JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
Version 01 - in effect as of: 15 June 2006

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SECTION A. General description of the project

A.1. Title of the project:

"Improvement of efficiency in power generation by Bratsk Hydropower Plant, Irkutsk Oblast (Russia)"

Version 01, completed on 30 October 2006.

A.2. Description of the project:

Bratsk Hydropower Plant (BHPP) is the second one in the cascade of hydropower plants on the River of Angara and is a world leader in the total electricity generation since the start of the first generation unit. It has 18 electricity generating units with the total installed capacity of 4500 MW that can produce up to 26-28 bln kW-hr of electricity a year. BHPP's share in total power generation by JSC "Irkutskenergo" (the owner of BHPP) is more than 40%. Due to unique and rather stable water resources BHPP plays an important role in sustainable and reliable energy supply for the whole Siberian energy zone. BHPP supplies energy to industrial enterprises and households located Siberia.

The Project aims at replacement of 6 turbine wheels in BHPP, which will allow to increase efficiency of electricity generation by 8% and produce additional 883,2 mln kW-hr per year. The additional electricity will be supplied to the energy system of Irkutskenergo Company and substitute coal-fired power generation in Siberian region.

The six turbine wheels currently used by BHPP were installed in 1960s, when the BHPP reservoirs were filled in with water, so now they have the highest deterioration rate. The high cavitation wear of the wheels leads to increased deterioration of the hydraulic units. Under the regular maintenance work the wheels are rehabilitated by welding of 600-700 kg of metal on the wheels. However this metal has much worse strength properties than the one-piece turbine wheel. Also the maintenance work leads to changes of the turbine wheel blade profiles and reduces their efficiency.

BHPP intends to replace these 6 turbine wheels by the new stainless steel ones, produced by the JSC "Leningrad Machinery Plant" (LMP), which have much less cavitation wear (18,5 kg of metal a year) and higher efficiency of power generation. Experience of exploitation of such wheels in Vietnam, India, Greece and other countries shows that the period between the maintenance works could then be increased from 6 to 9 years while the efficiency of such stainless steel wheels is not changing over that period.

According to measurements undertaken in 2002 replacement of the turbine wheels will allow to increase efficiency of power generation by these 6 wheels by 8% from 88,1% up to maximum 95,3%. Relative increase in the efficiency can be calculated as follows:

$$(95,3/88,1 - 1) * 100\% = 8,17\%$$

Such energy efficiency improvement would lead to generation of additional 147,2 mln kW-hr a year by each wheel[1] or 883,2 mln kW-hr/year by all 6 turbine wheels. Total additional power generation by all 6 wheels within 2008-2012 is estimated as **3974,4 mln kW-hr** taking into account the schedule of the working wheels replacement (see Table A.4.2.1.).

[1] It is supposed that the average capacity of each hydraulic unit is 230 MW, duration of work is 8000 hours a year, efficiency increase is 8%, hence the additional power generation is estimated as 147,2 mln kW-hr a year.

The additional electricity generated by BHPP will be supplied into the energy system of "Irkutskenergo" and substitute power generation by the company's low efficiency coal-fired thermal power plants; some of the additional power may be supplied to the federal wholesale electricity market "FOREM"[2].

The thermal power plants where the power generation will be substituted by BHPP include Novo-Ziminskaya TPP, Novo-Irkutskaya TPP, TPP-10, TPP-11, TPP-12, TPP-16, TPP-6, TPP-9, Ust-Ilimskaya TPP, that are located in Irkutsk region and owned by JSC "Irkutskenergo". The total installed capacity of thermal power plants is 28780 GCal-hr of heat and 3877,5 MW of power generation[3].

The total CO_2 emission reduction under the Project is estimated as **4398916 tons of CO_2** for the period of 2008-2012.

A.3. Project participants:

Table A.3.1. Project participants.

Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Russian Federation (host Party)	• Irkutsk Joint Stock Company of Energetics and Electrification (JSC Irkutskenergo) • JSC "Alfa-Carbon"	No
Sweden	• Climate Change Management Sweden AB	No

Irkutskenergo. Irkutsk Joint Stock Company (JSC) of Energetics and Electrification was founded in accordance with the Decree of the President of the Russian Federation dated 01 July 1992 No.721 "On arrangement of transformation of state-owned enterprises and voluntary associations of state-owned enterprises into joint-stock companies". 40% of the company's shares belong to the State.
The power generation base of Irkutskenergo comprises various hydro- and thermal power plants: 3 hydraulic power plants, 12 thermal power plants, electricity transmission networks (including backbone transmission networks with voltage of 500 kW) and heat transmission networks. The Irkutsk power generation system can produce over 70 bn. kWh of electric power and up to 46 mln. Gcal of thermal power. The installed capacity of the Irkutsk power generation system equals 12.9 thousand MW.
JSC "Irkutskenergo" is the largest independent energy company in Russia. The company is ranked third among the Russian companies by volume of generated electric power, and second by volume of generated thermal power. As for Siberia, the company ranks first both by electric and thermal power in this region. Irkutsk power generation system is a redundant one.
Consumers of the energy produced by JSC "Irkutskenergo" include large Russian companies from metallurgical, chemical, timber processing and other industries. In 2004 the overall revenue of JSC "Irkutskenergo" reached US$657 mln.
Since 1996 the accounting system of JSC "Irkutskenergo" is corresponding to the US GAAP standards, that is regularly audited by Big 4 companies. The company's shares are traded at the Russian Trading

[2] Detailed description of the FOREM is available on the web-site of RAO UESR http://www.rao-ees.ru/en/reforming/market/show.cgi?market.htm

[3] See the official information on installed capacities at the web-site of Irkutskenergo http://www.irkutskenergo.ru/qa/757.2.html

System (RTS) and Moscow Interbank Currency Exchange (MICEX). The company's ADR are traded in the US and Germany. JSC "Irkutskenergo" is a first class borrower from the Russian banks. In 1998 the company successfully issued and paid off the Eurobonds of DM125 mln. The Standard and Poor's rating of JSC "Irkutskenergo" is B for the international scale and ruBBB+ for the Russian scale.

Alfa-carbon. Limited liability Company "Alfa-Carbon" was established in April 2005. The company provides consulting services on business development of the Russian companies on the international market for carbon emission reduction as well as increase of the capitalization and value of assets through acquiring additional revenues from the sales on this market.
Alfa-Carbon involves highly qualified Russian carbon market experts with above 7 years of experience in the area of UNFCCC and Kyoto Protocol. They have been the active participants of UNFCCC COPs as the official delegates and observers involved in elaboration of the international legal framework, as well as the members of working groups on development of the Russian legal basis, elaboration of the international and Russian methodologies for GHG emission accounting and control, preparation of project documentation, creation of the corporate programs on emission management. Specific activities of the experts were related to creation of the national GHG emission accounting systems in CIS countries, regional emission inventories in Russia, establishing the corporate emission management systems.

Climate Change Management. Climate Change Management Sweden AB is a Swedish financial management company providing services in using financial instruments on the international carbon market, management of carbon assets of the form of emission reduction units obtained under JI and CDM, organization of financing for the carbon emission reduction projects and broker services.

A.4. Technical description of the project:

A.4.1. Location of the project:

The Russian Federation

A.4.1.1. Host Party(ies):

The Russian Federation

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

Irkutsk Oblast

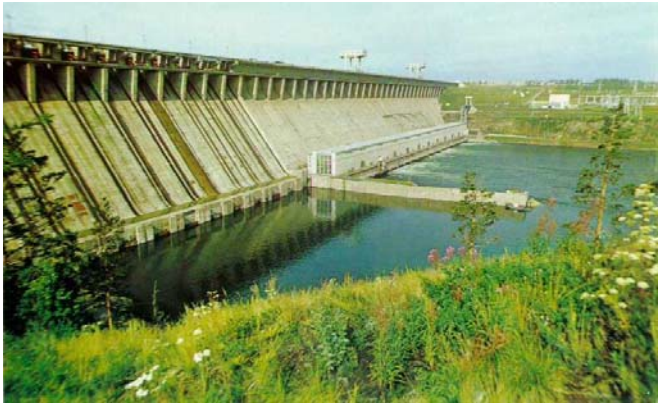
A.4.1.3. City/Town/Community etc.:

Bratsk City

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

Irkutsk Oblast is located in south-eastern Siberia in the basins of Angara, Lena, and Nizhnyaya Tunguska Rivers, and occupies an area of 767,900 km² (4.6% of Russia's territory). See the map below.

The City of Bratsk is located in the North-West of Irkutsk Oblast near Bratsk water reservoir. The City occupies the territory of



Picture A.4.1.4.1. Bratsk Hydropower Plant.

43,000 hectares. It was created in 1955 when the BHPP construction started.

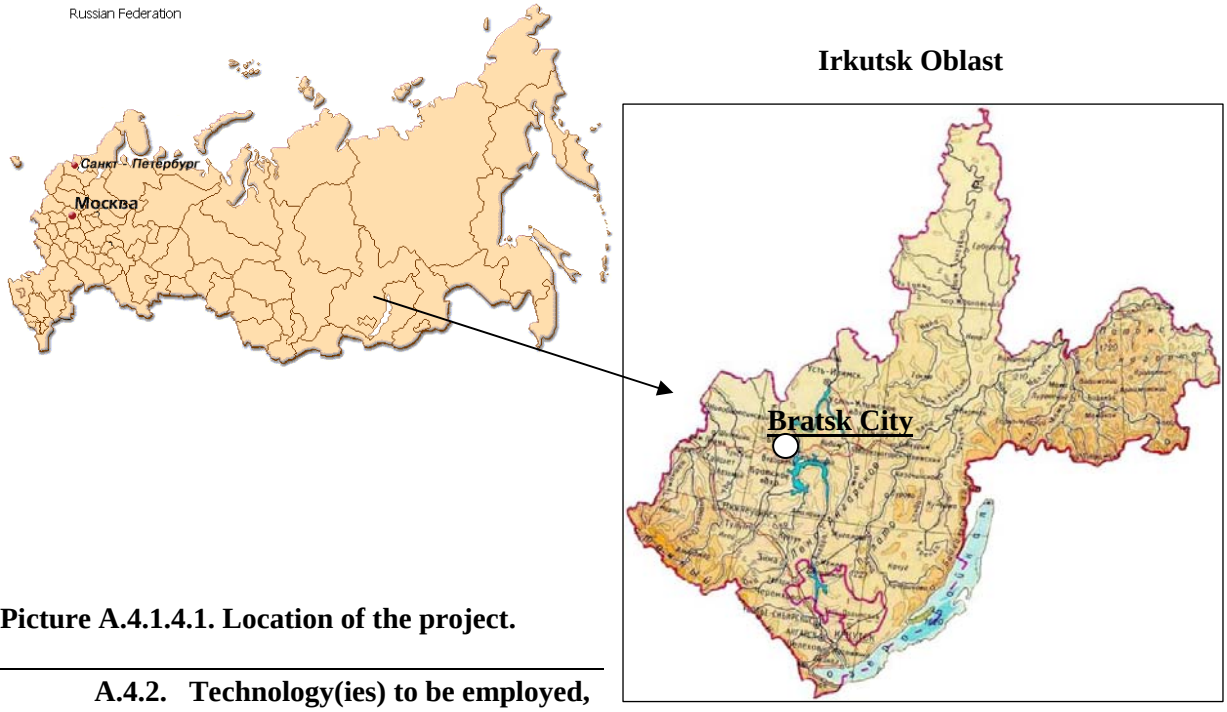
The City is situated in severe climatic conditions. Its economic and geographical location is rather favorable due to well developed infrastructure (transit railways, automobile roads, electricity networks, international airport, etc.), high resource and economic potential (energy resources of Bratsk hydropower plant, , unlimited water resources of Angara River, etc.).

The City population is above 250,000 people. Bratsk is one of the largest industrial centers of Eastern Siberia. The largest industries of the City include Bratsk Aluminium Plant, Bratsk Ferroalloys Plant, Ilim Timber Processing Plant, and some others. In the last years the investment activity in the City was rather stable.

BHPP is situated on Angara River. The decision about construction of BHPP was taken in September 1954 and the first preparation works started in December 1954. In 1967 the State commission accepted the Bratsk hydraulic station into exploitation.

The installed capacity of BHPP is 4500 MW (18 hydraulic units per 250 MW). The annual power generation is 22,6 bln kW-hr. BHPP has 5 power lines of 500 kW and 20 power lines of 220 kW, 10 transformers of 220 kW, and other equipment.

BHPP is owned by “Irkutskenergo” Company with the headquarters in Irkutsk City, the capital of Irkutsk Oblast.



Picture A.4.1.4.1. Location of the project.

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

Currently the total installed capacity of BHPP is 4500 MW, including 18 hydropower units by 250 MW each. Total power generation by these units is 22,6 bln kW-hr per annum. The working wheels and turbines of BHPP were installed in 1960s. The efficiency of modern hydropower units is some higher than at BHPP, that is caused by using new materials and technologies for production of modern turbine wheels of the hydropower plants.

The technology to be employed in the Project deals with replacement of 6 old turbine wheels in Bratsk Hydropower Plant by the new much more efficient ones that will allow to increase efficiency of electricity generation by 8% and produce additional 883,2 mln kWh/year.

BHPP intends to replace these 6 turbine wheels by the new stainless steel ones, produced by the Leningrad Machinery Plant (LMP), which have much less cavitation wear and higher efficiency of power generation. The existing experience shows that the efficiency of such wheels is not decreasing during the period of exploitation between subsequent regular maintenance works.

According to the measurements undertaken by JSC "NIIES" (Energy Research Institute), the maximum efficiency of the six turbine wheels to be replaced is 88,1% without taking into account their decreasing efficiency during the periods between the regular maintenance works[4].

The new turbine wheels produced by LMP will allow to reach maximum efficiency of the turbine up to 95,3%[5]. Relative increase in the efficiency can be calculated as follows:

$$(95,3/88,1 – 1) * 100\% = 8,17\%$$

Installation of the LMP's turbine wheels will lead to generation of additional 147,2 mln kW-hr a year by each wheel or **3974,4 mln kW-hr** by all 6 wheels within 2008-2012 regarding the plan of the working wheels replacement (Table A.4.2.1).

Table A.4.2.1. The plan of replacement of the working wheels at BHPP.

Item	Deadline for installation and start of the wheel's operation
Replacement of the 1st wheel	2006
Replacement of the 2nd wheel	July 2007
Replacement of the 3rd wheel	January 2008
Replacement of the 4th wheel	July 2008
Replacement of the 5th wheel	January 2009
Replacement of the 6th wheel	July 2009

Source: JSC "Irkutskenergo"

Previous experience of work with LMP is rather successful: in 1970s LMP installed new wheels in Ust-Ilimsk HPP with the efficiency of 94,5% and very good cavitation characteristics, satisfying the requirements of this Project.

The turbine equipment of BHPP is described in Table A.4.2.2. Table A.4.2.3 presents the dynamics of power and heat production by JSC "Irkutskenergo". The main fuel consumed by the company's thermal power plants is coal, mazut is used as a reserve and starting fuel, its share in total fuel balance is less than 1%.

The additional power generated by BHPP under the Project will substitute power production by the less efficient thermal power plants of JSC "Irkutskenergo" and will be supplied to industries and population in the region. The main reason for that is that power supply to the federal wholesale power market FOREM is less beneficial than substitution of power from thermal power plants. According to the

[4] Official report on the measurements (in Russian) is available in Irkutskenergo.

[5] Source of information is Irkutskenergo, based on technical proposal of LMP on new turbine wheels

estimates of Department of project implementation of JSC "Irkutskenergo", saving of fuel costs at the less efficient power plants is about 30% more beneficial than the sale of electricity to FOREM.

The thermal power plants where the power generation will be substituted by BHPP include Novo-Ziminskaya TPP, Novo-Irkutskaya TPP, TPP-10, TPP-11, TPP-12, TPP-16, TPP-6, TPP-9, Ust-Ilimskaya TPP, that are located in Irkutsk region and owned by JSC "Irkutskenergo".

Table A.4.2.2. Turbine equipment of BHPP, as of 01.01.2006.

Turbine	#	Type (mark) of turbine	Producer	Installed power capacity, MW
Hydroturbine	01	PO-662-BM-550	LMP	250
Hydroturbine	02	PO-662-BM-550	LMP	250
Hydroturbine	03	PO-662-BM-550	LMP	250
Hydroturbine	04	PO-662-BM-550	LMP	250
Hydroturbine	05	PO-662-BM-550	LMP	250
Hydroturbine	06	PO-662-BM-550	LMP	250
Hydroturbine	07	PO-662-BM-550	LMP	250
Hydroturbine	08	PO-662-BM-550	LMP	250
Hydroturbine	09	PO-662-BM-550	LMP	250
Hydroturbine	10	PO-662-BM-550	LMP	250
Hydroturbine	11	PO-662-BM-550	LMP	250
Hydroturbine	12	PO-669-BM-550	LMP	250
Hydroturbine	13	PO-662-BM-550	LMP	250
Hydroturbine	14	PO-669-BM-550	LMP	250
Hydroturbine	15	PO-669-BM-550	LMP	250
Hydroturbine	16	PO-669-BM-550	LMP	250
Hydroturbine	17	PO-669-BM-550	LMP	250
Hydroturbine	18	PO-669-BM-550	LMP	250

Source: JSC "Irkutskenergo"

Table A.4.2.3. Dynamics of power and heat production by JSC "Irkutskenergo".

	9 months of 2005	**9 months of 2004**
Power production, total, bln kW-hr	40,55	38,3
Including: hydropower plants	35,5	31,52
Thermal power plants	5,06	6,78
Heat production, mln Gcal-hr	17,68	18,27
Export of power from the region, bln kW-hr	4,04	1,98
Power consumption in the region, bln kW-hr	35,37	32,78
Heat consumption, mln GCal-hr	16,55	17,02
Fuel consumption, tons of coal equivalent	3692872	4384593

Source: JSC "Irkutskenergo"

Table A.4.2.4. Dynamics of power and heat production by JSC "Irkutskenergo".

	2004	10 months of 2004	10 months of 2005
Power production, total, mln kW-hr	53717,4	42950,1	44830,2
Sale of power, mln kW-hr	45253,3	36666,2	39161,7
Sale of power to FOREM, mln kW-hr	3203,9	2356,3	4254,6
Sale of power to own consumers, mln kW-hr	42049,3	34309,9	34907,1

Source: JSC "Irkutskenergo"

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:

GHG emissions will be reduced through the increase of efficiency of power generation by BHPP after replacement of 6 outdates working wheels by the new ones with higher efficiency characteristics, generation of additional electricity that will substitute power production in the condensation cycle of the less efficient thermal power plants of JSC "Irkutskenergo" and reduce their fossil fuel (coal) consumption and emissions of CO_2.

Substitution of the power production by thermal power plants will be done with regards to the actual capacity load of the plants, fuel costs, operational costs, potential for reduction of capacity load and other factors.

If the reduction of power production in the condensation cycle of thermal power plants will not be enough, e.g. due to higher demand for power in the region in winter seasons and/or increased power generation by BHPP due to high water in Angara River, the residual power will be supplied to the electricity market FOREM.

Without the Project, replacement of the working wheels at BHPP would not be made, the power production will be as usual, demand for electricity in the regions would be satisfied via the load of existing capacities of hydro and thermal power plants or JSC "Irkutskenergo" or purchases of electricity in FOREM. The latter is hard to estimate now due to high uncertainties in development and functioning of the power market in Russia as a whole and Irkutsk region in particular.

The following main parameters were taken into account in estimation of the emission reduction:

- The average fuel consumption in the condensation cycle of thermal power plants of JSC "Irkutskenergo", where the substitution of power generation is planned, is 0,436 tons of coal equivalent per 1000 kW-hr;
- Additional power production by BHPP for the period of 2008-2012 is estimated as 3974,4 mln kW-hr.

Expected total emission reduction under the Project is 4398916 tons of CO_2 for 2008-2012.

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

4398916 tons of CO_2 (ERUs) for the period of 2008-2012.

The dynamics of annual emission reduction is presented in Table A.4.3.1.1.

Table A.4.3.1.1. Estimates of the Project annual emission reduction.

	2008	2009	2010	2011	2012
Substitution of electricity generation with regard to losses in transportation, mln kW-hr	474,0	744,8	812,5	812,5	812,5
Prevented fossil fuel (coal) consumption, 1000 tons of coal equivalent	206,7	324,7	354,3	354,3	354,3
Emission reduction, t CO_2/year	570230	896076	977537	977537	977537

A.5. Project approval by the Parties involved:

At the moment of preparation of this Project the JI approval procedures in Russia were not adopted, however all requests for consideration of the Project as a JI Project proposal have been delivered to the corresponding Russian authorities.

SECTION B. Baseline

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

The Project uses as a reference the approved consolidated baseline methodology ACM0002 (Version 06, 19 May 2006) for CDM entitled "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", approved for CDM projects[6].

The methodology ACM0002 is applied to the projects on grid-connected power generation from renewable sources, including hydraulic power plants, that do not imply increase of the water reservoir.

This Project does not include any measures on changing the water flows characteristics in BHPP, so the ACM0002 methodology can be applied for the Project.

The baseline and project GHG emissions are evaluated on a series of key factors which have the potential to affect the baseline development, the project activity level and therefore GHG emissions. Potential impacts of the key factors are summarized below.

Demographic factor

The population of areas which are supplied with electricity from the thermal plants and BHPP may potentially affect the demand for power from the households sector. According to the Federal Statistical Service of Russia, in 1990-2004 the population in the regions declined from 2,825 to 2,561 mln people, or about 10% (Table B.1.1.1.). At the same time, in 2002-2004 the population was declining with much less rate (about 0,5% per year).

Table B.1.1.1. Dynamics of population of Irkutsk region, 1980-2004.

	1980	1990	2002	2003	2004
Population, 1000 people	2558	2825	2582	2578	2561

Source: Federal Statistical Service of Russia.

There is no information about any serious changes in the population of Irkutsk region at least until 2012. It is likely that the population will be stable at the level of 2,5 mln people. Thus it is assumed in the Project that there will be no significant changes in demand for electricity from population due to the demographic factors, at least until 2012.

Climatic factor

The climatic conditions in Irkutsk region are characterized by rather cold winters (average temperature is -20°C) and warm summers (on average +17°C). There are occasional fluctuation of the air temperature from -40°C in winter and up to +40°C and more in summer.

Table B.1.1.1.2 presents the data on average monthly temperatures in January and July 2003. It could be noted that in that particular year the deviations from the observation period were +3,4°C in January and +1,1°C in July. However there is not enough scientific information to predict possible trends in temperature in the regions.

Hence, it is assumed in the Project, that the climatic factors will not substantially affect the power consumption in the region. However, the monitoring plan will include some indicators, indirectly reflecting such possible effects.

[6] The methodology (version 6 of 19 May 2006) is presented on the UNFCCC web-site http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_BW759ID58ST5YEEV6WUCN5744MN763

Table B.1.1.1.2. Monthly average temperature in Irkutsk region, 2003.

Air temperature, °C			
January		July	
Actual temperature	Deviation from the norm	Actual temperature	Deviation from the norm
-20,3	3,4	17,5	1,1

Source: Federal Statistical Service of Russia.

Economic factors

Changes of demand for electricity from industries

Currently, there are above 57,000 industrial enterprises operating in Irkutsk region, including large metallurgical, forestry, pulp-and-paper, food, transport and other industries.

The industrial sector is a stably developing one that provides majority of the gross regional production and, hence the main source of income for the local population. Table B.1.1.1.3 presents the dynamics of industrial production in the region in 2002-2004 by the main industries.

Table B.1.1.1.3. Industrial production in Irkutsk region, 2002-2004, % to previous year.

Industry	2002	2003	2004
Industrial sector, total	107,0	103,9	104,1
Power production	100,7	94,1	102,8
Oil refinery	110,9	100,1	105,7
Coal	76,4	96,8	95,3
Non-Ferrous metallurgy	99,7	101,2	106,2
Ferrous metallurgy	76,3	174,0	126,7
Chemical and petrochemical	104,0	99,3	103,3
Machinery	134,0	107,1	103,7
Forestry	108,0	102,9	102,3
Construction	104,0	107,5	100,8
Food production	110,0	97,0	88,5

Source: Federal Statistical Service of Russia.

Perspectives of the regional economic development are dealt with the following main directions:

- Irkutsk region may become a significant producer of oil and gas: estimated oil reserves are 2 bln tons, gas condensate – 0,5 bln tons. Industrial exploitation of these reserves is dealt to construction of the Talakan - Ust-Kut oil pipeline, then the oil will be transported via Eastern Siberia-Pacific Ocean pipeline, part of which shall be constructed and put in operation by the end of 2008.

  The forecasted reserves of natural gas in the region are above 8,5 trillion cubic meter, which are mainly located in Kovykta gas field. Its experimental industrial exploitation (presumably starting before 2012) may be dealt with gasification of some districts of Irkutsk region and, possibly, the neighboring regions of Buryatia and Chita. The industrial gas extraction is planned for 2013 and will be dealt with construction of a large gas processing plant and export of “energetic gas” (methane) from Irkutsk region.

- The chemical sector is presented by 3 large plants: Angarsk petrochemical company (oil refinery and ethylene production), Sayankhimplast and Usoliekhimprom (PVC and hydrate of sodium production). In case of extraction of 30 bln cubic meters of gas in Kovykta gas field, it is possible to launch new production capacities that will be able to make Irkutsk region a leader in production of all kinds of basic plastics.
- Development of the regional metallurgical industry is dealt with the plans of construction of new aluminium plant in Taishet (Rusal company), modernization of Irkutsk aluminium plant (SUAL company) and Bratsk aluminium plant (Rusal), construction of a new plant on production of primary aluminium (SUAL).

In case of significant growth of industrial production in the region, demand for electricity may significantly rise. In order to satisfy it, the following options are available: 1) increase of the load of installed capacities of "Irkutskenergo" thermal power plants; 2) construction of new energy units for power generation by the industries; 3) import of electricity from FOREM.

Nowadays, there is no information on how the industries' demand for electricity may be changing up to 2012. Hence the monitoring plan includes indicators, that allow directly or indirectly take into account the possible impacts of this factor on the baseline and emission reductions.

Fuel mix changes

Currently the main type of fuel in the thermal power plants of Irkutskenergo are coal and mazut (as starting fuel). The share of mazut in the energy balance is below 1%.

The perspectives of the thermal power sector may be dealt with possible gasification of the region. However, by now there is no reliable information on the possibilities of switching thermal power plants from coal to natural gas. It is partly caused by the fact, that the operator of the regional gas sector development JSC "Vostochno-Sibirskaya gas company" had not made any contracts on gas supply to the power plants yet.

In case of the thermal power plants switching to gas under the business as usual scenario (but not JI projects) GHG emission changes caused by new fuel balance will be reflected in the indicators included in the monitoring plan.

Technological factors

It is not expected that any substantial changes in efficiency of the fuel use can be reached at the thermal power plants of Irkutskenergo up to 2012.

In case of the supply of additional electricity from BHPP to FOREM, it will be required to estimate how the structure of energy supply to FOREM will be changing over time and what would be the average fuel use per 1 kW-hr of electricity supplied to FOREM.

Currently due to continuing reforms in the Russian electricity sector and beginning of formation of the federal and regional electricity markets, it is impossible to forecast these indicators. Hence the monitoring plan includes parameters reflecting changes in such indicators.

The conclusion is that the key factors determine the baseline emissions corresponding to the quantity of additional electricity generated by BHPP that substitutes generation by the thermal power plants of Irkutskenergo and exported to FOREM, with multiplication by the corresponding average fuel consumption per unit of production and CO_2 emission factors.

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:

The GHG emission reductions generated by the Project meet the CDM/JI definitions of additionality by 1) having taken JI into account at the earliest stages of Project development; 2) the technology for improvement of power generation efficiency would not be applied without the Project; 3) carbon financing was integral in arranging the long-term financing of the Project.

The additionality of the Project is demonstrated and assessed below by applying the latest version (of 28.11.2005) of the "Tool for the demonstration and assessment of additionality"[7], originally developed for CDM projects, but that can be applied to JI projects as well.

Step 0. Preliminary screening

Not relevant to JI.

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

Sub-step 1a. Define alternatives to the project activity

The alternative to the Project is continuation of the currently quantity of electricity generation by BHPP and possible increase of power generation by the thermal power plants.

Besides, the following two possibilities will be available:

1) import of electricity from Boguchanskaya hydropower plant of the neighboring Krasnoyarsks region (the Karabul aluminium plant will use only half of its installed capacity);
2) development of thermal energy on the basis of Kovykta's gas and coal from Mugunsk coal open-cast mine.

There are no other projects similar to this one in the region.

Sub-step 1b. Enforcement of applicable laws and regulations

The current legislation and regulation do not provide any administrative measures requiring JSC "Irkutskenergo" to implement this Project or other measures aimed at energy efficiency improvement without commercial benefits for the company.

Hence both the baseline and Project scenarios are fully consistent with the current laws and regulations.

Step 2: Investment analysis

In order to illustrate the investment barrier for implementation of this Project one can compare the key financial indicators of the project with and without carbon component (see Table B.2.1).

Table B.2.1. Investment indicators of the Project.

Scenario	Internal rate of return (IRR), %	Payback period, years
Without sale of carbon credits	17%	7,6
With sale of carbon credits*	29%	6,6

* Sale of carbon credits over the period of 2008-2012 only.

[7] http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

Hence the sale of ERUs generates additional income and provides a more acceptable rate of return and payback period for the Project.

Without sale of carbon credits this Project would be much less attractive for JSC "Irkutskenergo" as the minimum rate of borrowing available for the company now is 20% per annum, that is higher than IRR without sale of carbon credits.

Step 3: Barrier analysis

Access to capital

JSC "Irkutskenergo" has opportunities to attract commercial loans with the interest rate of 15% per year. Even with such rate the Project is not so commercially attractive without the sale of ERUs.

The company's own resources do not allow to fully finance this Project, while the State subsidies or low-rate borrowings are not available now.

Technological barriers

It is not possible to make low cost technological solutions for energy efficiency improvements in the thermal power plants and BHPP under the baseline scenario as far as all such measures have been implemented already. Other measures require substantial capital investments that are not planned by the company yet.

Step 4: Common practice analysis

Sub-step 4a. Analysis of other activities similar to the proposed project activity

There are no other projects similar to this one in the electricity sector of Irkutsk region. In general, construction of new hydropower plants or increase of existing capacities of the hydropower plants in Russia is not planned. The only exemption is Boguchanskaya hydropower plant which construction was recently continued in Krasnoyarsk region.

Measures on modernization and energy efficiency improvement of the existing capacities are occasional in Russia and, due to high costs and technological problems.

Hence, this Project activity can be considered as unique for Irkutsk region and for the Russian Federation as a whole.

Sub-step 4b. Discussion of similar options that are occurring

In the longer term perspective the activities on gasification of Irkutsk region may be possible, that would allow to switch energy utilities and local population to natural gas. In this case it could be expected that some GHG emission reduction from the fossil fuel-fired power plants will be achieved in the region.

The main problems with such option are: 1) high cost of gasification, 2) expected high prices for natural gas to be proposed by the gas operating company (that is due to the preference of gas exports to China rather than sales in the regulated domestic gas market with much lower prices).

Currently the gasification program in the region is still under consideration and its concrete parameters are not determined yet. Particularly, it is not known what would be the terms of gas supply to the thermal power plants and whether these terms would be satisfactory for JSC "Irkutskenergo".

Step 5: Impact of JI registration

Registration of this Project as a JI project will allow to attract buyers of carbon credits for investing in implementation of it, improve financial attractiveness of the Project, provide stable financing of the project activities.

Step 6: Conclusion

Analysis of the impacts mentioned above allows to conclude that the Project activity is additional.

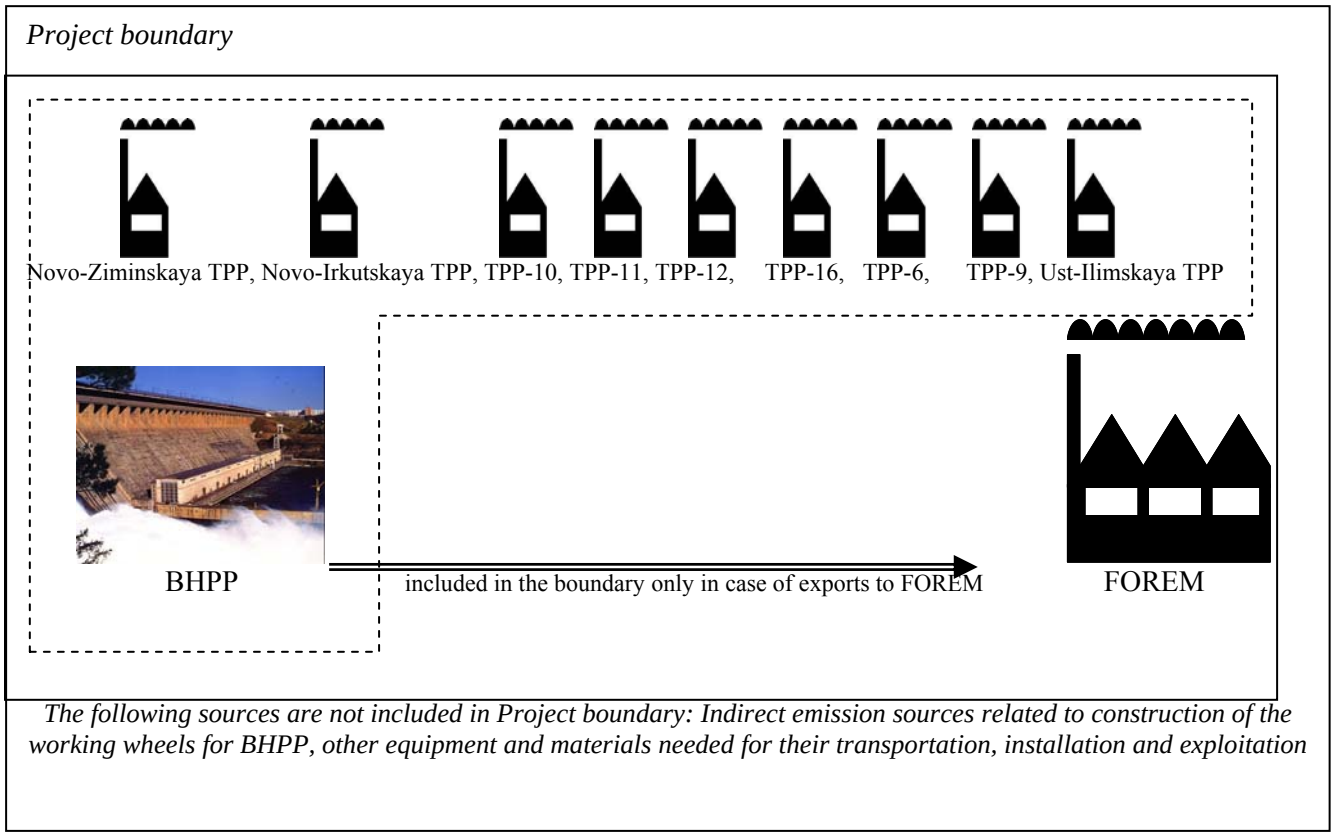
B.3. Description of how the definition of the project boundary is applied to the project:

Project boundary

The Project boundary is the physical, geographical site of the energy units affected by the Project efficiency improvement measures, including BHPP and thermal power plants of JSC "Irkutskenergo", including Novo-Ziminskaya TPP, Novo-Irkutskaya TPP, TPP-10, TPP-11, TPP-12, TPP-16, TPP-6, TPP-9, Ust-Ilimskaya TPP. Besides, in case of export of electricity from BHPP to FOREM, the average values of carbon emission factors for FOREM will be taken into account.

The Project boundary includes direct sources of GHG emissions from fossil fuel combustion for electricity generation. Indirect emission sources, such as those related to production of the working wheels for BHPP and other equipment and materials for transportation, installation, and exploitation of the wheels are estimated as insignificant and not accounted in the Project. (Scheme B.3.1 illustrates the Project boundary.)

Scheme B.3.1. The Project boundary.



Leakages

Leakage is, as such, defined as the net change of anthropogenic emissions by sources of GHG emissions which occurs outside of the project boundary, and which is measurable and attributable to the project activity.

Negative leakages

- Emissions from the sources related to production of the working wheels, materials and equipment required for their installation in BHPP. Data on energy or fossil fuel consumption for that purposes is not available as it is too difficult to distinguish that data from the total energy and fuel use by the producer "Leningradsky Machinery Plant".
- Emissions from transportation of the working wheels to BHPP. The Russian railways will be used for the transportation. The total distance from the production site to BHPP is about 2500 km. It will be possible to estimate corresponding carbon emissions after inventory of GHG emissions in the Russian railways sector which is not available yet.

Preliminary expert estimates by JSC "Irkutskenergo" show that these negative leakages are insignificant and not comparable to the emission reductions under the Project.

Positive leakages

- Reduction of GHG emissions from sources related to transportation of the corresponding amounts of fossil fuel to the thermal power plants included in the Project and their fuel storage management.
- Prevention of emissions related to repairing and technical maintenance of the outdated working wheels, hydraulic units and equipment at BHPP related to reduction of inter-maintenance period from 9 to 6 years and more reliable functioning of the new wheels.
- Prevention of emissions resulting from possible accidents in functioning of the outdated equipment in the thermal power plants, especially in the winter seasons.

Positive leakages lead to additional reduction of GHG emissions. However we used a conservative approach to emission reduction estimation in this Project and did not include these minor reductions in the total amount of Project emission reductions.

Positive or negative leakages

- Both negative and positive leakages on the Project are estimated as insignificant, so that the net leakage is not included in estimation of the Project emission reductions.

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

The baseline study was finished on 1 August 2006.

The entity determining the baseline is Alfa-Carbon.
General Director – George V. Styazhkin
Address: 1, 3rd Pavlovsky pereulok, Moscow, 103055
Tel. +7 (495) 221 45 20
Email: info@alfa-carbon.ru

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Implementation of the Project starts on 1 December 2006.

Preliminary investigations, modeling and measurements on the Project were held in 2005.

C.2. Expected operational lifetime of the project:

The expected operational lifetime of the Project is 40 years.

The operational lifetime of the turbines is determined by the State standard GOST 27807-88 "Vertical Hydraulic Turbines" (at least 40 years).

C.3. Length of the crediting period:

The emission reduction units will be earned during the period:

- from 1 January 2008 through 31 December 2012.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

Implementation of this Project will result in improved efficiency of electricity generation by BHPP, additionally produce above 880 mln kW-hr per year during the lifetime of the project (above 40 years), substitute power generation in the condensation cycle of thermal power plants of JSC "Irkutskenergo" and reduce their carbon emissions. It is possible that part of the additional electricity will be exported form BHPP to FOREM, however it is very hard to estimate the amount of such export now as the parameters of FOREM market operations are not defined clearly by now.

The monitoring will require special focus on the following main factors:

- Actual dates of the operation start of the replaceable working wheels
- Actual amount of the efficiency increase after installation of new working wheels
- Actual amount of substitution of electricity generation in the thermal power plants of JSC "Irkutskenergo"
- Amount of the additional electricity generated by the new wheels in BHPP to be exported (if any) to FOREM
- Estimation of the average CO_2 emission factors for electricity production by the power plants that are suppliers to FOREM (in case of exports to FOREM).

Besides it is required to take into account the data on fossil fuel consumption per unit of electricity produced by the thermal power plants where the electricity generation will be substituted by supplies from BHPP. These data has high precision as they are used for calculation of electricity tariffs and approved by the Regional energy commission.

In case of fuel switch from coal to natural gas under the business-as-usual scenario (but not the corresponding JI projects), the IPCC emission factors for natural gas will be used for estimation of CO_2 emissions for electricity generation.

The data for emission monitoring will be collected and reported annually.

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

The main parameters monitored for Project performance include data on generation of additional electricity by 6 new working wheels of BHPP, saving of fossil fuel for electricity generation by thermal power plants of JSC "Irkutskenergo" and, in case of export of the additional electricity to the wholesale market FOREM, the amount of this export and CO_2 emission factors per unit of production by the power plants supplying to FOREM.

In tables D.1.1.1 and D.1.1.3 below, ID numbers beginning with MP indicate data collected to monitor emissions from the Project activity, ID numbers beginning with MB indicate data collected to monitor emissions from the baseline.

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
MP1	Generation of additional electricity by 6 new working wheels of BHPP, replaced under the Project	Irkutskenergo	Thousand kW-hr	c	Annually	100%	Hard copy, electronic worksheet	To be estimated based on efficiency improvement measurement
MP2	Quantity of electricity generation by thermal power plants substituted by the additional power from BHPP	Irkutskenergo	Thousand kW-hr	c	Annually	100%	Hard copy, electronic worksheet	To be estimated based on the planned under-load of generating capacities of the thermal power plants
MP3	Export of the additional electricity from BHPP to FOREM	Irkutskenergo	Thousand kW-hr	c	Annually	100%	Hard copy, electronic worksheet	This indicator is used only in case of supply of the additional electricity to FOREM marker.

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

It is assumed that for generation of additional electricity by BHPP the Project emissions equal to zero. PE = 0

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
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
MB1	Fuel consumption per unit of electricity generation by the thermal power plants within the Project boundary	Irkutskenergo	Tons of coal equivalent/ thousand kW-hr	c	Annually	100%	Hard copy, electronic worksheet	The indicators for each power plant are approved by the Regional Energy Commission
MB2	Average CO_2 emission factor per unit of electricity supplied to FOREM	Irkutskenergo, RAO UES Rossii, FOREM	Tons of CO_2/ thousand kW-hr	c	Annually	100%	Hard copy, electronic worksheet	Estimation of the indicator will be based on the data about annual supply of electricity to FOREM, and average fuel consumption per unit electricity generated by the suppliers

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

For estimation of the baseline emission the following formulae will be used:

$$\sum_{i=1}^{9} (QS_i * FCPU_i * C_{TJ} * EF_C * OXID * EF_{CO2}) + (QExp * EF_{FOREM}) = BE$$

where i corresponds to the following thermal power plant within the Project boundary:

1 = Novo-Ziminskaya TPP,
2 = Novo-Irkutskaya TPP,
3 = TPP-10,
4 = TPP-11,
5 = TPP-12,
6 = TPP-16,
7 = TPP-6,
8 = TPP-9,
9 = Ust-Ilimskaya TPP

QS_i – amount of the additional electricity from BHPP that will substitute power generation by the thermal power plants within the Project boundary, thousand kW-hr
$FCPU_i$ – fossil fuel consumption by the thermal power plants per unit of electricity substituted by BHPP, tons of coal equivalent /thousand kW-hr
C_{TJ} - Factor for recalculation of fuel consumption from tons of coal equivalent into TJ, TJ/tce
EF_C - Carbon emission factor for fossil fuel consumed by the thermal power plants within the Project boundary, t C/TJ
OXID – oxidization factor, %
EF_{CO2} - Factor for recalculation of C emission into CO_2 emission, t CO_2/t C
QExp – amount of the additional electricity from BHPP that will be supplied to FOREM, thousand kW-hr
EF_{FOREM} – average CO_2 emission factor for electricity supplied to FOREM, tons CO_2/ thousand kW-hr
BE – Baseline emissions, tons of CO_2

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

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:

Not applicable.

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):

BE – PE = ER

where BE – Baseline emissions, tons of CO_2
PE – Project emissions, tons CO_2
ER – Emission reduction, tons CO_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 JI approval procedures are not adopted in the host country (Russian Federation) yet, but other legislative requirements do not require collection and archiving of such information for this particular Project.

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.
MP 1	Low	Estimation of the additional electricity generation will be based on comparison of efficiencies of 6 existing and new working wheels. Accuracy of data is high due to its use for commercial purposes, including calculation of payments for electricity sale.
MP 2	Low	Estimation of this indicator will be made regarding the planned under-loading of generating capacities of the thermal power plants included in the Project boundary. Accuracy of data is high due to its use for commercial purposes, including calculation of payments for electricity sale.
MP3	Low	Supply of the additional electricity from BHPP to FOREM will be equal to the total additional electricity generated by the 6 new working wheels minus the amount of substitution of power generation by the thermal power plants. Both indicators have high accuracy due to its use for commercial purposes.
MB1	Low	Accuracy of data is high due to its use for commercial purposes, including setting-up the power tariffs regulated by the Regional energy commission
MB2	Medium	Accuracy of data is rather high as they are based on the official data on supply of electricity to FOREM. However it is difficult to predict the quality of data on the fuel balance of FOREM, use of fossil fuels by its suppliers. For data quality assurance all required requests to the FOREM operator will be made and the data provided will be cross checked using official statistics and other information.

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

JSC “Irkutskenergo” as the Project operator will be responsible for all measurement, tests and analyses required to obtain the necessary data for the monitoring plan.

JSC “Irkutskenergo” is also responsible for all data input and computations, reporting and archiving. The operational and management structure is presented below in two parts: data collection and data management. The person responsible for the implementation and management of the monitoring plan will be:

Mr. Artem Markelov
Head of Division on analysis and assessment, JSC “Irkutskenergo”
Tel +7 (3952) 790-338
Email: markelov@irkutskenergo.ru

Data collection

ID number	Responsible person	
	Name	**Position and department**
MP1	Mr. Vladimir Vashurkin	Manager, Division of project implementation, JSC “Irkutskenergo”
MP2	Mr. Vladimir Vashurkin	Manager, Division of project implementation, JSC “Irkutskenergo”
MB1	Mr. Vladimir Vashurkin	Manager, Division of project implementation, JSC “Irkutskenergo”
MB2	Mr. Vladimir Vashurkin	Manager, Division of project implementation, JSC “Irkutskenergo”
MB3	Mr. Vladimir Vashurkin	Manager, Division of project implementation, JSC “Irkutskenergo”
MB4	Mr. Vladimir Vashurkin	Manager, Division of project implementation, JSC “Irkutskenergo”

All data collected above will be forwarded to Mr. Artem Markelov, Head of Division on Analysis and Assessment of JSC “Irkutskenergo” for further data management.

Data management

Activity	Responsible person	
	Name	**Position and department**

Data entry and computation	Mr. Vladimir Vashurkin	Manager, Division of project implementation, JSC "Irkutskenergo"
Data monitoring and reporting	Mr. Vladimir Vashurkin	Manager, Division of project implementation, JSC "Irkutskenergo"
Data storage and archiving	Mr. Vladimir Vashurkin	Manager, Division of project implementation, JSC "Irkutskenergo"
Monitoring plan assessment	Mr. Artem Markelov	Head of Division on Analysis and Assessment of JSC "Irkutskenergo"
Quality assurance, audit and verification	Mr. Artem Markelov	Head of Division on Analysis and Assessment of JSC "Irkutskenergo"

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

The entity determining the monitoring plan is Alfa-Carbon.
General Director – George V. Styazhkin
Address: 1, 3rd Pavlovsky pereulok, Moscow, 103055
Tel. +7 (495) 221 45 20
Email: info@alfa-carbon.ru

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

In case of the Project implementation generation of electricity by 6 new working wheels will be made without any additional fuel or energy consumption.

Hence, the Project GHG emissions will be:

	2008	2009	2010	2011	2012
Project CO_2 emissions, tons of CO_2 per year	0	0	0	0	0

E.2. Estimated leakage:

According to the analysis in part B.3, leakages from the sources within and beyond the Project boundaries are estimated as insignificant and are not taken into account.

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

As far as the leakage is estimated as insignificant for the project, the emissions are:

	2008	2009	2010	2011	2012
Project CO_2 emissions, tons of CO_2 per year	0	0	0	0	0

E.4. Estimated baseline emissions:

For estimation of the additional electricity generation by BHPP the following indicators were used:

- Annual electricity generation by existing working wheels of BHPP = 1840 mln kW-hr by each wheel,
- Efficiency improvement = 8%,
- Operations of the new wheels will start according to the agreed schedule (section A.4.2.),
- Losses in electricity transportation are estimated as 8% on average.

The additional electricity generation by BHPP in 2008-2012 is as follows:

	2008	2009	2010	2011	2012
Additional electricity generation, mln kW-hr	515,2	809,6	883,2	883,2	883,2
Substitution of electricity with regard to losses in transportation, mln kW-hr	474,0	744,8	812,5	812,5	812,5

For estimation of carbon emissions related to substitution of the corresponding quantity of electricity by BHPP the following data were used:

Average fuel (coal) consumption per unit of electricity generation by thermal power plants of JSC "Irkutskenergo"	0,436	tce/1000 kW-hr
1000 tons of coal equivalent (tce) =	29,3	TJ
Carbon emission factor for coal[8]	26,2	tC/TJ
Recalculation factor	3,7	t CO_2/t C
Oxidization factor[9]	0,98	

Hence, the baseline GHG emissions are:

	2008	2009	2010	2011	2012
Baseline emissions, tons CO_2 per year	570230	896076	977537	977537	977537

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

	2008	2009	2010	2011	2012
Emission reductions, tons CO_2 per year	570230	896076	977537	977537	977537

Total emission reduction for the period of 2008-2012 is **4398916** tons CO_2.

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

	2008	2009	2010	2011	2012
Project CO_2 emissions, tons of CO_2 per year	0	0	0	0	0
Baseline emissions, tons CO_2 per year	570230	896076	977537	977537	977537
Emission reductions, tons CO_2 per year	570230	896076	977537	977537	977537

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:

The Russian legislation does not require an environmental assessment to be undertaken for the implementation of this Project Activity.

Implementation of the Project does not lead to any negative impacts on the environment, as it is not planned to change the existing volume of the water reservoir.

[8] IPCC default value recommended in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Workbook, p. 1.6.

[9] Ibid., p. 1.8.

At the same time, prevention of electricity generation by fossil fuel-fired power plants will provide significant benefits to the local environment and population due to reduction of air pollution. According to the expert estimates, the air pollution may be reduced as follows:

Pollutant	Emission reduction, tons per year
Ash	29765
SO_2	61271
NO_2	20535
NO	3337
CO	343
Coal ash	24

Hence, the project activity will result in improvement of the environmental quality in Irkutsk region.

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:

Not applicable. Impacts are not considered to be significant by the Project participants and the host Party.

SECTION G. Stakeholders' comments

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

Plans of JSC "Irkutskenergo" on improvement of energy efficiency and increase of electricity generation by BHPP are supported by the Governor and Administration of Irkutsk region.

The Project has received approval by the Regional Energy Commission. After implementation it will be considered for replication in other hydropower generating facilities of Russia.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Represented by:	
Title:	Head of Division
Salutation:	Mr.
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Annex 2

BASELINE INFORMATION

The baseline relates to continuation of using the same 6 turbine wheels at BHPP with the same amount of power generation per year, and continued power generation in the condensation cycle by the thermal coal-fired power plants owned by Irkutskenergo in order to satisfy demand for electricity in the region.

The baseline emissions are evaluated on a series of key factors which have the potential to affect the baseline development. Potential impacts of the key factors are considered in Chapter 2.

Annex 3

MONITORING PLAN

Implementation of this Project will result in improved efficiency of electricity generation by BHPP, additionally produce above 880 mln kW-hr per year during the lifetime of the project (above 40 years), substitute power generation in the condensation cycle of thermal power plants of JSC "Irkutskenergo" and reduce their carbon emissions. It is possible that part of the additional electricity will be exported form BHPP to FOREM, however it is very hard to estimate the amount of such export now as the parameters of FOREM market operations are not defined clearly by now.

The monitoring will require special focus on the following main factors:

- Actual dates of the operation start of the replaceable working wheels
- Actual amount of the efficiency increase after installation of new working wheels
- Actual amount of substitution of electricity generation in the thermal power plants of JSC "Irkutskenergo"
- Amount of the additional electricity generated by the new wheels in BHPP to be exported (if any) to FOREM
- Estimation of the average CO_2 emission factors for electricity production by the power plants that are suppliers to FOREM (in case of exports to FOREM).

Besides it is required to take into account the data on fossil fuel consumption per unit of electricity produced by the thermal power plants where the electricity generation will be substituted by supplies from BHPP. These data has high precision as they are used for calculation of electricity tariffs and approved by the Regional energy commission.

In case of fuel switch from coal to natural gas under the business-as-usual scenario (but not the corresponding JI projects), the IPCC emission factors for natural gas will be used for estimation of CO_2 emissions for electricity generation.

The data for emission monitoring will be collected and reported annually.

The main parameters monitored for Project performance include data on generation of additional electricity by 6 new working wheels of BHPP, saving of fossil fuel for electricity generation by thermal power plants of JSC "Irkutskenergo" and, in case of export of the additional electricity to the wholesale market FOREM, the amount of this export and CO_2 emission factors per unit of production by the power plants supplying to FOREM.