CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• 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>.
03	22 December 2006	• 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.

SECTION A. General description of the small-scale project activity

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

"Cascade Credit small-scale hydro bundled project in Armenia"
Completed in June 2007. Version 2.

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

The bundled project

The purpose of the "Cascade Credit small-scale hydro bundled project in Armenia" is to install and operate ten mini hydro power stations (six run-of- river plants and three plants constructed on artificial water flows) each with electric capacity below 3.6 MW for generation of renewable energy and to bundle them in one CDM project. The total capacity of the ten power plants is **14.839 MW** and the estimated average annual electric generation of the ten mini-hydro plants is 69,459 MWh.

All ten mini hydropower plants receive funding and consulting services from Cascade Credit, a Closed Joint Stock Company located in Armenia which acts as the project proponent and provider of channelled funding. Cascade Credit in turn receives a loan from the European Bank for Reconstruction and Development (EBRD, USD 7 million), a loan from the World Bank (USD 5 million) and contributes USD 3 million of its own equity. The purpose of bundling the ten project activities is to reduce transaction costs and documentation preparation costs for each of the small scale power plants.

All ten mini hydro power plants belong to the same type (Type I, renewable energy project), same category (D. Electricity generation for a system) and same technology (hydro electric generation). The electricity will be supplied to one single grid, the national grid of Armenia. Thus, according to Part IV of "The guidelines for completing the simplified PDD", version 04 of 22 December 2006, a single small scale CDM PDD must be submitted and the same baseline can be used for all ten project activities.

The development of this bundled project contributes to a total emission reduction of **257,937 tCO_{2e}** over a ten years crediting period from April 2006 to March 2016, by offsetting more carbon-intensive electricity production from the Armenian electric grid. The emission coefficient for the Armenian electric grid calculated in Section B.6.4. of this PDD is **0.4339** CO2e/kWh.

The project includes the following ten mini hydropower plants located in different regions in Armenia:

Name	Capacity (MW)	Expected Generation (MWh/year)	Commissioning date	Run-of-river or artificial
Aygedzor-2	1.6	3,500	November 2008	Run-of-river
Ayri	1.1	4,500	January 2008	Run-of-river
Aygezard	2.0	6,418	June 2006	Artificial
Agstev-1	3.6	14,400	March 2009	Run-of-river
Lernapat	0.57	3,810	November 2007	Run-of river
Vahagni	0.923	6,900	July 2009	Run-of-river
Chanaghci-2	1.62	6,400	February 2007	Run-of-river
Ler-Ex cascade (1, 3, 4, 5, 6)	1.546	10,850	April 2006	Artificial
Bovadzor	0.38	2,300	September 2007	Artificial
Apres	1.5	10,381	September 2007	Run-of-river
Total	**14.839**	**69,459**		

The Armenian energy sector
In the Soviet period thermal power plants (TPP) produced 59% of gross electricity production in Armenia primarily consuming Russian natural gas; the Armenian Nuclear Power Plant (ANPP) produced 31%, and hydropower plants (HPP) only 10% (data for 1988). The ANPP was shut down after the 1988 earthquake. After the independence of Armenia, due to a potential energy crisis, the Armenian government had to re-open the ANPP. Nevertheless, given its poor technical condition, the ANPP is expected to be shut down by 2016 and more capacity on the national Armenian grid will be needed.

According to data of the Armenian Public Service Regulatory Commission in 2005, 43% of the Armenian electric generation came from nuclear, 30% came from HPP, and 28. 9% from TPP (operated mainly with natural gas). The installed capacity of the TPPs in Armenia is 1756 MW, the capacity of Hydro-Power Plants (HPPs) is about 1030 MW and the ANPP's installed capacity is 880 MW.

During the period of the energy crisis, the hydro potential of Sevan Lake, the only big natural water reservoir, was intensively exploited. Outflows from the lake have been reduced over the last years to just cover the irrigation needs of Armenia. Reduced outflows resulted in a proportional reduction of power generation by Sevan-Hrazdan Cascade. According to the Ministry of Armenia the estimated hydropower potential economically and technically available in the country is 3.2-3.4 billion kWh/year.

According to "Energy Sector Development Strategies in the Context of Economic Development in Armenia" adopted by the Government of Armenia in August 2005, modernizing and replacing the current thermal and hydro generating capacity is essential. The capacity additions between 2005 and 2016 planned in the same document include additions to existing thermal power plants and installation of new hydro and wind power plants. The planned thermal power plants capacity additions would increase the carbon emission factor of the Armenian electric grid compared to the carbon emission factor calculated as the average between the approximate operating margin and the build margin.

Sustainable development
This project contributes to sustainable development in Armenia, as it:

- Diversifies the sources of electricity generation and decreases dependence on imported natural gas. The increase in capacity by this project can also be a small contribution to the capacity that is required to balance the needed closure of the Armenian Nuclear Power Plant (ANPP) by 2016.
- Helps the Armenian Government to achieve the goal of increasing hydro and other renewable energy (the strategy of the government is the obtainment of 70 % of electric energy from large and small scale hydro power plants).
- Increases employment opportunities to local people both during construction and operation of the project in the area where the project is located. In total, the ten mini hydro plants will employ around 68 employees during the operation of the respective plants. On average every of these employees, that in some plants include operational and administrative staff, will earn a monthly wage of 75-100$ (which correspond to the average monthly wage in Armenia). Thus, the CDM project as a whole will contribute to a total of 61-82,000 $ in annual wages.[1]

[1] For example, the Aygezard mini hydro plant creates 5 additional jobs with average monthly wage of 75$ per employee. Saravan employes 7 to 10 people at the plant including administration officers with around 100$ monthly wages. Aygedzor plant will employ 5 people, Ayri plant: 7 people, Ler Ex Cascade: 7 people, Chanaghchi: 7 people, Aghstev: 7 people, while Apres will employ 12 people during the operation of the plant, including the administrative staff.

- Increases funds for the municipalities located near the power plants via the land-lease contracts and land taxes.[2] In total the ten hydro power plants sites (both the dam structure and the power plant) will occupy a territory of around 18.3 hectares. All the power plants concluded renting agreements with nearby villages or community administrations. The renting agreements generally last for 50 to 100 years and imply a payment of an average 70$ per year with great variance depending on size of the land rented and position and quality of the land.

A.3. Project participants:

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Armenia (host)	Cascade Credit	No
Armenia (host)	ATLAS-Energo LLC	No
Armenia (host)	Zorakar CJSC	No
Armenia (host)	Bitlis Men LLC	No
Armenia (host)	Elenex LLC	No
Armenia (host)	Lernapati Kantexh LLC	No
Armenia (host)	Apahov Taniq LLC	No
Armenia (host)	Mavr LLC	No
Armenia (host)	Ler Ex LLC	No
Armenia (host)	Hosq LLC	No
Armenia (host)	Syunik LLC	No
UK	EBRD	No

EBRD is an intergovernmental organisation which provides project financing for banks, industries and businesses, both new ventures and investments in existing companies. It also works with publicly owned companies to support privatization, restructuring state-owned firms and improvement of municipal services.
Cascade Credit is a Closed Joint Stock Company, which with support from USAID and involvement from other International Financial Institutions is developing unique and customer tailored financial services within Armenia.
The project hosts are Armenian companies owning the power stations and in charge of construction and implementation of the hydropower stations. Follow the names, the descriptions and the contractual obligations of the project hosts:

1. **Aygedzor-2** is developed by ATLAS-Energo LLC (Limited Liability Company). The company is

[2] For example, the company Bitlis Men, concluded a land renting agreement with the Qaghtsrashen community for the construction of the Aygezard plant covering 0.75 hectares and expiring in May 2104. The rent payment is $145 per annum. Hosq LLC has a land renting agreements for the installation of Bovadzor plant for 0.54 hectares, which expires in November 2028 and guarantees an annual income of 36$ to the Bovadzor community. Saravan plant occupies 4.5 hectares and Firma G.A.H. pays rent for 90 years to community administration 340$/year. Ayri plant will occupy 2 hectares of land and Zorakar CJSC pays the administration of the village Soflu 30$/year. Ler Ex Cascade occupies 0.6 hectares of land and pays 88$ per year to the village administration of Payahan. Chanaghchi occupies 0.8 hectares of land and the plant owners will pay a land rent of 14$ per year to the nearby Debet village administration. Agstev occupies 3.14 hectares of land which belongs to the Tavush administration that receives an annual payment of 1,177 $. Apres occupies 6 hectares of land which belongs to the Uytc village that receives an annual payment of 90 $.

domiciled in Armenia and has 5-year working experience in construction and exploitation of small scale hydropower plants including Aygedzor-1. Construction licence was obtained in January 2006. The water utilisation licence was obtained in August 2005. The water utilization rights are properly registered in the State Water Cadastre.

2. **Ayri** is developed by Zorakar CJSC (Closed Joint Stock Company). The company is domiciled in Armenia and has no previous working experience in construction and exploitation of small scale hydropower plants. The company already obtained construction licence in November 2004. There is also the water utilization permission issued by the Ministry of Nature Protection in July 2004.
3. **Aygezard** is developed by Bitlis Men LLC (Limited Liability Company). "Bitlis-MEN" LLC was established in August 2004 and registered in the State Register of Legal Entities of Armenia in September 2004. The company is domiciled in Armenia and has no previous working experience in construction and exploitation of small scale hydropower plants. By August 2006, the company has already implemented some construction works and obtained construction permits for the project. The Construction license was given in June 2005, expiring in 2008; the license for energy production was given in June 2006 with the term of 15 years; the contract with "Irrigation and Water Intake CJSC", valid for 25 years, permits the Artashat water canal utilization.
4. **Agstev-1** is developed by Elenex LLC (Limited Liability Company). The company is domiciled in Armenia and has gained working experience in construction and exploitation of small scale hydropower plants since 1995. The company is currently maintaining a 0.75 MW mini hydro plant on the Yerevan Lake and a 1.7 MW plant on the Kotay water pipe.
5. **Lernapat-1 is developed by "Lernapati Kantekh" LLC (Limited Liability Company).** The company is domiciled in Armenia and has no previous working experience in construction and exploitation of small scale hydropower plants. The plant has received a construction licence in April 2006 that expiries in April 2008. The plant also received a water utilisation permission issued by the Ministry of Nature Protection in February 2006. The water utilization rights are properly registered in the State Water Cadastre.
6. **Vahagni is developed by "Apahov taniq" LLC (Limited Liability Company).** The company is domiciled in Armenia and has no previous working experience in construction and exploitation of small scale hydropower plants. The plant has received a construction licence in April 2005 that expiries in April 2007. The plant also received a water utilisation permission issued by the Ministry of Nature Protection in October 2003. The water utilization rights are properly registered in the State Water Cadastre.
7. **Chanaghci-2** is developed by Mavr LLC (Limited Liability Company). The company is domiciled in Armenia and has no previous working experience in construction and exploitation of small scale hydropower plants. The plant has received a construction licence and a water utilisation licence.
8. **Ler-Ex cascade (1, 3, 4, 5, 6)** is developed by Ler Ex LLC (Limited Liability Company). The company is domiciled in Armenia and has been maintaining the existing Ler-Ex 2 unit since March 2006. It received the construction licence in March 2005. There is also the water utilization permission issued by the Ministry of Nature Protection (Water Management unit) in June 1994.
9. **Bovadzor** is developed by Hosq LLC (Limited Liability Company). The Company was established in 2003. In November 2004 it received the construction license. The construction license term was extended twice until September 2006 and will be renewed again. The company is domiciled in Armenia and has no previous working experience in construction and exploitation of small scale hydropower plants.
10. **Apres** is developed by Syunik LLC (Limited Liability Company), which is domiciled in Armenia

and does not have previous experience in hydro power development. The construction and water utilisation licences are already obtained.

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

The technology to be employed at all ten mini power stations consists in the installation of synchronous generators coupled with a various number of electric turbines of Pelton type (on six power stations) or Francies type (on three power station).

The technical characteristics of each mini hydropower plant are described as follows:

1. **Aygedzor-2** plans to install two Pelton type turbines of 800 kW each (1.6 MW total) of 750 revolutions per minute (rpm) and 88% efficiency. One generator will have power capacity of 1.6 MW, 95% efficiency. A state-owned dam already exists. The designed pressure is 305-328 meters, while the expected designed outflow of water is 0.1-0.65 cubic meters per second. The water pressure pipeline has 600-800 mm at the intake in the plant and 1200 mm at the exit. A new pipeline of 50 metres is added to an existing irrigation water pipeline of 13.2 km. The plant is expected to run 2,187 hours per year on average (i.e. 3 months per year) and generate an annual average of 3,500 MWh. High voltage line is 2000 volt. The implementation of the project entails the construction and installation of: water pipeline, high voltage transmission line, two turbines, generator.
2. **Ayri** plans to install two Pelton type turbines of 700 kW each of 750 revolutions per minute (rpm) each. Only one generator will have power capacity of 1.1 MW (90% efficiency). The project as a whole will have a capacity of 1.1 MW. The designed pressure of the dam is 105 meters, the dam is 3 metres high and 20 metres long. The expected designed outflow of water is 0.3 cubic meters per second. The water pipeline is 4.3 km long the diameter of the pipeline is 1000 mm. The plant is expected to run 4,090 hours per year on average (i.e. 5.6 months per year) and generate an annual average of 4,500 MWh. The implementation of the project entails the construction and installation of: hydro power station building, dam, water pool, pressured water pipeline, kW transformer substation, high-voltage transmission line, one generator, 2 turbines, pumps.
3. **Aygezard** plans to install one Pelton type turbine of 1000 revolutions per minute (rpm), 0.2 MW, 4 pumps. The total power capacity will be 2.0 MW (2 generators of 0.5 MW each, 2 generators of 0.4 MW each and one generator of 0.2 MW). The plant is expected to run 3,200 hours per year on average (i.e. 4.5 months per year between April and November) and generate an annual average of 6,418 MWh of electricity. The implementation of the project entails the construction and installation of: hydro power station building, dam, water pool, pressured water pipeline (the water passes through two pipelines of 734 m in length and diameter of 1220 mm), drinking water pipeline, 35 kW transformer substation, high-voltage transmission line, 4 generators, 1 turbine, 2 pumps of 750 rpm. The designed pressure of the dam is 898 – 938.5 meters, while the expected maximum designed outflow of water is 4.2 cubic meters per second in July-August.
4. **Agstev-1** plans to install two Pelton type turbines 1,800 kW each and characterised by 1,000 revolutions per minute. Two generators will be installed totalling 3.6 MW of power capacity. The designed pressure of the dam is 242 meters, the height of the dam is 2 to 3 metres, the length of 30 metres, while the expected designed outflow of water is 2 cubic meters per second in spring. The plant is expected to run 4,000 hours per year on average (i.e. 5.5 months per year) and generate an annual average of 14,400 MWh. The implementation of the project entails the construction and installation of: hydro power station building, dam, water pool, pressured water pipeline (the water passes through a pipeline of 5,300 m in length and diameter of 900 mm), transformer substation,

high-voltage transmission line, 2 generators, 2 turbines.

5. **Lernapat** plans to install two Pelton type turbines 300 kW each and characterised by 1,500 revolutions per minute. Two generators will be installed totalling 570 kW of power capacity. The designed pressure is 118.8 meters, the height of the dam is 2,6m, while the expected designed outflow of water is 0.6 cubic meters per second. The plant is expected to run 6,684 hours (i.e. over 9.4 months per year) and generate an annual average of 3,810 MWh. The implementation of the project entails the construction and installation of: hydro power station building, dam, water pool, pressured water pipeline (the water passes through a pipeline of 3,180 m in length and diameter of 630 mm), transformer substation, high-voltage transmission line, 2 generators, 2 turbines.
6. **Vahagni** plans to install three Turgo type turbines 400 kW each and characterised by 1,500 revolutions per minute. Three generators will be installed totalling 0.923MW of power capacity. The designed pressure is 240.75 meters, the height of the dam is 3.5m, while the expected designed outflow of water is 0.5 cubic meters per second. The plant is expected to run 7475 hours (i.e. over 10 months per year) and generate an annual average of 6.9 MWh. The implementation of the project entails the construction and installation of: hydro power station building, dam, water pool, pressured water pipeline (the water passes through a pipeline of 20,120 m in length and diameter of 630 mm), transformer substation, high-voltage transmission line, 3 generators, 3 turbines.
7. **Chanaghci-2** plans to install three Pelton type turbines of 540 kW each and with 500 revolutions per minute each. Three generators will have power capacity totalling 1.62 MW. The designed pressure of the dam is 100.42 meters, the designed height is 7.2 metres, while the expected designed outflow of water is 2 cubic meters per second. The plant is expected to run 3,950 hours per year on average (i.e. 5.5 months per year) and generate an annual average of 6,400 MWh. The implementation of the project entails the construction and installation of: power station building, dam, pipeline (1,670 metres long, and 1,400 mm of diameter), fish pass, take off canal, pipeline trench, 3 turbines, 3 generators, power intake, transformer substation, high-voltage transmission line.
8. **Ler-Ex cascade (1, 3, 4, 5, 6)** plans to install Francis type turbines of 1,800 kW each and with 1000 revolutions per minute each. The generators will have total power capacity of 1.546 MW. The designed pressure of the dams is between 29 and 126 meters, while the expected designed outflow of water is 1.1 cubic meters per second. The Ler-Ex cascade second turbine is already in place and operating and is not included in this project. The pipeline diameter is 500 mm and it already existed to supply water for drinking purposes. The plant is expected to run 7,018 hours per year on average (i.e. around 9.7 months per year, with mostly productive months between May and June) and generate an annual average of 10,850 MWh. The implementation of the project entails the construction and installation of: stilling devices, , pipeline trench, 6 turbines, 6 generators, power intake, transformer substation, high-voltage transmission line.
9. **Bovadzor** will install a generator of 380 kW power capacity and a Francis type turbine of 350 rpm. The plant is expected to run 6,050 hours per year on average (i.e. 8.4 months per year) and generate an annual average of 2,300 MWh. The implementation of the project entails the construction and installation of: 1 turbine, 1 generator, power intake, transformer substation, pipeline trench, high-voltage transmission line, 1,500 metres of pipelines. The expected designed outflow of water is 1.5 cubic meters per second.
10. **Apres** will install two generators (one of 1,250 kW and one of 650 kW of power capacity) and three Francis type turbines (two of 600 kW each and one of 300 kW and each with 1000 revolutions per minute). The project as a whole will have a capacity of 1.5 MW The plant is expected to run 6,920 hours per year on average (i.e. 9.6 months per year) and generate an annual average of 10,381 MWh. The water pipeline will be 1,700 metres long, of 1,600 mm of diameter. The implementation

of the project entails the construction and installation of: a dam (9 metres high and 50 metres long) , fish pass, water pipeline, take off canal, pipeline trench, 3 turbines, 2 generators, power intake, transformer substation, high-voltage transmission line. The expected designed outflow of water is 2.1 cubic meters per second.

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

Armenia

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

The ten power plants are located in the following regions (i.e. marz in Armenian): Tavush marz (two plants), Syunik marz (three plants), Ararat marz, Lori marz (four power plants).

A.4.1.3. City/Town/Community etc:

Various, see A.4.1.4

A.4.1.4. Detail of physical location, including information allowing the unique identification of this small-scale project activity(ies):

The following are the specific locations of each mini hydro power plant:

1. **Aygedzor-2** is located on the Hndzorut river in the Tavush marz (i.e. region) near Berd city in the north-east of Armenia. The Tavush marz is a mountainous region of Armenia, characterised by smooth winter conditions and a water rise from April to July.
   Longitude: 40° 88’ 10’’ N
   Latitude: 45° 39’ 20’’ E
2. **Ayri** is located on the Ayri river, which is the right tributary of Sisian river in the Syunik marz (i.e. region) of the Berd area in the south-east of Armenia. The Syunik marz is a mountainous region of Armenia, characterised by a well-expressed spring flood (April-June).
   Latitude: 39°46’ 50’’ N
   Longitude: 45 ° 96’ 90’’ E
3. **Aygezard** is located at Qaghtsrashen on the Artashat water canal near the Aygezard village in the Ararat marz (i.e. region) in the south of Armenia. The Artashat canal is an irrigation canal that operates in the months of April through November.
   Latitude: 39° 96’ 70’’ N
   Longitude: 44°61’ 70’’ E
4. **Agstev-1** is located on the Agstev river, near Diligen city in the Tavush marz (i.e. region) of the Berd area in the north-east of Armenia. The Tavush marz is a mountainous region of Armenia, characterised by smooth winter conditions and a water rise from April to July.
   Latitude: 40° 75’ 40’’ N
   Longitude: 44° 87’ 50’’ E
5. **Lernapat** is located on the river Kharachoban, which is the left tributary of Lernajur river, near Lernapat vilige in the Lori marz (i.e. region) in the northern part of Armenia.

Latitude: 44° 20’ 341’’ N
Longitude: 44° 22’ 302’’ E

6. **Vahagni** is located on the river Tandzut, which is the right tributary of Pambak river, near Vahagni vilige in the Lori marz (i.e. region) in the northern part of Armenia.
   Latitude: 40° 90’ 80’’ N
   Longitude: 44° 60’ 70’’ E
7. **Chanaghci-2** is located on the Chanagchi river, which is the right tributary of Pambak river, near the Debet village, located in the Lori marz (i.e. region) in the northern part of Armenia.
   Latitude: 40° 91’ 80’’ N
   Longitude: 44° 64’ 90’’ E
8. **Ler-Ex cascade (1, 3, 4, 5, 6)** is located on the Adjidadg-Gehi water pipe near the Gehi river near Kapan village in the Syunik marz (i.e. region) of Armenia. The Syunik marz is a mountainous and windy region of south east Armenia, characterised by a water rise from May to July.
   Latitude: 39° 20’ 10’’ N
   Longitude: 46° 41’ 50’’ E
9. **Bovadzor** is located on the water pipe near Bovadzor and Stepanavan villiages in the Lori marz (i.e. region) in the northern part of Armenia.
   Latitude: 41° 00’ 80’’ N
   Longitude: 44° 38’ 70’’ E
10. **Apres** is located on the Vorotan river near the Uyts village in the Syunik marz (i.e. region) of Armenia. The Syunik marz is a mountainous and windy region of south east Armenia, characterised by a water rise from May to July.
   Latitude: 39° 50’ 70’’ N
   Longitude: 46° 05’ 30’’ E

The locations of the plants are indicated with red stars in the map below.

A.4.2. Type and category(ies) and technology of the small-scale project activity:

According to the simplified modalities and procedures for small-scale CDM project activities, this project falls under the Type/Category (i) D. (Renewable Energy Projects / Electricity generation for a system). The project conforms to the project category since the total nominal installed capacity (i.e. sum of the capacity of all ten mini hydro power plants) is below the 15 MW threshold and the plants will sell its generated electricity to the grid. It will not increase beyond 15 MW at any point during the crediting period.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Average annual emission reductions from the electricity generated by the project are estimated to be 25,793 tCO2e. Total emission reductions over a 10 year crediting period are estimated to be **257,937** tCO2e.

Years	Emissions Reductions in tCO_2e
Year 1) Jan 2008- Dec 2008	19,630
Year 2) Jan 2009- Dec. 2009	27,349
Year 3) Jan. 2010- Dec. 2010	30,137
Year 4) Jan. 2011- Dec. 2011	30,137
Year 5) Jan. 2012- Dec. 2012	30,137
Year 6) Jan. 2013- Dec. 2013	30,137
Year 7) Jan. 2014- Dec. 2014	30,137
Year 8) Jan. 2015- Dec. 2015	30,137
Year 9) Jan. 2016- Dec. 2016	30,137
Year 10) Jan. 2017- Dec. 2017	30,137
Total baseline (tCO2e)	**257,937**

A.4.4. Public funding of the small-scale project activity:

The EBRD is providing a loan of USD 7 million to Cascade Credit for the development of the mini hydro power plants (See Annex 2 for details). This loan is combined with a loan from the World Bank of USD 5 million. Neither the World Bank nor the EBRD claim any compensation in the form of certified emission reductions for the repayment of the loans. Both EBRD's and World Bank's funding do not result in a diversion of official development assistance as EBRD and World Bank provide loans and not grants to Cascade Credit.
Cascade Credit also benefits from USD 3 million in grant funding from the Global Environmental Facility to help with project screening and evaluation, documentation, legal due diligence and monitoring operations. This is a technical assistance grant which does not divert official development assistance to developing countries.

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

The project proponents hereby confirm that the proposed small-scale project activity is not a de-bundled component of a larger project activity, but instead is a bundle of mini-scale project activities.

The project participants further confirm that they have neither registered any other small-scale CDM activity nor have applied for registration of any other small-scale CDM project activity within the same project boundary, in the same project category or in the same technology within the last two years.

SECTION B. Application of a baseline and monitoring methodology

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

Project Activity Type 1.D: Renewable electricity generation for a grid
Predefined baseline methodology according to its latest version "AMS-I.D./Version11, Scope 1, EB 31" (i.e. from decision of 31st meeting of the CDM Executive Board of May 2007)

B.2 Justification of the choice of the project category:

The "Cascade Credit small-scale hydro bundled project in Armenia" is a hydropower project bundling ten mini hydro plants and providing electricity to the grid. It can be qualified as a small scale project because the total capacity of all ten mini hydro power plants is 14.839 MW and does not exceed the 15 MW limit. Herewith the project can be considered a project activity falling under category 1.D of Appendix B of the simplified modalities and procedures for small scale CDM project activities.
According to these guidelines, projects that qualify under category 1.D can use the predefined baseline methodology according to its latest version "AMS-I.D./Version 11, Scope 1, EB 31" .

B.3. Description of the project boundary:

Project boundary as per the 'AMS I.D. of Appendix B of the simplified modalities and procedures for small-scale CDM project activities' encompasses the physical, geographical site of the renewable generation source.
For the proposed CDM project activity "Cascade Credit small-scale hydro bundled project in Armenia", the project boundary encompasses the equipment specified for each mini hydro plant in the technical description section (section A.4)
According to the above-mentioned methodology, paragraph 12, leakage is to be considered "If the energy generating equipment is transferred from another project activity or if the existing equipment is transferred to another activity", which is not the case for these mini hydro power plants.

B.4. Description of baseline and its development:

Baseline methodology

Option (a) of paragraph 9 of the latest version of the methodology from project type "I.D Grid connected renewable electricity generation" defines the baseline as the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2e/kWh) calculated in a transparent and conservative manner as the combination of the "operating margin" and the "build margin", where:
(i) The "operating margin (OM)" is based on one of the following methods: a) Simple OM b) Simple adjusted OM c) Dispatch data analysis OM d) Average OM. The OM emission factor can be calculated using either of the two following data vintages for years(s) y:

Option 1: The full generation-weighted average for the most recent 3 years for which data are available at the time of submission of the PDD

Option 2: The year in which project generation occurs, if emission factor is updated based on ex post monitoring.

(ii) The "build margin" is the weighted average emissions (in kg CO2equ/kWh) of recent capacity additions to the system, 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. Power plant capacity additions registered as CDM project activities should be excluded from the sample group m. If 20% falls on part capacity of a plant, that plant is included in the calculation.
The build margin emission factor can be calculated using either of the following data vintages for years(s) y:

- Option 1: Most recent information available on plants already built at the time of PDD submission.
- Option 2: For the first crediting period, emission factor is updated based on ex-post monitoring. For subsequent crediting periods, emission factor should be calculated ex-ante, as described in option 1 above.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

According to "Energy Sector Development Strategies in the Context of Economic Development in Armenia" adopted by the Government of Armenia in August 2005, modernizing and replacing the generating capacity is essential since:

- 38% of Armenian installed capacity has been in operation for more than 30 years;
- The primary equipment at TPPs has reached 200 thousand hours level and does not correspond to international standards in terms of technical, economic and ecologic criteria;
- 70 % of the installed equipment at HPPs has been in operation for more than 30 years, and 50% for more than 40 years.

The same document indicates that the capacity additions planned for 2005-2010 will include a mix of thermal power plants (capacity additions to the two existing Yerevan and Hrazdan plants) and new hydro and wind plants. The following additions to the grid are currently planned:

- gas fired addition to the Yerevan power plant 208 MW
- gas fired addition to the Hrazdan power plant 440 MW
- small hydro plants 70 MW
- Meghri hydro plant 140 MW
- wind plants 100 MW

For the period 2010-16 the planned capacity additions are:

- gas fired addition to the Yerevan power plant 208 MW
- gas fired addition to the Hrazdan power plant 400 MW
- Loriberd hydro plant 60 MW
- small hydro plants 65 MW
- wind plants 200 MW

In total the plan expects the addition of 1,256 MW of thermal power plants and 635 MW of renewable energy, of which the planned addition of 300 MW wind power plants by 2016 appears to be quite optimistic, given the fact that currently no wind farms are installed in Armenia. If the plans are implemented and the Armenian nuclear power planned is phased out as envisaged, then the Armenian energy mix would look as follows in 2016: thermal power plants would contribute to 65.05% of total capacity while carbon- free generation would contribute to 34.95%. In 2005, thermal power plants contributed to 48.2% of total capacity while carbon free plants contributed to 51.8%.

The distribution of the capacity within the actual (2005) Armenian energy mix and the planned (2016) energy mix is shown in the table below.

Sr. No.	Power Plants	Dates commissioned	Fuel Source	Capacity	Energy mix
	2005			MW	%
1	International Energy Corporation (former Sevan-Hrazdan Hydro Power Plant)		Hydro	556	15.26%
	Sevan	1949	Hydro	96	
	Hrazdan	1959	Hydro	34	
	Argel	1953	Hydro	79	
	Arzni	1956	Hydro	211	
	Kanaker	1936	Hydro	5	
	Yerevan 1	1961	Hydro	67	
	Yerevan 3	1956	Hydro	40	
2	Yerevan Thermal Power Plant		Natural gas	550	15.10%
	Section 1	1963-1965	Natural gas	250	
	Section 2	1966-1968	Natural gas	300	
3	Hrazdan Thermal Power Plant		Natural gas	1110	30.47%
	Section 1	1966-1969	Natural gas	300	
	Section 2	1971-1974	Natural gas	810	
4	Vorotan Hydro Power Plant, including		Hydro	400	10.98%
	Spandaryan	1984	Hydro	157	
	Shamb	1977	Hydro	168	
	Tatev	1970	Hydro	75	
5	Armenia Nuclear Power Plant		Nuclear fuel	880	24.16%
	Unit 1	1980	Nuclear fuel	440	
	Unit 2	1995	Nuclear fuel	440	
6	Vanadzor Thermal Power Pla	1976	Natural gas	96	2.64%
7	Small Hydro Power Plants	last 2004	Hydro	51	1.40%
				3643	100%

Sr. No.	Power Plants	Dates commissioned	Fuel Source	Capacity	Energy mix
	2016			MW	%
1	International Energy Corporation (former Sevan-Hrazdan Hydro Power		Hydro	532	11.49%
	Sevan	1949	Hydro	96	
	Hrazdan	1959	Hydro	34	
	Argel	1953	Hydro	79	
	Arzni	1956	Hydro	211	
	Kanaker	1936	Hydro	5	
	Yerevan 1	1961	Hydro	67	
	Yerevan 3	1956	Hydro	40	
2	Yerevan Thermal Power Plant		Natural gas	966	20.86%
	Section 1	1963-1965	Natural gas	250	
	Section 2	1966-1968	Natural gas	300	
	Section 3-4	2010-2015	Natural gas	416	
3	Hrazdan Thermal Power Plant		Natural gas	1950	42.12%
	Section 1	1966-1969	Natural gas	300	
	Section 2	1971-1974	Natural gas	810	
	Section3-4	2010-2015	Natural gas	840	
4	Vorotan Hydro Power Plant, including		Hydro	400	8.64%
	Spandaryan	1984	Hydro	157	
	Shamb	1977	Hydro	168	
	Tatev	1970	Hydro	75	
6	Vanadzor Thermal Power P	1976	Natural gas	96	2.07%
7	Small Hydro Power Plants	last 2004	Hydro	51	1.10%
8	Wind power plants	2010-2015	Wind	300	6.48%
9	Meghri HPP	2010-2016	Hydro	140	3.02%
10	Loriberd	2010-2016	Hydro	60	1.30%
11	Small Hydro Power Plants	2010-2017	Hydro	135	2.92%
	Total			4630	100%

The planned thermal power plants capacity additions would thus increase the carbon emission factor of the Armenian electric grid compared to the carbon emission factor, calculated in Section B.6.3 and B.6.4. as the average between the approximate operating margin and the build margin. The carbon emission factor used in this PDD is therefore very conservative and the proposed small-scale bundled project is clearly additional to the baseline energy sector in Armenia.

The project specifically faces following significant barriers (i) Investment barriers, (ii) Technological barriers.

<u>Starting Date of the Project Activity</u>

The starting date of the project activity must be, according to the UNFCCC guidelines on small scale bundled CDM projects, the date when the first plant (Ler Ex Cascade) of the bundle begins to supply electricity to the Armenian grid. The starting date of the project activity is 1 April 2006. The starting date of the crediting period is the expected registration date of project activity by the CDM Executive Board, estimated for 1 January 2008. Thus, the starting date of the project activity is before the registration date of the project activity. The structuring of the loan provided to Cascade Credit by EBRD began in January 2006 and the loan's project summary description was posted on EBRD's website on 18 January 2006. Cascade Credit began to identify eligible hydro project developers starting in January 2006. The CDM component was fully integrated by Cascade Credit when assessing the eligibility of Ler Ex Cascade to obtain the loan. Cascade Credit included the expected revenue flow from carbon credits in the financial analysis of the project before arranging the loan to the power plant developer. The loan passed EBRD's Board approval on 25 April 2006 and disbursed thereafter. Cascade Credit assessed the eligibility to receive loans for about 20 hydro project proposals in Armenia, based on technical, financial and environmental criteria. Several months were needed for Cascade Credit to finalise the final composition of the CDM bundle. Thus, the PDD was developed between June 2006 and June 2007 .

Barrier Analysis:

1. *Investment barriers*: The project faces the following perceived risks and barriers.

a. Lack of capital for small scale power plants

The lack of capital is seen as the main barrier, as the following problems exist for small hydro projects that want to raise funds:

- *The interest rates applied to loans in drams by Armenian twenty commercial banks to corporate clients are too high averaging at about 16-18% (the reference rate of the banking interest is 15% to which a commercial bank margin of 1-3% needs to be added)*
- *The loan terms are too short for a long term investment such as a power plant*
- *The Armenian banks are too small to provide loans for even small hydro projects*
- *The loan amounts are too small for international capital markets*
- *Due to the history of payment and credit problems, it will take a long time to cover the sector image for investors*

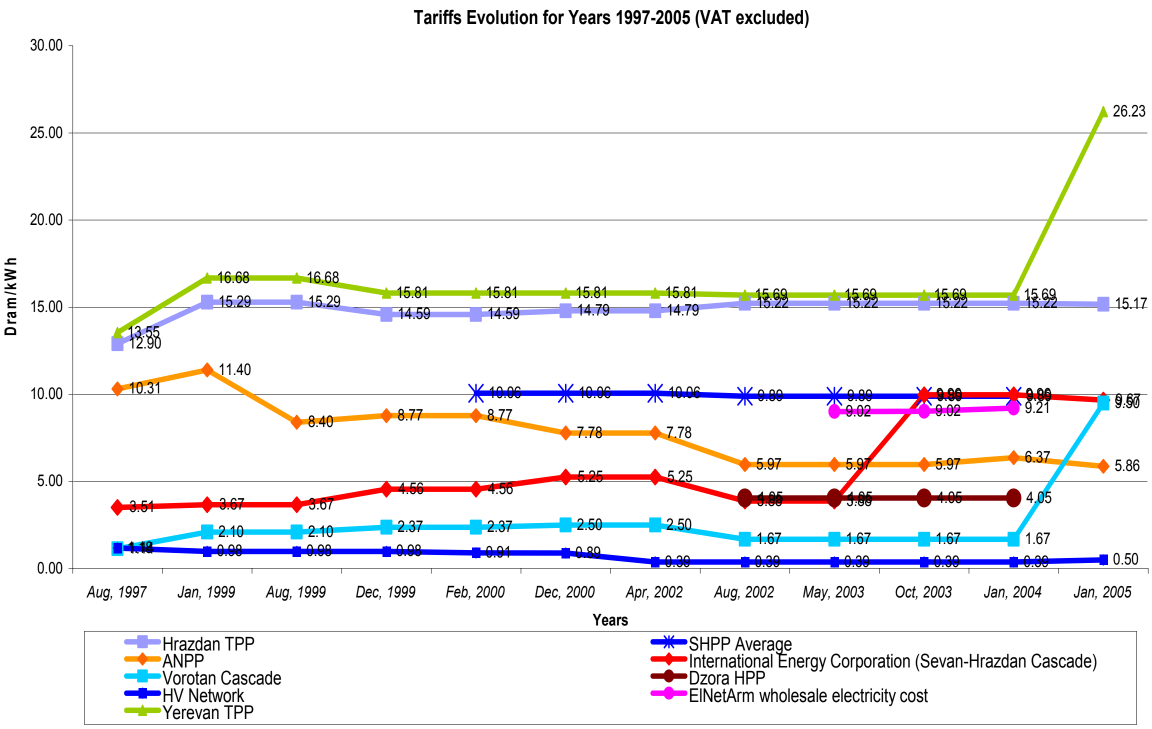
It must be noted that all ten mini hydro project hosts have in fact faced large problems in attracting capital. All of the mini hydro projects were stranded at business plan or feasibility study phase of their projects and were not able to proceed to the construction phase because of lack of funds and before they were selected by Cascade Credit. Many projects had to extend or renew their construction permits, because construction works were delayed due to lack of funds.

Cascade Credit has approached EBRD directly for a loan, and also asked to assist them in developing the bundled project as a CDM project, to improve the financial performance of all mini hydro power sub-projects. The extra cash flow from Certified Emission Reductions (CERs) in hard currency will increase the project's internal rate of return (IRR) and increase the attractiveness of the bundled project to investors, local banks and international development banks.

b. Risks due to level of tariffs

The tariffs paid to each small hydropower generation facility for energy supplied to the network are fixed by the Public Service Regulatory Commission of Armenia (PSRC), based on the cost and operating data provided by the power plant owner. Hence, the tariffs are different for each generator and thus a new project developer may not know the expected revenues (based on the approved tariffs) until the project is operational. Since no uniform methodology exist for establishing future tariffs power plant owners can estimate their revenues only upon completion of the projects. The additional cash flows stemming from the sale of CERs will reduce the overall uncertainties regarding the expected revenues. The average tariffs for privatised hydro power plants oscillated between 10.06 drams/kWh in 2001 and 9.98 drams/kWh in

2005 (i.e. around 2 US$ cents/kWh). The tariffs are way below those granted to thermal power plants but above those granted to existing big hydro power plants.



Source: PA Consulting, “Financial Performance of the Armenian Power Sector”,(January – December 2004), March 29, 2005

c. Risks due to non-payments of energy tariffs

The PSRC adopted a resolution according to which the power market was transformed to a direct contracts system effective October 1, 2004. Previously, Armenergo (the state owned monopoly) was buying power from generators and selling it to the distribution company. The distribution company ElNetArm is now the single buyer for internal consumption and it has signed direct contracts with Generators and service providers. It is also obliged to make all payments for the services rendered after October 1, 2004 based on effective tariff. All the small-scale hydropower producer are obliged to sell their power to ElNetArm as per the terms of the power purchase agreement. The developer must accept the power purchase price offered by the ElNetArm and fixed by PSRC.
Both Armenergo before October 2004 and ElNetArm after October 2004 failed to pay all the billed energy supplied by the generators. For example in 2001 Armenergo paid only 51.9% of payments billed by generators, in 2002 Armenergo paid 102.6%, while in 2003 Armenergo was able to pay 162.3% of the bill and partly reimburse the previous years shortages.[3] However, in 2004, total payments by ElNetArm to the generators equalled to only 85% of the generators’ bills for the period. Hrazdan TPP and International Energy Corporation were underpaid (70% and 72% respectively). Small HPPs were paid 101% of their billed amount.[4]

[3] PA Consulting, “Financial Performance of the Armenian Power Sector”, for January- December 2003”, 2004
[4] PA Consulting, “Financial Performance of the Armenian Power Sector for January- December 2004”, 2005

Thus, it is yet unclear whether the Armenian electricity system will soon be immune from non-payments risk. The risk of non-payments for power generators could remain for the next years and revenues from CERs could partly offset this risk.

d. Licences-related risks

The PSRC issues the appropriate licenses to the developer of a renewable energy project following the procedures similar to those already developed for the issuance of licenses to other generation facility owners, notwithstanding the fact that mini hydro power plants are much smaller and require less technical and economic planning.
The PSRC requires the applicant to submit a long list of economic justifications and technical assessments for the construction of new generation facilities. For small hydro power installations, this list is too cumbersome and unnecessary.
By achieving the status of CDM project activity, Armenian small scale hydro facilities can gain international visibility and potentially go through the licensing procedure in a more speedy way compared to local and unknown projects.

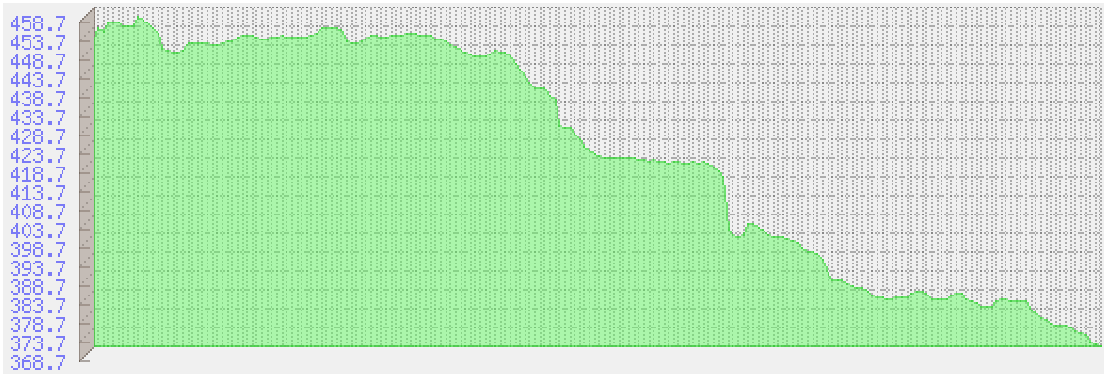
e. Exchange risks

The exchange risk between US dollars and local Armenian currency (Armenian dram) is a very relevant risk for mini hydro project developers. On the expenditure side hydropower plant developers face investment and operational & maintenance costs in Armenian drams. On the debt side each hydropower plant developer accounts for the loan received from Cascade Credit in US dollars (with loan terms of 6 to 10 years). On the revenue side the hydropower developers account for revenues stemming from the sale of the generated electricity. The Armenian electricity tariffs are set in US dollars but are paid by ElNetArm to the electricity generators in Armenian drams. In case the US dollar depreciates compared to the Armenian dram, the hydropower generators are affecting by:

- declining electricity revenues, since the price paid in Armenian drams per MWh declines due to depreciation of the dollar;
- declining value of the received loan and thus lower level of capital available for covering investment and operational costs, since the loan is received in dollars and the dollar value decreases.

The figure below shows how the dollar depreciated in the course of 2006 compared to the Armenian dram.

Exchange rate history of USD versus Armenian drams from 3 March 2006 to 4 December 2006



Source: http://www.armtown.com/rates/en/20061204/840/#er

The additional revenues derived from Certified Emission Reductions will be provided in Euros, a hard currency which can offset, at least partly, the US dollar- Armenian dram exchange risk faced by the project developers in Armenia.

f. Power purchase agreement risks

Energy generation investment opportunities in small-scale hydropower facilities in Armenia are relatively limited. In that limited market, investments in small-scale hydropower sector are exposed to higher risks compared to investments in a thermal power projects or large hydro power plants. PSRC pays a capacity charge to all the thermal power plants and existing large hydro power plants in order to cover up front capital costs for modernisation and construction of plants. The capacity charge is fixed each year for each installation by the PSRC. No capacity charge is paid to the small scale hydropower plants, but only a monthly fixed tariff per kWh actually delivered by the plant.
The disparities in payments terms between existing thermal power plants and large hydro at one hand and small hydropower plants on the other hand make investment in small-scale hydro less attractive relative to investment in thermal power stations, and therefore, represent a real barrier to investment in small scale hydro power plants. CDM can help mitigate the investment risk by providing an additional source of revenue.

2. *Technological barriers:* The project faces the following barriers related to the specific of small scale hydro power plants

a. Hydrology risks

The "Cascade Credit small-scale hydro bundled project in Armenia" includes small scale power plants located both on artificial canals and natural rivers. The rivers on which all the run-of river plants are located are mountainous rivers affected by seasonal changes. They do not have the advantage of receiving a regulated flow from the reservoir upstream and the plants are exposed to the risk of uncertain water levels from droughts or poor rain. The power production by the proposed small-scale hydropower run of the river projects is always contingent on the rainfall in that year. A drought like situation could decrease the net power output of a hydropower plant and thus increase the financial burden for a hydropower facility.
Small hydropower developers can claim a payment from ElNetArm to compensate for drought induced generation shortfalls and other external factors not under developer's control that can affect electricity generation. This compensation can be given in the form of augmented fixed tariffs. However, the

authorization for the payment must be given on a case by case basis by the PSRC and the authorization is not guaranteed, and requires time and efforts by the project developer.
The revenues derived from CERs increase the ability of project developers to mitigate hydrology risk. During low precipitation seasons, hydro electricity production decreases and therefore less than expected CERs are generated. Notwithstanding the decreased volume of CERs, additional revenues are obtained other than electricity payments.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Application of the methodology

The operating margin and the build margin are derived from the data published by the following organizations:

- Public Service Regulatory Commission of Armenia, which published data on the total electricity generation of Armenian power plants and the type of fuels consumed in 2005 and which supplied information regarding the capacity additions to the electricity system and expected generation of these power plants.
- Government of Armenia, which adopted the "Energy Sector Development Strategies in the Context of Economic Development in Armenia", August 2005 and which includes information on Armenian policies in the energy sector and fully describes the existing plants' operations (sub-units, commissioning dates, total electric capacity etc.)
- World Bank, which published the paper "From Crisis to Stability in the Armenian Power Sector" February 2006 and which includes data on existing power plants.
- Platts (a division of The McGraw-Hill Companies), which published the Utility Data Institute (UDI) database for year 2005. These data were used to calculate the heat rate of the power plants.

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

- The Dispatch Data Analysis OM cannot be selected because of the unavailability of the detailed dispatch data for the Armenian grid. Such data were formally requested but not received from the Public Service Regulatory Commission of Armenia.
- The Simple OM (method a) cannot be applied in Armenia since the low-cost/must run resources (i.e. hydro and nuclear generation) constitute more than 50% of total grid generation in the average of the five most recent years as shown in the table below (Source of data: Public Service Regulatory Commission of Armenia).

Year	2005	2004	2003	2002	2001
Percentage of low-cost/must run resources in total generation	70.75%	72.91%	72%	70%	50%
Average of five years					67.13%

- The Armenian Electricity Settlement Center has supplied the project proponent with the data necessary for plotting the Load Duration Curve and estimating the factor lambda for the year 2005 for the Armenian electricity grid. Given the difficulty for the project developer to obtain such a large number of data ex post for each year in which the electricity generation occurs from the CDM project, the ex ante vintage was chosen. Although data were requested for vintage years 2003 and 2004 as well, the Armenian Electricity Settlement Center was not able to supply these data, therefore only the vintage year 2005 is available at the time of PDD submission.

The calculations that quantify the baseline and the emissions coefficient are shown in the Section B 6.4 of this PDD, relevant sourcing has also been indicated.

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

Choice of plants for the operating margin calculation

The table below presents all the plants considered for the **ex-ante** calculation of the operating margin. If hydro, geothermal, wind, low-cost biomass, nuclear and solar generation are excluded, then only three thermal power plants remain for the adjusted operating margin: Yerevan, Hrazdan and Vonadzor thermal power plants. It must be noted that Vanadzor has not been running since 2001.
The imports from Iran and Artsach region are also included in the calculation of the operating margin. It must be noted that since the emission factor of the Artsach region is unknown, the emission factor of all the imports was assumed in a conservative manner to be 0 tons of CO_2 per MWh (as prescribed on page 4 of the ACM0002 methodology).
The power sources included in the operating margin calculation are underlined in yellow in the table below.

Sr. No.	Power Plants	Dates commissioned	Fuel Source	Capacity		Generation (2005)
					MW	GWh
1	International Energy Corporation (former Sevan-Hrazdan)		Hydro	556		519.2
	Sevan	1949	Hydro		96	
	Hrazdan	1959	Hydro		34	
	Argel	1953	Hydro		79	
	Arzni	1956	Hydro		211	
	Kanaker	1936	Hydro		5	
	Yerevan 1	1961	Hydro		67	
	Yerevan 3	1956	Hydro		40	
2	Yerevan Thermal Power Plant		Natural gas	550		391.7
	Section 1	1963-1965	Natural gas		250	
	Section 2	1966-1968	Natural gas		300	
3	Hrazdan Thermal Power Plant		Natural gas	1110		1435.5
	Section 1	1966-1969	Natural gas		300	
	Section 2	1971-1974	Natural gas		810	
4	Vorotan Hydro Power Plant, including		Hydro	400		1027.6
	Spandaryan	1984	Hydro		157	
	Shamb	1977	Hydro		168	
	Tatev	1970	Hydro		75	
5	Armenia Nuclear Power Plant		Nuclear fuel	880		2716.3
	Unit 1	1980	Nuclear fuel		440	
	Unit 2	1995	Nuclear fuel		440	
6	Vanadzor Thermal Power Plant	1976	Natural gas	96		0.0
7	Small Hydro Power Plants	last 2004	Hydro	51		155.8
8	Dzora Hydro Power Plant	1930	Hydro	25		70
9	Imports from Iran and Artsach	-	-	-		337.6
	Total			3693		6653.7

Choice of plants for the build margin calculation

For the calculation of the Build Margin **Option 2** is chosen, by which the Build Margin emission factor will be updated annually **ex-post** for the year in which actual project generation and associated emissions reductions occur. This choice is justified by the fact that a large number of power plants have obtained a construction licence and will be soon commissioned in Armenia. An ex-post calculation of the build margin will therefore represent more realistically the capacity additions to the Armenian electricity grid. The information on power plants that obtained a construction licence was supplied by the Public Service Regulatory Commission of Armenia.
It must be noted that generation and capacity data are unavailable for each of the small hydro power plants that contribute to the 27.35 MW capacity and labeled under category "Other small Hydro Power Plants". All small hydro power plants were therefore considered as one category and the year of commissioning of the last of the small hydro power plants (2004) was used as the year of commissioning of the whole group.

The build margin can be calculated as 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 or as the five power plants that have been built most recently. Since it is impossible to state at the moment of PDD submission which five power plants will be the most recently built, the first definition of the build margin is chosen. Thus, the plants that constitute the newest 20% of the system generation comprise hydro and thermal power plants and correspond to 1,455.9 MWh. The choice of plants for the build margin calculation is highlighted in yellow in the table below. The highlighted plants contribute to 19.25% of total expected generation. The actual generation of the plants that obtained the construction licence is not yet known. It must be pointed out that this build margin composition is for reference only and the exact composition of the build margin will be determined annually ex-post.

Definition of the build margin						
Power Plants	Dates commissioned	Fuel Source	Capacity	Generation (2005)	Percentage of generation mix	Cumulative Percentage of generation mix
			MW	GWh	%	%
			A	B	C	D
Gumri	1928	Hydro	5.28	16.1	0.21%	100.00%
Yeghegnazor	1931	Hydro	0.416	1.3	0.02%	99.79%
Ijevan	1931	Hydro	0.612	1.9	0.02%	99.77%
Megri	1936	Hydro	1.26	3.8	0.05%	99.75%
Martuni	1948	Hydro	0.448	1.4	0.02%	99.69%
Areni	1951	Hydro	0.704	2.2	0.03%	99.68%
Azatek	1951	Hydro	1.04	3.2	0.04%	99.65%
Ayrum	1957	Hydro	3.28	10.0	0.13%	99.61%
International Energy Corporation (former Sevan-Hrazdan Hydro Power Plant)						
Kanaker	1936	Hydro	96	89.6	1.19%	99.47%
Sevan	1949	Hydro	34	31.7	0.42%	98.29%
Hrazdan	1959	Hydro	79	73.8	0.98%	97.87%
Argel	1953	Hydro	211	197.0	2.61%	96.89%
Yerevan 3	1956	Hydro	5	4.7	0.06%	94.29%
Arzni	1956	Hydro	67	62.6	0.83%	94.23%
Yerevan 1	1961	Hydro	40	37.4	0.49%	93.40%
Yerevan Thermal Power Plant						
Section 1	1965	Natural gas	250	178.0	2.35%	92.91%
Section 2	1968	Natural gas	300	213.7	2.82%	90.55%
Hrazdan Thermal Power Plant						
Section 1	1969	Natural gas	300	388.0	5.13%	87.73%
Section 2	1974	Natural gas	810	1047.5	13.85%	82.60%
Vorotan Hydro Power Plant, including						
Tatev	1970	Hydro	157	403.3	5.33%	68.75%
Shamb	1977	Hydro	168	431.6	5.71%	63.42%
Spandaryan	1984	Hydro	75	192.7	2.55%	57.71%
Vanadzor Thermal Power Plant	1976	Natural gas	96	0.0	0.00%	55.16%
Armenia Nuclear Power Plant						
Unit 1	1980	Nuclear fuel	440	1358.2	17.96%	55.16%
Unit 2	1995	Nuclear fuel	440	1358.2	17.96%	37.21%
Gerger	1996	Hydro	1.26	3.8	0.05%	19.25%
Yerevan reservoir 1	1997	Hydro	0.75	2.3	0.03%	19.20%
Kotoyak canal	2000	Hydro	2.2	6.7	0.09%	19.17%
Yeghesis	2004	Hydro	6.4	19.6	0.26%	19.08%
Other Small Hydro Power Plants	2004	Hydro	27.35	83.6	1.10%	18.82%
New plants				**Expected generation**		
Talin	obtained licence	Hydro	5.14	28.4	0.38%	17.72%
Chichan	obtained licence	Hydro	0.6	0.4	0.01%	17.34%
Apres	obtained licence	Hydro	1.5	11.7	0.15%	17.34%
Hermon	obtained licence	Hydro	1.2	4.1	0.05%	17.18%
Getik-1	obtained licence	Hydro	6.5	21.1	0.28%	17.13%
Getik-2	obtained licence	Hydro	0.9	4.3	0.06%	16.85%
Aghstev-6	obtained licence	Hydro	6.52	16.8	0.22%	16.79%
Meghri	obtained licence	Hydro	2	11.5	0.15%	16.57%
Pambak	obtained licence	Hydro	21	79.2	1.05%	16.42%
Bovadzor	obtained licence	Hydro	0.38	1.8	0.02%	15.37%
Manushakadzor	obtained licence	Hydro	0.35	1.433	0.02%	15.35%
Kurtan-1	obtained licence	Hydro	0.67	2.9	0.04%	15.33%
Kurtan-2	obtained licence	Hydro	5.2	17	0.22%	15.29%
Ayri	obtained licence	Hydro	1.1	4.6	0.06%	15.06%
Argichi	obtained licence	Hydro	8.6	29.1	0.38%	15.00%
Rine	obtained licence	Hydro	0.09	0.8	0.01%	14.62%
Tatev	obtained licence	Hydro	2.35	13	0.17%	14.61%
Eghvard	obtained licence	Hydro	0.9	4	0.05%	14.44%
Spitak-1	obtained licence	Hydro	0.5	2.3	0.03%	14.38%
Chanachchi	obtained licence	Hydro	1.4	6.2	0.08%	14.35%
Jradzor	obtained licence	Hydro	4.84	17.3	0.23%	14.27%
Hoktember	obtained licence	Hydro	0.06	0.5	0.01%	14.04%
Ler Ex-1	obtained licence	Hydro	0.28	2.4	0.03%	14.03%
Ler Ex-2	obtained licence	Hydro	0.25	2.2	0.03%	14.00%
Ler Ex-3	obtained licence	Hydro	0.37	2.7	0.04%	13.97%
Ler Ex-4	obtained licence	Hydro	1.23	1.8	0.02%	13.94%
Ler Ex-5	obtained licence	Hydro	0.24	1.8	0.02%	13.91%
Ler Ex-6	obtained licence	Hydro	0.34	2.6	0.03%	13.89%
Vahagni	obtained licence	Hydro	1	8	0.11%	13.86%
Sandaghbyur	obtained licence	Hydro	0.66	2.4	0.03%	13.75%
Dzor-Dzor	obtained licence	Hydro	0.3	1.8	0.02%	13.72%
Elegis-1 (retrofit)	obtained licence	Hydro	3.16	5.3	0.07%	13.69%
Amasia	obtained licence	Hydro	0.9	1	0.01%	13.62%
Sisakan	obtained licence	Hydro	0.5	1.9	0.03%	13.61%
Eghvard-2	obtained licence	Hydro	9.31	18.2	0.24%	13.59%
Geghi-1	obtained licence	Hydro	4.09	15.4	0.20%	13.35%
Haghpat-1	obtained licence	Hydro	0.32	1.05	0.01%	13.14%
Haghpat-2	obtained licence	Hydro	1.9	8.09	0.11%	13.13%
Aygezard	obtained licence	Hydro	0.84	3.32	0.04%	13.02%
Saravan	obtained licence	Hydro	2.488	7.7	0.10%	12.98%
Aghstev-1	obtained licence	Hydro	3.6	14.4	0.19%	12.88%
Jermuk-2	obtained licence	Hydro	2.35	10.2	0.13%	12.69%

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

(Copy this table for each data and parameter)

Data / Parameter:	**CO2 operating margin emission factor of the grid**
Data unit:	kgCO2/kWh
Description:	The Co2 operating margin emission factor is calculated according to the simple adjusted operating margin methodology detailed in Section B.6.3. and B.6.4.
Source of data used:	• Public Service Regulatory Commission of Armenia, which published data on the total electricity generation of Armenian power plants and the type of fuels consumed in 2005. • Government of Armenia, which adopted the "Energy Sector Development Strategies in the Context of Economic Development in Armenia", August 2005 and which includes information on Armenian policies in the energy sector and fully describes the existing plants' operations (sub-units, commissioning dates, total electric capacity etc.) • World Bank, which published the paper "From Crisis to Stability in the Armenian Power Sector" February 2006 and which includes data on existing power plants. • Platts (a division of The McGraw-Hill Companies), which published the Utility Data Institute (UDI) database for year 2005. These data were used to calculate the heat rate of the power plants. The Platts database was acquired by the Carbon Consultant.
Value applied:	0.47347025 kgCO2/kWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	The justification for using the adjusted operating margin method is described in Section B.6.1. and relates to the availability on data on the Armenian electricity system. The actual steps of the calculation are detailed in Section B.6.3. and B.6.4.
Any comment:	-

Data / Parameter:	**Heat rate of each power plant**
Data unit:	MJ/MWh
Description:	The heat rate is the thermal efficiency of the thermal power plants supplying electricity to the Armenian grid
Source of data used:	- Platts (a division of The McGraw-Hill Companies), which published the Utility Data Institute (UDI) database for year 2005. These data were used to calculate the heat rate of the power plants. The Platts database was acquired by the Carbon Consultant. - Public Service Regulatory Commission of Armenia, which published data on the total electricity generation of Armenian power plants and the type of fuels consumed in 2005.
Value applied:	Hrazdan TPP: 11,161.9 MJ/MWh

	Yerevan TPP: 11,607.1 MJ/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	The heat rate was calculated using the UDI database data and a complex non-linear regression developed by ICF International Power Modelling Team using statistical data on US and European power plants. The inputs of the regression formula are the capacity of each unit of a plant, date of construction, type of fuel consumed, technology applied in the plant. The output of the regression is the heat rate of each power unit. The heat rate of the entire plant was calculated as the average of the heat rates of each unit comprising the plant.
Any comment:	-

Data / Parameter:	**CO2 emission coefficient of each fuel type**
Data unit:	tC/TJ
Description:	The CO2 emission coefficient of a fuel type is the carbon content of each fuel type, adjusted by the combustion efficiency factor (or oxidation factor) of 0.995
Source of data used:	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Workbook Vol 2. Table 1-2, page 1.6 (http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1wb1.pdf)
Value applied:	Natural gas (dry), adjusted: 15.22 Nuclear: 0 Hydro: 0
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data given by the IPCC is considered to be authoritative in this field.
Any comment:	-

Data / Parameter:	**Electricity generation of each power plant**
Data unit:	GWh
Description:	This data variable indicates the level of electricity of a certain power plant that is supplied to the national electricity grid.
Source of data used:	- Public Service Regulatory Commission of Armenia, which published data on the total electricity generation of Armenian power plants and the type of fuels consumed in 2005.
Value applied:	Please see table at page 21 and page 30 for the generation level data of the power plants included in the calculation of the operating margin
Justification of the choice of data or description of measurement methods and procedures actually applied :	These were the most accurate data available for 2005 generation levels of existing power plants supplying electricity to the Armenian grid. Data were collected and inputted in the calculation table of the adjusted operating margin.
Any comment:	-

Data / Parameter:	**Identification of power plants for the OM**
Data unit:	Name of plant

Description:	The methodology ACM0002 allows the calculation of operating margin according to four methodologies. The adjusted simple operating margin was chosen for this CDM project.
Source of data used:	- Public Service Regulatory Commission of Armenia, which published data on the total electricity generation of Armenian power plants and the type of fuels consumed in 2005.
Value applied:	Yerevan, Hrazdan and Vonadzor thermal power plants
Justification of the choice of data or description of measurement methods and procedures actually applied :	The calculation of the adjusted operating margin implies the division of generation sources in low cost must run resources (hydro, geothermal, wind, low-cost biomass, nuclear and solar generation) and other resources. If the low-cost must-run resources are excluded, then only three thermal power plants can be included in the calculation of the adjusted operating margin
Any comment:	-

Data / Parameter:	**Fraction of time during which low-cost / must run sources are on the margin**
Data unit:	Hours
Description:	Amount of hours of the year when the low-cost must-run resources are on the margin.
Source of data used:	The Armenian Electricity Settlement Center has supplied the project proponent with the data necessary for plotting the Load Duration Curve and estimating the factor lambda for the year 2005 for the Armenian electricity grid.
Value applied:	940
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data variable was calculated as the crossing point of the load Duration Curve and the Low-Cost Must-Run Resources curve,a s shown in Section B.6.4.
Any comment:	-

Data / Parameter:	**Electricity imports to the project electricity system**
Data unit:	GWh
Description:	Amount of electricity currently imported from Iran and Artsach in the Armenian electric grid
Source of data used:	- Public Service Regulatory Commission of Armenia, which published data on the total electricity generation of Armenian power plants and the type of fuels consumed in 2005. - World Bank, which published the paper "From Crisis to Stability in the Armenian Power Sector" February 2006 and which includes data on existing power plants.
Value applied:	337.6
Justification of the choice of data or description of measurement methods and procedures actually	These were the most accurate data available for 2005 electricity imports into the Armenian grid. Data were collected and inputted in the calculation table of the adjusted operating margin.

applied :	
Any comment:	-

Data / Parameter:	**CO2 emission coefficient of fuels used in connected electricity systems (if imports occur)**
Data unit:	tCO2/MWh
Description:	Carbon content of the electricity imported in the Armenian grid
Source of data used:	Methodology ACM0002
Value applied:	Not applicable
Justification of the choice of data or description of measurement methods and procedures actually applied :	Since the imported electricity comes from other countries, the emission factor of all the imports was assumed to be 0 tons of CO2 per MWh (as prescribed on page 4 of the ACM0002 methodology).
Any comment:	-

B.6.3 Ex-ante calculation of emission reductions:

The current section discusses the derivation of baseline emission coefficient by developing the 'operating margin' and the 'build margin'. The various formulas applied will be developed from step-1 through step-5. The various variables and their sources are also indicated.

Step 1. Calculate the simple adjusted operating margin

a. Contribution to the total thermal power produced in the grid (%):

Percentage contribution = Generation in 2005 (GWh) including imports / Total thermal generation in 2005

Data Source: Public Service Regulatory Commission of Armenia -2005

b. Determine each plant's heat rate (specific to fuel used) (MJ/MWh)

Plant heat rate (MJ/ MWh) = 1.055 **X** Plant heat rate (BTU/ kWh)

Data Source: Plant heat rate (specific to fuel used) – Platts,Utility Data Institute (UDI) database 2005

c. Estimated carbon content (adjusted) of each of the fuel (tons of C/ TJ):

Carbon content (adjusted) of each fuel (tons of carbon/ TJ) = Carbon content of each fuel (tons of carbon / TJ) **X** Combustion efficiency of each power plant (%)

Data Source: Carbon content (unadjusted) & combustion efficiency: WB GHG Assessment Handbook

d. Emission factor of each power plant (specific to each fuel consumed) (kgC/MWh):

Emission factor of each power plant (specific to each fuel consumed) (kgC/ MWh)	=	Heat rate (MJ/ MWh)	**X**	Carbon content (adjusted) of each fuel (tons of Carbon/ TJ)	/ 10^(3)

e. <u>Emission factor converted into CO2equ (specific to each fuel consumed) (kg CO2/kWh):</u>

CO2equ emissions of each power plant (kgCO2/ kWh)	=	Emission factor of each power plant (specific to each fuel consumed) (kgC/ MWh	**X**	(44/12)	/ 10^(3)

f. <u>Weighted average emissions of each power plant (specific to each fuel consumed):</u>

Weighted CO2equ emissions of each plant for every kWh in the grid (kgCo2/every kWh in the grid)	=	CO2equ emissions of each power plant (kgCO2/kWh)	**X**	Percentage contribution to the grid in 2005 (%)

g. <u>Calculate the operating margin for 2005:</u>

Operating margin (kgCO2equ/kWh)	=	Sum of weighted CO2equ emissions of each plant for every kWh in the grid (kgCo2/every kWh in the grid)

h. <u>Calculate λ for 2005</u>

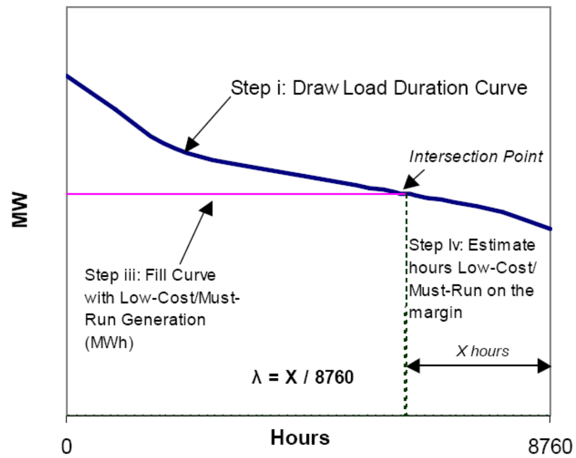
The factor λ is the number of hours per year for which low-cost/must run resources are on the margin over the total 8760 hours of the year. It is calculated following the following steps:

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

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

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

Step iv) Determine the "Number of hours per year for which low-cost/must-run sources are on the margin". First, locate the intersection of the horizontal line plotted in step (iii) and the load duration curve plotted in step (i). The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin. If the lines do not intersect, then one may conclude that low cost/must-run sources do not appear on the margin and λ is equal to zero. Lambda (λ) is the calculated number of hours divided by 8760.



i. Apply (1- λ) to the operating margin

Simple adjusted operating margin = (1- λ) X Operating margin

(kgCO2equ/kWh) (kgCo2equ/ kWh)

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

Build Margin = Sum of weighted CO2equ emissions of each plant for every kWh in the grid generated by the 20% newest plants

(kgCO2equ/kWh) (kgCO2equ/kWh)

Step 3: Calculate the baseline emission factor of the grid

Emission coefficient of the grid = Build Margin + Simple Adjusted Operating Margin / 2

(kgCO2equ/kWh) (kgCO2equ/kWh) (kgCO2equ/kWh)

NB. Alternative weights are not used for hydro power projects

Step 4: Calculate the baseline emissions of the project activity

Baseline emissions of the project = Estimated generation of the bundle * Emission coefficient of the grid /1000

(tCO2equ) over crediting period (kWh) (kgCO2equ/kWh)

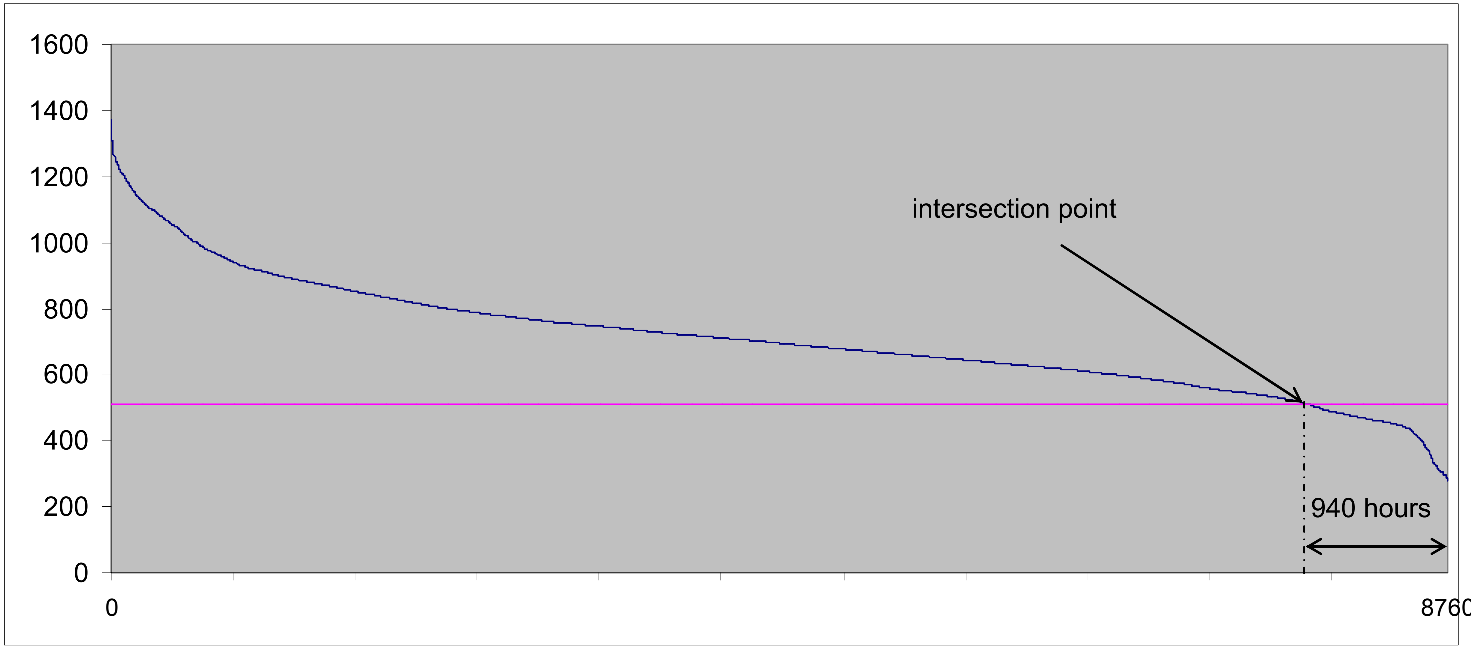
B.6.4 Summary of the ex-ante estimation of emission reductions:

Step 1. The table below calculates the relative energy contribution of each of the thermal plant connected to the grid, calculates the emission factor of each plant and develops the simple operating margin for 2005.

Approximate Operating margin for 2005

Sr. No.	Power Plants	Dates commissioned	Fuel Source	Capacity	Generation (2005)	Contribution to total energy mix	Thermal plants generation	Contribution to thermal energy mix	Heat rate	Heat rate	Carbon content (unadjusted)	Combustion efficiency factor	Carbon content (adjusted)	Emission factor	Emissioin factor	Weighted Average Emissions	Approximate Operating Margin
				MW	GWh	(%)	GWh	(%)	btu/kwh	MJ/MWh	tC/TJ	(%)	tC/TJ	kgC/MWh	kg CO2/kwh	kgCO2/ every kWh in the grid	kgCO2/ kWh
				A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	International Energy Corporation (former Sevan-Hrazdan Hydro Power Plant)		Hydro	556	519.2	7.80%			0.0	0.0	0	0	0	0	0	0	
	Sevan	1949	Hydro	96													
	Hrazdan	1959	Hydro	34													
	Argel	1953	Hydro	79													
	Arzni	1956	Hydro	211													
	Kanaker	1936	Hydro	5													
	Yerevan 1	1961	Hydro	67													
	Yerevan 3	1956	Hydro	40													
2	Yerevan Thermal Power Plant		Natural gas	550	391.7	5.89%	391.7	18.09%	11002.0	11607.1	15.30	0.995	15.22	176.70	0.648	0.1172	
	Section 1	1963-1965	Natural gas	250													
	Section 2	1966-1968	Natural gas	300													
3	Hrazdan Thermal Power Plant		Natural gas	1110	1435.5	21.57%	1435.5	66.31%	10580.0	11161.9	15.30	0.995	15.22	169.92	0.623	0.4132	
	Section 1	1966-1969	Natural gas	300													
	Section 2	1971-1974	Natural gas	810													
4	Vorotan Hydro Power Plant, including		Hydro	400	1027.6	15.44%											
	Spandaryan	1984	Hydro	157													
	Shamb	1977	Hydro	168													
	Tatev	1970	Hydro	75													
5	Armenia Nuclear Power Plant		Nuclear fuel	880	2716.3	40.82%											
	Unit 1	1980	Nuclear fuel	440													
	Unit 2	1995	Nuclear fuel	440													
6	Vanadzor Thermal Power Plant	1976	Natural gas	96	0.0	0.00%	0.0	0.00%	11439.0	12068.1	15.30	0.995	15.22	183.72	0.674	0.0000	
7	Small Hydro Power Plants	last 2004	Hydro	51	155.8	2.34%											
8	Imports from Iran and Artsach				337.6	5.07%	337.6	15.59%							0.000	0.0000	
9	Dzora Hydro Power Plant	1930	Hydro	25	70	1.05%											
				7140	6653.7		2164.8										0.5304
Sources:	From Crisis to Stability in the Armenian Power Sector, World Bank, February 2006	UDI database	Public Service Regulatory Commission : Armenia: Total4Q_2005.pdf	Energy Sector Development Strategies in the Context of Economic Development in Armenia	Main indicators of Electric Energy System in 2005: Maincharateristics4Q_2005	Calculation			Source: UDI database	calculated MJ/MWh = btu/kwh X 1.055	GHG Assessemnt Handbook: World Bank	GHG Assessemnt Handbook: World Bank	Calculated: H X I	Calculated: (G X J)/(10^3)	Calculated: K X (44/12)/(10^3)	Calculated: C X L	Calculated: Sum of all in M

Calculation of lambda			
Year	Unit	Description	Value
2005	X	Number of hours low cost/must run resources are on the margin	940
	λ	λ= X/8760	0.107305936
	1- λ		0.892694064



Step 3: The table below calculates the emission factor of each plant included in the build margin and develops the build margin

Power Plants	Dates commissioned	Fuel Source	Capacity	Generation	Contribution to total energy mix of the capacity additions	Emission factor	Weighted Average Emissions	Build Margin
			MW	GWh	(%)	kg CO2/kwh	kgCO2/ every kWh in the grid for the thermal plants	kgCO2/ kWh
Existing plants				**2005 generation**				
Gerger	1996	Hydro	1.26	3.8	0.26%	0	0	
Yerevan reservoir 1	1997	Hydro	0.75	2.3	0.16%	0	0	
Kotoyak canal	2000	Hydro	2.2	6.7	0.46%	0	0	
Yeghesis	2004	Hydro	6.4	19.6	1.34%	0	0	
Other Small Hydro Power Pla	2004	Hydro	27.35	83.6	5.74%	0	0	
New plants				**Expected generation**				
Talin	obtained licence	Hydro	5.14	28.4	1.95%	0	0	
Chichan	obtained licence	Hydro	0.6	0.4	0.03%	0	0	
Apres	obtained licence	Hydro	1.5	11.7	0.80%	0	0	
Hermon	obtained licence	Hydro	1.2	4.1	0.28%	0	0	
Getik-1	obtained licence	Hydro	6.5	21.1	1.45%	0	0	
Getik-2	obtained licence	Hydro	0.9	4.3	0.30%	0	0	
Aghstev-6	obtained licence	Hydro	6.52	16.8	1.15%	0	0	
Meghri	obtained licence	Hydro	2	11.5	0.79%	0	0	
Pambak	obtained licence	Hydro	21	79.2	5.44%	0	0	
Bovadzor	obtained licence	Hydro	0.38	1.8	0.12%	0	0	
Manushakadzor	obtained licence	Hydro	0.35	1.433	0.10%	0	0	
Kurtan-1	obtained licence	Hydro	0.67	2.9	0.20%	0	0	
Kurtan-2	obtained licence	Hydro	5.2	17	1.17%	0	0	
Ayri	obtained licence	Hydro	1.1	4.6	0.32%	0	0	
Argichi	obtained licence	Hydro	8.6	29.1	2.00%	0	0	
Rine	obtained licence	Hydro	0.09	0.8	0.05%	0	0	
Tatev	obtained licence	Hydro	2.35	13	0.89%	0	0	
Eghvard	obtained licence	Hydro	0.9	4	0.27%	0	0	
Spitak-1	obtained licence	Hydro	0.5	2.3	0.16%	0	0	
Chanachchi	obtained licence	Hydro	1.4	6.2	0.43%	0	0	
Jradzor	obtained licence	Hydro	4.84	17.3	1.19%	0	0	
Hoktember	obtained licence	Hydro	0.06	0.5	0.03%	0	0	
Ler Ex-1	obtained licence	Hydro	0.28	2.4	0.16%	0	0	
Ler Ex-2	obtained licence	Hydro	0.25	2.2	0.15%	0	0	
Ler Ex-3	obtained licence	Hydro	0.37	2.7	0.19%	0	0	
Ler Ex-4	obtained licence	Hydro	1.23	1.8	0.12%	0	0	
Ler Ex-5	obtained licence	Hydro	0.24	1.8	0.12%	0	0	
Ler Ex-6	obtained licence	Hydro	0.34	2.6	0.18%	0	0	
Vahagni	obtained licence	Hydro	1	8	0.55%	0	0	
Sandaghbyur	obtained licence	Hydro	0.66	2.4	0.16%	0	0	
Dzor-Dzor	obtained licence	Hydro	0.3	1.8	0.12%	0	0	
Elegis-1 (retrofit)	obtained licence	Hydro	3.16	5.3	0.36%	0	0	
Amasia	obtained licence	Hydro	0.9	1	0.07%	0	0	
Sisakan	obtained licence	Hydro	0.5	1.9	0.13%	0	0	
Eghvard-2	obtained licence	Hydro	9.31	18.2	1.25%	0	0	
Geghi-1	obtained licence	Hydro	4.09	15.4	1.06%	0	0	
Haghpat-1	obtained licence	Hydro	0.32	1.05	0.07%	0	0	
Haghpat-2	obtained licence	Hydro	1.9	8.09	0.56%	0	0	
Aygezard	obtained licence	Hydro	0.84	3.32	0.23%	0	0	
Saravan	obtained licence	Hydro	2.488	7.7	0.53%	0	0	
Aghstev-1	obtained licence	Hydro	3.6	14.4	0.99%	0	0	
Jermuk-2	obtained licence	Hydro	2.35	10.2	0.70%	0	0	
Gevorgavan	obtained licence	Hydro	0.06	0.32	0.02%	0	0	
Pambak-1	obtained licence	Hydro	1.91	13.9	0.95%	0	0	
Tej	obtained licence	Hydro	2.26	7.01	0.48%	0	0	
Ajgedzor-2	obtained licence	Hydro	2	6	0.41%	0	0	
Hnevank-1	obtained licence	Hydro	0.967	5.75	0.39%	0	0	
Hnevank-2	obtained licence	Hydro	0.5	2.7	0.19%	0	0	
Hrazdan unit-5	obtained licence	Natural gas	215	717.75	49.30%	0.623	0.307127455	
Yerevan TPP New unit	obtained licence	Natural gas	400	195.85	13.45%	0.648	0.087167778	
			766.585	1455.9				**0.3942952**
From Crisis to Stability in the Armenian Power Sector, World Bank, February 2006	UDI database	Public Service Regulatory Commission: Armenia: Total4Q_2005.pdf	Energy Sector Development Strategies in the Context of Economic Development in Armenia	Main indicators of Electric Energy System in 2005: Maincharateristics4Q_2005 and information supplied by PRSC and referenced in the PDD of "Jradzor" Small Hydro Electric CDM Project, published on UNFCCC website	Calculated: each plants generation divided for the total generation of the five plants	Calculated in the operating margin table	Calculated: contribution to total energy mix times the emission factor	Calculated: sum of weighted avarge emissions

Step 4: The table below calculates the emission factor of the grid

Final results				
Year	Operating Margin of resources excluding low cost must run	Operating Margin of resources excluding low cost must run adjusted with (1-λ)	Build Margin	Emission coefficient for the grid
	kgCO2/ kWh	kgCO2/ kWh	kgCO2/ kWh	kgCO2/ kWh
2005	0.530383554	0.47347025	0.394295233	
Average of operating margin and build margin				0.4339

Step 5: The table below calculates the baseline. Plants included in the CDM bundle have different start dates in the years 2008 and 2009. In order to estimate the expected total level of electricity generation by the bundle in each year of the crediting period, it was decided to calculate the expected pro rata generation of each plant, given the exact start date of each plant. The pro-rata calculations are shown in the table below. It must be noted that these calculations are done for the purposes of the PDD only. The exact value of baseline emissions for this CDM project will be determined after monitoring of effective generation takes place ex-post.

Plant name	Expected Annual Generation MWh	Starting Date	Pro rata Generation January 2008-December 2008	Pro rata Generation January 2009-December 2009

Ler-Ex cascade (1, 3, 4, 5, 6)	10850	Apr-06	10850	10850
Aygezard	6418	Jun-06	6418	6418
Chanaghci-2	6400	Feb-07	6400	6400
Apres	10381	Sep-07	10381	10381
Bovadzor	2300	Sep-07	2300	2300
Lernapat	3810	Nov-07	3810	3810
Ayri	4500	Jan-08	4500.0	4500
Aygedzor-2	3500	Nov-08	583.3	3500
Agstev-1	14400	Mar-09		12000
Vahagni	6900	Jul-09		2875
Total	**69,459.00**		**45,242**	**63,034**

The following table shows the calculated annual baseline of the project.

Years	Annual Generation in MWh	Annual Baseline in tCO_2e
Year 1) Jan 2008- Dec 2008	45,242	19,630
Year 2) Jan 2009- Dec. 2009	63,034	27,349
Year 3) Jan. 2010- Dec. 2010	69,459	30,137
Year 4) Jan. 2011- Dec. 2011	69,459	30,137
Year 5) Jan. 2012- Dec. 2012	69,459	30,137
Year 6) Jan. 2013- Dec. 2013	69,459	30,137
Year 7) Jan. 2014- Dec. 2014	69,459	30,137
Year 8) Jan. 2015- Dec. 2015	69,459	30,137
Year 9) Jan. 2016- Dec. 2016	69,459	30,137
Year 10) Jan. 2017- Dec. 2017	69,459	30,137
Total	**594,489**	**257,939**

Final table

Years	Estimation of Project Emissions in tCO_2e	Estimation of Baseline Emissions in tCO2e	Estimation of leakage in tCO2e	Estimation of overall Emissions Reductions in tCO_2e
Year 1) Jan 2008- Dec 2008	0	19,630	0	19,630
Year 2) Jan 2009- Dec. 2009	0	27,349	0	27,349
Year 3) Jan. 2010- Dec. 2010	0	30,137	0	30,137
Year 4) Jan. 2011- Dec. 2011	0	30,137	0	30,137
Year 5) Jan. 2012- Dec. 2012	0	30,137	0	30,137
Year 6) Jan. 2013- Dec. 2013	0	30,137	0	30,137
Year 7) Jan. 2014- Dec. 2014	0	30,137	0	30,137
Year 8) Jan. 2015- Dec. 2015	0	30,137	0	30,137
Year 9) Jan. 2016- Dec. 2016	0	30,137	0	30,137
Year 10) Jan. 2017- Dec. 2017	0	30,137	0	30,137
Total baseline (tCO_2e)	**0**	**257,939**	**0**	**257,939**

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)	
Data / Parameter:	**Electricity supplied to the grid by each project of the bundle**
Data unit:	MWh
Description:	Electricity supplied to the grid by the ten mini hydro power plants included in the bundled project
Source of data to be used:	Electricity meters located at each power plant site will measure the electricity inputted un the Armenian grid by each plant.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The expected electricity generation of each mini hydro plant is detailed in the table in Section A.2.
Description of measurement methods and procedures to be applied:	The project proponents will build the switchyard close to the generation facilities that contain the meter for recording of electricity sold to the ElNetArm. The meter will be inspected, tested, verified and then sealed by the network operator. The owners of the ten mini hydro power plants will prepare the invoice to ElNetArm for electricity sold based on metering readings. The network operator has the right to access the meter at any time. The metering of generated electricity in Armenia occurs through an automatic electronic system called ASKOE held and managed by the Public Service Regulatory Commission of Armenia. The electronic system calculates the amount of generated electricity by each plant each 30 minutes. The generated amounts are then recorded at the end of each month.
QA/QC procedures to be applied:	A qualified company employee will be responsible (and, if necessary, trained) to meter and log the electricity data. Each project developer collects generation data from their meter as registered by the automatic system ASKOE. Each project developer will supply Cascade Credit with monthly generation data relative to their hydro power plant. Cascade Credit will collect the generation data supplied by all ten project developers and managers of the hydro power plants and will consolidate the data. Cascade Credit will also double check the data supplied by power plant managers each month with the data supplied by the Public Service Commission of Armenia (PSRC). The PSRC publishes monthly electricity generation data of all major Armenian power plants on its website. The PSRC can also supply upon request monthly generation data of the small hydro plants operating in Armenia. All management measures will be taken to ensure the attention to detail and transparency of this process. Neither the buyer of power (ElNetArm) nor the sellers of power (owners of the small hydropower plants) have the right to access or disrupt the functioning of the meter and the automatic monitoring system.
Any comment:	-

Data / Parameter:	**Identification of power source plant for the BM**
Data unit:	Name of plant
Description:	The build margin includes either the newest five power plants or newest power plants that have been built more recently and contributed to 20% of electricity generation of a certain year, whichever definition includes the largest generation.
Source of data used:	• Public Service Regulatory Commission of Armenia, which published data on the total electricity generation of Armenian power plants and the type of fuels consumed in 2005. • Public Service Regulatory Commission of Armenia, which supplied data on names, power capacity and expected electricity generation of power plants that already obtained a construction licence. • World Bank, which published the paper "From Crisis to Stability in the Armenian Power Sector" February 2006 and which includes data on existing power plants. • Platts (a division of The McGraw-Hill Companies), which published the Utility Data Institute (UDI) database for year 2005. These data were used to calculate the heat rate of the power plants. The Platts database was acquired by the Carbon Consultant.
Value applied:	The names of the plants currently included in the build margin are detailed in Section B.6.1. The names of plants to be included in the build margin will be determined annually ex post
Justification of the choice of data or description of measurement methods and procedures actually applied :	The names of plants to be included in the build margin will be determined annually ex post. The plants included in the build margin at the time of PDD submission reflect the better data available on future capacity additions.
Any comment:	

Data / Parameter:	**CO2 build margin emission factor of the grid**
Data unit:	kgCO2/kWh
Description:	Calculated as the weighted emission factor of all the power plants included in the build margin
Source of data used:	• Public Service Regulatory Commission of Armenia, which published data on the total electricity generation of Armenian power plants and the type of fuels consumed in 2005. • Public Service Regulatory Commission of Armenia, which supplied data on names, power capacity and expected electricity generation of power plants that already obtained a construction licence. • World Bank, which published the paper "From Crisis to Stability in the Armenian Power Sector" February 2006 and which includes data on existing power plants. • Platts (a division of The McGraw-Hill Companies), which published the Utility Data Institute (UDI) database for year 2005. These data were used to calculate the heat rate of the power plants. The Platts database was acquired

	by the Carbon Consultant.
Value applied:	0.394295233
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of the build margin carbon emission factor will be determined annually ex post. The plants included in the build margin at the time of PDD submission reflect the better data available on future capacity additions.
Any comment:	-

Data / Parameter:	**CO2 emission factor of the grid**
Data unit:	kgCO2/kWh
Description:	Calculated as the average of the Operating Margin emission factor and the Build Margin emission factor
Source of data used:	• Public Service Regulatory Commission of Armenia, which published data on the total electricity generation of Armenian power plants and the type of fuels consumed in 2005. • Public Service Regulatory Commission of Armenia, which supplied data on names, power capacity and expected electricity generation of power plants that already obtained a construction licence. • Government of Armenia, which adopted the "Energy Sector Development Strategies in the Context of Economic Development in Armenia", August 2005 and which includes information on Armenian policies in the energy sector and fully describes the existing plants' operations (sub-units, commissioning dates, total electric capacity etc.) • World Bank, which published the paper "From Crisis to Stability in the Armenian Power Sector" February 2006 and which includes data on existing power plants. • Platts (a division of The McGraw-Hill Companies), which published the Utility Data Institute (UDI) database for year 2005. These data were used to calculate the heat rate of the power plants. The Platts database was acquired by the Carbon Consultant.
Value applied:	0.433882742
Justification of the choice of data or description of measurement methods and procedures actually applied :	The detailed calculations of the emission factor of the electricity grid are attached in an Excel spreadsheet and can be examined by the Designated Operational Entity.
Any comment:	-

B.7.2 Description of the monitoring plan:

The monitoring methodology for Type 1.D. projects of the simplified methodologies for baseline determination and monitoring plans is applied to this project, because this project complies with the relative eligibility requirements: it is a small scale project and it generates renewable energy.

According to paragraph 13 of the According to the latest version of the methodology "AMS-I.D./Version 11, Scope 1, EB31", "Monitoring shall consist of metering the electricity generated by the renewable technology." The monitoring procedure of metered electricity is described in detail in the first box in Section B.7.1.

The monitoring plan contains simplified monitoring requirements to reduce monitoring costs as permitted by small-scale project procedures. Once implemented, the relevant data report will be submitted to a designated operational entity contracted to verify the emission reductions achieved during the crediting period. Any revisions requiring improved accuracy and/or completeness of information will be justified and will be submitted to a designated operational entity for validation. This bundled project will request to be registered with an overall monitoring plan and the verification and certification of the emission reductions achieved will cover all of the ten bundled mini hydro power plants.

The monitoring plan is designed to collect and archive all data needed to:

- Estimate or measure anthropogenic emissions by sources of GHG occurring within the project boundary during the crediting period as specified in appendix B for the Type/Categories I.D.
- Determine the baseline of anthropogenic emissions by sources of GHG occurring within the project boundary during the crediting period, as specified in appendix B for the Type/Category I.D.
- Calculate the reductions of anthropogenic emissions by sources by the proposed small-scale CDM project activity, and for leakage effects, in accordance with provisions of appendix B for the Type/Category I.D.

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1	Net generation by Aygedzor-2	$EG_{Aygedzor-2}$	kWh	Measured	Monthly	All	Electronic plus paper (invoices)	During the whole crediting period +2 years	Direct monitoring via meters, and control step via invoicing to the distribution company. Used for baseline calculation.
2	Net generation by Ayri	EG_{Ayri}	kWh	Measured	Monthly	All	Electronic plus paper (invoices)	During the whole crediting period +2 years	Direct monitoring via meters, and control step via invoicing to the distribution company. Used for baseline calculation.
3	Net generation by Aygezard	$EG_{Aygezard}$	kWh	Measured	Monthly	All	Electronic plus paper (invoices)	During the whole crediting period +2 years	Direct monitoring via meters, and control step via invoicing to the distribution company. Used for baseline calculation.
4	Net generation by Agstev 1	$EG_{Agstev\ 1}$	kWh	Measured	Monthly	All	Electronic plus paper (invoices)	During the whole crediting period +2 years	Direct monitoring via meters, and control step via invoicing to the distribution company. Used for baseline calculation.
5	Net generation by Lernapat	$EG_{lernapat}$	kWh	Measured	Monthly	All	Electronic plus paper (invoices)	During the whole crediting period +2 years	Direct monitoring via meters, and control step via invoicing to the distribution company. Used for baseline calculation.
6	Net generation by Vahagni	$EG_{Vahagni}$	kWh	Measured	Monthly	All	Electronic plus paper (invoices)	During the whole crediting period +2 years	Direct monitoring via meters, and control step via invoicing to the distribution company. Used for baseline calculation.
7	Net generation by Chanaghci 2	$EG_{Chanaghci\ 2}$	kWh	Measured	Monthly	All	Electronic plus paper (invoices)	During the whole crediting period +2 years	Direct monitoring via meters, and control step via invoicing to the distribution company. Used for baseline calculation.
8	Net generation	$EG_{Ler-Ex\ cascade}$	kWh	Measured	Monthly	All	Electronic	During the whole crediting period +2	Direct monitoring via meters, and control step via invoicing to the

	by Ler-Ex cascade (1, 3, 4, 5, 6)						plus paper (invoices)	years	distribution company. Used for baseline calculation.
9	Net generation by Bovadzor	$EG_{Bovazor}$	kWh	Measured	Monthly	All	Electronic plus paper (invoices)	During the whole crediting period +2 years	Direct monitoring via meters, and control step via invoicing to the distribution company. Used for baseline calculation.
10	Net generation by Apres	EG_{Apres}	kWh	Measured	Monthly	All	Electronic plus paper (invoices)	During the whole crediting period +2 years	Direct monitoring via meters, and control step via invoicing to the distribution company. Used for baseline calculation.
11	Total CDM activity generation	EG_{total}	kWh	Calculated	Monthly	All	Electronic	During the whole crediting period +2 years	Sum of figures obtained in D.3.1 to D.3.9

Existing management structures at the ten mini hydro power plants will ensure QC and QA of the collected data. The Managing Directors of each of the ten mini hydro plants take the responsibility for ensuring the full implementation of the monitoring methodology outlined in the PDD for their respective power plant.

Name of power plant	Name of company	Name of director	Responsible for monitoring of ID
Aygedzor-2	**ATLAS-Energo LLC**	Director and owner - Armen Mejlumyan	1
Ayri	**Zorakar CJSC**	Director and owner – Hakob Hakobyan	2
Aygezard	**Bitlis-Men**	Director and owner – Samvel Minasyan	3
Agstev-1	**Elenex LLC**	Director and owner – Gevorg Paytyan	4
Lernapat	**Lernapati Kantegh LLC**	Director and owner – Zhirayr Ghazaryan	5
Vahagni	**Apahov Taniq LLC**	Director and owner – Mikael Aramyan	6
Chanaghci-2	**Mavr LLC**	Director – Rafik Antonyan	7
Ler-Ex cascade (1, 3, 4, 5, 6)	**Ler-Ex LLC**	Director and owner – Hamlet Aloyan	8
Bovadzor	**Hosq LLC**	Director and owner – Hovik Paravyan	9
Apres	**Syunik LLC**	Director and owner – Kochar Davtya	10
Consolidation	**Cascade Credit LLC**	Executive Director – Garegin Gevorgyan	11

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

Date of completing the final draft of the baseline and monitoring methodology:
The final draft of the baseline for the proposed CDM activity was completed in June 2007.

Name of person/entity determining the baseline and monitoring methodology:
Ms. Natalia Gorina
ICF International (Carbon Advisor)
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E-mail: ngorina@icfi.com

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

Starting date: 1 April 2006. This is the expected date when the earliest power plant included in the bundle is commissioned and begins to generate electricity.

C.1.2. Expected operational lifetime of the small-scale project activity:

The operational lifetime of the mini hydro plants is at least 15 to 20 years.

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

Fixed crediting period

C.2.1. Renewable crediting period:

Not applicable

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

10 years

C.2.2.1. Starting date:

The starting date of the crediting period is the expected date of registration of the project by the CDM Executive Board. Chosen starting date of the crediting period is 1 January 2008.

C.2.2.2. Length:

10 years

SECTION F.: Environmental impacts:

F.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

As required by the Ministry of Environmental Protection of the Republic of Armenia, construction energy projects need to obtain an Environmental Impact Assessment in addition to construction and water permits.

A number of impacts on the environment can be expected from hydro power generation in particular in the case of dam-type hydropower projects. These impacts include the following:

- Soil erosion during construction works;
- Inundation of areas in front of the dam structure resulting in the destruction of homes and wildlife habitat;
- Interference with fish migration patterns;
- Disruption of local vegetation during construction works of the dam and the power plant;
- Alteration of the stream flow impacting water quality, sedimentation, wildlife and fisheries and limiting water use and availability;
- Changes of river temperatures by releasing colder water from the reservoir bottom (thermal stratification in the reservoir), which changes downstream river habitat;
- Interference with the movement of sediments and deposition along riverbanks;
- Changes in downstream groundwater levels affecting water availability and quality, vegetation and land use;
- Downstream or upstream flood events resulting from the storage of water;
- Eutrophication due to the accumulation of reservoir nutrients leading to impacts such as the proliferation of algae and aquatic plants, the reduction of the water quality and the spread of diseases;
- Emissions of greenhouse gases linked to the decaying vegetation in the reservoir submerged by flooding;
- Development of new forms of bacteria posing health hazards such as the increase of mercury concentration in the water.

Many of these impacts are strongly related to the construction of a dam and to the resulting water storage. The scale of the impacts depends strongly on the size of the installation. Given the small size of the hydro projects included in this CDM project activity, major impacts are not expected on the surrounding environment. Given the remote location of the hydro plants, no displacement of local inhabitants will be required. All projects are required to carry out a reforestation program after construction works. Fish passes are obligatory for every run-of-river hydro plants and will be installed.

Cascade Credit and the project developers are aware of these potential impacts listed above and will undertake all the necessary steps to minimize them. These steps will include, among others, cutting down of the vegetation in the areas subject to inundation (to avoid its decomposition and relative methane emissions), enforcement of road structures to avoid soil erosion near the rivers etc.

All the projects included in the bundle obtained an environmental permit. In some cases the Ministry of Environmental Protection approved the projects with comments. For example:

The Ministry of Environmental Protection has approved the Aygezard project on 09.08.2005 according to expert's statement. The design solutions of Aygezard hydro plant, the impact of the planned construction works and operation on the environment and social-economic consequences were studied and evaluated in accordance with the legislative requirements. No negative environmental impacts were identified. The only issues identified were:

- The canal construction is old and there is a danger of collapse of the canal walls. Accordingly "Bitlis-MEN" LLC already plans to repair the canal preventively.
- A water leak was detected near the water pool foundation. "Bitlis-MEN" LLC will repair the leak appropriately.

In addition, after the completion of construction works the Company will plant trees in the area surrounding the Aygezard SHPS.

An environmental study was prepared for Bovadzor mini hydro plant by "ERA LLC", dated 16.02.2005. The Ministry of Environmental Protection approved the report on 16.02.2005 according to protocol No: 03. The environmental report claims that the project will not have any adverse impact on the environment. There is no necessity to cut trees to realize the project. The project developer "Hosк" Ltd is thus in compliance with all formal requirements regarding environmental regulation.

An Environmental Questionnaire to be supplied by EBRD will be completed by Cascade Credit on all the mini hydro projects included in this CDM project activity. The responses to the questionnaire will be sent to the DOE in a timely manner. EBRD and World Bank have agreed with Cascade Credit an Environmental Management Plan which includes recommended procedures for project appraisal, design measures, construction supervision methods, monitoring actions and public disclosure requirements which will help to minimize and avoid potential short and long-tern environmental impacts associated with any sub-projects. Cascade Credit will therefore also draw on international good practice referencing, where appropriate, relevant World Bank guidelines, European guidance and EBRD criteria developed specifically for small-hydro projects.

SECTION G. Stakeholders' comments:

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

The following local stakeholders were identified for this CDM project:

- Land owners of the project sites
- Nearby villagers to the project sites

According to the legal requirements in Armenia, before any construction project can take place, the so-called "community elderly committees" must be contacted and informed. These committees reunite the oldest representatives of a community, village or town and are generally unanimously respected and listened to by the local inhabitants. According to current regulations, if a project does not receive approval from the "community elderly committee", then the project may not receive the construction licence and proceed to construction phase. All the projects included in the CDM bundle, received approval from the respective "community elderly committees".

The municipalities have been involved from the earliest stage, as land is leased for the construction of mini hydro plants. The contacts with the relevant municipalities were positive, as the projects increase local funding. The projects pay for the lease of the land, for tax on land, and will pay property tax over the equipment installed.

- Ministry of Nature Protection

The Ministry of Nature Protection is also informed about each of the hydro projects included in the bundle, and the projects have received environmental permits.

- Ministry of Energy

The Ministry of Energy is also informed about the project, and small scale hydro projects are in line with the policies of the ministry.

- Grid operator

The grid operator is informed about each of the projects included in the bundle and each project received permission to connect to the Armenian grid. No negative comments are expected, as small scale projects increase the security of supply.

- Armenian general public and environmental NGOs

The latest version of this PDD will be posted on the Cascade Credit website to inform the general public in Armenia. (http://www.cascadecapitalholdings.com/credit/about_us.cfm?language=2&section=123)

The PDD will also be sent out to several short-listed environmental NGOs to seek their comment.

G.2. Summary of the comments received:

To the moment no comments have been received, apart from minor comments by the Ministry of Environmental Protection that have been described in section G1.

Any responses to the website announcements and letters that may yet come in will be made available to the validator.

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

In the stakeholder consultation that is being performed specifically for the CDM, there are not yet any comments requiring any specific action.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Represented by:	
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Salutation:	Ph.D
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

23 May 2006

Green energy gets a boost in Armenia

EBRD lends $7 million for renewables projects

The European Bank for Reconstruction and Development (the Bank) will lend up to $7 million to Cascade Credit, a universal credit organisation registered in Armenia, for investments in small mini-hydro power generation projects and other competitive renewable energy projects.

The EBRD funds will be combined with $5 million from the World Bank and a $3 million equity investment from Cascade Credit's owner, the Cafesjian Family Foundation. The Foundation was founded by Gerard Cafesjian, an American entrepreneur of Armenian descent, to promote the well-being of Armenians and to foster economic development in Armenia. The $15 million total will be used to capitalise a programme to provide long-term debt financing to developers of renewable energy projects-- primarily mini-hydro generation, but potentially wind and biomass as well. The project will also benefit from $3 million in grant funding from the Global Environment Facility for technical assistance.

The project reflects two of the Bank's main priorities: commitment to renewable energy resources and investment in "Early Transition Countries" (ETC) – the Bank's least economically developed countries of operation. The Bank will continue to support creditworthy renewable energy and energy efficiency projects in Armenia and other ETC countries, EBRD President Jean Lemierre said at the signing. The Early Transition Countries initiative was launched in 2004 to stimulate market activity in the Bank's poorest countries of operations by using a streamlined approach to financing more and smaller projects.

Additional renewable energy supply should reduce Armenian dependence on imported fuel used for power generation, thereby increasing the country's energy security. The project will also offer Armenian developers the opportunity to benefit from the international emissions trading market. "We are delighted to cooperate with the EBRD on bringing more alternative energy supplies to Armenia," said Garegin Gevorgyan, Executive Director of Cascade Credit.

The EBRD aims to promote environmentally sound and sustainable development in the full range of its activities. One of the Bank's objectives is to improve environmental performance of the power sector, including supporting actions to address the climate change issue. The Bank's active pursuit of renewable energy projects such as Armenia's is part of this broader objective.

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Source: http://www.ebrd.com/new/pressrel/2006/63may23.htm

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

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