JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
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Annexes

SECTION A. General description of the project

A.1. Title of the project:

Hidroelectrica Hydropower Development Portfolio Track 1 JI Project

A.2. Description of the project:

The **Hidroelectrica Hydropower Development Portfolio Track 1 JI Project** aims at developing nine new hydropower plants, which will be located in different hydrographic basins in Romania (see Section A.4.1 below). The project will start in 2009 with the construction of the first plants and will be completed by 2011. Eventually, upon project completion, 278.4 MW hydropower capacity will have been installed, which will increase electricity generation by **1532.35 GWh** during the project's crediting lifetime.

For this project, the baseline for determining the CO_2 emissions that would have occurred in the absence of the project, will be determined annually on an *ex post* basis, thereby using verified data for grid-connected Romanian power production installations under the EU Emissions Trading Scheme (ETS). The advantage of this methodology is that the baseline will be based on verified data, instead of a counterfactual, hypothetical scenario as in the case of *ex ante* baseline determination. However, for the purpose of completing the project preparation steps (*i.e*. obtaining a letter of approval from the Parties involved in this project and the completion of an emission reduction procurement agreement or ERPA) the baseline emission factor has been estimated at **860** gCO_2/kWh (see for further explanations, Section B.1 and B.2).

Using the baseline emission factor of 860 gCO_2/kWh and given that the project will have zero CO_2 emissions, the project will reduce the emissions of **1,317,821** tonnes CO_2. These CO_2 emissions would otherwise have occurred because the power generated by this project would have been produced by thermal power plants based on fossil fuels. The calculation of the expected emission reductions is conservative as it is based on a baseline emission factor at the lower end (see Section B.1-2) and an electricity production estimate that assumes lower than average water availability and a staged, slower than usual reaching of full load operations after starting the new units. In case the project generates more electricity and/or the actual *ex post* EU ETS based baseline emission values would be higher, the Romanian State would benefit by having a larger surplus within its Kyoto Protocol assigned amount.

The project will be carried out under the Romanian Track I Procedures (based on the Ministerial order No. 297 dated 21 March 2008, Ministry for Environment and Sustainable Development).

When expressing the capacity and output addition of this hydropower project as a percentage of the overall electricity generation capacity and output in Romania in the year 2007, it can be concluded that the project will have a share in the total hydro-based electricity supplied to the Romanian power grid of 5.18% by 2012 (278.4 MW capacity increase). In terms of annual output (compared to total electricity output in Romania in 2007), the project would, at full scale, have a share of 1.34 %. The project is expected to use 3.1% of the overall additional hydropower output potential in Romania (estimated at 9 GW, see Section B.2).

Country context

Romania has been a Party to the UNFCCC since 1994 and it ratified the Kyoto Protocol in 2001. Under the Kyoto Protocol, Romania has a commitment to reduce its GHG emissions by 8% below its 1989 level during the period 2008-2012. According to Romania's National Communication to the UNFCCC of 2006, the country's GHG emissions in 2004 were approximately 33% below the Kyoto Protocol target. This is mainly due to the rapid decrease of GHG emissions during the first half of the 1990s when Romania entered a phase of transition to a market-based economic system. In 2007, total electricity output was 61,397 GWh, of which 26,711 GWh was produced in coal and oil-based fossil fuel-fired power plants, 11,054 GWh in natural gas power plants and liquid fuel installations (*e.g.* petroleum), 7,709 GWh through nuclear power plants, and 15,916 GWh in hydropower plants (of which 15,807 GWh took place in plants managed by Hidroelectrica SA).[1] Table A.2.1 below shows the share of these energy technologies in Romania's electricity production for the years 2004-2007.

Table A.2.1 - Shares in Romania's grid-connected electricity production of power production technologies (%)

	2004	2005	2006	2007
Coal	37.55	35.80	39.57	41.69
Hydropower	31.61	37.10	32.02	25.80
Natural gas	16.01	14.07	16.69	17.42
Nuclear energy	10.07	9.57	9.20	13.10
Crude oil & petroleum	3.26	2.68	1.83	1.11
Conventional fuels	1.50	0.75	0.68	0.89

Source: ANRE Annual report *Date Statistice Aferente Energiei Electrice*, 2004-2007

From the table it becomes clear that during the period 2004-2007 the variation in hydropower (largely weather-related) was mainly covered by adjustments in the production of coal and natural gas-based electricity. This fossil fuel-based production capacity has therefore been functioning at the margin of increasing production when hydropower output was lower and of reducing production when hydropower output was higher. A different picture could be seen in 2007 when almost half of the relatively low hydropower output (due to weather circumstances) was covered by an increase in power production through nuclear energy. The latter was due to the commissioning of the second unit of the Cernavoda nuclear power plant during 2007 (official opening in October 2007), which has increased Romania's nuclear power capacity by 700 MW to 1400 MW. It is expected that the two Cernavoda units will produce approximately 20% of Romania's grid-based electricity as of 2008.

Currently, 70% of natural gas consumed in Romania is produced domestically, although it is expected that the natural gas sources in the country will be depleted by around 2030 (similar to Romania's oil reserves).[2] In order to meet future energy demand, Romania will have to increase its reliance on coal.[3] It is expected that Romania will have enough coal reserves for the next 40 years.[4]

Romania has been an active country in terms of JI collaboration. It signed 10 Memoranda of Understanding on JI co-operation with JI investor countries: Austria, Denmark, France, the Netherlands, Norway, Sweden, Switzerland, Italia, Finland, and World Bank. Presently, 15 JI projects have been

[1] Sources: Traian Oprea, Bedros Petru Naianu, and Razvan Cojoc, 2008. S.C Hidroelectrica S.A's Development Strategy - A Significant Contribution To Increasing The National Energy System, *Reference No: S1-38-En*; ANRE Annual report *Date Statistice Aferente Energiei Electrice* 2007.

[2] Report of a visit of NATO's Science and Technology Committee Sub-Committee on Energy and Environmental Security in Romania and Bulgaria on 12-15 May 2008; this information was presented at a meeting with Members of the Romanian Parliament.

[3] Ibid.

[4] Ibid.

approved and another 20 JI projects in Romania are in the pipeline at different stages of the project cycle for implementation.

Since 2007, Romania has been an EU Member State and as part of that installations[5] in the country that fall within the EU ETS categories and sectors have now joined the EU ETS (see also Section B.1).

The project will have a strong contribution to Romania's sustainable energy market development during the period towards at least the year 2020. Since its accession to the EU, Romania will have to comply with EU energy and climate policy standards (see for a recent example, the adoption in March 2007 of the EU Energy and Climate Package for the year 2020). One important element for Romania to comply with the Energy and Climate Package would be to increase the country's hydropower potential towards the target year 2020. This JI Track 1 project contributes to achieving that long-term target. In addition, an increase in hydropower capacity, as an indigenous energy source, also helps Romania to become less vulnerable for international energy market volatility.

Description of the project units

The following hydropower units are covered by this Track I project:

- Dumitra HPP
- Bumbesti HPP
- Nehoiasu II HPP
- Firiza I + II HPP
- Râul Alb HPP
- Plopi HPP
- Racovita HPP
- Rastolita HPP
- Robesti HPP

These HPP units, with the exception of Dumitra and Bumbesti HPPs, which were approved by a Governmental Decree in 2003, were all initially approved by the Government of Romania during the 1980s. However, for reasons explained in Section B.2 below, the actual development of the investment and construction works took place at a very slow speed if they were not just stopped. Only during the years 2000-2004, the investments were re-initiated and/or accelerated with the aim to complete investments before 2012 (instead of after 2012, as would have been the case under business-as-usual circumstances, see Section B.2) and, thus, to obtain the financial and implementation benefits of JI.

The **Dumitra and Bumbesti HPP** will be constructed at the same river Jiu within the Bumbesti – Livezeni region in the Gorj County. The main objective of the two units is to generate electricity for delivery to the Romanian central electricity grid (Sistemul Energetic National – SEN). According to a technical study carried out in 2002, the two units together have a potential of producing 275 GWh on average per year based on 65 MW installed capacity. The investment was approved by the Governmental Decision nr. 10/2003 and the works started in 2004. Thus far, 60% of the excavation and concrete covering of headraces has been performed. Under this JI project, the units are planned to be made operational in 2011; the technical operational lifetime will be 30 years.

[5] 'Installation' refers to the definition used by the EU Emissions Trading Scheme: "…any installation, which includes one or more pieces of stationary technical apparatus in which a combustion process takes place and that together on the same site and under the responsibility of the same operator has a rated thermal input exceeding $20MW_{th}$…" Consequently, one company or organisation could have more than one installation. For instance, Bucuresti-CET Progresu, Bucuresti Vest, Titan, Grozavesti, Bucuresti sud are all installations under the SC Electr.centrt.Bucuresti company.

Nehoiasu II HPP will be carried out as a hydropower project with basins in the Buzau County at the river Basca Mare. It is part of a programme which contains a number of stages to optimise the use of the hydropower capacity of the rivers Buzau, Basca Mare and Basca Mica in the Buzau County. Based on a technical study carried out in 2003, the programme will be carried out in three stages and the Nehoiasu II HPP project will be implemented in stage 1. The JI status of the Nehoiasu II unit will speed up the implementation of the plant towards the year 2012. The Nehoiasu II unit has the potential to deliver to the SEN grid 172.3 GWh/year on average based on 55 MW installed capacity. The investment programme for this HPP was approved by the Decree of the State Council nr. 294/1981. During the period 1981-1990, the Ciresu-Surduc stage was finalised and the construction of the Nehoiasu I HPP and the headrace began. Afterwards, up until 2005 the works were deferred, although they were never fully stopped. As of 2005, the construction work accelerated so that, at present, the HPP building has been finalised and 60% of the headrace has been completed. Under this JI project, the unit is planned to be made operational in 2012; the technical operational lifetime will be 30 years.

The **Firiza I + II HPPs** will be located as hydropower projects with basins in the north of Romania at the rivers Mara and Firiza in the Maramures County. Firiza I and Firiza II are built in a manner that they cannot operate independently. Therefore, they will be treated as a single unit within the portfolio for this JI Track 1 project. According to the Romanian categorization, the units fall within the category of micro-hydropower plants with 4.4 and 8.4 MW capacity respectively. The Firiza I + II units has the potential to deliver to the SEN grid 47.2 GWh per year on average based on 12.8 MW installed capacity. The investment was approved by the Governmental Decree nr. 95/1989, but before 1990 only organisational works were carried out at the construction site. The works continued very slowly between 1990 and 2005. At present, the headrace between Valea Neagră and Firiza I is almost finished and 40% of the headrace between Firiza I and Firiza II is completed. The HPP building work has not started yet. Under this JI project, the units are planned to be made operational in 2010; the technical operational lifetime will be 30 years.

The Râul Alb HPP will be located in the Caras-Severin County, in the southwest of Romania, in the Timis hydrographic basin. It is part of the Bistra-Poiana Mărului-Ruieni-Poiana Ruscă hydroelectric development programme. The HPP will be a hydropower station on diversion which uses water from the Poiana Rusca lake. The Râul Alb unit has the capacity to deliver to the SEN grid 60.6 GWh/year on average based on 40 MW installed capacity. The project was approved by the State Decree no 29/1981, but by 1990 the construction work had only just started, and the work continued very slowly, if at all, up until the early years of the present decade. Since 2000, the financing of the whole project, which includes the Poiana Rusca dam and the Raul Alb HPP, has been restarted. Until 2005, the most important work was done on finalising the dam but the works at the HPP itself were progressing slowly. After 2005, the construction work at HPP was accelerated which has led to a situation in which, at present, the construction activities (HPP building and headrace) are almost (98%) finished, whereas the purchase and installation of the turbine and automation equipment are about halfway. Under this JI project, the unit is planned to be made operational in 2009; the technical operational lifetime will be 30 years.

Plopi HPP is a run-of-river hydropower project located in the County of Hunedoara in the West of Romania on in the river Strei nearby Plopi. Plopi HPP is part of a larger programme of which one unit, Subcetate HPP, was put in operation in 2005. The Plopi HPP unit has the potential to deliver to the SEN grid 27.4 GWh/year on average based on 12 MW installed capacity. The investment was approved by Decree nr. 40/1989, but only documentation developing was done before 1990. The construction activities started in 2006 after finishing the previous stage of the programme, *i.e.*, Subcetate HPP. At present, 30% of HPP building and 80% of headrace have been finalized. Under this JI project, the unit is planned to be made operational in 2009; the technical operational lifetime will be 30 years.

Racovita HPP is located at the river Olt in the County of Sibiu in the center of Romania. It is part of a programme of five hydropower units, one of which (Cornetu HPP) is operational. The unit is aimed to deliver annually 74 GWh on average to SEN, based on a 31.5 MW capacity. The investment programme for this HPP was approved by Decree nr.24/1989 and Decree nr.28/1990. Between 1990 and 2004, the development stages of the project proceeded very slowly. Only after 2004, the work accelerated and at present, 35% of construction work has been completed. Under this JI project, the unit is planned to be made operational in 2010; the technical operational lifetime will be 30 years.

The **Rastolita HPP** unit will make use of the flow of the river Rastolita in the County of Mures, north of the center in Romania. It is a hydropower plant with a basin of 38 million m^3. It will have a capacity of 35 MW and is estimated at an average annual electricity delivery to SEN of 94.6 GWh. The investment was approved by the Decree nr. 95/1989 and until 1996 the construction works were conducted by RENEL. Between 1996 and 2003, the beneficiary of the investment was the Romanian Waters National Administration**.** After 2003, the investment programme was taken over by Hidroelectrica. At present 50% of the dam (at a functional low level), 40 % of the headraces and 70% of the HPP building have been completed. Under this JI project, the unit is planned to be made operational in 2010; the technical operational lifetime will be 30 years.

The **Robesti HPP** plant is part of the same programme of which the abovementioned Racovita HPP is part. The plant is expected to deliver to the SEN 74.6 GWh per year from an installed capacity of 27.1 MW. The investment programme was approved by the Decree nr.24/1989 and Decree nr.28/1990 but no construction work was done before 1990. Between 1990 and 2004, the development stages of the project were done very slowly and only after 2004 the works accelerated and at present 80% of construction works, 90% of purchasing equipments and 60% of electrical parts have been completed. Under this JI project, the unit is planned to be made operational in 2010; the technical operational lifetime will be 30 years.

A.3. Project participants:

Party involved	Legal entity – project participant	Party involved considered as project participant
Romania	Hidroelectrica	no
The Netherlands	SenterNovem	no

The details of the participants are shown in Annex 1.

A.4. Technical description of the project:

A.4.1. Location of the project:

See Annex 3 for the map indicating the HPP locations.

A.4.1.1. Host Party(ies):

Romania

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

Hydropower plants	County
HPP Dumitra and HPP Bumbesti	Gorj
HPP Nehoiasu II	Buzau
HPP Firiza I + II	Maramures
HPP Râul Alb	Caras-Severin
HPP Plopi	Hunedoara
HPP Racovita	Sibiu
HPP Rastolita	Mures
HPP Robesti	Valcea

A.4.1.3. City/Town/Community etc.:

Hydroelectricity plants	City/Town/Community
HPP Dumitra and HPP Bumbesti	City Targu Jiu; towns of Livezeni and Bumbesti
HPP Nehoiasu II	Town Nehoiu, Community of Nehoiasu
HPP Firiza I + II	City Baia Mare, Community of Firiza
HPP Râul Alb	Citu Caransebes, Communit of Fenes
HPP Plopi	City Hunedoara, Community of Plopi
HPP Racovita	City Sibiu, Community of Racovita
HPP Rastolita	City Targu Mures, Community of Lunca Bradului and Deda
HPP Robesti	City Ramnicu Valcea, Community of Robesti

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

Hydropower plants	Details of physical location
Dumitra and Bumbesti HPPs	The units are located at the river Jiu near the towns of Livezeni and Bumbesti in the zone of South-West Oltenia at a distance of approximately 55 km from Targu Jiu city (see Map in Annex 3).
Nehoiasu II HPP	The unit is located at the intersection of the rivers Buzau and Basca Mare in the County of Buzau, which is approximately 200 km Northeast of Bucharest (see Map in Annex 3).
Firiza I + II HPPs	The units are located in the County of Maramures (in the North of Romania) at approximately 25.5 km of Baia Mare city (see Map in Annex 3).
HPP Râul Alb	The unit is located in the County of Caras-Severin (in the south vest part of Romania) at approximately 27 km of Caransebeş city and 1 km of Fenes community (see Map in Annex 3).
Plopi HPP	The unit is located at the river Strei in the County of Hunedoara (in the West of Romania) at a distance of approximately 25 km of Hunedoara city (see Map in Annex 3).
Racovita HPP	The unit is located at the river Olt in the County of Sibiu at 27 km of Sibiu city (in the centre of Romania) (see Map in Annex 3).
Rastolita HPP	The unit is located at the river Muresul in the sector Ilva-Rastolita-Bistra, within the Mures County near the communities of Lunca Bradului and Deda at 68 km of Targu Mures (see Map in Annex 3).
Robesti HPP	The unit is located at the river Olt in the County of Valcea near the town of Robesti, at 51 km of Ramnicu Valcea city (see Map in Annex 3).

A.4.2. Technology(ies) to be employed, or measures, operations or actions to be implemented by the project:

Table A.4-1 below gives an overview of the HPPs covered by this JI Track 1 project with a summary of their installed capacity after completion of the investment, expected annual output when fully implemented, and the key dates in the HPPs' planning and implementation history. The Table is followed by descriptions of each HPP.

Table A.4-1. Summarising overview HPPs covered by Hidroelectrica JI Track I project

Hydropower plants (HPP)	Installed capacity (MW)	Expected output per year (GWh)	Date of approving the investment	Date of starting the finishing investments	Years of commissioning before end 2012
Dumitra HPP	24.5	98.0	2003	2004	2011
Bumbesti HPP	40.5	177.0	2003	2004	2011
Nehoiasu II HPP	55.0	172.3	1981	2005	2012
Firiza I + II HPP	12.8	47.2	1989	2005	2010
Râul Alb HPP	40.0	60.6	1981	2000	2009
Plopi HPP	12.0	27.4	1989	2006	2009
Racovita HPP	31.5	74.0	1989	2004	2010
Rastolita HPP	35.0	94.6	1989	2005	2010
Robesti HPP	27.1	74.6	1989	2004	2010
Total	**278.4**	**825.7**			

➤ ***Dumitra** HPP and **Bumbesti** HPP*

This part of the project consists of two hydropower plants on diversion (Dumitra HPP and Bumbesti HPP), with a total installed capacity of 65 MW and an operational lifetime of 30 years. Dumitra HPP is located on the right bank of the Jiu River, upstream from its interflow with the Dumitra Stream. Bumbesti HPP is located on the right bank of Jiu River, upstream from Sadu Train Station.

The Hydro energetic scheme of the proposed units consists of: the Livezeni barrage-dam, the Livezeni-Dumitra diversion headrace (6,9 km), the Dumitra power structure (surge chamber, valve chamber and metallic penstock with 142 m length), the Dumitra above-ground hydropower plant, the tailrace channel that makes the coupling with the step II of the arrangement, box structure pond (with 1500 m length), the Dumitra-Bumbesti diversion headrace (11 km), the Bumbesti power structure (surge chamber, valve chamber and metallic penstock with 250 m length), the Bumbesti above-ground hydropower plant, and the tailrace channel that restores the processed flow of the water used in Jiu River.

The following secondary catchments are foreseen:

- The Jiu River catchment (difference of the basin), which diverts the water flow from the river into the box structure pond of the Bumbesti HPP;
- The intake of Dumitra River, which diverts the water flow into the box structure pond of Bumbesti HPP; and
- The intake of Bratcu Stream, which guides the water flow into the Dumitra-Bumbesti headrace.

The electricity generators of the Dumitra HPP and Bumbesti HPP are estimated to generate power at a rated voltage of 6,3 kV and 10,5 kV, respectively. The power is afterwards transferred to the outdoor substation where the step-up transformers line the voltage level to 110 kV. The energy is lead through a 110 kV switchyard and delivered to the SEN.

Both hydropower plants are equipped with 3 vertical Francis turbines and synchronous generators with the following characteristics:

Table A.4–2. Technical data of the turbine types

	No. of Units	Type	Installed Power (MW)	Installed flow (m^3/s)	Nominal voltage (kV)
Dumitra HPP	3	FVM 10.1 – 93	3 x 8.17 = 24.5	3 x 12	6.3
Bumbeşti HPP	3	FVM 16.3 – 150	3 x 13.5 = 40.5	3 x 12	10.5

➢ ***Nehoiasu II HPP***

The Nehoiasu II HPP will have an installed capacity of 55 MW and will consist of a pit power station, on diversion, equipped with two hydropower units. The water flow which drives the turbines in the power plant is transferred from the Surduc reservoir through the main under-pressure discharge between the Basca Mare River and its intersection with the Buzau River and which has a length of 16.6 km. The Power structure is formed by: a surge chamber, a pressure gallery (2.2 km length), an aboveground penstock (0.284 km length) and an aboveground butterfly valve chamber.

The Surduc reservoir will have following characteristics:
- Normal Top Level – 873 mBsl
- Minimum Operation Level – 868.5 mBsl
- Total Volume – 400,000 m^3
- Efficient Volume – 280,000 m^3
- Occupied surface at NTL – 9.3 ha.

The Nehoiasu II dam for the Surduc reservoir will have a length of 28 m and a height of 15 m.

The Nehoiasu II plant, in the first stage envisaged under this JI Track I project, will be equipped with a Francis turbine that operates with the installed flow of 13 m^3/s, on a gross head of 488 m. The expected energy generation is 172.3 GWh/year. The structure of the tailrace is of reinforced concrete.

The electricity will be generated at a rated voltage of 10.5 kV and delivered to the grid through a 110 switchyard. The Nehoiasu 110 kV switchyard has double bars and transfer coupling.

The power plant is equipped with one vertical Francis turbine.

Table A.4–3. Technical data of the turbine types

	No of units	Type	Installed Power (MW)	Installed flow (m^3/s)	Nominal voltage (kV)
Nehoiasu II HPP	1	FVM 55 - 458	55	13	10.5

➢ ***Firiza I HPP and Firiza II HPP***

The Runcu - Firiza hydroelectric development programme (in which stage Firiza I and stage Firiza II are part) has the objective to exploit the hydroenergetic potential, created by the Romanian Ministry for Environment and Sustainable Development (MESD), for the flow diversion in the hydrographic basin of the Raul Mare River into the one of Firiza River. The main purpose of this diversion is to enhance the water supply in the existent towns in the Maramures district.

The 265 m water head (between the existent gallery outfall Runcu-Valea Neagra and the Stramtori reservoir) will be developed in 2 stages, namely Firiza I and Firiza II.

The stage of **Firiza I** is formed by an alluvia trap, the Valea Neagra headrace – compensation basin (2,85 km), water inlet, valves chamber, metallic penstock (260 m) and the actual hydropower plant. The power plant is of an aboveground type, located on the left side of Jolobodul Mare Stream.

The **Firiza II** stage is formed by a stilling basin, a surge chamber, a headrace (1,25 km), a loading chamber, water inlet, a valve chamber, a metallic penstock (650 m), and the actual hydropower unit. The power plant is of an aboveground type. The box structure tailrace leads the used water flow into the Firiza River, at the Stramtori Lake reservoir tail.

The power generated is transferred into the 110/20/6kV switchyard Ferneziu Baia Mare through the 110 kV circuit of the 110 kV+20 kV line Firiza II HPP-Ferneziu switch yard.

Firiza I and Firiza II are built in a manner that they cannot operate independently. Therefore, they will be treated as a single unit within the portfolio.

Both power plants will be equipped with 2 Francis turbines.

Table A.4–4 Technical data of the turbine types

	No. of Units	Type	Installed Power (MW)	Installed flow (m^3/s)	Nominal voltage (kV)
Firiza I + II HPP	4	FVM	4 x 3.2 = 12.8	4 x 3	6.3

- ***Râul Alb HPP***

The Râul Alb HPP is part of the Bistra-Poiana Mărului-Ruieni-Poiana Ruscă hydroelectric development programme and is a pit power station, on diversion. The water flow which drives the turbines in the power plant is transferred from the Poiana Ruscă reservoir through the main under-pressure discharge has a length of 4.2 km.

The Power structure is formed by: a surge chamber, an aboveground penstock (338 m length) and a pressure gallery with 40 m length. After the power generation process, the water is discharged through a tailrace gallery (930 m length) into a thickener which will be built on the Lung river.

The electricity will be generated at a rated voltage of 10.5 kV and delivered to the grid through the 110 kV Râul Alb – Armeniş line.

The power plant will be equipped with 2 vertical Francis turbines.

Table A.4–5 Technical data of the turbine types

	No. of Units	Type	Installed Power (MW)	Installed flow (m^3/s)	Nominal voltage (kV)
CHE Răul Alb	2	FVM 21 - 235	2 x 20 = 40	2 x 10.25	10.5

- ***Plopi HPP***

The Plopi HPP (12 MW) is an aboveground power plant with a loading chamber, which is equipped with two power generation units. It uses the outgoing flow from an upstream power plant, Subcetate HPP, by transferring the water through a headrace channel where it is processed by a gross head of 15,00 m with two vertical Kaplan Units which process 100 m^3 of water per second (2 x 50 m^3/s). The power generation is 27.40 GWh/year. After the power generation process the water is discharged through a tailrace with a length of 2070 m.

The two synchronous generators divide the generated power on the common bus bar of the 6.3 kV switchyard. Next, the power is delivered to the SEN, at 110 kV voltage, through a 16 MVA step-up transformer and a 110 kV switch yard.

The power plant will be equipped with 2 vertical Kaplan turbines.

Table A.4–6. Technical data of the turbine types

	No. of Units	Type	Installed Power (MW)	Installed flow (m^3/s)	Nominal voltage (kV)
Plopi HPP	2	KVB 6.4 – 14.5	2 x 6 = 12	2 x 50	6.3

- ***Racovita HPP***

The Racovita HPP (31.3 MW) is a gravitational low-head dam power plant type and it is located in the retaining front of the concrete spill dam on the River Olt. The power plant is located at the left side of the spill dam.

The Racovita reservoir has the following characteristics:

- Normal Top Level – 373.5 mBsl
- Minimum Operation Level – 371.5 mBsl
- Total Volume – 14.83 mil. m^3
- Efficient Volume – 5.83 mil. m^3
- Occupied surface at NTL – 331 ha.

The dam for this HPP will have a length of 82 m and a height of 21.5 m.

For the development of the Racovita HPP the construction of dikes are foreseen along the shoreline (about 20 km length) to prevent the Olt River from expanding and occupying agricultural areas and affecting households.

The Racovita spill dam is of a mobile type with four overfill gaps, each gap being equipped with radial gates with a hinged valve of 16 x 10 m^2. The front and longitudinal sides of the reservoir will be enhanced with dikes.

Downstream from the hydraulic structures assembly there is the plunge (toe) basin of the spill dam, and the still dam of the hydropower plant. They are followed by downstream regulation and the tailrace, which has a double role of discharging the water flows away from the turbines and discharging water from the reservoir in case of high water. The length of the tailrace is 5,626 m and it has a trapezoidal section with 70 m base width.

The two generators divide the electrical power produced on the common bus bar on the 10.5 kV switchyard. From there the energy is transferred to SEN, at 110 kV, through a 40 MVA step-up transformer and a 110 kV switchyard.

The power plant will be equipped with two identical Kaplan Units

Table A.4-7. Technical data of the turbine types

	No. of Units	Type	Installed Power (MW)	Installed flow (m^3/s)	Nominal voltage (kV)
Racovita HPP	2	KVB	2 x 15.75 = 31.5	2 x 165	10.5

➢ ***Rastolita HPP***

The Rastolita HPP, with an installed capacity of 35 MW, is a diversion-type aboveground hydropower plant equipped with two power generation units. The water flow to be processed by the turbines comes from a discharge of the Rastolita water reservoir and from the other right bank tributaries of the Mures River on the Ilva-Rastolita-Bistra sector. These flows are transferred under pressure through the main diversion channel with a length of 8.5 km and an installed discharge capacity of 17 m^3 of water per second through two secondary headraces:

– the western arm of 12 km length (which comprises Bistra, Galoaia Mare, Galoaia Mica and Visa catchments), and
– the eastern arm of 5 km length (which comprises Ilva Mare and Bradului catchments).

The Rastolita HPP reservoir has the following characteristics:

- Normal Top Level – 760 mBsl
- Minimum Operation Level – 720 mBsl
- Total Volume – 40 mil. m^3
- Efficient Volume – 38 mil. m^3
- Occupied surface at NTL – 134.5 ha.

The dam for this HPP will have a length of 360 m and a height of 115 m.

The HPP's power structure consists of: a surge chamber, a valve chamber, and a penstock. The power generation is expected at 94.6 GWh/year.

A pond type re-regulating reservoir with a volume of 100.000 m^3 is located downstream from the Rastolita HPP site. The power plant outfall quota is 490 msl.

Rastolita HPP will transfer the generated power to the SEN in a 110 kV switchyard, located upstream from the power plant, on the right bank, at approximately 200 m from the plant.

The plant is equipped with two Francis turbines.

Table A.4-8. Technical data of the turbine types

	No of Units	**Type**	**Installed Power (MW)**	**Installed flow (m^3/s)**	**Nominal voltage (kV)**
Rastolita HPP	2	FVM	2 x 17.5 = 35	2 x 8,5	10.5

➢ ***Robesti HPP***

The Robesti hydropower plant (27.1 MW) is a gravitational low-head dam power plant type and it is located in the retaining front of the concrete spill dam on the River Olt. The power plant is located at the right side of the spill dam.

The Robesti reservoir has the following characteristics:

- Normal top level – 335.0 mBsl
- Minimum Operation Level – 334.0 mBsl
- Total Volume – 6.22 mil. m^3
- Efficient Volume – 1.62mil. m^3
- Occupied surface at NTL – 171.8 ha.

The dam for this HPP will have a length of 82 m and a height of 21.5 m.

Longitudinal protection dikes of 2.05 km length for the railway and National Way 7 will be constructed at the Robesti HPP reservoir, on the right bank. On the left side, the dam is embanked with an approximately 240 m dike in the slope.

The Robesti still dam is of a mobile type with four overfill gaps, each opening being equipped with radial gates with hinged valves of 16 x 9 m^2.

Downstream from the hydraulic structures assembly there is the plunge (toe) basin of the spill dam, and the still dam of the hydropower plant. They are followed by downstream regulation and the tailrace, which has a double role of discharging the water flows away from the turbines and discharging water from the reservoir in case of high water. The length of the tailrace is 2430 m, with a trapezoidal section with a 70 m base width.

The two generators divide the power generated by the common bus bar of the 10.5 kV switchyard. Next, the power is delivered to the SEN at 110 kV through a 40 MVA step-up transformer and a 110 kV switchyard.

The power plant will be equipped with two identical Kaplan Units.

Table A.4-9. Technical data of the turbine types

	No of Units	Type	Installed Power (MW)	Installed flow (m^3/s)	Nominal voltage (kV)
Robesti HPP	2	KVB	2 x 13.55 = 27.1	2 x 165	10.5

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

The proposed JI Track 1 project will reduce anthropogenic GHG emissions by increasing the production of electricity from hydropower sources, which replaces power production based on fossil fuel burning, *e.g.* natural gas and coal/lignite. From the electricity production figures in 2004-2007 (see Section A.2) it becomes clear that the variation in hydropower in Romania was mainly covered by adjustments in the production of coal and natural gas-based electricity. This fossil fuel-based production capacity has thus been functioning at the margin of increasing production when hydropower output was lower and of reducing production when hydropower output was higher.

The JI project's main contribution is to ensure that the construction of the nine hydropower units in the project will take place during 2009-2011. From the perspective of Hidroelectrica, the implementation of the units was planned before, but this was delayed so that the actual construction of the units was not envisaged before 2012. From a national energy perspective, such as reflected by Romania's latest national energy strategy, further expansion of the hydropower capacity can be expected for the future, but with the recent increase (doubling) of the nuclear power capacity and the flexibility in the output expansion (and reduction) of coal and natural gas-fired power plants (thermal plants on average operate at around 57% of their full capacity) no strong short-term incentive exists for Hidroelectrica to increase its hydropower capacity. In addition, Hidroelectrica is currently involved in a process of privatising some of its smaller (less profitable) units, which has created a large uncertainty about the status of planned and low-profitability units, such as those covered by this project.

A.4.3.1. Estimated amount of emission reductions over the crediting period:

During the project's crediting lifetime of 2008-2012, in total 1532.35 GWh of additional electricity will be delivered to the grid by the nine units. Given that the Romanian baseline grid factor for PDD calculation and ERPA preparation purposes has been determined at 860 gCO_2/kWh (actual baseline emission factors will be calculated on an *ex post* basis, see Section B.1 and 2) and given that the project will have zero CO_2 emissions, the project will reduce the emissions of **1,317,821** tCO_2 during the crediting lifetime.

A.5. Project approval by the Parties involved:

Issuance of the Letter of Endorsement for this JI Track 1 project by MESD took place on 12 May 2008. The Declaration of Approval by the Netherlands Government will take place after the issuance of the Romanian Letter of Approval. However, the Netherlands Designated Focal Point (DFP) will issue a statement accompanying the Request for the Letter of Approval expressing the commitment of SenterNovem for the project in line with the Track 1 Ministerial Order that requires the identification of the other Party at the time of the LoA request.

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

Methodology
The 'Hidroelectrica Hydropower Development Portfolio Track 1 JI Project' belongs to the category of projects which deliver electricity to the power grid that would otherwise have been generated by operation of grid-connected power plants and by the addition of new generation sources. The project is a so-called *greenfield* project which creates new capacity on sites where formerly no power production took place. For the accounting of the CO_2 emission reductions generated by such projects under the Clean Development mechanism (CDM), the CDM Executive Board has approved the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002 methodology). This methodology enables project participants to determine a CO_2 emission factor for the grid to which the project will deliver its electricity output.

Since it is generally very complex to accurately identify beforehand the grid-connected capacity that will be replaced by the additional capacity of a greenfield project (after all, the capacity replaced will depend on such factors as grid capacity usage, load factor, weather conditions throughout the year, *etc*.), the baseline methodology will have to enable a reasonable estimate of the electricity production capacity that will appear at the margin of being disconnected when new electricity production capacity becomes online. The ACM0002 methodology allows for both calculating a weighted average of CO_2-eq. emissions of existing and operational plants, and estimating the CO_2-eq. emissions of plants that are planned and/or expected to be built and connected to the grid. The resulting emission factor is a so-called combined margin factor.

EU ETS data set for Romania
Similarly, for this project an average CO_2 emission factor (expressed in gCO_2/kWh) for the power grid of Romania will be calculated in order to determine a baseline emissions scenario. However, contrary to the ACM0002 (version 7) methodology, which has been developed for *ex ante* baseline calculation, for this project the CO_2 baseline emissions factor will be calculated on an *ex post* basis using data verified for Romanian electricity generation installations covered by the EU ETS. As will be explained below, this data set can be considered an accurate representation of the composition of the Romanian grid-connected power production capacity as it contains both installations that have been operational for a long time (*e.g*. over 20 years) and those that have been installed during recent years. Below, criteria are formulated for selecting, from this data set, those installations that are likely to appear at the margin of being disconnected when new capacity comes on-line. A strong advantage of using these data is that they are verified within the ETS context on an annual basis and published on the Internet site of the Ministry of Environment and Sustainable Development (MESD).[6]

The EU ETS has been operational since 2005. It allocates (through National Allocation Plans determined by Member States) allowances in the form of CO_2-eq. emissions to a broad range of installations within the EU (presently around 12,000 installations). Installations can trade these allowances with other installations so that an EU market has emerged for trading of CO_2-eq. emission allowances. The first phase of the ETS ended in 2007 and the present second phase coincides with the commitment period of the Kyoto Protocol (from 2008 through 2012). Romanian installations have been part of the ETS since Romania's accession to the EU on 1 January 2007.

[6] http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf; as well as on the CITL Internet site of the European Commission: http://ec.europa.eu/environment/climat/emission/citl_en.htm

Each Member State has to report on the CO_2-eq. emissions of its ETS installations during a particular year by 30 April of the following year at the latest. This implies that as of 30 April of each year the verified emission data for all ETS installations must be available. Given that almost all Romanian grid-connected electricity production capacity are covered by the ETS and that most of the non-ETS grid connected capacity is based on hydro and nuclear energy, which are unlikely to appear at the margin of being disconnected when new capacity comes online (for reasons explained below) and since the ETS verified data can be considered the best available data set for grid-connected CO_2 emissions in Romania, this approach delivers the most reasonable estimate of a baseline CO_2-eq. emission factor (expressed as grams of CO_2-eq per kWh).

However, as a consequence, since data on emissions for a particular year will only become available in the following year, using this data will imply an *ex-post* determination of the baseline emissions scenario for this project. For instance, the project's baseline for the year 2009 will be based on verified ETS data for grid-connected power plants in Romania for the year 2009, which will become available during the first half of 2010. This would be fully in line with the provision in the methodological "Tool to calculate the emission factor for an electricity system", adopted by the CDM Executive Board at its 35th meeting (Annex 12 of the meeting report), which recommends that for *ex-post* baseline calculations for grid-connected CDM power production projects data required to calculate the emission factor for year *y* would need to be available within six months after the end of year *y*; otherwise, data from year *y-1* may be used.

This would also imply that the baseline emission factors could differ across the years of the project's crediting lifetime.

Defining the marginal capacity

Another justification of using the Romanian ETS installations' data for the baseline calculations is that these installations produce power mainly with fossil fuel combustion (that is the reason why they have been included in the ETS in the first place). Usually, a country's power production capacity is as big as the highest annual peak in electricity demand, so that throughout the year there is excess capacity. Power plants are operated in different modes with nuclear energy and run-of-river hydropower plants normally being operational as many hours as possible because of their relatively low operational costs. According to the *Operational Guidelines for Baseline Studies, Validation, Monitoring and Verification of Joint Implementation Projects* (Vol.1, version 2.0; published by the Ministry of Economic Affairs of the Netherlands, October 2001), fossil fuel based plants, instead, are usually modulated depending on electricity demand developments while securing electricity supply. For the latter plants, it could generally be assumed that the higher the fuel costs and the lower the energy efficiency, the higher will be their variable costs and, therefore, it will be more attractive to reduce their operation when new capacity becomes available.

It is therefore reasonable to assume that grid-connected hydropower and nuclear power plant capacity (which are not included in the ETS) will not appear at the margin of being modulated when new capacity becomes available or when electricity demand increases. Consequently, hydropower and nuclear power plants will not be included in the baseline emission factor for Romania. However, as stated by the "Tool to calculate the emission factor for an electricity system" (adopted by the CDM Executive Board at its 35th Session, see above), if 'coal' is obviously used as must-run, it should also be included in the list of must-run technology plants which are dispatched independently of the daily or seasonal load of the grid.[7] For each year for which the baseline will be established, the Romanian Energy Market Authority ANRE will be consulted for its expert judgement about which of the coal-based grid-connected ETS plants in

[7] CDM EB, "Tool to calculate the emission factor for an electricity system", Annex 12 of EB 35 report, footnote 3, p.4.

Romania can be considered low-cost, must run plants and therefore be excluded from the baseline calculations.

In addition, the baseline calculations will incorporate the issue that some power production technologies have, according to Romanian legislation, a preferential status in the dispatch order (*e.g.* co-generation for district heating, see also below). Capacity with a preferential dispatch treatment is unlikely to be replaced when new power production capacity becomes available, such as through a JI project. Therefore, similar to must-run and/or low operational cost power production technologies, power production capacity with a preferential dispatch status will not be included in the baseline CO_2 emission factor.

When an installation contains a heat-only boiler, then the emissions related to this heat production will be left out of installation's total annual CO_2 emissions.

Combined Heat and Power connected to the electricity grid
One further specific aspect that needs to be considered in this baseline methodology is how to deal with CO_2 emissions that originate from Combined Heat and Power (CHP or co-generation) plants. Within the context of Romania, most CHP plants are used for district heating.[8] Until 2002, heat was mainly produced by district heating and CHP plants owned by Termoelectrica and municipality-owned district heating plants. As part of the liberalisation of the Romanian energy market, several Termoelectrica district heating and CHP plants have become independent, with in many cases municipalities as single shareholder.[9]

An important general problem for district heating and CHP plants during the process of energy market liberalisation was that many households decided to disconnect from the centralised heating systems, because of increasing fuel prices, poor status of the heat distribution systems and lack of metering for individual measurement of heat consumption. For CHP-based district heating this rate of disconnection could range from 3 to 18% of total apartments.[10] This led to the closure of several CHPs in smaller communities. Nowadays, the situation seems to have stabilised with a number of 5.5 million inhabitants connected to residential district heating systems (including CHP).

CHP plants produce electricity and heat in a combined manner, which is much more efficient than producing heat and power in separate processes. CHPs could reach an efficiency level of over 90%, thereby increasing efficiency by 15-40% compared to separate processes. According to the OECD database,[11] about a quarter of Romania's electricity output in 2005 was produced by CHP plants. CHP plants in Romania generally run on burning coal or natural gas.

The complexity with CHP plants is that when, irrespective of the reason for it, a plant delivers less electricity to the grid, there is still a heat demand that needs to be met. A typical CHP plant produces heat for baseload heat demand (*e.g.* hot water during the summer) so that additional heat-only boilers are needed for meeting peak-load heat demand. Should a CHP plant's delivery of electricity to the grid be reduced and in combination with that the heat production reduced, then extra heat needs to be produced elsewhere in order to be able to meet the municipality's baseload heat demand, which would still cause

[8] SAVE II PROCHP, 2003. Promoting CHP in the Liberalised Energy Markets - Outline and Recommendations, with a case-study on: Romania – CHP in the Liberalised Market, http://www.kape.gov.pl/PL/Programy/Programy_UniiEuropejskiej/SAVE/aP_PROCHP/Promoting_CHP_in_Liberalised_Energy_Markets.pdf
[9] COGEN Romania: http://www.cogen.ro/
[10] ibid.
[11] http://oecd-stats.ingenta.com/OECD/TableViewer/tableView.aspx

emissions of CO_2.[12] Therefore, calculating CO_2 emissions in terms of kWh of electricity produced and including this emission factor in the baseline would not be a conservative approach.

In principle, there would not be a large difference between CHP plants that are driven by heat demand with electricity as a 'residual' product and CHP plants driven by electricity demand with residual heat production. In both cases, the heat demand will have to be met with an alternative technology. Generally, it is considered inefficient to disconnect CHP-based electricity from the grid as this would reduce the efficiency of CHPs and it is therefore reasonable to give these plants a preferential treatment in the dispatch procedure.

With a view to the above, and in order to follow a conservative approach, CHP plants will be treated as follows in this baseline methodology. When CHP plants have, according to Romanian legislation, a preferential status in the dispatch order (*e.g.* co-generation for district heating which has a guaranteed access to the grid, by Energy Efficiency law – no. 199 / 2000), then these plants will be left out of the baseline as they are unlikely to become marginal plants due to a JI project.[13]

All other CHPs which deliver electricity to the grid and which are included in the EU ETS, but which are not serving district heating purposes (but, instead, *e.g*. CHPs delivering industrial heat/steam), will be treated as follows. For these plants, the total energy output will be taken (heat and power) and expressed in GWh (by converting heat output from PetaJoule to GWh by a conversion rate of 1000/3.6). Subsequently, a CHP plant's annual CO_2 energy output will be divided by its total annual energy output (instead of electricity alone). Therefore, for these plants the CO_2 emission factor that is included in the overall electricity grid factor will become lower. Applying this rule has the advantage that no site-specific analysis is required of the efficiency rate at which the heat demand will be met if not in a CHP plant (recall footnote 12: heat production in a CHP plant has an efficiency of around 55%, whereas in a heat-only boiler this could be 80%).

Nuclear electricity

Ex post baseline determination will also enable a careful incorporation of the impact on the Romanian power production of the operationalisation of the second unit of the Cernavoda nuclear power plants in 2007. This second unit (700 MW capacity) is expected to increase the share of nuclear power-based electricity production in Romania from 13.1% in 2007 to approximately 20% after 2007. Relying on 2007 power sector data for baseline determination may then not deliver a reasonable description of the CO_2 emissions in the absence of the project.

Electricity imports

A final issue that has been considered in this project design document is the possible incorporation of electricity imported to the grid from abroad. Generally, within the CDM context, electricity imports are referred to as electricity transported from one grid to another grid within the same host country. Such situations may occur in countries which have layered dispatch systems (*e.g.* provincial/ regional/

[12] Although the efficiency of heat production in a heat-only boiler is generally higher, around 80%, then in a CHP, around 55%, so that CO_2 per kWh heat produced would become lower, see WADE, 2003, *Guide to Decentralised Energy Technologies*, December 2003.

[13] By Energy Efficiency law – no. 199 / 2000, CHP plants delivering heat to the residential sector have guaranteed access to the electricity grid. However, there could be reasons in actual practice for a reduced delivery, such as unfavourable electricity and energy source price developments and difficulties with concluding longer-term purchasing power agreements. Nonetheless, such reduced delivery would unlikely be caused by the extra JI project electricity capacity, so that these CHP plants for district heating could be left out of the baseline for ex-ante baseline emission factor purposes. In the *ex-post* analysis, however, a situation may occur that the non-delivery of power by CHP plants to the grid could result in a reduction of electricity supply, so that it could become unnecessary to disconnect non-CHP power producing plants. That judgement will be part of the ex-post baseline determination model described below.

national). When a project boundary chosen is a regional grid, then also electricity acquired from other regional grids will need to be incorporated as this electricity import could also appear at the margin when new capacity becomes available through a JI or CDM project. However, such layered dispatch systems are usually bound by the borders of a host country, which is why the above-mentioned CDM-based tool ("for calculating a baseline emission factor for an electricity system") states that electricity imports must be determined as far as they are from a connected electricity system within the same host country. Following this reasoning, electricity imports in Romania will be left out of the modified grid-factor baseline calculations. Moreover, given that Romania's electricity import in 2007 (1,301 TWh) was only 2.3% of all electricity supplied to the grid (*Raport Privind Rezultatele monitorizãrii Pieţei De Energie Electricã*, *În Luna Decembrie 2007*, ANRE), including electricity import would, for the time of the crediting period, make a small difference only in the CO_2 baseline emission factor (around 20 g/kWh, own calculations).

Calculating the baseline CO_2 emission factor

For the calculation of such a modified (*i.e*. based on marginal technologies) grid-connected CO_2 baseline emission factor, the following data are needed:

– **The verified CO_2 emissions data of Romanian power sector installations in the ETS that operate at the margin.** These data are published on the published on the Internet site of MESD (between 1 May and 30 June of the following year) and are freely accessible.[14]

– **Electricity supply to the grid by each of the ETS installations operating at the margin.** These data will be provided by the *Autoritatea Nationalã De Reglementare În Domeniul Energiei* (Energy Market Authority in Romania, ANRE).

These two data sources will be combined as follows in order to acquire a CO_2 baseline emission factor for the Romanian grid:

$$EF_{grid,y} = \frac{(\sum_{i=1}^{x} CO_{2,i,y} + \sum_{j=1}^{z} CO_{2,j,y})}{(\sum_{i=1}^{x} Gen_{i,y} + \sum_{j=1}^{z} ENER_{j,y})} \qquad (1)$$

Where,

$EF_{grid,y}$	=	A modified CO_2 emission factor of the Romanian grid (non-must-run thermal power plants) in year y; it is expressed in g/kWh (=tonne/MWh).
$CO_{2,i,y}$	=	CO_2 emissions in year *y* of installation *i* expressed tonnes.
$GEN_{i,y}$	=	The electricity (MWh) delivered to the Romanian grid by installation *i* in year *y*. These figures are based on the total electricity production of installation *i* minus the electricity used onsite by *i*.
i = 1..x	=	All thermal non-must-run electricity producing, non-CHP installations under the EU ETS in the entire Romanian electricity grid.
$ENER_{j,y}$	=	The total of electricity production of marginal CHP installation *j* minus the electricity used onsite by *j* and the heat output of *j* in year *y* expressed in MWh.
$CO_{2,j,y}$	=	CO_2 emissions in year *y* of installation *j* expressed in tonnes.
j = 1...z	=	Installations selected as marginal CHP plants in Romania within the EU ETS.

For the calculation of this modified grid-based CO_2 emission factor, an Excel worksheet has been developed with the following purposes:

[14] http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf; as well as on the CITL Internet site of the European Commission: http://ec.europa.eu/environment/climat/emission/citl_en.htm

1. Calculation of aggregate CO_2 emissions of marginal Romanian ETS-covered electricity producing installations during the baseline year y (= $\Sigma\ CO_{2,i,\ y} + \Sigma\ CO_{2,j,y}$).
2. Calculation of aggregate electricity output for the Romanian marginal power producing installations, and electricity and heat output for Romanian marginal CHP installations covered by the EU ETS during the baseline year y (= $\Sigma\ GEN_{i,y} + \Sigma\ ENER_{j,y}$).

Dividing the aggregate figures of 1) and 2) above results in the Romanian electricity-grid baseline CO_2 emission factor: $EF_{grid,y}$.

For the application of the worksheet a **CO_2 Emission Factor (CEF) Data Collection Protocol** has been developed, which is presented in Annex 2 of this PDD. It is important that this protocol is concluded between the organisations from which data will need to be collected, while respecting the provisions in Directive 2003/4/EC on confidentiality of CO_2 emissions data verified for EU ETS installations.

The **CEF Data Collection Protocol** consists of the following steps:

1. From the list of Romanian EU ETS installations annually published on the Internet site of MESD (http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf) those installations will be selected which generate electricity for the Romanian electricity grid. In Annex 2, this has been done for the year 2007, resulting in a list of 44 installations (Table Annex 2.1).
2. The Romanian Energy Market Authority ANRE will, based on its professional judgement, remove from this EU ETS list those power producing installations which have had a preferential status in the dispatch procedure (*e.g*. co-generation for district heating) and coal-based power plants that are “unlikely to appear at the margin” must-run installations and which have low variable costs (*e.g.* Turceni and Rovinari; as an illustration, these two plants have been cross-out in Table Annex 2.1).
3. This final worksheet list with marginal, **baseline** installations will be copied: one copy stays with ANRE and one copy is provided to the Romanian Environmental Protection Agency NEPA/ANPM.
4. ANRE will complete its copy of the worksheet with the power output data for the selected ETS installations in Romania for the baseline year. It is important to note that these output data are confidential and will not be disclosed to the project participants. The ANRE copy of the worksheet will only be made available for verification purposes. ANRE will provide the total electricity production figure for grid-based marginal capacity ETS installations to MESD and/or to NEPA/ANPM.
5. In the NEPA/ANPM copy of the worksheet, CO_2 emission data for each installation will be collected by NEPA/ANPM from the MESD EU ETS database (http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf) and filled in in the worksheet. This results in a total CO_2 emission figure for the selected marginal ETS installations.
6. NEPA/ANPM will deduct the CO_2 emissions from heat-only boilers (HOB) in case an installation includes one or more HOBs;
7. NEPA/ANPM will provide MESD with the total annual CO_2 emissions related to electricity production by marginal ETS installations, excluding the emissions from HOBs.
8. The final phase of the CEF Data Collection Protocol consists of dividing the total CO_2 emissions figure (under 7) by the total electricity output (under 4) in order to obtain a CO_2 emission factor for baseline determination purposes (expressed in gCO_2/kWh). MESD will calculate this factor and publish it on its website from where JI project participants will obtain it for the purpose of calculating JI project emission reductions. Therefore, individual installation data will not be disclosed to any project participants.

An important aspect in the protocol is to establish a working relationship with NEPA/ANPM and ANRE under the co-ordination of the MESD and the Ministry of Economy and Finance. During 2008 and 2009 the baseline calculation and CEF Data Collection Process will be tested with the organisations concerned and in collaboration with MESD. This will enable the establishment of a working relationship among the organisations from which required data will be required during the crediting lifetime.

Finally, it is noted that the project partners have developed a contingency plan for calculating a CEF for grid-connected electricity production JI projects in Romania in case not all data requirements for the **CEF Data Collection Protocol** are met by the time the methodology needs to be applied for the first time during the crediting lifetime of this JI Track 1 project. This contingency plan is presented in Annex 5.

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the JI project:

Baseline emissions

As explained in Section B.1, the methodology for calculating a modified CO_2 emission grid factor for Romania will be used for an *ex-post* determination of the baseline. The project's baseline emissions will therefore be calculated as follows:

$$BE_y = \sum_{a=1}^{9}((GEN_{a,y} - GEN_{a,baseline})\, x\, EF_{grid,y}) \qquad (2)$$

Where,

BE_y	=	Baseline emissions in year y in tonnes CO_2 per year.
$GEN_{a,y}$	=	Electricity supplied by project unit *a* to the grid (MWh); As the units in this project are not retrofit activities, $GEN_{a,baseline}$ = 0. $GEN_{a,y}$ will be collected from Hidroelectrica (see Section D).
a = 1..9	=	The nine HPP units under this JI Track 1 project.
$EF_{grid,\ y}$	=	A modified CO_2 emission factor of the Romania grid in year y; it is expressed in g/kWh (see the methodology description in Section B.1; equation 1).

The first year for which the baseline will be prepared is 2009 based on data that will become available during the first six months of 2010. Subsequently, in 2011, 2012 and 2013 baseline emissions will be calculated for 2010, 2011, and 2012, respectively.

One implication of determining the baseline on an *ex post* basis is that a reasonable *ex ante* factor will have to be estimated for the purpose of completing the project preparation steps (*i.e*. obtaining a Letter of Approval from the Parties involved in this project and the completion of an emission reduction procurement agreement or ERPA).

A first impression of the CO_2 emissions per kilowatt-hour can be obtained from the annual statistical reports prepared by ANRE, which contain for each year the overall CO_2 emission factor for the Romanian electricity grid. An overview of these factors is presented in Table B.2-1 (column A). However, since these factors also include the (close to) 0-emission values for hydropower and nuclear energy, these need to be corrected because hydro and nuclear power production generally will not appear at the margin of disconnection when new capacity becomes operational. This correction is done by taking the share of fossil fuel-based electricity production and dividing the overall grid factor by this remaining fossil-fuel share (in %). The resulting CEFs are shown for 2005-2007 in the table below.

Table B.2-1: Development Romanian CO_2 emission factor based on annual ANRE reports

Year	Overall CO_2 emission factor for the grid (g/kWh) determined by ANRE	Hydropower share in electricity supplied to grid	Nuclear power share in electricity supplied to grid	Fossil fuel share in electricity supplied to grid (100% = 1)	CEF without hydro and nuclear capacity (gCO_2/kWh)
	A	B	C	D	E
				(100-B+C)/100	(A / D)
2005	485	37.11	9.59	0.53	**910**
2006	547	32.02	9.20	0.59	**931**
2007	566	25.80	13.10	0.61	**926**
				Average for 2005-2007	**922**

Source: ANRE Annual report *Date Statistice Aferente Energiei Electrice, 2004-2007*

However, these factors cannot be used for calculating an *ex-ante* CEF because the factors shown in column E in Table B.2-1 still include emissions caused by CHP plants for district heating and electricity production, which will, as discussed in Section B.1, when they use their guaranteed right to deliver electricity to the grid, not appear at the margin of technologies to be disconnected when new JI-based capacity comes on line. Therefore, the CHP-based CO_2 emissions must be excluded in order to arrive at an *ex-ante* CEF that follows precisely the methodology to be used for the *ex-post* CEF. The main difference is that the *ex-ante* CEF will be an estimate of what is likely to happen when CHP plants act according to what can be reasonably expected from them, whereas the *ex-post* CEF will precisely show what will actually have happened.

Following this logic, the *ex ante* CEF has been calculated as follows. The 44 electricity producing Romanian ETS installations during 2007 have been categorised under the headings of the energy companies (*i.e*. several Romanian energy companies have more than one installation covered under the ETS). Subsequently, for each energy company the verified CO_2 emissions of its ETS installations during 2007 have been taken together. From the ANRE report *"Data Statistice Aferente Energiei Electrice 2007"* the CO_2 emission factor for each energy company for 2007 has been taken so that the annual electricity output at the company level could be calculated (*i.e*. total CO_2 per company divided by the company's 2007 CO_2 emission factor according to ANRE). Totalling the CO_2 and the output results in a rough CO_2 emission factor for the Romanian electricity grid.

Subsequently, for the *ex ante* CEF calculations two situations are envisaged:

1. All CHP installations use their guaranteed right to deliver electricity to the grid, so that they will not appear as marginal technologies. Then, from the 44-installation list the CHP installations for district heating and electricity are given a binary value of 0 (considering these as must-run), so that a list of electricity-production-only installations and companies remains. In this case, the CEF would be based on the CO_2 emission and electricity output figures of electricity-production-only installations in Romania: **1,053 gCO_2/kWh** (see for the detailed calculations Annex 6).
2. As explained in Section B.1, although CHP plants have, by Energy Efficiency law – no. 199 / 2000, a guaranteed access to the electricity grid, there could be reasons in actual practice for a reduced delivery, such as unfavourable electricity and energy source price developments and difficulties with concluding longer-term purchasing power agreements. In those cases, the reduce electricity supply by CHP plants could *de facto* be compensated by the additional electricity output of this JI Track 1 project. Hence, although this CHP production reduction would not be caused by the JI project, the latter output would in practice replace CHP based production capacity. Should such a situation happen, the CEF would need to include CHP CO_2 emissions, according to the methodology for treating CHP plants explained in Section B.1.

As a proxy of the *ex-post* CEF in these situations, the following calculation can be made. The most recent CEF calculation for Romania on the basis of the baseline methodology in Section B.1 (*i.e.* CHP CO_2 emissions expressed in terms of energy output: heat and electricity) can be found in the International Energy Agency database for the year 2005:[15] 394.14 gCO_2/kWh. Excluding from this figure the share of must-run technologies hydro and nuclear power (54% in 2007) leads to a CEF of 744 gCO_2/kWh. However, this CEF still contains the emissions of the must-run coal plants Turceni and Ruvinari. These two plants have a share in the Romanian power grid of 23.8% and their average CO_2 factor is 1068 g/kWh. Leaving these two plants out of the CEF, requires a reduction of the above CEF of: 744 - (1068-744) * 0,238 = **667 gCO_2/kWh.**

The two above CEFs – 1053 and 667 gCO_2/kWh – represent the two possible cases of, on the one hand, all CHP using their guaranteed right to supply electricity to the grid, and, on the other hand, that CHPs may decide not to deliver to the grid.

Since it cannot be stated beforehand what the exact baseline situation during the project lifetime will look like (after all, this may change from period to period within the crediting lifetime: in some periods, it could be 1053 and in other periods 667), the *ex-ante* CEF will be an average of the two above figures, whereby both figures have been given an equal share: ((0.5 * 1,053) + (0.5 * 667)) / 2 = **860 gCO_2/kWh.**

It should be noted that it is unclear what the impact will be of the increase in nuclear power capacity on the operationalisation of fossil fuel-based power plants. From a static perspective, it would not make a difference for the CO_2 grid factor because nuclear energy would be a must-run technology so that fossil fuel plants would remain at the margin of dispatch as they were before. However, the considerable addition of nuclear capacity could also imply, in particular with a view to the ETS emission caps for installations, that the relatively inefficient coal-based plants would be replaced more quickly than the relatively efficient installations. From such a more dynamic perspective, the CO_2 baseline factor would be reduced with extra nuclear power capacity.

The Table below shows the estimate electricity production of this JI Track 1 project for each year of the crediting period up to 2012 (for the precise build-up of electricity production capacity during 2009-2012, see Table E.6.1) and the resulting baseline emissions for each crediting year of the project.

Table B.2-2.Estimated annual emissions according to the baseline scenario

Year in crediting lifetime	Estimated aggregate annual electricity production of project units (GWh)	Estimated annual baseline emission factor (based on verified 2007 ETS data) (g CO_2/kWh)	Annual baseline emissions (t CO_2)
2009	43.70	860	37,582
2010	233.20	860	200,552
2011	515.90	860	443,674
2012	739.55	860	636,013
Total	**1,532.35**		**1,317,821**

[15] http://oecd-stats.ingenta.com/OECD/TableViewer/tableView.aspx

Project emissions

According to guidance provided in the CDM EB approved methodology ACM0002, emissions from hydropower projects activities that result in new reservoirs or in the increase of existing reservoirs can be estimated as follows:

(a) If the power density (*PD – installed power capacity in relation of the surface of the reservoir when it is full*) of a power plant or unit (in the case of this project) is greater than 4 W/m^2 and less than or equal to 10 W/m^2, then the project emissions are calculated by multiplying a default CO_2 emission factor of 90 kg CO_2/MWh (as per the decision of the CDM Executive Board at its 23rd meeting) with the electricity production from the unit.

(b) If the power density (*PD*) of the power unit is greater than 10 W/m^2, then the project emissions can be considered zero by default.

The table below gives an overview of the type of hydropower project and shows that in some cases (where dams are constructed) there will be new reservoirs.

Table B.2-3. Overview of power density and project emissions per HPP unit

Hydropower plants (HPP)	Type of project	Reservoir	Power density (PD; W/m^2)	Project emissions (PE)
Dumitra HPP	Diversion	No	Not applicable	0
Bumbesti HPP	Diversion	No	n.a.	0
Nehoiasu II HPP	Dam	New reservoir	591.39	0
Firiza I & II HPP	Diversion	no	n.a	0
Râul Alb HPP	Diversion	Existing reservoir	n.a.	0
Plopi HPP	Diversion	no	n.a.	0
Racovita HPP	Run-of-river	New reservoir	10.57	0
Rastolita HPP	Dam	New reservoir	26.30	0
Robesti HPP	Run-of-river	New reservoir	15.77	0

Since all of the units where new reservoirs will be created have a power density which is higher than 10 W/m^2, project emissions amount to 0.

Additionality

According to Romania's "National Procedure for Using Joint Implementation (JI) Mechanism under Track I (National JI Track I Procedure)", the criteria applied for additionality assessment during the PDD determination for JI Track I projects shall be the same as under the JI Track II procedure. This implies that the additionality of the CO_2 emission reductions generated by this JI Track I project is carried out in two steps:

1. To show *how* the project activities reduce CO_2 emissions.
2. To analyse *why* the project activities would not have taken place without the JI status.

For the first step, the baseline methodology developed in Section B.1 is applied as it shows which fossil fuel-based capacity this JI Track I project would replace. The second step has been carried out during the Letter-of-Endorsement phase when additionality was addressed in the Project Idea Note (PIN) as follows:
"Romania's newest renewable obligations and aims in line with the European Commissions new energy & climate package implies that low-GHG emitting renewable electricity, such as hydropower projects are by definition additional in Romania up to the volume of the JI reserve as defined in the EU ETS National Allocation Plan of Romania. Moreover, the proposed project intends to follow the Track 1 JI route as defined in the latest Ministerial order."

This additionality assessment was endorsed by the Romanian National Committee on Climate Change (NCCC) by the issuance of the Letter of Endorsement.

The general picture for the hydropower units covered by this JI Track I project is that the investments were approved by the Government of Romania during the 1980s (with the exception of Dumitra and Bumbesti HPPs). However, for reasons explained below, the actual development of the investment and construction works took place at a very slow speed if they were not just stopped. The benefits that implementing these investments as a JI project would bring, created an incentive to move the completion of the investments forward in time before 2012, instead of somewhere after 2012.

The reasons why the units were delayed during the 1990s and what JI incentives have stimulated Hidroelectrica to re-initiate the investments after the year 2002 are described below.

1. **New capacity additions in the field of hydropower are less likely than production increase from thermal power plants**.

In Romania, electricity demand increased by about 2% in 2005 and by about 2.4% in 2006. According to Transelectrica estimations, electricity demand is expected to grow at an annual rate of 2.8-3.75% whilst peak demand is expected to grow annually by 3.3-4.2% in the period until 2020. Simultaneously, electricity supply by Romanian installations decreased during 2007 by 2.1%, where electricity imports increased by 31% (although, as argued in Section B.1, imports still have a very small share in Romania's total electricity supply: 2.3%).[16] Since the nuclear and the hydroelectric plants are already fully utilized,[17] the incremental demand will therefore have to be covered by the excess capacity of thermal power plants which requires an increase in production of coal and/or imports of natural gas. Generally, thermal power plants in Romania 'conserve' excess capacity (in 2004, coal-based power plants in Romania had an annual utilisation rate of 57% - for CFBC, PFBC, PCFBC and IGCC),[18] whereas hydropower plants operate at close to maximum capacity levels (over 90%). Consequently, under business-as-usual circumstances, thermal power production is likely to increase faster than the growth rate of power demand because relatively little increases in production from hydropower and nuclear power capacity is projected from 2008 onwards.

According to Romania's *National Communication on Climate Change to the UNFCCC* (of 2006), the installed capacity of hydropower is 6,120 MW, representing nearly 30% of Romania's total installed electricity generating capacity. The *National Communication* report states that "the country's hydropower potential is extremely large, with an estimated additional potential of over 9 GW", but also that "lack of funding is the greatest barrier to increasing current capacity."[19] A report by the Danish Ecological Council (funded by the Danish Energy Agency) in 2006[20] underlines this statement as it argues that the prospects for hydropower development in Romania are very good with a potential production capacity of 40 TWh/year, of which 12 TWh/year are utilised.[21] However, the report argues

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[16] ANRE, *Raport Privind Rezultatele onitorizãrii Pieþei De Energie Electricã*, În Luna Decembrie 2007,

[17] Units 1 and 2 of the Cernavoda nuclear power plant are presently operational at 93-97% of gross capacity. Two new units, 3 and 4, are expected to be operational by 2014 and 2015, respectively.

[18] Joint Implementation Project Design Document for Clean Coal Technologies in Romania, in: IEA Clean Coal Centre, Implementing clean coal projects under Kyoto, p. 6, 2005.

[19] Romania's National Communication, p. 20.

[20] Ecological Council (2006), Country Report Romania: Barriers and Recommendations for Development of Joint Implementation (JI) in end-use Energy Efficiency Projects in the Residential Sector.

[21] It must be noted that different figures have been published about the potential hydropower capacity in Romania. For example, the Central Europe Trust Company in its 'Romanian Power Sector Overview-Power Generation Privatisation just Starting' in 2006 estimates the technically feasible hydropower capacity at 36 TWh/year, whereas it estimates the economically feasible potential at 23-25 TWh/year. At the visit of NATO's Science and Technology Committee Sub-Committee on Energy and Environmental Security to the Romanian Parliament (May 2008) it was mentioned that approximately 51% of Romania's hydropower potential is used.

that "there are no special incentives for the implementation of hydro projects" in Romania (p.7), which underlines the above statement that the largest part of the short-term increase in power production in Romania is likely to come from thermal power plants. It should be noted though that, recently, Romanian Governmental Decision 750/2008 has been adopted which describes incentives for hydropower projects in the category of capacity below 10 MW. However, none of the hydro power units included in this JI Track I project is eligible for these incentives as one of the eligibility criteria is that the projects are not to be started (the Firiza I and II units have less than 10 MW installed power capacity but their construction has been initiated already, see Section A.2).

When expressing the capacity and output addition of this hydropower project as a percentage of the overall electricity generation capacity and output in Romania in the year 2007, it can be concluded that the project will have a share in the total hydro-based electricity supplied to the Romanian power grid of 5.18% in 2011-2012 (278.4 MW capacity increase). In terms of annual output compared to total electricity output in Romania in 2007, the project would at full scale have a share of 1.34 %. The project is expected to use 3.1% of the overall additional hydropower output potential in Romania (estimated at 9 GW, see Section B.2).

2. Delay in hydropower unit construction within Hidroelectrica.

In terms of hydropower unit management, Hidroelectrica has been involved in both the process of privatising some of its smaller (and obviously less profitable) units and commissioning new hydropower plants. According to the *Central Europe Trust Company*, in its 2006 report "*Romanian Power Sector Overview – Power Generation Privatisation just Starting*", Hidroelectrica had proposed by then to make 26 new hydropower units operational with a total rated capacity of 392 MWe (16 plants between 2006 and 2008 and 10 between 2009 and 2011; with an expected annual output of 1,400 GWh in total). However, these plans have up until now been delayed.

Against this backdrop, there has been a large uncertainty about the status of the units covered by this project. Initially, plans for their implementation were developed during the 1980s, but actual implementation has never taken place (for an overview of the history of each unit, see Section A.2). This was mainly caused by the long lasting overcapacity in the Romanian power grid, which reduced the need to build extra hydro capacity other than to replace outdated existing large-scale hydropower capacity, and by the insufficient annual turnover from the individual units. Although the project participants cannot rule out the possibility that some of the units covered by this project would eventually have become operational in the medium term after 2012, the implementation has thus far been delayed (for a summary of the project units' history, see Section A.2).

During the years 2000-2002, Hidroelectrica began to consider the possibility of implementing some of its initially planned, but still delayed hydropower units under the scheme of JI, in order to acquire additional revenues from the generation of the Emission Reduction Units (ERUs). This JI opportunity created a strong incentive to move implementation of the units forward in time before the year 2012. This would provide the project owner with a revenue stream that it would otherwise (*i.e.* by completing the investments after 2012) have missed.[22]

However, this JI development was delayed again due to a sudden personnel change in the management team of Hidroelectrica, which temporarily lowered the priority to implement new JI activities. Only during 2007, the Hidroelectrica management reconsidered the JI status of some of its HPP plans and decided to continue developing a portfolio of nine relatively small-scale and less profitable units under JI. Consequently, the delay between 2005 and 2007 due to a change in the Hidroelectrica management

[22] Obviously, it implies that there will also be operating and maintenance costs for the plants during 2011-2012 but these would have accrued anyway as the HPP units would have been implemented at a later stage after 2012 during the 30-years lifetime.

team for new HPP investments, has reduced the eventual scope for ERU generation as not the full period of the 2008-2012 crediting period could be used, but only the period 2009-2012.

3. Financial, implementation benefits from the JI project
An important benefit that the JI project status offers is to bundle the individual units and generate the ERUs as originating from one project. Under business-as-usual circumstances, the multi-location nature of the project implementation has thus far caused delays in the commissioning process. The JI status of the project and the implementation momentum that it creates significantly reduces this risk of such delays.

In addition to the economic/ financial and implementation related arguments given above of why the implementation of the project units would have been unlikely during the envisaged crediting period, also possible legal obligations for Hidroelectrica to carry out such investments have been considered. However, the present EU renewable electricity generation and other environmental norms and targets within Romania do not oblige Hidroelectrica to carry out the project. Moreover, Romania does not urgently need the CO_2 emission reduction generated by the project for compliance with its Kyoto Protocol quantitative commitments (for the period 2008-2009), since Romania's actual GHG emissions are, and are expected to remain well below the country's assigned amount of annual GHG emissions (see Section A.2).

Overall additionality conclusion
With a view to be above, it can be concluded that this project is intended to complete a series of semi-completed hydropower investment plans which have in the past been delayed at a number of occasions and for which in the short term no direct economic and government-based energy policy incentives exist. JI Track-I has created a strong opportunity to move implementation of the units forward in time before the year 2012 for financial reasons and reasons of being able to bundle the units into one programme and thus avoid further delays.

B.3. Description of how the definition of the project boundary is applied to the project:

The project boundary comprises all thermal non-must-run power producing installations under the EU ETS in the entire Romanian electricity grid.

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

Date of completion of the baseline study:
13 August 2008

Name of the person/entity setting the baseline:
Wytze van der Gaast
Joint Implementation Network (JIN)
Laan Corpus den Hoorn 300
9728 JT Groningen
The Netherlands
tel.: 00 31 50 5248430
e-mail: jin@jiqweb.org

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

2009

C.2. Expected operational lifetime of the project:

30 years

C.3. Length of the crediting period:

4 years (2009-2012)

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

As explained in Section B.1, the baseline methodology developed for this JI Track 1 project will enable the calculation of a CO_2 emission grid factor for Romania on an *ex post* basis using EU ETS verified data for Romania. For the monitoring plan for this project, the approved consolidated monitoring methodology ACM0002 "*Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources*" will be used as it can be considered the best available, approved methodology for this type of projects. As explained in Section B.1, the aggregated data and other information required are available and can be assessed and reviewed whilst individual fossil fuel fired power plant data is accessible from the Romanian Energy Authority (ANRE) and the Romanian Environmental Protection Agency (NEPA/ANPM). This monitoring plan only considers electricity supplied to the grid (and therefore it does not take into consideration the electricity produced by the units for on-site use), as well as heat output from non-must run CHP plants.

This monitoring methodology is expected to improve the accuracy of the baseline CEF by its yearly calculation based on verified data for each relevant EU ETS installation of Romania.

D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

As explained in Section B.2, some of the nine HPP units covered by this JI Track 1 project will be associated with the construction of new reservoirs.

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

As the power density (*PD*) of each of the power unit with a reservoir is greater than 10 W/m^2, the project emissions can be considered zero by default.

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:

ID number (*Please use numbers to ease cross-referencing to D.2.)*)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. $GEN_{a,y}$	Electricity supplied to the grid by the Project	Meters at each HPP	MWh	m	Hourly measurement and monthly recording	100%	Electronic	Electricity supplied to the grid by the Project; to be supplied by Hidroelectrica.
2. $CO_{2,i,y}$	CO_2 emissions in year y of non-CHP installations selected as marginal power production plants in Romanian under the EU ETS	http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf; as well as on the CITL Internet site of the European Commission: http://ec.europa.eu/environment/climat/emission/citl_en.htm	tonnes	m	Yearly	0%	Electronic	CO_2 emissions of EU ETS-covered installations are monitored and verified for year *y* according to the EU ETS rules as applied under the supervision of MESD
3. $CO_{2,j,y}$	CO_2 emissions in year y of CHP installations selected as marginal power production plants in Romanian under the EU ETS	http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf; as well as on the CITL Internet site of the European Commission: http://ec.europa.eu/environment/climat/emission/citl_en.htm	tonnes	m	Yearly	0%	Electronic	CO_2 emissions of EU ETS-covered installations are monitored and verified for year *y* according to the EU ETS rules as applied under the supervision of MESD

4. $GEN_{i,y}$	Electricity generated during year y by non-CHP non-must run power producing installations in Romania covered by the EU ETS	ANRE	MWh	m	Yearly	50%	Electronic	These data are considered confidential and will be included by ANRE in the Excel sheet developed for the baseline calculations for this project. The completion of the Excel sheet by ANRE could be subject to monitoring.
5 $ENER_{i,y}$	Electricity and heat generated during year y by marginal CHP installations in Romania covered by the EU ETS	ANRE	MWh	m	Yearly	50%	Electronic	These data are considered confidential and will be included by ANRE in the Excel sheet developed for the baseline calculations for this project. The completion of the Excel sheet by ANRE could be subject to monitoring.
6. EF grid,y	CO_2 emission factor of the grid	Published by MESD (ANPM; ANRE based)	tCO_2/MWh	c	Yearly	100%	Electronic	Determined using the EU ETS verified data based protocol by ANRE/ANPM

The spreadsheet to be used for reporting monitoring data is attached as Annex 2 ($EF_{grid,y}$).

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

The formulae used to estimate baseline emissions follow the Baseline Methodology as described in Section B.2.

$$BE_y = \sum_{a=1}^{9}((GEN_{a,y} - GEN_{a,baseline})\, x\, EF_{grid,y}) \qquad (2)$$

Where,

BE_y = Baseline emissions in year y in tonnes CO_2 per year.

$GEN_{a,y}$ = Electricity supplied by project unit *a* to the grid (MWh); As the units in this project are not retrofit activities, $GEN_{a,\ baseline} = 0$. $GEN_{a,y}$ will be collected from Hidroelectrica (see Section D.1.1.3).

a = 1..9 = The nine HPP units under this JI Track 1 project.

$EF_{grid,\ y}$ = A modified CO_2 emission factor of the Romania grid in year y; it is expressed in g/kWh (see the methodology description in Section B.1; equation 1).

The first year for which the baseline will be prepared is 2009 based on data that will become available during the first six months of 2010. Subsequently, baseline emissions will be calculated for the following years.

D. 1.2. Option 2 – Direct monitoring of emission reductions from the project (values should be consistent with those in section E.):

Since Option 1 in D.1.1 above was applied, this section is not applicable.

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

Not applicable.

D.1.3. Treatment of leakage in the monitoring plan:

The main emissions potentially giving rise to leakage in the context of this project are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land cover with water, but, in the case of the proposed project and for every project that applies the ACM0002 Methodology, there is no need to consider these emission sources.

For this kind of projects, these emissions are thought to be comparable to the life cycle emissions that would result from the eventual construction and operation of alternative capacity. The life-cycle emission of alternative power generation plants, in particular of fossil fuel power plants, are typically higher than from hydro-power plants when including emission due to the mining, refining and transportation of fossil fuel.

On the other hand, the Project does not claim emission reduction from these activities. Therefore no significant net leakage from the above activities was identified.

Consequently, no sources of leakages were identified, and therefore no data will be collected, archived and summarized in the following table.

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

Not applicable

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

Since the Project is a hydropower project and does not give rise to direct GHG emissions, the emission reductions (ER) are equal to the baseline emissions.

$$ER_y = \sum_{i=1}^{9}(BE_y - PE_y - L_y) = \sum_{i=1}^{9} BE_y \; ;$$

Where,

BE_y = Baseline emissions in year y in tonnes CO_2 per year.

PE_y = 0 (as has been explained in Section D.1.1), and

L_y = 0 [leakage, see Section D.1.3.2]

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

The environmental monitoring programmes will be developed in accordance with the Romanian legislation; permits/licences are requested from the authorities.

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1. $GEN_{a\,y}$	*Low*	*QA/QC procedures shall be adopted for monitoring the energy production as accurately as possible. Meters will be subject to regular maintenance and testing to ensure accuracy. Sales record to the grid and other records are to be used to ensure the consistency.*
2. $CO_{2,i,\,y}$	*Low*	*The annual data for carbon emissions of marginal, non-CHP electricity production installations will be taken from the MESD EU ETS database (http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf).*
3. $CO_{2,j,\,y}$	*Low*	*The annual data for carbon emissions of marginal, non-must-run CHP electricity production installations will be taken from the MESD EU ETS database (http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf).*
4. $GEN_{i,\,y}$	*Low*	*QA/QC procedures shall be adopted to ensure regular annual revision of ANRE sustained electricity production data for the Romanian EU ETS installations concerned.*
5. $ENER_{i,y}$	*Low*	*QA/QC procedures shall be adopted to ensure regular annual revision of ANRE sustained electricity and heat production data for the Romanian EU ETS installations concerned.*
6. $EF_{grid,y}$	*Low*	*QA/QC procedures shall be adopted to ensure regular annual revision of carbon emission factor calculated using the EU ETS installation level verified CO2 emissions and ANRE sustained electricity production data*

D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:

In the context of JI projects, the monitoring plan (MP) describes the systematic surveillance of a project's performance by measuring and recording performance-related indicators relevant to the project or activity. This MP defines a standard to monitor the project performance in terms of its GHG reductions, in conformity with all relevant JI project monitoring criteria.

The nine HPPs will have a modern metering system installed, so that each kWh produced and delivered to the grid can be monitored. The metering equipment will be installed according to the regulation of the utility. Record of the units' electricity generation will be archived for a period of at least ten years.
The MP is fully consistent with the scenario identified in the baseline study and it provides the basis for the projection of the GHG emissions reductions (ERUs) that the project expects to generate over its lifetime.

The MP also provides a practical framework for the collection and management of project performance data which will be used for retrospective verification of actual ERUs generated.

Verification is the periodic auditing by a third party of monitoring results, the assessment of achieved ERUs and of the project's continued conformance with all relevant project criteria. This MP does not contain specific guidelines on emission reduction auditing and verification, but it provides sufficient detail on the project structure, the proposed data monitoring methodologies and relevant operational issues, to allow an independent verifier to develop suitable auditing and verification procedures for portfolio project.

The MP will constitute integral part of the Hidroelectrica Quality Management System and will be embedded in the overall Standard Operating Procedures.

The MP must be used by the operator when planning and implementing the project activity and during the project's operation. Adherence to the instructions in the MP is necessary for the project operators to measure and track the project impacts and prepare for the verification process that must be undertaken to confirm the achieved ERUs. The MP is thus the basis for the production and delivery of ERUs to the buyer, and for any related revenue stream that the operator expects to receive.

The MP assists the operator in establishing a credible, transparent, and adequate data measurement, collection, recording and management system to successfully develop and maintain the proper information required for the verification and certification of the achieved ERUs and other project outcomes. The MP ensures environmental integrity and accuracy of crediting ERUs by only allowing actual ERUs to be accounted for after they have been achieved. The MP must therefore be used throughout the lifetime of the project by being:

- Adopted as a key input into the detailed planning of the project; and
- Included into the operational manuals of the implemented projects.

The MP can be updated and adjusted to meet operational requirements, provided such modifications are approved by the verifier during the process of initial or periodic verification.

The baseline grid emission factor will be determined using the document "*Protocol for the annual establishment of carbon emission factor for grid-connected JI project on the basis of EU ETS verified emissions"* and performed annually by ANRE and NEPA/APNM under co-ordination of MESD. The emission factors will be calculated *ex-post* from actual power generation and fuel consumption data of selected EU ETS installations.

The technical staff of the subsidiaries and the responsible person of distributing local operators will both check the net electricity produced. All operational data will be recorded while the delivery and sales documentation copies will be stored for documentation.

As no leakage needs to be considered in this project, no operational and management structure will be implemented to monitor such effects.

All operational staff will have annual training scheme that include training on monitoring issue.

MP will be constituted by a workbook (in excel format), fully consistent with the baseline scenario identified. The workbook provides the basis for an easy calculation of the projection of the GHG emissions reduction that the project expects to generate over its lifetime taking the data to be monitored as input and automatically calculating the GHG emission reductions for each crediting year.

Responsible for monitoring are the operational staff. Responsible for checking the monitored data, supervision the monitoring and checking the calculation of emission reductions is the responsible personnel appointed by Commercial Division Director, Mr Eugeniu Tanase. Below, the activities to be completed and the responsibilities assigned for each activity under this MP are described.

Table D.1: MP management and operating system		
Activities	**HPPs Operator and Management**	**Responsible**
Monitoring system	Review MP and suggest adjustments if necessary Develop and establish management and operations system Establish and maintain monitoring system and implement MP Prepare for initial verification and project commissioning	Project team
Data Collection	Establish and maintain data measurement and collection systems for all MP indicators Check data quality and collection procedures regularly	Project team
Data computation	Enter date in MP workbooks Use MP workbooks to calculate emission reductions	Project team
Data storage systems	Implement record maintenance system Store and maintain records (paper trail) Implement sign off system for completed worksheets Forward monthly and annual worksheet outputs	Project team
Performance monitoring and reporting	Analyse data and compare project performance with project targets Analyse system problems and recommend improvements (performance management) Prepare and forward periodic reports	Project team
MP Training and Capacity Building	Develop and establish MP training, skills review and feedback system Ensure operational staff trained and enabled to meet needs of MP Consider providing training support to national authorities and other JI projects	Project team
Quality assurance, audit and verification	Establish and maintain quality assurance system with a view to ensuring transparency and allowing for audits and verification Prepare for, facilitate and co-ordinate audits and verification process	Project team

D.4. Name of person(s)/entity(ies) establishing the monitoring plan:

Hidroelectrica S.A.
Str. Constantin Nacu nr. 3,
Sector 2, 70219,
Bucharest
Romania

The entity establishing the monitoring plan is a project participant.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Table E.1.1 Project emissions during 2008-2012					
	2009	2010	2011	2012	2009-2012
Project emissions (t CO_2)	0	0	0	0	0

As explained in Section B.2, some of the nine HPP units covered by this JI Track 1 project will cause the construction of new reservoirs, but the power density calculated for them are > 10 W/m^2, therefore:

$$PEy = 0$$

E.2. Estimated leakage:

As reported in the chapter D.2.3 no sources of leakages were identified, therefore:

$$Ly = 0$$

E.3. The sum of E.1 and E.2.:

Based on paragraph E.1 and E.2, it is assumed that $PEy + Ly = 0$;

Table E.3.1. Project emissions during 2008-2012					
	2009	2010	2011	2012	2009-2012
Project emissions (t CO_2)	0	0	0	0	0
Leakage	0	0	0	0	0
Sum E.1 and E.2	0	0	0	0	0

E.4. Estimated baseline emissions:

The formulae used to estimate baseline emissions follow the Baseline Methodology as described in Section B.2.

$$BE_y = \sum_{a=1}^{9} ((GEN_{a,y} - GEN_{a,baseline}) \, x \, EF_{grid,y})$$

where,

BE_y = Baseline emissions in year y in tonnes CO_2 per year.

$GEN_{a,y}$ = Electricity supplied by project unit *a* to the grid (MWh); As the units in this project are not retrofit activities, $GEN_{a,baseline}$ = 0. $GEN_{a,y}$ will be collected from Hidroelectrica (see Section D).

$EF_{grid, y}$ = A modified CO_2 emission factor of the Romania grid in year y; it is expressed in g/kWh (see the methodology description in Section B.1; equation 1).

a = 1..9 = Nine HPP units in this JI Track 1 project.

The first year for which the baseline will be prepared is 2009 based on data that will become available during the first six months of 2010. Subsequently, in 2011, 2012, 2013, baseline emissions will be calculated for 2010, 2011 and 2012, respectively.

The annual electricity generation is given by the project's annual electricity dispatched to the grid times the CO_2 emission rate of the estimated baseline.

The electricity dispatched to the grid by each HPP ($GEN_{a,y}$) will be yearly monitored while the emission factor is calculated as reported in Section B.2 and Annex 2.

The nine HPPs are expected to generate 1532.35 GWh in the period 2009-2012 and to reduce the emissions of 1,613,564 tonnes of CO_2 during 2008-2012 (see Table E.4.1).

Table E.4.1. Baseline emissions during 2008-2012

	2009	2010	2011	2012	2009-2012
Baseline emissions (t CO_2)	37,582	200,552	443,674	636,013	**1,317,821**

E.5. Difference between E.4 and E.3 representing the emission reductions of the project:

Since project emissions and leakages are zero, the emission reductions are those calculated in Section E.4:

$$ERy = BEy - PEy - Ly = BEy \; ;$$

The following table summarises the emission reductions for each HPP during the crediting period.

Therefore the expected emissions reductions are: 1,317,821 tCO_2 in the period 2008-2012 (see Table E.5.1).

Table E.5.1. Emission reductions during 2008-2012

	2009	2010	2011	2012	2009-2012
Baseline emissions (t CO_2)	37,582	200,552	443,674	636,013	**1,317,821**

E.6. Table providing values obtained when applying formulae above:

Table E.6.1. Baseline emissions and CO_2 emission reductions during 2008-2012

2009

	Annual output (GWh)	**CO_2 baseline emission factor (g/kWh)**	**CO_2 baseline emissions (tonnes)**	**CO_2 emissions (tonnes)**	**CO_2 emission reductions (tonnes)**
	A	B	$((A*10^6) * B)/10^6$		
Dumitra HPP	0	860	-	0	0
Bumbesti HPP	0	860	-	0	0
Nehoiasu II HPP	0	860	-	0	0
Firiza I + II HPP	0	860	-	0	0
Raul Alb HPP	30	860	25,800	0	25,800
Plopi HPP	13,7	860	11,782	0	11,782
Racovita HPP	0	860	-	0	-
Rastolita HPP	0	860	-	0	-
Robesti HPP	0	860	-	0	-
Total 2009	43,7	860	37,582	0	37,582

2010

	Annual output (GWh)	**CO_2 baseline emission factor (g/kWh)**	**CO_2 baseline emissions (tonnes)**	**CO_2 emissions (tonnes)**	**CO_2 emission reductions (tonnes)**
	A	B	$((A*10^6) * B)/10^6$		
Dumitra HPP	0	860	-	0	-
Bumbesti HPP	0	860	-	0	-
Nehoiasu II HPP	0	860	-	0	-
Firiza I + II HPP	24	860	20,640	0	20,640
Raul Alb HPP	60.6	860	52,116	0	52,116
Plopi HPP	27.4	860	23,564	0	23,564
Racovita HPP	37	860	31,820	0	31,820
Rastolita HPP	47	860	40,420	0	40,420
Robesti HPP	37	860	31,820	0	31,820
Total 2010	233.2	860	200,552	0	200,552

2011

	Annual output (GWh) A	CO_2 baseline emission factor (g/kWh) B	CO_2 baseline emissions (tonnes) $((A*10^6) * B)/10^6$	CO_2 emissions (tonnes)	CO_2 emission reductions (tonnes)
Dumitra HPP	49	860	42,140	0	42,140
Bumbesti HPP	88.5	860	76,110	0	76,110
Nehoiasu II HPP	0	860	-	0	-
Firiza I + II HPP	47.2	860	40,592	0	40,592
Raul Alb HPP	60.6	860	52,116	0	52,116
Plopi HPP	27.4	860	23,564	0	23,564
Racovita HPP	74	860	63,640	0	63,640
Rastolita HPP	94.6	860	81,356	0	81,356
Robesti HPP	74.6	860	64,156	0	64,156
Total 2011	515.9	860	443,674	0	443,674

2012

	Annual output (GWh) A	CO_2 baseline emission factor (g/kWh) B	CO_2 baseline emissions (tonnes) $((A*10^6) * B)/10^6$	CO_2 emissions (tonnes)	CO_2 emission reductions (tonnes)
Dumitra HPP	98	860	84,280	0	84,280
Bumbesti HPP	177	860	152,220	0	152,220
Nehoiasu II HPP	86.15	860	74,089	0	74,089
Firiza I + II HPP	47.2	860	40,592	0	40,592
Raul Alb HPP	60.6	860	52,116	0	52,116
Plopi HPP	27.4	860	23,564	0	23,564
Racovita HPP	74	860	63,640	0	63,640
Rastolita HPP	94.6	860	81,356	0	81,356
Robesti HPP	74.6	860	64,156	0	64,156
Total 2012	739.55	860	636,013	0	636,013
Total 2009-2012			**1,317,821**	**0**	**1,317,821**

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

For the **Bumbeşti and Dumitra HPPs**, the Environmental Impact Assessment (EIA) related to the entire hydropower project Livezeni-Bumbeşti, which was developed in 2003, contains a statement on the possibility to use extracted sterile material from the headrace construction work in the road and railway construction. No other specific statements were made. Based on this EIA, in 2003 the environmental permit was obtained.

For **Nehoiaşu II HPP** an EIA report on "Hydropower works Surduc-Siriu – stage Surduc-Nehoiaşu" was initially prepared in 2004, which was followed by an addendum to the EIA in 2006 after some technical modifications of the project. The EIA includes statements and conditions for management of construction waste, stabilisation of the sterile material landfill, soil coverage and reforestation. In 2005, based on this EIA, the environmental permit was obtained for this HPP.

In 1996, a technical report was prepared for the **Firiza I + II HPP** regarding the project works and the documentation for a "Territorial Development Site Plan" for which an environmental permit was obtained.

For **Plopi HPP** an EIA for the entire Subcetate-Simeria project was developed in 1997 and it contained statements regarding site management requirements and rehabilitation of all temporarily occupied areas. The environmental permit was obtained in 2005.

For **Racovita HPP and Robesti HPP** the EIA report on "Hydropower works on Olt River, Cornetu – Avrig sector", prepared in 2002, contains statements and condition for construction waste management, stabilization of the sterile material landfill, soil covering and reforestation. In 2005, based on this EIA, the environmental permit was obtained.

For **Râul Alb HPP** a water management permit was obtained in 1980 and in 2008, the water management licence was issued. In order to obtain the environmental licence a new EIA for the project will be developed.

For **Rastolita HPP** no EIA was developed as the environmental permit was obtained in 1990 and the legislation at that time did not require such documentation.

In conclusion, for six hydropower plants under this JI Track I project, EIAs have been carried out: Bumbeşti, Dumitra, Nehoiaşu II, Plopi, Racovita and Robesti. Based on these assessments it has been concluded that the plant construction and implementation activities are in conformity with the relevant Romanian and EU legislation on environmental protection. This has facilitated the issuance of environmental permits for the units.

For the three HPP for which no EIA has been carried out (Râul Alb, Rastolita, and Firiza I+II), all the required studies for the EIA will be done before commissioning of these plants, in order to obtain the Environmental Licenses.

A specific aspect of the EIAs was that the electricity produced by hydropower plants is clean energy and reduces, in addition to CO_2 emissions, the emissions of NOx, SO_2, VOC, solid particles which would be otherwise produced in the thermal power plant. As such, the project contributes to meeting EU requirements for Romania regarding electricity generation from renewable energy sources.

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

No environmental impacts were considered significant by the project participants.

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

As a standard procedure for obtaining environmental permits for hydropower plants, (local) public debates need to be held for the plants covered by this project and public comments taken into account when developing further work.

For all HPP which obtained environmental permits after 1997, public consultation meetings were held together with the local Environmental Protection Agencies. No comments were made. The only exception is Rastolita HPP which obtained the permit in 1990 when the legislation did not require public hearings. However, when the power plants under this project will be commissioned (see the Table in Section A.2), they will proceed to obtain Environmental Licenses. As part of that final process, a new public stakeholder consultation will be held and the comments to be received from stakeholders will be included in the environmental monitoring programmes

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	SC HIDROELECTRICA SA
Street/P.O.Box:	Constantin Nacu nr. 3
Building:	
City:	Bucuresti
State/Region:	România
Postal code:	70219
Country:	România
Phone:	021.30.32.500
Fax:	021.30.32.564
E-mail:	<secretariat.general@hidroelectrica.ro>
URL:	www.hidroelectrica.ro
Represented by:	Traian Oprea
Title:	Mr
Salutation:	General Manager
Last name:	Oprea
Middle name:	
First name:	Traian
Department:	
Phone (direct):	021.30.32.578
Fax (direct):	021.30.32.564
Mobile:	
Personal e-mail:	

Organisation:	SenterNovem
Street/P.O.Box:	Catherijnesingel 59
Building:	
City:	Utrecht
State/Region:	
Postal code:	3503 RE
Country:	The Netherlands
Phone:	+31 30-214 7829
Fax:	+31 30-231 6491
E-mail:	z.lengyel@senternovem.nl
URL:	www.carboncredits.nl
Represented by:	Zsolt Lengyel
Title:	Mr
Salutation:	
Last name:	Lengyel
Middle name:	
First name:	Zsolt
Department:	Global Cooperation Energy & Climate
Phone (direct):	+31 30-214 7829
Fax (direct):	+31 30-231 6491
Mobile:	
Personal e-mail:	z.lengyel@senternovem.nl

Annex 2

BASELINE INFORMATION

For the calculation of the modified grid-based CO_2 baseline emission factor, an Excel worksheet has been developed with the following purposes:

1. Calculation of aggregate CO_2 emissions of marginal Romanian ETS-covered power producing installations during the baseline year.
2. Calculation of aggregate electricity output for the marginal Romanian power producing installations covered by the EU ETS during the baseline year.

Table Annex 2.1 below shows the worksheet in which for the individual installation CO_2 emissions and electricity output must be filled in and which leads to a total CO_2 emissions figure for all ETS covered power generation installations in Romania in year *y*, which are not must-run plants.

The **CO_2 Emission Factor data collection protocol** developed for the baseline calculations consists of the following steps:

1. From the list of Romanian EU ETS installations annually published on the Internet site of MESD (http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf) those installations will be selected which generate electricity for the Romanian electricity grid. In Annex 2, this has been done for the year 2007, resulting in a list of 44 installations (Table Annex 2.1).
2. The Romanian Energy Market Authority ANRE will, based on its professional judgement, remove from this EU ETS list those power producing installations which have had a preferential status in the dispatch procedure (*e.g.* co-generation for district heating) and coal-based plants that are "unlikely to appear at the margin" must-run installations and which have low variable costs (*e.g.* Turceni and Rovinari; as an illustration, these two plants have been cross-out in Table Annex 2.1).
3. This final worksheet list with marginal, **baseline** installations will be copied: one copy stays with ANRE and one copy is provided to Romanian Environmental Protection Agency NEPA/ANPM.
4. ANRE will complete its copy of the worksheet with the power output data for the selected ETS installations in Romania for the baseline year. It is important to note that these output data are confidential and will not be disclosed to the project participants. The ANRE copy of the worksheet will only be made available for verification purposes. The total electricity production figure for grid-based marginal capacity ETS installations will be provided by ANRE to MESD and/or to NEPA/ANPM.
5. In the NEPA/ANPM copy of the worksheet, CO_2 emission data for each installation will be collected by NEPA/ANPM from the MESD EU ETS database (http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf) and filled in in the worksheet. This results in a total CO_2 emission figure for the selected marginal ETS installations.
6. NEPA/ANPM will deduct the CO_2 emissions from heat-only boilers (HOB) in case an installation includes one or more HOBs;
7. NEPA/ANPM will provide MESD with the total annual CO_2 emissions related to electricity production by marginal ETS installations, excluding the emissions from heat only boilers.
8. The final phase of the CO_2 Emission Factor Data Collectio Protocol consists of dividing the total CO_2 emissions figure by the total electricity output in order to obtain a CO_2 emission factor for baseline determination purposes (expressed in $grCO_2/kWh$). MESD will calculate this factor and publish it on its website from where JI project participants will obtain it for the purpose of calculating JI project emission reductions. Therefore, individual installation data will not be disclosed to any Project Participants.

An important aspect in the protocol is to establish a working relationship with NEPA/ANPM and ANRE under the co-ordination of the MESD and The Ministry of Economy and Finance. During 2008-9 the baseline calculation and data collection process will be tested with the organisations concerned and in collaboration with MESD. This will enable the establishment of a working relationship among the organisations from which required data will be required during the crediting lifetime.

Table Annex 2.1

	ETS power producing installations, Romania	Annual CO_2 emissions (excl. heat-only boilers) for each installation - by *NEPA/ANPM*	Total electricity output (only aggregate figure provided to MESD and/or NEPA/ANPM) - by *ANRE*
1	1 SC Termoelectrica SA - SE Borzesti		
2	2 SC Termoelectrica SA - SE Braila		
3	SC Termoelectrica SA - SE Doicesti		
4	SC Complex Energetic Craiova SA - SE Isalnita		
~~5~~	~~SC Complex Energetic Rovinari SA~~		
~~6~~	~~SC Complex Energetic Turceni SA~~		
7	SC Electr.centrt.Bucuresti-CET Iernut		
8	SC CET ARAD SA - CET Lignit		
9	SC CET ARAD SA - CET Hidrocarburi		
10	SC TERMOFICARE 2000 SA - Pitesti Sud		
11	SC TERMOFICARE 2000 SA - Gavana		
12	SC TERMON SRL		
13	SC CET SA Bacau - Inst nr 1		
14	SC Electrocentrale Oradea SA		
15	SC CET Brasov SA - CET Brasov		
16	SC CET SA Braila		
17	SC Electr.centrt.Bucuresti-CET Progresu		
18	SC Electr.centrt.Bucuresti-CET Bucuresti Vest		
19	SC Electr.centrt.Bucuresti-CET Titan		
20	SC Electr.centrt.Bucuresti-CET Grozavesti		
21	SC Electr.centrt.Bucuresti-CET Bucuresti Sud		
22	SC Vest Energo SA		
23	SC Electr.centrt.Bucuresti-SE Const.-CET Palas		
24	CCNE CT ZONA SOMES NORD		
25	SC CET ENERGOTERM RESITA SA		
26	SC Termica SA Targoviste		
27	SC Compl.Energ.Craiova SA-SE Craiova II		
28	SC ELECTROCENTRALE GALATI SA		
29	SC Uzina Termoelectrica Giurgiu SA		
30	SC Termoelectrica SA - SE Paroseni		
31	SC Electrocentrale Deva SA		
32	SC CET IASI SA CET Iasi I		
33	SC CET IASI SA CET Iasi II		
34	R.A.A.N. Sucursala ROMAG TERMO		
35	SC DALKIA TERMO PRAHOVA SRL Punct de lucru Brazi		
36	SC UZINA ELECTRICA ZALAU SA		
37	SC CET Govora SA		
38	SC TERMICA SA Suceava - CET pe huila		
39	CET TIMISOARA Centru		
40	SC ENET SA Focsani		
41	SC CET GRIVITA SRL		
42	Societ. National "Nucl.electr." SA-Dir.CNE Cern.v.		
43	SC Enercompa SRL		
44	SC NUONSIB SRL		
	Total		

Annex 3

Maps of the hydropower plants under this project

Annex 4

ACM	Approved Consolidated Methodology
ANPM /NEPA	Romanian National Environmental Protection Agency
ANRE	Autoritatea Nationalã De Reglementare În Domeniul Energiei - Romanian Energy Market Authority
CDM	Clean Development Mechanism
CEF	CO_2 Emission Factor (for baseline calculation)
CFBC	Circulating fluidised bed combustion
CHP	Combined Heat and Power
CITL	Community Independent Transaction Log
CO_2	Carbon dioxide
DFP	Designated Focal Point
EIA	Environmental Impact Assessment
ERPA	Emission Reduction Purchase Agreement
ERU	Emission Reduction Units
ETS	EU Emissions Trading Scheme
GHG	Greenhouse gas
GWh	Gigawatt-hour
HOB	Heat-only boilers
HPP	Hydropower plant
IGCC	Integrated Gasification Combined Cycle
JI	Joint Implementation
JISC	JI Supervisory Committee
kV	kilovolt
KWh	Kilowatt-hour
LoA	Letter of Approval
MBsl	Meter over Black sea level
MESD	Romanian Ministry for Environment and Sustainable Development
MP	Monitoring Plan
msl	Meter above Sea Level
MW	Megawatt
NATO	North Atlantic Treaty Organisation
NEPA/ANPM	Romanian National Environmental Protection Agency
PCFBC	Pulverised Circulating fluidised bed combustion
PD	Power density
PE	Project emissions
PFBC	Pressurized fluidized-bed combustion
SA	Romanian Joint stock company
SEN	Sistemul Energetic National – Romanian electricity grid
TPP	Thermal power plant
TWh	Terawatt-hour
UNFCCC	United Nations Framework Convention on Climate Change
VOC	Volatile Organic Compounds

Annex 5

Contingency plan when using ETS verified emissions data

Introduction

This Annex describes a method for calculating a CO_2 baseline emission factor for grid-connected electricity production JI projects in case not all data requirements for the methodology described in Section B.1 are met by the time the methodology needs to be applied for the first time during the crediting lifetime of this JI Track 1 project.

The reason for including this 'back-up methodology' as an Annex in the PDD is as follows. For the baseline methodology in Section B.1 data will be used from the Romanian power sector installations under the EU ETS. The advantage of this data set is that it contains monitored and independently verified CO_2 emission data at installation level. These data are published annually on the Internet site of the Romanian Ministry of Environment and Sustainable Development (MESD) and on the Internet site of the Community Independent Transaction Log (CITL) of the European Commission.[23] From this list, electricity-producing installations are selected with the exclusion of must-run or 'unlikely to be disconnected' coal-fired power plants (based on expert judgement of ANRE - Energy Market Authority in Romania - officials, see Section B.1). In addition, in accordance with the explanation in Section B.1, must-run CHPs delivering heat to the residential sector will be excluded from the baseline. CHPs delivering heat for different purposes, such as steam for industrial use or heat for cooling towers, will be included in the baseline calculation. In the latter case, the CO_2 emissions will be expressed in terms of energy output (heat and electricity) of the CHP plant.

However, as explained in Section B.1, this list needs to be modified since some electricity producing installations also run heat-only boilers within their system boundary. In order to arrive at an electricity-production-only CO_2 emission figure, the CO_2 emissions caused by heat-only boilers need to be subtracted from the overall annual emission level of the installations concerned (see step 6 in the **CO_2 Emission Factor Data Collection Protocol** in Section B.1 and Annex 2). It must be noted though that presently, in accordance with the Romanian transposition of the EU ETS Directive, CO_2 emissions of Romanian EU ETS installations are verified at the installation level and no distinction is made between emissions originating from electricity production and heat-only production. According to the regulation, the verified data available for MESD, NEPA/ANRE and the European Commission are of an aggregate nature. The present monitoring protocol of the EU ETS installations therefore requires the individual annual reporting of the various sources within an EU ETS installation only for the discretion of the verifier, in addition to the regular laboratory checks of the fossil fuels burnt.

Based on consultation with NEPA/ANPM experts, it has become clear that NEPA/ANPM aims at operationalising a reporting system to be used for the following ETS reporting years which would distinguish between CO_2 emissions origination from electricity production (also from co-generation) and heat-only production. Moreover, Romania's intention to improve its GHG reporting to the UNFCCC necessitates further steps in establishing country-specific fuel and technology-specific emission factors. With this reporting system operational, the modification required to exclude heat-only boiler emissions from the EU ETS reported CO_2 emissions could be made. Fort this JI Track 1 project, this would imply that the baseline methodology of Section B.1 and Annex 2 can be used in 2010, when a baseline needs to be determined *ex post* for the project's first crediting year 2009.

[23] http://www.eu-ets.ro/files/Emisii_verificate_2007_29_aprilie_2008.pdf; as well as on the CITL Internet site of the European Commission: http://ec.europa.eu/environment/climat/emission/citl_en.htm

ACM0002 as a fall back methodology

However, should complications arise and this reporting system be delayed, then the methodology for calculating a CO_2 baseline emission factor, as described in CDM methodology ACM0002, would be used.[24] Based on ACM0002 the following formula for calculating a baseline emission factor for the Romanian electricity grid would apply:

$$EF_{grid,y} = \frac{(\sum_{j=1}^{x}(F_{i,j,y} * NCV_i * EF_{carbon,i} * (44/12) * OXID_{i}) + \sum_{h=1}^{z}(F_{i,h,y} * NCV_i * EF_{carbon,i} * (44/12) * OXID_i))}{(\sum_{j=1}^{x} Gen_{j,y} + \sum_{h=1}^{z} ENER_{h.y})}$$

Where,

$EF_{grid,,y}$	=	A modified CO_2 emission factor of the Romania grid in year y; it is expressed in g/kWh.
$F_{i,j,y}$	=	The amount of fuel *i* (in a mass or volume unit) consumed by relevant Romanian ETS-based non-CHP installations *j* in year *y*;[25]
NCV_i	=	The net caloric value (energy content) per mass or volume unit of a fuel *i*.
$EF_{carbon,\ i}$	=	The carbon emission factor per unit of energy of the fuel *i* (tonne carbon per Mega Joule).
$OXID_i$	=	The oxidation factor of the fuel *i*.
$F_{i,h,y}$	=	The amount of fuel *i* (in a mass or volume unit) consumed by relevant Romanian ETS-based CHP installations *h* in year *y*;[26]
$GEN_{j,y}$	=	The electricity (MWh) delivered to the Romanian grid by installation *j* in year *y*. These figures are based on the total electricity production of installation *j* minus the electricity used onsite by *j*.
$ENER_{h,y}$	=	The total of electricity production of marginal CHP installation *j* minus the electricity used onsite by *h* and the heat production of *h* in year *y* expressed in MWh.

For applying this formula the following data are needed:

- **Fossil fuel consumption data for Romanian power sector installations in the ETS that operate at the margin ($F_{i,j,y}$):** These data will be collected for each year of the crediting period of the project with the help of ANRE. The data requested from ANRE are the annual consumption figures for each fossil fuel type at the level of Romanian ETS-based power producing installations.
- **The energy content for each fossil fuel consumed (NCV_i)**: This is expressed as the net caloric value per mass (*e.g.* in case of solid fuels; megajoule/tonne) or volume unit (*e.g.* in case of gas; megajoule/m^3). Although default IPCC (2006) factors could be used for this, it is preferred to use specified factors for Romania. These will be provided by NEPA and/or ANRE.
- **Romanian carbon emission factors for each fossil fuel ($EF_{carbon,i}$)**: Although default IPCC (2006) factors could be used for this, it is preferred to use specified factors for Romania. These will be provided by NEPA and/or ANRE. The factors will subsequently be multiplied by 44/12 in order to obtain the molecular density of CO_2.

[24] As explained in Section B.1, of the CDM Executive Board approved baseline and monitoring methodologies, ACM0002 is the most applicable to this grid-connected renewable energy power production project (next to using EU ETS verified data).

[25] Relevant installations are those for which it can reasonably be expected that they appear in the margin of being disconnected when new capacity comes online. Must-run and/or low operational cost power production technologies, power production capacity with a preferential dispatch status will not be included in the baseline CO_2 emission factor.

[26] Relevant installations are those for which it can reasonably be expected that they appear in the margin of being disconnected when new capacity comes online. Must-run and/or low operational cost power production technologies, power production capacity with a preferential dispatch status will not be included in the baseline CO_2 emission factor.

- **Oxidation percentage when burning a fuel ($OXID_i$).** Although default IPCC (2006) factors could be used for this, it is preferred to use specified factors for Romania. These will be provided by NEPA and /or ANRE.
- **Electricity supply to the grid by each of the ETS installations operating at the margin - $GEN_{j,y}$.** These data will be provided by the *Autoritatea Nationalã De Reglementare În Domeniul Energiei* (Energy Market Authority in Romania, ANRE).

Application of ACM0002 within the context of the Hidroelectrica Hydropower Development Portfolio Track 1 JI Project

For the calculation of this modified grid-based CO_2 baseline emission factor, an Excel spreadsheet model has been developed to apply the above formula for all fossil fuels *i* consumed in year *y* by installation *j* (see below). The model structure consists of two data collection worksheets:

1. **Worksheet 1 - Calculation of aggregate CO_2 emissions of Romanian ETS power producing installations**: This worksheet collects data for the fossil fuel consumption of installations in year *y*, the emission factor per unit of energy, oxidation factor, and net caloric values, as well as information about an installation's nature of dispatch. In case a particular installation turns out to apply a technology that is unlikely to appear at the margin of being disconnected (*e.g.* low-variable cost coal-based production, or co-generation plants for district heating), then to that installation a binary value of 0 will be applied. Subsequently, the model automatically calculates CO_2 emissions for each of the ETS power producing installations in Romania. Finally, all annual installation-level CO_2 emissions will be collected in one summary sheet, which will calculate the aggregate CO_2 emissions of Romanian ETS power producing installations.
2. **Worksheet 2 - Calculation of aggregate electricity output for ETS power producing installations in Romania**. This worksheet collects the output data for Romanian ETS power producing installations.

The final step in applying this spreadsheet model is to divide the aggregate CO_2 emissions figure for Romanian ETS power producing installations in year *y*, as collected in worksheet 1, by the aggregate electricity output figure per year *y* as collected in worksheet 2. This results in an annual **Romanian CO_2 baseline emission factor for the electricity grid.**

Management of the methodology

It is important to note here that the data collection for formula (1) must respect the provisions in EU Council Directive 2003/4/EC on confidentiality of CO_2 emissions data verified for EU ETS installations. All ETS installation operators in Romania have decided to ask the ETS co-ordinating authority in Romania not to publish from their CO_2 emission reports the fuel consumption data, the production data, *etc*., as these data are considered commercially sensitive.

Therefore, the two worksheets mentioned above will be operated and completed separately from each other without disclosing individual installation data, as follows:

- **Worksheet 1** will need to be filled out by ANRE and/or NEPA/ANPM – fossil fuel consumption per installation (ANRE), carbon emission factors, and caloric values per volume or mass unit (NEPA/ANPM and/or ANRE). The worksheet will be protected with a userID and password to be determined by ANRE and/or NEPA/ANPM officials, and it will remain with ANRE and/or NEPA/ANPM. The data inside will only be made available for verification purposes. After completing the spreadsheet NEPA/ANPM and/or ANRE presents to MESD an **aggregate CO_2 emissions figure** for the installations included in the sheet.
- In **worksheet 2** ANRE will fill out the electricity production data for the selected ETS installations in year y. This model too will be password protected and will remain with ANRE and the data inside will only be made available for verification purposes. The model will deliver an

aggregate electricity production figure per year for grid-based marginal capacity ETS installations in Romania, which will be presented to MESD.

MESD will subsequently calculate a CO_2 emission factor for baseline determination purposes (expressed in grCO_2/kWh) and publish it on its website from where JI project participants will obtain it for the purpose of calculating JI project emission reductions. Therefore, individual installation data will not be disclosed to any project participant or to the public in order to guarantee that sensitive commercial information is treated according to the legal provisions applicable to NEPA/ANPM and ANRE data handling.

During 2008-2009, this contingency plan will be tested by NEPA/ANPM and ANRE (*i.e*. with a view to data collection and handling) in collaboration with MESD.

Worksheets

Tables Annex 5.1-4 are all part of worksheet 1:

- Table **Annex 5.1** collects the annual fossil fuel consumption figures per thermal power ETS installation in Romania for electricity production only (*i.e*. excluding heat-only boilers).
- Table **Annex 5.2** collects the caloric value for each fossil fuel in Romania, the carbon emission factor per mass or volume, and the oxidation percentage for each fossil fuel.

Both Tables will be completed by NEPA/ANPM and/or ANRE as explained above:

- Table **Annex 5.**3 will be automatically generated for each installation included in the spreadsheet when completing Tables Annex 5.1 and 5.2.
- Table **Annex 5.4** will automatically collect the individual installation CO_2 emissions and lead to a total emissions figure for the selected ETS covered power generation installations in Romania in year *y*.

Table **Annex 5.5** forms worksheet 2. This table collects the data on electricity supplied to the Romanian grid by the selected ETS installations and will be completed by ANRE.

Table Annex 5.1: Annual fossil fuel consumption figures per thermal power ETS installation in Romania for electricity production only

	Power plant Nature of dispatch***	raw coal	cleaned coal	other washed coal	coke	coke oven gas	other gas	crude oil	gasoline	diesel oil	fuel oil	LPG	refinery gas	natural gas	other petroleum products
		10^4 t *	10^4 t	10^4 t	10^4 t	10^8 m^3	10^8 m^3	10^4 t	10^4 t	10^4 t	10^4 t	10^4 t	10^4 t	10^8 m^3	10^4 t
1	1 SC Termoelectrica SA - SE Borzesti														
2	2 SC Termoelectrica SA - SE Braila														
3	SC Termoelectrica SA - SE Doicesti														
4	SC Complex Energetic Craiova SA - SE Isalnita														
~~5~~	~~SC Complex Energetic Rovinari SA~~														
~~6~~	~~SC Complex Energetic Turceni SA~~														
7	SC Electr.centrt.Bucuresti-CET Iernut														
8	SC CET ARAD SA - CET Lignit														
9	SC CET ARAD SA - CET Hidrocarburi														
10	SC TERMOFICARE 2000 SA - Pitesti Sud														
11	SC TERMOFICARE 2000 SA - Gavana														
12	SC TERMON SRL														
13	SC CET SA Bacau - Inst nr 1														
14	SC Electrocentrale Oradea SA														
15	SC CET Brasov SA - CET Brasov														
16	SC CET SA Braila														
17	SC Electr.centrt.Bucuresti-CET Progresu														
18	SC Electr.centrt.Bucuresti-CET Bucuresti Vest														

19	SC Electr.centrt.Bucuresti-CET Titan														
20	SC Electr.centrt.Bucuresti-CET Grozavesti														
21	SC Electr.centrt.Bucuresti-CET Bucuresti Sud														
22	SC Vest Energo SA														
23	SC Electr.centrt.Bucuresti-SE Const.-CET Palas														
24	CCNE CT ZONA SOMES NORD														
25	SC CET ENERGOTERM RESITA SA														
26	SC Termica SA Targoviste														
27	SC Compl.Energ.Craiova SA-SE Craiova II														
28	SC ELECTROCENTRALE GALATI SA														
29	SC Uzina Termoelectrica Giurgiu SA														
30	SC Termoelectrica SA - SE Paroseni														
31	SC Electrocentrale Deva SA														
32	SC CET IASI SA CET Iasi I														
33	SC CET IASI SA CET Iasi II														
34	R.A.A.N. Sucursala ROMAG TERMO														
35	SC DALKIA TERMO PRAHOVA SRL Punct de lucru Brazi														
36	SC UZINA ELECTRICA ZALAU SA														
37	SC CET Govora SA														
38	SC TERMICA SA Suceava - CET pe huila														
39	CET TIMISOARA Centru														
40	SC ENET SA Focsani														
41	SC CET GRIVITA SRL														

42	Societ. National "Nucl.electr." SA-Dir.CNE Cern.v.														
43	SC Enercompa SRL														
44	SC NUONSIB SRL														

* 10^4 t = 10.000 tonnes

** 10^8 m^3 = 100.000.000 cubic metres

Table Annex 5.2: Caloric value, emission factor and oxidation-% for Romania

	Average low caloric value (MJ/t, m^3)	Emission factor (tC/TJ)	Oxidation (%)
Raw coal			
Cleaned coal			
Other washed coal			
Coke			
Coke oven gas			
Other gas			
Crude oil			
Gasoline			
Diesel oil			
Fuel oil			
LPG			
Refinery gas			
Natural gas			
Other petroleum products			
Other fuels			
Other fuels			
Other fuels			

Table Annex 5.3: Automatic generation of CO_2 emissions per installation (based on Tables Annex 5.1 and Annex 5.2

Installation X

	Fuel consumption		Caloric value	Emission factor	Oxidation	CO_2 emissions
	Amount	Unit	(MJ/t, km3)	(tC/TJ)	(0,1)	(t CO_2)
Raw coal	-	10^4 t	0	-	0	-
Cleaned coal	0	10^4 t	0	-	0	-
Other washed coal	-	10^4 t	0	-	0	-
Coke	-	10^4 t	0	-	0	-
Coke oven gas	0	10^8 m^3	0	-	0	-
Other gas	-	10^8 m^3	0	-	0	-
Crude oil	0	10^4 t	0	-	0	-
Gasoline	-	10^4 t	0	-	0	-
Diesel oil	-	10^4 t	0	-	0	-
Fuel oil	0	10^4 t	0	-	0	-
LPG	-	10^4 t	0	-	0	-
Refinery gas	0	10^4 t	0	-	0	-
Natural gas	-	10^8 m^3	0	-	0	-
Other petroleum products	-	10^4 t	0	-	0	-
Total						**0**

Table Annex 5.4. Summary table (collecting all totals from Table Annex 5.3)

	Power plants	CO_2 emissions (t CO_2)
1	1 SC Termoelectrica SA - SE Borzesti	
2	2 SC Termoelectrica SA - SE Braila	
3	SC Termoelectrica SA - SE Doicesti	
4	SC Complex Energetic Craiova SA - SE Isalnita	
~~5~~	~~SC Complex Energetic Rovinari SA~~	
~~6~~	~~SC Complex Energetic Turceni SA~~	
7	SC Electr.centrt.Bucuresti-CET Iernut	
8	SC CET ARAD SA - CET Lignit	
9	SC CET ARAD SA - CET Hidrocarburi	
10	SC TERMOFICARE 2000 SA - Pitesti Sud	
11	SC TERMOFICARE 2000 SA - Gavana	
12	SC TERMON SRL	
13	SC CET SA Bacau - Inst nr 1	
14	SC Electrocentrale Oradea SA	
15	SC CET Brasov SA - CET Brasov	
16	SC CET SA Braila	
17	SC Electr.centrt.Bucuresti-CET Progresu	
18	SC Electr.centrt.Bucuresti-CET Bucuresti Vest	
19	SC Electr.centrt.Bucuresti-CET Titan	
20	SC Electr.centrt.Bucuresti-CET Grozavesti	
21	SC Electr.centrt.Bucuresti-CET Bucuresti Sud	
22	SC Vest Energo SA	
23	SC Electr.centrt.Bucuresti-SE Const.-CET Palas	
24	CCNE CT ZONA SOMES NORD	
25	SC CET ENERGOTERM RESITA SA	
26	SC Termica SA Targoviste	
27	SC Compl.Energ.Craiova SA-SE Craiova II	
28	SC ELECTROCENTRALE GALATI SA	
29	SC Uzina Termoelectrica Giurgiu SA	
30	SC Termoelectrica SA - SE Paroseni	
31	SC Electrocentrale Deva SA	
32	SC CET IASI SA CET Iasi I	
33	SC CET IASI SA CET Iasi II	
34	R.A.A.N. Sucursala ROMAG TERMO	
35	SC DALKIA TERMO PRAHOVA SRL Punct de lucru Brazi	
36	SC UZINA ELECTRICA ZALAU SA	
37	SC CET Govora SA	
38	SC TERMICA SA Suceava - CET pe huila	
39	CET TIMISOARA Centru	
40	SC ENET SA Focsani	
41	SC CET GRIVITA SRL	
42	Societ. National "Nucl.electr." SA-Dir.CNE Cern.v.	
43	SC Enercompa SRL	
44	SC NUONSIB SRL	
	Total CO_2 emissions Romanian ETS installations	**0**

Table Annex 5.5. **Romanian grid power supply**

	Power plants	Power supply (MWh)
1	1 SC Termoelectrica SA - SE Borzesti	
2	2 SC Termoelectrica SA - SE Braila	
3	SC Termoelectrica SA - SE Doicesti	
4	SC Complex Energetic Craiova SA - SE Isalnita	
~~5~~	~~SC Complex Energetic Rovinari SA~~	
~~6~~	~~SC Complex Energetic Turceni SA~~	
7	SC Electr.centrt.Bucuresti-CET Iernut	
8	SC CET ARAD SA - CET Lignit	
9	SC CET ARAD SA - CET Hidrocarburi	
10	SC TERMOFICARE 2000 SA - Pitesti Sud	
11	SC TERMOFICARE 2000 SA - Gavana	
12	SC TERMON SRL	
13	SC CET SA Bacau - Inst nr 1	
14	SC Electrocentrale Oradea SA	
15	SC CET Brasov SA - CET Brasov	
16	SC CET SA Braila	
17	SC Electr.centrt.Bucuresti-CET Progresu	
18	SC Electr.centrt.Bucuresti-CET Bucuresti Vest	
19	SC Electr.centrt.Bucuresti-CET Titan	
20	SC Electr.centrt.Bucuresti-CET Grozavesti	
21	SC Electr.centrt.Bucuresti-CET Bucuresti Sud	
22	SC Vest Energo SA	
23	SC Electr.centrt.Bucuresti-SE Const.-CET Palas	
24	CCNE CT ZONA SOMES NORD	
25	SC CET ENERGOTERM RESITA SA	
26	SC Termica SA Targoviste	
27	SC Compl.Energ.Craiova SA-SE Craiova II	
28	SC ELECTROCENTRALE GALATI SA	
29	SC Uzina Termoelectrica Giurgiu SA	
30	SC Termoelectrica SA - SE Paroseni	
31	SC Electrocentrale Deva SA	
32	SC CET IASI SA CET Iasi I	
33	SC CET IASI SA CET Iasi II	
34	R.A.A.N. Sucursala ROMAG TERMO	
35	SC DALKIA TERMO PRAHOVA SRL Punct de lucru Brazi	
36	SC UZINA ELECTRICA ZALAU SA	
37	SC CET Govora SA	
38	SC TERMICA SA Suceava - CET pe huila	
39	CET TIMISOARA Centru	
40	SC ENET SA Focsani	
41	SC CET GRIVITA SRL	
42	Societ. National "Nucl.electr." SA-Dir.CNE Cern.v.	
43	SC Enercompa SRL	
44	SC NUONSIB SRL	
	Total CO_2 emissions Romanian ETS installations	**0**

Annex 6

Calculation of ex-ante CO_2 baseline emission factor when all CHP plants use guaranteed right to supply electricity to the grid

Installations in list in Annex 2 PDD	Installation name	CHP	If not CHP, then tonnes CO_2
SC Termoelectrica SA - SE Borzesti	SC Termoelectrica SA	x	
SC Termoelectrica SA - SE Braila	SC Termoelectrica SA	x	
SC Termoelectrica SA - SE Doicesti	SC Termoelectrica SA		192.023
SC Complex Energetic Craiova SA - SE Isalnita	SC Complex Energetic Craiova SA		3.756.033
SC Complex Energetic Rovinari SA	SC Complex Energetic Rovinari SA		6.103.822
SC Complex Energetic Turceni SA	SC Complex Energetic Turceni SA		6.837.217
SC Electr.centrt.Bucuresti-CET Iernut	SC Electrocentrale Bucuresti SA	x	
SC CET ARAD SA - CET Lignit	SC Arad SA	x	
SC CET ARAD SA - CET Hidrocarburi	SC Arad SA	x	
SC TERMOFICARE 2000 SA - Pitesti Sud	SC Termoficare 2000	x	
SC TERMOFICARE 2000 SA - Gavana	SC Termoficare 2000		106.124
SC TERMON SRL	SC Termon SRL	?	0
SC CET SA Bacau - Inst nr 1	SC CET Bacau	x	
SC Electrocentrale Oradea SA	SC Electrocentrale Oradea	x	
SC TERMICA SA BOTOSANI	SC Termica		
SC CET Brasov SA - CET Brasov	SC CET Brasov SA	x	
SC CET SA Braila	SC CET SA Braila	x	
SC Electr.centrt.Bucuresti-CET Progresu	SC Electrocentrale Bucuresti SA	x	
SC Electr.centrt.Bucuresti-CET Bucuresti Vest	SC Electrocentrale Bucuresti SA	x	
SC Electr.centrt.Bucuresti-CET Titan	SC Electrocentrale Bucuresti SA	x	
SC Electr.centrt.Bucuresti-CET Grozavesti	SC Electrocentrale Bucuresti SA	x	
SC Electr.centrt.Bucuresti-CET Bucuresti Sud	SC Electrocentrale Bucuresti SA	x	
SC Vest Energo SA	SC Vest Energy SA		52.370
SC Electr.centrt.Bucuresti-SE Const.-CET Palas	SC Electrocentrale Bucuresti SA	x	
CCNE CT ZONA SOMES NORD	SC Colonia Cluj Napoca Energys	x	
SC CET ENERGOTERM RESITA SA	SC CET Energoterm Resita SA	x	
SC Termica SA Targoviste	SC Termica SA Targoviste	x	
SC Compl.Energ.Craiova SA-SE Craiova II	CE Craiova		2.022.746

ANRE Companies*	tCO_2 (ETS 07)	CEF (gCO_2/kWh)*	MWh output non-CHP power plants 2007	MWh without must-run Rovinari/Turceni
			(F/G)*1000	(F/G)*1000
Termoelectrica	1.171.074	737	1.588.974,22	1.588.974,22
CE Craiova	5.778.779	1127	5.127.576,75	5.127.576,75
Rovinari	6.103.822	1055	5.785.613,27	
Turceni	6.837.217	1080	6.330.756,48	
Bucuresti	0	480	-	-
Arad	0	611	-	-
Termoficare 2000	106.124	499	212.673,35	212.673,35
Bacau	0	1180	-	-
Oradea	0	1109	-	-
Brasov	0	1065	-	-
Galati	0	1026	-	-
Giuriu	0	1479	-	-
Deva	3.908.394	1137	3.437.461,74	3.437.461,74
Iasa	0	695	-	-
RAAN	0	796	-	-
Dalkia	0	411	-	-
Govora	0	1184	-	-
Sucueva	0	1017	-	0,00
Vest energo	52.370	523	100.133,84	100.133,84
Total	**23.957.780**		**22.583.189,66**	**10.466.820 (MWh)**
	CO_2 emissions without CHP and without must -run coal			**11.016.741 (tCO_2)**

* According to ANRE Annual report Date Statistice Aferente Energiei Electrice 2007

CEF 2007 without must-run coal and CHP
(11.016.741 tCO_2 / 10.466.820 MWh) = 1.053 g/kWh

SC ELECTROCENTRALE GALATI SA	SC Electrocentrale Galati SA	x	
SC Uzina Termoelectrica Giurgiu SA	SC Uzina Termoelectrica Giurgiu SA	x	
SC Termoelectrica SA - SE Paroseni	SC Termoelectrica SA		979.051
SC Electrocentrale Deva SA	SC Electrocentrale Deva SA		3.908.394
SC CET IASI SA CET Iasi I	SC CET Iasi SA	x	
SC CET IASI SA CET Iasi II	SC CET Iasi SA	x	
R.A.A.N. Sucursala ROMAG TERMO	R.A.A.N. Sucursala ROMAG TERMO	x	
SC DALKIA TERMO PRAHOVA SRL Punct de lucru Brazi	SC DALKIA TERMO PRAHOVA SR	x	
SC UZINA ELECTRICA ZALAU SA	SC UZINA ELECTRICA ZALAU SA	x	
SC CET Govora SA	SC CET Govora SA	x	
SC TERMICA SA Suceava - CET pe huila	SC Termica sucueva	x	
CET TIMISOARA Centru	SC Colterm	x	
SC ENET SA Focsani	SC ENET SA Focsani	x	
SC CET GRIVITA SRL	SC CET GRIVITA SRL	x	
Societ. National "Nucl.electr." SA-Dir.CNE Cern.v.	Societ. National "Nucl.electr." SA-Dir.CNE Cern.v.		3.348
SC Enercompa SRL	SC Enercompa SRL		12.186
			23.973.314

Companies in red are not covered by ANRE's Annual report Date Statistice Aferente Energiei Electrice 2007