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

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Annexes

SECTION A. General description of the project

A.1. Title of the project:

"Implementation of energy efficiency measures at SE "Prydniprovska zaliznytsya"

Sectoral Scopes:

Sectoral Scope 1 – Energy industries – (Renewable/Nonrenewable Sources)
Sectoral Scope 2 – Energy distribution
Sectoral Scope 3 – Energy demand

Version of Project Design Documentation: 02
Date: 15/12/2011

A.2. Description of the project:

Purpose of project activities
The main purpose of the Joint Implementation Project (JIP) **"Implementation of energy efficiency measures at SE "Prydniprovska zaliznytsya"** 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 «Prydniprovska zaliznytsya».

Historical details of SE «Prydniprovska zaliznytsya»
SE «Prydniprovska zaliznytsya» was registered by the Executive committee of Dnipropetrovsk City Council in May 1998. The company is included into the structure of the Ministry of Infrastructure of Ukraine. The company is subordinated to the State Administration of Railway Transport of Ukraine (Ukrzaliznytsya). SE «Prydniprovska zaliznytsya» provides transportation services for more than 1.8 thousand cargo owners at 189 stations open for freight traffic. The link between the railway and the users is 172 trade offices and 16 branches.

Description of conditions whereunder the project will be implemented:

Before the JI project the SE «Prydniprovska zaliznytsya» 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 for maintaining 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 and carry 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 «Prydniprovska zaliznytsya» 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 uses technological complex, which includes: gauges, facilities for transportation of cargo and passengers and means for servicing railways, railway stations and stations, transformer substation, boiler-houses, 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 cargo 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 provision of freight and passenger rail transportation is complex and includes all administrative and technical resources and means of SE «Prydniprovska zaliznytsya», it is impossible to divide modernization of the facilities into separate directions. Therefore, the project provides for a comprehensive modernization of facilities of SE «Prydniprovska zaliznytsya», leading to reduced consumption of electricity, diesel and fossil fuels. Measures to be implemented within the framework of 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 «Prydniprovska zaliznytsya» which in turn will reduce greenhouse gas (GHG) emissions.

SE «Prydniprovska zaliznytsya» has all licenses and permits necessary for project implementation.

Major contracts for the procurement of raw materials (electricity and diesel fuel) have been already concluded 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 the development of the JI project "Implementation of energy efficiency measures at SE "Prydniprovska zaliznytsya".

18/08/2003 – In the meeting of the Management Board of SE «Prydniprovska zaliznytsya» a decision to create a Joint Implementation project entitled "Implementation of electric energy efficiency measures at SE «Prydniprovska zaliznytsya» was made

12/09/2003 - date of commencement of project documentation elaboration for Joint Implementation project *"Implementation of energy efficiency measures at SE "Prydniprovska zaliznytsya".*

01/01/2004 - date of introduction of new energy efficient equipment according to project documentation.

10/10/2011 - preparation and submitting of the project proposal relating to justification of the reduction of anthropogenic emissions of greenhouse gases to the State Environmental Investment Agency of Ukraine.

13/12/2011- receiving of a Letter of Endorsement from the State 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 «Prydniprovska zaliznytsya»	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 «Prydniprovska zaliznytsya» connects Donbas and Kryvyi Rig iron ore basins and serves southern east of Ukraine: Dnipropetrovsk, Zaporizhzhya regions, a part of Kharkiv and Kherson regions and the Autonomous Republic of Crimea. Prydniprovska railway includes one of the oldest lines in the south of the country – Lozova-Alexandrovsk (Zaporozhye) with a branch to Nyzhnyodniprovsk Katerynoslav.

Project location is outlined on the map of Ukraine (Figure 1.).

Figure 1.Location of SE «Prydniprovska zaliznytsya» 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 the UN FCCC on February 4, 2004; it is listed in the Annex 1 and is eligible for participation in Joint Implementation projects[1].

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

SE «Prydniprovska zaliznytsya» is located in the territory of Dnipropetrovsk, Zaporizhzhya, Kharkiv and Kherson regions as well as the Autonomous Republic of Crimea.

[1] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?page=1&nreg=995_801

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

The JI project includes all administrative and territorial units wherein SE «Prydniprovska zaliznytsya» is located and which are located in the territory of Dnipropetrovsk, Zaporizhzhya, Kharkiv and Kherson regions as well as the Autonomous Republic of Crimea.

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

The Project is located in Ukraine and covers the territories of Dnipropetrovsk, Zaporizhzhya, Kharkiv and Kherson regions as well as the Autonomous Republic of Crimea.
Geographic coordinates of the head office of SE «Prydniprovska zaliznytsya»: 48°27′59.76NL 35°01′05.35EL
The project includes the entire technological complex of public rail transportation, which includes: gauges, facilities for transportation of cargo and passengers and means for servicing railways, railway stations and stations, transformer substation, boiler-houses, etc.

Figure 2. Scheme of SE «Prydniprovska zaliznytsya»

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

The JI project "Implementation of energy efficiency measures at SE "Prydniprovska zaliznytsya" provides for comprehensive modernization of company's facilities to reduce energy consumption of energy resources in the process of provision of services for cargo and passengers rail transportation. 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 it is planned that the equipment manufacturers will provide training on the use and maintenance of introduced equipment for employees of SE «Prydniprovska zaliznytsya».

Detailed description of the main measures and technologies provided by the project is provided below, details of all implemented energy efficiency measures at the company will be presented at the stage of monitoring of JIP "Implementation of energy efficiency measures at SE "Prydniprovska zaliznytsya":

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

Electric locomotive DE1 is an 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 with towing lugs - transfer of traction and braking efforts through two rubber-metal shackle links; transfer of weight load - through the springs supported by equalizing lever hung from below to journal –box. On the roof in the front section there are accelerating and braking resistors (ABRs), at the backend there are non-symmetric single arm pantograph current collecting device and main reservoirs. To ensure control of the power circuit and diagnostics of equipment, each section has a microprocessor control and diagnostics system (MCDS). Principal controller is installed on the locomotive driver's desk, and assistant's desk has monitor with a keyboard that manages MCDS.

Table 1. Technical characteristics of electric locomotive DE1

DE1 (Dnipropetrovsk Electric Locomotive,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 gauge track: 230 kN Design speed: 100 km / h. One-hour rating: 6260 kW Traction effort in hour rating: 440 kN Power of regeneration braking: 6600 kW Power of dynamic braking: 6500 kW

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

2. Modernization of diesel-powered locomotives by means of split-phase start system (SPSS). Brief description and characteristics of the equipment are provided below and on equipment seller's web-site[2].

Split-phase start systems (SPSS) are designed to improve reliability, increase the life span of starting systems of diesel-powered locomotives and improve the conditions of operation and maintenance of locomotives, especially in case of worn-out rechargeable batteries and low ambient temperatures. SPSSs allow for overcoming mechanical resistance at the start cranking of the crankshaft and significantly decrease electrical load of battery when one starts a diesel engine. SPSSs are designed to: improve reliability, increase the life span of starting systems of diesel-powered locomotives and improve the conditions of operation and maintenance of locomotives.

Figure3. Split-phase start system *(SPSS).*

Implementation of SPSSs will allow for the decrease of diesel fuel consumption due to overcoming mechanical resistance at the start cranking of the crankshaft and significantly decrease electrical load of battery when one starts a diesel engine; this will result in reduction of GHG emissions into the atmosphere.

3. Introduction of the system of control and accounting of diesel fuel consumption of «BIS-R» type. Brief description and characteristics of the system are provided below and on equipment seller's web-site.[3]

Software of the system of control and accounting of diesel fuel consumption of «BIS-R» type can provide a visual record of fuel consumption and an analysis of the locomotive operation; it can also store and archive all data received by the system.
The system "BIS-R" is distributed control-measuring microprocessor structure with the following specifications:
▪ power supply of the system is carried out by locomotive on-board network with a voltage of 60-120V;
▪ measurement of volume within the range of 500-5600 l, at calibration of fuel tank with volumetric ware with capacity of 50 l.;
▪ accuracy of the operating power measurement is 7%, within the range of up to 1000 kW;
▪ accuracy of the fuel temperature measurement is ± 1 ˚C within the range of from -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 the control system "BIS-R" will increase the control over the use of diesel fuel by diesel-powered locomotives, due to ongoing monitoring and analysis of fuel consumption; this will reduce GHG emissions into the atmosphere.

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

Application of additive "Adizol T-6" provides reduction in specific consumption of diesel fuel and leads to:

[2] http://uttm.com.ua/products-3.html
[3] http://www.cmt.perm.ru/index.files/Page832.htm
[4] http://www.adioz.com.ua/

- Fuel economy;
- Increasing the life span of parts, components and assemblies;
- Reducing time and cost of repairs;
- Increase in engine power;
- Cleaning the fuel system and prevention from further pollution;
- Reduction of engine noises;
- Increasing the storage of fuel.

All the above will reduce GHG emissions into the atmosphere.

5. Introduction of the system of control over fuel consumption and operating modes of diesel engines of diesel-powered locomotives of "Delta SU" type. Brief description and characteristics of the system are provided below and on equipment seller's web-site.[5]

Figure4. On-board system of control over parameters of diesel locomotive operation "Delta SU"

"Delta SU" is an onboard system of control over 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 locomotive utilization efficiency factor;
- Determination of fuel use;
- Measurement and record of the dynamics of fuel quantity in the locomotive tank;
- Automatic record of fuel in the course of shift changeover and servicing, the current diagnostics of diesel-generator set;
- Control of the location of the locomotive in real time;
- Transfer of the accumulated information is carried out in automatic mode on a shift basis through radio channel on ARM "Delta WEB / GPS" for further processing.

Implementation of the on-board system of control over parameters of diesel locomotive operation "Delta SU" will provide automatic recording of fuel consumption that will reduce GHG emissions into the atmosphere.

[5] http://dneproteh.com/Dneproteh_CKPRT_Delta_CY.html

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

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

Figure5. Appearance of engines 4D80

Table 2. Technical characteristics of engines 4D80

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

The 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 greenhouse gases into the atmosphere.

[6] http://malyshevplant.com/

7. Introduction of high-efficiency natural gas-based boilers. Brief description characteristics of equipment and are provided below, as well as on equipment seller's web-site.[7]

Figure6. Boiler VK-21

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

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

Technical characteristics of Boiler VK - 21	
Power, MW (Gcal)	2.0 (1.72)
Burner 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
Efficience Factor, %	91
Maximum mass, kg	4000
Overall dimensions, mm: Length Width Height	 3580 1810 2340

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

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

8. Replacement of burners. Brief description and characteristics of equipment are provided below, as well as on equipment seller's web-site. [8]

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 carried out by gas valve control, which is consistent with an air valve through the electronic control unit. Easily accessible examination and repair of burners are due to ball system of burner attachment to the fan. Burner may open both to the right and left. Burners are able to control the length and diameter of the torch.

Figure7. Gas block burner

The burner provides offline operation, during which power of burner or operating temperature of the heat carrier are set by an operator or by using the program and in such a case these parameters are 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
Type of fuel	Natural gas according to State Standard 5542-87

Installation of gas burners with higher Efficiency Factor will make allow for more efficient burning of fuel in boilers that would reduce gas consumption for heating needs. This, in turn, will reduce GHG emissions into the atmosphere.

9. Installation of contact and contactless heat-utilization gas-cleaning apparatus. Brief description and characteristics of equipment are provided below, as well as on equipment seller's web-site[9].

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 return network water.

[8] http://www.ugt.com.ua/index.php?option=com_content&view=article&id=42&Itemid=75
[9] http://zgo.com.ua/home/teploytilizator.html

Figure 8. Heat-regenerator

Table 5. Technical characteristics of heat-regenerators

Technical data:	
Temperature of boiler (furnace) discharge gases, ^{0}C	160-280
Temperature of discharge gases after heat-regenerator, ^{0}C	120-140
Water consumption by heat-regenerators, m^3 / h	25
Efficience 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 into the atmosphere.

10. Replacement of heat networks in boilers with pre-insulated pipelines. Brief description and characteristics are provided below, as well as on equipment seller's web-site [10]

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

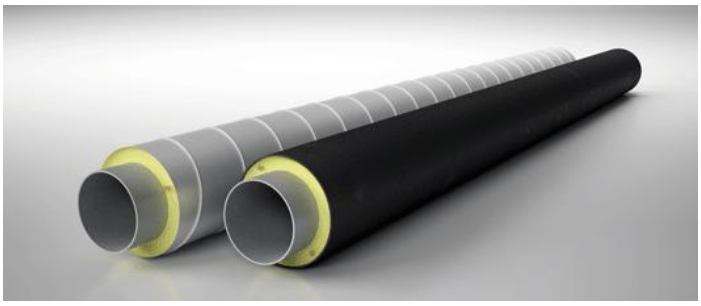

Figure 9. Pre-insulated pipelines

Implementation of this measure will improve the terms of accident-free service of heat supply, reduce heat loss due to the insulation of pipelines and reduce leakage of heat carrier in emergency areas, which would reduce heat losses in the heat supply system and save fuel for heating of the heat carrier that will reduce GHG emissions into the atmosphere.

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

11. Replacement of heat networks with pre-insulated pipelines. Brief description and characteristics are provided below, as well as on equipment seller's web-site. [11]

Thermal pump uses low-grade heat that is in a "scattered" state in the environment: in the land, water and air. By 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.

Figure 10. Thermal pump

Table 6. Technical characteristics of thermal pump

Thermal pump	
Heat power [kW]:	268.8
Power consumption[kWh]:	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 due to the use of low-grade heat for the needs of heating and hot water supply that will reduce GHG emissions into the atmosphere without reducing capacity of thermal energy production.

12. Implementation of frequency control devices of pump electrical drives. Brief description and characteristics of equipment are provided below.

Implementation of frequency control over electrical drives of heat supply pumps 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.

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

Figure 11.Frequency control device

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

13. Replacement of circulating pumps of heat supply and HWS system. Brief description and characteristics are provided below, as well as on equipment seller's web-site[12].

Circulating pumps are equipped with two-pole engine and consist of a hydraulic body made of stamping aluminum and cast iron sealing flange. Flange unions with threaded holes for pressure gauge connection. Impeller is made of technological polymers. Engine shaft is made of stainless steel. The protective cover of the rotor and stator casing are made of stainless steel.

Figure12. Pumps

Table 7. Technical characteristics of pumps.

Technical characteristics of pumps:	
Maximal operating pressure:	10 bar (1000 kPa)
Standard flanges:	DN40, DN50, DN65, DN80, PN6 / PN10 (with four holes)
Installation:	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

[12] http://kotloteh.com.ua

Replacement of circulating pumps of the heat and hot water supply systems with the ones characterized by a higher efficiency factor and better performances in terms of energy efficiency will reduce power consumption, which in turn will result in lower consumption of fossil fuel for Ukrainian power plants and decrease in GHG emissions into the atmosphere.

14. The use of modern gas meters. Technical characteristics of the equipment are provided below.

Figure13. 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 working pressure of gas, kPa, (mmAq)	1.2(120)

Application of modern gas metering devices allows for the more efficient use of gas, monitoring, simplification of control, ensures safe operation and leads to reduction of fossil fuel combustion and GHG emissions into the atmosphere.

15. Installation of solar collectors in order to use solar energy for heat supply. Brief description and characteristics of equipment are provided below, as well as on equipment seller's web-site[13]

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.

[13] http://ekonomteplo.com.ua/2010/07/12/vakuumnyj-sonyachnyj-kolektor/

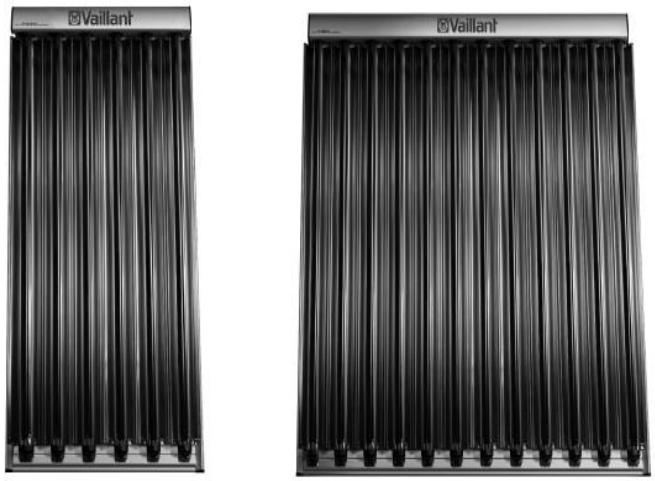

Figure14. Solar collectors

Table 9. Technical characteristics of solar collectors

Technical data		
Area	M^2	1.0-2.0
Collector volume	l	0.9
Operating pressure	bar	10
Temperature of idle time	^0C	295
Productivity factor k 1	W/m.K	0.885
Height	mm	1652
Width	mm	702
Depth	mm	111
Weight	kg	19

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

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

Thermal insulation of external walls and roofs consists in creation of an additional layer of insulation on the outside or the inside of the wall or roof. In such a way 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 threefold or fourfold.

Figure15. 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 by means of fencing constructions; this reduces the heat consumption for heating of buildings. This will reduce the consumption of fuel combusted for heat supply needs and, accordingly, reduce GHG emissions into the atmosphere.

17. Replacement of windows to improve the efficiency of their thermal resistance. Brief description of technology is provided below.

Windows are a major source of heat loss in the building. Therefore, installation of energy saving 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.

Figure16. Energy saving metal-plastic window

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

18. Introduction of automated system for commercial metering of electricity consumption (ASCMEC) along the perimeter of SE «Prydniprovska zaliznytsya». Brief description and characteristics of equipment are provided below.

Main functions of ASCMEC:

- Maintain a database of resource consumption on a PC;
- - Preparation of analytical information, reports, minutes;
- - Drawing up of inner-facility balance of energy resources inflow and consumption in order to detect unauthorized use;
- - Multi-tariff energy accounting;
- - Control of connection lines with energy meters;
- - Protection of information from unauthorized access.

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

19. Replacement of cables and wires of transformer substation. Brief description and characteristics of equipment are provided below.

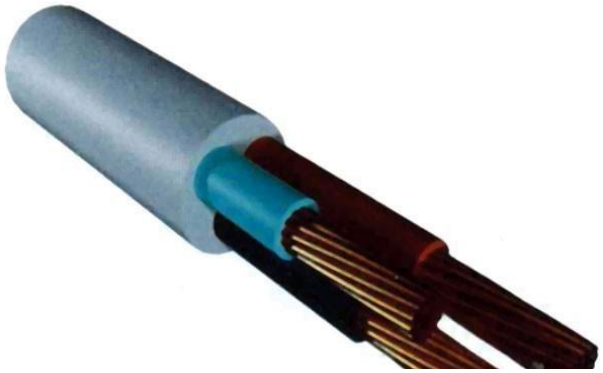

Figure17. Cable of power lines

Figure18. Wire of power lines

Replacement of cables and wires of transformer substations will reduce costs and energy consumption during transportation resulting in decrease of gas and fossil fuel consumption at power plants in the process of electricity generation, which in turn, will reduce GHG emissions into the atmosphere.

20 Replacement of transformers at transformer substations. Brief description and characteristics of equipment are provided below, as well as on equipment seller's web-site[14].

Transformers that are installed at substations, are designed to convert electricity from one voltage class to another one. Three-phase transformer are the most effective nowadays, since the loss of electricity in them is lower and consumption of active materials is lower.

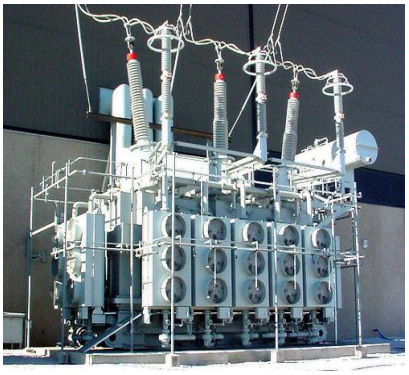

Figure19. Transformer

Implementation of energy efficient transformers will reduce electricity consumption for the needs of company's own substations, 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 into the atmosphere.

21. Replacement of meters with lower accuracy class by meters with higher accuracy class. Brief description and characteristics of equipment are provided below, as well as on equipment seller's web-site[15].

Figure20. 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 baud
Possibility of connection of external power source (12 V) for reading in case of voltage absence	

Application of new meters with higher accuracy class will improve the energy audit procedure at the enterprise and monitoring of electricity consumption; this will reduce GHG emissions into the atmosphere.

[14] http://forca.com.ua/transformatori.html
[15] http://electrica-shop.com.ua/pi/products_id/2512

Stages of project implementation

Table 11. Schedule of rehabilitation and modernization of unified 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									
Transformer substation									
18									
19									
20									
21									
* - *description of measures by clauses see in Section A.4.2.*									

At the beginning of the Project SE «Prydniprovska zaliznytsya» carried out only those measures aimed at maintaining the unified complex of rail transportation in working order. Basically, these measures included repair to correct malfunctions that arose in the process of providing services on cargo and passenger rail transportation 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:

The process of rendering services on cargo and passenger rail transportation is very complex, it includes: locomotive facilities, heat supply system, buildings and structures, transformer substation. Based on this it is necessary to use complex modernization of the facilities of SE «Prydniprovska zaliznytsya» in order to increase efficiency of energy consumption and quality of rendering services on cargo and passenger rail transportation it is necessary to apply complex modernization of SE "Prydniprovska zaliznytsya".

Complex modernization includes:

- Modernization of locomotive facilities 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 the 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 transformer substation that will result in decrease of electric power losses and consumption in the course of rendering services on cargo and passenger transportation.

Maximal decrease in energy resources consumption that will result in reduction of GHG emissions into the atmosphere will be achieved due to complex modernization of company's facilities under the project "Implementation of energy efficiency measures at SE "Prydniprovska zaliznytsya".

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

Table 12.Estimated amount of emission reductions for the period before the first commitment period (2004-2007)

	Years
Length of the crediting period	4
Year	Estimate of 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 CO_2 equivalent)	1 867 909
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	466 977

Table 13. Estimated amount of emission reductions during the first commitment period (2008-2012)

	Years
Length of the crediting period	5
Year	Estimate of 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 CO_2 equivalent)	2 830 347
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	566 069

Table 14. Estimated amount of emission reductions for the period following the first commitment period (2013-2020)

	Years
Length of the crediting period	8
Year	Estimate of 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 CO_2 equivalent)	4 522 368
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	565 296

More detailed information is provided in the Supporting 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:

A Letter of Endorsement №3603/23/7 dated 13/12/2011 of the JI project "Implementation of energy efficiency measures at SE "Prydniprovska zaliznytsya" was issued by the State Environmental Investment Agency of Ukraine.

After analysis of the project, the PDD and Determination report will be submitted to the State Environmental Investment Agency of Ukraine for receiving a Letter of Approval.

The project was also approved by Switzerland, the country – buyer of GHG emission reductions (Letter of Approval № J294-0485, issued by the Federal Office for the Environment (FOEN) dated 23/01/2012).

SECTION B. Baseline

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

Dynamic baseline is a scenario that reasonably represents the anthropogenic emissions of greenhouse gases by sources that would occur in case if the project is not implemented. The baseline was chosen in accordance with the Guidance on criteria for baseline setting and, Version 03[16]. According to the Guidelines for users of the JI PDD form, Version 04, the following stepwise approach is used for description and justification of the chosen baseline:

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

For the proposed project aimed at reduction of energy consumption by the facilities of SE «Prydniprovska zaliznytsya» in the process of providing services on freight and passenger rail transportation, none of the existing methodologies can be applied. The Project Participant has chosen a specific approach based on the requirements to JI projects in accordance with paragraph 9 (a) of the Guidance on criteria for baseline setting and monitoring for JI projects, version 03.

The Baseline was set by choosing the most plausible scenario with a list and description of plausible future scenarios based on conservative assumptions.
The following steps were used to determine the most plausible baseline scenario:
1. Identification of plausible alternatives that could be the baseline scenario;
2. Justification of exclusion of alternatives, which are not plausible from a technical and / or economic point of view.

To set 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;
– availability of capital (including investment barriers);
– local availability of technology / equipment;
– price and availability of fuel.

Step 2. Application of the approach chosen

The choice of the plausible baseline scenario is based on assessment of alternative options of provision of freight and passenger rail transportation, which potentially could take place.
These options are the following alternatives:
Alternative 1.1: Continuation of current practice, without the JI project.
Alternative 1.2: The project activities without the Joint Implementation mechanism.
Alternative 1.3: Partial project activities (not all project activities will be implemented) without use of the Joint Implementation mechanism.
A detailed analysis of each alternative is provided below.

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.

[16] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

State of the Railway Transport system of Ukraine.

In the baseline period the state and trends of development of the railway transport system of Ukraine were quite unsatisfactory.

The level of depreciation of the assets of the Railway Transport of Ukraine is extremely high. Most of the gauge tracks is mounted on wooden cross-ties, which requires constant maintenance and periodic replacement. Certain part of railway sector infrastructure (railway stations, stations, hotels, technical facilities, etc.) is quite obsolete.

Tariff policy of "Ukrzaliznytsya" that is approved annually[17], regulates tariffs for all types of rail transport in Ukraine. Decree "On approval of Rules for the carriage of passengers, baggage, cargo and mail by railway transport of Ukraine"[18] defines category of people that have concessional terms for passenger transportation. Compensation of non-obtained revenue from carrying out socially necessary passenger transportation of suburban and regional traffic is provided by the State Budget of Ukraine, but it does not provide compensation to the full extent. "Ukrzaliznytsya" provides the following data: losses from uncompensated transportation of reduced fare passengers (26 categories of reduced fare passengers) in 2004 were 1.8 billion UAH.; in 2005 - almost 2.2 billion UAH, in 2006 - 2.8 billion UAH, in 2007 - 4 billion UAH. and in 2008 - 4.3 billion UAH[19]. This situation leads to significant losses of "Ukrzaliznytsya" and actually makes it impossible to implement modernization measures to improve energy efficiency of rail transport on company's own expense. An appropriate law could solve the existing problems of accounting of cheap fare transportaiton, calculation and payment of compensations at the state level, but such law is still at the development stage.

Due to depreciation of carriage rolling stock quantity of operating cars decreases annually. In this situation, there is a lack of wagons for rhythmic loading and shipping of goods to domestic enterprises and for export. This leads to lack of funds at mining companies for payment of electricity, which is also used for pumping water from borrow pits; other servicing entities stop businesses resulting in environmental and social problems.

Analysis conducted by "Ukrzaliznytsya" demonstrated that one of the causes of the deficit of freight wagons, primarily high-sided wagons, lies in the irresponsible attitude to the requirements of the standards in terms of loading and unloading of such wagons at state enterprises of the hard coal and energy industries. Thus, among 38 mining unions 36 do not comply with the standards for cargo operations. Instead of stipulated 5-16 hours, each wagon is idle almost for the whole day, and therefore the loss of freight resources amounts to more than 570 wagons daily. The causes of this situation are the technical backwardness of the infrastructure of hard coal companies, imperfect technology of product quality determination (analysis is carried out after loading of wagons), many problems on access roads of state mines and concentration plants. Many cars are damaged in the seaports, where grab cranes operate. This lead to the situation when Dnipropetrovsk railway lost 381 freight wagons. Standards of holding of wagons with hard coal at electric power plants, SRPP etc. are exceeded.

In order to reform rail transport to meet the growing needs of the national economy and population in transportation, improve quality and reduce the cost of transport component in the price of products a Concept of the State program of reforming railway transport of Ukraine[20] № 651-r, 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 conditions for equal access to the services of infrastructure of railway transport and additional services;
- Improvement of rail transportation management system;
- Creation of favorable conditions for investment needed to upgrade and modernize the production and technical base of railways;

[17] *http://www.uz.gov.ua/?m=info.normdocs.tarpolmain&lng=uk*
[18] *http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=z0310-07*
[19] *http://www.uz.gov.ua/?m=info.news&lng=uk*
[20] http:/www.uz.gov.ua/?m=info.menu_koncepc&lng=uk

- 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;
- Ensuring transparency of financial activities of railway transport.

Reforming is planned to be implemented in three stages.

At the 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 subdivisions that carry out cargo and passenger transportation, carry out repair of cars, gauges, buildings and other facilities from the structure of railways will be solved; creation of conditions for the gradual reduction of volume of cross-subsidization of passenger transportation at the expense of freight transportation; conduction of preliminary financial and economic, organizational and legal analysis to determine the possibility and expediency of the further creation of Company's subsidiaries, including those dealing with passenger and freight transportation; development of basic principles of formation (with the participation of local governments and business entities of different forms of ownership) of 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 the third stage of the reform it is planned to carry out full separation of the functions of management of railway infrastructure facilities and transportation; for this purpose it is planned to create conditions to prevent cross-subsidization of passenger transportation at the expense of freight transportations; withdrawal of the Company's non-core production and enterprises that are not related to rail transportation, their privatization; creation of enterprises that would deal with passenger long-distance and suburban transportation and division 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 planned to be provided by railway and rail transport companies, which makes it unattractive from an investment standpoint, given the poor economic situation of the enterprises. In addition, the mechanisms for encouragement of implementation of the measures described in program are not provided, which leads to lack of interest of rail transport companies in conducting measures to improve energy efficiency and reduce environmental impact.

This alternative is the most plausible baseline scenario since:
- it enables to provide the necessary volume of freight and passenger transportation by using existing facilities;
- it does not require investment in new technological equipment.

Accordingly, Alternative 1.1 could be considered as the most plausible baseline.

Alternative 1.2

The project activities without the Joint Implementation mechanism. In this case there are two barriers: investment barrier (see more details in Section B2) because this scenario requires additional substantial investment and has a very long payback period and high risks, so it is unattractive for investors, and also technological barrier because the 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 plausible baseline scenario as there is a need to invest in new technological equipment and it is characterized by lack of qualified personnel for servicing the equipment, therefore, *Alternative 2.1* can not be regarded as the plausible baseline.

Alternative 1.3

Partial project activities (not all project activities will be implemented) without the Joint Implementation mechanism.

Alternative 1.3 provides for excluding from the project boundary any non-key measures of the project, such as exclusion of modernization transformer substation, etc.. As the process of transportation of cargo and passengers by rail is a very complex process which requires only a comprehensive approach, 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 technological equipment and is characterized by lack of qualified personnel for servicing the equipment, therefore, *Alternative 1.3* may not be considered a a plausible baseline.

Analysis of the alternatives described above shows that *Alternative 1.1* is the most plausible, and *Alternative 1.2* as well as *Alternative 1.3* are the least plausible.

Results of investment analysis in Section B.2 showed that the *Alternative 1.2 and Alternative 1.3* can not be considered as the most plausible alternatives from a financial point of view. These assumptions are provided in Section B.2. The results of the analysis made in accordance with the "Tool for the 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 provides for continuation of current practice with the introduction of minimal repairs on the background of the overall deterioration of freight and passenger rail transportation.
This scenario is less environmentally-friendly in the near future (including the first commitment period from 2008 to 2012), because greenhouse gases will remain at the same level or even rise, but this scenario is more attractive from economical point of view. 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 diesel fuel, fossil fuel and electricity consumption that would result in the harmful effects on the atmosphere because of pollution by GHG.
Detailed information on the algorithm for calculating the baseline is provided in Section D.1.

Key information for baseline setting is stated in the tables given below:

Data/Parameter	N_{b}^{j}
Data unit	mln t km
Description	Total volume of rail transportation in historical period «j», in the baseline 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)	**2001**: 39 955; **2002**: 44 214; **2003**: 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 volumes of transportation is the official enterprise's data used to calculate the tariff for the provision of railway transportation services, which is further agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine
Any comment	Information on volumes of rail transportation is the basis for calculation of GHG emissions; it will be archived in paper and electronic form

Data/Parameter	N_{p}^{y}
Data unit	mln t km
Description	Total volume of rail transportation in historical period «y», in the project scenario
Time of	Annually

determination/monitoring	
Source of data (to be) used	Driver's running schedule
Value of data applied (for ex ante calculations/determinations)	The 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 volumes of transportation is the official enterprise's data used to calculate the tariff for the provision of railway transportation services, which is further agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine
Any comment	Information on volumes of rail transportation is the basis for calculation of GHG emissions; it will be archived in paper and electronic form

Data/Parameter	EC_b^j
Data unit	MWh
Description	Electric power consumption in historical period «j», in the baseline scenario
Time of determination/monitoring	Every 30 minutes
Source of data (to be) used	Readings of electricity meters, which shall be included in monthly report "Departmental reporting form 1B-TVE DAEK «Structure of balance of electric power and technological power consumption (TPC) for power transmission in electrical grids»
Value of data applied (for ex ante calculations/determinations)	**2001**: 1165020; **2002**: 1184691.17; **2003**: 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 and informational complex, which operated along the perimeter of the enterprise. Backup method of determination was automated system for commercial metering of electricity consumption (ASCMEC)
QA/QC procedures (to be) applied	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality control, Law of Ukraine "On metrology and metrological activity"[21]. The final results were recorded in the official reports that were submitted 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; it will be archived in paper and electronic form

Data/Parameter	$EF_{b,CO2,ELEC}^j$

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

Data unit	tCO_2/MWh
Description	Carbon dioxide emission factor for electricity consumption by electricity consumers in historical period «j», in the 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)[22]) issued by the Ministry of Economy of Netherlands
Value of data applied (for ex ante calculations/determinations)	**2001**: 0.976; **2002**: 0.956; **2003**: 0.936
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 carbon dioxide emission factors are applied in the process of JI project elaboration, and in case of their absence the factors for 2001-2003 from ERUPT are applied.
Any comment	Data allowing for calculation of GHG emissions

Data/Parameter	$FC^{j}_{b,NG}$
Data unit	ths m^3
Description	Total volume of natural gas consumed in historical period «j», in the 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)	**2001**: 44670.968; **2002**: 43298.926; **2003**: 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 gas consumed before the project implementation. The main method of determination was operational and informational 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 control, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports that were submitted 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; it will be archived in paper and electronic form

Data/Parameter	$NCV^{j}_{b,NG}$

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

Data unit	TJ/ ths m^3
Description	Net Calorific Value of natural gas in historical period "j, in the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[23]
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 measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National Inventory of anthropogenic GHG emissions by sources and removals by 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 net calorific value of gas is applied

Data/Parameter	$EF_{b,C,NG}^{j}$
Data unit	t C/TJ
Description	Carbon emission factor for the process of natural gas combustion in historical period "j", in the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[24]
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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form.

Data/Parameter	$OXID_{b,NG}^{j}$
Data unit	Relative units
Description	Carbon oxidation factor for the process of natural gas combustion

[23] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[24] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

	in historical period "j", in the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[25]
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 procedures (to be) applied	N/A
QA/QC procedures (to be) applied	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form.

Data/Parameter	$FC^{j}_{b,diesel}$
Data unit	t
Description	Total amount of diesel fuel consumed in historical period "j", in the baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Meters of diesel fuel at fuel-filling columns
Value of data applied (for ex ante calculations/determinations)	**2001**: 60183.104; **2002**: 62390.207; **2003**: 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 and informational 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 control, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports that were submitted 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; it will be archived in paper and electronic form

Data/Parameter	$NCV^{j}_{b,diesel}$
Data unit	TJ/ ths m^3
Description	Net Calorific Value of diesel fuel in historical period "j", in the

[25] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

	baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[26]
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
QA/QC procedures (to be) applied	National Inventory of anthropogenic GHG emissions by sources and removals by 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 net calorific value of diesel fuel is applied

Data/Parameter	$EF^{j}_{b,C,diesel}$
Data unit	t C/TJ
Description	Carbon emission factor for the process of diesel fuel combustion in historical period "j", in the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[27]
Value of data applied (for ex ante calculations/determinations)	According to the principles of conservatism the minimal value of diesel fuel calorific value is applied
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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form

Data/Parameter	$OXID^{j}_{b,diesel}$
Data unit	Relative units
Description	Carbon oxidation factor for the process of diesel fuel combustion in historical period "j", in the baseline scenario

[26] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[27] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[28]
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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form

Data/Parameter	$FC_{b,coal}^{j}$
Data unit	t
Description	Total amount of hard coal consumed in historical period "j", in the baseline scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Form N 11-MTP «Report on results of fuel, heat energy and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	**2001**: 55358; **2002**: 46219; **2003**: 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 hard 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 the amount of consumed hard coal is the basis for calculation of GHG emissions; it will be archived in paper and electronic form

Data/Parameter	$NCV_{b,coal}^{j}$
Data unit	TJ/ ths. t
Description	Net Calorific Value of hard coal in historical period "j, in the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[29]

[28] 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)		**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 Inventory of anthropogenic GHG emissions by sources and removals by 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 net calorific value of hard coal is applied				

Data/Parameter	$EF^{j}_{b,C,coal}$			
Data unit	t C/TJ			
Description	Carbon emission factor for the process of hard coal combustion in historical period "j", in the baseline scenario			
Time of determination/monitoring	Annually			
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[30]			
Value of data applied (for ex ante calculations/determinations)		**2001**	**2002**	**2003**
		26.75	26.75	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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)			
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form			

Data/Parameter	$OXID^{j}_{b,coal}$
Data unit	Relative units
Description	Carbon oxidation factor for the process of hard coal combustion in historical period "j", in the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[31]

[29] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[30] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[31] 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)	**2001**	**2002**	**2003**	
	0.98	0.98	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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)			
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form			

Data/Parameter	$FC_{b,FO}^{j}$			
Data unit	t			
Description	Total amount of fuel oil consumed in historical period "j", in the baseline scenario			
Time of determination/monitoring	Monthly			
Source of data (to be) used	Form N 11-MTP «Report on results of fuel, heat energy and electricity consumption»			
Value of data applied (for ex ante calculations/determinations)	**2001**	**2002**	**2003**	
	8130.6	5380.9	4333.6	
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 fuel oil 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 fuel oil is the basis for calculation of GHG emissions; it will be archived in paper and electronic form			

Data/Parameter	$NCV_{b,FO}^{j}$			
Data unit	TJ/ ths t			
Description	Net Calorific Value of fuel oil in historical period "j, in the baseline scenario			
Time of determination/monitoring	Annually			
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[32]			
Value of data applied (for ex ante calculations/determinations)	**2001**	**2002**	**2003**	
	39.92	39.92	39.92	
Justification of the choice of data or description of	N/A			

[32] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

measurement methods and procedures (to be) applied	
QA/QC procedures (to be) applied	National Inventory of anthropogenic GHG emissions by sources and removals by 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 net calorific value of fuel oil is applied

Data/Parameter	$EF^{j}_{b,C,FO}$
Data unit	t C/TJ
Description	Carbon emission factor for the process of fuel oil combustion in historical period "j", in the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[33]
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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form

Data/Parameter	$OXID^{j}_{b,FO}$
Data unit	Relative units
Description	Carbon oxidation factor for the process of fuel oil combustion in historical period "j", in the baseline scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[34]
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

[33] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[34] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

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

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

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 unified complex of public rail transportation by means of 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 the process of providing services on freight and passenger rail transportation, which will cause the reduction of emissions of greenhouse gases into the environment.

Additionality of the project

The additionality of the project activity is demonstrated and assessed by using the "Tool for the demonstration and assessment of additionality"[35] (Version 06.0.0). This manual was elaborated in original for CDM projects, but it may also be applied to JI projects.

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

Sub-step 1a. Definition of alternatives to the project activity

There are three alternatives to this project. (that were described in Section B1)
Alternative 1.1: Continuation of the current practice, without the JI project implementation.
Alternative 1.2: The proposed project activity without the use of the Joint Implementation mechanism.
Alternative 1.3: Partial project activities (to implement not all project measures) without the use of the Joint Implementation Mechanism.

Outcome of sub-step 1a. Three realistic alternative scenarios to the project activity are identified

Sub-step 1b. Consistency with mandatory laws and regulations
Alternative 1.1: Continuation of the current practice of exploitation of existing facilities of SE «Prydniprovska zaliznytsya» is the most realistic and reliable alternative to Project implementation, since this variant is related to the minimal expenses for enterprise.
According to the Law of Ukraine «On Rail Transport»[36]

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;

[35] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf
[36] http://zakon1.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=273%2F96-%E2%F0

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

- "Income of railways from transportation of cargo and passengers in direct traffic are formed according to their specific contributions to transportation process."
- Existing Ukrainian system of setting 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 «Prydniprovska zaliznytsya» is not obliged and motivated to build and improve the system of rail transport for its own account.

Alternative 1.2: SE «Prydniprovska zaliznytsya» didn't carry out any significant measures to modernize the system of rail transport. Moreover, SE «Prydniprovska zaliznytsya» has neither incentive nor funds to implement the measures planned 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 plausible baseline.
Alternative 1.3: This alternative provides for exclusion from the project boundary any non-key measures on the project implementation, such as exclusion of upgrading of external transformer substation, etc. Since the process of freight and passenger rail transportation is very complicated, which requires only a comprehensive approach, the partial implementation of the measures will not achieve a significant reduction in consumption of fuel and energy resources; in addition *Alternative 1.3* requires investment in new technological equipment and is characterized by a lack of qualified personnel to service this equipment, therefore *Alternative 1.3* can not be considered as a plausible baseline.
Conducting of comprehensive modernization of a unified system of rail transportation without the JI mechanism is consistent with mandatory laws and regulations; Detailed analysis of consistency with the law was made for *Alternative 1.1*, and it is similar in terms of consistency with mandatory laws and regulations for *Alternative 1.2.* and *Alternative 1.3.*

Outcome of sub-step 1b. Under such circumstances one may say that all scenarios are consistent with current laws and regulatory acts. Therefore Step 1. is satisfied.
According to the document the "Tool for the demonstration and assessment of additionality[37] (Version 06.0.0) further justification of additionality shall be performed by means of investment analysis.

Step 2 - Investment Analysis.
The main purpose of investment analysis is to determine whether the proposed project:
(a) is not the most economically or financially attractive, or
(b) is not economically or financially feasible without income from sale of emission reduction units (ERUs) related to the JI project.

Sub-step 2a - Determination of appropriate analysis method.
There are three methods used for investment analysis:
- a simple cost analysis (Variant I);
- a comparative investment analysis (Variant II);
- a benchmark analysis (Variant III).

If the project activities and alternatives identified in Step 1 do not receive financial or economic benefits other than income related to JI, then the simple cost analysis (Variant I) is applied. Otherwise, the comparative investment analysis (Variant II) or the benchmark analysis (variant III) are used.
Guidelines for additionality allow for performance of comparative investment analysis, which compares corresponding financial indices for the most realistic and reasonable investment alternatives (Variant II), or the benchmark analysis (Variant III). For this project it is appropriate to apply analysis using Variat III, according to the instructions of Guidelines for additionality.

[37] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

Sub-step 2b–Benchmark analysis.
The proposed project "Implementation of energy efficiency measures at SE "Prydniprovska zaliznytsya" will be implemented by the project participant, namely SE «Prydniprovska zaliznytsya». The approach recommended in paragraph 6 (a) of the Guidelines for additionality provides for using of a discount rate that is determined by considering the weighted average cost of capital (WACC). WACC is calculated as a weighted average cost of own and debt capital. The structure of capital is taken in the form of 50% of own and 50% of debt capital. In accordance with paragraph 18 of the "Guidelines on the assessment of investment analysis ver.05"[38] cost of own capital is calculated as the sum of risk-free rate (3%), the risk premium on investment in own capital (6.5%) and country risk (6.75%)[39]. Thus the cost of own capital is 16.25%. The cost of own capital is estimated at the average cost of credit in foreign currency as of the beginning of 2004 according to the NBU, which was 12.3%[40]. Nominal discount rate (WACC) is equal to 14.3%. And real discount rate (IRR benchmark) is adjusted by inflation index for the eurozone (2.2%)[41] .
If the proposed project (not implemented as a JI project) has a less favourable rate, i.e. lower internal rate of return (IRR), than the total limit level, the project may not be considered as financially attractive.

Sub-step 2c – Calculation and comparison of financial indicators.
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 investment of approximately 2 billion euros (According to the NBU's rate)[42]
1. The project duration is 15 years (minimal term of the equipment operation);
2. The residual value is calculated as the result of multiplication of unused resource for initial expenses.
Analysis of cash flow takes into account the cash outflow connected with investments and operating costs[43] and cash inflow associated with the receipt of revenues from providing of services by the enterprise.
Financial indicators of the project are provided below in table.

Table 15. Financial indicators of the project

Revenue without VAT (ths EURO)	Cash flow (ths EURO)	p (discount rate)	NPV (ths EURO)	IRR (%)	Residual value (ths EURO)
1823057.195	-868697.6073	14.3%	-351,464	1.9%	1,076,702

The source of data on income and expenses of SE «Prydniprovska zaliznytsya» 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 which is 14.3%. As a result NPV is negative. Therefore the project cannot be considered as financially attractive.

Sub-step 2d: Sensitivity analysis
The sensitivity analysis is conducted to confirm whether the conclusions on the financial / economic attractiveness are enough stable at different substantiated variants of the baseline conditions change. The following two key factors were considered in sensitivity analysis: investment and operational expenses as well as tariff for freight and passenger rail transportation. According to the guidelines for additionality (paragraph 17) the sensitivity analysis should be made for key indicators in the range of variation ± 10%.

[38] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf
[39] http://pages.stern.nyu.edu/~adamodar/pc/archives/ctryprem03.xls
[40] http://www.bank.gov.ua/doccatalog/document?id=36530
[41] http://www.finfacts.ie/inflation.htm
[42] http://www.bank.gov.ua/files/Exchange_r.xls
[43] Accompanying document 2

Revenue for transportation of cargo and passengers

Company's income (ths EURO)	2180685.814	1842384.026	2006207.344
Investment costs (ths EURO)	355407.3374	355407.3374	355407.3374
Operating costs (ths 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 (ths EURO)	1962617.233	1842384.026	2398754.396
Investment costs (ths EURO)	390948.0711	355407.3374	319866.6036
Operating costs (ths 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 may occur during the project implementation and operation of the unified complex of rail transportation. Analysis of changes in revenue for the rail transportation of cargo and passengers between -10% and +10% demonstrated that IRR varies within 0.1% - 7.6%. Analysis of investment and operating costs between -10% and +10% showed that IRR varies within 4.7% - 0.28%. Costs considered in this project are high and their increase will lead to a negative NPV. However in case of expected price of the investment and the income from the sale of ERUs the project is viable and will bring enough profit even in case of credit financing of the project and it should make a profit even if the above changes in price of investment take place.

Outcome of 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 of 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 other activity similar to the one proposed in the Project 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 modernization and measures to improve the railway system by means of the use of energy saving technologies are to be carried out by the company, and SE «Prydniprovska zaliznytsya» has no incentive to introduce new equipment and new technologies.

Outcome of sub-step 4a: Since there is no similar project in Ukraine, there is no need to conduct analysis of similar project activity.

According to the «Tool for the demonstration and assessment of additionality»[44] (Version 06.0.0) all steps are satisfied, but some obstacles still exist.

One of these obstacles is additional costs on modernization of facilities.

Obstacle associated with the structure of existing tariffs for cargo and passenger rail transportation which does not include an investment component to improve the railway system, by creating suitable conditions for the reduction of greenhouse gases emissions into 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.

[44] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

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 «Prydniprovska zaliznytsya» has no obstacles to the further operation of railways and the unified 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, heat supply system, railway stations, stations, buildings and structures, transmission substation.

Project's borders include:
- Boiler-houses – 33 pcs.;
- Existing buildings and facilities – 1445 pcs;
- Substations – 49 pcs.

List all objects is bringing in the "Register of title documents SE «Prydniprovska zaliznytsya» as of 01.09.2011r. JI project «Implementation of electric energy efficiency measures at SE «Prydniprovska zaliznytsya»

And also:
- multiple unit - 89 pcs;
- traction rolling stock - 894 pcs;

The list of rolling stock is given in Annex according to the letter dated 05/12/2011 #TsZE - 11/2274 from the Ministry of Infrastructure of Ukraine State Administration of Railway Transport of Ukraine Ukrzaliznytsya.

Table 16 demonstrates an overview of sources of greenhouse gases emissions in the baseline scenario for the JI project.

Table 16. 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 process of providing services on rail transportation of cargo and passengers the unified complex system is used; it includes: locomotive facilities consuming electricity and diesel fuel, and consequently causing emissions into the atmosphere, heating system consuming fossil fuel for heat generation and as a consequence it causes GHG emissions into the atmosphere, transformer substation that consume electricity from the Unified Power Grid

			of Ukraine and consequently cause GHG emissions into the atmosphere.

Baseline scenario boundary is showed in Figure 21 (outlined with blue line).

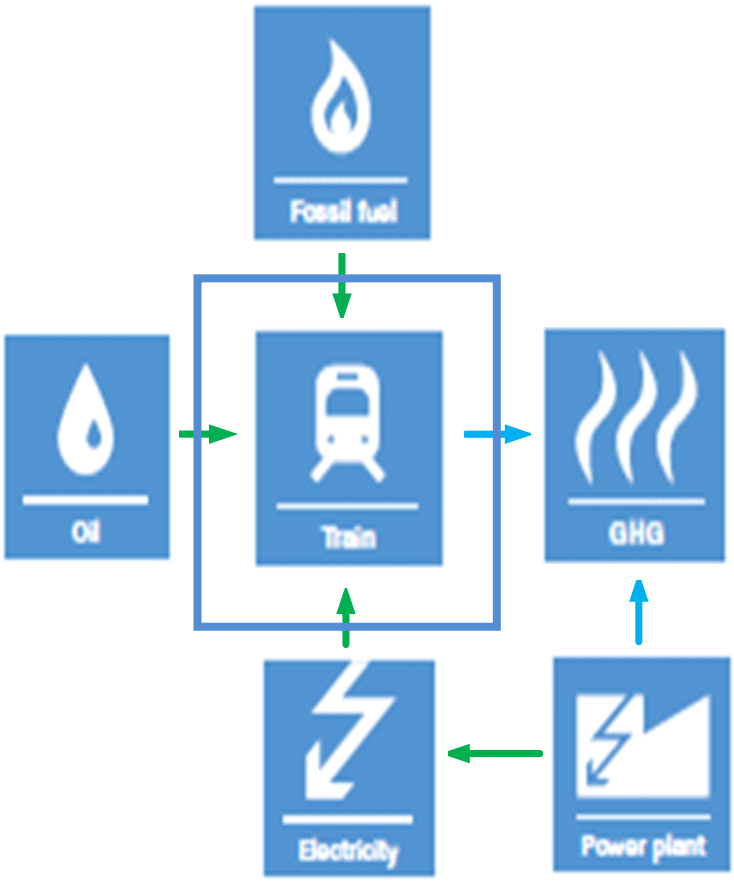

Figure 21. Baseline scenario boundary.

Table 17 demonstrates an overview of sources of greenhouse gases emissions in the project scenario.

Table 17. Overview of emission sources in the 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 process of providing services on rail transportation of cargo and passengers the unified complex system is used; it includes: locomotive facilities consuming electricity and diesel fuel, and consequently causing emissions into the atmosphere, heating system consuming fossil fuel for heat generation and as a consequence it causes GHG emissions into the atmosphere, transformer substation that consume

			electricity from the Unified Power Grid of Ukraine and consequently cause GHG emissions into the atmosphere.

Project scenario boundary is showed in Figure 22 (outlined with blue line).

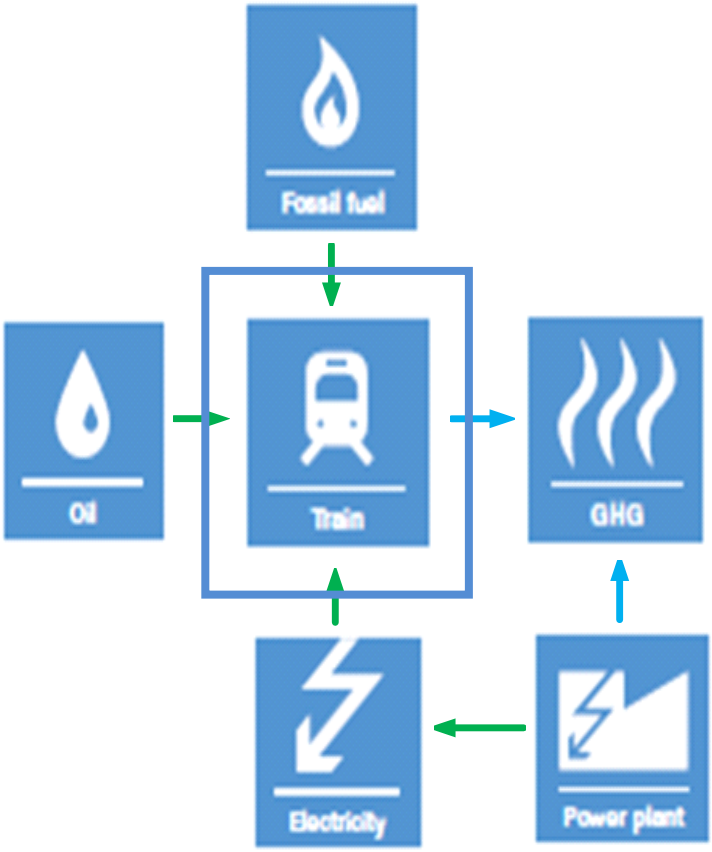

Figure 22. Project scenario boundary.

In the process of rendering cargo and passenger rail transportation services SE «Prydniprovska zaliznytsya» uses traction power systems and power distribution systems wherein SF_6 circuit breakers and current transformers are used.
They are characterized by high reliability, durability, simplicity of construction and installation as well as safety. A distinguishing feature of hexafluoride circuit breakers and current transformers is the fact that sulfur hexafluoride (electrical and technical gas) fulfils the function of arc control and heat insulating medium. Sulfur hexafluoride (SF_6) is a greenhouse gas whose density under normal conditions is five times higher than density of air.
Since this equipment provides for a system of leak-proofness control and equipment manufacturers guarantee its smooth operation for 25 years, we can conclude that leakage of SF_6 is absent and excluded from the project boundary.
Indirect extraneous leakage (CO_2, CH_4, N_2O), which takes place in the process of rendering cargo and passenger rail transportation services, from each type of equipment proposed in the project is excluded. This leakage is not controlled by the project developer (it is impossible to estimate quantity of leakage); due to this fact it was 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 setting: 15/12/2011
Baseline is set by VEMA S.A., project's developer, and SE «Prydniprovska zaliznytsya».

State enterprise «Prydniprovska zaliznytsya»
Momot Oleksandr Ivanovych
Head of Railway
Telephone: +380-562-330024
Fax: +380-562-33-09-04
e-mail: www.dp.uz.gov.ua/ukr
State enterprise «Prydniprovska zaliznytsya» is the project participant (stated in Annex 1).

VEMA S.A.:
Geneva, Switzerland.
Fabian Knodel,
Director.
Telephone: +41 (76) 346 11 57
Fax: +41 (76) 346 11 57
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 the project is 18/08/2003, which is the date of the meetings of the management board of SE «Prydniprovska zaliznytsya» during which a decision on JI project creation was made.

C.2. Expected operational lifetime of the project:

From 01/01/2004 to /12/2020 (17 years, or 204 months), subject to due maintenance.

C.3. Length of the crediting period:

From 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)
The starting date of the crediting period is the date when the first assigned amount units are expected to be generated, namely January 1, 2004. Generation of ERUs relates to the first commitment period of 5 years (January 1, 2008 - December 31, 2012). Prolongation of the crediting period after 2012 is subject to approval by the host Party and calculations of emission reductions are presented separately for the period before 2012 and for the period after 2012.
If after the first commitment period under the Kyoto Protocol, its effect is projonged, the crediting period for the project will also by prolonged by 8 years/96 months to December 31, 2020

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

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

Monitoring plan is developed for accurate and clear measurement and calculation of greenhouse gas emissions and carried out according to the practice established at SE «Prydniprovska zaliznytsya» to measure the consumed electric power, natural gas, diesel fuel, hard coal and fuel oil. 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 implemented to meet the requirements of the chosen methodology of monitoring and ensure the possibility to check calculations on GHG emission reductions. The main stages of the monitoring plan are described below.

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

N_b^j	Total volume of rail transportation in historical period «j», in the baseline scenario, mln t km
EC_b^j	Electric power consumption in historical period «j», in the baseline scenario, MWh
$EF_{b,CO2,ELEC}^j$	Carbon dioxide emission factor for electricity consumption by electricity consumers in historical period «j», in the baseline scenario, tCO_2/MWh
$FC_{b,NG}^j$	Total volume of natural gas consumed in historical period «j», in the baseline scenario, ths m^3
$NCV_{b,NG}^j$	Net Calorific Value of natural gas in historical period "j, in the baseline scenario, TJ/mln.m^3
$EF_{b,C,NG}^j$	Carbon emission factor for the process of natural gas combustion in historical period "j", in the baseline scenario, t C/TJ
$OXID_{b,NG}^j$	Carbon oxidation factor for the process of natural gas combustion in historical period "j", in the baseline scenario, Relative units.
$FC_{b,diesel}^j$	Total amount of diesel fuel consumed in historical period "j", in the baseline scenario, t
$NCV_{b,diesel}^j$	Net Calorific Value of diesel fuel in historical period "j, in the baseline scenario, TJ/ ths t

$EF^{j}_{b,C,diesel}$	Carbon emission factor for the process of diesel fuel combustion in historical period "j", in the baseline scenario, t C/TJ
$OXID^{j}_{b,diesel}$	Carbon oxidation factor for the process of diesel fuel combustion in historical period "j", in the baseline scenario, Relative units.
$FC^{j}_{b,coal}$	Total amount of hard coal consumed in historical period "j", in the baseline scenario, t
$NCV^{j}_{b,coal}$	Net Calorific Value of hard coal in historical period "j, in the baseline scenario, TJ/ ths t
$EF^{j}_{b,C,coal}$	Carbon emission factor for the process of hard coal combustion in historical period "j", in the baseline scenario, t C/TJ
$OXID^{j}_{b,coal}$	Carbon oxidation factor for the process of hard coal combustion in historical period "j", in the baseline scenario, Relative units
$FC^{j}_{b,FO}$	Total amount of fuel oil consumed in historical period "j", in the baseline scenario, t
$NCV^{j}_{b,FO}$	Net Calorific Value of fuel oil in historical period "j, in the baseline scenario, TJ/ ths t
$EF^{j}_{b,C,FO}$	Carbon emission factor for the process of fuel oil combustion in historical period "j", in the baseline scenario, t C/TJ
$OXID^{j}_{b,FO}$	Carbon oxidation factor for the process of fuel oil combustion in historical period "j", in the baseline scenario, Relative units

j – - relates to historical period;

b – - relates to baseline scenario;

ELEC - relates to electric power;

NG - relates to natural gas;

diesel - relates to diesel fuel;

coal – - relates to hard coal;

FO - relates to fuel oil.

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 monitored throughout the crediting period:

N_p^y	Total volume of rail transportation in monitoring period «y», in the project scenario, mln t km
EC_p^y	Electric power consumption in monitoring period «y», in the project scenario, MWh
$EF_{p,CO2,ELEC}^y$	Carbon dioxide emission factor for electricity consumption by electricity consumers in monitoring period «y», in the project scenario, tCO_2/MWh
$FC_{p,NG}^y$	Total volume of natural gas consumed in monitoring period «y» in the project scenario, ths m^3
$NCV_{p,NG}^y$	Net Calorific Value of natural gas in monitoring period «y», in the project scenario, TJ/ths.m^3
$EF_{p,C,NG}^y$	Carbon emission factor for the process of natural gas combustion in monitoring period «y», in the project scenario, t C/TJ
$OXID_{p,NG}^y$	Carbon oxidation factor for the process of natural gas combustion in monitoring period «y», in the project scenario, Relative units
$FC_{p,diesel}^y$	Total amount of diesel fuel consumed in monitoring period «y», in the project scenario, t
$NCV_{p,diesel}^y$	Net Calorific Value of diesel fuel in monitoring period «y», in the project scenario, TJ/ ths t
$EF_{p,C,diesel}^y$	Carbon emission factor for the process of diesel fuel combustion in monitoring period «y», in the project scenario, t C/TJ
$OXID_{p,diesel}^y$	Carbon oxidation factor for the process of diesel fuel combustion in monitoring period «y», in the project scenario, Relative units
$FC_{p,coal}^y$	Total amount of hard coal consumed in monitoring period «y», in the project scenario, t
$NCV_{p,coal}^y$	Net Calorific Value of hard coal in monitoring period «y», in the project scenario, TJ/ ths t
$EF_{p,C,coal}^y$	Carbon emission factor for the process of hard coal combustion in monitoring period «y», in the project scenario, t C/TJ
$OXID_{p,coal}^y$	Carbon oxidation factor for the process of hard coal combustion in monitoring period «y», in the project scenario, Relative units

$FC^{y}_{p,FO}$	Total amount of fuel oil consumed in monitoring period «y», in the project scenario, t
$NCV^{y}_{p,FO}$	Net Calorific Value of fuel oil in monitoring period «y», in the project scenario, TJ/ ths t
$EF^{y}_{p,C,FO}$	Carbon emission factor for the process of fuel oil combustion in monitoring period «y», in the project scenario, t C/TJ
$OXID^{y}_{p,FO}$	Carbon oxidation factor for the process of fuel oil combustion in monitoring period «y», in the project scenario, Relative units

y – - relates to monitoring period;

p – - relates to project scenario;

$ELEC$ - relates to electric power;

NG - relates to natural gas;

diesel – - relates to diesel fuel;

coal – - relates to hard coal;

FO - relates to fuel oil

Table of parameters that will be included into monitoring and verification process for ERU calculation is provided 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	EC^{y}_{p}
Data unit	MWh
Description	Electric power consumption in monitoring period «y», in the project scenario
Time of determination/monitoring	Every 30 minutes

Source of data (to be) used	Readings of electricity meters, which shall be included in monthly report "Departmental reporting form 1B-TVE DAEK «Structure of balance of electric power and technological power consumption (TPC) for power transmission in electrical grids»
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 system for commercial metering of electricity consumption (ASCMEC)
QA/QC procedures (to be) applied	Measurements will be made by meters, which will be regularly calibrated and verified in accordance with the procedures of quality control, Law of Ukraine "On metrology and metrological activity"[45]. The final results are recorded in the official reports that are submitted to the state regulating authorities, where they are additionally checked.
Any comment	Information on the amount of consumed power is the basis for calculation of GHG emissions; it will be archived in paper and electronic form

Data/Parameter	$EF^{y}_{p,CO2,ELEC}$
Data unit	tCO_2/MWh
Description	Carbon dioxide emission factor for electricity consumption by electricity consumers in monitoring period «y», in the 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

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

<table>
<tr><td></td><td>Joint Implementation Projects, Volume 1: General guidelines (ERUPT)[46]) 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[47];
- Carbon emission factors for 2008 were taken from the Decree of the National Environmental Investment Agency of Ukraine (hereinafter referred to as NEIAU) №62 dated 15/04/2011 "On approval of specific carbon dioxide emission factors in 2008"[48];
- Carbon emission factors for 2009 were taken from the Decree of the National Environmental Investment Agency of Ukraine №63 dated 15/04/2011 " On approval of specific carbon dioxide emission factors in 2009 ";[49]
- Carbon emission factors for 2010 were taken from the Decree of the National Environmental Investment Agency of Ukraine №43 dated 28/03/2011 " On approval of specific carbon dioxide emission factors in 2010";[50]
- Carbon emission factors for 2011 were taken from the Decree of the National Environmental Investment Agency of Ukraine №75 dated 12/05/2011 "On approval of specific carbon dioxide emission factors in 2011";[51]</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td>
<table>
<tr><th>2004</th><th>2005</th><th>2006-2007</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th></tr>
<tr><td>0.916</td><td>0.896</td><td>0.896</td><td>1.082</td><td>1.096</td><td>1.093</td><td>1.090</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>Only officially approved factors are used for calculations.</td></tr>
</table>

[46] http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html
[47] http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514
[48] http://www.neia.gov.ua/nature/doccatalog/document?id=127171
[49] http://www.neia.gov.ua/nature/doccatalog/document?id=127172
[50] http://www.neia.gov.ua/nature/doccatalog/document?id=126006
[51] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

QA/QC procedures (to be) applied	State carbon dioxide emission factors are applied in the process of JI project elaboration, and in case of their absence the factors for 2004-2005 from ERUPT shall be applied; for 2006-2007 – factors from the document «Carbon dioxide emission factor», approved by TUV SUD are used
Any comment	Data allowing for calculation of GHG emissions

Data/Parameter	$FC_{p,NG}^{y}$
Data unit	ths m^3
Description	Total volume of natural gas consumed in monitoring period «y», in the 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 is operational and informational complex, which operated along the perimeter of the enterprise.
QA/QC procedures (to be) applied	Measurements will be made by meters, which will be regularly calibrated and verified in accordance with the procedures of quality control, Law of Ukraine "On metrology and metrological activity"[52]. The final results are recorded in the official reports that are submitted to the state regulating authorities, where they are additionally checked.
Any comment	Information on the volume of consumed gas is the basis for calculation of GHG emissions; it will be archived in paper and electronic form

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

Data/Parameter	$NCV^{y}_{p,NG}$
Data unit	TJ/ ths m^3
Description	Net Calorific Value of natural gas in monitoring period «y», in the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[53]
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 Inventory of anthropogenic GHG emissions by sources and removals by 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 net calorific value of gas is applied. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[54]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

[53] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[54] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Data/Parameter	$EF_{p,C,NG}^{y}$
Data unit	t C/TJ
Description	Carbon emission factor for the process of natural gas combustion in monitoring period «y», in the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[55]
Value of data applied (for ex ante calculations/determinations)	2004: 15.3 **2005**: 15.3 **2006**: 15.3 **2007**: 15.3 **2008**: 15.12 **2009**: 15.11 **2010**: 15.11 **2011**: 15.11
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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[56]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

[55] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[56] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Data/Parameter	$OXID_{p,NG}^{y}$
Data unit	Relative units
Description	Carbon oxidation factor for the process of natural gas combustion in monitoring period «y», in the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[57]
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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[58]; if new inventories enter into force, new values will be taken

[57] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[58] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

	and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

Data/Parameter	$FC^{y}_{p,diesel}$
Data unit	t
Description	Total amount of diesel fuel consumed in monitoring period «y», in the project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	The main method for determination is the system of control and accounting of diesel fuel consumption of «BIS-R» type, operating along the enterprise's perimeter.
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 control and accounting of diesel fuel consumption of «BIS-R» type is regularly certified and verified according to the procedures of quality control, Law of Ukraine "On metrology and metrological activity". The final results are recorded in the official reports and submitted to the state regulating authorities, where they are additionally checked.
Any comment	Information on amount of consumed diesel fuel is the basis for calculation of GHG emissions; it will be archived in paper and electronic form

Data/Parameter	$NCV^{y}_{p,diesel}$
Data unit	TJ/ ths t
Description	Net Calorific Value of diesel fuel in monitoring period "y", in the project scenario

Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[59]
Value of data applied (for ex ante calculations/determinations)	**2004** 42.5 **2005** 42.5 **2006** 42.5 **2007** 42.5 **2008** 42.5 **2009** 42.3 **2010** 42.3 **2011** 42.3
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 Inventory of anthropogenic GHG emissions by sources and removals by 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 net calorific value of diesel fuel is applied. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[60]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

Data/Parameter	$EF^{y}_{p,C,diesel}$
Data unit	t C/TJ

[59] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[60] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Description	Carbon emission factor for the process of diesel fuel combustion in monitoring period "y", in the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[61]
Value of data applied (for ex ante calculations/determinations)	**2004**: 20.2 **2005**: 20.2 **2006**: 20.2 **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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[62]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

[61] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[62] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Data/Parameter	$OXID_{p,diesel}^{y}$
Data unit	Relative units
Description	Carbon oxidation factor for the process of diesel fuel combustion in monitoring period "y", in the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[63]
Value of data applied (for ex ante calculations/determinations)	**2004** 0.99 **2005** 0.99 **2006** 0.99 **2007** 0.99 **2008** 0.99 **2009** 0.99 **2010** 0.99 **2011** 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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[64]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period

[63] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[64] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

	in accordance with the monitoring plan.

Data/Parameter	$FC^{y}_{p,coal}$
Data unit	t
Description	Total amount of hard coal consumed in monitoring period «y», in the project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Form N 11-MTP «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 hard 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 hard coal is the basis for calculation of GHG emissions; it will be archived in paper and electronic form

Data/Parameter	$NCV^{y}_{p,coal}$
Data unit	TJ/ ths t
Description	Net Calorific Value of hard coal in monitoring period «y», in the project scenario
Time of determination/monitoring	Annually

Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[65]
Value of data applied (for ex ante calculations/determinations)	**2004** 20.9 **2005** 21.16 **2006** 21.34 **2007** 21.95 **2008** 21.5 **2009** 21.8 **2010** 21.8 **2011** 21.8
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 Inventory of anthropogenic GHG emissions by sources and removals by 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 net calorific of hard coal is applied. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[66]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

Data/Parameter	$EF^{y}_{p,C,coal}$
Data unit	t C/TJ
Description	Carbon emission factor for the process of hard coal combustion in monitoring period «y», in the project scenario

[65] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[66] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[67]
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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[68]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

Data/Parameter	$OXID^{y}_{p,C,coal}$
Data unit	Relative units

[67] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[68] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Description	Carbon oxidation factor for the process of hard coal combustion in monitoring period "y", in the project scenario
Time of determination/monitoring	Annually
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[69]
Value of data applied (for ex ante calculations/determinations)	**2004**: 0.98 **2005**: 0.98 **2006**: 0.98 **2007**: 0.98 **2008**: 0.963 **2009**: 0.963 **2010**: 0.963 **2011**: 0.963
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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[70]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.

Data/Parameter	$FC_{p,FO}^{y}$

[69] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[70] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Data unit	t
Description	Total amount of fuel oil consumed in monitoring period "y", in the project scenario
Time of determination/monitoring	Monthly
Source of data (to be) used	Form N 11-MTP «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 fuel oil 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 fuel oil is the basis for calculation of GHG emissions; it will be archived in paper and electronic form

Data/Parameter	$NCV^{y}_{p,FO}$		
Data unit	TJ/ ths t		
Description	Net Calorific Value of fuel oil in monitoring period "y", in the project scenario		
Time of determination/monitoring	Annually		
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[71]		
Value of data applied (for ex ante calculations/determinations)		**2004**	39.98
		2005	39.92
		2006	39.98
		2007	40.5

[71] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

		2008	39.8	
		2009	39.9	
		2010	39.9	
		2011	39.9	
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 Inventory of anthropogenic GHG emissions by sources and removals by 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 net calorific value of fuel oil is applied. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[72]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.			

Data/Parameter	$EF^{y}_{p,C,FO}$			
Data unit	t C/TJ			
Description	Carbon emission factor for the process of fuel oil combustion in monitoring period "y", in the project scenario			
Time of determination/monitoring	Annually			
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[73]			
Value of data applied (for ex ante calculations/determinations)		**2004**	21.1	
		2005	21.1	

[72] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[73] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

		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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)			
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[74]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.			

Data/Parameter	$OXID_{p,FO}^{y}$			
Data unit	Relative units			
Description	Carbon oxidation factor for the process of fuel oil combustion in monitoring period "y", in the project scenario			
Time of determination/monitoring	Annually			
Source of data (to be) used	National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[75]			
Value of data applied		**2004**	0.99	

[74] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip
[75] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

(for ex ante calculations/determinations)		**2005**	0.99	
		2006	0.99	
		2007	0.99	
		2008	0.99	
		2009	0.99	
		2010	0.99	
		2011	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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)			
Any comment	Data allowing for calculation of GHG emissions. Information will be archived in paper and electronic form. Values for 2010 and 2011 are taken from the National Inventory of anthropogentic GHG emissions by sources and removals by sinks in Ukraine for 1990-2009.[76]; if new inventories enter into force, new values will be taken and amounts of ERUs will be recalculated for any reporting period in accordance with the monitoring plan.			

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 in accordance with a specific approach to JI projects):

$$PE_p^y = PE_{p,ELEC}^y + PE_{p,NG}^y + PE_{p,diesel}^y + PE_{p,coal}^y + PE_{p,FO}^y, \text{ where} \quad (1)$$

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

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

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

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

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

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

y - index corresponding to monitoring period;

p - index corresponding to project scenario;

$ELEC$ - relates to electric energy;

NG - relates to natural gas;

$diesel$ - relates to diesel fuel;

$coal$ - relates to hard coal;

FO - relates to fuel oil.

$$PE^{y}_{p,ELEC} = EC^{y}_{p} * EF^{y}_{p,CO2,ELEC} \quad (2)$$

EC^{y}_{p} - consumption of electric energy in monitoring period «y», in the project scenario, (MWh);

$EF^{y}_{p,CO2,ELEC}$ - Carbon diozide emission factor for electricity consumption by electricity consumers in monitoring period «y», in the project scenario, (tCO_2/MWh);

y - index corresponding to monitoring period;

p - index corresponding to project scenario;

$ELEC$ - relates to electric energy;

$$PE^{y}_{p,NG} = FC^{y}_{p,NG} * NCV^{y}_{p,NG} * EF^{y}_{p,CO2,NG} \quad (3)$$

$FC^{y}_{p,NG}$ - Total volume of natural gas consumed in monitoring period «y», in the project scenario, (ths m^3);

$NCV^{y}_{p,NG}$ - Net Calorific Value of natural gas in monitoring period «y», in the project scenario, (TJ/thous.m^3);

$EF^{y}_{p,CO2,NG}$ - Carbon emission factor on default for stationary combustion of natural gas in monitoring period «y», in the project scenario, (t CO_2 /TJ).

$$EF^{y}_{p,CO2,NG} = EF^{y}_{p,C,NG} * OXID^{y}_{p,NG} * 44/12 \quad (4)$$

$EF^{y}_{p,C,NG}$ - Carbon emission factor for the process of natural gas combustion in monitoring period «y», in the project scenario, (t C/TJ);

$OXID^{y}_{p,NG}$ - Carbon oxidation factor for the process of natural gas combustion in monitoring period «y», in the project scenario, (relative units);

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

y - - index corresponding to monitoring period;

p - - index corresponding to project scenario.

NG - relates to natural gas;

$$PE^{y}_{p,diesel} = FC^{y}_{p,diesel} * NCV^{y}_{p,diesel} * EF^{y}_{p,CO2,diesel} \quad (5)$$

$FC^{y}_{p,diesel}$ - Total amount of diesel fuel consumed in monitoring period «y», in the project scenario, (t);

$NCV^{y}_{p,diesel}$ - Net Calorific Value of diesel fuel in monitoring period «y", in the project scenario, (TJ/ths t);

$EF^{y}_{p,CO2,diesel}$ - Carbon dioxide emission factor on default for stationary combustion of diesel fuel in monitoring period «y», in the project scenario, (t CO_2 /TJ).

$$EF^{y}_{p,CO2,diesel} = EF^{y}_{p,C,diesel} * OXID^{y}_{p,diesel} * 44/12 \quad (6)$$

$EF^{y}_{p,C,diesel}$ - Carbon emission factor for the process of diesel fuel combustion in monitoring period «y", in the project scenario, (t C/TJ);

$OXID^{y}_{p,diesel}$ - Carbon oxidation factor for the process of diesel fuel combustion in monitoring period «y", in the project scenario, (relative units);

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

y - - index corresponding to monitoring period;

p - - index corresponding to project scenario.

diesel – - relates to diesel fuel;

$$PE^{y}_{p,coal} = FC^{y}_{p,coal} * NCV^{y}_{p,coal} * EF^{y}_{p,CO2,coal} \quad (7)$$

$FC^{y}_{p,coal}$ - Total amount of hard coal consumed in monitoring period «y», in the project scenario, (t);

$NCV^{y}_{p,coal}$ - Net Calorific Value of hard coal in monitoring period «y», in the project scenario, (TJ/ths t);

$EF^{y}_{p,CO2,coal}$ - Carbon emission factor on default for stationary combustion of hard coal in monitoring period «y», in the project scenario, (t CO_2 /TJ).

$$EF^{y}_{p,CO2,coal} = EF^{y}_{p,C,coal} * OXID^{y}_{p,coal} * 44/12 \quad (8)$$

$EF^{y}_{p,C,coal}$ - Carbon emission factor for the process of hard coal combustion in monitoring period «y», in the project scenario, (t C/TJ);

$OXID^{y}_{p,coal}$ - Carbon oxidation factor for the process of hard coal combustion in monitoring period «y", in the project scenario, (relative units);

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

y - - index corresponding to monitoring period;

p - - index corresponding to project scenario.

coal – - relates to hard coal;

$$PE^{y}_{p,FO} = FC^{y}_{p,FO} * NCV^{y}_{p,FO} * EF^{y}_{p,CO2,FO} \quad (9)$$

$FC^{y}_{p,FO}$ - Total amount of fuel oil consumed in monitoring period "y", in the project scenario, (t);

$NCV^{y}_{p,FO}$ - Net Calorific Value of fuel oil in monitoring period "y", in the project scenario, (TJ/ths t);

$EF^{y}_{p,CO2,FO}$ - Carbon emission factor on default for stationary combustion of fuel oil in monitoring period «y», in the project scenario, (tCO_2 /TJ).

$$EF^{y}_{p,CO2,FO} = EF^{y}_{p,C,FO} * OXID^{y}_{p,FO} * 44/12 \quad (10)$$

$EF^{y}_{p,C,FO}$ - Carbon emission factor for the process of fuel oil combustion in monitoring period "y", in the project scenario, (t C/TJ);

$OXID^{y}_{p,FO}$ - Carbon oxidation factor for the process of fuel oil combustion in monitoring period "y", in the project scenario, (relative units);

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

y - - index corresponding to monitoring period;

p - - index corresponding to project scenario.

FO - relates to fuel oil.

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

Data/Parameter	N_p^y
Data unit	mln. tkm
Description	Total volume of rail transportation in monitoring period «y», in the 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 volumes of transportation is the official enterprise's data used to calculate the tariff for the provision of railway transportation services, which is further agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine
Any comment	Information on volumes of rail transportation is the basis for calculation of GHG emissions; it 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):

$$BE_b^j = N_p^y * BPER \quad (11)$$

N_p^y - Total volume of rail transportation in monitoring period "y", in the project scenario, (mln. t km);

$BPER$ - before-project efficiency ratio of rail transportation, (tCO_2-equiv / mln. t km);

$$BPER = \frac{\sum_{n=1}^{3} BE_b^j}{\sum_{n=1}^{3} N_b^j} \quad (12)$$

BE_b^j - total GHG emissions in the process of rendering services on rail transportation in historical period «j», in the baseline scenario, (tCO_2-equiv);

N_b^j - total reduced volume of rail transportation in historical period «j», in the baseline scenario, (mln t km gross);

y - index corresponding to monitoring period;

p - index corresponding to project scenario;

j - index corresponding to historical period;

b - index corresponding to baseline scenario;

$BE_b^j = BE_{b,ELEC}^j + BE_{b,NG}^j + BE_{b,diesel}^j + BE_{b,coal}^j + BE_{b,FO}^j$, where (13)

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

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

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

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

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

j - index corresponding to historical period;

b - index corresponding to baseline scenario;

$ELEC$ - relates to electric energy;

NG - relates to natural gas;

$diesel$ - relates to diesel fuel;

$coal$ - relates to hard coal;

FO - relates to fuel oil.

$$BE^{j}_{b,ELEC} = EC^{j}_{b} * EF^{j}_{b,CO2,ELEC}, \quad (14)$$

EC^{j}_{b} - consumption of electric energy in historical period "j", in the baseline scenario, (MWh);

$EF^{j}_{b,CO2,ELEC}$ - Carbon dioxide emission factor for electricity consumption by electricity consumers in historical period "j", in the baseline scenario, (tCO_2/MWh);

j - index corresponding to historical period;

b - index corresponding to baseline scenario;

$ELEC$ - relates to electric energy;

$$BE^{j}_{b,NG} = FC^{j}_{b,NG} * NCV^{j}_{b,NG} * EF^{j}_{b,CO2,NG} \quad (15)$$

$FC^{j}_{b,NG}$ - Total volume of natural gas consumed in historical period "j", in the baseline scenario, (ths m^3);

$NCV^{j}_{b,NG}$ - Net Calorific Value of natural gas in historical period "j", in the baseline scenario, (TJ/ths.m^3);

$EF^{j}_{b,CO2,NG}$ - Carbon emission factor on default for stationary combustion of natural gas in historical period "j", in the baseline scenario, (t CO_2 /TJ).

$$EF^{j}_{b,CO2,NG} = EF^{j}_{b,C,NG} * OXID^{j}_{b,NG} * 44/12 \quad (16)$$

$EF^{j}_{b,C,NG}$ - Carbon emission factor for the process of natural gas combustion in historical period "j", in the baseline scenario, (t C/TJ);

$OXID^{j}_{b,NG}$ - Carbon oxidation factor for the process of natural gas combustion in historical period "j", in the baseline scenario, (relative units);

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

j - index corresponding to historical period;

b - index corresponding to baseline scenario;

NG - relates to natural gas;

$$BE^{j}_{b,diesel} = FC^{j}_{b,diesel} * NCV^{j}_{b,diesel} * EF^{j}_{b,CO2,diesel} \quad (17)$$

$FC^{j}_{b,diesel}$ - Total amount of diesel fuel consumed in historical period "j", in the baseline scenario, (t);

$NCV^{j}_{b,diesel}$ - Net Calorific Value of diesel fuel in historical period "j", in the baseline scenario, (TJ/ths t);

$EF^{j}_{b,CO2,diesel}$ - Carbon dioxide emission factor on default for stationary combustion of diesel fuel in historical period "j", in the baseline scenario, (t CO_2 /TJ).

$$EF^{j}_{b,CO2,diesel} = EF^{j}_{b,C,diesel} * OXID^{j}_{b,diesel} * 44/12 \quad (18)$$

$EF^{j}_{b,C,diesel}$ - Carbon emission factor for the process of diesel fuel combustion in historical period "j", in the baseline scenario, (t C/TJ);

$OXID^{j}_{b,diesel}$ - Carbon oxidation factor for the process of diesel fuel combustion in historical period "j", in the baseline scenario, (relative units);

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

j – - index corresponding to historical period;

b - - index corresponding to baseline scenario;

diesel – - relates to diesel fuel;

$$BE^{j}_{b,coal} = FC^{j}_{b,coal} * NCV^{j}_{b,coal} * EF^{j}_{b,CO2,coal} \quad (19)$$

$FC^{j}_{b,coal}$ - Total amount of hard coal consumed in historical period "j", in the baseline scenario, (t);

$NCV^{j}_{b,coal}$ - Net Calorific Value of hard coal in historical period "j", in the baseline scenario, (TJ/ths t);

$EF^{j}_{b,CO2,coal}$ - Carbon dioxide emission factor on default for stationary combustion of hard coal in historical period "j", in the baseline scenario, (t CO_2 /TJ).

$$EF^{j}_{b,CO2,coal} = EF^{j}_{b,C,coal} * OXID^{j}_{b,coal} * 44/12 \quad (20)$$

$EF^{j}_{b,C,coal}$ - Carbon emission factor for the process of hard coal combustion in historical period "j", in the baseline scenario, (t C/TJ);

$OXID^{j}_{b,coal}$ - Carbon oxidation factor for the process of hard coal combustion in historical period "j", in the baseline scenario, (relative units);

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

j – - index corresponding to historical period;

b - - index corresponding to baseline scenario;

coal – - relates to hard coal;

$$BE^{j}_{b,FO} = FC^{j}_{b,FO} * NCV^{j}_{b,FO} * EF^{j}_{b,CO2,FO} \quad (21)$$

$FC^{j}_{b,FO}$ - Total amount of fuel oil consumed in historical period "j", in the baseline scenario, (t);

$NCV^{j}_{b,FO}$ - Net Calorific Value of fuel oil in historical period "j", in the baseline scenario, (TJ/ths t);

$EF^{j}_{b,CO2,FO}$ - Carbon dioxide emission factor on default for stationary combustion of fuel oil in historical period "j", in the baseline scenario, (tCO_2 /TJ).

$$EF^{j}_{b,CO2,FO} = EF^{j}_{b,C,FO} * OXID^{j}_{b,FO} * 44/12 \quad (22)$$

$EF^{j}_{b,C,FO}$ - Carbon emission factor for the process of fuel oil combustion in historical period "j", in the baseline scenario, (t C/TJ);

$OXID^{j}_{b,FO}$ - Carbon oxidation factor for the process of fuel oil combustion in historical period "j", in the baseline scenario, (relative units);

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

j – index corresponding to historical period;

b - index corresponding to baseline scenario;

FO - relates to fuel oil.

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 reductions as a result of project activities shall be made by specific approach to JI projects):

$$ER^{y} = BE_{b}^{y} - PE_{p}^{y} \quad (23)$$

ER^{y} – emission reductions as a result of project activities in monitoring period "y", in the project scenario, (t CO_2-equiv);

BE_{b}^{y} - total GHG emissions caused by the process of rendering services on cargo and passenger rail transportation in monitoring period "y", in the baseline scenario, (t CO_2-equiv);

PE_{p}^{y} - total GHG emissions caused by the process of rendering services on cargo and passenger rail transportation in monitoring period "y", in the project scenario, (t CO_2-equiv);

y - - index corresponding to monitoring period;

p - - index corresponding to project scenario;

b - - index 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:

The environmental impact assessment is provided in accordance with effective legislation of Ukraine:

- Law of Ukraine № 1264-XII «On environmental protection" dated 25/06/1991
- Law of Ukraine № 2707-XII «On atmospheric air protection» dated 16/10/1992.
- Current rules on emission limitation: «Norms of maximum permissible emissions of pollutants from permanent sources» – approved by the Ministry of Environmental Protection of Ukraine dated 27/06/2006, №309 and registered in the Ministry of Justice of Ukraine dated 01/09/2006, №912/12786.

Information on the project's impact on the environment is collected within the framework of 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 volumes of transportation is the official enterprise's data used to calculate the tariff for the provision of railway transportation services, which is further agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine
EC_b^j	Low	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality control, Law of Ukraine "On metrology and metrological activity"[77]. The final results were recorded in the official reports that were submitted to the state regulating authorities, where they were additionally checked.
$EF_{b,CO2,ELEC}^j$	Low	State carbon dioxide emission factors are applied in the process of JI project elaboration, and in case of their absence the factors for 2001-2003 from ERUPT are applied.
$FC_{b,NG}^j$	Low	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality control, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports that were submitted to the state regulating authorities, where they were additionally checked.
$NCV_{b,NG}^j$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)

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

$EF^{j}_{b,C,NG}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$OXID^{j}_{b,NG}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$FC^{j}_{b,diesel}$	Low	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality control, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports that were submitted to the state regulating authorities, where they were additionally checked.
$NCV^{j}_{b,diesel}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$EF^{j}_{b,C,diesel}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$OXID^{j}_{b,diesel}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$FC^{j}_{b,coal}$	Low	Information on consumed hard 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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$EF^{j}_{b,C,coal}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$OXID^{j}_{b,coal}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$FC^{j}_{b,FO}$	Low	Information on consumed fuel oil is the official enterprise's data agreed by Ukrzaliznytsya and approved by the Ministry of Fuel and Energy of Ukraine
$NCV^{j}_{b,FO}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$EF^{j}_{b,C,FO}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$OXID^{j}_{b,FO}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
N^{y}_{p}	Low	Information on volumes of transportation is the official enterprise's data used to calculate the tariff for the provision of railway transportation services, which is further agreed by Ukrzaliznytsya and approved by the Ministry of Transport of Ukraine

EC_p^y	Low	Measurements will be made by meters, which will be regularly calibrated and verified in accordance with the procedures of quality control, Law of Ukraine "On metrology and metrological activity"[78]. The final results are recorded in the official reports that are submitted to the state regulating authorities, where they are additionally checked.
$EF_{p,CO2,ELEC}^y$	Low	State carbon dioxide emission factors are applied in the process of JI project elaboration, and in case of their absence the factors for 2004-2005 from ERUPT shall be applied; for 2006-2007 – factors from the document «Carbon dioxide emission factor», approved by TUV SUD are used
$FC_{p,NG}^y$	Low	Measurements will be made by meters, which will be regularly calibrated and verified in accordance with the procedures of quality control, Law of Ukraine "On metrology and metrological activity"[79]. The final results are recorded in the official reports that are submitted to the state regulating authorities, where they are additionally checked.
$NCV_{p,NG}^y$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$EF_{p,C,NG}^y$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
N_b^{j*}	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
EC_b^j	Low	System of control and accounting of diesel fuel consumption of «BIS-R» type is regularly certified and verified according to the procedures of quality control, Law of Ukraine "On metrology and metrological activity". The final results are recorded in the official reports and submitted to the state regulating authorities, where they are additionally checked.
$EF_{b,CO2,ELEC}^j$	Low	State carbon dioxide emission factors are applied in the process of JI project elaboration, and in case of their absence the factors for 2001-2003 from ERUPT are applied.
$FC_{b,NG}^j$	Low	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality control, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports that were submitted to the state regulating authorities, where they were additionally checked.
$NCV_{b,NG}^j$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$EF_{b,C,NG}^j$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)

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

$OXID^{j}_{b,NG}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$FC^{j}_{b,diesel}$	Low	Measurements were made by meters, which were regularly calibrated and verified in accordance with the procedures of quality control, Law of Ukraine "On metrology and metrological activity". The final results were recorded in the official reports that were submitted to the state regulating authorities, where they were additionally checked.
$NCV^{j}_{b,diesel}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$EF^{j}_{b,C,diesel}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$OXID^{j}_{b,diesel}$	Low	National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$FC^{j}_{b,coal}$	Low	Information on consumed hard 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 Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)

*For the purpose to define 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 emission reductions resulting from the JI project activity, shall be conducted according to the practice established at SE «Prydniprovska zaliznytsya», since the monitoring plan is developed for accurate and clear measurement and calculation of greenhouse gas emissions.

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

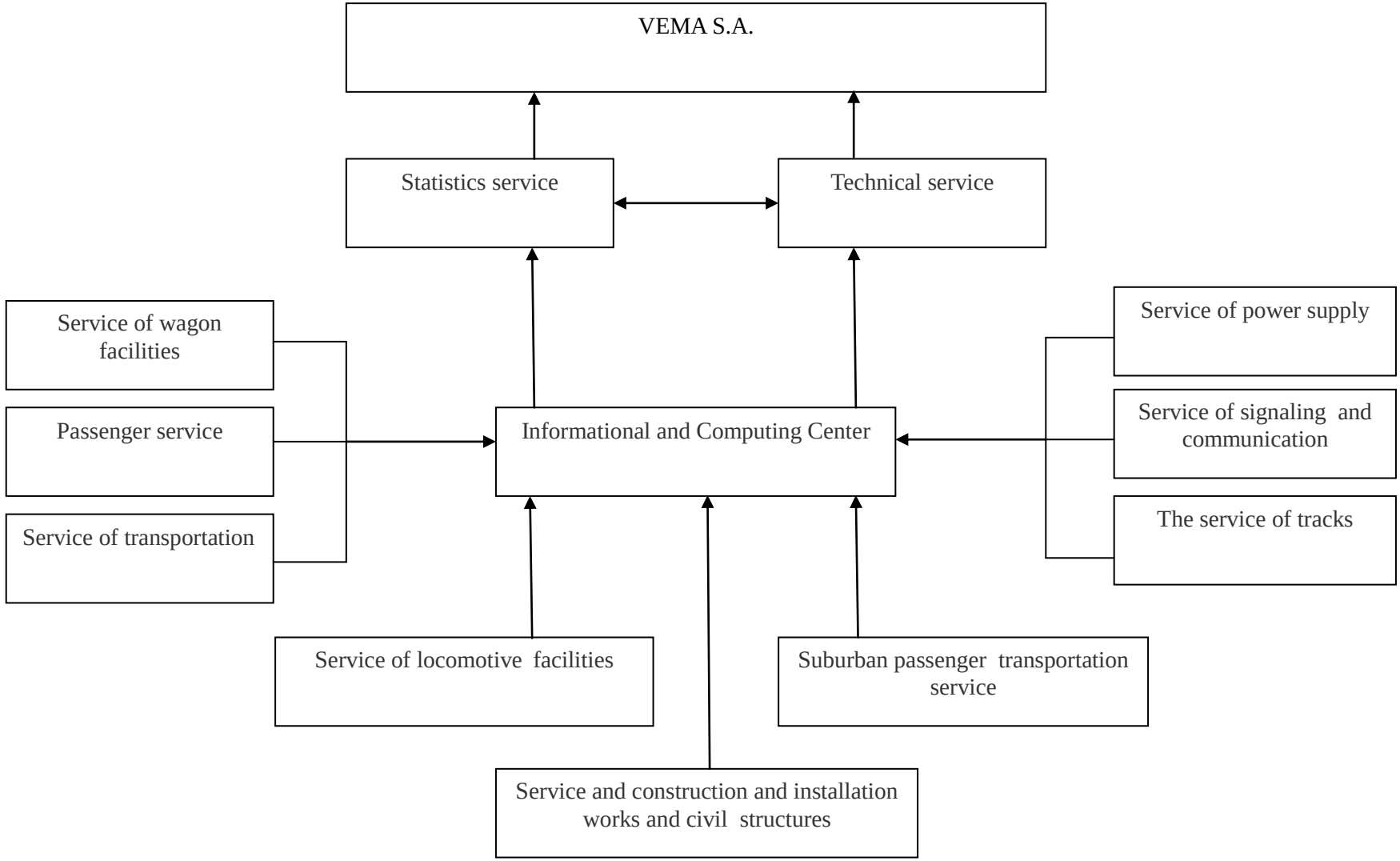

Figure23. Structure of collection and processing of data according to the monitoring plan

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

The Monitoring plan is determined by VEMA S.A., project developer, and SE «Prydniprovska zaliznytsya», project supplier.

State enterprise «Prydniprovska zaliznytsya»
Momot Oleksandr Ivanovych
Head of Railway
Telephone: +380-562-330024
Fax: +380-562-33-09-04
e-mail: www.dp.uz.gov.ua/ukr
State enterprise «Prydniprovska zaliznytsya» is the project participant (stated in Annex 1).

VEMA S.A.:
Geneva, Switzerland
Fabian Knodel,
Director.
Telephone: +41 (76) 346 11 57
Fax: +41 (76) 346 11 57
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 formulae provided in Section D.1.1.2.

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

For the period from 2004 to 2011 estimated project emissions of GHG are calculated based on actual data of the volumes of cargo and passengers rail transportation by SE «Prydniprovska zaliznytsya», and for the period from 2012 to 2020 predicted data according to the strategic development plan of railway transportation sector were used.

Table 18. Estimated project emissions for the period January 1, 2004– December 31, 2007

Year	Project emissions (tons of CO_2 equivalent)
2004	1 526 750
2005	1 452 906
2006	1 499 634
2007	1 500 565
Total project emissions over the crediting period from 2004 to 2007 (tons of CO_2 equivalent)	**5 979 855**

Table 19. Estimated project emissions for the period January 1, 2008 – December 31, 2012

Year	Project emissions (tons of CO_2 equivalent)
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 from 2008 to 2012 (tons of CO_2 equivalent)	**7 750 774**

Table 20. Estimated project emissions for the period January 1, 2013 - December 31, 2020

Year	Project emissions (tons of CO_2 equivalent)
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 from 2013 to 2020 (tons of CO_2 equivalent)	**12 214 944**

E.2. Estimated leakage:

Leakage is not expected.

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

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

Table 21. Table containing sum of emissions from leakage and project activities before the first commitment period,.

Year	Estimated project emissions (tons of CO_2 equivalent)	Estimated leakage (tons of CO_2 equivalent)	Total emissions and leakage (tons of CO_2 equivalent)
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 (tons of CO_2 equivalent)	**5 979 855**	0	**5 979 855**

Table 22. Table containing sum of emissions from leakage and project activities during the first commitment period.

Year	Estimated project emissions (tons of CO_2 equivalent)	Estimated leakage (tons of CO_2 equivalent)	Total emissions and leakage (tons of CO_2 equivalent)
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 (tons of CO_2 equivalent)	**7 750 774**	0	**7 750 774**

Table 23. Table containing sum of emissions from leakage and project activities after the first commitment period.

Year	Estimated project emissions (tons of CO_2 equivalent)	Estimated leakage (tons of CO_2 equivalent)	Total emissions and leakage (tons of CO_2 equivalent)
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 (tons of CO_2 equivalent)	**12 214 944**	0	**12 214 944**

E.4. Estimated baseline emissions:

Estimation of baseline emissions was made according to the formulae provided in Section D.1.1.4.

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

For the period from 2004 to 2011 estimated baseline emissions of GHG are calculated based on actual data of the volumes of cargo and passengers rail transportation by SE «Prydniprovska zaliznytsya», and for the period from 2012 to 2020 predicted data according to the strategic development plan of railway transportation sector were used.

Table 24. Estimated baseline emissions for the period January 1, 2004– December 31, 2007

Year	Estimated baseline emissions (tons of CO_2 equivalent)
2004	1 765 132
2005	1 991 882
2006	2 098 868
2007	1 991 882
Total baseline emissions over the crediting period from 2004 to 2007 (tons of CO_2 equivalent)	**7 847 764**

Table 25. Estimated baseline emissions for the period January 1, 2008 року – December 31, 2012

Year	Estimated baseline emissions (tons of CO_2 equivalent)
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 from 2002 to 2012 (tons of CO_2 equivalent)	**10 581 121**

Table 26. Estimated baseline emissions for the period January 1, 2013 - December 31, 2020

Year	Estimated baseline emissions (tons of CO_2 equivalent)
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 from 2013 to 2020 (tons of CO_2 equivalent)	**16 737 312**

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

Emission reductions were calculated according to the formula (23) provided in Section D.1.1.4.

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

Table 27. Estimated emission reductions for the period from January 1, 2004– December 31, 2007

Year	Estimated emission reductions (tones of CO_2 equivalent)
2004	238 382
2005	538 976
2006	599 234
2007	491 317
Total estimated emission reductions over the crediting period from 2004 to 2007 (tons of CO_2 equivalent)	**1 867 909**

Table 28. Estimated emission reductions for the period from January 1, 2008 року – December 31, 2012

Year	Estimated emission reductions (tones 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 from 2008 to 2012 (tons of CO_2 equivalent)	**2 830 347**

Table 29. Estimated emission reductions for the period January 1, 2013 - December 31, 2020

Year	Estimated emission reductions (tones 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 from 2013 to 2020 (tons of CO_2 equivalent)	**4 522 368**

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

Table 30. Table containing results of estimation of emission reductions for the period from January 1, 2004 to December 31, 2007.

Year	Estimated project emissions (tones of CO_2 equivalent)	Estimated leakage (tones of CO_2 equivalent)	Estimated baseline emissions (tones of CO_2 equivalent)	Estimated emission reductions (tones of CO_2 equivalent)
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 (tones of CO_2 equivalent)	**5 979 855**	0	**7 847 764**	**1 867 909**

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

Year	Estimated project emissions (tones of CO_2 equivalent)	Estimated leakage (tones of CO_2 equivalent)	Estimated baseline emissions (tones of CO_2 equivalent)	Estimated emission reductions (tones of CO_2 equivalent)
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 (tones of CO_2 equivalent)	**7 750 774**	0	**10 581 121**	**2 830 347**

Table 32. Table containing results of estimation of emission reductions for the period from January 1, 2013 to December 31, 2020

Year	Estimated project emissions (tones of CO_2 equivalent)	Estimated leakage (tones of CO_2 equivalent)	Estimated baseline emissions (tones of CO_2 equivalent)	Estimated emission reductions (tones of CO_2 equivalent)
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 (tones of CO_2 equivalent)	**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:

All necessary documentation for the analysis of project impact on the environment as follows:

- ▪ Law of Ukraine № 1264-XII «On environmental protection" dated 25/06/1991;
- ▪ Law of Ukraine № 2707-XII «On atmospheric air protection» dated 16/10/1992;
- ▪ Current rules on emission limitation: «Norms of maximum permissible emissions of pollutants from permanent sources» – approved by the Ministry of Environmental Protection of Ukraine dated 27/06/2006, №309 and registered in the Ministry of Justice of Ukraine dated 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 «Prydniprovska zaliznytsya» and complying with the law "On Railway Transport"[80] enable to minimize the probabililty of 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 «Prydniprovska zaliznytsya» has all necessary permits and licenses for the maintenance and operation of rail routes, means of rolling stock, heating, transformer substation, complex of administrative and 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:

According to the law of Ukraine "On Environmental Protection"[81] and State Building Norms A.2.2-1-2003, "Structure and content of environmental impact assessment (EIA) in the process of design and construction of plants, buildings and structures"[82] SE «Prydniprovska zaliznytsya» is not obliged to develop the environmental impact assessment for this type of project, it is clear that the project does not create any significant adverse environmental impact.

[80] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=273%2F96-%E2%F0
[81] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1264-12
[82] http://www.budinfo.com.ua/dbn/8.htm

SECTION G. Stakeholders' comments

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

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

The program on increase in the efficiency of fuel and energy resources consumption in the process of providing services on rail transportation of freight 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 «Prydniprovska zaliznytsya» http://www.dp.uz.gov.ua/ukr/prima.

Numerous specialized conferences and seminars under the auspices of the Ministry of Transport of Ukraine were held on the basis of SE "Prydniprovska zaliznytsya". They related directly to the ways of improvement of the performance of the enterprise and the introduction of electronic documentation circulation relating to the rail transportation of cargo and passengers. Information about work on energy efficiency increase is highlighted on the official website of SE «Prydniprovska zaliznytsya» http://www.dp.uz.gov.ua.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	State enterprise «Prydniprovska zaliznytsya»
Street/P.O.Box:	pr. Karla Marksa
Building:	108
City:	Dnipropetrovsk
State/Region:	
Postal code:	49600
Country:	Ukraine
Phone:	+380-562-330024
Fax:	+380-562-33-09-04
E-mail:	
URL:	http://www.dp.uz.gov.ua/ukr
Represented by:	
Title:	Head of railway
Salutation:	
Last name:	Momot
Middle name:	Ivanovych
First name:	Oleksandr
Department:	
Phone (direct):	
Fax (direct):	+380-562-330024
Mobile:	
Personal e-mail:	

Organisation:	VEMA S.A.
Street/P.O.Box:	Route de Thonon
Building:	45
City:	Geneva
State/Region:	
Postal code:	Case postale 170 CH-1222
Country:	Switzerland
Phone:	+41 (76) 346 11 57
Fax:	+41 (76) 346 11 57
E-mail:	info@vemacarbon.com
URL:	www.vemacarbon.com
Represented by:	
Title:	Director
Salutation:	
Last name:	Knodel
Middle name:	
First name:	Fabian
Department:	
Phone (direct):	
Fax (direct):	+38(044)-594-48-10
Mobile:	
Personal e-mail:	

Annex 2

BASELINE INFORMATION

Dynamic baseline is a scenario that reasonably represents the anthropogenic emissions of greenhouse gases by sources that would occur in case if the project is not implemented. The baseline was chosen in accordance with the Guidance on criteria for baseline setting and, Version 03[83]. According to the Guidelines for users of the JI PDD form, Version 04, the stepwise approach is used for description and justification of the chosen baseline.

For the proposed project aimed at reduction of energy consumption by the facilities of SE «Prydniprovska zaliznytsya» in the process of providing services on freight and passenger rail transportation, none of the existing methodologies can be applied. The Project Participant has chosen a specific approach based on the requirements to JI projects in accordance with paragraph 9 (a) of the Guidance on criteria for baseline setting and monitoring for JI projects, 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 in historical period «j», in the baseline scenario	**2001**: 39 955; **2002**: 44 214; **2003**: 50 940
N_p^y	mln t km	Total volume of rail transportation in monitoring period «y», in the project scenario	Value shall be determined for each monitoring period
EC_b^j	MWh	Electric power consumption in historical period «j», in the baseline scenario	**2001**: 1165020; **2002**: 1184691.17; **2003**: 1243587.53
$EF_{b,CO2,ELEC}^j$	tCO_2/MWh	Carbon dioxide emission factor for electricity consumption by electricity consumers in historical period «j», in the baseline scenario	**2001**: 0.976; **2002**: 0.956; **2003**: 0.936
$FC_{b,NG}^j$	ths m^3	Total volume of natural gas consumed in historical period «j», in the baseline scenario	**2001**: 44670.968; **2002**: 43298.926; **2003**: 48161.3693
$NCV_{b,NG}^j$	TJ/mln.m^3	Net Calorific Value of natural gas in historical period "j, in the baseline scenario	**2001**: 33.71; **2002**: 33.71; **2003**: 33.71
$EF_{b,C,NG}^j$	t C/TJ	Carbon emission factor for the process of natural gas combustion in historical period "j", in the baseline scenario	**2001**: 15.3; **2002**: 15.3; **2003**: 15.3
$OXID_{b,NG}^j$	Relative units	Carbon oxidation factor for the process of natural gas combustion in historical period "j", in the baseline scenario	**2001**: 0.995; **2002**: 0.995; **2003**: 0.995
$FC_{b,diesel}^j$	t	Total amount of diesel fuel consumed in historical period "j", in the baseline scenario	**2001**: 60183.104; **2002**: 62390.207; **2003**: 80109.379

[83] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

$NCV^{j}_{b,diesel}$	TJ/ ths t	Net Calorific Value of diesel fuel in historical period "j, in the baseline scenario	**2001**: 42.5; **2002**: 42.5; **2003**: 42.5
$EF^{j}_{b,C,diesel}$	t C/TJ	Carbon emission factor for the process of diesel fuel combustion in historical period "j", in the baseline scenario	**2001**: 20.2; **2002**: 20.2; **2003**: 20.2
$OXID^{j}_{b,diesel}$	Relative units	Carbon oxidation factor for the process of diesel fuel combustion in historical period "j", in the baseline scenario	**2001**: 0.99; **2002**: 0.99; **2003**: 0.99
$FC^{j}_{b,coal}$	t	Total amount of hard coal consumed in historical period "j", in the baseline scenario	**2001**: 55358; **2002**: 46219; **2003**: 44591
$NCV^{j}_{b,coal}$	TJ/ ths t	Net Calorific Value of hard coal in historical period "j, in the baseline scenario	**2001**: 18.41; **2002**: 18.41; **2003**: 18.41
$EF^{j}_{b,C,coal}$	t C/TJ	Carbon emission factor for the process of hard coal combustion in historical period "j", in the baseline scenario	**2001**: 26.75; **2002**: 26.75; **2003**: 26.75
$OXID^{j}_{b,coal}$	Relative units	Carbon oxidation factor for the process of hard coal combustion in historical period "j", in the baseline scenario	**2001**: 0.98; **2002**: 0.98; **2003**: 0.98
$FC^{j}_{b,FO}$	t	Total amount of fuel oil consumed in historical period "j", in the baseline scenario	**2001**: 8130.6; **2002**: 5380.9; **2003**: 4333.6
$NCV^{j}_{b,FO}$	TJ/ ths t	Net Calorific Value of fuel oil in historical period "j, in the baseline scenario	**2001**: 39.92; **2002**: 39.92; **2003**: 39.92
$EF^{j}_{b,C,FO}$	t C/TJ	Carbon emission factor for the process of fuel oil combustion in historical period "j", in the baseline scenario	**2001**: 21.1; **2002**: 21.1; **2003**: 21.1
$OXID^{j}_{b,FO}$	Relative units	Carbon oxidation factor for the process of fuel oil combustion in historical period "j", in the baseline scenario	**2001**: 0.99; **2002**: 0.99; **2003**: 0.99

Annex 3

MONITORING PLAN

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

Monitoring plan is developed for accurate and clear measurement and calculation of greenhouse gas emissions and carried out according to the practice established at SE «Prydniprovska zaliznytsya» to measure the consumed electric power, natural gas, diesel fuel, hard coal and fuel oil. 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 implemented to meet the requirements of the chosen methodology of monitoring and ensure the possibility to check calculations on GHG emission reductions. 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 in the framework of the project.
2. Collection of the information on GHG emissions in the framework of 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 impacts on the 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 throughout the whole monitoring period:

N_b^j	Total volume of rail transportation in monitoring period «y», in the project scenario, mln t km
EC_b^j	Electric power consumption in monitoring period «y», in the project scenario, MWh
$EF_{b,CO2,ELEC}^j$	Carbon dioxide emission factor for electricity consumption by electricity consumers in monitoring period «y», in the project scenario, tCO_2/MWh
$FC_{b,NG}^j$	Total volume of natural gas consumed in monitoring period «y», in the project scenario, ths m^3
$NCV_{b,NG}^j$	Net Calorific Value of natural gas in monitoring period "y» in the project scenario, TJ/mln.m^3
$EF_{b,C,NG}^j$	Carbon emission factor for the process of natural gas combustion in monitoring period «y», in the project scenario t C/TJ
$OXID_{b,NG}^j$	Carbon oxidation factor for the process of natural gas combustion in monitoring period «y», in the project scenario, Relative units.
$FC_{b,diesel}^j$	Total amount of diesel fuel consumed in monitoring period «y», in the project scenario, t
$NCV_{b,diesel}^j$	Net Calorific Value of diesel fuel in monitoring period "y» in the project scenario, TJ/ ths t

$EF^{j}_{b,C,diesel}$	Carbon emission factor for the process of diesel fuel combustion in monitoring period «y», in the project scenario, t C/TJ
$OXID^{j}_{b,diesel}$	Carbon oxidation factor for the process of diesel fuel combustion in monitoring period «y», in the project scenario, Relative units.
$FC^{j}_{b,coal}$	Total amount of hard coal consumed in monitoring period «y», in the project scenario, t
$NCV^{j}_{b,coal}$	Net Calorific Value of hard coal in monitoring period "y" in the project scenario, TJ/ ths t
$EF^{j}_{b,C,coal}$	Carbon emission factor for the process of hard coal combustion in monitoring period «y», in the project scenario t C/TJ
$OXID^{j}_{b,coal}$	Carbon oxidation factor for the process of hard coal combustion in monitoring period «y», in the project scenario, Relative units
$FC^{j}_{b,FO}$	Total amount of fuel oil consumed in monitoring period «y», in the project scenario, t
$NCV^{j}_{b,FO}$	Net Calorific Value of fuel oil in monitoring period "y" in the project scenario, TJ/ ths t
$EF^{j}_{b,C,FO}$	Carbon emission factor for the process of fuel oil combustion in monitoring period «y», in the project scenario, t C/TJ
$OXID^{j}_{b,FO}$	Carbon oxidation factor for the process of fuel oil combustion in monitoring period «y», in the project scenario, Relative units

y – - relates to monitoring period;

b – - relates to project scenario;

ELEC - relates to electric power;

NG - relates to natural gas;

diesel - relates to diesel fuel;

coal – - relates to hard coal;

FO - relates to fuel oil.