex-ante for the entire crediting period.

Details are provided in Annex 3 – Baseline information.

B.3. Project boundary

According to methodology AMS I.D (Version 17.06, EB 61, Annex 17, dated 3 June 2011, Valid from 17 June 11 onwards)

"The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system10 that the CDM project power plant is connected to.". For the project activity, the project boundary includes the intake of Gudauri Stage II till to the grid interconnection point, i.e. the existing substation of the 110 kV transmission line. It thus covers the intakes of stage I&II, the forebay, the penstocks of Stage I&II, the powerhouses, the tailraces, the switchyards, the power lines and all other accessory equipments.

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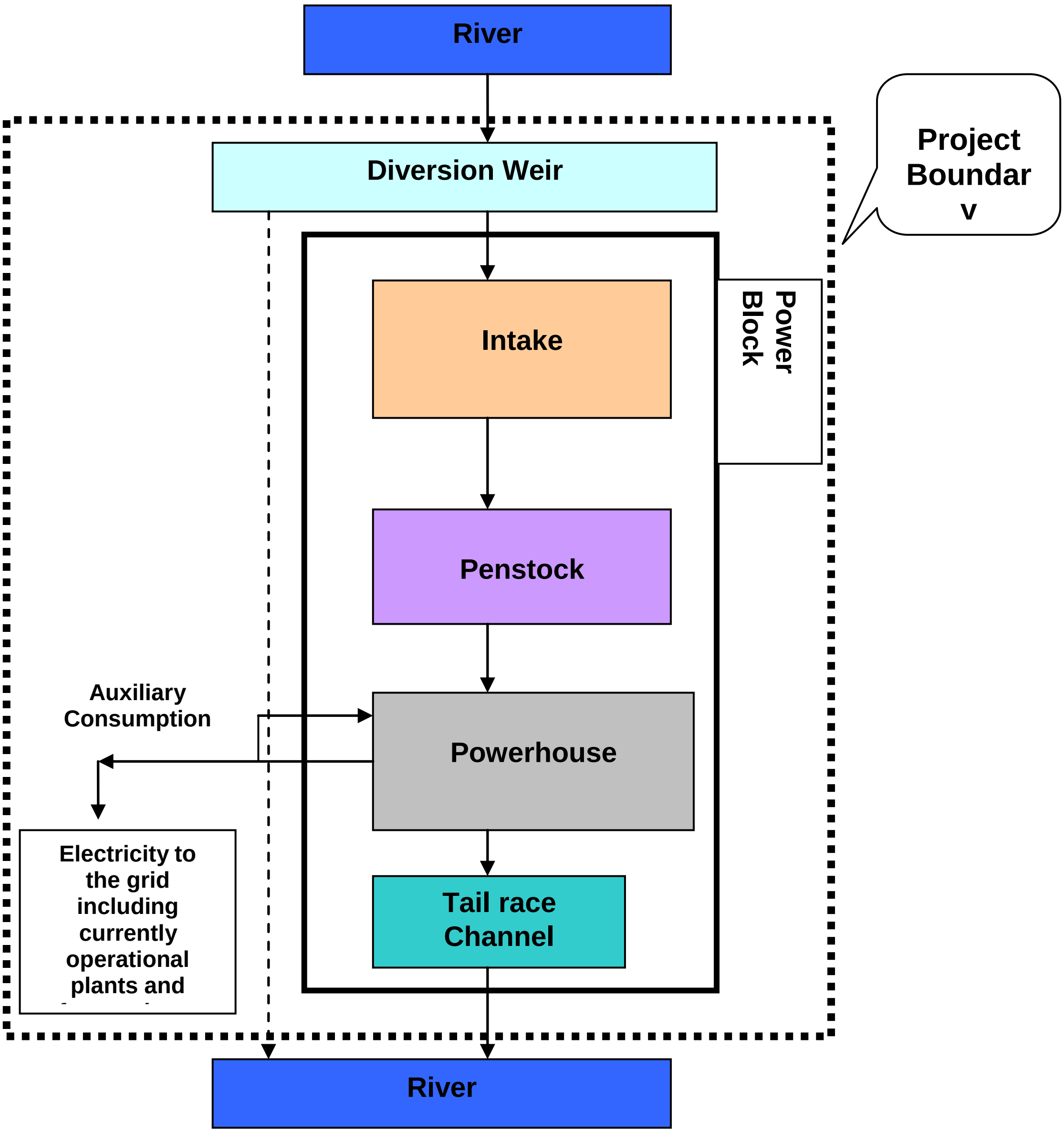
9 http://moe.gov.ge/files/Klimatis%20Cvlileba/Sufta%20Ganvitarebis%20Mekanizmi/SMG%20Erovnuli%20Uflebamosili%20Organo/Baseline_EF_2004-2006.pdf

10 Refer to the latest approved version of the "Tool to calculate the emission factor for an electricity system" for definition of an electricity system.



B.4. Establishment and description of baseline scenario

>> Energo-Aragvi Ltd identified the following alternatives that are viable in absence of the proposed CDM project activity.

Alternative 1 – Continuation of existing scenario: no project activity and electricity generated by the present fossil fuel fired grid connected thermal power plants

In absence of the CDM project activity, the project proponent would not have set up the small hydro power plant due to the lack of financing (as discussed below in the PDD) and no electricity would have been generated by the project activity. The electrical energy generation in the region comes from thermal sources *i.e.* fossil fuel based power plants. Therefore, in absence of the project activity, the same amount of electricity would have been generated by the grid mix which mainly consists of fossil fuel fired units resulting in an equivalent amount of GHG emission. If the project activity will not supply the power to grid, the requirement shall be met by new grid

connected thermal power plants as per the trend indicated by Build Margin for the National grid of Georgia.

This will result in GHG emissions as per the carbon intensity of the Regional Electricity Grid of Georgia. This alternative is in compliance with all applicable legal and regulatory requirements of Georgia. Therefore, this alternative may be a part of the baseline.

Therefore the Alternative 1 is considered further for arriving at the baseline scenario.

<u>Alternative 2- *The proposed project activity not undertaken as a CDM project activity.*</u>

In this case, the project activity would be implemented without the consideration of CDM revenues. The Gudauri hydropower project would have been connected to national grid and therefore would displace an equivalent amount of electricity of the grid mix of National Electricity grid. This alternative is in compliance with all applicable legal and regulatory requirements. But without the consideration of CDM revenues, it would not have been viable for the project proponent to go ahead with the project activity due to the barriers associated with it as discussed in section B.5 of the PDD. Therefore this alternative cannot be further considered for arriving at the baseline scenario.

Hence from the above discussion it can be concluded that the baseline scenario would be the continuation of the current scenario *i.e.* same amount of electricity would have been generated by the grid mix consisting of fossil fuel fired generating units resulting in equivalent amount of GHG emissions at the grid end.

According to AMS I.D[6] (Version 17.0, EB 61, Annex 17, Valid from 17 June 11 onwards), project activity will be the installation of a new grid-connected renewable power plant, the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources. The baseline emissions are the product of electrical energy baseline $EG_{BL,\,y}$ expressed in kWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

Since the project is an installation of a new grid-connected renewable power plant, the baseline scenario is formulated in ACM0002, Version 13.0.0.1: *"Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculate the emission factor for an electricity system"..*

The emission factor of the grid, according to the outlines of the methodology, is calculated in a transparent and conservative manner following ACM0002/version 13.0.0.1 as a combined margin which is calculated as the average of the operating margin and the build margin. As mentioned above the emission factor has been calculated by the Georgian DNA in order to have a common

emission factor for Georgian National Grid. This Emission factor was provided by the DNA and detailed information is available in Annex 3, Baseline information.

B.5. Demonstration of additionality

>> **Additionality**

The project activity meets the eligibility criteria to use simplified modalities and procedure for small-scale CDM project activities as set out in paragraph 6 (C) of decision 17/CP.7. As per the decision 17/CP.7 Para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity. Further as per the applied methodology, Energo- Aragvi Ltd have applied “Guidelines on the demonstration of additionality of small-scale project activities”, (EB68, annex 27)[11] (previously known as Attachment A to appendix B), a proposed small scale CDM project activity will be considered as additional if the project activity would not have occurred any way due to at least one of following barriers:

a) **Investment barrier:** a financially more viable alternative to the project activity would have led to higher emissions;
b) **Technological barrier:** A less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
c) **Barrier due to prevailing practice:** Prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
d) **Other barriers:** without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

The proposed project activity involves the installation of a small scale hydro power project in the country Georgia. It is noteworthy that the activities under the project activity involve an investment, to the tune of approximately 8.2 million USD[12]. [13]. Energo- Aragvi Ltd will not be in a position to make such investment for implementing the project activity through internal accruals only.. This is elaborated hereunder:

Financial resources:

Energo Aragvi Ltd with an intent to invest in the Gudauri Small Hydro power project has approached to Gerogian financial institution JSC Basisbank (http://www.basisbank.ge/en/) with regard to credit application

[11] http://cdm.unfccc.int/Reference/Guidclarif/meth/methSSC_guid05.pdf

[12] The LoI issued from VA-Tech finance GmbH dated 12/03/2008, ref no: PA.

[13] Please refer the link: http://www.menr.gov.ge/en/4758

for project financing dated 21/09/2006[14], however after several rounds of discussion with JSC Basisbank, bank had issued loan request disapproval letter on 04/10/2006[15] stating that they could not provide the loan to Energo-Aragvi with 9% annual interest rate and also cannot comply with the duration of the requested credit request as the loan term issued by JSC Basisbank is maximum 5-7 years . Hydro Power projects owing to its long gestation period could not be financed with such short tenure term loan as mentioned by the JSC Basisbank. In addition to this, project financing from a bank in this region is possible only with the security deposit of collaterals. This brought Energo Aragvi Ltd to a real time financial crisis i.e. non availability of requisite project financing to move ahead with the materialization of the project plan and to reach the financial closure.

During 2006, Energo Aragvi Ltd came across on the concept related to CDM being a very helpful mechanism to support renewable energy projects in Developing Countries like Georgia and after acquiring initial understanding on CDM modalities, the board of Energo-Aragvi Ltd has decided to implement the project considering the CDM revenue necessary to acquire the possibility for financing the Gudauri small hydropower project. The formal board meeting in this regard was conducted on 11/10/2006[16]. Energo Aragvi Ltd has approached VA-Tech Finance GmbH, the Financial Institution, with the implementation plan of the proposed power project activity. A formal loan application letter in this regard was sent to VA-Tech Finance GmbH dated 12/02/ 2007. VA-Tech Finance has expressed interest[17] to finance 6.75 million USD (approximately 75% of the total project cost) subjected to the registration of the proposed project activity under CDM registry. VA-Tech Finance from Austria finally agreed to assist in financing under the conditions that the proposed project will be registered with UNFCC to use the CER certificates as cash flow for the loan repayment to reduce the risks considerably. The letter of interest (LoI) in this regard was issued by VA-Tech Finance GmbH dated 12/03/2008[14]. According to the issued LoI[14], the said amount will be financed subjected to the clause mentioned under the security package which mentions that the pledge of the receivables generated under the Emission Reduction Purchase Agreement (ERPA) on an off-shore escrow account. Furtherance to this, the LoI[14] also mentioned several clauses, one of which is the submission of the CDM project documents, PPA concluded with the reputable power off-taker and Emission Reduction Purchase Agreement (ERPA) concluded with a reputable off-taker of the CERs. Thriving on the provisional LoI received from VA-Tech Finance GmbH[14] on the project financing, Energo-Aragvi Ltd had entered into an agreement with the DOE on 17/07/2008 to start the validation process for the proposed CDM project activity. Energo- Aragvi Ltd also signed the Emission Reduction Purchase Agreement (ERPA) with the Republic of Austria, Federal minister of Agriculture, Forestry, Environment and water management represented by KomunalKredit Public Consulting GmbH (KPC) dated 23/07/2008[18]. The signed ERPA will be used as collateral for part of the project credit based on the conditions stated by VA-Tech Finance GmbH in their LoI. Based on the LoI as issued by the financial institution (VA-Tech Finance GmbH) dated 12/03/2008[14],

[14] Loan Application letter from Energo- Argavi Ltd to JSC Basisbank dated 21/09/2006 was shared with the DOE

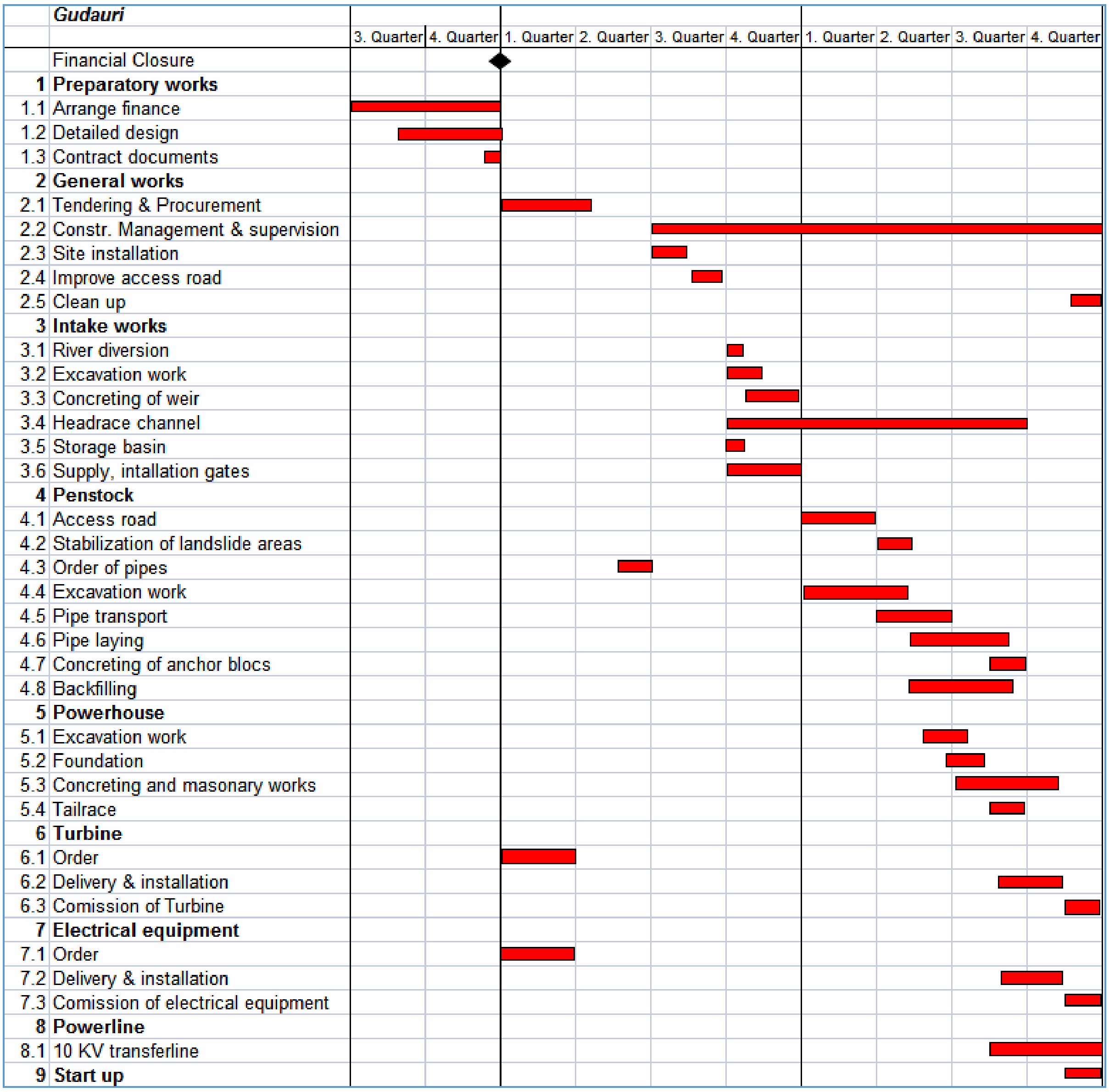
[15] An official bank letter from the Basis Bank dated 04/10/2006 was shared with the DOE.

[16] Minutes of Meeting of Energo-Aragvi’s shareholders conducted on October11, 2006 was shared with the DOE.

[17] Financing proposal from VA-Tech Finance GmbH to Energo-Aragvi Ltd dated 09/05/2007, ref no: PA

[18] Copy of the signed ERPA with KPC dated 23/07/2008 was shared with the DOE.

Energo Aragvi has decided to move ahead with the project financing of 25% for implementation of the proposed project activity with the help of internal accruals only. Likewise the E&M contract was signed between PP and Kössler GmbH dated 01/09/2011[19] which is considered as the first real action towards project implementation i.e. start date for the proposed CDM project activity. The proposed detailed project Implementation Plan[20] is presented below for reference:



As evident from above, Energo Aragvi Ltd is unable to materialize the project implementation plan on site prior to the actual loan approval from the financial institution (in this case VA-Tech Finance GmbH) and which is conditional with CDM registration and CER certification for the proposed project activity. Therefore the high level uncertainty and delay on materialization the of the project activity implementation plan is only

[19] A copy of the signed contract with Kössler GmbH dated 01/09/2011 was shared with the DOE.

[20] This is as per the Project design report prepared for the CDM project activity on June 2010, page 49/50.

due to the lack of long term financing in the region and non achieving financial closure for the proposed project activity.

Impact of CDM registration

Hence from the **financial resource barrier** as mentioned above it is quite evident that it would never have been financially viable for the project proponent to go ahead with the project activity without CDM revenues. Overall success of the project activity would also act as a precursor for other private enterprises to invest in small hydro projects in the country leading to further reduction of GHG emissions.

Consideration of the CDM

The results of the barrier analysis conducted clearly show that the implementation of this type of project is not the economically most attractive course of action and it is very difficult to close the financing of the project. As this kind of project is not part of the baseline scenario, it is concluded that the Gudauri Project is additional and it would not occur in the absence of the CDM. According to the issued LoI[14], the said amount will be financed subjected to the clause mentioned under the security package which mentions that the pledge of the receivables generated under the Emission Reduction Purchase Agreement (ERPA) on an off-shore escrow account. Furtherance to this, the LoI[14] also mentioned several clauses, one of which is the submission of the CDM project documents, PPA concluded with the reputable power off-taker and Emission Reduction Purchase Agreement (ERPA) concluded with a reputable off-taker of the CERs.

The CDM chronology is presented below as per the guidelines of EB62, Annex13[21]. The project activity falls under the category of "new project" as the start date of the project activity is after 02/08/2008 .ie; 01/09/2011. As per the guideline, "*Project Participant must inform a Host party designated DNA and the UNFCCC secretariat in writing of the commencement of the project activity and their intention to seek CDM status. Such notification must be made within six months of the project activity start date and shall contain the precise geographical location and a brief description of the proposed project activity, using the standardized form F-CDM-Prior Consideration. Such notification is not necessary if a project design document (PDD) has been published for global stakeholder consultation or a new methodology proposed to the Executive Board for the specific project before the project activity start date*."

The GSP of the CDM project activity was done on 29/07/2008[22] and the same was uploaded in the UNFCCC webpage for global stakeholder comments. As the date of GSP was prior to the start date of the project activity, it is clearly evident that the CDM was seriously considered by the PP. The same is also in line with the guidelines, EB62, Annex13, para2. The detailed milestone related to the CDM project activity as follow:

CDM milestone	Timeline	Documentary evidences
Start Date of Project Activity Details		
Contract awarded for E&M equipment	01/09/2011	Contract signed for E&M between Energo-Aragvi and Kössler GmbH

21 http://cdm.unfccc.int/filestorage/P/U/2/PU2ARNBM3KFXS9HZ6OELGTICJ81VYD/eb62_repan13.pdf?t=SEd8bWJ5MHFlfDCjEAt3yTjGaWm5SRKdiSTp

22 http://cdm.unfccc.int/Projects/Validation/DB/21RPBBC6KVMB40C0F5OO6545ZJ18WT/view.html

Serious Consideration Details		
Board Decision	11/10/2006	Board note of Energo Aragvi Ltd for conceiving the project under CDM.
Contract awarded for validation	17/07/2008	Agreement signed with DOE for the CDM validation
PDD web hosted for global stakeholder consultation process	29/07/2008 until 27/08/2008	http://cdm.unfccc.int/Projects/Validation/DB/21RPBBC6KVMB40C0F5OO6545ZJ18WT/view.html
Continued and Real actions undertaken by PP		
Stakeholder meeting	12/03/2007	The Minutes of Meeting (MoM) for the stakeholder meeting conducted by PP on 12/03/2007.
Power Purchase Agreement	14/12/2007	Copy of signed PPA between PP and Electricity System Commercial Operator Ltd dated 14/12/2007
ERPA signing	23/07/2008	Agreement of Energo Aragvi with KPC for the sale of the potential CERs
Contract awarded for training related to O&M of the project activity.	18/03/2009	Signed contract between PP and consultant (Werner Johannides) dated 18/03/2009 for providing technical assistance.
Letter of Approval (LoA)	18/11/2009	Letter of Approval to PP dated 18/11/2009 ref no: 05-06-06/4164 from DNA of Georgia, Minister of Environment Protection and Natural Resources of Georgia.
Relevant permissions	27/01/2012	Land Permission issued to PP by the Chairman of Kazbegi Municipality Administration, Mr. G.Malania dated 27/01/2012
	17/02/2012	Permission for construction of the hydro power project issued to PP by Kazbegi Municipality Administration dated 17/02/2012.
Contract awarded for civil works	01/06/2012	Contract signed with Peri Ltd dated 01/06/2012.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

>>

The methodology AMS-I.D. version 17 is applied in the context of the project activity in order to calculate the baseline emissions, project emissions, leakages and emission reductions as follows:

I. Baseline Emissions:

According to AMS.I.D (Version 17.0[6], EB 61, Annex 17, Valid from 17 Jun 11 onwards),

1. The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$BE_y = EG_{BL,y} * EF_{CO_2,grid,y} \quad (1)$$

Where:

BE_y	Baseline Emissions in year *y* (t CO_2)
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,grid,y}$	CO_2 emission factor of the grid in year *y* (t CO_2/MWh)

2. The emission factor can be calculated in a transparent and conservative manner as follows:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system";

OR

(b) The weighted average emissions (in t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Hence, the baseline emissions may be estimated to be the product of two factors. One of the factors, *i.e.*, $EG_{BL,y}$ is equal to $EG_{facility,y}$, which is the "Quantity of net electricity supplied to the grid in year *y"* for a Greenfield renewable energy power plant.

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

$EG_{facility,y}$ is measured directly using export-import energy meters.

The other factor, *i.e.*, $EF_{CO_2,grid,y}$ is determined in line with the guidance provided in the methodology.

<u>*Determination of*</u> $EF_{CO_2,grid,y}$:

As per AMS-I.D. version 17 (Paragraph 12),

The emission factor can be calculated in a transparent and conservative manner as follows:

(a) *A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system";*

OR

(b) *The weighted average emissions (in t CO_2/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.*

Calculations shall be based on data from an official source (where available) and made publicly available.

Since the project activity affects both current and future generation mix of the grid, the project proponent has opted to use combined margin (CM), consisting of the combination of 'operating margin' and the 'build margin', for estimating the emission coefficient of the regional grid.

$$EF_{CO_2,grid,y} = EF_{grid,CM,y}$$

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

Where,

$EF_{grid,CM,y}$	=	Combined margin emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
W_{OM}	=	Weighting of operating margin emissions factor (%)
$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
W_{BM}	=	Build margin CO_2 emission factor in year y (tCO2/MWh)

$$EF_{grid,CM,y} = W_{OM} \bullet EF_{grid,OM,y} + W_{BM} \bullet EF_{grid,BM,y}$$

According to Methodology ACM0002, default values are: $W_{OM} = W_{BM} = 0.5$.

$EF_{grid,CM,y}$ *= 0.5* • *(0.276 +0.523)* tCO_2/MWh = *0.3999* tCO_2/MWh.

The details of the calculation are provided in the Annex 3 of the PDD.

Combined Margin Emission Factor for the project activity	Values	Source
	0.3999 tCO_2/MWh	Baseline Emission Factor for the Electricity System of Georgia, version 1 prepared by DNA of Georgia[24]

II. Project emissions:

There are no anthropogenic emissions by sources of GHGs in the project boundary as a result of the project activity. In case of emergency and grid failure no emergency generator will be available.

From the above arguments, it can be concluded that for the project activity under consideration,

Hence, Project emissions for the project activity, $PE_y = 0$

III. Leakage emissions:

As per paragraph 22 of the approved methodology AMS-I.D. (Version-17, EB- 61, page 8), "*if the energy generating equipment is transferred from another activity, leakage is to be considered"*. Since there has been no transfer of equipment from another activity to the proposed project activity, no leakage estimation on this account is required.

Hence, leakage emission for the project activity $LE_y = 0$.

Emission Reductions:

The emission reductions of the project activity are calculated as the difference between the baseline emissions and the project emissions.

$$ER_y = BE_y - PE_y - LE_y$$

where,

ER_y = emission reductions for the project activity in tonnes of CO_2 e

BE_y = Baseline emissions in tonnes of CO_2 e

PE_y = Project emissions in tonnes of CO_2 e

LE_y = Leakage emissions in tonnes of CO_2 e

Since $PE_y = LE_y = 0$ (as explained above), hence, $ER_y = BE_y$

B.6.2. Data and parameters fixed ex ante

B.6.3. Ex ante calculation of emission reductions

>>

Data/parameter:	$EF_{CO2,grid,y}$
Unit	tCO_2/ MWh
Description	CO_2 emission factor of the grid electricity per year *y*
Source of data	As per the “baseline emission factor for the electricity system of Georgia” published for the year 2008[23], version 1Please refer Annex 3 of the PDD for further details.
Value(s) applied)	0.3999
Choice of data or measurement methods and procedures	The baseline emission factor was provided by the DNA in accordance with the Ministry of Energy and other relevant authorities. It is fixed ex-ante for the entire crediting period.
Purpose of data	
Additional comments	The grid emission factor is fixed *ex-ante.*

Data/parameter:	$EF_{grid,BM,y}$
Unit	tCO_2 /MWh
Description	Build margin for the grid electricity system of Georgia
Source of data	As per the “baseline emission factor for the electricity system of Georgia” published for the year 2008, version 1 Please refer Annex 3 of the PDD for further details.
Value(s) applied)	0.523
Choice of data or measurement methods and procedures	The baseline emission factor was provided by the DNA in accordance with the Ministry of Energy and other relevant authorities. It is fixed ex-ante for the entire crediting period.
Purpose of data	
Additional comments	The build margin is fixed *ex-ante.*

23 http://moe.gov.ge/files/Klimatis%20Cvlileba/Sufta%20Ganvitarebis%20Mekanizmi/SMG%20Erovnuli%20Uflebamosili%20Organo/Baseline_EF_2004-2006.pdf

Data/parameter:	$EF_{grid,OM,y}$
Unit	tCO_2/MWh
Description	Simple Operating margin for the grid electricity system of Georgia
Source of data	As per the “baseline emission factor for the electricity system of Georgia” published for the year 2008, version 1. Please refer Annex 3 of the PDD for further details.
Value(s) applied)	0.276
Choice of data or measurement methods and procedures	The baseline emission factor was provided by the DNA in accordance with the Ministry of Energy and other relevant authorities. It is fixed ex-ante for the entire crediting period.
Purpose of data	
Additional comments	The simple operating margin is fixed *ex-ante.*

Baseline emissions:

Calculation of grid emission factor:

As mentioned in section B.6.1 of the PDD, the simple OM has been obtained by calculating 3-year generation-weighted average for the most recent three years data during the PDD webhosting from “Baseline Emission Factor for the Electricity System of Georgia”, version 1, Tbilisi, April 2008[24].

Simple Operating Margin:

Year	Net Generation in OM	Simple OM	Weighted Average OM
	(MWh)	tCO_2/MWh	tCO_2/ MWh
2004-05	7,994,510	0.193	0.276
2005-06	8,277,380	0.218	
2006-07	8,173,739	0.415	

Build Margin:

As per the “Baseline Emission Factor for the Electricity System of Georgia”, version 1[24], the latest available data during PDD webhosting is for the year 2006-07:

Build Margin	**Values**	**Source**
2006-07	0.523 tCO_2/ MWh	“Baseline Emission Factor for the Electricity System of Georgia”, version 1 prepared by DNA of Georgia [24]

As per the methodological tool “Tool to calculate the emission factor for an electricity system”, version 2.2.1

“The following default values should be used for w_{OM} and w_{BM}:

- *Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.*
- *All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool."*

$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,CM,y} \times w_{BM}$			
Abbreviation	**Description**	**Value**	**Source**
$EF_{grid,CM,y}$	Combined Margin of the NEWNE electricity grid in t CO_2/MWh	0.3999	Estimated as per formula explained in section B.6.1
$EF_{grid,OM,y}$	Simple operating margin for NEWNE grid (simple average of recent 3 years) in t CO_2/MWh	0.276	"Baseline Emission Factor for the Electricity System of Georgia", version 1, Tbilisi, April 2008 prepared by DNA of Georgia
w_{OM}	Weighting of operating margin emissions factor	0.75	Default value provided in the 'Tool to calculate the emission factor for an electricity system, version 2.2.1"
$EF_{grid,BM,y}$	Build margin for NEWNE grid (last year's data) in t CO_2/MWh	0.523	"Baseline Emission Factor for the Electricity System of Georgia", version 1 Tbilisi, April 2008 prepared by DNA of Georgia
w_{BM}	Weighting of build margin emissions factor	0.25	Default value provided in the 'Tool to calculate the emission factor for an electricity system version 2.2.1"

Baseline emission from generation of electricity			
$BE_y = EG_{BL,y} * EF_{CO_2,grid,y}$			
Abbreviation	**Description**	**Value**	**Source**
BE_y	Baseline emissions in year y (tCO_2/ yr)	20,235 tCO2/ year in the first two years and	Calculated as per formula explained in section B.6.1, rounded down to the nearest integer

		23,954 tCO2/year in the following years after commissioning of stage 2.	
$EG_{BL,y}$	Quantity of net electricity generation that will be produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh /yr)	50,600 for first two years. 59,900 for subsequent years	Net electricity is estimated from the cumulative implementation of two stages, stage I- 8.5 MW and stageII- 1.2 MW and is sourced from the Project Design Report. For *ex-post* calculation, net electricity would be monitored.
$EF_{CO2,grid,y}$	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/ MWh)	0.3999	Equal to the value of $EF_{grid,CM,y}$ as calculated above.

Baseline emissions or emission reduction generated by the project is then estimated as follows:

Baseline emissions = Baseline Emission factor x Power generated from the project and supplied to the grid.

(tCO_2) (tCO_2/ MWh) (MWh /Year)

The emission reductions due to the project activity are 20,235 tCO_2/ year in the first two years after commissioning stage 1 and 23,954 tCO_2/year in the following years after commissioning of stage 2. The table below is presented to depict the generation details and the estimated emission reduction achieved stage wise:

Stages	Net Generation (MWh/ year)	Estimated emission reductions (tCO2/ year)
Stage-I	50,600	20,235
Stage-II	59,900	23,954

The installation of the proposed capacity of the project is planned to be carried out in two phases- Stage I consisting of 8.5 MW generating 50,600 MWh/ year and stage-II consisting of 1.2 MW generating 9,300 MWh/year. This is as per the Project Design Report which was available to Energo-Aragvi Ltd. This is also in accordance with the "Guidelines for the reporting and validation of Plant Load Factors", EB 48, Annex 11.

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

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2013-2014	20,234	0	0	20,234
2014-2015	20,234	0	0	20,234
2015-2016	23,954	0	0	23,954
2016-2017	23,954	0	0	23,954
2017-2018	23,954	0	0	23,954
2018-2019	23,954	0	0	23,954
2019-2020	23,954	0	0	23,954
Total	**160,238**	0	0	**160,238**
Total number of crediting years	7			
Annual average over the crediting period	22,891	0	0	22,891

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	$EG_{facility,y}$
Unit	MWh/year
Description	Quantity of net electricity supplied to the grid in year y
Source of data	Plant log book data recorded from the energy meter
Value(s) applied	59,900
Measurement methods and procedures	Monitoring procedure: is monitored through a bidirectional energy meter installed at 110kV side of the substation (PM4). Accuracy class of energy meter: 0.5S
Monitoring frequency	Monitoring Frequency: Continuously Recording Frequency: Monthly

QA/QC procedures	The data is monitored regularly with the bidirectional meter (PM4) installed at substation to the national grid, see monitoring plan. The calibration of the installed meters has to be organised by the owner. The electronic meters will be calibrated normally every 10 years by a certified laboratory following the national standards and specifications set up by the relevant electricity board. The cross-check of the monitoring data is done thanks to a set of power meters installed (PM1, 2,3 and 5) and a SCADA system, see monitoring plan. In case of failure of PM4, the SCADA and the set of meters (PM1, PM2, PM3 and PM5) will be used as a back-up option.
Purpose of data	
Additional comment	Monthly readings and the SCADA data will be archived electronically for crediting period+2 years

B.7.2. Sampling plan

>>

B.7.3. Other elements of monitoring plan

>>

The project activity is a grid-connected hydropower project, with a total installed capacity of 9.72 MW and therefore the small scale methodology AMS-I.D (Version 17.0, EB 61, Annex 17, Valid from 17 June 11 onwards) will be applied. The methodology requires the project-monitoring plan to consist of metering the electricity generated by the project activity. In order to monitor GHG emission reductions due to the project activity, the total energy supplied to the national grid needs to be measured. The net energy supplied to grid by the project activity multiplied by the emission factor for Georgian National grid forms the base for the creation of CDM revenues. For details please refer to Annex 4 monitoring plan for electricity delivered to the national grid of Georgia.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>

Date of completion and application of baseline and monitoring methodology: 12/06/2008

Name of responsible person/entity: Mr. Hannes Posch, Director and Project Manager

of Energo Aragvi Ltd.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>

C.1.2. Expected operational lifetime of project activity

>>

The lifetime of the project considered is 30 years[24]

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>> renewable

C.2.2. Start date of crediting period

>>

01/01/2013 or the date of registration whichever is later.

C.2.3. Length of crediting period

>>07year 00months

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

An Environmental Impact Assessment (EIA) was carried out by the Consultant and was accepted by the Ministry of Environment. The recommendations of the EIA were followed up by the project owner and are further elaborated in section 8 of the feasibility study. A summary of the main findings of the EIA is given below:

Project Analysis

The small hydro power scheme in Gudauri at the Tetri Aragvi river is a "flume diversion", involving diversion of some water flow from the river, using it for power generation and then returning it to the river's flow.

- First, the planned hydro power scheme contributes to a sustainable development of a tourist region in Georgia and helps in mitigating the global climate change.

- Second, the planned hydro power scheme will have approx. 9.72 MW installed capacity that is considered a small hydro power system. Consequently water extraction from the river basin is moderate.

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[24] The expected lifetime of the project is 30 years as sourced from the International Renewable Energy Agency (IRENA), page13/44: http://www.irena.org/DocumentDownloads/Publications/RE_Technologies_Cost_Analysis-HYDROPOWER.pdf

- Third, the planned water extraction does not have major impacts on habitats, the riparian zone and the entire river ecosystem.

As a consequence, proper siting, design, and operation, with respect to ecological and economic considerations can solve most of the environmental problems and turn a hydropower plant project to a environmentally sound and sustainable project. In order to minimise adverse short and long-term impacts on the environment the proposed environmental planning must be based on comprehensive environmental, ecological, hydrological, social, and geological surveys.

1. Geology of river basin and surrounding areas
2. Hydrology
3. Climatic conditions of the region
4. Fauna and Flora

- fluvial ecosystem of the river
- riparian areas

4. Social impacts of hydro power plant

General Layout

The present location of water intake, weir, weir channel, gravel spill, penstock and powerhouse is the result of intensive discussions of a multi-disciplinary expert group. Planners, hydrologists, water/civil engineers, geologists, ecologists and financial experts shaped this project into an environmentally sound and economical comprehensive project. Two alternative sites have been cancelled during this process of modelling due to major environmental impacts.

Pollution

Deterioration of water quality (including detrimental changes in water temperature) downstream have been studied, and appropriate measures adopted.

(a) Pollution during construction phase:

In general a hydropower plant causes only minor pollution impacts. Mainly during construction of the water intake and the penstock, water quality will deteriorate, due to the activities in the river basin. During construction of weir, weir channel and structures at the intake site special care has to be taken to prevent adverse effects to fish and other aquatic organisms downstream. A pH rise caused by the washout of cement from concrete during construction of the water intake and weir might cause migration of aquatic organisms. Worst case scenario would be a fish kill. To minimise adverse affects on water organisms the ecologists' proposal is to do construction of the weir, weir channel, and penstock during the non-spawning period. If this is not possible monetary compensation to the tenant fish farmers may have to be considered.

(b) Pollution during plant operation:

During operation of the hydro power plant no impacts on water quality are expected.

Natural Environment Issues

1. Effects of construction of the facility on the ecology:

The effect of the access roads, the weirs and weir channels, etc., as well as reduced volume of water downstream, on fish, animals and vegetation in the watershed area have been studied and appropriate measures adopted. These include vegetation conservation planning, afforestation planning, measures to protect rare species25 and measures to determine the discharge flow levels, based on winter run off, that is adequate in terms of river conservation.

- Water intake / weir:

The weirs in each of the branches will be embedded in a -blocking A ramp- whose size and construction enables a permanent migration of organisms especially fish upstream to reach their spawning habitats and back downstream as well. Both intakes will be supplied with such a fishway that is specifically designed to meet the requirements of the branches.

- Spilling channel / sand trap:

The sand trap is a channel–like construction and does not have impacts on the environment. In general, flushing of water through channels can result in super saturation and (fine) sediment transportation downstream. The gas bubbles, which are absorbed into fish tissue and the fine sediment, may cause damage to the fish. To prevent such adverse affects to aquatic organisms, this weir channel needs to be flushed only during natural occurring floods in the river. During such periods almost all aquatic organisms have taken shelter eg in tributaries where bed load regime and sediment transportation is less than in the main river. Therefore no additional measures are needed to prevent fish and water-borne invertebrates from damage as a result of flushing the weir channel.

- Water storage basin

The water storage basin has a mountain-lake character. The dam would be an earthfill structure and intensive re-vegetation measures should take place after construction to minimise impacts. The reservoir and the storage basin could both be used for fish farming during summer season and for recreational purpose.

- Penstock:

The penstock runs approx. 5.1 km adjacent to the river basin within the riparian zone of the river, embedded in a gravel bed which, after construction, will be covered by loose rocks that will protect the penstock pipe during floods. Attached drawings show typical cross sections of the river basin with re-established local vegetation

Riparian areas are the green ribbons of life on or near a watercourse. They are characterised by the transition of wet areas, which support natural vegetation, to drier upland areas, which support vegetation different from that found growing in the wet area. Riparian areas range in width from narrow ribbons to wide bands depending on the steepness of the land, soil properties, and adjacent water body. Riparian areas provide critical space, shelter, water, and food for wildlife and humans. Although they occupy a small percentage of the land base, they contribute significantly to biological diversity.

[25] During the site visits and contact to local experts no rare or endangered species have been found in the nearer area of the proposed location of the power house, the penstock, water storage basin, and water intake.

In order to conserve and rehabilitate this riparian area, strategies are planned as follows:

- Prevent the protection rock layer turning the river into a straightened channel, pool and riffle sequences will be introduced randomly. As a consequence new aquatic (micro-) habitats and a more diverse community will be re-established.
- Landscape planning that includes re-vegetation of site road slope and "Faschine-like" structures embedded in the protection rock layer will help preventing slopes from erosion.
- Prevent damage to the concrete pipe; local plants and trees, which have low rooting depths, have to be planted.

2. Effects of hydropower operation:

The operation plans for the hydropower plant will be designed so as to provide for a discharge release sufficiently controlled to avoid adversely affecting downstream water demands, such as irrigation, water supply, fisheries, etc. As mentioned above a determined discharge flow level is guaranteed and therefore existing downstream utilisation will not face problems such as water shortage.

The construction of the weir and water intake provides a discharge flow adequately in terms of river conservation. A control system guarantees this discharge flow level (residual water) during any time of operation of the power plant.

3. Effect on landscape:

The effects of the access roads, and water intake, etc, constructed on the scenic landscape have been studied, and appropriate measures adopted (see above).

Social Impacts

- No relocation or resettlement is needed;
- No cultural land will be used during construction and operation;
- Environmental monitoring will be established after start-up;
- Reforestation will be initiated.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>> The project proponent has organised stakeholder consultation with the objective to inform the interested stakeholders on the environmental and social impacts of the project activity and discuss their concerns regarding the project activity.

Invitations to the stakeholder consultation were sent by email, letter or communicated telephonically to potential participants identified among the stakeholders.

The stakeholder consultation was held on 12/03/2007 at the Meeting Hall “Salkhino”, Metekhi Sheraton Palace Hotel, 20 Telavi street, Tbilisi, 0103, Georgia. The meeting was conducted both in Georgian and English translations. The questionnaire on their feedbacks to the proposed project activity was duly archived. The copies of the same were shared with the DOE.

Mr. Wachtang Mikeladze, Member of the Board and stakeholder in Energo – Aragvi Ltd has permanent contact to the local stakeholders in the Gudauri region, being the general manager of the ski resort hotel.

In all the discussions with them no specific comments on the layout of the project was made. The only request comes to implement as soon as possible to get a continuous and good quality electricity supply.

E.2. Summary of comments received

>>

No special comments received (see above).

E.3. Report on consideration of comments received

>>

As the Consultant is coming from Austria, all international standards will be considered and environmental issues carefully implemented.

SECTION F. Approval and authorization

>>

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	“Energo – Aragvi” Ltd
Street/P.O. Box	3, Gotua str. 0162
Building	
City	Tbilisi
State/Region	Tbilisi
Postcode	0162
Country	Georgia
Telephone	+995 99 563506
Fax	+995 32 998009
E-mail	taras@energo-aragvi.ge
Website	N/A
Contact person	Mr. Taras Nizharadze
Title	Director
Salutation	N/A
Last name	Nizharadze
Middle name	N/A
First name	Taras
Department	N/A
Mobile	+995 99 563506
Direct fax	+995 32 998009
Direct tel.	+995 32 999333
Personal e-mail	taras.nizharadze@gmail.com

Appendix 2. Affirmation regarding public funding

The project does not receive any public funding.

Appendix 3. Applicability of methodology and standardized baseline

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

Ministry of Environment Protection and

Natural Resources of Georgia

Clean Development Mechanism Designated National AuthorityBaseline Emission Factor for the Electricity System of GeorgiaVersion 1[26]

Introduction

Georgia ratified UNFCCC on 29 October 1994 and has accessed to the Kyoto Protocol on 16 June 1999.

From three mechanisms defined by the Kyoto Protocol, Georgia, as a Non-annex I party to the UNFCCC can participate only in Clean Development Mechanism (CDM). Georgia satisfies CDM participation requirements:

- Georgia participates voluntary in CDM;
- Georgia has nominated CDM “Designated National Authority” (DNA);
- Georgia is a Party to the Kyoto Protocol.

By the Decree of the Government of Georgia dated 20 January 2005 the Ministry of Environment Protection and Natural Resources of Georgia was appointed as CDM DNA.

As the scope of CDM Projects is wide, evolving practically all key sectors of economy, the Government of Georgia has decided to create an entity consisting of representatives of the key Ministries related with the CDM. By the Decree of the Government of Georgia (dated 28 September 2005) CDM National Council of Georgia was formed. The main task of the CDM National Council is to determine according to the criteria, established for the CDM projects, whether the proposed project contributes to Sustainable development of the country and to recommend DNA to issue a letter of approval on behalf of the Government of Georgia.

1. Clean Development Mechanism

The Clean Development Mechanism (CDM) is a mechanism based on the provision of article 12 of the Kyoto Protocol. There is a scheme for greenhouse gas (GHG) reduction through cooperation

26 http://moe.gov.ge/files/Klimatis%20Cvlileba/Sufta%20Ganvitarebis%20Mekanizmi/SMG%20Erovnuli%20Uflebamosili%20Organo/Baseline_EF_2004-2006.pdf

between developed countries (parties included in Annex I to the United Nations Framework Convention on Climate Change (UNFCCC), which are committed to certain GHG emission reduction targets in the Kyoto Protocol, and developing countries (non-Annex I Parties to the UNFCCC), which do not have any commitments to reduce GHG emissions.

CDM will assist non-Annex I Parties in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Annex I Parties in achieving compliance with their quantified emission limitation and reduction commitments under the Kyoto Protocol.

2. CDM potential in power industry

Carbon dioxide (CO_2) is the most common greenhouse gas produced by anthropogenic activities, accounting for about 60 per cent of the increase in radiative forcing since preindustrial times. By far the largest source of CO_2 emissions is the oxidation of carbon when fossil fuels are burned, which accounts for 70-90 per cent of total anthropogenic CO_2 emissions.

The dominant source of CO_2 emissions is fuel consumption for power generation. Renewable energy (hydro, wind, etc.) utilization for power generation is one of the most efficient ways to reduce CO_2 emissions.

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

Georgia has significant reserve to develop the hydro power sector. In future it will be possible to build hydro power plants with 100–500 MW net capacity with conditional gradation as powerful plants (>100 MW), medium plants (10–100 MW), small plants (1–10 MW) and mini and micro plants (<1 MW).

The first hydro power plants have been built in Georgia in the end of XIX and in the beginning of XX centuries. Their capacity was equal to 2 MW in 1913. In 1990 the total rated capacity of working plants was 2 700 MW and rated generation was equal to approximately 10 TWh, what was only 20–25 % from economically effective potential.

Due to economic crisis the state owned plants were in pure conditions and now their generation is much less than rated one. Privatization of hydro power plants proceeds in country. It is anticipated (very likely) that possible additional investments (carbon credits) from CDM will improve financial viability of these plants and stimulate new owners to rehabilitate existing facilities. Additional power generation will partly replace fuel based electricity and as a result CO_2 emissions will be reduced.

CDM will stimulate construction of new plants also. Now there are barriers hampering development of hydro power sector in Georgia.

Besides hydro power plants the electricity system of Georgia in 2004-2006 was served by the thermal power plants and by the electricity systems of neighboring countries (imported electricity).

List of plants serving electricity system of Georgia in 2004-2006 is presented in Annex: *Table A1*.

3. Estimate the baseline emission factor for the electricity system of Georgia

A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity. The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity. Consequently generated by the CDM project emission reduction is difference between baseline and project emissions.

To calculate generated by the CDM project Certified Emission Reductions (CERs) it is necessary to determine the baseline emissions. As emissions from the renewable CDM project practically are zero, CDM project emission reduction equals to the baseline emissions.

Baseline emissions were calculated multiplying generated by CDM project electricity on baseline emission factor ($EF_{Baseline}$):

$$Emissions = GEN_{Project} \bullet EF_{Baseline}. \qquad (1)$$

Baseline emission factor should be calculated using approved by CDM Executive Board methodology.

Baseline emission factor for the electricity system of Georgia was established on the basis of the approved consolidated baseline methodology **ACM0002** "Consolidated baseline methodology for grid-connected generation from renewable sources".

This methodology is applicable to grid-connected renewable power generation project activities:

- 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/m;
- Wind sources;
- Geothermal sources;
- Solar sources;
- Wave and tidal sources.

Defining baseline emission factor for the energy projects the key analytical challenge is to identify the generation resources avoided by a CDM project (i.e. "what would happen otherwise"). It discusses the fundamental question of whether the avoided generation is on the "build margin" (i.e. replacing another new source of electricity) or "operating margin" (i.e. affecting the operation of current power plants).

The baseline emission factor ($EF_{Baseline,y}$) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors:

$$EF_{Baseline} = w_{OM} \bullet EF_{Operating\ Margin} + w_{BM} \bullet EF_{Build\ Margin} \qquad (2)$$

where $EF_{Operating\ Margin}$ *and* $EF_{Build\ Margin}$ are "Operating margin" and "Build margin" emission factors.

Calculations for the combined margin must be based on data from an official source (where available) and made publicly available.

To calculate $EF_{Baseline}$ there are three following steps:

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

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

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

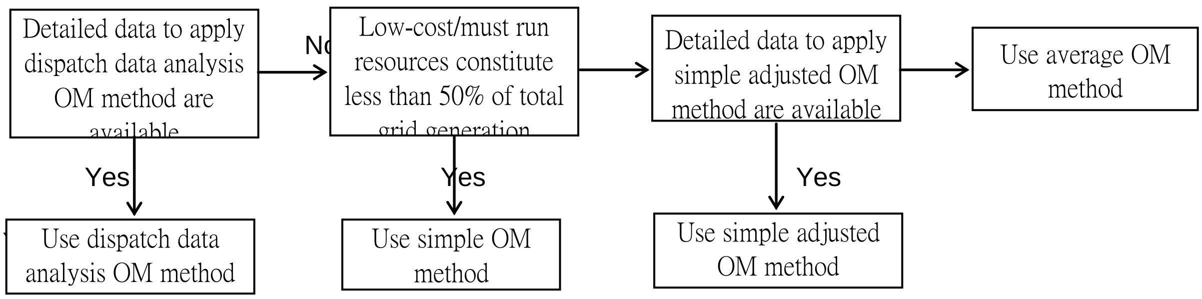
According to the methodology ACM0002 dispatch data analysis should be the first methodological choice. Where this option is not selected the project participants shall justify why and may use the simple OM, the simple adjusted OM or the average emission rate method taking into account the provisions outlined hereafter.

Dispatch data analysis method is based on the data on the amount of power (MWh) that is dispatched from all plants in the system during each hour that the project activity is operating. This however is not possible in Georgia due to lack of availability of these activity data.

The simple OM method (a) can only be used where low operating cost and must run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term normals for hydroelectricity production.

The average emission rate method (d) can only be used where low-cost/must run resources constitute more than 50% of total grid generation and detailed data to apply option (b) is not available, and where detailed data to apply option (c) above is unavailable.

Decision tree



Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants. In case of Georgia low cost/must run sources are only hydro power plants.

Delivered into grid electricity by sources and their share in total delivered electricity are given in *Table 1*. According to this Table low-cost/must run resources (electricity supplied by hydro power plants) averaged of 2002-2006 years constitutes about 75%, i.e. more than 50% and consequently simple OM method can not be used.

The Ministry of Energy of Georgia provided necessary information to apply Simple adjusted OM method. Thus baseline emission factor was calculated using Simple adjusted OM method.

Table 1: The shares of sources serving electricity system in 2002-2006

Source	2002	2003	2004	2005	2006	Averaged
Generation from Hydro power plants (MWh)	6652,1	6420,7	5893,1	5920,3	5292,9	6035,8
Share, %	85,8	80,3	73,7	71,5	64,8	75,2
Generation from Thermal power plants (MWh)	467,9	587,9	813,2	958,4	2103,8	986,2
Share, %	*6,0*	*7,4*	*10,2*	*11,6*	*25,7*	*12,2*
Import (MWh)	635,1	988,6	1288,2	1398,6	777,0	1017,5
Share, %	*8,2*	*12,4*	*16,1*	*16,9*	*9,5*	*12,6*
Total (MWh)	**7755,1**	**7997,2**	**7994,5**	**8277,4**	**8173,7**	**8039,6**

The Simple OM, simple-adjusted OM, and average OM emission factors can be calculated using either of the two following data vintages for years(s) *y*:

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

The choice between *ex-ante* and *ex-post* vintage should be specified in the PDD, and cannot be changed during the crediting period.

As the Simple OM emission factor is a part of the Simple adjusted OM emission factor [see formulae (3) and (5) below], let’s consider this method in details.

(a) ***Simple Operating Margin method*****.** The Simple OM emission factor (*EFOM,simple,y*) is calculated as the generation-weighted average emissions per electricity unit (t*CO2*/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{SimpleOM} = \frac{\sum_{i,j} F_{i,j,y} COEF_{i,j}}{\sum_{j} GEN_{j,y}}, \qquad (3)$$

where

$F_{i,j,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*,

j refers to the power sources delivering electricity to the grid, not including low-operating cost and must run power plants, and including imports to the grid. An import from a connected electricity system should be considered as one power source *j*. For imports from connected electricity system located in another country, the emission factor is 0 tons CO_2 per MWh,

$COEF_{i,j\,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*, and

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j*.

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \cdot EF_{CO2,i} \cdot OXID_i, \qquad (4)$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*,

$OXID_i$ is the oxidation factor of the fuel,

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel *i*.

Where available, local values of NCV_i and $EF_{CO2,\,i}$ should be used. Presented in *Table 2 NCV* values were provided by the Ministry of Energy of Georgia.

Because only natural gas is used for the electricity generation in Georgia, index *i* is canceled.

For natural gas oxidation factor (*OXID*) and the CO_2 emission factor per unit of energy (EF_C) *IPCC* default values were used, particularly *OXID*= 1 and EF_C =15,3 t C/Tj (see *Table 2*).

Natural gas consumption (thousand m^3), natural gas calorific value and other parameters used in calculations and calculated *COEF* for years 2004-2006 are given in *Table 2*.

Table 2: Natural gas consumption (thousand m^3), natural gas calorific value and other parameters used in calculations and calculated COEF for years 2004-2006

Plant	j	2004	2005	2006
		$F_{j,y}$ – Natural gas consumption, Thousand m^3		
Tbilsresi	*1*	9 755	108 909	232 662
AES Mtkvari	*2*	248 873	206 712	349 820
Gas-turbine	*3*	-	-	91 676
Total	*t*	258 628	315 621	674 158
NCV, kcal/m^3		8 039	8 041	8 045
NCV, Tj/1000 m^3		0,033658	0,033666	0,033683
EF_C, t C /Tj		15,3	15,3	15,3
EF_{CO2}, t CO_2/Tj		56,1	56,1	56,1
Oxidation factor – OXID		1	1	1
COEF, tCO_2/1000 m^3		**1,888**	**1,889**	**1,890**

Electricity delivered from other than low-cost/must run sources (import and thermal power plants) to the electricity system of Georgia, CO_2 emissions and estimated Simple OM emission factors ($EF_{Simple\ OM}$) for years 2004-2006 are shown in *Table 3*.

Table 3: Electricity delivered from other than low-cost/must run sources (import and thermal power plants) to the electricity system of Georgia, CO_2 emissions and estimated Simple OM emission factors for years 2004-2006

y Year	j Source	$GEN_{j,y}$ – Delivered electricity, MWh	Emissions, tCO_2	Emission factor tCO_2/MWh	$EF_{Simple\ OM,y}$ CO_2/MWh
2004	Import	1288,2	0	0	
	Tbilsresi	21,5	18 419	0,8578	
	AES Mtkvari	791,7	469 921	0,5935	**0,2324**
	Total	**2 101,4**	**488 340**	**0,2324**	
2005	Import	1398,6	0	0	
	Tbilsresi	292,1	205 693	0,7042	
	AES Mtkvari	666,3	390 410	0,5859	**0,2529**
	Total	**2 357,1**	**596 103**	**0,2529**	
2006	Import	777,0	0	0	
	Tbilsresi	663,9	439 639	0,6622	
	AES Mtkvari	1 149,4	661 022	0,5751	
	Gas-turbine-1	290,4	173 231	0,5964	**0,4422**
	Total	**2 880,8**	**1 273 893**	**0,4422**	

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

$$EF_{OM,\ simple\ \ adjusted,\ y} = (1-\lambda_y)\cdot\frac{\sum_j F_{j,y}COEF_j}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_k F_{k,y}COEF_k}{\sum_k GEN_{k,y}} \qquad (5)$$

where $F_{k,y}$, $COEF_k$ and GEN_k are analogous to the variables described for the simple OM method above for plants k; the years(s) *y* can reflect either of the two vintages noted for simple OM

Because low-cost/must run sources are only Hydro PPs with zero emissions

$$\sum_{i,k} F_{i,k,y}COEF_{i,k} / \sum_k GEN_{k,y} = 0, \qquad (6)$$

and the equation (2) takes on form:

$$EF_{OM,\ simple\ adjusted,\ y} = (1 - \lambda_y)\ EF_{OM,\ simple\ OM,\ y} \qquad (7)$$

λ parameter was calculated as *λ = X / T,* where *X* is the number of hours for which low-cost/must-run sources are on the margin, *T* is number of hours in year.

Step i) Plot a Load Duration Curve. Chronological load data for each hour of year for electricity system of Georgia were ranked from highest to lowest and load duration curves were plotted for years 2004-2006 (see *Figures 1-3*). Revised data (excel spreadsheets) were provided by the Ministry of Energy of Georgia.

Step ii) Organize Data by Generating Sources. Revised data for annual generation (in MWh) from low-cost/must run resources (HPPs) have been collected and total annual generation from low-cost/must run resources (i.e. $\Sigma_k\ GEN_{k,y}$) have been calculated (see Annex: *Tables A2-A4*). Relevant revised data (excel spreadsheets) were provided by the Ministry of Energy of Georgia.

Step iii) Fill Load Duration Curve. A horizontal line across the load duration curve was plotted such that the sum of areas (as an illustration dashed area on *Fig.1*) under the straight line and under the right part (relative to intersection point) of the load duration curve equals to the total generation (in MWh) from low-cost/must run resources (i.e. $\Sigma_k GEN_{k,y}$).

Step iv) Determine the "Number of hours per year for which low-cost/must-run sources are on the margin". First, the intersection of the horizontal line plotted in step (iii) and the load

duration curve plotted in step (i) was located. The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin. If the lines do not intersect, then one may conclude that low-cost/must-run sources do not appear on the margin and λ_y is equal to zero. Lambda (λ_y) is the calculated number of hours divided by 8760 (in leap-year by 8784). Relevant diagrams for years 2004-2006 are given on figures 1-3, and calculated $EF_{Adjusted\ Simple\ OM}$ in *Table 4*.

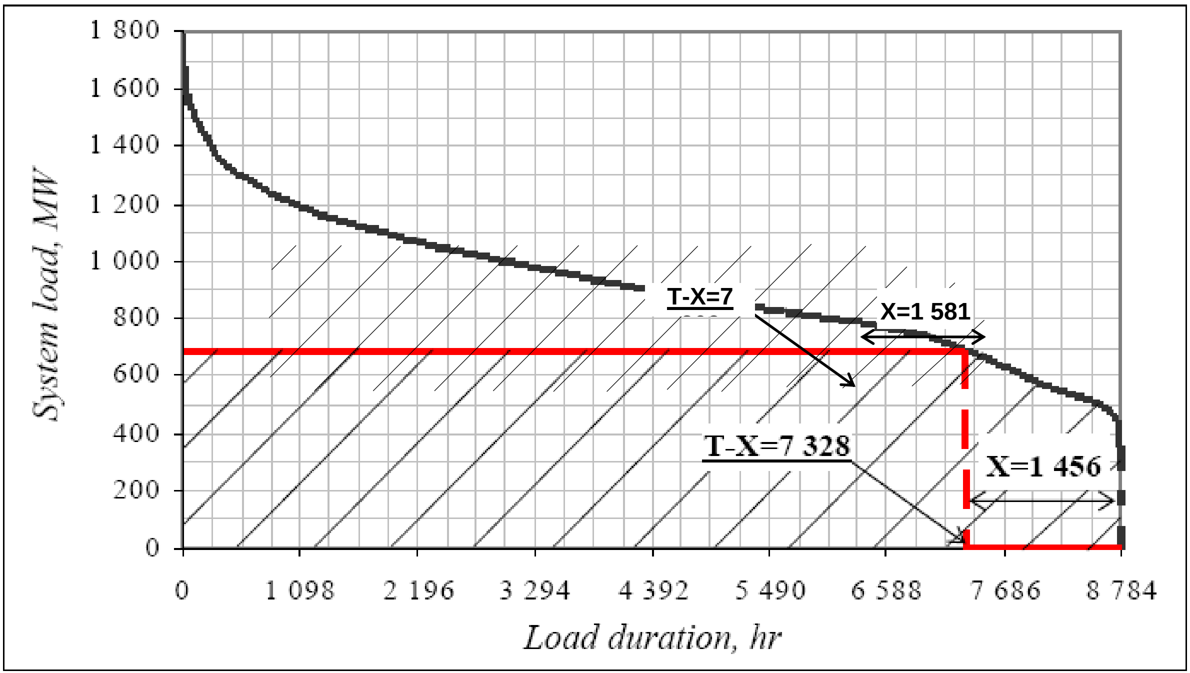


Fig.1: Load duration curve for the Georgian electricity system for year 2004

Fig.2: Load duration curve for the Georgian electricity system for year 2005

Fig.3: Load duration curve for the Georgian electricity system for year 2006

Table 4: Calculated $EF_{Adjusted\ Simple\ OM}$ for years 2004-2006 and generation weighted $EF_{Adjusted\ Simple\ OM}$

$EF_{Simple\ Adjusted\ OM,\ y}$ = (7994.501 • 019387+8277.38 • 0.21886+8173.739 • 0.41590)/ (7994.510+8277.380+8173.739)=**0.27657** tCO_2/MWh

7 467

X=1293

"Simple Adjusted Operating Margin" Emission Factor (2004-2006)

0.27657 *tCO_2/ MWh*

STEP 2. Calculate the Build Margin emission factor (*EFBM,y*). $EF_{BM,y}$ for year 2006 was calculated as the generation-weighted average emission factor (*tCO2/MWh*) of a sample of power plants *m*, as follows:

$$EF_{BM,y} = \frac{\sum_m F_{m,y} COEF_m}{\sum_m GEN_{m,y}} \qquad (7)$$

where *m* index refers to the plant, $F_{m,y}$, $COEF_m$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method above for plants *m*. Here index referring to fuel absent as only natural gas is used in Georgia.

Project participants shall choose between one of the following two options: *ex-ante* and *ex-post*. The choice among the two options should be specified in the PDD, and cannot be changed during

the crediting period. In case of the *ex-post* option the Build Margin emission factor $EF_{BM,y}$ must be updated annually for the first crediting period.

To calculate $EF_{BM,y}$ *ex-ante* version was used.

***Option 1*. (*ex-ante*)** The Build Margin emission factor $EF_{BM,y}$ must be calculate based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. 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. If 20% falls on part capacity of a plant, that plant is fully included in the calculation.

According to ACM0002 for the purpose of determining the Build Margin (BM) emission factor, 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.

It is not planned to increase the transmission capacities in Georgia.

Power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently are given In *Table 5* (for details see Annex: *Table A5*).

According to this table generation of the five power plants that have been built most recently is less than 20%. AES Mtkvari is fully included in calculations.

According to formula (7): Build margin Emission Factor = 0,52332 (=834 225/ 1 594 092) tCO_2/MWh

$EF_{Build\ Margin,\ 2006}$ – **Build margin Emission Factor**
0.52332 tCO_2/MWh

Calculate Baseline emission factor.

As mentioned above baseline Emission factor was calculated by formula:

$$EF_{Baseline} = w_{OM} \bullet EF_{Operating\ Margin} + w_{BM} \bullet EF_{Build\ Margin}$$

According to Methodology ACM0002 default values are: $w_{OM} = w_{BM} = 0.5$.

$EF_{Baseline} = 0,5 \cdot (0,27657 + 0,52334)$ tCO_2/MWh = *0,3999* tCO_2/MWh.

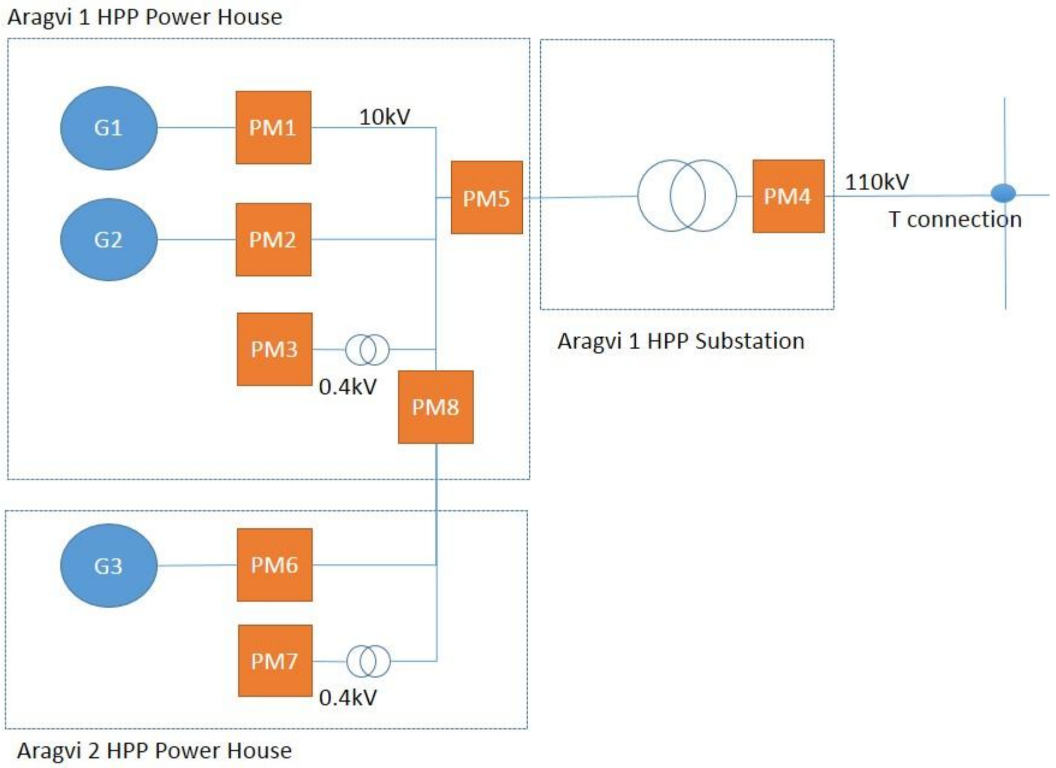
$EF_{Baseline,\ 2006}$ – **Baseline Emission Factor**
0.3999 tCO_2/MWh

All detailed data are available on request.

Appendix 5. Further background information on monitoring plan

The purpose of the monitoring plan is to ensure that the monitoring and calculation of emission reductions of the project within the crediting period is complete, consistent, clear and accurate.

The power metering system of the Gudauri hydropower plant consists of 8 power meters, one main and 6 used for backup. They function to measure electricity generation of the plant as well as electricity imported by the plant from the national grid. The following diagram indicates the power meters location:



Legend :

G1	Generator 1 of phase I	4.26 MW
G2	Generator 2 of phase I	4.26 MW
G3	Generator of phase II	1.2 MW

All the power meters of the Gudauri hydropower plant will be at least class 0.5S and will be calibrated by a third party and sealed to prevent any illegal interference.

PM5, located at the 10kV side of the transformer in use as a cross-check.

PM1 and PM2 are measuring the gross electricity produced by each unit (Respectively Generator 1 and 2). PM3 is measuring the power consumed by the auxiliaries of Aragvi I.

The main billing meter PM4 is located at the outlet of the substation.

Two meters (PM6, PM7) will be installed at a later point of time at the Aragvi II power house where the 1.2 MW turbine will be installed. Power meter PM8 will be installed at the Aragvi 1 power house to measure the net electricity production of Phase II.

On top of the set of power meters described above, there is a SCADA specially designed for this plant by Schubert Elektroanlagen Ges.m.b.H. which continuously measures the voltage and amperage at several points and can be therefore used to cross-check the energy produced and exported.

CDM project management system

A CDM team/committee comprising of persons from relevant departments, which will be responsible for monitoring of all the parameters mentioned in this section. The CDM team also comprises of a special group of operators who are assigned the responsibility of monitoring different parameters and record. On a monthly basis, the monitoring reports are checked and discussed by the seniors CDM team members/managers. In case of any irregularity observed by any of the CDM team member, it is informed to the concerned person for necessary actions

Data to be monitored and recorded

The monitoring plan for Gudauri Small Hydropower Project requires the project owner to monitor the power generation from the proposed project. The net MWh generated from the proposed project and supplied to the grid is monitored continuously by an on-site power meter (PM4) installed at the 110 kV level in the substation in accordance with applicable national standards.

The data is collected on a monthly basis by GSE (Georgian State Electrosystem) in presence of ESCO (Electricity Commercial Operator) and Energo Aragvi LTd.

In parallel to the main billing power meter, the monitoring plan includes six additional power meters used for cross-check : PM1, PM2, PM3, PM6, PM7 and PM8 which data is also collected in parallel to PM4 by GSE, ESCO and Energo Aragvi Ltd. on a monthly basis.

On top of that, Energo Aragvi Ltd. (the “Company”) has also installed another power meter at the 10kV side of the transformer (PM5) and operates a SCADA system which continuously monitors voltage and amperage at many levels of the HPP. These additional systems are also used as a crosscheck.

Installation of Meters

The Grid Operator has installed at the Point of Delivery (substation 110 kV line) one calibrated meter comprising a bidirectional Main Billing meter with an accuracy class of 0.5s to measure the Electrical Energy/Net Electrical Output supplied to the national grid by the Company and the

Electrical Energy imported from the Grid System by the Company at the Point of Delivery. Metering is done at the 110 kV-level (PM4).

The Company is providing in addition the back-up Meters:

- PM1 to measure the gross power generated by generator 1
- PM2 to measure the gross power generated by generator 2
- PM3 to measure the consumption of the auxiliaries of Aragvi 1
- PM5 to measure the electricity at the 10kV transformer side
- PM6 to measure the gross power generated by generator 3
- PM7 to measure the consumption of the auxiliaries of Aragvi 2
- PM8 to measure the net power generated by generator 3

The company will also provide all accessories and expenses for installation of the above mentioned meters. The company will install and maintain in good order the meters.
The calibration of the electronic meters will be done every 10 years by an authorised laboratory. 10 years has been chosen conservatively as the shortest period between manufacturer's recommendation (10 years) and Georgian legislation (12 years).

The Company and the grid operator will respect the IEC standards.

Inspection and Testing
Grid Operator will inspect power meter PM1, PM2, PM3, PM4, PM6, PM7 and PM8 upon installation, and thereafter at intervals following their procedures. The Company shall have a representative present during such inspection of the Metering System or adjustment thereof.

Testing and calibration of the meters will be done in an authorised laboratory only.

Each set of meters may also be inspected at any reasonable time upon request of the Company.

Sealing
PM1, PM2, PM3, PM4, PM6, PM7 and PM8 are sealed with a seal owned by each of the Parties and may not be opened without the presence of a representative of each parties.

Readings
The net electric energy delivered to the grid from the Project will be measured on the basis of meter readings from the bidirectional meter PM4.

The timing of readings
The Company, GSE and ESCO jointly conduct visual readings of PM1, PM2, PM3, PM4, PM6, PM7 and PM8 on the first day of each month. The parties will prepare joint statements recording the readings of the meters for the relevant month immediately following the reading of the meters. If the readings are significantly different from each other and / or demonstrate a level of inaccuracy outside standard class 0.5, then the Billing Meters and / or the Back-up Meters will immediately be tested by the Parties.

Readings are consigned in a document called ACT in Georgia and signed by the three parties.

If the Company's representative is not present, then the grid operator shall provide the Company with a signed copy of the meter reading within forty-eight (48) hours of each reading of the Metering System. Such meter reading shall be treated as the accurate and final measurement of the Net Electrical Output supplied to the grid by the Company for the concerned month.

If the Grid Operator does not read the meters on the specified date of any month, the Company shall read the meters on its own and these readings shall be treated as an accurate and final measurement of the Net electrical Output supplied by the Company to the Grid Operator. The

Company shall provide signed copies of the meter reading to the grid within forty-eight (48) hours of such reading.

Inaccuracy of Meters

If, the and main meter PM4 is not in service as a result of maintenance, repairs, testing, or fails to register or, upon being tested, if found not to be with in accuracy standards Class 0.5, the Net Electrical Output of the Project will be measured as the lowest value between :

i) The net export provided by the SCADA system; and
ii) The net export calculated as (PM1 + PM2 +PM8 –PM3)*(1 – transformer loss). Transformer losses will be calculated by comparing PM4 and PM5 during the three previous months before the problem occur.

Appendix 6. Summary of post registration changes

There are three main registration changes :

- Project capacity has been increased from 9.2 MW to 9.72 MW.
- Reservoir size has been changed from 50,000 m3 to 53,463 m3.
- Monitoring plan has been modified.

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Document information

Version	*Date*	*Description*
06.0	9 March 2015	Revisions to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for small-scale CDM project activities (these instructions supersede the "Guidelines for completing the project design document form for small-scale CDM project activities" (Version 01.1)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and **Error! Reference source not found.**; • Change the reference number from *F-CDM-SSC-PDD* to *CDM-SSC-PDD-FORM*; • Editorial improvement.
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	13 March 2012	EB 66, Annex 9 Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities"

Version	*Date*	*Description*
03.0	15 December 2006	EB 28, Annex 34 • The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02.0	08 July 2005	EB 20, Annex 14 • The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
01.0	21 January 2003	EB 07, Annex 05 Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Registration

Keywords: project design document, SSC project activities