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:

Implementation of the energy efficiency measures at SE «Prindniprovsk Railway»

Sectoral Scopes:

Scope 2 – Energy distribution

Scope 3 – Energy demand

Scope 10 – Fugitive emissions from fuels (soil, oil, and gas)

Version of Project Design Documentation: 01

Date: 05/11/2011

A.2. Description of the project

Purpose of project activities

The main task of Joint Implementation Project (JIP) **«Implementation of the energy efficiency measures at SE «Prindniprovsk Railway»** is decrease in consumption of energy resources in the course of rendering services on cargo and passengers rail transportation.

This can be achieved due to complex modernization of economy of SE «Prindniprovsk Railway».

Historical details of SE «Prindniprovsk Railway»

In December 1991, established the State Administration of Railway Transport of Ukraine -UZ, which included Dnipropetrovsk branch railway.

In 1994, Dnipropetrovsk branch railway transformed into a state enterprise with cargo andpassengers DC "The Dnieper railway."

The Dnieper railway includes 4 Director: Dnepropetrovsk, Zaporozhye, Krivoy Rog andCrimea, transport operations carried out 244 stations, including 4 sorting, 7 passenger, 67cargo, 19 Precinct.

Situation existing prior to the starting date of the project

Description of the conditions under which the project implementation is provided

Before JI project the SE «Prindniprovsk Railway» almost did not perform the complex modernization of equipment due to limited funding of works, lack of perspective plan of development and insufficient level of legal framework which didn't allow regulating functionality of company's facilities. Most operated equipment is morally and physically obsolete - as a result of this consumption of fuel and electricity to maintain the same level of electricity and heat supply of the company constantly increases.

Despite the poor condition of low-effective but still operable equipment, operational experience and economic factors one may conclude that the equipment which has been operated before the realization of JI project may be operated for at least 15-20 years.

Baseline scenario

It is planned to use existing equipment with carrying out routine repair and restoration works without significant investment. Specific energy consumption in the course of rendering services for rail transportation of cargo and passengers would remain constant, leading to greenhouse gas emissions at the level of pre-project years. Justification of the baseline scenario is described in Section B.

Project scenario

SE «Prindniprovsk Railway» is an enterprise which main business is to transport passengers and cargo by railway.

To ensure the functioning of a unified system of public rail transportation the company applies technological complex, which includes: gauges, facilities for transportation of cargoes and passengers and means for servicing railways, railway stations and stations, power supply facilities, communications, alarm, centralization, blocking, information complex and traffic control system, etc. The process of transportation of cargo and passengers is very complex and consists of many elements: ensuring the timeliness and reliability of rail transportation, ensuring proper storage conditions, ensuring comfortable conditions for passengers during their staying at the passenger depots, stations and perrons and during transportation, ensuring continuous servicing of rolling stock and transport routes, ensuring proper conditions for work and recreation of the company's employees, ensuring uninterrupted supervisory control of freight and passenger rail transportation.
Based on the fact that providing freight and passenger rail transportation is complex and includes all administrative and technical resources and means of SE «Prindniprovsk Railway» DC, it is impossible to divide upgrading of the facilities on separate lines. Therefore, the project provides for a comprehensive modernization of facilities of SE «Prindniprovsk Railway», leading to reduced consumption of electricity, diesel and fossil fuels. Measures to be implemented within the project (see Section A.4.2 below), as well as implementation and constant monitoring of possible sources of losses and prevention of their occurrence will significantly reduce the consumption of electricity, diesel and fossil fuel by the facilities of SE «Prindniprovsk Railway» which in turn will reduce greenhouse gas (GHG) emissions.
SE «Prindniprovsk Railway» has all licenses and permits necessary for project implementation.
Major contracts for the procurement of raw materials (electricity and diesel fuel) were concluded already and are updated annually according to current practice. The necessary equipment for the project is planned to be purchased from the leading Ukrainian and European companies on the tender basis.

Historical details of JI project realization «Implementation of the energy efficiency measures at SE «Prindniprovsk Railway».
18/08/2003 – Board of Management of SE «Prindniprovsk Railway» made a decision to establish Joint Implementation project " *Implementation of the energy efficiency measures at SE «Prindniprovsk Railway»* at the meeting
12/09/2003 - date of commencement of project documentation elaboration for Joint Implementation project "*Implementation of the energy efficiency measures at SE «Prindniprovsk Railway».*
01/01/2004 - date of introduction of new energy efficient equipment according to project documentation.
11/11/2011 - preparation and submitting of project proposal concerning justification of the reduction of anthropogenic GHG emissions to the National Environmental Investment Agency of Ukraine.
30/11/2011- receiving letters of endorsement from the National Environmental Investment Agency of Ukraine.

A.3. 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)
Ukraine (Host Party)	• SE «Prindniprovsk Railway»	No
Switzerland	• "VEMA S.A."	No
* Please indicate if the Party involved is a host Party.		

A.4. Technical description of the project:

A.4.1. Location of the project:

SE "Prindniprovsk Railway" connects Donbas with Krivyy Rig iron basin fnd serves the southeast of Ukraine, namely Dnipropetrovsk, Zaporizhzhya, Kharkiv and Kherson regions, and Autonomous Republic of Crimea. Prindniprovsk Railway network includes one of the oldest lines in the south region Lozova-Alexandrivsk (Zaporizhzhya) with a branch to Nyzhnyodniprovsk in Katerinoslav

Project location is outlined on the map of Ukraine (Fig. 1.) by arrow.

Fig. 1.Location of SE «Prindniprovsk Railway» on the map of Ukraine

A.4.1.1. Host Party(ies):

The project is located in Ukraine.
Ukraine is an Eastern European country that ratified the Kyoto Protocol to UNFCCC on February 4, 2004, and is listed in the Addition 1 and is eligible for the Joint Implementation projects[1].

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

SE «Prindniprovsk Railway» is located on the territory of Dnipropetrovsk, Zaporizhzhya, Kharkiv and Kherson regions, and Autonomous Republic of Crimea.

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

JI project includes all administrative-territorial units wherein SE «Prindniprovsk Railway» is located and which are located on the territory of Dnipropetrovsk, Zaporizhzhya, Kharkiv and Kherson regions, and Autonomous Republic of Crimea.

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

Project is located in Ukraine and covers the territories of Dnipropetrovsk, Zaporizhzhya, Kharkiv and Kherson regions, and Autonomous Republic of Crimea.
Geographic coordinates of principal office of SE «Prindniprovsk Railway»: 48°27′59.76″ n.l. 35°01′05.35″ e.l.

Fig. 2. Scheme of SE «Prindniprovsk Railway»

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

JI project "Implementation of the energy efficiency measures at SE «Prindniprovsk Railway» provides for comprehensive modernization of company's facilities to reduce energy consumption of energy resources in the provision of services for cargo and passengers transportation by rail. It is planned to introduce advanced energy efficient equipment, taking into account the latest trends and technologies in the field of rail transportation. Technologies implemented by the project are advanced and will lead to significant productivity improvement.
The project doesn't provide for introduction of equipment which requires additional training of personnel. In case of such need the equipment manufacturers provide for training on use and maintenance of introduced equipment for employees of SE «Prindniprovsk Railway».

Detailed description of the main measures and technologies provided by the project are listed below, details of all implemented energy efficiency measures at the plant will be presented at the stage of monitoring of JIP " *Implementation of the energy efficiency measures at SE «Prindniprovsk Railway»*:

1. Introduction of domestic electric locomotives DE1 for cargo and passenger transportation. Brief description and its characteristics are given below.

Electric locomotive DE1 is electric locomotive of direct current produced by Dnipropetrovsk Electric Locomotive Building Plant for the needs of Railway Transport of Ukraine. Body of electric locomotive is metal with bearing frame. Bogies are double-axis - transfer of traction brake force through two rubber-metal locking dogs; transfer of load weight - through the spring supported by journal –box underswung cross arm. On the roof in the front sections there are start-brake resistors (SBRs) in the rear – single arm pantograph current collective device and main reservoirs. To control the power circuit and diagnostic of equipment, each section has a microprocessor control and diagnostics system (MCDS). Principal controller is installed on the driver's desk, and assistant's desk has monitor with a keyboard that manages MCDS.

DE1 (Dnipropetrovsk Electric Locomotive Building Plant,1 first)		Class of service: freight operation, driving of railway trains Class of current and voltage in trolley system, 3 kV weight on working order: 184 t Pressure of wage wheels on track: 230 kN Design speed: 100 km / h. Power in hour rating: 6260 kW Traction effort in hour rating: 440 kN Power of regeneration braking: 6600 kW Power of dynamic braking: 6500 kW

Table 1. Technical characteristics of electric locomotive DE1

The introduction of electric locomotives DE1 will enable to increase train-handling and traffic-carrying capacity of locomotive sector in providing services on rail transportation of goods and passengers, due to higher (compared to electric locomotives of previous generations) electric performance; this will reduce energy consumption resulted in decrease in GHG emissions to the atmosphere.

2. Modernization of diesel-powered locomotives through split-phase start system (SPSS). Brief description of the equipment and its characteristics are given below, at equipment seller's web-site[1].

Split-phase start systems (SPSS) are designed to improve reliability, increase resource of systems for running diesel engines and improve the conditions of operation and maintenance of locomotives, especially in case of worn-out rechargeable batteries and low ambient temperatures.
SPSS makes it possible to overcome mechanical resistance at the start cranking of the crankshaft and significantly decrease electrical load of battery when you start a diesel engine. SPSS is designed to: improve reliability, increase resource of systems for running diesel engines, improving conditions of operation and maintenance of locomotives.

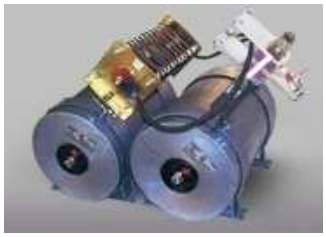

Fig.3. Split-phase start system *(SPSS).*

SPSS makes it possible to decrease diesel fuel due to overcoming mechanical resistance at the start cranking of the crankshaft and decrease in electrical load of battery when you start a diesel engine, that will result in reduction of GHG emissions to the atmosphere.

3. Introduction of the system of accounting and recording of diesel fuel loss of «БІС-Р» type. Brief description of the system and its characteristics are given below and at equipment seller's web-site. [1]

Software of system of accounting and recording of diesel fuel loss of «БІС-Р» type can get a visual record of fuel consumption and an analysis of the locomotive operation, as well as to store and archive all data received by the system.
The system " БІС-Р" is distributed microprocessor control-measuring structure with the following specifications:
▪ Power supply of the system is through locomotive on-board power system with a voltage of 60-120V;
▪ measurement of volume in the range of 500-5600 l, at calibration of fuel tank by measurement vessel with capacity of 50 l.;
▪ accuracy of the current voltage measurement is 7%, within the range up to 1000 kW;
▪ accuracy of the fuel temperature measurement - ± 1 ˚ C in the range of -30 ˚ C to +50 ˚ C;
▪ sensitivity of the system to changes in volume - 2-3 l.;
▪ maximum period of information accumulation – at least 10 days.
The introduction of control system БІС-Р will increase the control over the use of diesel by locomotives, due to ongoing monitoring and analysis of fuel consumption that will reduce GHG emissions to the atmosphere.

4. Implementation of multifunctional additive «Adizol T-6». Brief description is given below and at seller's web-site.[2]

Application of additive "Adizol T-6" provides reduction in specific consumption of diesel fuel and leads to:
- Fuel economy;
- Increasing the life of parts, components and assemblies;
- Reducing time and cost of repairs;
- Increase in engine power;
- Cleaning the fuel system and prevention of further pollution;
- Reduction of engine noises;
- increasing the storage of fuel.

All the above will reduce GHG emissions to the atmosphere.

5. Introduction of the system for control of fuel consumption and operating regimens of diesel locomotives of "DELTA SU" type. Brief description of the system and its characteristics are given below and at equipment seller's web-site.[3]

Fig.4. On-board system for control of parameters of diesel locomotive operation "DELTA SU"

[1] http://www.cmt.perm.ru/index.files/Page832.htm
[2] http://www.adioz.com.ua/
[3] http://dneproteh.com/Dneproteh_CKPRT_Delta_CY.html

"Delta SU" is onboard system for control of parameters of diesel locomotive operation; it has the possibility of continuous registration of the main parameters of locomotive operation:
- Definition of useful performed work, determination of the factor of locomotive use;
- Determination of fuel use;
- Measuring and recording the dynamics of fuel quantity in the locomotive tank;
- Automatic recording of fuel in the course of shift changeover and coal handling, the current diagnostics of diesel engine - generator set;
- Control of the location of the locomotive in real time;
- Transfer of the accumulated information is held in automatic mode on a shift basis through radio channel on ARM "Delta WEB / GPS" for further processing.

Implementation of on-board system for control of parameters of diesel locomotive operation “DELTA SU” provide automatic recording of fuel consumption that will reduce GHG emissions to the atmosphere.

6. Modernization of diesel locomotives diesel with the engines 4D80. Brief description of equipment and its characteristics are given below, as well as equipment seller’s web-site[4].

Diesel 4D80 is four-stroke, with gas-turbine pressuring and charge air cooling.

Fig.5. Appearance of engines 4Д80

Table 2. Technical characteristics of engines 4Д80

Power kW	Rotation frequency, Rotation/min	Maximal rotation torque, Nm.	Overall dimensions, mm (length, width, height)	Mass, kg	Quantity of cylinders and their location
1350	750	883	3980/1610/2845	17000	12V

Use of more efficient diesel engines 4D80 will result in reduction of fuel consumption in comparison with old diesel engines that will reduce emissions of harmful gases into the atmosphere.

[4] http://malyshevplant.com/

6. Introduction of high-efficiency natural gas boilers. Brief description of equipment and its characteristics are given below, as well as equipment seller's web-site. [5]

Fig.6. Boiler BK-21

Boiler BK- 21 is intended for heating and hot water supply (HWS) of residential, public and industrial buildings and premises. Heating boilers BK – 21 are steel water-heating fire-tube boilers, steel boilers, the first move which is formed by fire-tube and the second – by fumivorous tubes of convective part of boiler.

Table 3. Technical characteristics of high-efficiency gas boiler BK-21

Technical characteristics of Boiler BK - 21	
Power, Mw (Gcal)	2,0 (1,72)
Burning devices	GGSB – 2,2
Type of fuel	Natural gas, State Standard 5542-87
Water pressure, MPa	0,2 – 0,4
Gas pressure before burner, kPa	3,5..18
Temperature of discharge gases, ^{0}C	150..200
Efficient Factor, %	91
Maximum mass, ru	4000
Overall dimensions, mm: Length Width	 3580 1810

[5] http://teplomehanika.ru/ksv_vk2122.htm

Height	2340

Introduction of high-efficient natural gas boilers will significantly reduce GHG emissions due to higher efficient factor in comparison with the old boilers of similar capacity.

7. Change of burners. Brief description and its characteristics are given below, as well as equipment seller's web-site. [6]

Burners are equipped with separate electrical drives of air and gas valves, due to which design of burners and their service are significantly simpler. Even regulation of burner power is through a gas valve control, which is consistent with an air valve through the electronic control unit. Readily available examination and repair of burners are due to ball system of burner attachment to the fan. Burner may open as to the right and left. Burners enable to control the length and diameter of the torch.

Fig.7. Gas block burner

Burner provides offline operation, in which power of burner or operating temperature of the heat transfer agent shall be given by the operator or by using the program and maintained automatically.

Table 4. Technical characteristics of gas burners.

Rated thermal power, MW	2,3
Rated gas pressure, kPa	3
Rated gas consumption, m^3/h.	200
operating supply voltage, (50 Hz), V	220/380
Required power, kW	4
fuel	Natural gas according to State Standard 5542

Installation of gas burners with greater efficient factor will make it possible to burn the fuel more efficiently in boilers that would reduce gas consumption for heating needs. This, in turn, will reduce GHG emissions to the atmosphere.

8. Installation of contact and contactless heat-regeneration gas-cleaning apparatus. Brief description of equipment and its characteristics are given below, as well as on equipment seller's web-site[7]. Heat regenerators are designed for gas heat recovery and are used for heating of water intended for the purposes of heating, communal hot water supply and heating of back system water.

[6] http://www.ugt.com.ua/index.php?option=com_content&view=article&id=42&Itemid=75

Fig. 8. Heat-regenerator

Table 5. Technical characteristics of heat-regenerators

Technical data:	
Temperature of boiler (furnace) discharge gases, ^{0}C	160-280
Temperature of heat-regenerator discharge gases, ^{0}C	120-140
Water consumption through heat-regenerators, m^3 / h	25
Efficient factor of discharge gas heat, %	80
Dimensions, m	1,177 x0, 377x0, 45
Mass, kg	431

Introduction of heat-regenerators will reduce gas consumption and fossil fuel for needs of heat and hot water supply by using heat of discharge gases for heating the water that will reduce GHG emissions to the atmosphere.

9. Replacement of heat networks by pre-insulated pipelines. Brief description and its characteristics are given below, as well as equipment seller's web-site [7]

Shop pre-insulated pipelines consist of a leading internal steel pipe, outer protective shell of polyethylene pipe and polyurethane insulation placed between them. The top of the insulation layer has two conductors of heat control system of tightness of heat pipes (alarm). Alarm conductors are copper wires with square cross section of 1.5 mm.

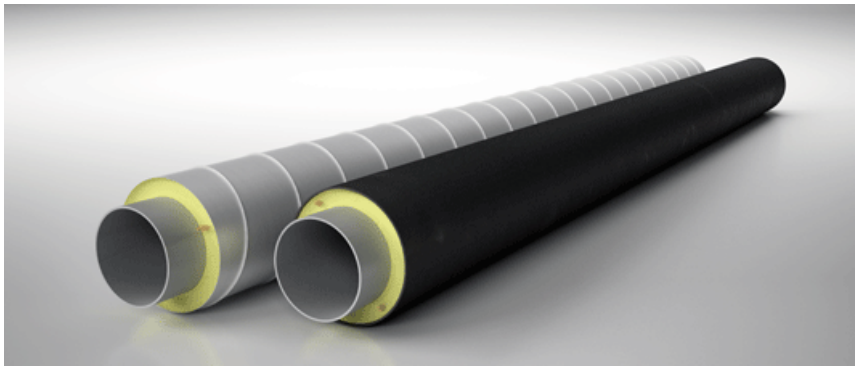

Fig. 9. Pre-insulated pipelines

Implementation of this measure will improve the terms of trouble-free service of heat supply, reduce heat loss through the insulation of pipelines and reduce leakages of heat carrier agent through the emergency area,

[7] http://www.transprogress.com.ua/products.htm

which would reduce heat losses in heating system and will save fuel for heating of the coolant that will reduce GHG emissions to the atmosphere.

10. Use of thermal pumps for heat supply and HWS. Brief description and its characteristics are given below, as well as equipment seller's web-site. [8]

Thermal pump uses low-temperature heat that is in a "scattered" state in the environment: in the land, water and air. Spending minimum kWh of electricity in the drive, the most heat is received. During the summer, if indoor temperature is above comfortable +23 ° C, the system will work in "reverse direction", i.e. as air conditioning, providing a room with "cold". Thermal pumps are easy to use, environmentally safe, reliable and durable.

Fig. 10. Thermal pump

Table 6. Technical characteristics of thermal pump

Thermal pump	
Heat power [kW]:	268,8
Power consumption[kW]:	67,2
Operating current [A]:	115,4

The introduction of thermal pumps for heat and hot water supply systems will significantly reduce the amount of consumed gas and fossil fuels through the use of low potential heat to the needs of heating and hot water supply that will reduce GHG emissions to the atmosphere without reducing capacity of thermal energy.

11. Implementation of frequency control devices of pump electrical drives. Brief description of equipment and its characteristics are given below.

Implementation of frequency control of thermal pump electrical drives will significantly reduce electricity consumption. These regulators allow changing of electric engine power depending on the connected load, both during the day and throughout the year.

[8] http://www.geoteplo.com.ua/katalog/catalogochsnere/industry/158.html

Fig. 11.Frequency control device

Implementation of frequency regulation will significantly reduce energy consumption by electric engines of thermal pumps of heating system. In the case of reducing electricity consumption from the network, quantity of combusted fossil fuel in Ukrainian power plants will reduce resulting in decrease of GHG emissions to the atmosphere.

12. Change of circulating pumps of heat supply system and HWS. Brief description and its characteristics are given below, as well as equipment seller's web-site[9].

Circulating pumps are equipped with two-pole engine and consist of a hydraulic body made of stamped aluminum and cast iron sealing flange. Flanges of nozzle with threaded holes for pressure gauge connection. Impeller is made of technological polymers. Shaft is made of stainless steel. The protective shell of the rotor and stator casing are made of stainless steel.

Fig.12. Pumps

Table 7. Technical characteristics of pumps.

Technical characteristics of pumps:	
Maximal operating pressure:	10 bar (1000 kPa)
Standard flanges:	DN40, DN50, DN65, DN80 в PN6 / PN10 (with four holes)
Set:	Engine shaft in horizontal position
Fluid temperature:	- from -10 ° to +120 ° C
Operating fluid:	clear, without solid particles and mineral oils, nonviscous, chemically neutral, similar to water in terms of characteristics

Replacement of circulating pumps of heating system and hot water supply with a higher efficient factor and better performances of energy efficiency compared to less efficient pumps will reduce power consumption,

which in turn will result in lower the costs of fossil fuel for Ukrainian power plants and decrease in GHG emissions to the atmosphere.

13. Using of modern gas meters. Technical characteristics of the equipment are given below.

Fig.13. Turbine gas meter

Table 8. Technical characteristics of gas meter.

Technical characteristics of gas meter	
Rated consumption, m^3/h	100
Maximal consumption, m^3/h	160
Minimal consumption, m^3/h	16
Threshold sensitivity, m^3/h, maximum	2,4
Measurement range	1:10
Minimal required pressure of gas, kPa, (mmAq)	1,2(120)

Application of modern gas metering devices makes it possible to use it more efficiently, to monitor, simplifies control and ensures safe operation and leads to reduction of fossil fuel and GHG emissions into the atmosphere.

14. Installation of solar collectors in order to use solar energy for heating. Brief description of equipment and its characteristics are given below, as well as equipment seller's web-site[9].

Solar collector (Heliocolector) is a device that is designed to absorb solar energy and its subsequent conversion into thermal energy, suitable for use in heat supply system.

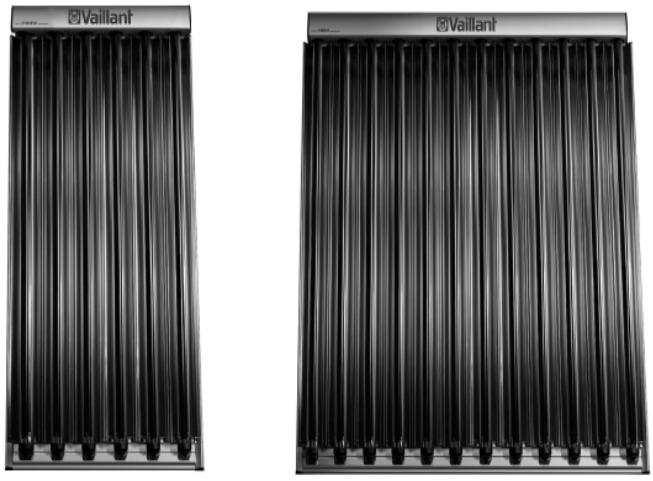

Fig.14. Solar collectors

Table 9. Technical characteristics of solar collectors

Technical data		
Area (km, net)	m	1,14/1,0
Collector volume	l	0,9
Operating pressure	bar	10
Temperature of idle time	^{0}C	295
Productivity factor k 1	W/m.K	0,885
Height	mm	1652
Width	mm	702
Depth	mm	111
Weight	kg	19

Solar panels use renewable energy of sun to generate heat. Using collectors will reduce GHG emissions in the course of heat generation by replacing the use of boiler and furnace equipment operable on fossil fuels.

15. Thermal insulation of external walls and roofs of buildings and structures to improve their thermal resistance. Brief description of technology is given below.

Thermal insulation of external walls and roofs is to create an additional layer of insulation on the outside or the inside of the wall or roof. At the same time the heat loss decreases and the temperature inside of the wall increases, which makes living in the house more comfortable and eliminates the cause of increasing humidity and mold formation. After additional insulation wall insulation properties improve by three or four times.

Fig.15. Scheme of thermal insulation of external walls

The introduction of thermal insulation of external walls and roofs of buildings and structures will reduce heat loss through the fencing constructions that reduces the heat consumption for heating buildings. This will reduce the cost of fuel combusted for heat supply needs and, accordingly, will reduce GHG emissions to the atmosphere.

14. Replacement of windows to improve their thermal resistance. Brief description of technology is given below.

Windows are a major source of heat loss by the building. Therefore, installation of energy efficient windows leads to a substantial reduction in heat loss, reduces the air permeabilty of the building, better protects from external noise. Additional thermal insulation of windows or their replacement with modern windows can increase the room temperature by 4-5 ° C.

Fig.16. Energy saving metal-plastic window

Introduction of energy-efficient windows will reduce heat loss and increase room temperature at constant power heating system that will reduce the consumption of thermal energy and fossil fuels for its production. This, in turn, will reduce GHG emissions to the atmosphere.

15. Introduction of automated system for commercial metering of electricity consumption (ACMEC) along the perimeter of SE «Prindniprovsk Railway». Brief description of equipment and its characteristics are given below.

Main functions of ACMEC:

- Maintain a database of resource consumption on a PC;
  - Preparation of analytical information, reports, minutes;
  - drawing up of internally - objective and of energy resources receipt and consumption in order to detect unauthorized use;
  - Many-tariff energy accounting;
  - Control of connection lines with energy meters;
  - Protecting information from unauthorized access.

Implementation of automated system for commercial metering of electricity consumption will improve accuracy, efficiency and reliability of electricity that will reduce energy consumption. Reducing energy consumption will reduce GHG emissions to the atmosphere.

16. Replacement of cables and wires overhead power lines. Brief description of equipment and its characteristics are given below.

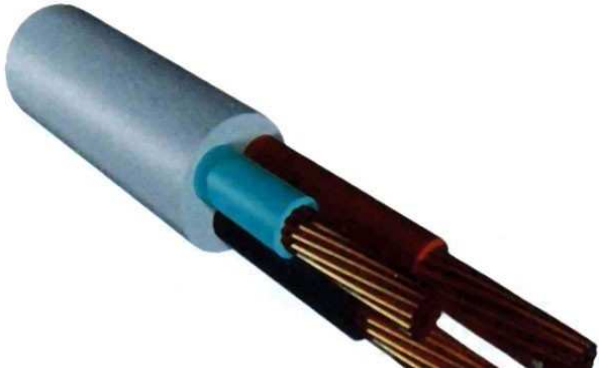

Fig.17. Cable of power lines

Fig.18. Wire of overhead power lines

Replacement of cables and wires of overhead transmission lines will reduce electricity losses during transportation resulting in decrease of gas and fossil fuel consumption at power plants in the course of electricity generation, which in turn, will reduce GHG emissions to the atmosphere.

17. Replacement of transformers at transformer substations. Brief description of equipment and its characteristics are given below, as well as on equipment seller's web-site[9].

Transformers are installed in substations, designed to convert electricity from one voltage to another. The most effective now is three-phase transformer, since the loss of electricity in them is lower and costs of active materials are less.

Fig.19. Transformer

Implementation of energy efficient transformers will reduce electricity consumption for the needs of own stations, as well as reduced electricity losses during transportation. It will help to reduce the quantity of burnt fossil fuel for electricity generation resulting in decrease of GHG emissions to the atmosphere.

17. Replacement of meters with less accuracy by meters with higher accuracy. Brief description of equipment and its characteristics are given below, as well as on equipment seller's web-site[9].

Fig.20. High-precision electricity meters

Table 10. Technical characteristics of meters

Technical characteristics	
Rated current	5 – 60 A
Accuracy class	1,0
Number of tariffs	4
Operating temperature	-30 - +50 ^{0}C
Speed of data transfer	9600 бод.
Possibility of connection of external power source (12 V) for reading in case of voltage absence	

Application of new meters with high accuracy will enhance the energy audit procedure in the enterprise and monitoring of electricity consumption that will reduce GHG emissions to the atmosphere.

18. The introduction of zonal lighting control with remote power control. Brief description of equipment and its characteristics are given below, as well as on equipment seller's web-site[9].

Light regulators are designed to turn on and off light with adjustable brightness of its separate series of lighting systems, control of individual lights. Light regulators provide efficient lighting in the necessary place city and within the required time.

Fig.21. Light regulator

Table 11. Technical characteristics of light regulator

Technical characteristics	
Supply voltage	220 V, 50Hz
Maximal load current	4,5 A
Maximal power of connected lamps	1000 W
Voltage impulse	Less than 1c
Power consumption	0,3 W
Connection of wires	Screw clips 2,5 mm^2
Operating temperature	From -25^0C to $+50^0$C

Using of lighting regulator will enable lighting devices to work with the capacity optimal for the surrounding light level, instead of continuous operation at full capacity, and thereby reduce the amount of electricity consumed. In the case of reducing electricity consumption from the network, fossil fuel burnt for its production will decrease resulting in reduction of GHG emissions to the atmosphere.

19. Introduction of cost-effective lightings and lamps in households of power supply. Brief description of equipment and its characteristics are given below, as well as on equipment seller's web-site[9].

Cost-effective lamps are used for lighting masts, for efficient lighting of large open areas, driveways, service points and areas of maintenance of freight and passenger trains, turnout switch and other areas of rail transport.

Fig. 22. Cost-effective lighting and lamp of external lighting

Table 12. Technical characteristics of lightings and lamps

Main technical characteristics	
Lightings	
Height of lighting support	30 m
Area of lighting	1,54 hectares
Weight of support with luminaires	1400 kg
Lamps	
Power	44 W
Illuminated surface	6m: 24m x 12m 8m: 32m x 14m 10m: 33m x 13m 12m: 40m x 16m
Type of cap:	E 40
Frequency (Hz)	50-60
Service hours (h)	>50000

Introduction of cost-effective lamps will significantly reduce electricity consumption. When reducing the power consumption of the network, quantity of fossil fuels burnt in Ukrainian power plants for its production will reduce resulting in decrease of GHG emissions to the atmosphere.

Stages of project implementation

Table 13. Schedule of rehabilitation and modernization of single complex of rail transportation

Name of measures	Date f implementation								
	2004	2005	2006	2007	2008	2009	2010	2011	2012
Rolling stock									
1*									
2									
3									
4									
5									
6									
Heat supply system									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
Power lines									
18									

19			
20			
21			
External lighting			
22			
23			
* - *description of measures by clauses see in Section A.4.2.*			

At the beginning of the Project SE «Prindniprovsk Railway» carried out only those measures aimed at maintaining a single complex of rail transportation in working order. Basically, these measures included repair to correct malfunctions that arise in the course of providing services on rail transportation of goods and passengers and replacement of the old faulty equipment with similar one, in connection with the cheapness of the latter. The project provides for introduction of new energy efficient equipment taking into account the latest trends in the field of rail transportation.

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:

Process of rendering services on transportation of cargo and passengers is very complex including: locomotive facilities, heating system, buildings and structures, exterior lighting and power networks. Based on this it is necessary to use complex modernization of the facilities of SE «Prindniprovsk Railway» in order to increase energy consumption and quality of rendering services on cargo and passenger rail transportation.

Complex modernization includes:

- Modernization of locomotive sector that will result in decrease of electric power and diesel fuel consumption in the course of rendering services on cargo and passenger transportation;
- Modernization of heat supply system that will result in decrease of electric power and fossil fuel consumption in the course of rendering services on cargo and passenger transportation;
- Modernization of buildings and structures that will result in decrease of heat energy consumption in the course of rendering services on cargo and passenger transportation;
- Modernization of exterior lighting and power networks that will result in decrease of losses and consumption of electric power in the course of rendering services on cargo and passenger transportation.

Maximal decrease in energy resources consumption resulting in reduction of GHG emissions to the atmosphere will be achieved due to complex modernization of company's facilities under the project "Implementation of the energy efficiency measures at SE «Prindniprovsk Railway»

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

Table 14.Estimated volume of emission reductions for the period before the first commitment period (2004-2007)

	Years
Length of the crediting period	4
Year	Estimated annual emission reductions in tonnes of CO_2 equivalent
2004	238 382
2005	538 976
2006	599 234
2007	491 317
Total estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	**1 867 909**
Annual average of estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	466 977

Table 15. Estimated volume of emission reductions during the first commitment period (2008-2012)

	Years
Length of the crediting period	5
Year	Estimated annual emission reductions in tonnes of CO_2 equivalent
2008	683 090
2009	454 887
2010	561 778
2011	565 296
2012	565 296
Total estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	**2 830 347**
Annual average of estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	566 069

Table 16. Estimated volume of emission reductions for the period following the first commitment period (2012-2020)

	Years
Length of the crediting period	8
Year	Estimated annual emission reductions in tonnes of CO_2 equivalent
2013	565 296
2014	565 296
2015	565 296
2016	565 296

2017	565 296
2018	565 296
2019	565 296
2020	565 296
Total estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	**4 522 368**
Annual average of estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	565 296

More detailed information is provided in the Accompanying Document 1.

Description of formulae used for estimation of emission reductions is represented in paragraph D.1.4.

A.5. Project approval by the Parties involved:

National Environmental Investment Agency of Ukraine issued a Letter of Endorsement for the JI Project. After project analysis the PDD and Determination report will be given to the National Environmental Investment Agency of Ukraine for Letter receipt.

SECTION B. Baseline

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

Dynamic baseline is a scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in case if the project is not implemented, which was elected in accordance with Guidance on criteria for baseline setting and monitoring (Guidance on criteria for baseline setting and monitoring, Version 03[18]). According to the Guidance for users the design of technical documentation for Joint Implementation projects, Version 04, the following stepwise approach is used for description and justification of chosen baseline:

Step 1. Identification and description of the approach chosen regarding baseline setting

For the proposed project aimed at reduction of energy consumption by the entities of SE «Prindniprovsk Railway» in providing services on goods and passengers rail transportation, none of the existing methodologies can be applied. Project Participant has selected a specific approach based on the requirements of JI projects in accordance with paragraph 9 (a) Guidance on criteria for baseline setting and monitoring for JI projects, version 03 (JI Guidance on criteria for baseline setting and monitoring, Version 03).

Baseline is determined by choosing the most likely scenario with a list and description of possible future scenarios based on conservative assumptions.The following steps were used to determine the most likely baseline scenario:1. Identification of possible alternatives that could be baseline;2. Justification of exclusion of alternatives, which are unlikely from a technical and / or economic point of view.

To establish a baseline and further development of additionality justification in section B.2. the following conditions are taken into account:
- government policy and legislation in the field of rail transportation;
– economic situation in the field of rail transportation in Ukraine and projected demand for services
– technical aspects of management and operation of the company equipment;
– access of capital (including investment barriers);
– The local availability of technology / equipment;
– Price and availability of fuel.

Step 2. Application of the approach chosen
Selection of the likely baseline scenario is based on assessment of alternative options to ensure freight and passenger rail transportation, which potentially could take place.
These options are the following alternatives:

Alternative 1.1: Continuation of current practice, without JI project.
Alternative 1.2: The project activities without Joint Implementation mechanism.
Alternative 1.3: Partial project activities (not all project activities will be implemented) without use of Joint Implementation mechanism.
Below is a detailed analysis of each alternative.

Alternative 1.1
Continuation of current practice with the introduction of minimal repairs on the background of the overall deterioration of the complex of freight and passenger rail transportation.

Status of Railway Transport system of Ukraine.
In the baseline period the status and trends of development of railway transport of Ukraine were quite unsatisfactory.

Level of good work of the assets of Railway Transport of Ukraine is extremely high. Much of the railway routes is mounted on wooden sleepers, which requires constant maintenance and periodic replacement. Certain part of railway sector infrastructure (railway stations, stations, hotels, technical facilities, communications and traffic control facilities, etc.) is quite old-fashioned.
Tariff policy of "Ukrzaliznytsya", approved annually[18], regulates rates for all types of rail transport in Ukraine. Decree "On approval of the carriage of passengers, baggage, cargo and mail by railway transport of Ukraine"[19] defines category of people that have privileged conditions for passenger transportation. Compensation of non-obtained revenue from implementation of socially necessary passenger transportation in suburban and regional traffic is provided by the State Budget of Ukraine, but it does not implemented to the full extent. "Ukrzaliznytsya" provides the following data: loss from uncompensated transportation of privileged passengers (26) in 2004 was 1.8 billion hrn.; in 2005 - almost 2.2 billion, in 2006 - 2.8 billion hrn, in 2007 - 4 billion hrn. and in 2008 - 4.3 billion hrn[18]. This fact leads to significant losses of "Ukrzaliznytsya" and actually makes impossible modernization measures to improve energy efficiency of rail transport for own funds. Solving the existing problems of accounting of privileged travels, calculation of compensation payments and their actual compensation at the state level would be provided for by the Law of Ukraine, but it is still in development.
Due to depreciation of carriage rolling stock quantity of operating wagons annually decreases. In this situation, wagons are not enough for rhythmic loading and shipping of goods to domestic enterprises and for export. This leads to lack of funds in mining companies for payment of electricity, which is also used for pumping water from the pits; other servicing entities stop businesses resulting in associated environmental and social problems.
Analysis conducted by "Ukrzaliznytsya" demonstrated that one of the reasons for the deficit of freight cars, primarily high-sided wagons, lies in the irresponsible attitude to the requirements of the standards on the terms of loading and unloading of such wagons on state enterprises of the coal and energy industries. Thus, among 38 mining unions 36 do not perform standards for cargo operations. Instead provided 5-16 hours, each car is idle almost daily, and therefore the loss of freight resources amounts to more than 570 cars daily. Causes - the technical backwardness of the infrastructure of coal companies, imperfect technology of product quality determination (analysis is carried out after loading wagons), many problems on public roads of mines and concentrating entities. Many cars are damaged in the seaports, where claw cranes operate. Standards of maintenance of wagons with coal at electric power stations.
In order to reform rail transport to meet the growing needs of the national economy and population in traffic, improve quality and reduce the cost of transport component in the price of products concept of the State program of reforming railway transport of Ukraine[18] № 651-p, approved by the Cabinet of Ministers of Ukraine dated December 27, 2006 was developed.

The program provides for a reform of railway transport in the following areas:
- Increasing the efficiency of industry by ensuring safe operation and availability of rail services market for all business entities;
- creation of the conditions for equal access to the service infrastructure of railway transport and additional services;
- Improvement of rail management system;
- creation of favorable conditions for investments needed to upgrade and modernize the production and technical base of railways;
- Integration of Railway Transport of Ukraine to European and global transportation system, creation of organizational, legal, economic, technical and technological preconditions for the introduction of European transport policy;
- guaranteeing transparency of financial activities of railway transport.

Reforming is planned to be implemented in three stages.
At first stage it is planned to create the legal framework needed for the reform, separation of the functions of public administration and management of economic activities.
At the second stage of reform the issues on withdrawal of units of railways, carrying cargo and passenger transportation, carrying out repair of cars, tracks, buildings and other objects will be solved; creation

conditions for the gradual reduction of volume of cross-subsidization of passenger transportation at the expense of passenger transportations; conduction of preliminary financial-economic, organizational and legal analysis to determine the possibility and expediency of the further formation of Company's subsidiaries, including passenger and freight transportation; development of basic principles of formation (with the participation of local governments and business entities of different forms of ownership) companies engaged in suburban passenger transportation; establishment of Company's subsidiaries that pursue activities not related to rail transport; creation of organizational and legal framework for increasing competition in the freight rail transportation, the mechanism for legal regulation of operator transportation companies and their interaction with objects of railroad infrastructure.
At third stage of the reform it is scheduled to carry out full separation of the functions of management of railway infrastructure objects and transportation, which provides for creation of conditions to prevent cross-subsidization of passenger transportation at the expense of passenger transportations; withdrawal of the Company's non-core industries and enterprises not related to rail transportation, their privatization; creation of enterprises on passengers' transportation in the long-distance and suburban traffic and distribution of service functions between them; creation of financial and economic model that will provide clear and transparent distribution of financial flows by activity types.
But the financing of the Program is provided at the own expense of railways and rail transport companies, which makes it an investment unattractive, given the poor economic situation of the enterprises. Also the mechanisms to encourage implementation of the measures described in program are not provided, which leads to lack of interest in rail transport companies in conducting measures to improve energy efficiency and reduce environmental impact.

This alternative is the most likely baseline scenario since:
- it enables to provide the necessary volume of freight and passenger traffic on existing facilities;
- it does not require investment in new technological equipment.
Accordingly, Alternative 1.1 could be considered as the most likely baseline.

Alternative 1.2
The project activities without Joint Implementation mechanism. In this case there are two obstacles: the investment (see in more details Section B2), because this scenario requires additional substantial investment and has a very big payback period and high risks, so it is attractive from investment point of view, and technological obstacle, because use of new modern equipment will require additional training of personnel. Reconstruction of equipment to improve energy efficiency is not a common practice in Ukraine. This alternative is the least likely scenario of baseline since there is need to invest in new manufacturing equipment and is characterized by lack of qualified personnel for the maintenance of this equipment, therefore Alternative 1.2 can not be regarded as a credible baseline.

Alternative 1.3
Partial project activities (not all project activities will be implemented) without Joint Implementation mechanism.
Alternative 1.3 provides for excluding from the project boundary any non-key measures for the project implementation, such as exclusion of modernization of external lighting or power lines, etc.. As the process of transportation of goods and passengers by rail is a very complex process which requires only a comprehensive approach, then partial implementation of the measures will not achieve a significant reduction in consumption of energy resources, in addition Alternative 1.3 requires investment in new manufacturing equipment and is characterized by lack of qualification of personnel for service this equipment, therefore Alternative 1.3 can not be regarded as credible baseline.

Analysis of the alternatives described above shows that the most probable is Alternative 1.1, and the least likely is Alternative 1.2 and Alternative 1.3.

The results of investment analysis in Section B2 show that Alternative 1.2 and Alternative 1.3 can not be considered as the most reliable from a financial point of view. These assumptions are provided in Section B2.

The results of analysis carried out in accordance with the "Tool for demonstration and assessment of additionality" (Version 5.2) in section B2 show that the project scenario is additional.

Description of baseline scenario
The baseline scenario assumes continuation of current practice with the introduction of minimal repairs on the background of the overall deterioration of goods and passengers rail transportation.
This scenario is less favorable environmentally for the near future (including the first period of obligations 2008 - 2012), because greenhouse gases remain at the same level or even rise, but this scenario is more attractive economically. Therefore, this practice can not ensure reduction of greenhouse gases. In addition, the continued operation of obsolete equipment (most of which is produced in the USSR) will increase the cost of diesel and fossil fuels and electricity that would result in the harmful effects on atmosphere because of its pollution emissions.
Detailed information on the algorithm for calculating the baseline is given in Section D.1.

We apply the following parameters for determination of baseline:

Data/Parameter	N_b^j			
Data unit	mln. t* km			
Description	Total volume of rail transportation for historical period «j», baseline			
Time of determination/monitoring	Annually			
Source of data (to be) used	Driver's running schedule			
Value of data applied (for ex ante calculations/determinations)		**2001p.**	**2002p.**	**2003p.**
		39 955	44 214	50 940
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A			
QA/QC procedures (to be) applied	Information on traffic volumes is the official enterprise's data used to calculate the tariff for the provision of railway transportation, and further agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine			
Any comment	Information on rail transportation volumes is the basis for calculation of GHG emissions and will be archived in paper and electronic form			

Data/Parameter	N_p^y
Data unit	mln. t* km
Description	Total volume of rail transportation for historical period «y», project
Time of determination/monitoring	Annually
Source of data (to be) used	Driver's running schedule
Value of data applied (for ex ante calculations/determinations)	Value shall be determined for each monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Information on traffic volumes is the official enterprise's data used to calculate the tariff for the provision of railway transportation, and further agreed by Ukrzaliznytsya and approved by the Ministry of

	Transport of Ukraine
Any comment	Information on rail transportation volumes is the basis for calculation of GHG emissions and will be archived in paper and electronic form

Data/Parameter	$MWh^{j}_{b,elec}$
Data unit	MW*h
Description	Electric power consumption for historical period «j», baseline
Time of determination/monitoring	half-hourly
Source of data (to be) used	Readings of electricity meters, which shall be recorded in monthly report "Departmental reporting form 1B-TVE DAEK «Structure of electric power and technological power consumption balance (TPC) for power system transmitting»
Value of data applied (for ex ante calculations/determinations)	**2001p.** | **2002p.** | **2003p.** 1165020 | 1184691,17 | 1243587,53
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Historical period (period «j») from 2001 to 2003 was chosen to determine the electricity consumed before the project implementation. The main method of determination was operational information complex, which operated along the perimeter of the enterprise. Backup method of determination was automated commercial metering of electricity consumption (AMR)
QA/QC procedures (to be) applied	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality management, Law of Ukraine "On metrology and metrological activity"[18]. The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked.
Any comment	Information on amount of consumed power is the basis for calculation of GHG emissions and will be archived in paper and electronic form

Data/Parameter	$\tilde{N}EF^{j}_{b,elec}$
Data unit	tCO_2/MW*h
Description	Emission factor CO_2e for United Power Grid (OEC) of Ukraine for historical period «j», baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon emission factors for 2011-2003 were taken from the document "Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines (ERUPT)[9]) issued by the Ministry of Economy of Netherlands
Value of data applied (for ex ante calculations/determinations)	2001 | 2002 | 2003 0,976 | 0,956 | 0,936

[9] http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html

Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	State factors of carbon oxide emission shall be applied when elaborating JI project, and in case of their absence the factors for 2011-2003 from ERUPT shall be applied.
Any comment	Data allowing calculation of GHG emissions

Data/Parameter	$V_{b,gas}^{j}$
Data unit	thous. m^3
Description	Total volume of natural gas consumed for historical period «j», baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Readings of gas meters
Value of data applied (for ex ante calculations/determinations)	**2001p.**: 44670,968; **2002p.**: 43298,926; **2003p.**: 48161,369
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Historical period (period «j») from 2001 to 2003 was chosen to determine the volumes of gas consumed before the project implementation. The main method of determination was operational information complex, which operated along the perimeter of the enterprise.
QA/QC procedures (to be) applied	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality management, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked
Any comment	Information on amount of consumed gas is the basis for calculation of GHG emissions and will be archived in paper and electronic form

Data/Parameter	$NCV_{b,gas}^{j}$
Data unit	TJ/mln.m^3
Description	Lowest Heat Value of natural gas for historical period “j, baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[10]
Value of data applied (for ex ante calculations/determinations)	2001: 33,71; 2002: 33,71; 2003: 33,71
Justification of the choice of data or description of	N/A

[10] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip

measurement methods and procedures (to be) applied	
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	According to the principles of conservatism the minimal value of gas calorific value is applied

Data/Parameter	$k_{b,gas}^{j,c}$
Data unit	t C/TJ
Description	Carbon emission factor when combusting natural gas for historical period "j", baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[11]
Value of data applied (for ex ante calculations/determinations)	2001: 15,3 / 2002: 15,3 / 2003: 15,3
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form.

Data/Parameter	$k_{b,gas}^{j,o}$
Data unit	Relative units
Description	Carbon oxidation factor when combusting natural gas for historical period "j", baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[12]
Value of data applied (for ex ante calculations/determinations)	2001: 0,995 / 2002: 0,995 / 2003: 0,995
Justification of the choice of data or description of measurement methods and	N/A

[11] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[12] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip

procedures (to be) applied	
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form.

Data/Parameter	$V_{b,diesel}^{j}$
Data unit	t
Description	Total amount of diesel fuel consumed for historical period "j", baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Meters of diesel fuel at fuel stations
Value of data applied (for ex ante calculations/determinations)	**2001p.** 60183,104 / **2002p.** 62390,207 / **2003p.** 80109,379
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Historical period (period «j») from 2001 to 2003 was chosen to determine the volumes of diesel fuel consumed before the project implementation. The main method of determination was operational information complex, which operated along the perimeter of the enterprise.
QA/QC procedures (to be) applied	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality management, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked.
Any comment	Information on amount of consumed diesel fuel is the basis for calculation of GHG emissions and will be archived in paper and electronic form

Data/Parameter	$NCV_{b,diesel}^{j}$
Data unit	TJ/ thous. t
Description	Lowest Heat Value of diesel fuel for historical period "j, baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[13]
Value of data applied (for ex ante calculations/determinations)	2001: 42,5 / 2002: 42,5 / 2003: 42,5
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A

[13] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip

QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	According to the principles of conservatism the minimal value of diesel fuel calorific value is applied

Data/Parameter	$k_{b,diesel}^{j,c}$
Data unit	t C/TJ
Description	Carbon emission factor when combusting diesel fuel for historical period "j", baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[14]
Value of data applied (for ex ante calculations/determinations)	2001: 20,2 / 2002: 20,2 / 2003: 20,2
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form

Data/Parameter	$k_{b,diesel}^{j,o}$
Data unit	Relative units
Description	Carbon oxidation factor when combusting diesel fuel for historical period "j", baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[15]
Value of data applied (for ex ante calculations/determinations)	2001: 0,99 / 2002: 0,99 / 2003: 0,99
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be)	National Cadaster of anthropogenic emissions from sources and

[14] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[15] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip

applied	absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form

Data/Parameter	$V_{b,coal}^{j}$		
Data unit	t		
Description	Total amount of coal consumed for historical period "j", baseline scenario		
Time of determination/monitoring	Monthly		
Source of data (to be) used	Form N 11-МТП «Report on results of fuel, heat energy and electricity consumption»		
Value of data applied (for ex ante calculations/determinations)	**2001p**	**2002p.**	**2003p.**
	55358	46219	44591
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A		
QA/QC procedures (to be) applied	Information on consumed coal is the official enterprise's data agreed by Ukrzaliznytsya and approved by the Ministry of Fuel and Energy of Ukraine		
Any comment	Information on amount of consumed coal is the basis for calculation of GHG emissions and will be archived in paper and electronic form		

Data/Parameter	$NCV_{b,coal}^{j}$		
Data unit	TJ/ thous. t		
Description	Lowest Heat Value of coal for historical period "j, baseline scenario		
Time of determination/monitoring	Annually		
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[16]		
Value of data applied (for ex ante calculations/determinations)	2001	2002	2003
	18,41	18,41	18,41
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A		
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)		
Any comment	According to the principles of conservatism the minimal value of coal calorific value is applied		

[16] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip

Data/Parameter	$k_{b,coal}^{j,c}$
Data unit	t C/TJ
Description	Carbon emission factor when combusting coal for historical period "j", baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[17]
Value of data applied (for ex ante calculations/determinations)	2001: 26,75; 2002: 26,75; 2003: 26,75
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form

Data/Parameter	$k_{b,coal}^{j,o}$
Data unit	Relative units
Description	Carbon oxidation factor when combusting coal for historical period "j", baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[18]
Value of data applied (for ex ante calculations/determinations)	2001: 0,98; 2002: 0,98; 2003: 0,98
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form

[17] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[18] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip

Data/Parameter	$V^{j}_{b,\,fuel-oil}$
Data unit	t
Description	Total amount of mazut consumed for historical period "j", baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Form N 11-МТП «Report on results of fuel, heat energy and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	**2001p**: 8130,6; **2002p.**: 5380,9; **2003p.**: 4333,6
Justification of the choice of data or description of measurement methods and procedures (to be) applied	H/B
QA/QC procedures (to be) applied	Information on consumed mazut is the official enterprise's data agreed by Ukrzaliznytsya and approved by the Ministry of Fuel and Energy of Ukraine
Any comment	Information on amount of consumed mazut is the basis for calculation of GHG emissions and will be archived in paper and electronic form

Data/Parameter	$NCV^{j}_{b,\,fuel-oil}$
Data unit	TJ/ thous. t
Description	Lowest Heat Value of mazut for historical period "j, baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[19]
Value of data applied (for ex ante calculations/determinations)	2001: 39,92; 2002: 39,92; 2003: 39,92
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	According to the principles of conservatism the minimal value of mazut calorific value is applied

Data/Parameter	$k^{j,c}_{b,\,fuel-oil}$
Data unit	t C/TJ
Description	Carbon emission factor when combusting mazut for historical

[19] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip

	period "j", baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[20]
Value of data applied (for ex ante calculations/determinations)	2001: 21,1 / 2002: 21,1 / 2003: 21,1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form

Data/Parameter	$k_{b,\,fuel-oil}^{j,o}$
Data unit	Relative units
Description	Carbon oxidation factor when combusting mazut for historical period "j", baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 2003.[21]
Value of data applied (for ex ante calculations/determinations)	2001: 0,99 / 2002: 0,99 / 2003: 0,99
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form

Baseline emissions are given in more details in Sections D, E and Annex 2.

[20] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[21] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip

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:

Anthropogenic emissions of greenhouse gases in the project scenario will be reduced due to the comprehensive modernization of the single complex of public rail transportation through implementation of measures proposed in the project activity as described above.

Implementation of these measures will significantly reduce the consumption of fuel-energy resources in providing services on goods and passengers transportation by rail, which causes the reduction of emissions of greenhouse gases into the environment.

Additionality of the project

Additionality of the project activity is demonstrated and evaluated below using the "Tool for demonstration and assessment of additionality[31]" (Version 05.2). This guide was developed originally for CDM projects, but it can also be used for JI projects.

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

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

There are three alternative variants of this project (which has been already discussed in Section B.1).
Alternative 1.1: Continuation of current practice, without JI project.
Alternative 1.2: The project activities without Joint Implementation mechanism.
Alternative 1.3: Partial project activities (not all project activities will be implemented) without use of Joint Implementation mechanism.

Conclusion from sub-step 1a**. One realistic alternative scenarios to the project activity was identified.**

Sub-step 1b. Consistency with current laws and regulations
Alternative 1.1: Continuation of current practice of exploitation of existing facilities of SE «Prindniprovsk Railway» is the most realistic and reliable alternative to Project implementation, since this variant is related to the minimal losses for enterprise.
According to the Law of Ukraine «On Rail Transport»[22]

Article 22, Carriers shall ensure:

- Timely high-quality transportation of passenger, cargo, baggage, freight baggage and mail;

- development of the public railway transportation infrastructure, transportation services, safety of transported cargo;

Article 10. Fundamentals of industrial and financial and investment activities in railway transport:

- "Income of railways for transportation of cargo and passengers through direct traffic are formed according to their specific contributions to transportation process."
- Existing Ukrainian system concerning establishment of tariffs for cargo and passenger rail transportation does not include an investment component to improve the railway system, by creating suitable conditions for the reduction of GHG emissions in the air.
According to the Law "On Railway Transport" SE «Prindniprovsk Railway» is not obliged and is not motivated to build and improve the system of rail transport for own funds.
Alternative 1.2: SE «Prindniprovsk Railway» didn't conduct significant steps to modernize the system of rail transport. Moreover, SE «Prindniprovsk Railway» has neither incentive nor funds to implement the measures

[22] http://zakon1.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=273%2F96-%E2%F0

provided by JI project, except revenues derived under the mechanism established by Article 6 of the Kyoto Protocol to the UN Framework Convention on Climate Change, therefore Alternative 1.2 can not be considered as credible baseline.
Alternative 1.3: This alternative provides for exclusion from the project boundary any non-key measures for the project implementation, such as exclusion of upgrading of external lighting or power lines, etc. Since the process of transportation of goods and passengers by rail is very complicated which requires only a comprehensive approach, the partial implementation of the measures will not achieve a significant reduction in consumption of energy resources; in addition Alternative 1.3 requires investment in new manufacturing equipment and is characterized by a lack of qualified personnel to service this equipment, therefore Alternative 1.3 can not be regarded as a credible baseline.

Conducting of comprehensive modernization of a unified system of rail transportation without JI mechanism is consistent with mandatory laws and regulations; details of the analysis of consistency with the law was made for Alternative 1.1, which is similar in the context of compliance with mandatory laws and regulations for Alternatives 1.2 and 1.3.
Conclusion from sub-step 1b. Under such circumstances one may say that all the scenarios do not conflict with applicable laws and regulations.
Therefore, Step 1. is satisfied.
According to the document "Tool for demonstration and assessment of additionality[32]" (Version 05.2) further proof of additionality is used through analysis of investments.

Step 2 - Investment analysis
The main purpose of investment analysis is to determine whether the proposed project:
- is the economically and financially attractive;
- is economically or financially realizable without income from ERUs' sale related to JI project.

Sub-step 2a. Determination of appropriate analysis method
There are three methods applied for investment analysis:
- simple cost analysis (variant I);
- comparative investment analysis (variant II);
- analysis with the use of basic level (variant III).

If the project activity and alternatives identified in Step 1 do not receive other financial or economic benefits, except revenue associated with the emission reduction, then use a simple cost analysis (Variant I). Otherwise, use the comparative investment analysis (Variant II) or analysis with the use of basic level (Variant III). Guidelines for additionality enable to perform comparative investment analysis, which compares the corresponding financial indices for the most realistic and reasonable investment alternatives (Variant II), or analysis with the use of basic level (Variant III). For this project it is correctly to apply the analysis with the use of basic level of Variant III, in accordance with the instructions "Tool for demonstration and assessment of additionality".

Sub-step 2b - Apply simple cost analysis
Proposed project "Implementation of the energy efficiency measures at SE «Prindniprovsk Railway»" will be implemented by project participant SE «Prindniprovsk Railway». The approach recommended in cl. 6 (a) of Guidelines on additionality involves the use of the discount rate that is determined by considering the average cost of capital (WACC). WACC is calculated as the weighted average cost of own and called capital. Since detailed information on the structure of financing, capital structure is accepted in the form of 50% own and 50% of called capital, in accordance with Clause 18 "Guidelines on the assessment of investment analysis ver.05[32]" cost of own capital shall be calculated as the sum of risk-free rate (3%), the risk premium on equity investment (6.5%). and country risk (6.75%)[33]. Thus the cost of own capital is 16.25%. The cost of own capital is estimated at the average cost of credit resources in foreign currency as of the beginning of 2004, according to data of NBU, which was 12.4%[32]. The nominal discount rate (WACC) is equal to 14.3% correspondingly. A real discount rate (IRR benchmark) is adjusted for inflation index for Eurozone (2.2%)[32].

If the proposed project (not implemented as a JI project) has a less favorable rate,i.e. lower than the internal rate of return (IRR) than the overall level limit, the project may not be financially attractive.

Sub-step 2c – Benchmark analysis

Financial analysis refers to the time of making investment decisions. The following assumptions were used based on information provided by the company.
The project requires an investment of more than 2 billion EUR (under NBU's rate)[32];
1. The project duration is 16 years 11 months (minimum term of equipment operation);
2. The liquidation value is calculated as the result of multiplying the unused resource by primary expenses.
Analysis of cash flow takes into account the cash outflow associated with the investments and operating costs[32] and cash inflow associated with the receipt of revenues from company's services rendering.
Financial indices of the project are presented in Table 17 below.

Table 17. Financial indices of the project

Revenue without VAT (thous. EURO)	Cash flow (thous. EURO)	p (discount rate)	NPV (thous. EURO)	IRR (%)	Liquidation cost (thous. EURO)
1823057,195	-868697,6073	14,3%	-351 464	1,9%	1 076 702

The source of data on income and expenses of SE «Prindniprovsk Railway» is information provided by the company.
When analyzing the cash flow the IRR is 1.9%, which is below the established limit level of IRR being 14.3%. As a result NPV is negative. Thus, the project may not be financially attractive.

Sub-step 2d: Sensitivity analysis
The sensitivity analysis is conducted to confirm whether the conclusions on the financial / economic attractiveness are quite stable at different reasonable variants of underlying conditions change. The next two key factors were considered in sensitivity analysis: investment and operational costs, tariff for rail transportation of cargo and passengers. According to the Guidelines for additionality (cl. 17) sensitivity analysis should be carried out for key indicators in the range of deviations of ± 10%.

Revenue for transportation of cargo and passengers

Company's income (thous. EURO)	2180685,814	1842384,026	2006207,344
Investment costs (thous. EURO)	355407,3374	355407,3374	355407,3374
Operating costs (thous. EURO)	1961810,687	2179789,652	2397768,617
NPV(EURO)	-381284,3127	-351463,85	-128510,0205
IRR(%)	0,1%	1,9%	7,6%

Investment and operating costs

Company's income (thous. EURO)	1962617,233	1842384,026	2398754,396
Investment costs (thous. EURO)	390948,0711	355407,3374	319866,6036
Operating costs (thous. EURO)	2179789,652	2179789,652	2179789,652
NPV(EURO)	-221988,64	-351463,85	-413035,52
IRR(%)	4,7%	1,9%	0,28%

Sensitivity analysis was used to assess the sensitivity of the project to the changes that occur during project implementation and operation of a single complex of rail transportation. Analysis of changes in profit for the rail transportation of cargo and passengers between -10% and +10% demonstrated that IRR changes within 0.1% - 7.6%. Analysis of investment and operating costs between -10% and +10% showed that IRR changes within 4.7% - 0.28%. Costs considered in this project are high and their increase leads to a negative NPV.

However subject to the expected value of the investment and the income from the sale of ERUs the project is viable and will bring sufficient profit even in the case of project financing through credits and shall produce a profit, even if the above changes in value of investments occur.

Conclusion from Step 2: sensitivity analysis consistently supports (for a realistic range of assumptions) the conclusion that the project is unlikely to be financially / economically attractive.

Step 3: Barrier analysis
According to the Guidelines for additionality the barrier analysis was not conducted.

Step 4: Common practice analysis

Sub-step 4a. Analysis of other activities similar to the proposed project activity
Analysis of similarity of the project activities demonstrated absence of similar projects in Ukraine.
The existing practice of existing facilities' operation represented in the variant of baseline, chosen for this project, is common for Ukraine. Due to the current practice all modernizations and measures to improve the railway system through the use of energy saving technologies rely on the company, and SE «Prindniprovsk Railway» has no incentive to introduce new equipment and new technologies.

Conclusion from sub-step 4a: Since there are no similar projects in Ukraine, there is no need to analyze similar project activity.
According to the "Tool for demonstration and assessment of additionality[32]" (Version 05.2) all steps are satisfied, but some obstacles still exist.
One of them is the additional costs for modernization of enterprises in the course of realizing JI project.

Obstacle associated with the structure of existing tariffs for cargo and passenger rail transportation does not include an investment component to improve the railway system, by creating suitable conditions for the reduction of greenhouse gases emissions in the air. This situation leads to a constant shortage of funds and inability of timely implementation of the overhaul, maintenance of equipment, investments in modernization and development of railway transport.

One concludes that all of the above may prevent the implementation of the proposed project as well as other alternatives - Partial project activities (not all project activities will be implemented) without use of Joint Implementation mechanism.
However one of the alternatives is a continuation of "business as usual." Since the barriers identified above directly relate to investment in upgrading the system of railway transportation the SE «Prindniprovsk Railway» has no obstacles to the further operation of railways and a single complex of rail transport at former level. Therefore identified obstacles can not prevent the introduction of at least one alternative scenario - continuation of "business as usual."
Conclusion

Taking into consideration the abovementioned analysis one may conclude that the project is additional.

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

To ensure the functioning of a unified system of public rail transportation the company applies technological complex, which includes: locomotive facilities, heating system, railway stations, stations, buildings and structures, power lines, power supply devices, communications, alarm and exterior lighting and others. Based on this one may conclude that the project boundary includes the entire technological complex of unified public rail transportation system of SE «Prindniprovsk Railway».
Table 18 demonstrates an overview of sources of greenhouse gases emissions within the baseline for JI project.

Table 18. Overview of emission sources under baseline scenario

Source	Gas	Included / excluded	Justification / Explanation
Baseline emissions			
GHG emissions related to rail transportation of cargo and passengers	CO_2	Included	In the course of providing services on rail transportation of goods and passengers the single complex system is used that includes: locomotive facilities consuming electricity and diesel fuel, and consequently causes emissions into the atmosphere, heating system consuming fossil fuel for heat generation and as a consequence causes GHG emissions to the atmosphere, external lighting and power lines that consume electricity from Unified Power Grid Ukraine and consequently cause GHG emissions to the atmosphere.

Baseline scenario boundary is showed in Figure 23 (inked with blue line).

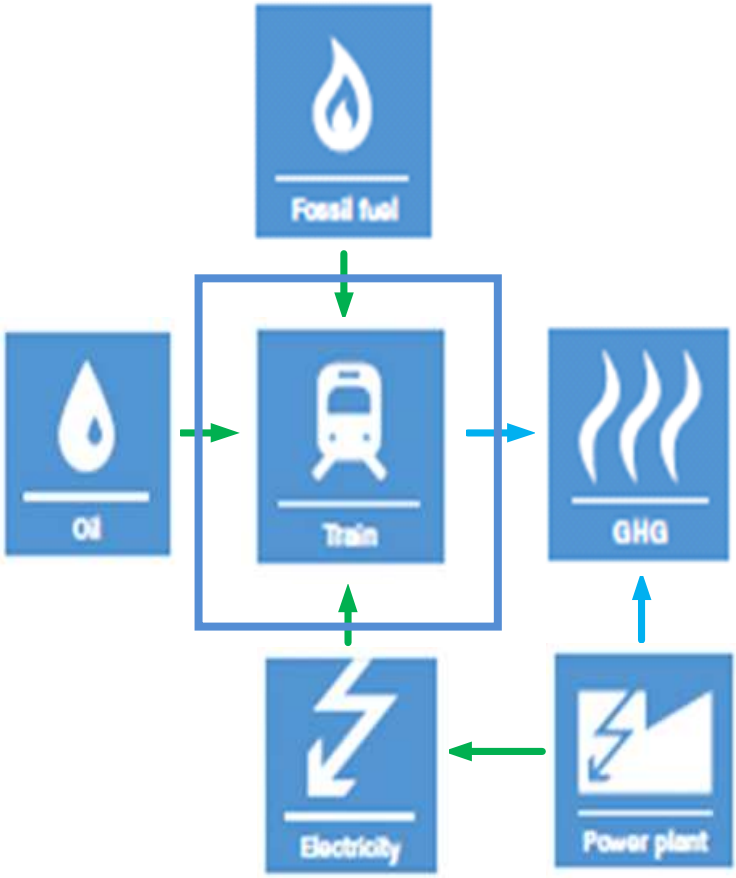

Fig. 23. Baseline scenario boundary.

Table 19 demonstrates an overview of sources of greenhouse gases emissions within project scenario.

Table 19. Overview of emission sources under project scenario

Source	Gas	Included / excluded	Justification / Explanation
Project emissions			
GHG emissions related to rail transportation of cargo and passengers	CO_2	Included	In the course of providing services on rail transportation of goods and passengers the single complex system is used that includes: locomotive facilities consuming electricity and diesel fuel, and consequently causes emissions into the atmosphere, heating system consuming fossil fuel for heat generation and as a consequence causes GHG emissions to the atmosphere, external lighting and power lines that consume electricity from Unified Power Grid Ukraine and consequently cause GHG emissions to the atmosphere.

Project scenario boundary is showed in Figure 34 (inked with blue line).

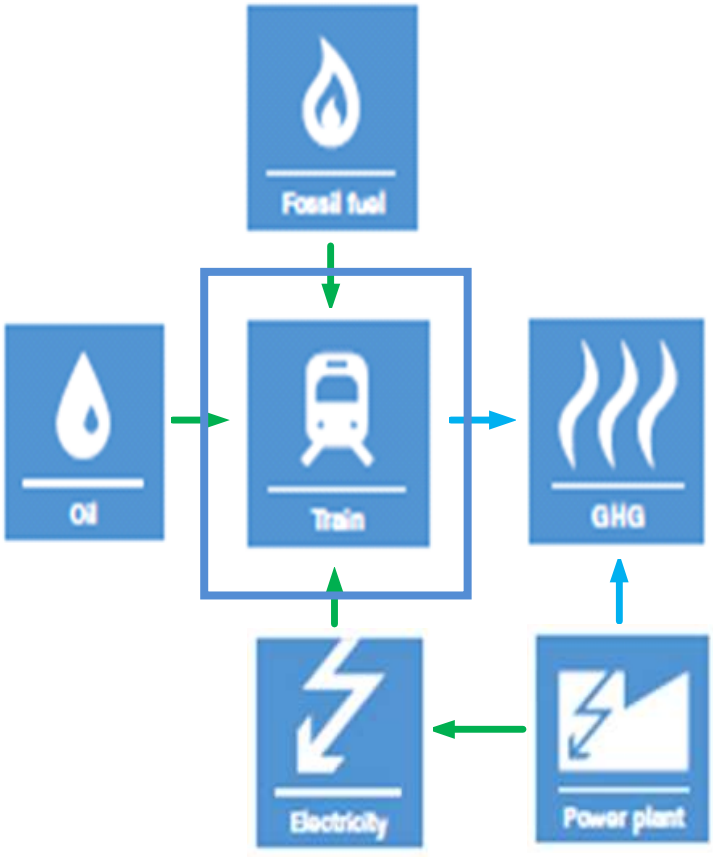

Fig. 24. Project scenario boundary.

Indirect external emissions of CO_2, CH_4, N_2O due to fuel extraction and its transportation are excluded. Leakages are not controlled by the project developer (it is impossible to assess amount of leakages), therefore they were excluded.

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 baseline determination: 05/11/2011
Baseline is determined by the VEMA S.A., project's developer, and SE «Prindniprovsk Railway».

State enterprise "Prindniprovsk Railway"
Momot Oleksandr Ivanovych
Head of Railway
Telephone: +380 562 33 00 24
Fax: +380 562 33 09 04
e-mail: www.dp.uz.gov.ua/ukr
State enterprise "Prindniprovsk Railway" is the project participant (stated in Annex 1).

VEMA S.A.:
Geneva, Switzerland.
Fabian Knodel,
Director.
Telephone: +38(044)-594-48-10
Fax: +38(044)-594-48-19
e-mail: info@vemacarbon.com
VEMA S.A. is the project participant (stated in Annex 1).

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Starting date of project is 18/08/2003, when the Board of Management of SE «Prindniprovsk Railway» made a decision on JI project establishment at the meeting.

C.2. Expected operational lifetime of the project:

From 01/01/2004 to 01/12/2020 (16 years 11 months, or 203 months), subject to due maintenance.

C.3. Length of the crediting period:

01/01/2008 to 31/12/2012 (5 years or 60 months), continuation from 01/01/2013 to 31/12/2020 (8 years or 96 months)

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The proposed project uses a specific approach based on the requirements of JI projects in accordance with clause 9 (a) Guidance on criteria for baseline setting and monitoring for JI projects, version 03.

Monitoring plan is developed for accurate and understandable measurement and calculation of greenhouse gas emissions and is carried out according to the practice established in SE «Prindniprovsk Railway» to measure the consumed electric power, natural gas, diesel fuel, coal and mazut. Project monitoring does not require changes in existing accounting system and data collection. All relevant data are calculated and recorded and stored for two years after the transfer of emission reduction units generated by the project.

The monitoring plan includes a complex of measures (measurements, maintenance, registration and calibration), which should be made to meet the requirements of the chosen methodology of monitoring and ensuring the possibility of check calculations on GHG emission reduction. The main stages of the monitoring plan are described below.

Data and parameters which are not monitored throughout the crediting period, but determined only once and available at the stage of PDD development:

N_b^j	Total volume of rail transportation for historical period «j», baseline, mln. t* km
$MWh_{b,elec}^j$	Electric power consumption for historical period «j», baseline, MW*h
$\tilde{N}EF_{b,elec}^j$	Emission factor CO_2e for United Power Grid (OEC) of Ukraine for historical period «j», baseline scenario, $tCO_2/MW*h$
$V_{b,gas}^j$	Total volume of natural gas consumed for historical period «j», baseline scenario, thous. m^3
$NCV_{b,gas}^j$	Lowest Heat Value of natural gas for historical period “j, baseline scenario, TJ/mln.m^3
$k_{b,gas}^{j,c}$	Carbon emission factor when combusting natural gas for historical period “j”, baseline scenario, t C/TJ
$k_{b,gas}^{j,o}$	Carbon oxidation factor when combusting natural gas for historical period “j”, baseline scenario, Relative units.
$V_{b,diesel}^j$	Total amount of diesel fuel consumed for historical period “j”, baseline scenario , t
$NCV_{b,diesel}^j$	Lowest Heat Value of diesel fuel for historical period “j, baseline scenario, TJ/ thous. t

$k_{b,diesel}^{j,c}$	Carbon emission factor when combusting diesel fuel for historical period "j", baseline scenario, t C/TJ
$k_{b,diesel}^{j,o}$	Carbon oxidation factor when combusting diesel fuel for historical period "j", baseline scenario, Relative units.
$V_{b,coal}^{j}$	Total amount of coal consumed for historical period "j", baseline scenario, t
$NCV_{b,coal}^{j}$	Lowest Heat Value of coal for historical period "j, baseline scenario, TJ/ thous. t
$k_{b,coal}^{j,c}$	Carbon emission factor when combusting coal for historical period "j", baseline scenario, t C/TJ
$k_{b,coal}^{j,o}$	Carbon oxidation factor when combusting coal for historical period "j", baseline scenario, Relative units
$V_{b,fuel-oil}^{j}$	Total amount of mazut consumed for historical period "j", baseline scenario, t
$NCV_{b,fuel-oil}^{j}$	Lowest Heat Value of mazut for historical period "j, baseline scenario, TJ/ thous. t
$k_{b,fuel-oil}^{j,c}$	Carbon emission factor when combusting mazut for historical period "j", baseline scenario, t C/TJ
$k_{b,fuel-oil}^{j,o}$	Carbon oxidation factor when combusting mazut for historical period "j", baseline scenario, Relative units

$[j]$ - relates to historical period;

$[b]$ - relates to baseline scenario;

$[elec]$ - relates to electric power;

$[gas]$ - relates to natural gas;

$[diesel]$ - relates to diesel fuel;

$[coal]$ - relates to coal;

$[fuel-oil]$ - relates to mazut.

Data and parameters which are not monitored throughout the crediting period, but determined only once and not available at the stage of PDD development: absent.

Data and parameters which are not monitored throughout the crediting period:

N_p^y	Total volume of rail transportation for monitoring period «y», project scenario, mln. t* km
$MWh_{p,elec}^y$	Electric power consumption for monitoring period «y», project scenario, MW*h
$\tilde{N}EF_{p,elec}^y$	Emission factor CO_2e for United Power Grid (OEC) of Ukraine for monitoring period «y», project scenario, tCO_2/MW*h
$V_{p,gas}^y$	Total volume of natural gas consumed for monitoring period «y» project scenario, thous. m^3
$NCV_{p,gas}^y$	Lowest Heat Value of natural gas for monitoring period «y», project scenario, TJ/mln.m^3
$k_{p,gas}^{y,c}$	Carbon emission factor when combusting natural gas for monitoring period «y», project scenario, t C/TJ
$k_{p,gas}^{y,o}$	Carbon oxidation factor when combusting natural gas for monitoring period «y» project scenario, Relative units
$V_{p,diesel}^y$	Total amount of diesel fuel consumed for monitoring period «y», project scenario, t
$NCV_{p,diesel}^y$	Lowest Heat Value of diesel fuel for monitoring period «y», project scenario, TJ/ thous. t
$k_{p,diesel}^{y,c}$	Carbon emission factor when combusting diesel fuel for monitoring period «y», project scenario, t C/TJ
$k_{p,diesel}^{y,o}$	Carbon oxidation factor when combusting diesel fuel for monitoring period «y», project scenario, Relative units
$V_{p,coal}^y$	Total amount of coal consumed for monitoring period «y», project scenario, t
$NCV_{p,coal}^y$	Lowest Heat Value of coal for monitoring period «y», project scenario, TJ/ thous. t

$k_{p,coal}^{y,c}$	Carbon emission factor when combusting coal for monitoring period «y», project scenario, t C/TJ
$k_{p,coal}^{y,o}$	Carbon oxidation factor when combusting coal for monitoring period «y», project scenario, Relative units
$V_{p,\,fuel-oil}^{y}$	Total amount of mazut consumed for monitoring period «y», project scenario, t
$NCV_{p,\,fuel-oil}^{y}$	Lowest Heat Value of mazut for monitoring period «y», project scenario, TJ/ thous. t
$k_{p,\,fuel-oil}^{y,c}$	Carbon emission factor when combusting mazut for monitoring period «y», project scenario, t C/TJ
$k_{p,\,fuel-oil}^{y,o}$	Carbon oxidation factor when combusting mazut for monitoring period «y», project scenario, Relative units

$[y]$ - relates to monitoring period;
$[p]$ - relates to project scenario;
$[elec]$ - relates to electric power;
$[gas]$ - relates to natural gas;
$[diesel]$ - relates to diesel fuel;
$[coal]$ - relates to coal;
$[fuel-oil]$ - relates to mazut

Table of parameters that will be included into monitoring and verification for ERU calculation is given in Sections **D.1.1.1** and **D.1.1.3.**

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

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

Data/Parameter	$MWh^{y}_{p,elec}$
Data unit	MW*h
Description	Electric power consumption for monitoring period «y» project scenario
Time of determination/monitoring	half-hourly
Source of data (to be) used	Readings of electricity meters, which shall be recorded in monthly report "Departmental reporting form 1Б-ТВЕ ДАЕК «Structure of electric power and technological power consumption balance (TPC) for power system transmitting»
Value of data applied (for ex ante calculations/determinations)	Value is determined for each monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The principal method of determination is automated commercial metering of electricity consumption (ACMEC)
QA/QC procedures (to be) applied	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality management, Law of Ukraine "On metrology and metrological activity"32. The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked..
Any comment	Information on amount of consumed power is the basis for calculation of GHG emissions and will be archived in paper and electronic form

Data/Parameter	$\tilde{N}EF^{y}_{p,elec}$
Data unit	$tCO_2/MW*h$
Description	Emission factor CO_2e for United Power Grid (OEC) of Ukraine for monitoring period «y», project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	- Carbon emission factors for 2004-2005 were taken from the document "Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines (ERUPT)[23]) issued by the Ministry of Economy of Netherlands - Carbon emission factors for 2006-2007 were taken from "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD on 17.08.2007[24]; - Carbon emission factors for 2008 were taken from the Decree of the National Environmental Investment Agency of Ukraine (hereinafter referred to as NEIAU) №62 as of 15.04.2011 "On approval of indices of specific carbon oxide emissions in 2008"[25]; - Carbon emission factors for 2009 were taken from the Decree of the National Environmental Investment Agency of Ukraine №63 as of 15.04.2011 " On approval of indices of specific carbon oxide emissions in 2009 ";[26] - Carbon emission factors for 2010 were taken from the Decree of the National Environmental Investment Agency of Ukraine №43 as of 28.03.2011p. " On approval of indices of specific carbon oxide emissions in 2010";[27] - Carbon emission factors for 2011 were taken from the Decree of the National Environmental Investment Agency of Ukraine №75 as of 12.05.2011 " On approval of indices of specific carbon oxide emissions in 2011";[28]

[23] http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html
[24] http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514
[25] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

Value of data applied (for ex ante calculations/determinations)	2004: 0,916; 2005: 0,896; 2006-2007: 0,896; 2008: 1,082; 2009: 1,096; 2010: 1,093; 2011: 1,090
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Only officially approved factors are used for calculations.
QA/QC procedures (to be) applied	State factors of carbon oxide emission shall be applied when elaborating JI project, and in case of their absence the factors for 2004-2005 from ERUPT shall be applied; for 2006-2007 – factors from the document «Carbon oxide emission factor», approved by TUV SUD
Any comment	Data allowing calculation of GHG emissions

Data/Parameter	$V_{p,gas}^{y}$
Data unit	thous. m^3
Description	Total volume of natural gas consumed for monitoring period «y», project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Readings of gas meters
Value of data applied (for ex ante calculations/determinations)	Value shall be determined for each monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The main method of determination was operational information complex, which operated along the perimeter of the enterprise..
QA/QC procedures (to be) applied	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality

[26] http://www.neia.gov.ua/nature/doccatalog/document?id=127172
[27] http://www.neia.gov.ua/nature/doccatalog/document?id=126006
[28] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

	management, Law of Ukraine "On metrology and metrological activity"[38]. The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked.
Any comment	Information on amount of consumed gas is the basis for calculation of GHG emissions and will be archived in paper and electronic form

Data/Parameter	$NCV_{p,gas}^{y}$
Data unit	TJ/mln.m^3
Description	Lowest Heat Value of natural gas for monitoring period «y», project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Lowest Heat Value of natural gas for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004».[29]; Lowest Heat Value of natural gas for 2005 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005».[30]; Lowest Heat Value of natural gas for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006».[31]; Lowest Heat Value of natural gas for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[32]; Lowest Heat Value of natural gas for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[33]; Lowest Heat Value of natural gas for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009 ».[34];

[29] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip
[30] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip

Value of data applied (for ex ante calculations/determinations)		2004	33,82	
		2005	33,82	
		2006	33,85	
		2007	33,85	
		2008	34	
		2009	34,1	
		2010	34,1	
		2011	34,1	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A			
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)			
Any comment	According to the principles of conservatism the minimal value of gas calorific value is applied			

Data/Parameter	$k_{p,gas}^{y,c}$
Data unit	t C/TJ
Description	Carbon emission factor when combusting natural gas for monitoring period «y», project scenario
Time of determination/monitoring	Annually

[31] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[32] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[33] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[34] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

<table>
<tr><td>Source of data (to be) used</td><td>Carbon emission factor for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004».[35];
Carbon emission factor for 2005 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005».[36];
Carbon emission factor for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006».[37];
Carbon emission factor for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[38];
Carbon emission factor for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[39];
Carbon emission factor for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009».[40];</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td><table>
<tr><td>2004</td><td>15,3</td></tr>
<tr><td>2005</td><td>15,3</td></tr>
<tr><td>2006</td><td>15,3</td></tr>
<tr><td>2007</td><td>15,3</td></tr>
<tr><td>2008</td><td>15,12</td></tr>
<tr><td>2009</td><td>15,11</td></tr>
<tr><td>2010</td><td>15,11</td></tr>
<tr><td>2011</td><td>15,11</td></tr>
</table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and</td><td>N/A</td></tr>
</table>

[35] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip
[36] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip
[37] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[38] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[39] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[40] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

procedures (to be) applied	
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form.

Data/Parameter	$k_{p,gas}^{y,o}$
Data unit	Relative units
Description	Carbon oxidation factor when combusting natural gas for monitoring period «y», project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon oxidation factor for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004».[41]; Carbon oxidation factor for 2005 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005».[42]; Carbon oxidation factor for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006».[43]; Carbon oxidation factor for 2007p. was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[44]; Carbon oxidation factor for 2008p. was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[45]; Carbon oxidation factor for 2009-2011pp. ви was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009».[46];

[41] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip

Value of data applied (for ex ante calculations/determinations)		2004	0,995	
		2005	0,995	
		2006	0,995	
		2007	0,995	
		2008	0,995	
		2009	0,995	
		2010	0,995	
		2011	0,995	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A			
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)			
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form.			

Data/Parameter	$V^{y}_{p,diesel}$
Data unit	t
Description	Total amount of diesel fuel consumed for monitoring period «y», project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	The main method for determination is system of accounting and recording of diesel fuel loss of «БІС-Р» type, operating along the enterprise's perimeter.

[42] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip
[43] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[44] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[45] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[46] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Value of data applied (for ex ante calculations/determinations)	Value shall be determined for each monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	system of accounting and recording of diesel fuel loss of «БІС-Р» type is regularly certified and verified according to the procedures of quality management, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked.
Any comment	Information on amount of consumed diesel fuel is the basis for calculation of GHG emissions and will be archived in paper and electronic form

Data/Parameter	$NCV^{y}_{p,diesel}$
Data unit	TJ/ thous. t
Description	Lowest Heat Value of diesel fuel for monitoring period “y”, project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Lowest Heat Value of diesel fuel for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004».[47]; Lowest Heat Value of diesel fuel for 2005 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005».[48]; Lowest Heat Value of diesel fuel for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006».[49];

[47] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip
[48] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip

<table>
<tr><td></td><td>Lowest Heat Value of diesel fuel for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[50];
Lowest Heat Value of diesel fuel for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[51];
Lowest Heat Value of diesel fuel for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009 ».[52];</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td><table>
<tr><td>2004</td><td>42,5</td></tr>
<tr><td>2005</td><td>42,5</td></tr>
<tr><td>2006</td><td>42,5</td></tr>
<tr><td>2007</td><td>42,5</td></tr>
<tr><td>2008</td><td>42,5</td></tr>
<tr><td>2009</td><td>42,3</td></tr>
<tr><td>2010</td><td>42,3</td></tr>
<tr><td>2011</td><td>42,3</td></tr>
</table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)</td></tr>
<tr><td>Any comment</td><td>According to the principles of conservatism the minimal value of coal calorific value is applied</td></tr>
</table>

[49] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[50] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[51] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[52] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Data/Parameter	$k_{p,diesel}^{y,c}$
Data unit	t C/TJ
Description	Carbon emission factor when combusting diesel fuel for monitoring period "y", project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon emission factor for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004».[53]; Carbon emission factor for 2005 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005».[54]; Carbon emission factor for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006».[55]; Carbon emission factor for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[56]; Carbon emission factor for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[57]; Carbon emission factor for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009».[58];
Value of data applied (for ex ante calculations/determinations)	2004: 20,2 2005: 20,2 2006: 20,2

[53] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip
[54] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip
[55] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[56] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[57] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[58] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

		2007	20,2	
		2008	20,2	
		2009	20,2	
		2010	20,2	
		2011	20,2	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A			
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)			
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form			

Data/Parameter	$k_{p,diesel}^{y,o}$
Data unit	Relative units
Description	Carbon oxidation factor when combusting diesel fuel for monitoring period "y", project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon oxidation factor for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004».[59]; Carbon oxidation factor for 2005 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005».[60]; Carbon oxidation factor for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption

[59] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip
[60] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip

<table>
<tr><td></td><td>by GHG sinks in Ukraine for 1990-2006».[61];
Carbon oxidation factor for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[62];
Carbon oxidation factor for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[63];
Carbon oxidation factor for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009».[64];</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td><table>
<tr><td>2004</td><td>0,99</td></tr>
<tr><td>2005</td><td>0,99</td></tr>
<tr><td>2006</td><td>0,99</td></tr>
<tr><td>2007</td><td>0,99</td></tr>
<tr><td>2008</td><td>0,99</td></tr>
<tr><td>2009</td><td>0,99</td></tr>
<tr><td>2010</td><td>0,99</td></tr>
<tr><td>2011</td><td>0,99</td></tr>
</table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)</td></tr>
<tr><td>Any comment</td><td>Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form</td></tr>
</table>

[61] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[62] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[63] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[64] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Data/Parameter	$V^{y}_{p,coal}$
Data unit	t
Description	Total amount of coal consumed for monitoring period «y», project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Form N 11-МТП «Report on results of fuel, heat energy and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	Value shall be determined for each monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Information on consumed coal is the official enterprise's data agreed by Ukrzaliznytsya and approved by the Ministry of Fuel and Energy of Ukraine
Any comment	Information on amount of consumed coal is the basis for calculation of GHG emissions and will be archived in paper and electronic form

Data/Parameter	$NCV^{y}_{p,coal}$
Data unit	TJ/ thous. t
Description	Lowest Heat Value of coal for monitoring period «y», project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Lowest Heat Value of coal for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004».[65]; Lowest Heat Value of coal for 2005 was taken from «National

[65] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip

<table>
<tr><td></td><td>report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005».[66];
Lowest Heat Value of coal for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006».[67];
Lowest Heat Value of coal for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[68];
Lowest Heat Value of coal for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[69];
Lowest Heat Value of coal for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009».[70];</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td><table>
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<tr><td>2006</td><td>21,34</td></tr>
<tr><td>2007</td><td>21,95</td></tr>
<tr><td>2008</td><td>21,5</td></tr>
<tr><td>2009</td><td>21,8</td></tr>
<tr><td>2010</td><td>21,8</td></tr>
<tr><td>2011</td><td>21,8</td></tr>
</table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate</td></tr>
</table>

[66] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip
[67] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[68] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[69] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[70] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

	Change (UNFCCC)
Any comment	According to the principles of conservatism the minimal value of coal calorific value is applied

Data/Parameter	$k_{p,coal}^{y,c}$
Data unit	t C/TJ
Description	Carbon emission factor when combusting coal for monitoring period «y», project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon emission factor for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004 гг.».[71]; Carbon emission factor for 2005 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005 гг.».[72]; Carbon emission factor for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006 ».[73]; Carbon emission factor for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[74]; Carbon emission factor for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[75]; Carbon emission factor for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009».[76];

[71] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip
[72] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip
[73] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[74] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[75] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip

Value of data applied (for ex ante calculations/determinations)		2004	26,78	
		2005	26,8	
		2006	26,8	
		2007	26,8	
		2008	25,95	
		2009	25,97	
		2010	25,97	
		2011	25,97	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A			
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)			
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form			

Data/Parameter	$k_{p,coal}^{y,o}$
Data unit	Relative units
Description	Carbon oxidation factor when combusting coal for monitoring period "y", project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon oxidation factor for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004».[77]; Carbon oxidation factor for 2005 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for

[76] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[77] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip

<table>
<tr><td></td><td>1990-2005».[78];
Carbon oxidation factor for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006».[79];
Carbon oxidation factor for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[80];
Carbon oxidation factor for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[81];
Carbon oxidation factor for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009».[82];</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td><table>
<tr><td>2004</td><td>0,98</td></tr>
<tr><td>2005</td><td>0,98</td></tr>
<tr><td>2006</td><td>0,98</td></tr>
<tr><td>2007</td><td>0,98</td></tr>
<tr><td>2008</td><td>0,963</td></tr>
<tr><td>2009</td><td>0,963</td></tr>
<tr><td>2010</td><td>0,963</td></tr>
<tr><td>2011</td><td>0,963</td></tr>
</table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)</td></tr>
</table>

[78] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip
[79] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[80] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[81] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[82] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form

Data/Parameter	$V^{y}_{p,fuel-oil}$
Data unit	t
Description	Total amount of mazut consumed for monitoring period "y", project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Form N 11-МТП «Report on results of fuel, heat energy and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	Value shall be determined for each monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	H/B
QA/QC procedures (to be) applied	Information on consumed mazut is the official enterprise's data agreed by Ukrzaliznytsya and approved by the Ministry of Fuel and Energy of Ukraine
Any comment	Information on amount of consumed mazut is the basis for calculation of GHG emissions and will be archived in paper and electronic form

Data/Parameter	$NCV^{y}_{p,fuel-oil}$
Data unit	TJ/ thous. t
Description	Lowest Heat Value of mazut for monitoring period "y", project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Lowest Heat Value of mazut for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in

<table>
<tr><td></td><td>Ukraine for 1990-2004».[83];
Lowest Heat Value of mazut for 2005 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005».[84];
Lowest Heat Value of mazut for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006».[85];
Lowest Heat Value of mazut for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[86];
Lowest Heat Value of mazut for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[87];
Lowest Heat Value of mazut for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009».[88];</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td><table>
<tr><td>2004</td><td>39,98</td></tr>
<tr><td>2005</td><td>39,92</td></tr>
<tr><td>2006</td><td>39,98</td></tr>
<tr><td>2007</td><td>40,5</td></tr>
<tr><td>2008</td><td>39,8</td></tr>
<tr><td>2009</td><td>39,9</td></tr>
<tr><td>2010</td><td>39,9</td></tr>
<tr><td>2011</td><td>39,9</td></tr>
</table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>QA/QC procedures (to be)</td><td>National Cadaster of anthropogenic emissions from sources and</td></tr>
</table>

[83] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip
[84] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip
[85] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[86] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[87] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[88] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

applied	absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	According to the principles of conservatism the minimal value of mazut calorific value is applied

Data/Parameter	$k_{p,fuel-oil}^{y,c}$
Data unit	t C/TJ
Description	Carbon emission factor when combusting mazut for monitoring period "y", project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon emission factor for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004».[89]; Carbon emission factor for 2005 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005».[90]; Carbon emission factor for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006».[91]; Carbon emission factor for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[92]; Carbon emission factor for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[93]; Carbon emission factor for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009».[94];

[89] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip
[90] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip
[91] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip

Value of data applied (for ex ante calculations/determinations)		2004	21,1	
		2005	21,1	
		2006	21,1	
		2007	21,1	
		2008	21,1	
		2009	21,1	
		2010	21,1	
		2011	21,1	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A			
QA/QC procedures (to be) applied	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)			
Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form			

Data/Parameter	$k^{y,o}_{p,\,fuel-oil}$
Data unit	Relative units
Description	Carbon oxidation factor when combusting mazut for monitoring period "y", project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon oxidation factor for 2004 was taken from «National report on cadastre of GHG emissions and their absorption in Ukraine for 1990-2004 гг.».[95]; Carbon oxidation factor for 2005 was taken from «National report

[92] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[93] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[94] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[95] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2006_nir_26may.zip

<table>
<tr><td></td><td>on cadastre of GHG emissions and their absorption in Ukraine for 1990-2005».[96];
Carbon oxidation factor for 2006 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2006».[97];
Carbon oxidation factor for 2007 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2007».[98];
Carbon oxidation factor for 2008 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2008».[99];
Carbon oxidation factor for 2009-2011 was taken from «National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine for 1990-2009».[100];</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td><table>
<tr><td>2004</td><td>0,99</td></tr>
<tr><td>2005</td><td>0,99</td></tr>
<tr><td>2006</td><td>0,99</td></tr>
<tr><td>2007</td><td>0,99</td></tr>
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<tr><td>2009</td><td>0,99</td></tr>
<tr><td>2010</td><td>0,99</td></tr>
<tr><td>2011</td><td>0,99</td></tr>
</table></td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)</td></tr>
</table>

[96] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/x-zip-compressed/ukr_2007_nir_rus_23jul.zip
[97] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2008_nir_21may.zip
[98] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr_2009_nir_25may.zip
[99] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2010-nir-22may.zip
[100] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Any comment	Data allowing calculation of GHG emissions. Information will be archived in paper and electronic form

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

Project emissions according to the actual monitoring (they are calculated by specific approach for JI projects):

$$PE^{y}_{p} = PE^{y}_{p,elec} + PE^{y}_{p,gas} + PE^{y}_{p,diesel} + PE^{y}_{p,coal} + PE^{y}_{p,fuel-oil}, \text{ where} \quad (1)$$

$PE^{y}_{p,elec}$ - GHG emissions from combustion of fossil fuel when generating electric energy consumed in the course of rendering services on cargo and passenger rail transportation, for monitoring period "y", project scenario, (t CO_2-equiv.);

$PE^{y}_{p,gas}$ - GHG emissions from combustion of natural gas when rendering services on cargo and passenger rail transportation, for monitoring period "y", project scenario, (t CO_2-equiv.);

$PE^{y}_{p,diesel}$ - GHG emissions from combustion of diesel fuel when rendering services on cargo and passenger rail transportation, for monitoring period "y", project scenario, (t CO_2-equiv.);

$PE^{y}_{p,coal}$ - GHG emissions from combustion of coal when rendering services on cargo and passenger rail transportation, for monitoring period "y", project scenario, (t CO_2-equiv.);

$PE^{y}_{p,fuel-oil}$ - GHG emissions from combustion of mazut when rendering services on cargo and passenger rail transportation, for monitoring period "y", project scenario, (t CO_2-equiv.);

$[y]$ - factor corresponding to monitoring period;

$[p]$ - factor corresponding to project scenario;

$[elec]$ - relates to electric energy;

$[gas]$ - relates to natural gas;

$[diesel]$ - relates to diesel fuel;

$[coal]$ - relates to coal;

$[fuel-oil]$ - relates to mazut.

$$PE^{y}_{p,elec} = MWh^{y}_{p,elec} * \tilde{N}EF^{y}_{p,elec}, \quad (2)$$

$MWh^{y}_{p,elec}$ - consumption of electric energy for monitoring period «y», project scenario, (Mw*h);

$\tilde{N}EF^{y}_{p,elec}$ - CO_2e emission factor for United Power Grid of Ukraine України for monitoring period «y», project scenario, (tCO_2/Mw*h);

$[y]$ - factor corresponding to monitoring period;

$[p]$ - factor corresponding to project scenario;

$[elec]$ - relates to electric energy;

$$PE^{y}_{p,gas} = V^{y}_{p,gas} * NCV^{y}_{p,gas} * EF^{y}_{p,gas} \quad (3)$$

$V^{y}_{p,gas}$ - Total volume of natural gas consumed for monitoring period «y», project scenario, (thous. m^3);

$NCV^{y}_{p,gas}$ - Lowest Heat Value of natural gas for monitoring period «y», project scenario, (TJ/thous.m^3);

$EF^{y}_{p,gas}$ - Carbon emission factor on default for stationary combustion of natural gas for monitoring period «y», project scenario, (t CO_2 /TJ).

$$EF^{y}_{p,gas} = k^{y,c}_{p,gas} * k^{y,o}_{p,gas} * 44/12 \quad (4)$$

$k^{y,c}_{p,gas}$ - Carbon emission factor when combusting natural gas for monitoring period «y», project scenario, (t C/TJ);

$k^{y,o}_{p,gas}$ - Carbon oxidation factor when combusting natural gas for monitoring period «y», project scenario, (relative units);

$44/12$ - stoichiometric ratio between molecular weight and of carbon oxide and carbon, (t CO_2 /t C);

$[y]$ - factor corresponding to monitoring period;

$[p]$ - factor corresponding to project scenario.

$[gas]$ - relates to natural gas;

$$PE^{y}_{p,diesel} = V^{y}_{p,diesel} * NCV^{y}_{p,diesel} * EF^{y}_{p,diesel} \quad (5)$$

$V^{y}_{p,diesel}$ - Total amount of diesel fuel consumed for monitoring period «y», project scenario, (thous. m^3);

$NCV^{y}_{p,diesel}$ - Lowest Heat Value of diesel fuel for monitoring period "y", project scenario, (TJ/thous. m^3);

$EF^{y}_{p,diesel}$ - Carbon emission factor on default for stationary combustion of diesel fuel for monitoring period «y», project scenario, (t CO_2 /TJ).

$$EF^{y}_{p,diesel} = k^{y,c}_{p,diesel} * k^{y,o}_{p,diesel} * 44/12 \quad (6)$$

$k^{y,c}_{p,diesel}$ - Carbon emission factor when combusting diesel fuel for monitoring period "y", project scenario, (t C/TJ);

$k^{y,o}_{p,diesel}$ - Carbon oxidation factor when combusting diesel fuel for monitoring period "y", project scenario, (relative units);

$44/12$ - stoichiometric ratio between molecular weight and of carbon oxide and carbon, (t CO_2 /t C);

$[y]$ - factor corresponding to monitoring period;

$[p]$ - factor corresponding to project scenario.

$[diesel]$ - relates to diesel fuel;

$$PE^{y}_{p,coal} = V^{y}_{p,coal} * NCV^{y}_{p,coal} * EF^{y}_{p,coal} \quad (7)$$

$V^{y}_{p,coal}$ - Total amount of coal consumed for monitoring period «y», project scenario, (thous. m^3);

$NCV^{y}_{p,coal}$ - Lowest Heat Value of coal for monitoring period «y», project scenario, (TJ/thous. m^3);

$EF^{y}_{p,coal}$ - Carbon emission factor on default for stationary combustion of coal for monitoring period «y», project scenario, (t CO_2 /TJ).

$$EF^{y}_{p,coal} = k^{y,c}_{p,coal} * k^{y,o}_{p,coal} * 44/12 \quad (8)$$

$k^{y,c}_{p,coal}$ - Carbon emission factor when combusting coal for monitoring period «y», project scenario, (t C/TJ);

$k^{y,o}_{p,coal}$ - Carbon oxidation factor when combusting coal for monitoring period "y", project scenario, (relative units);

$44/12$ - stoichiometric ratio between molecular weight and of carbon oxide and carbon, (t CO_2 /t C);

$[y]$ - factor corresponding to monitoring period;

$[p]$ - factor corresponding to project scenario.

$[coal]$ - relates to coal;

$$PE^{y}_{p,fuel-oil} = V^{y}_{p,fuel-oil} * NCV^{y}_{p,fuel-oil} * EF^{y}_{p,fuel-oil} \quad (9)$$

$V^{y}_{p,fuel-oil}$ - Total amount of mazut consumed for monitoring period "y", project scenario, (thous.m^3);

$NCV^{y}_{p,fuel-oil}$ - Lowest Heat Value of mazut for monitoring period "y", project scenario, (TJ/thous. m^3);

$EF^{y}_{p,fuel-oil}$ - Carbon emission factor on default for stationary combustion of mazut for monitoring period «y», project scenario, (tCO_2 /TJ).

$$EF^{y}_{p,fuel-oil} = k^{y,c}_{p,fuel-oil} * k^{y,o}_{p,fuel-oil} * 44/12 \quad (10)$$

$k^{y,c}_{p,fuel-oil}$ - Carbon emission factor when combusting mazut for monitoring period "y", project scenario, (t C/TJ);

$k^{y,o}_{p,fuel-oil}$ - Carbon oxidation factor when combusting mazut for monitoring period "y", project scenario, (relative units);

$44/12$ - stoichiometric ratio between molecular weight and of carbon oxide and carbon, (t CO_2 /t C);

$[y]$ - factor corresponding to monitoring period;

$[p]$ - factor corresponding to project scenario.

$[fuel-oil]$ - relates to mazut.

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:

Data/Parameter	
Data unit	mln. t*km
Description	total volume of rail transportation for monitoring period «y», project scenario
Time of determination/monitoring	annually
Source of data (to be) used	Driver's running schedule
Value of data applied (for ex ante calculations/determinations)	Value shall be determined for each monitoring period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Information on traffic volumes is the official enterprise's data used to calculate the tariff for the provision of railway transportation, and further agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine
Any comment	Information on rail transportation volumes is the basis for calculation of GHG emissions and will be archived in paper and electronic form

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

$$BE^{y}_{b,elec} = N^{y}_{p} * BPER \quad (11)$$

N^{y}_{p} - Total volume of rail transportation for monitoring period «y", project scenario, (mln. t*km);

$BPER$ - pre-project efficiency factor of rail transportation, (tCO_2-equiv / mln. t*km);

$$BPER = \frac{\sum_{n=1}^{3} BE^{j}_{b}}{\sum_{n=1}^{3} N^{j}_{b}} \quad (12)$$

BE^{j}_{b} - total GHG emissions when rendering services on rail transportation for historical period «j», baseline scenario, (tCO_2-equiv);

N^{j}_{b} - total adjusted volume of rail transportation for historical period «j», baseline scenario, (mln. t*km);

$[y]$ - factor corresponding to monitoring period;

$[p]$ - factor corresponding to project scenario;

$[j]$ - factor corresponding to historical period;

$[b]$ - factor corresponding to baseline scenario;

$$BE^{j}_{b} = BE^{j}_{b,elec} + BE^{j}_{b,gas} + BE^{j}_{b,diesel} + BE^{j}_{b,coal} + BE^{j}_{b,fuel-oil}, \text{ where} \quad (13)$$

$BE^{j}_{b,elec}$ - GHG emissions from combustion of fossil fuel when generating electric energy consumed in the course of rendering services on cargo and passenger rail transportation, for historical period "j", baseline scenario, (t CO_2-equiv.);

$BE^{j}_{b,gas}$ - GHG emissions from combustion of natural gas when rendering services on cargo and passenger rail transportation, for historical period "j", baseline scenario, (t CO_2-equiv.);

$BE^{j}_{b,diesel}$ - GHG emissions from combustion of diesel fuel when rendering services on cargo and passenger rail transportation, for historical period "j", baseline scenario, (t CO_2-equiv.);

$BE^{j}_{b,coal}$ - GHG emissions from combustion of coal when rendering services on cargo and passenger rail transportation, for historical period "j", baseline scenario, (t CO_2-equiv.);

$BE^{j}_{b,fuel-oil}$ - GHG emissions from combustion of mazut when rendering services on cargo and passenger rail transportation, for historical period "j", baseline scenario, (t CO_2-equiv.);

$[j]$ - factor corresponding to historical period;

$[b]$ - factor corresponding to baseline scenario;

$[elec]$ - relates to electric energy;

$[gas]$ - relates to natural gas;

$[diesel]$ - relates to diesel fuel;

$[coal]$ - relates to coal;

$[fuel-oil]$ - relates to mazut.

$$PE^{j}_{b,elec} = MWh^{j}_{b,elec} * \tilde{N}EF^{j}_{b,elec}, \quad (14)$$

$MWh^{j}_{b,elec}$ - consumption of electric energy for historical period "j", baseline scenario, (Mw*h);

$\tilde{N}EF^{j}_{b,elec}$ - CO_2e emission factor for United Power Grid of Ukraine України for historical period "j", baseline scenario, (tCO_2/Mw*h);

$[j]$ - factor corresponding to historical period;

$[b]$ - factor corresponding to baseline scenario;

$[elec]$ - relates to electric energy;

$$PE^{j}_{b,gas} = V^{j}_{b,gas} * NCV^{j}_{b,gas} * EF^{j}_{b,gas} \quad (15)$$

$V^{j}_{b,gas}$ - Total volume of natural gas consumed for historical period "j", baseline scenario, (thous. m^3);

$NCV^{j}_{b,gas}$ - Lowest Heat Value of natural gas for historical period "j", baseline scenario, (TJ/thous.m^3);

$EF^{j}_{b,gas}$ - Carbon emission factor on default for stationary combustion of natural gas for historical period "j", baseline scenario, (t CO_2 /TJ).

$$EF^{j}_{b,gas} = k^{j,c}_{b,gas} * k^{j,o}_{b,gas} * 44/12 \quad (16)$$

$k^{j,c}_{b,gas}$ - Carbon emission factor when combusting natural gas for historical period "j", baseline scenario, (t C/TJ);

$k^{j,o}_{b,gas}$ - Carbon oxidation factor when combusting natural gas for historical period "j", baseline scenario, (relative units);

$44/12$ - stoichiometric ratio between molecular weight and of carbon oxide and carbon, (t CO_2 /t C);

$[j]$ - factor corresponding to historical period;
$[b]$ - factor corresponding to baseline scenario;
$[gas]$ - relates to natural gas;

$$PE^{j}_{b,diesel} = V^{j}_{b,diesel} * NCV^{j}_{b,diesel} * EF^{j}_{b,diesel} \quad (17)$$

$V^{j}_{b,diesel}$ - Total amount of diesel fuel consumed for historical period "j", baseline scenario, (thous. m^3);
$NCV^{j}_{b,diesel}$ - Lowest Heat Value of diesel fuel for historical period "j", baseline scenario, (TJ/thous. m^3);
$EF^{j}_{b,diesel}$ - Carbon emission factor on default for stationary combustion of diesel fuel for historical period "j", baseline scenario, (t CO_2 /TJ).

$$EF^{j}_{b,diesel} = k^{j,c}_{b,diesel} * k^{j,o}_{b,diesel} * 44/12 \quad (18)$$

$k^{j,c}_{b,diesel}$ - Carbon emission factor when combusting diesel fuel for historical period "j", baseline scenario, (t C/TJ);
$k^{j,o}_{b,diesel}$ - Carbon oxidation factor when combusting diesel fuel for historical period "j", baseline scenario, (relative units);
$44/12$ - stoichiometric ratio between molecular weight and of carbon oxide and carbon, (t CO_2 /t C);

$[j]$ - factor corresponding to historical period;
$[b]$ - factor corresponding to baseline scenario;
$[diesel]$ - relates to diesel fuel;

$$PE^{j}_{b,coal} = V^{j}_{b,coal} * NCV^{j}_{b,coal} * EF^{j}_{b,coal} \quad (19)$$

$V^{j}_{b,coal}$ - Total amount of coal consumed for historical period "j", baseline scenario, (thous. m^3);
$NCV^{j}_{b,coal}$ - Lowest Heat Value of coal for historical period "j", baseline scenario, (TJ/thous. m^3);
$EF^{j}_{b,coal}$ - Carbon emission factor on default for stationary combustion of coal for historical period "j", baseline scenario, (t CO_2 /TJ).

$$EF^{j}_{b,coal} = k^{j,c}_{b,coal} * k^{j,o}_{b,coal} * 44/12 \quad (20)$$

$k^{j,c}_{b,coal}$ - Carbon emission factor when combusting coal for historical period "j", baseline scenario, (t C/TJ);
$k^{j,o}_{b,coal}$ - Carbon oxidation factor when combusting coal for historical period "j", baseline scenario, (relative units);
$44/12$ - stoichiometric ratio between molecular weight and of carbon oxide and carbon, (t CO_2 /t C);

$[j]$ - factor corresponding to historical period;

$[b]$ - factor corresponding to baseline scenario;

$[coal]$ - relates to coal;

$$PE^{j}_{b,fuel-oil} = V^{j}_{b,fuel-oil} * NCV^{j}_{b,fuel-oil} * EF^{j}_{b,fuel-oil} \quad (21)$$

$V^{j}_{b,fuel-oil}$ - Total amount of mazut consumed for historical period "j", baseline scenario, (thous.m^3);

$NCV^{j}_{b,fuel-oil}$ - Lowest Heat Value of mazut for historical period "j", baseline scenario, (TJ/thous. m^3);

$EF^{j}_{b,fuel-oil}$ - Carbon emission factor on default for stationary combustion of mazut for historical period "j", baseline scenario, (tCO_2 /TJ).

$$EF^{j}_{b,fuel-oil} = k^{j,c}_{b,fuel-oil} * k^{j,o}_{b,fuel-oil} * 44/12 \quad (22)$$

$k^{j,c}_{b,fuel-oil}$ - Carbon emission factor when combusting mazut for historical period "j", baseline scenario, (t C/TJ);

$k^{j,o}_{b,fuel-oil}$ - Carbon oxidation factor when combusting mazut for historical period "j", baseline scenario, (relative units);

$44/12$ - stoichiometric ratio between molecular weight and of carbon oxide and carbon, (t CO_2 /t C);

$[j]$ - factor corresponding to historical period;

$[b]$ - factor corresponding to baseline scenario;

$[fuel-oil]$ - relates to mazut.

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

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

N/A

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):

N/A

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

Increase of GHG emissions outside of the project boundary, which might be caused by the project are not expected.

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

N/A

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

N/A

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):

Calculation of emission reduction as a result of project activities shall be made by specific approach for JI projects):

$$ER^y = BE_b^y - PE_p^y \quad (23)$$

ER^y – emission reduction as a result of project activities for monitoring period "y", project scenario, (t CO_2-equiv);

BE_b^y - total GHG emissions when rendering services on cargo and passenger rail transportation for monitoring period "y", baseline scenario, (t CO_2-equiv);

PE_p^y - total GHG emissions when rendering services on cargo and passenger rail transportation for monitoring period "y", project scenario, (t CO_2-equiv);

$[y]$ - factor corresponding to monitoring period;

$[p]$ - factor corresponding to project scenario;

$[b]$ - factor corresponding to baseline scenario.

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:

Impacts on the environment is presented in accordance with the laws of Ukraine:
- Law of Ukraine № 1264-XII "On Environmental Protection" as of 25.06.1991;
- Law of Ukraine № 2707-XII "On Air Protection" dated 16.10.1992;
- Actual rules limiting emissions "Standards of maximum permissible pollutant emissions from stationary sources" - approved by the Ministry of Environmental Protection of Ukraine as of 27.06.2006, № 309 and registered with the Ministry of Justice of Ukraine on 01.09.2006, № 912/12786.

Information on the project's impact on the environment is collected with the operating activities of the company and archived throughout the life of the JI project and within two years after the transfer of emission reduction units generated by the 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.
N_b^{j*}	Low	Information on traffic volumes is the official enterprise's data used to calculate the tariff for the provision of railway transportation, and further agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine.
$MWh_{b,elec}^{j}$	Low	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality management, Law of Ukraine "On metrology and metrological activity"[101]. The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked.
$\tilde{N}EF_{b,elec}^{j}$	Low	State factors of carbon oxide emission shall be applied when elaborating JI project, and in case of their absence the factors for 2001-2003 from ERUPT shall be applied

101 http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

$V^{j}_{b,gas}$	Low	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality management, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked
$NCV^{j}_{b,gas}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{j,c}_{b,gas}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{j,o}_{b,gas}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$V^{j}_{b,diesel}$	Low	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality management, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked
$NCV^{j}_{b,diesel}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{j,c}_{b,diesel}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{j,o}_{b,diesel}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$V^{j}_{b,coal}$	Low	Information on consumed coal is the official enterprise's data agreed by Ukrzaliznytsya and approved by the Ministry of Fuel and Energy of Ukraine
$NCV^{j}_{b,coal}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{j,c}_{b,coal}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)

$k_{b,coal}^{j,o}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$V_{b,fuel-oil}^{j}$	Low	Information on consumed mazut is the official enterprise's data agreed by Ukrzaliznytsya and approved by the Ministry of Fuel and Energy of Ukraine
$NCV_{b,fuel-oil}^{j}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k_{b,fuel-oil}^{j,c}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k_{b,fuel-oil}^{j,o}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
N_{p}^{y}	Low	Information on traffic volumes is the official enterprise's data used to calculate the tariff for the provision of railway transportation, and further agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine
$MWh_{p,elec}^{y}$	Low	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality management, Law of Ukraine "On metrology and metrological activity"[102]. The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked.
$\tilde{N}EF_{p,elec}^{y}$	Low	State factors of carbon oxide emission shall be applied when elaborating JI project, and in case of their absence the factors for 2004-2005 from ERUPT shall be applied, for 2006-2007 from document "Carbon emission factors" approved by TUV SUD
$V_{p,gas}^{y}$	Low	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality management, Law of Ukraine "On metrology and metrological activity"[103]. The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked
$NCV_{p,gas}^{y}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)

[102] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15
[103] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

$k^{y,c}_{p,gas}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{y,o}_{p,gas}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$V^{y}_{p,diesel}$	Low	System for control and accounting of diesel fuel consumption «БІС-Р» is regularly certified and verified according to the quality management procedures, Law of Ukraine " On metrology and metrological activity ". The final results were recorded in the official reports provided to the state regulating authorities, where they were additionally checked
$NCV^{y}_{p,diesel}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{y,c}_{p,diesel}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{y,o}_{p,diesel}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$V^{y}_{p,coal}$	Low	Information on consumed coal is the official enterprise's data agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine.
$NCV^{y}_{p,coal}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{y,c}_{p,coal}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{y,o}_{p,coal}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$V^{y}_{p,fuel-oil}$	Low	Information on consumed mazut is the official enterprise's data agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine.
$NCV^{y}_{p,fuel-oil}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)

$k^{y,c}_{p,fuel-oil}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$k^{y,o}_{p,fuel-oil}$	Low	National Cadaster of anthropogenic emissions from sources and absorption by GHG sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)

*For definition of parameters see Section D.1.

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

Collection of the information necessary for calculation of GHG emissions reduction resulting from JI project activity, shall be conducted according to the practice established at SE «Prindniprovsk Railway», since the monitoring plan is developed for accurate and understandable measurement and calculation of greenhouse gas emissions.

The operational structure allows company to collect original data, consolidate and make cross-check, as part of preparing the monitoring plan, as shown below:

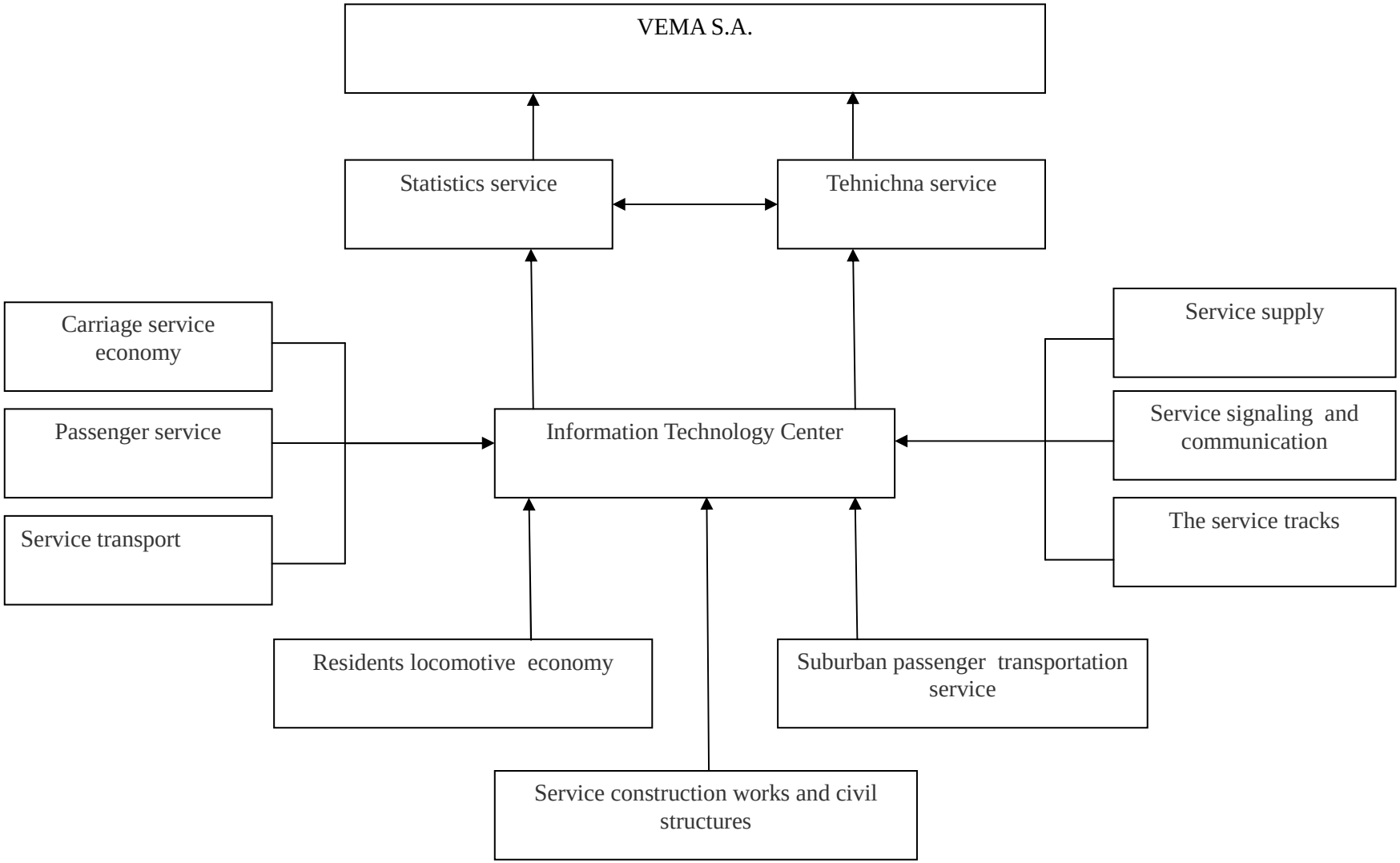

Fig.25. Structure of collection and processing of data according to the monitoring plan

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

Monitoring plan is determined by VEMA S.A., project developer, and SE «Prindniprovsk Railway», project supplier.

State enterprise “Prindniprovsk Railway”
Momot Oleksandr Ivanovych
Head of Railway
Telephone: +380 562 33 00 24
Fax: +380 562 33 09 04
e-mail: www.dp.uz.gov.ua/ukr
State enterprise “Prindniprovsk Railway” is the project participant (stated in Annex 1).

VEMA S.A.:
Geneva, Switzerland
Fabian Knodel,
Director.
Telephone: +38(044)-594-48-10
Fax: +38(044)-594-48-19
e-mail: info@vemacarbon.com
VEMA S.A. is the project participant (stated in Annex 1).

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Estimation of project emissions was made according to the formulas given in Section D.1.1.2.

Results of calculations are given in tables below. The calculations are presented in Accompanying document 1 attached to PDD.

For the period from 2004 to 2011 estimated GHG project emissions are calculated under actual data of the volumes of cargo and passengers rail transportation by SE «Prindniprovsk Railway», and for the period from 2012 to 2020 they are forecasted according to the strategic plan of rail transport sector development.

Table 20. Estimated project emissions for the period January 1, 2004– December 31, 2007

Year	Project emissions (t CO_2e)
2004	1 526 750
2005	1 452 906
2006	1 499 634
2007	1 500 565
Total project emissions over the crediting period (tons of equivalent CO_2e)	**5 979 855**

Table 21. Estimated project emissions for the period January 1, 2008 – December 31, 2012

Year	Project emissions (t CO_2e)
2008	1 702 800
2009	1 463 852
2010	1 530 386
2011	1 526 868
2012	1 526 868
Total project emissions over the crediting period (tons of equivalent CO_2e)	**7 750 774**

Table 22. Estimated project emissions for the period January 1, 2013 - December 31, 2020

Year	Project emissions (t CO_2e)
2013	1 526 868
2014	1 526 868
2015	1 526 868
2016	1 526 868
2017	1 526 868
2018	1 526 868
2019	1 526 868
2020	1 526 868
Total project emissions over the crediting period (tons of equivalent CO_2e)	**12 214 944**

E.2. Estimated leakage:

Leakages are not expected.

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

As there is no leakage, the sum of emissions from leakages and project activities will be equal to emissions from project activities; results are given below in tables.

Table 23. Table containing sum of emissions from leakages and project activities of the first commitment period,.

Year	Expected project emissions (t CO_2e)	Expected leakages (t CO_2e)	Expected emission reduction (t CO_2e)
2004	1 526 750	0	1 526 750
2005	1 452 906		1 452 906
2006	1 499 634	0	1 499 634
2007	1 500 565	0	1 500 565
Total emissions (tCO_2e)	**5 979 855**	0	**5 979 855**

Table 24. Table containing sum of emissions from leakages and project activities during the first commitment period.

Year	Expected project emissions (t CO_2e)	Expected leakages (t CO_2e)	Expected emission reduction (t CO_2e)
2008	1 702 800	0	1 702 800
2009	1 463 852	0	1 463 852
2010	1 530 386	0	1 530 386
2011	1 526 868	0	1 526 868
2012	1 526 868	0	1 526 868
Total emissions (tCO_2e)	**7 750 774**	0	**7 750 774**

Table 25. Table containing sum of emissions from leakages and project activities after the first commitment period.

Year	Expected project emissions (t CO_2e)	Expected leakages (t CO_2e)	Expected emission reduction (t CO_2e)
2013	1 526 868	0	1 526 868
2014	1 526 868	0	1 526 868
2015	1 526 868	0	1 526 868
2016	1 526 868	0	1 526 868
2017	1 526 868	0	1 526 868
2018	1 526 868	0	1 526 868
2019	1 526 868	0	1 526 868
2020	1 526 868	0	1 526 868
Total emissions (tCO_2e)	**12 214 944**	0	**12 214 944**

E.4. Estimated baseline emissions:

Estimation of baseline emissions was made according to the formulas given in Section D.1.1.4.

Results of calculations are given in tables below. The calculations are presented in Accompanying document 1 attached to PDD.

For the period from 2004 to 2011 estimated GHG baseline emissions are calculated under actual data of the volumes of cargo and passengers rail transportation by SE «Prindniprovsk Railway», and for the period from 2012 to 2020 they are forecasted according to the strategic plan of rail transport sector development.

Table 26. Estimated baseline emissions for the period January 1, 2004– December 31, 2007

Year	Expected baseline emissions (t CO_2e)
2004	1 765 132
2005	1 991 882
2006	2 098 868
2007	1 991 882
Total baseline emissions over the crediting period (tons of equivalent CO_2e)	**7 847 764**

Table 27. Estimated baseline emissions for the period January 1, 2008 року – December 31, 2012

Year	Expected baseline emissions (t CO_2e)
2008	2 385 890
2009	1 918 739
2010	2 092 164
2011	2 092 164
2012	2 092 164
Total baseline emissions over the crediting period (tons of equivalent CO_2e)	**10 581 121**

Table 28. Estimated baseline emissions for the period January 1, 2013 - December 31, 2020

Year	Expected baseline emissions (t CO_2e)
2013	2 092 164
2014	2 092 164
2015	2 092 164
2016	2 092 164
2017	2 092 164
2018	2 092 164
2019	2 092 164
2020	2 092 164
Total baseline emissions over the crediting period (tons of equivalent CO_2e)	**16 737 312**

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

Emission reduction was calculated according to the formula (23) given in Section D.1.1.4.

Results of calculations are given in tables below. The calculations are presented in Accompanying document 1 attached to the PDD.

Table 29. Estimated emission reduction for the period from January 1, 2004– December 31, 2007

Year	Expected emission reduction (t CO_2e)
2004	238 382
2005	538 976
2006	599 234
2007	491 317
Total baseline emissions over the crediting period (tons of equivalent CO_2e)	**1 867 909**

Table 30. Estimated emission reduction for the period from January 1, 2008 року – December 31, 2012

Year	Expected emission reduction (t CO_2e)
2008	683 090
2009	454 887
2010	561 778
2011	565 296
2012	565 296
Total baseline emissions over the crediting period (tons of equivalent CO_2e)	**2 830 347**

Table 31. Estimated emission reduction for the period January 1, 2013 - December 31, 2020

Year	Expected emission reduction (t CO_2e)
2013	565 296
2014	565 296
2015	565 296
2016	565 296
2017	565 296
2018	565 296
2019	565 296
2020	565 296
Total baseline emissions over the crediting period (tons of equivalent CO_2e)	**4 522 368**

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

Table 32. Table containing results of estimation of emission reduction for the period from January 1, 2004 to December 31, 2007.

Year	Estimated project emissions (t CO_2e)	Estimated leakages (tCO_2e)	Estimated baseline emissions (t CO_2e)	Estimated emission reduction (t CO_2e)
2004	1 526 750	0	1 765 132	238 382
2005	1 452 906		1 991 882	538 976
2006	1 499 634	0	2 098 868	599 234
2007	1 500 565	0	1 991 882	491 317
Total calculated emission reduction (t CO_2e)	**5 979 855**	0	**7 847 764**	**1 867 909**

Table 33. Table containing results of estimation of emission reduction for the period from January 1, 2008 to December 31, 2012

Year	Estimated project emissions (t CO_2e)	Estimated leakages (tCO_2e)	Estimated baseline emissions (t CO_2e)	Estimated emission reduction (t CO_2e)
2008	1 702 800	0	2 385 890	683 090
2009	1 463 852	0	1 918 739	454 887
2010	1 530 386	0	2 092 164	561 778
2011	1 526 868	0	2 092 164	565 296
2012	1 526 868	0	2 092 164	565 296
Total calculated emission reduction (t CO_2e)	**7 750 774**	0	**10 581 121**	**2 830 347**

Table 34. Table containing results of estimation of emission reduction for the period from January 1, 2013 to December 31, 2020

Year	Estimated project emissions (t CO_2e)	Estimated leakages (tCO_2e)	Estimated baseline emissions (t CO_2e)	Estimated emission reduction (t CO_2e)
2013	1 526 868	0	2 092 164	565 296
2014	1 526 868	0	2 092 164	565 296
2015	1 526 868	0	2 092 164	565 296
2016	1 526 868	0	2 092 164	565 296
2017	1 526 868	0	2 092 164	565 296
2018	1 526 868	0	2 092 164	565 296
2019	1 526 868	0	2 092 164	565 296
2020	1 526 868	0	2 092 164	565 296
Total calculated emission reduction (t CO_2e)	**12 214 944**	0	**16 737 312**	**4 522 368**

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:

According to the law of Ukraine "On Environmental Protection"[104] and State Building Norms A.2.2-1-2003, "Structure and content of environmental impact assessment (EIA) in the design and construction of plants, buildings and structures"[105]. SE «Prindniprovsk Railway» is not obliged to develop the impacts on the environment for this type of project.

Factors of impact of the objects of railway transport on the environment can be classified according to the following features:
- Mechanical (solid waste, mechanical effects on soil of building, road, railway and other vehicles);
- Physical (heat radiation, electric fields, electromagnetic fields, noise, infrasound, ultrasound, vibration, etc.);
- Chemicals and compounds (acids, alkalis, metal salts, aldehydes, aromatic hydrocarbons, paints and solvents, organic acids and compounds, etc.).

The main directions of reducing the factors of impacts on the environment are a rational selection of technological processes on rendering services on rail transportation of goods and passengers, use of the means for environmental protection and maintaining them in good condition.
In any case whole harmful effect on environment arising in the course of rendering services for rail transportation of cargo and passengers does not exceed the permissible limits prescribed by the rules:
- Law of Ukraine № 1264-XII "On Environmental Protection" as of 25.06.1991;
- Law of Ukraine № 2707-XII "On Air Protection" dated 16.10.1992;
- Actual rules limiting emissions "Standards of maximum permissible pollutant emissions from stationary sources" - approved by the Ministry of Environmental Protection of Ukraine as of 27.06.2006, № 309 and registered with the Ministry of Justice of Ukraine on 01.09.2006, № 912/12786.
Implementation of this project will improve the efficiency of rendering services on rail transportation of cargo and passengers. Experience of staff of SE «Prindniprovsk Railway» and complying with the law "On Railway Transport"[104] enable to minimize the potential for accidents in the course of this project implementation.

Transboundary impacts of project activities according to their definitions in the text of "Convention on long-range transboundary pollution " ratified by Ukraine will not take place.

Project implementation doesn't provide for harmful effects on the environment.
SE «Prindniprovsk Railway» has all necessary permits and licenses for the maintenance and operation of rail routes, means of rolling stock, heating systems, traction power system and exterior lighting, complex of administrative-technical constructions and buildings.

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:

As noted above, the analysis of environmental impact demonstrated that the project does not create significant adverse environmental impact, but rather has a positive impact on the environment.

SECTION G. Stakeholders' comments

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

As the project activities do not imply a negative impact on the environment and the negative social impact, special public discussions were not necessary. Consultations with stakeholders were held at meetings of local authorities.

Program on increase of the efficiency of fuel and energy resources consumption in providing services on rail transportation of goods and passengers is regularly highlighted in the press. There have been numerous publications of company's employees in specialized nationwide magazines. For more information on publications please refer to the press service of the SE «Prindniprovsk Railway» http://www.dp.uz.gov.ua/ukr/prima.

Numerous specialized conferences and seminars under the auspices of the Ministry of Transport of Ukraine were conducted and related directly to the ways to improve the productivity of the enterprise and the introduction of electronic documents circulation associated with the rail transportation of cargo and passengers. Information about energy efficiency increase is highlighted on the official website of the SE «Prindniprovsk Railway» http://www.dp.uz.gov.ua.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organization:	State enterprise «Prindniprovsk Railway»
Street, number and/c:	Karl Marx Avenue.
House:	108
City:	Dnipropetrovsk
State/region	
Postal code	49600
Country	Ukraine
Telephone	+380 562 33 00 24
Fax	+380 562 33 09 04
e-mail	
Address of site	http://www.dp.uz.gov.ua/ukr
Who presented	
Position name	Head of railway
Address	
Surname	Momot
Patronymic	Ivanovych
Name	Oleksandr
Department	
Direct fax	
Direct telephone	+380 562 33 00 24
Mobile telephone	
Personal e-mail	

Organization:	VEMA S.A.
Street, number and/c:	Route de Thonon
House:	45
City:	Geneva
State/region	
Postal code	Case postale 170 CH-1222
Country	Switzerland
Telephone	+380 (50) 473 55 67
Fax	
e-mail	info@vemacarbon.com
Address of site	www.vemacarbon.com
Who presented	
Position name	Director
Address	
Surname	KNODEL
Patronymic	
Name	Fabian
Department	
Direct fax	
Direct telephone	+38(044)-594-48-10
Mobile telephone	
Personal e-mail	

Annex 2

BASELINE INFORMATION

Dynamic baseline is a scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in case if the project is not implemented, which was elected in accordance with Guidance on criteria for baseline setting and monitoring (Guidance on criteria for baseline setting and monitoring, Version 03[104]). According to the Guidance for users the design of technical documentation for Joint Implementation projects, Version 04, the following stepwise approach is used for description and justification of chosen baseline:
For the proposed project aimed at reduction of energy consumption by the entities of SE «Prindniprovsk Railway» in providing services on goods and passengers rail transportation, none of the existing methodologies can be applied. Project Participant has selected a specific approach based on the requirements of JI projects in accordance with paragraph 9 (a) Guidance on criteria for baseline setting and monitoring for JI projects, version 03 (JI Guidance on criteria for baseline setting and monitoring, Version 03).

For baseline identification we apply the following indices:

Parameter	Unit of measurement	Description	Value
N_b^j	mln. t* km	Total volume of rail transportation for historical period «j», baseline	**2001p.** 39 955; **2002p.** 44 214; **2003p.** 50 940
N_p^y	mln. t* km	Total volume of rail transportation for monitoring period «y», project scenario	Value shall be determined for each monitoring period
$MWh_{b,elec}^j$	MW*h	Electric power consumption for historical period «j», baseline	**2001p.** 1165020; **2002p.** 1184691,17; **2003p.** 1243587,53
$\tilde{N}EF_{b,elec}^j$	tCO_2/MW*h	Emission factor CO_2e for United Power Grid (OEC) of Ukraine for historical period «j», baseline scenario	**2001p.** 0,976; **2002p.** 0,956; **2003p.** 0,936
$V_{b,gas}^j$	thous. m^3	Total volume of natural gas consumed for historical period «j», baseline scenario	**2001p.** 44670,968; **2002p.** 43298,926; **2003p.** 48161,3693
$NCV_{b,gas}^j$	TJ/mln.m^3	Lowest Heat Value of natural gas for historical period "j, baseline scenario	**2001p.** 33,71; **2002p.** 33,71; **2003p.** 33,71
$k_{b,gas}^{j,c}$	t C/TJ	Carbon emission factor when combusting natural gas for historical period "j", baseline scenario	**2001p.** 15,3; **2002p.** 15,3; **2003p.** 15,3
$k_{b,gas}^{j,o}$	Relative units	Carbon oxidation factor when combusting natural gas for historical period "j", baseline scenario	**2001p.** 0,995; **2002p.** 0,995; **2003p.** 0,995

$V_{b,diesel}^{j}$	t	Total amount of diesel fuel consumed for historical period "j", baseline scenario	**2001p.** 60183,104 / **2002p.** 62390,207 / **2003p.** 80109,379
$NCV_{b,diesel}^{j}$	TJ/ thous. t	Lowest Heat Value of diesel fuel for historical period "j, baseline scenario	**2001p.** 42,5 / **2002p.** 42,5 / **2003p.** 42,5
$k_{b,diesel}^{j,c}$	t C/TJ	Carbon emission factor when combusting diesel fuel for historical period "j", baseline scenario	**2001p.** 20,2 / **2002p.** 20,2 / **2003p.** 20,2
$k_{b,diesel}^{j,o}$	Relative units	Carbon oxidation factor when combusting diesel fuel for historical period "j", baseline scenario	**2001p.** 0,99 / **2002p.** 0,99 / **2003p.** 0,99
$V_{b,coal}^{j}$	t	Total amount of coal consumed for historical period "j", baseline scenario	**2001p** 55358 / **2002p.** 46219 / **2003p.** 44591
$NCV_{b,coal}^{j}$	TJ/ thous. t	Lowest Heat Value of coal for historical period "j, baseline scenario	**2001p.** 18,41 / **2002p.** 18,41 / **2003p.** 18,41
$k_{b,coal}^{j,c}$	t C/TJ	Carbon emission factor when combusting coal for historical period "j", baseline scenario	**2001p.** 26,75 / **2002p.** 26,75 / **2003p.** 26,75
$k_{b,coal}^{j,o}$	Relative units	Carbon oxidation factor when combusting coal for historical period "j", baseline scenario	**2001p.** 0,98 / **2002p.** 0,98 / **2003p.** 0,98
$V_{b,fuel-oil}^{j}$	t	Total amount of mazut consumed for historical period "j", baseline scenario	**2001p** 8130,6 / **2002p.** 5380,9 / **2003p.** 4333,6
$NCV_{b,fuel-oil}^{j}$	TJ/ thous. t	Lowest Heat Value of mazut for historical period "j, baseline scenario	**2001p.** 39,92 / **2002p.** 39,92 / **2003p.** 39,92
$k_{b,fuel-oil}^{j,c}$	t C/TJ	Carbon emission factor when combusting mazut for historical period "j", baseline scenario	**2001p.** 21,1 / **2002p.** 21,1 / **2003p.** 21,1
$k_{b,fuel-oil}^{j,o}$	Relative units	Carbon oxidation factor when combusting mazut for historical period "j", baseline scenario	**2001p.** 0,99 / **2002p.** 0,99 / **2003p.** 0,99

Annex 3

MONITORING PLAN

The proposed project uses a specific approach based on the requirements of JI projects in accordance with clause 9 (a) Guidance on criteria for baseline setting and monitoring for JI projects, version 03.

Monitoring plan is developed for accurate and understandable measurement and calculation of greenhouse gas emissions and is carried out according to the practice established in SE «Prindniprovsk Railway» to measure the consumed electric power, natural gas, diesel fuel, coal and mazut. Project monitoring does not require changes in existing accounting system and data collection. All relevant data are calculated and recorded and stored for two years after the transfer of emission reduction units generated by the project.

The monitoring plan includes a complex of measures (measurements, maintenance, registration and calibration), which should be made to meet the requirements of the chosen methodology of monitoring and ensuring the possibility of check calculations on GHG emission reduction. The main stages of the monitoring plan are described below.

Monitoring plan provides for the following measures:
1. Determination of all potential sources of emission within the project.
2. Collection of the information on GHG emissions within the project during “Crediting” period 3. Assessment of project implementation schedule.
4. Collection of the information on measurement equipment and its calibration.
5. Collection and archiving of the information on project activity effect on environment.
6. Data archiving.
7. Determination of the structure of responsibility for project monitoring.
8. Analysis of the personnel training organization.

Data and parameters controlled during monitoring period:

N_p^y	Total volume of rail transportation for monitoring period «y», project scenario, mln. t*km
$MWh_{p,elec}^y$	Electric power consumption for monitoring period «y», project scenario, MW*h
$\tilde{N}EF_{p,elec}^y$	Emission factor CO_2e for United Power Grid (OEC) of Ukraine for monitoring period «y», project scenario, $tCO_2/MW*h$
$V_{p,gas}^y$	Total volume of natural gas consumed for monitoring period «y» project scenario, thous. m^3
$NCV_{p,gas}^y$	Lowest Heat Value of natural gas for monitoring period «y», project scenario, TJ/mln.m^3
$k_{p,gas}^{y,c}$	Carbon emission factor when combusting natural gas for monitoring period «y», project scenario, t C/TJ
$k_{p,gas}^{y,o}$	Carbon oxidation factor when combusting natural gas for monitoring period «y» project scenario, Relative units
$V_{p,diesel}^y$	Total amount of diesel fuel consumed for monitoring period «y», project scenario, t

$NCV^{y}_{p,diesel}$	Lowest Heat Value of diesel fuel for monitoring period «y», project scenario, TJ/ thous. t
$k^{y,c}_{p,diesel}$	Carbon emission factor when combusting diesel fuel for monitoring period «y», project scenario, t C/TJ
$k^{y,o}_{p,diesel}$	Carbon oxidation factor when combusting diesel fuel for monitoring period «y», project scenario, Relative units
$V^{y}_{p,coal}$	Total amount of coal consumed for monitoring period «y», project scenario, t
$NCV^{y}_{p,coal}$	Lowest Heat Value of coal for monitoring period «y», project scenario, TJ/ thous. t
$k^{y,c}_{p,coal}$	Carbon emission factor when combusting coal for monitoring period «y», project scenario, t C/TJ
$k^{y,o}_{p,coal}$	Carbon oxidation factor when combusting coal for monitoring period «y», project scenario, Relative units
$V^{y}_{p,fuel-oil}$	Total amount of mazut consumed for monitoring period «y», project scenario, t
$NCV^{y}_{p,fuel-oil}$	Lowest Heat Value of mazut for monitoring period «y», project scenario, TJ/ thous. t
$k^{y,c}_{p,fuel-oil}$	Carbon emission factor when combusting mazut for monitoring period «y», project scenario, t C/TJ
$k^{y,o}_{p,fuel-oil}$	Carbon oxidation factor when combusting mazut for monitoring period «y», project scenario, Relative units

$[y]$ - relates to monitoring period;
$[p]$ - relates to project scenario;
$[elec]$ - relates to electric power;
$[gas]$ - relates to natural gas;
$[diesel]$ - relates to diesel fuel;
$[coal]$ - relates to coal;
$[fuel-oil]$ - relates to mazut.