JOINT IMPLEMENTATION PROJECT

"Development and improvement of water-supply systems, drainage system and wastewater treatment of CE "Dniprovodokanal"

Position of the head of the organization, institution, body, which prepared the document

Director, VEMA S.A. Switzerland. ____________ **Fabian Knodel**

(position) (signature) (name and patronymic, last name)

PS

VEMA S.A.

Position of the economic entity – owner of the source, where the Joint Implementation Project is planned to be carried out

P. o. director

CE "Dniprovodokanal" ____________ **K.Y. Orel**

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PS

«ДНІПРОВОДОКАНАЛ»

Dnipropetrovsk 2012

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

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SECTION A. General description of the project

A.1. Title of the project:

“Development and improvement of water supply systems, drainage system and wastewater treatment of CE “Dniprovodokanal”

Sectoral Scope:

Sector 3 – “Energy demand”.

PDD Version: 02

Date: 28/11/2012

A.2. Description of the project:

- *Purposes of the project activity*

The project’s main purpose is reduction of electric energy consumption by modernization and development of central water supply, drainage and wastewater treatment systems, which includes replacement and modernization of pumps and water distribution and water drainage systems, installation of frequency regulators and optimization of the technological process of water transportation in Dnipropetrovsk city. Implementation of the above-mentioned technologies will allow for a decrease of greenhouse gas emissions (CO_2) and promote sustainable development of city.

Table 1. Historical details of development of CE “Dniprovodokanal”

Type of activity	Documentary evidence	Date
The owner of the Project decided to implement the JI mechanism for the project, the management of the company made a corresponding decision.	Certificate of commissioning of new 140 D 70 pumping unit dated 30/11/2004	30/11/2004
Signing the Agreement for emission reductions purchase relating to the JI project concluded between VEMA S.A. and CE “Dniprovodokanal”.	Agreement for emission reductions purchase relating to the JI project	01/08/2011
Obtaining of a Letter of Endorsement for the project “Development and improvement of water-supply systems, drainage system and wastewater treatment of CE “Dniprovodokanal”	Letter of Endorsement #3311/23/7 dated 31/10/2012	31/10/2012

The main activities of CE "Dniprovodokanal” are the following:

1. Centralized water supply, drainage and wastewater treatment;
2. Operation of outdoor systems of water supply, drainage and wastewater treatment;
3. Development of regime and technological operational parameters for systems of water supply and drainage;
4. Development of and provision of legal entities and individuals (consumers) with technical requirements towards water supply and drainage of architectural units;
5. Construction and operation of production facilities on water intake and treatment, wastewater pumping and treatment;
6. Construction and operation of water supply and drainage pipelines;
7. Chemico-bacteriological testing of drinking water quality;
8. Design, manufacture, assembly, operation, technical maintenance of water metering units; manufacture, repair, testing, verification and certification of water flow meters.

The circumstances of project implementation. CE “Dniprovodokanal” is one of Ukrainian companies with typical water supply, drainage and wastewater treatment systems that are usually operated in an unsatisfactory technical state.

Power consumption by CE "Dniprovodokanal" for lifting and pumping-over of water, transportation and treatment of wastewater in the baseline period is high resulting in ineffective consumption of energy resources and significant financial costs.

The current state of water supply and drainage systems of the city:

- high energy consumption of production processes;
- poor condition of urban networks. More than 1 300 km of water supply and 700 km of drainage networks are used in order to ensure water supply of the city; a large proportion of them is in catastrophic condition;
- difficult economic situation of the company affected by growing debt of population for the services used.

Table 2. Baseline quantitative values of key parameters used in the project

Year	Pumping plants of CE "Dniprovodokanal"					
	Water supply pumping plants (WSPP)		Drainage pumping plants (DPP)		Wastewater treatment facilities – aeration stations (AS)	
	Baseline volume of pumped water, 1000 m^3, ($V^j_{b,w}$)	Baseline electricity consumption, MWh ($EC^j_{b,w}$)	Baseline volume of drained wastewater, 1000 m^3 ($V^j_{b,m}$)	Baseline electricity consumption, MWh ($EC^j_{b,m}$)	Baseline volume of treated wastewater, 1000 m^3 ($V^j_{b,t}$)	Baseline electricity consumption, MWh ($EC^j_{b,t}$)
1998	306,823.7	111,107.9	133,622.90	20,970.00	152,287.70	61,450.00
1999	294,371.8	111,296.2	128,631.70	21,510.00	145,698.70	63,623.40
2000	264,108.0	103,446.0	116,561.20	21,253.00	138,795.80	61,630.00
2001	239,377.0	100,367.5	114,935.70	20,846.00	136,713.80	62,291.60
2002	235,813.8	100,840.0	112,794.30	21,771.00	137,718.90	63,681.80
2003	221,307.3	98,051.0	110,744.60	22,567.00	137,539.80	65,119.30
2004	223,032.0	97,856.2	115,050.50	23,717.80	129,253.10	61,314.40

Quantitative indexes for baseline emission calculation are sourced from the "Notice on electricity consumption by water supply, drainage pumping plants and water treatment aeration plants of CE "Dniprovodokanal" in 1998-2004" and the "Notice on volumes of water and wastewater transported by water supply, drainage pumping plants and supplied to water treatment aeration plants of CE "Dniprovodokanal" for 1998-2004".

Constant deterioration of the equipment, outdated technological schemes, general lack of modernization of facilities and water supply, drainage networks, absence of new technologies result in:

- ineffective and excessive consumption of electric energy;
- ineffective wastewater treatment.

In case of absence of the Joint Implementation (JI) Project amount of consumed electric energy as well as fossil fuel for water and wastewater transportation would increase (due to moral depreciation and technical wearing out of the equipment).

The baseline scenario is "business as usual" scenario providing for carrying out of repair works against the background of total degradation of the technical condition of the water supply system. There are no barriers for implementation of this Baseline scenario (there are no investment barriers as this scenario doesn't require any additional investment and there are no technological barriers as this equipment is operated by skilled personnel and there is no need to additionally retrain the personnel). This scenario reflects customary practice in Ukraine.

The project provides for GHG emission reductions due to:

- modernization of pumping equipment;
- replacement of pumping equipment;
- optimization of the technological process of water pumping, i.e. change of operation modes of pumping plants;
- replacement of water supply and drainage networks;
- replacement of shut-off and control valves;
- installation of a new set of metering devices;
- installation of frequency regulators;
- modernization of air tanks.

Due to reduction of consumed electric energy from the electrical grid of Ukraine used by the pumping plants, burning of fossil fuel for electric energy generation to the grid will be decreased, which, in turn, will reduce GHG emissions into the atmosphere.
These measures will be implemented after the project implementation, when servicing in the sphere of water supply becomes more effective.
The project may promote sustainable development of CE "Dniprovodokanal" in the following aspects:

- decrease of national economy's dependence on import of energy and increase of country's energy security;
- improvement in quality of water supply and water treatment before water is supplied to customers;
- high rates of labour and health protection;
- improvement of the global ecology state (counteraction in response to global climate change by means of reduction of greenhouse gases (GHG) emissions into the atmosphere).

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)	• CE "Dniprovodokanal"	No
Switzerland	• "VEMA S.A."	No
*Please indicate if the Party involved is a host Party.		

CE "Dniprovodokanal" is the project implementation organization (Applicant). EDRPOU code 03341305. Name of the kind of economic activity according to the standard industrial classification of economic activities: 41.00.0 Pumping, treatment and distribution of water. CE "Dniprovodokanal" operates equipment for water withdrawal from the Dnipro River, as well as equipment designed for water treatment and supply to household and industrial needs of the region. The company has all licenses and permits under the Ukrainian legislation to provide water supply and drainage services. CE "Dniprovodokanal" is responsible for project, design and assembly work performed using in-house manpower or by subcontractors. The company funds the project and receives no profit.

VEMA S.A. is a research and engineering organization. It is responsible for development of project design documentation of the joint implementation project. In addition it will also take part in determination, monitoring and verification processes.

A.4. Technical description of the project:

A.4.1. Location of the project:

The Project is located in the city of Dnipropetrovsk (Figure1).

Figure 1. Location of CE "Dniprovodokanal" 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 Framework Convention on Climate Change (UN FCCC) on February 4, 2004; it is listed in the Annex 1 to the UN FCCC and eligible for participation in the Joint Implementation projects[1].

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

Dnipropetrovsk region is an administrative unit of Ukraine located in south-central part of the country. The region has an area of 31 900 km^2 (5.3% of Ukraine's total area). The regional capital is Dnipropetrovsk city.

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

Dnipropetrovsk is a city of regional subordination in Ukraine, the administrative centre of Dnipropetrovsk region. As of September 2011, Dnipropetrovsk city is on the fourth place in terms of population (999 250 people).

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

Figure 2. City of Dnipropetrovsk and location of CE “Dniprovodokanal”

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

Coordinates of location of CE “Dniprovodokanal”: 48°27′31″. 35°02′24″ E.

Table 3. Facilities involved into the project, within Dnipropetrovsk city

Number of water intakes	2
Number of water supply pumping plants	9
Number of local boosting pumping stations	43
Length of main water supply networks, km	452.5
Length of city water distribution networks, km	1,529.1
Number of wastewater treatment facilities	4
Length of drainage collectors, km	182
Number of drainage pumping plants	50
Length of drainage networks without collectors	1,023.3

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

Measures to be implemented in order to increase the efficiency of water supply, drainage and wastewater treatment at CE “Dniprovodokanal” are the following:

1. PDD elaboration

PDD elaboration includes the projects on modernization and introduction of new equipment, up-to-date technologies within the JI project framework.

2. Modernization of pumping equipment

CE “Dniprovodokanal” uses horizontal and submerged pumps. A submerged pump is the pump submerged below the level of pumped over fluid. This ensures deep water lifting, high quality cooling of pump components and enables to lift the water with dissolved gas. Horizontal pumps are designed for pumping over of fresh water with the temperature below +100°C and are used to supply water to urban settlements and industrial companies. The project provides for cutting of pump rotor. Output edge of the pump rotor is skived along the length, thereby increasing output channel area of the rotor on the periphery. Conducted experiments demonstrated that increase of output area by 11.7% enables to increase feed by 16.7% on condition of the highest value of Efficiency Factor and invariable power and head. Such types of pumps as type D, NDS, etc. will be modernized in the process of the JI project implementation. Technical characteristics of pumps that are planned to be modernized under the project implementation are given in the *Table 4.*

Table 4. Technical characteristics of pumping units to be modernized

Nominal size of pumping unit	Supply (Q), m^3/h	Head (H), m	Engine power (Nd), kW
D 630-90	630-4000	75-100	250-1600
D 3200-75			
D 2000-100			
D4000-95			
18NDS			

Figure 3. a) Horizontal double-entry pump of a) D 630-90 type, and b) 18NDS type

3. Replacement of pumping equipment

One of the main purposes of replacement of pumping equipment is decrease in energy consumption. The main reason of significant reduction of energy consumption in case of replacement of pumps is compliance of their parameters with the system requirements. This is achieved by correct selection of pumping equipment according to the actual needs of the system. Old pumps with low efficiency will be replaced by the pumps with the efficiency of 81-89%. Technical characteristics of new pumps that are planned to be installed are stated in the *Table 5*

Table 5. Characteristics of some types of pumps with electric motors of general industrial application that are planned to be installed

Nominal size of pump unit	Supply (Q), m^3/h	Head (N), m	Engine power (Nd), kW
Wilo TS40H90/5.5[2]	14-2000	8-90	250-1600
Wilo TC40-8[3]			
CM125-80-315/4			
WILO VeroNorm NPG[4]			

Figure 4. Centrifugal pump of WILO VeroNorm NPG type

4. Optimization of the technological process of water pumping

Current operation mode of the pumping plant #14 will be changed into energy efficient one due to switching over to gravity-head water supply; shutdown of WSPP #7 due to putting into operation VK-31.

It is also planned that there will be the transfer of load from pumping plants with old equipment to the pumping plants fitted with high-efficiency equipment. Improvement of hydraulic circuit of water supply with disconnecting of pumps takes place.

Energy is consumed to surmount gravity forces and friction of the liquid in the process of pumping. Thus, the savings will be attained due to achieving proportionality of the pumps operation under the minimum requirements (pressure and flow rate of liquid).

5. Replacement of shut-off and control valves

Shut-off and control valves are a key element of all technological systems based on the use of any carrier (in this case pure water) because they allow you to adjust their flow. These are devices of physical control over working flow of the carrier: shut-off, balance, regulation of flow pressure. It is planned to replace obsolete shut-off and control valves of the USSR production with the shut-off and control valves of European manufacturers in the framework of the project. *Table 5* shows characteristics of high-efficiency shut-off and

[2] http://www.inasos.com.ua/product/wilo-ts-40-h-9055/

[3] http://вило.рф/index.php?productID=2756

[4] http://www.wilo-shop.ru/use/heating/wilo-veronorm-np.html

control valves that would greatly improve the level of energy efficiency of the water supply and drainage system (by 5-10% efficiency compared to the old equipment).

Table 6. Characteristics of typical shut-off and control valves to be implemented[5]

Nominal size of shut-off and control valves	Diameter, mm	Length, mm	Height, mm	Weight, kg	Material
Hawle E2 D600	600	350	720	490	Malleable cast iron EN-GJS-400-18
Hawle DN200	200	230	679	41	Ductile iron GGG400
Hawle DN 50-400	50-400	125-512	349-1,353	13-184	Grey iron EN-GJL -250

a) b) c)

Figure 5. a) Wedge seated gate valve with smooth straight-through bore Hawle E2 D600; b) Resilient seated gate valve with smooth straight-through bore Hawle DN200; c) Slide seated gate valve with non-rising spindle and with adapter for installation of electric drive of Hawle DN 50 – 400 types

In addition to the above mentioned examples of shut-off and control valves, other models of valves of this as well as other manufactures will be installed.

6. Replacement of water-supply and drainage networks

Replacement of water supply and drainage networks provides for replacement of obsolete pipes with new high-efficient[6] ones. Technically worn out pipes will be replaced with fibreglass[7] and plastic[8] pipes that are characterized by durability (over 50 years), effectiveness in operation and corrosion resistance. Modernization of the water supply and drainage systems will enable decrease of water losses in a network and correspondingly electric energy losses for water pumping due to full use of water, change of pressure within the network. This will enable the pumps to operate in optimal regime.

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[5] http://www.havvle.ru/index.php

[6] http://www.infox.ua/projects/fiberglasspipes/

[7] http://www.metallprofil.avcom.in.ua/vodoprovod/flowtite.html

[8] http://www.aquatherm.ua/main_ua/products/

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Figure 6. Fiberglass pipes FLOWTITE

CE "Dniprovodokanal" makes annual estimates of water losses in the network. Based on these calculations, the company determines planned replacement. If the loss of water in the section of a pipeline does not exceed the standard water loss, the company is not obliged to carry out scheduled replacement of pipeline. Pipelines to be replaced as a result of the project implementation are not a part of maintenance (emergency situations, scheduled replacement). Replacement of pipelines takes place in the sections that have not exceeded the planned loss of water, but are in poor condition. Detailed information on replacement of water supply networks is provided in Supporting Document *3.*

7. Installation of a new group of metering devices

New group of metering devices will be installed for adjustment of control and metering of water and electric energy consumption.

Table 7. Characteristic of metering devices

Type of metering device	Accuracy	Calibration interval	Purpose
"Akunstron"[9]	0.5-1.5	Once per 1-6 years	Water flow meter
SL-761 CO 71[10]			Electric energy meter
LZQM 321.02.534[11]			Electric energy meter
N1K 2303 APK-1[12]			Electric energy meter

8. Installation of frequency regulators

Installation of frequency regulation of electric motors of water supplying pumps will enable to decrease electric energy consumption significantly. Such equipment will enable to regulate power of electric motors depending on connected load both within twenty-four-hours of water supply change and within a year. That is, regulation of electric energy and water consumption will greatly change the overall picture of water-power

[9] http://www.ekransamara.ru/e_mag/121

[10] *http://electroline.com.ua/produkcija/aktaris_sl7000_smart.html*

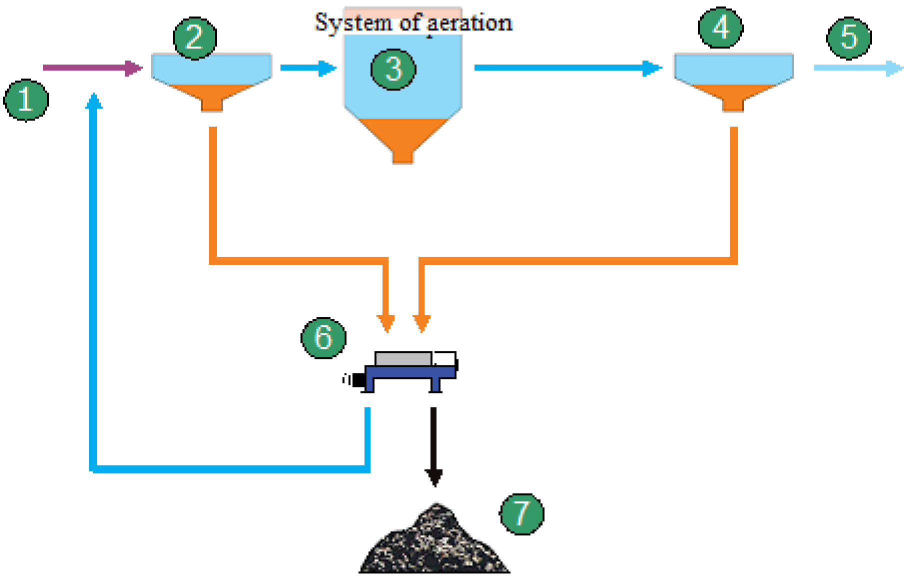
[11] http://www.energoportal.net/tovar_63_59338.html

[12] http://axiomplus.com.ua/goods.php?id=106&gclid=CNjpl--W7LMCFTJ2cAodiWAAdQ

dependence. Precise data regarding overall improvement of efficiency of the water supply system will be presented after the monitoring process. *Table 8. Characteristics of frequency regulators*

Type of frequency regulator	Power, kW	Place of installation
Danfoss FC 202[13] 	132 – 630	129 B Kirov Ave.; 18 Novokrymska St.; TRP -126, 93 Myru Ave.; TRP -130, 4 Festivalny Ave.; Divocha street, 11; 8 Bereznya street, Yuvileyne village, Dnipropetrovsk region; Kojemyaki street, 2; Kosiora street, 16A; Khmelnitskogo street, 18
VLT AQUA FC 202 P-160[14] 	132 – 630	NSV-6 Nab. Peremogi, 48-N; NSV-51, p.g. Pravdy, 106 A; NSV-8, pr. Dobrovoltsiv, 19; NSV-61 pr. Odeskyi, 29-N; NSV-80 Kolska street.

9. Modernization of aeration system at treatment facilities (air tanks)



[13] http://www.danfoss.com/BusinessAreas/DrivesSolutions/Software+FC202+Updates/

[14] http://www.ntc-eserv.ru/equipment/38-energosberegayushchee-oborudovanie/chastotnye-preobrazovateli/chastotnye-preobrazovateli-danfoss/50-danfossvltaqua

Figure 7. Technological scheme of treatment plants after implementation of the project (modernization of aeration system)

1 – inlet of wastewaters; 2 – primary clarifiers; 3 - air tanks; 4 – secondary clarifiers; 5 – discharge of treated water into the waters; 6 – mechanical dewatering of raw sludge or activated sludge; 7 – inlet of dewatered sludge to the sludge fields.

The process of biological treatment of contaminated matter is carried out in the air tanks. Here direct contact of wastewaters with organisms of activated sludge along with availability of right amount of dissolved oxygen takes place. This allows for further isolation of activated sludge from cleaned water that takes place in clarifiers. Activated sludge is farmed biocenosis populated with bacteria, simple microorganisms and metazoans that transform contaminants and treat wastewaters due to biosorption and biological oxidation. Oxygenation occurs via barboration of wastewaters with oxygen from air that comes in through network of holed tubes that are placed at the bottom of air tanks.

The most important factors that influence the development and vital activity of activated sludge as well as quality of biological treatment are: temperature, availability of nutrients and dissolved oxygen content in sludge mixture, pH index, presence of toxins. Biological treatment is the most power-intensive stage, it uses 85% of needed electricity for all treatment facilities for aeration structures. The role of activated sludge is to conduct biological oxidation of organic matters in wastewaters up to single units and process of sorption.

Losses caused by friction can be a considerable part of energy consumption needed for aeration. This can occur during colmatation (locking) of air dispersants of aeration systems if they are in production for a period longer than their operational life or in cases when the air incoming to the dispersants is unfiltered and dusty.

The project provides for modernization of air tanks (aeration system). Air tanks will be equipped with new system of air distribution. When replacing the aeration system with highly effective one, electric energy will be saved by reducing the contact time of wastewater with air. For new and more powerful equipment will provide more air within shorter time span, and this in turn accelerates aeration process and speeds up the process of wastewater treatment in general. Thus, air blowers and all pumps (including airlifts) will be completely replaced.

Project provides for the implementation of cycle loading (feed of needed amount of air). Adjustment of air feed will be made via special equipment:

- Pressurization blowers of extensive operation with ac-to-dc inverter;
- Centred air blowers equipped with special directional control equipment at the entrance.

The main milestones of the project activities implementation provided by the project are given in the table below:

Table 9. Schedule of project implementation

#	Project stage	Period
1	PDD elaboration	2004-2012
2	Modernization of pumping equipment	2004-2012
3	Replacement of pumping equipment	2004-2012
4	Optimization of the technological process of water pumping, change of operation modes of pumping plants	2004-2012
5	Replacement of shut-off and control valves	2004-2012
6	Replacement of water-supply and drainage networks	2004-2012

7	Installation of a new group of metering devices	2004-2012
8	Installation of frequency regulators	2004-2012
9	Modernization of aeration system at treatment plants (air tanks)	2004-2012

Results which will be obtained after implementation of such technologies and measures are given in Supporting Documents 1, 2, 3.
30/11/2004 is the start date of all project activities implementation.
31/12/2012 is the final date of all project activities implementation.

Technologies that are implemented under the project are state-of-the-art technologies in the sphere of water supply. They are already proven and will result in significantly better productivity. Taking into consideration general economic circumstances, replacement of technologies proposed in the project with more effective technologies is unlikely to take place in the nearest 20-30 years.
Since the core activities of CE "Dniprovodokanal" won't change when implementing the Joint Implementation (JI) project, special trainings for the personnel are not necessary. When using new equipment (the one that has not been used before), the company-manufacturer of the equipment should conduct trainings for the personnel. Technical personnel of the enterprise possess necessary knowledge and experience for implementation of the project activities and repair of the equipment implemented under the project. The new equipment to be installed doesn't require any special maintenance. The personnel of CE "Dniprovodokanal" will carry out maintenance of the new equipment in operating mode (exploitation, scheduled repairs) during the period of the project implementation, and after the project period.
CE "Dniprovodokanal" retrains the personnel according to the requirements of Norms of labour protection. The enterprise has the Labour Protection Department responsible for professional development and trainings of the personnel.
In the course of elaboration of JI project the specialists of VEMA S.A. carried out broadened consultations for involved representatives of CE "Dniprovodokanal" about collection of necessary data according to the Monitoring plan of the project.

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:

Reduction of the GHG emissions will be attained due to the following measures:

- GHG emission reductions due to reduced consumption of electric energy form the national grid which results from the replacement and modernization of pumps, water distribution networks, installation of frequency regulators, and optimization of technological processes.

In the absence of the proposed project all equipment, including the old equipment and the one characterized by low efficiency but which is still operable equipment, will work in the usual mode for a long time, and no emission reductions will take place.
But there are several main reasons which make the implementation of the project without the mechanism of joint implementation unlikely to happen:

- There are no legislative documents committing CE "Dniprovodokanal" to additionally modernize pumping and treatment equipment of water distribution networks;
- No significant changes in the legislation of Ukraine in the water supply and drainage spheres, which could force the company to refuse from the existing practices, are expected;

- Currently, there are no restrictions for Ukrainian enterprises regarding GHG emissions, and they are unlikely to be imposed by 2012;
- Additional, quite risky financial investment and risks connected with new equipment exploitation in the absence of a JI project.

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

In the course of the project implementation, the following emission reductions will be achieved at each stage of the project:

Table 10. Estimated amount of emission reductions before the first commitment period (2005-2007)

	Years
Length of the crediting period	3
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2005	53 542
2006	72 665
2007	80 202
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	206 409
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	68 803

Table 11. 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	114 596
2009	107 503
2010	103 563
2011	84 409
2012	84 409
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	494 480
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	98 896

Table 12. Estimated amount of emission reductions after 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	84 409
2014	84 409

2015	84 409
2016	84 409
2017	84 409
2018	84 409
2019	84 409
2020	84 409
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	675 272
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	84 409

More detailed information is provided in the Supporting Document 1.

Description of formulae used for preliminary estimation of emission reductions is provided in Section D and Supporting Document 1.

A.5. Project approval by the Parties involved:

The project "Development and improvement of water-supply systems, drainage system and wastewater treatment of CE "Dniprovodokanal" has obtained Letter of Endorsement #3311/23/7 dated 31/10/2012 issued by the State Environmental Investment Agency of Ukraine.
After analysing the project, the PDD and the Determination Report will be submitted to the State Environmental Investment Agency of Ukraine to obtain a Letter of Approval. The second letter of approval will be obtained from the other party-participant of the Joint Implementation project before the first Verification.

SECTION B. Baseline

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

The baseline of the JI project is set in accordance with the requirements of Appendix B to Decision 9/CMP.1[15] (JI Guidelines) and paragraphs 23-29 of "Guidance on criteria for baseline setting and monitoring", Version 03[16], developed by the Joint Implementation Supervisory Committee (JISC) (hereinafter - the "Guidelines") and elements of CDM approved methodology AM0020 "Baseline methodology for water pumping efficiency improvements", version 02[17]. According to the above stated Guidelines, the project participants may use methodologies approved under the Clean Development Mechanism (CDM) for developing the baseline and monitoring (paragraph 9 (b)) or they may set a baseline in accordance with Appendix B of the JI Guidelines (paragraph 9 (a) of the Guidelines), at the same time, if necessary, using some elements or combinations of approved CDM methodologies for developing the baseline and monitoring (paragraph 11 of the Guidelines).
When choosing the baseline for the JI project a specific approach was used.

Baseline setting

The baseline scenario is a scenario that accurately describes the anthropogenic greenhouse gases emissions by sources that would have occurred in the absence of the proposed project in accordance with the JI Guideline, Appendix B. As none of the approved CDM methodologies for baseline setting and monitoring may not fully apply to this project, plausible future scenarios are defined based on conservative assumptions (paragraph 24 of the Guidelines).
The choice of the baseline is based on determining the most plausible alternatives. The alternatives for CE "Dniprovodokanal" facilities are the following.

Alternative ways of electric energy consumption:

Alternative 1.1: Operation of existing equipment will continue (continuation of the current situation), and electric energy consumption will increase.
Alternative 1.2: Modernization (the proposed project activity) without the use of the Joint Implementation mechanism.
Alternative 1.3: Reduction of the project activities, the exclusion of any non-key activities from the project, for example, exclusion of frequency control from the project implementation, etc.
None of the abovementioned alternatives contradicts the legislation of Ukraine. The detailed analysis of each alternative is stated below.

Alternative 1.1

Operation of existing equipment will continue (continuation of the current situation), and electric energy consumption will increase.

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[15] *http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=2*

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

[17] *http://cdm.unfccc.int/filestorage/C/D/M/CDMWF_AM_K96TMFSTMHPPDMHSR8A5R3SJHLG32F/AM0020_was_NM0042rev_ver2_AM.pdf?t=V0x8bTlndWp5fDCApnmpFBIxtGUTeirChrfq*

Since the operation of existing equipment does not require any significant investment, despite the fact that the equipment exceeded its design service life, the old system that supplies city of Dnipropetrovsk could still continue to operate.
Despite the fact that the equipment at CE “Dniprovodokanal” exceeded its design service life, its further use is allowed by Energy and Mechanical Service of the company in compliance with the legislation of Ukraine “On Drinking Water and Water Supply”[18]. This practice is widespread in Ukraine.
This alternative is the most plausible alternative because the company is able to meet the needs of consumers without the project.
Accordingly, *Alternative 1.1* can be viewed as the most plausible baseline

Alternative 1.2

Modernization (the proposed project activity) without the use of the Joint Implementation mechanism.
The project implementation will allow for reduction of electric energy consumption by modernization and development of the centralized water supply system, including replacement and modernization of pumps and water distribution networks, installation of frequency regulators, optimization of the process of water pumping. Implementation of the above said technologies will allow for reduction of greenhouse gas (CO_2) emissions.
The project implementation is connected with overcoming significant technical and operational barriers, as well as commercial risks. This is due to the complexity and novelty of technology to be used for the project.
In addition, the project implementation requires considerable financial expenditures. The economic performance of the project will be low without the involvement of the JI mechanism in comparison with alternative options.
Thus, without involving outward investment the project is unlikely to be implemented, because such technical solutions are complex, and operation of facilities are connected with difficulties. Thus, the plausibility of *Alternatives 1.2* implementation (without the JI project) is very low, although it will be considered in the investment analysis.

Alternative 1.3

Reduction of the project activities, exclusion of any non-core activities from the project. For example, exclusion of frequency regulation installation, etc. Economic efficiency of the project depends on a complex of energy-efficient measures implementations, partial implementation of the project will lead to local improvements of the work of equipment, but it will not promote reduction of power consumption.

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

Table 13. Analysis of the alternatives 1.1-1.3

# of Alternatives	Alternative	Low plausibility	High plausibility
1.1	Operation of existing equipment will continue (continuation of the current situation), and electric energy consumption will increase.		•

[18] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=2196-15

1.2	The project implementation is carried out by means of modernization (the proposed project activity) without the use of the Joint Implementation mechanism.	•	
1.3	The project implementation is carried out by means of reduction of the project activities, the exclusion of any non-core activities from the project, for example, exclusion of frequency control implementation from the implementation project, etc.	•	

Conclusion

The barrier analysis showed that the analysed project implementation alternatives could not be considered the most attractive from a financial, organizational and technological point of view. The substantiation of this conclusion is provided in Section B.2.

As a result of evaluation of several alternatives the most plausible one of them has been identified and will be used as the baseline:

- *Alternative 1.1*: Operation of existing equipment will continue (continuation of the current situation), and electric energy consumption will increase.

Detailed description of the baseline scenario

The baseline scenario provides for operation of existing equipment of the water supply, drainage and wastewater treatment system in the city of Dnipropetrovsk, which is characterized by continuing worsening and lowering of effectiveness of the pump, water distribution and treatment equipment. However, at the same time routine, on-the-spot and capital repairs do not increase efficiency of pumping plants operation.

Baseline setting will be carried out in accordance with a specific approach to joint implementation projects for each year. After this, the sale of emission reductions will take place to improve and perfect the system of water supply.

The level of activity is reflected by annual electric energy consumption. Elaboration of the JI PDD started at the end of 2004. Calculation of GHG emissions started in 2005. Implementation of new and modernization of old equipment under the project took place at the end of 2004. With the view of conservative approach, reductions due to these implementations are not considered in the project, the baseline is based on historical data for the period of 1998-2004.

Specific electricity consumption in the baseline scenario is calculated taking into account the fact of its linear increase with time. This happens for several reasons:

- A permanent reduction in the efficiency of pumping and purification equipment with time;
- A permanent increase in losses in water and sewer networks.

Detailed information is provided in **Section D. 1** and Supporting document 1.

Therefore, when determining GHG emission reductions due to the modernization of pumping equipment at water treatment plants, which pump sludge to sludge fields, and aeration systems (aerators) which feed sir into air tanks, Methodology AM0020 is inapplicable since the GHG emission reductions calculation formulae include accurate data on water and wastewater pumped.

The main factors that determine the greenhouse gas emissions

The main factors that determine GHG emissions are GHG emissions as a result of consumption of electric energy used by the water supply, drainage and wastewater treatment system.

Detailed information is provided in **Section D and Supporting document 1.**
Thus, according to the alternatives described above, the analysis and choice of these alternatives some conclusions can be made. During the project development there were no approved CDM methodologies for the projects implemented in Ukraine which could be applied to the unsatisfactory current activities of this kind. The proposed project uses a specific approach to joint implementation projects based on the approved by the UN Framework Convention on Climate Change Executive Committee clean development mechanism baseline methodology:AM0020 "Baseline methodology for water pumping efficiency improvements", version 02).

Modernization

This type of modernization refers to the sector "**Energy Demand**". Current CE "Dniprovodokanal" activity is characterized by continuous worsening of the water supply system as well as high and inefficient power consumption. This results from a lack of funds for modernization and replacement of the equipment as well as implementation of new technologies.
The project activity is targeted at reducing of greenhouse gas emissions by the national power grid due to modernization of the water supply system in Dnipropetrovsk city: replacement of old pumping units with new and modern ones, replacement of water distribution networks, implementation of new technologies of water supply and drainage, modernization of wastewater treatment.

Table 14. Application of the methodology AM0020 (version 02)

Applied AM0020 (version 02)	Project activities
This methodology may be applied for the project activities, which:	
(a) try to reduce GHG emissions due to reduction of energy quantity necessary for water supply to end users in municipal water and wastewater treatment plants.	(a) project activities provide for decrease in electric energy consumption, necessary for water supply to end users in municipal water.
(b) increase efficiency of energy consumption in the system of water pumping, including decrease in technical loss and leakage of water, as well as energy efficiency of pump schemes consuming electric energy from electrical supply networks, where:	(b) project activities provide increase in efficiency of energy consumption in the water pumping system, including decrease in technical loss and leakage of water, as well as energy efficiency of pump schemes consuming electric energy from electrical grid.
(c) increase in efficiency (energy and water) of already existing schemes of water supply	(c) project activity provides increase in efficiency (energy and water) of already existing schemes of water supply.
(d) elaboration of new schemes that will replace the old one, which will not be used anymore. This method will apply to new scheme only for measurement of capacity (annual volume of supplied water) of old scheme.	

(e) this methodology cannot be applied for project activities in cases of development of absolutely new schemes for increase in available potential. Only emission reductions up to existing potential of the system will be considered.	(e) project activity provides increase in efficiency (energy and water) of already existing schemes of water supply.
(f) this methodology shall be applied in combination with the approved monitoring methodology AM0020 ("Methodology for water pumping efficiency improvements", version 02[19]).	(f) specific approach elaborated for this project applies monitoring methodology AM0020 ("Methodology for water pumping efficiency improvements", version 02).

It is impossible to apply Methodology AM0020 in full since the formulae for preliminary estimation of project emission reductions include exact values of electric energy consumption and volumes of water supplied to the system. In our case it is impossible to state necessary quantity of electric energy for water pumping to the consumers and wastewater pumping from them in project year.

Current operation of the water supply, drainage and wastewater treatment system in the city of Dnipropetrovsk is characterized by continuing worsening and lowering of effectiveness of the pumping and water distribution equipment. Consumption of electric energy in baseline year is provided in the Table 15.

Table 15. Baseline consumption of electric energy

CE "Dniprovodokanal"	
Baseline consumption of electric energy, ths kWh	
Year	Water supply, drainage pumping plants and treatment plants
1998	193,527.9
1999	196,429.6
2000	186,329.0
2001	183,505.1
2002	186,292.8
2003	185,737.3
2004	182,888.4

Quantitative indexes for baseline emission calculation are sourced from the "Notice on eklectricity consumption by water supply, drainage pumping plants and water treatment aeration plants of CE "Dniprovodokanal" in 1998-2004" and the "Notice on volumes of water and wastewater transported by water supply, drainage pumping plants and supplied to water treatment aeration plants of CE "Dniprovodokanal" for 1998-2004".

Detailed information on calculation of baseline data is provided in Supporting Document 1.

Status and compliance of the current water supply system

Current operation of the water supply system in the city of Dnipropetrovsk is based on pumping equipment of Ukrainian or Russian manufacturers, including such types as D, SDN, NDS and some other types. Detailed information is provided in Supporting Document 2

There are two types of water losses at this enterprise: productive and non-productive; this is a current practice of water supply system exploitation in Ukraine. Such losses include own needs of water supply company (water consumption for preventive maintenance of water supply networks, disinfection and washing of

[19] http://cdm.unfccc.int/methodologies/DB/TH0MTJC0KYJYYMQLL9B71Q9QJHOPZ9

technological constructions and leakage therefrom, etc.). The main component of water loss is deemed to be water leakage from the water distribution network. The company is obliged to make annual theoretical calculation in accordance with the order [20] of the State Committee of Ukraine on housing and community amenities # 33 dated 17/02/2004 and actual calculation of water loss from the water-supply system. Results of calculations in the reporting form[21] shall be submitted to the State agency of water resources of Ukraine"[22].
Calculation of total annual baseline carbon dioxide gas emissions, which would take place during the baseline year if the water supply system in the city of Dnipropetrovsk remained unchanged, is provided in the Supporting document 1 (the Baseline). They consist of accurate amount of total t CO_2e emissions, which took place in baseline years.

$$BE_{b,e}^{y} = BE_{b,w}^{y} + BE_{b,m}^{y} + BE_{b,t}^{y}, \quad (B.1)$$

where:

$BE_{b,w}^{y}$ - GHG emissions due to electricity consumption by water supply system *w* in period *y* in the baseline scenario, t CO_2e;

$BE_{b,m}^{y}$ - GHG emissions due to electricity consumption by water drainage system *m* in period *y* in the baseline scenario, t CO_2e;

$BE_{b,t}^{y}$ - GHG emissions, due to electricity consumption by air tank system *t* in period *y* in the baseline scenario, t CO_2e;

$[e]$ - electricity consuming system;

$[w]$ - water supply system;

$[m]$ - drainage system;

$[t]$ - air tank system;

$[y]$ - monitoring period;

$[b]$ - baseline period.

GHG emissions due to electricity consumption by pumping equipment used by water supply system *w*

$$BE_{b,w}^{y} = V_{r,w}^{y} * SEC_{b,w}^{y} * EF_{CO_2,ELEC,y}, \quad (B.2)$$

where:

$SEC_{b,w}^{y}$ - specific electricity consumption by water supply system *w* in period *y* in the baseline scenario, MWh/1000 m^3;

$EF_{CO_2,ELEC,y}$ - specific carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine in period *y*, t CO_2e/MWh;

$V_{r,w}^{y}$ - total water pumped by water supply system *w* in period *y* in the project scenario, 1000 m^3;

$[w]$ - water supply system;

[20] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=z1557-04%20

[21] http://search.ligazakon.ua/l_doc2.nsf/link1/ZX000218.html

[22] http://www.scwm.gov.ua/

$[y]$ - monitoring period;

$[b]$ - baseline period;

$[r]$ - project period.

Specific electricity consumption in the baseline scenario is calculated, taking into account the assumption of its linear increase in course of time. This linear dependence is based on historical data for the period from 1998 to 2004 using the method of least squares. Specific electricity consumption in the baseline scenario is determined by the formula:

$$SEC^{y}_{b,w} = a \cdot y + b, \qquad (B.3)$$

$$a = \frac{7\sum_{j}(SEC^{j}_{b,w} \cdot j) - \sum_{j} SEC^{j}_{b,w} \cdot \sum_{j} j}{7\sum_{j} j^2 - (\sum_{j} j)^2}, \qquad (B.4)$$

$$b = \frac{\sum_{j} SEC^{j}_{b,w} - a \cdot \sum_{j} j}{7}, \qquad (B.5)$$

where:

$SEC^{y}_{b,w}$ - specific electricity consumption by water supply system *w* in period *y* in the baseline scenario, MWh/1000 m^3;

a - coefficient of linear dependence;

b - coefficient of linear dependence;

$[w]$ - water supply system;

$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;

$[7]$ - number of years in the historical period;

$[y]$ - monitoring period;

$[b]$ - baseline period.

Specific consumption in *j* year is determined as:

$$SEC^{j}_{b,w} = EC^{j}_{b,w} / V^{j}_{b,w}, \qquad (B.6)$$

where:

$EC^{j}_{b,w}$ - total electricity consumption by water supply system *w* in period *j* of the baseline scenario, MWh;

$V^{j}_{b,w}$ - total water pumped by water supply system *w* in period *j* of the baseline scenario, 1000 m^3;

$[w]$ - water supply system;

$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;

$[b]$ - baseline period.

GHG emissions due to electricity consumption by water drainage system *m*

$$EB_{b,m}^{y} = V_{r,m}^{y} * SEC_{b,m}^{y} * EF_{CO_2,ELEC,y} \,, \tag{B.7}$$

where:

$SEC_{b,m}^{y}$ - specific electricity consumption by water drainage system *m* in period *y* of the baseline scenario, MWh/1000 m^3;

$EF_{CO_2,ELEC,y}$ - specific carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine in period *y*, t CO_2e/MWh;

$V_{r,m}^{y}$ - total volume of wastewater pumped over by drainage system *m* in period *y* of the project scenario, 1000 m^3;

$[m]$ - drainage system;

$[y]$ - monitoring period;

$[b]$ - baseline period;

$[r]$ - project period.

Specific electricity consumption in the baseline scenario is calculated, taking into account the assumption of its linear increase in course of time. This linear dependence is based on historical data for the period from 1998 to 2004 using the method of least squares. Specific electricity consumption in the baseline scenario is determined by the formula:

$$SEC_{b,m}^{y} = a \cdot y + b, \tag{B.8}$$

$$a = \frac{7\sum_{j}(SEC_{b,m}^{j} \cdot j) - \sum_{j} SEC_{b,m}^{j} \cdot \sum_{j} j}{7\sum_{j} j^2 - (\sum_{j} j)^2}, \tag{B.9}$$

$$b = \frac{\sum_{j} SEC_{b,m}^{j} - a \cdot \sum_{j} j}{7}, \tag{B.10}$$

where:

$SEC_{b,m}^{y}$ - specific electricity consumption by water drainage system *m* in period *y* of the baseline scenario, MWh/m^3;

a - coefficient of linear dependence;

b - coefficient of linear dependence;

$[m]$ - drainage system;

$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;

$[7]$ - number of years in the historical period;

$[y]$ - monitoring period;

$[b]$ - baseline period.

Specific consumption in *j* year is determined as:

$$SEC_{b,m}^{j}=EC_{b,m}^{j}/V_{b,m}^{j}, \quad (B.11)$$

where:

$EC_{b,m}^{j}$ - total electricity consumption by water drainage system *m* in period *j* in the baseline scenario, MWh;

$V_{b,m}^{j}$ - total volume of wastewater pumped over by drainage system *m* in period *j* of the baseline scenario, 1000 m^3;

$[m]$ - system of sludge drainage to sludge fields;

$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;

$[b]$ - baseline period.

GHG emissions, due to electricity consumption by air tank system *t* in period *y*

$$BE_{b,t}^{y} = V_{r,t}^{y} * SEC_{b,t}^{y} * EF_{CO_2,ELEC,y}, \quad (B.12)$$

where:

$SEC_{b,t}^{y}$ - specific electricity consumption by air tank system *t* in period *y* in the baseline scenario, MWh/1000 m^3;

$EF_{CO_2,ELEC,y}$ - specific carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine in period *y*, t CO_2e/MWh;

$V_{r,t}^{y}$ - total volume of wastewater purified by air tank system *t*, in the period *y* of the project scenario, 1000 m^3;

$[t]$ - air tank system;

$[y]$ - monitoring period;

$[b]$ - baseline period;

$[r]$ - project period.

Specific electricity consumption in the baseline scenario is calculated, taking into account the assumption of its linear increase in course of time. This linear dependence is based on historical data for the period from 1998 to 2004 using the method of least squares. Specific electricity consumption in the baseline scenario is determined by the formula:

$$SEC_{b,t}^{y} = a \cdot y + b, \quad (B.13)$$

$$a = \frac{7\sum_j (SEC_{b,t}^j \cdot j) - \sum_j SEC_{b,t}^j \cdot \sum_j j}{7\sum_j j^2 - (\sum_j j)^2},$$

(B.14)

$$b = \frac{\sum_j SEC_{b,t}^j - a \cdot \sum_j j}{7},$$

(B.15)

where:

$SEC_{b,t}^y$ - specific electricity consumption by air tank system *t* in period *y* of the baseline scenario, MWh/1000 m^3;

a - coefficient of linear dependence;

b - coefficient of linear dependence;

$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;

$[7]$ - number of years in the historical period;

$[y]$ - monitoring period;

$[b]$ - baseline period.

Specific consumption in *j* year is determined as:

$$SEC_{b,t}^j = EC_{b,t}^j / V_{b,t}^j,$$

(B.16)

where:

$EC_{b,t}^j$ - total electricity consumption by air tank system *t* in period *j* in the baseline scenario, MWh;

$V_{b,t}^j$ - total volume of wastewater treated by aerotank system *t* in period *j* of the baseline scenario, 1000 m^3;

$[t]$ - air tank system;

$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;

$[b]$ - baseline period.

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

Data/Parameter	$EF_{CO_2,ELEC,y}$
Data unit	t CO_2e/MWh
Description	Carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine in period *y*
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon dioxide emission factors for 2005 are sourced from the Operational Guidelines for Project Design Documents of Joint Implementation Projects, Volume 1: General guidelines (ERUPT) Operational Guidelines for Project Design Documents of Joint

	Implementation Projects, Volume 1: General guidelines (ERUPT)[23]). For 2006-2007: according to Table 8: "Emission factors for the Ukrainian power grid 2006-2012" Annex 2 "Standardized emission factors for UPG of Ukraine" to "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD Industrie Service GmbH on 17/08/2007[24]. Carbon dioxide emission factors for 2008 are sourced from Decree No.62 of the National Environmental Investment Agency of Ukraine (hereinafter NEIAU) dated 15/04/2011 "On approval of carbon dioxide emission factors for 2008" [25] Carbon dioxide emission factors for 2009 are sourced from NEIAU Decree No.63 dated 15/04/2011 "On approval of carbon dioxide emission factors for 2009"[26] Carbon dioxide emission factors for 2010 are sourced from NEIAU Decree No.43 dated 28/03/2011 "On approval of carbon dioxide emission factors in 2010[27]" Carbon dioxide emission factors for 2011 are sourced from NEIAU Decree No.75 dated 12/05/2011 "On approval of carbon dioxide emission factors in 2011"[28]
Value of data applied (for ex ante calculations/determinations)	see table below
Justification of the choice of data or description of measurement methods and procedures (to be) applied	If other carbon dioxide emission factors are adopted for Ukrainian power grids, the baseline will be recalculated for any reporting period in accordance with the monitoring plan.
QA/QC procedures (to be) applied	N/A
Any comment	The research did not consider electricity production by nuclear plants

Year	$EF_{CO_2,ELEC,y}$	
2005	0.896	
2006	0.896	
2007	0.896	
Year	**consumer class 1**	**consumer class 2**
2008	1.082	1.219
2009	1.096	1.237
2010	1.093	1.225
2011	1.090	1.227

Data/Parameter	$EC^{j}_{b,w}$
Data unit	MWh
Description	Total electricity required for water transportation to consumers via the water supply system *w* for the period

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

[24] http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

[25] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

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

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

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

Time of determination/monitoring	Determined prior to the start of the project in baseline years 1998-2004
Source of data (to be) used	Readings of electricity meters installed at pumping plants
Value of data applied (for ex ante calculations/determinations)	See Supporting Document 1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	AM0020 Methodology (Version 02)
QA/QC procedures (to be) applied	Measurements by meters calibrated on a regular basis
Any comment	Data to calculate greenhouse gas emissions in the project period; data will be archived in paper and electronic format.

Data/Parameter	$EC_{b,m}^{j}$
Data unit	MWh
Description	Total electricity required for wastewater transportation via the drainage system *m* by pumping plants in the period
Time of determination/monitoring	Determined prior to the start of the project in baseline years 1998-2004
Source of data (to be) used	Readings of electricity meters installed at water drainage pumping plants
Value of data applied (for ex ante calculations/determinations)	See Supporting Document 1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Electricity consumption is measured by electricity meters
QA/QC procedures (to be) applied	Measurements by meters calibrated on a regular basis
Any comment	Data to calculate greenhouse gas emissions in the project period; data will be archived in paper and electronic format.

Data/Parameter	$EC_{b,t}^{j}$
Data unit	kWh
Description	Total electricity consumption by air tank system *t* over the period
Time of determination/monitoring	Determined prior to the start of the project in baseline years 1998-2004
Source of data (to be) used	Readings of electricity meters installed at sewage treatment plants (aeration stations).
Value of data applied (for ex ante calculations/determinations)	See Supporting Document 1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Electricity consumption is measured by electricity meters
QA/QC procedures (to be) applied	Measurements by meters calibrated on a regular basis
Any comment	Data to calculate greenhouse gas emissions in the project period; data will be archived in paper and electronic format.

Data/Parameter	$V_{b,w}^{j}$
Data unit	1000 m^3
Description	Total water supplied to consumers via the water supply system *w* for the period
Time of determination/monitoring	Determined prior to the start of the project in baseline years 1998-2004
Source of data (to be) used	Readings of flow meters installed at lift stations
Value of data applied (for ex ante calculations/determinations)	See Supporting Document 1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	AM0020 Methodology (Version 02)
QA/QC procedures (to be) applied	Measurements by meters calibrated on a regular basis
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

Data/Parameter	$V_{b,m}^{j}$
Data unit	1000 m^3
Description	Total volume of wastewater pumped over by drainage system *m* over the period
Time of determination/monitoring	Determined prior to the start of the project in baseline years 1998-2004
Source of data (to be) used	Readings of flow meters (volume of wastewater) installed at sewage treatment plants (aeration stations).
Value of data applied (for ex ante calculations/determinations)	See Supporting Document 1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Company data
QA/QC procedures (to be) applied	Measurements by meters calibrated on a regular basis
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

Data/Parameter	$V_{b,t}^{j}$
Data unit	m^3
Description	Total volume of wastewater pumped over by air tank system *t* over the period
Time of determination/monitoring	Determined prior to the start of the project in baseline years 1998-2004
Source of data (to be) used	Indications of flow meters (volume of waste water) installed at sewage treatment plants (aeration stations).
Value of data applied (for ex ante calculations/determinations)	See Supporting Document 1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Company data

QA/QC procedures (to be) applied	Measurements by meters calibrated on a regular basis
Any comment	Data allowing of calculation of GHG emissions in the baseline scenario will be archived in paper and electronic format.

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:

Step 1. Indication and description of the approach applied.

The baseline scenario. In the absence of the proposed project, all equipment, including old, characterized by low efficiency, but still operable equipment, will work in a usual mode for a long time, and reduction of emissions will not take place.

The project scenario. Anthropogenic emissions of greenhouse gases in the project scenario will be decreased due to complex modernization of pumping, water-distribution and treatment equipment (aeration systems) by introduction of technologies that are proposed in the project activity and that are described above, which include replacement of old pumps with new high efficiency pumps, frequency regulators installation and modernization of old water-distribution networks, modernization of air tanks (aeration system).

Reduction of greenhouse gas emissions in the project scenario will be achieved by saving of traditional carbon fossil fuel at power plants, which will reduce emissions of tCO_2e from the national electrical grid.

Additionality of the project. In accordance with paragraph 44 (c) of the Guidance additionality of the project activity is demonstrated and assessed by using the “Tool for the demonstration and assessment of additionality"[29] (Version 6.0.0). This manual was elaborated in original for CDM projects, but it may be also applied to JI projects.

Step 2. Application of the approach chosen

STEP 1: Identification of alternatives to the project activity and their consistency with current laws and regulations

Sub-Step 1a: Define alternatives to the project activity

There are three alternatives of this project.

Alternative 1.1: continuation of existing situation (there aren’t any project activities or other alternatives), i.e. scenario “business as usual” with carrying out of minimal repair works against the background of total degradation of the water supply, drainage and wastewater treatment system.

It should be noted that there is no local legislation in relation to the period of replacement of pumps, air tanks and their maximal period of operation. Customary practice is exploitation of pumps installed in the 1970th or even 1950-1960th years and earlier, if they underwent technical examination of the authorized body (State Inspectorate of Labour Protection).

Alternative 1.2: modernization (the proposed project activity) without involving of the Joint Implementation mechanism.

Alternative 1.3: reduction of the project activity, exclusion of any non-core measures from the project, for example, exclusion of frequency regulation from the project implementation, etc.

Outcome of Sub-Step 1a: Three realistic alternatives to the project activity were identified.

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

Sub-Step 1b: Consistency of the alternatives with mandatory laws and regulations

Alternative 1.1: According to the Ukrainian Law "On drinking water and drinking water supply"[30] entrepreneurial activity in the sphere of supply of drinking water to consumers is subject to licensing. There aren't any legislative documents binding the CE "Dniprovodokanal" to modernize pumping equipment, water treatment and water-distribution networks. In accordance with the law "On drinking water and drinking water supply"[31] the enterprise is obliged only to maintain the system in good running order and prevent accidents. Current practice of water losses detection and repair corresponds to all current laws and standards of Ukraine. Legislation admits water losses. Standards stipulate only periodicity of calculations of water losses from water-distribution networks to be made by the water-distribution organizations. The practice of water loss detection at CE "Dniprovodokanal" corresponds to stated standards. Control of adherence to the standards is executed by calculation of water loss of distribution systems once per 10 years.
The project is also consistent with existing regulatory requirements in Ukraine relating to detection of water loss at water-distribution networks, and to any other current applicable legislative norms.
Moreover, Ukraine has Decree from February 5, 1997 # 148 "On Complex State Programme on Energy Saving of Ukraine"[32], that was created to ensure the efficient use of energy resources and promote energy independence of Ukraine. However, the measures that will be implemented by the project are not mandatory under this document.

Alternative 1.2: Modernization without the JI mechanisms is consistent with statutory laws and decrees; detailed information about analysis of consistency with the legislation was provided in relation to *Alternative 1.1*.
Alternative 1.3: Modernization without the JI mechanisms and with exclusion of any non-core measures from the project shall be consistent with statutory laws and decrees; detailed information about analysis of consistency with the legislation was provided in relation to *Alternative 1.1*

Outcome of Sub-Step 1b: Under such conditions one may say that all scenarios don't contradict current laws and regulatory acts. Hence, the **Step 1** is satisfied.

STEP 2: Investment analysis

According to the "Tool for the demonstration and assessment of additionality"[33] (Version 6.0.0), investment analysis is not mandatory if barrier analysis is applied.

STEP 3: Barrier analysis

Sub-step 3a: Identification of barriers that would prevent the implementation of the proposed project activity

Financial barriers

Additional expenses on the project implementation include the costs of:

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[30] http://zakon3.rada.gov.ua/laws/show/2918-14

[31] http://zakon2.rada.gov.ua/laws/show/2918-14

[32] http://zakon3.rada.gov.ua/laws/show/148-97-п

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

Period	Cost of modernization, mln. grn.						
	Modernization of current pumping equipment	Purchase and introduction of new pumping equipment	Purchase and introduction of valves	Purchase and replacement of water-supply networks	Installation of a new group of metering devices	Purchase and introduction of frequency regulators	Modernization of air tanks (aeration system)
30/11/2004 - 31/12/2012	1.04	41.7	3.2	55.42	0.26	18.19	9.83

Additional financial costs include design and forecast operating costs of the project, based on the calculation of technical experts in this field of activity and JI projects wich have been implemented before.
(“Modernization of water supply and drainage system "Luganskvoda Ltd."[34]”, “Development and improvement of water supply system, drainage system and wastewater treatment of city communal enterprise “Mykolayivvodokanal”[35]”, “Development and improvement of water supply system, drainage system and wastewater treatment of "Infox Ltd." branch "Infoxvodokanal"[36]”).
Financial barriers are connected with the structure of existing tariffs for water supply that are regulated by the state, and don’t include depreciation and investment needs of water suppliers. Such situation leads to permanent lack of funds and impossibility of timely performance of capital repair, ensuring of equipment operation, investment in modernization and development of water-supply infrastructure.

Technological barriers

The project includes the installation and operation of equipment that is new to Ukraine.

In Ukraine (or neighbouring countries with similar levels of access to technology and financial resources), there are no similar projects implemented that are not registered as JI / CDM projects.
Ukraine already has the experience in introduction of new fiberglass pipes, pumping equipment, aeration system components at water supply and wastewater drainage companies, but this is not a common practice. Due to this fact the operation of such equipment may be considered as technological barrier.

Organizational barriers

Experience in JI projects implementation management including conducting of international negotiations, validation, verification, registration, monitoring, etc. is absent.

Outcome of Sub-step 3a: Thus, the identified barriers that prevent the implementation of the proposed project activity.

Sub-step 3b: Demonstration of the fact that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

One of the alternatives is continuation of “business as usual”. Since the barriers identified above directly relate to investment in modernization of the water supply, drainage and wastewater treatment system in the city of Dnipropetrovsk, CE “Dniprovodokanal” doesn’t have any obstacles for further exploitation of the water supply system at the previous level.

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[34] http://ji.unfccc.int/JIITLProject/DB/UM92XEB0QFT42Z3UDKOX9QDY30YPL9/details

[35] http://ji.unfccc.int/JIITLProject/DB/YJQJMA903XJMSOIFU64OAAIT4I4JV8/details

[36] http://ji.unfccc.int/JIITLProject/DB/7PE5JHSBJFO0Y6V8URCHW2V2GS1NPY/details

Outcome of Sub-step 3b: Identified barriers can impede the implementation of the proposed project but do not impede introduction of at least one alternative scenario – continuation of "business as usual". Therefore Step 3 is satisfied.

STEP 4: Common practice analysis

Sub-step 4a. Analysis of other activities similar to the proposed project activity
Analysis of project activity similarity demonstrated absence of similar JI projects in Ukraine are :

- Modernization of water supply and drainage system "Luganskvoda Ltd."[37] is similar project.
- Development and improvement of water supply system, drainage system and wastewater treatment of city communal enterprise “Mykolayivvodokanal”[38]
- Development and improvement of water supply system, drainage system and wastewater treatment of "Infox Ltd." branch "Infoxvodokanal"[39].

These projects have been realized through the sale of emission reduction units.
Absence of financial incentives, described in Step 2 and barriers described in Step 3, relate not only to CE “Dniprovodokanal”, but also other companies operating water-distribution networks in Ukraine. In this respect existing practice of equipment maintenance represented in the variant of baseline conditions chosen for this Project is customary for Ukraine. Due to current practice all losses of electric energy are borne by end consumers of water supply services (population and companies in Dnipropetrovsk city); that is why water supply companies don’t have incentives for energy effective projects implementation.
Outcome of sub-step 4a: As a whole the same pumping equipment and water-distribution, drainage networks are used in Ukraine as in the city of Dnipropetrovsk.

Sub-step 4b. Analysis of any similar alternatives

N/A

Provision of additionality proofs

CONCLUSION

Based on the requirements of additionality demonstration mechanism, the proposed project is additional to the one that might take place in the case the project implementation doesn’t occur.

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

Geographical boundary of the project coincides with the territory of the city of Dnipropetrovsk and Dnipropetrovsk region. CE “Dniprovodokanal” is divided into subdepartments and departments. Water supply system, drainage system and wastewater treatment system of CE “Dniprovodokanal” are within the project boundary. Detailed list of facilities is provided in Supporting Document 2.

Sources of greenhouse gases and boundary of the baseline scenario

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[37] http://ji.unfccc.int/JIITLProject/DB/UM92XEB0QFT42Z3UDKOX9QDY30YPL9/details

[38] http://ji.unfccc.int/JIITLProject/DB/YJQJMA903XJMSOIFU64OAAIT4I4JV8/details

[39] http://ji.unfccc.int/JIITLProject/DB/7PE5JHSBJFO0Y6V8URCHW2V2GS1NPY/details

Activities of CE "Dniprovodokanal" are associated with the following GHG emissions:
• CO_2 – due to consumption of electric energy generated in the process of fossil fuel combustion at a thermal power plant.

Table 16. The table shows an overview of all sources of emissions in the baseline scenario

Source of emissions	Gas	Included or excluded	Explanations
Baseline emissions			
Emissions from power plant(s) in the process of electric energy generation for the national power grid	CO_2	Included	Source of emissions
	CH_4	Excluded	Is not included for reasons of simplification. Analysis is conservative
	N_2O	Excluded	Is not included for reasons of simplification. Analysis is conservative

Project boundary for the baseline scenario is represented in black rectangle in the graphic figure (Figure 8)

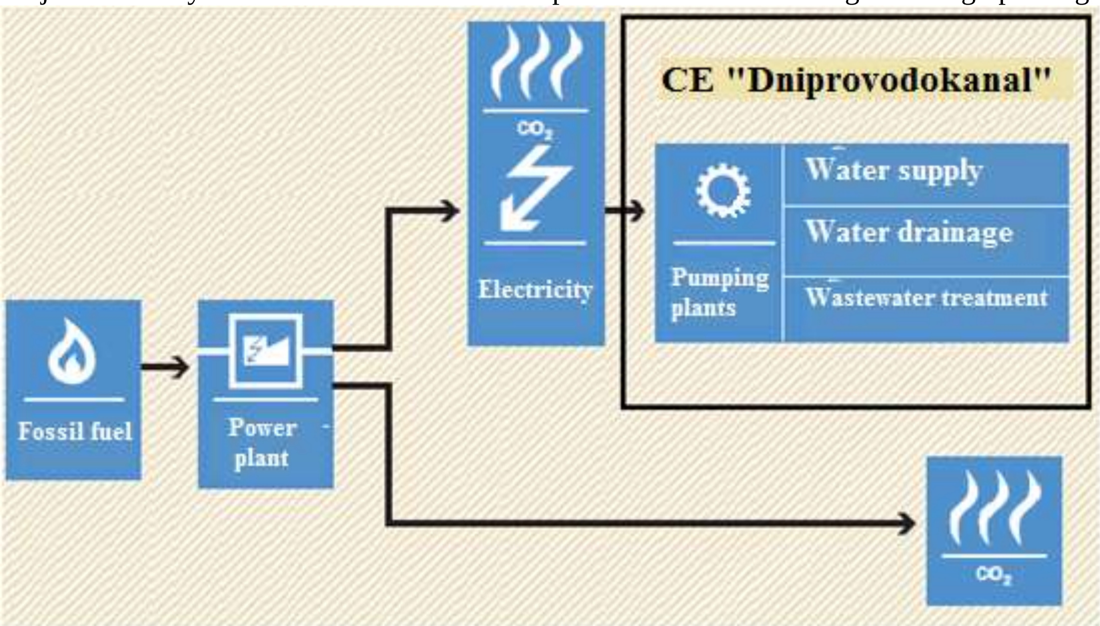

Figure 8. Project boundary for the baseline scenario

Sources of greenhouse gases and boundary of the project scenario:

Activities of CE "Dniprovodokanal" are associated with the **following GHG emissions**:
• CO_2 – due to consumption of electric energy generated in the process of fossil fuel combustion at a thermal power plant.
The following table provides an overview of GHG emission sources.

Table 17. The table shows an overview of all emission sources in the project scenario

Source of emissions	Gas	Included or excluded	Explanations
Project emissions			
Emissions from power plant(s) in the process of generation of electric energy	CO_2	Included	Source of emissions
	CH_4	Excluded	Is not included for reasons of simplification. Analysis is conservative

for the state electric energy grid	N_2O	Excluded	Is not included for reasons of simplification. Analysis is conservative

Project boundary for the project scenario is represented in black rectangle in graphic figure (Figure 9).

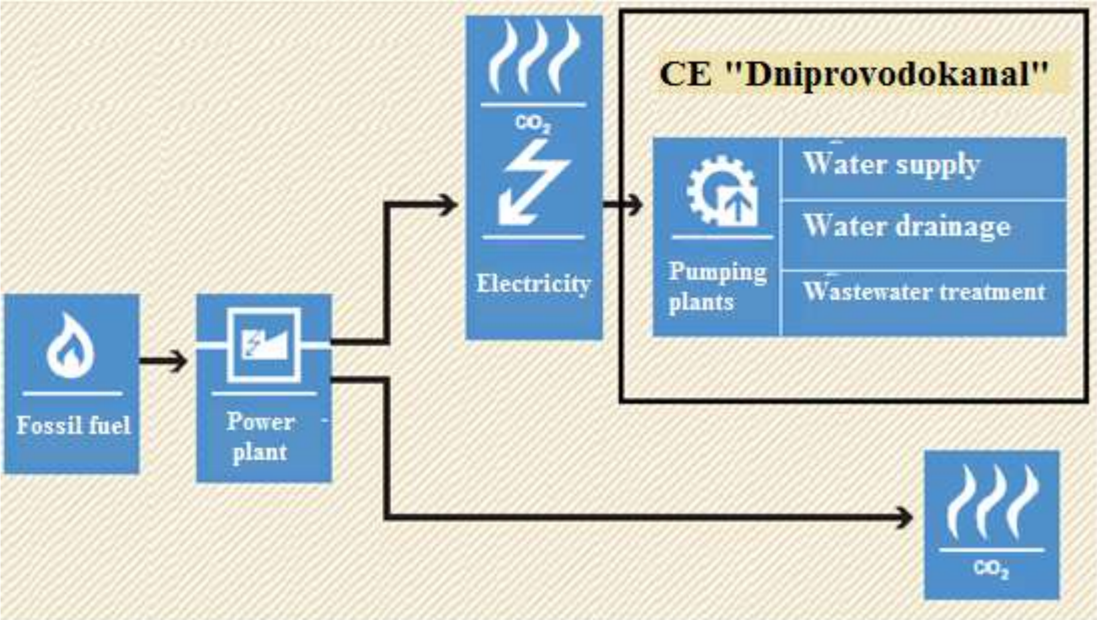

Figure 9. Project boundary for the project scenario

Indirect extraneous leakage of CO_2, CH_4, N_2O from fuel production and its transportation are excluded. Leakages are not controlled by the project developer (it is impossible to estimate quantity of leakages), due to this fact they were excluded.

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

Date of baseline setting: 12/12/2011
The baseline was set by VEMA S.A., the project developer, and CE "Dniprovodokanal", the owner of the project.
VEMA S.A.:
Genève, Switherland.
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).

CE "Dniprovodokanal":
Dnipropetrovsk city, Ukraine
Kostiantyn Orel, Acting Director

Telephone: +38(056) 744-64-60
e-mail: Vodokanal@dp.ukrtel.net, Dniprovodokanal@optima.com.ua
CE “Dniprovodokanal” is the project participant (stated in Annex 1).

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

The starting date of the project activity is deemed 30/11/2004, when it was commissioned equipment on one of the pumping stations of CE "Dniprovodokanal".

C.2. Expected operational lifetime of the project:

November 30, 2004 – December 31, 2020 (16 years and one month, or 193 months).
Real average life-cycle of new equipment for pumps and water-distribution networks, equipment is estimated to be about 30-40 years and it is confirmed by the equipment certificates. Following the principle of conservatism the life-cycle of the project will be 16 years and one month.

C.3. Length of the crediting period:

The date on which first emission reduction units are expected to be generated was taken as the starting date of the crediting period, namely January 1, 2005. Crediting period not exceeding operational lifetime of the project.

- 01/01/2005 – 31/12/2007 - the period of early credits, 3 years or 36 months (the project will qualify for an early test of quotas in accordance with Article 17 of the Kyoto Protocol);
- 01/01/2008 – 31/12/2012 рр. – crediting period (the period of liability), 5 years or 60 months;
- 01/01/2013 – 31/12/2020 рр. – статус скорочення викидів або збільшення чистої абсорбції створених проектами СВ після status of emission reductions or enhancements of removals generated JI after the first commitment period under the Kyoto Protocol (lengthening of the crediting period after 2012) may be determined in accordance with appropriate arrangements and procedures under the UNFCCC and host Party (crediting period will be extended by 8 years/96 months to 31 December 2020).

If after the first commitment period under the Kyoto Protocol its validity is prolonged, the crediting period under the project will be prolonged by 8 years/96 months until December 31, 2020.
Thus, the total crediting period is from January 1, 2005 to December 31, 2020 (16 years or 192 months).

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

Step 1. Indication and description of the approach chosen regarding monitoring.

a)The choice of the baseline and monitoring is made according to requirements of the Guidance on criteria for baseline setting and monitoring with consideration of Decision 9/CMP.1[40], Appendix «B» "Criteria for baseline setting and monitoring" and pp.23-29 of the "Guidance on criteria for baseline setting and monitoring" (version 03)[41], and using a stepwise approach, defined in the "Guidelines for users of the JI PDD form" (version 04) [42]. According to these Guidances, the project developer uses JI specific approach and elements of AM0020 "Baseline methodology for water pumping efficiency improvements" (version 02[43]) to establish monitoring. All key parameters required for calculation of GHG emission volumes are taken the same way as they used to at CE "Dniprovodokanal", for measuring fuel, energy, waste materials and environmental impact. Monitoring under the project does not require changes in existing data accounting and collection system. All data is calculated and recorded in any case. All leakage was considered and taken into account using the conservative approach and seen as insignificant. Refer to section E.2. Monitoring plan data should be stored for at least 2 years after the crediting period.

Step 1. Application of the approach chosen

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

$EC_{b,w}^{j}$	Total electricity consumption by water supply system *w* in period *j* in the baseline scenario, MWh
$EC_{b,m}^{j}$	Total electricity consumption by water drainage system *m* in period *j* in the baseline scenario, MWh
$EC_{b,t}^{j}$	Total electricity consumption by air tank system *t* in period *j* in the baseline scenario, MWh
$V_{b,w}^{j}$	Total water pumped by water supply system *w* in period *j* in the baseline scenario, 1000 m^3
$V_{b,m}^{j}$	Total volume of wastewater pumped over by drainage system *m* in period *j* of the baseline scenario, 1000 m^3.

[40] *http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=2*

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

[42] *http://ji.unfccc.int/Ref/Documents/Guidelines.pdf*

[43] *http://cdm.unfccc.int/filestorage/C/D/M/CDMWF_AM_K96TMFSTMHPPDMHSR8A5R3SJHLG32F/AM0020_was_NM0042rev_ver2_AM.pdf?t=V0x8bTlndWp5fDCApnmpFBIxtGUTeirChrfq*

$V_{b,t}^{j}$	Total volume of wastewater treated by air tank system *t* in period *j* of the baseline scenario, 1000 m^3

b) Data and parameters that are not monitored throughout the crediting period, but are determined only once but that are not available already at the stage of PDD development: none

c) Data and parameters that are monitored throughout the crediting period:

EF_{y}	Carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine in period *y*, t CO_2eq/MWh
$V_{r,w}^{y}$	Total water pumped by water supply system *w* in period *y* in the project scenario, 1000 m^3
$V_{r,m}^{y}$	Total volume of wastewater pumped over by drainage system *m* in period *y* of the project scenario, 1000 m^3
$V_{r,t}^{y}$	Total volume of wastewater purified by air tank system *t*, in the period *y* of the project scenario, 1000 m^3
$EC_{r,w}^{y}$	Total electricity consumption by water supply system *w* in period *y* in the project scenario, MWh
$EC_{r,m}^{y}$	Total electricity consumption by water drainage system m in period *y* in the project scenario, MWh
$EC_{r,t}^{y}$	Total electricity consumption by air tank system *t* in period *y* of the project scenario, MWh

Tables of parameters for monitoring and verification of ERU calculation are 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 in 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:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1-M	$V_{r,w}^{y}$ - total water pumped	Readings of flow meters installed at lift stations and	1000 m^3	M	Daily	Company data	Data will be archived in paper and	Data to calculate greenhouse gas

	by water supply system w in period y in the project scenario	pumping plants					electronic format.	emissions. See Accompanying document 1.
2-M	$V_{r,m}^{y}$ - total volume of wastewater pumped over by drainage system m in period y of the project scenario	Readings of flow meters (volume of wastewater) installed at sewage treatment plants.	1000 m^3	M	Daily	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.
3-M	$V_{r,t}^{y}$ - total volume of wastewater purified by air tank system t, in the period y of the project scenario	Readings of flow meters (volume of waste water) installed at sewage treatment plants.	1000 m^3	M	Daily	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.
4-M	$EC_{r,w}^{y}$ - total electricity consumption by water supply system w in period y in the project scenario	Readings of electricity meters installed at lift stations and pumping plants	MWh	M	Monthly	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.
5-M	$EC_{r,m}^{y}$ - total electricity consumption by water drainage system m in period y in the project scenario	Readings of electricity meters installed at water drainage pumping plants	MWh	M	Monthly	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.

6-M	$EC_{r,t}^{y}$ - total electricity consumption by air tank system t in period y of the project scenario	Readings of electricity meters installed at sewage treatment plants.	MWh	M	Monthly	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.
7- M	$EF_{CO_2,ELEC,y}$ - carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine	See B.1.	t CO_2e/MWh	C	Every year	See B.1.	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See B.1.

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

$$PE_{r,e}^{y} = PE_{r,w}^{y} + PE_{r,m}^{y} + PE_{r,t}^{y}, \qquad \text{(D.1)}$$

where:

$PE_{r,w}^{y}$ - GHG emissions, due to electricity consumption by water supply system *w* in period *y* in the project scenario, t CO_2e;

$PE_{r,m}^{y}$ - GHG emissions, due to electricity consumption by water drainage system *m* in period *y* in the project scenario, t CO_2e;

$PE_{r,t}^{y}$ - GHG emissions, due to electricity consumption by air tank system *t* in period *y* in the project scenario, t CO_2e;

$[w]$ - water supply system;

$[m]$ - drainage system;

$[t]$ - air tank system;

$[y]$ - monitoring period;

$[r]$ - index for reporting period.

GHG emissions due to electricity consumption by pumping equipment used by water supply system *w*

$$PE_{r,w}^{y} = EC_{r,w}^{y} * EF_{CO_2,ELEC,y},\tag{D.2}$$

where:

$EF_{CO_2,ELEC,y}$ - carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine, t CO_2e/MWh;

$EC_{r,w}^{y}$ - total electricity consumption by water supply system *w* in period *y* in the project scenario, MWh;

$[w]$ - water supply system;

$[y]$ - monitoring period;

$[r]$ - index for reporting period.

GHG emissions due to electricity consumption by water drainage system *m*

$$PE_{r,m}^{y} = EC_{r,m}^{y} * EF_{CO_2,ELEC,y},\tag{D.3}$$

where:

$EF_{CO_2,ELEC,y}$ - carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine, t CO_2e/MWh;

$EC_{r,m}^{y}$ - total electricity consumption by water drainage system m in period *y* in the project scenario, MWh;

$[m]$ - drainage system;

$[y]$ - monitoring period;

$[r]$ - project period.

GHG emissions, due to electricity consumption by air tank system *t* in period *y*

$$PE_{r,t}^{y} = EC_{r,t}^{y} * EF_{CO_2,ELEC,y},\tag{D.4}$$

where:

$EF_{CO_2,ELEC,y}$ - carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine, t CO_2e/MWh;

$EC_{r,t}^{y}$ - total electricity consmption by air tank system *t* in period *y* of the project scenario, MWh;

$[t]$ - air tank system;

$[y]$ - monitoring period;

$[r]$ - project period.

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

1-B	$V_{b,w}^{j}$ - total water pumped by water supply system *w* in period *j* in the baseline scenario	Readings of flow meters installed at lift stations and pumping plants	1000 m^3	M	Daily	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.
2-B	$V_{b,m}^{j}$ - total volume of wastewater pumped over by drainage system *m* in period *j* of the baseline scenario	Readings of flow meters (volume of wastewater) installed at sewage treatment plants.	1000 m^3	M	Daily	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.
3-B	$V_{b,t}^{j}$ - total volume of wastewater treated by aerotank system *t* in period *j* of the baseline scenario	Readings of flow meters (volume of waste water) installed at sewage treatment plants.	1000 m^3	M	Daily	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.

4-B	$EC_{b,w}^{j}$ - total electricity consumption by water supply system *w* in period *j* in the baseline scenario	Readings of electricity meters installed at lift stations and pumping plants	MWh	V	Monthly	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.
5-B	$EC_{b,m}^{j}$ - total electricity consumption by water drainage system *m* in period *j* in the baseline scenario	Readings of electricity meters installed at water drainage pumping plants	MWh	V	Monthly	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.
6-B	$EC_{b,t}^{j}$ - total electricity consumption by aerotank system *t* in period *j* in the baseline scenario	Readings of electricity meters installed at sewage treatment plants.	MWh	V	Monthly	Company data	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See Accompanying document 1.

7-B	$EF_{CO_2,ELEC,y}$ - carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine	See in B.1.	t CO_2e/MWh	C	Every year	See B.1.	Data will be archived in paper and electronic format.	Data to calculate greenhouse gas emissions. See B.1.

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

$$BE_{b,e}^{y} = BE_{b,w}^{y} + BE_{b,m}^{y} + BE_{b,t}^{y}, \qquad (D.5)$$

where:

$BE_{b,w}^{y}$ - GHG emissions due to electricity consumption by water supply system *w* in period *y* in the baseline scenario, t CO_2e;

$BE_{b,m}^{y}$ - GHG emissions due to electricity consumption by water drainage system *m* in period *y* in the baseline scenario, t CO_2e;

$BE_{b,t}^{y}$ - GHG emissions, due to electricity consumption by air tank system *t* in period *y* in the baseline scenario, t CO_2e;

$[e]$ - electricity consuming system;

$[w]$ - water supply system;

$[m]$ - drainage system;

$[t]$ - air tank system;

$[y]$ - monitoring period;

$[b]$ - baseline period.

GHG emissions due to electricity consumption by pumping equipment used by water supply system *w*

$$BE^{y}_{b,w} = V^{y}_{r,w} * SEC^{y}_{b,w} * EF_{CO_2,ELEC,y}, \qquad \text{(D.6)}$$

where:

$SEC^{y}_{b,w}$ - specific electricity consumption by water supply system *w* in period *y* in the baseline scenario, MWh/1000 m^3;

$EF_{CO_2,ELEC,y}$ - specific carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine in period *y*, t CO_2e/MWh;

$V^{y}_{r,w}$ - total water pumped by water supply system *w* in period *y* in the project scenario, 1000 m^3;

$[w]$ - water supply system;

$[y]$ - monitoring period;

$[b]$ - baseline period;

$[r]$ - project period.

Specific electricity consumption in the baseline scenario is calculated, taking into account the assumption of its linear increase in course of time. This linear dependence is based on historical data for the period from 1998 to 2004 using the method of least squares. Specific electricity consumption in the baseline scenario is determined by the formula:

$$SEC^{y}_{b,w} = a \cdot y + b, \qquad \text{(D.7)}$$

$$a = \frac{7\sum_{j}(SEC^{j}_{b,w} \cdot j) - \sum_{j} SEC^{j}_{b,w} \cdot \sum_{j} j}{7\sum_{j} j^2 - (\sum_{j} j)^2}, \qquad \text{(D.8)}$$

$$b = \frac{\sum_{j} SEC^{j}_{b,w} - a \cdot \sum_{j} j}{7}, \qquad \text{(D.9)}$$

where:

$SEC^{y}_{b,w}$ - specific electricity consumption by water supply system *w* in period *y* in the baseline scenario, MWh/1000 m^3;
a - coefficient of linear dependence;
b - coefficient of linear dependence;
$[w]$ - water supply system;
$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;
$[7]$ - number of years in the historical period;
$[y]$ - monitoring period;
$[b]$ - baseline period.

Specific consumption in *j* year is determined as:

$$SEC^{j}_{b,w} = EC^{j}_{b,w} / V^{j}_{b,w}, \qquad \text{(D.10)}$$

where:
$EC^{j}_{b,w}$ - total electricity consumption by water supply system *w* in period *j* of the baseline scenario, MWh;
$V^{j}_{b,w}$ - total water pumped by water supply system *w* in period *j* of the baseline scenario, 1000 m^3;
$[w]$ - water supply system;
$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;
$[b]$ - baseline period.

GHG emissions due to electricity consumption by water drainage system *m*

$$BE_{b,m}^{y} = V_{r,m}^{y} * SEC_{b,m}^{y} * EF_{CO_2,ELEC,y} \,, \qquad \text{(D.11)}$$

where:

$SEC_{b,m}^{y}$ - specific electricity consumption by water drainage system *m* in period *y* of the baseline scenario, MWh/1000 m^3;

$EF_{CO_2,ELEC,y}$ - specific carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine in period *y*, t CO_2eq/MWh;

$V_{r,m}^{y}$ - total volume of wastewater pumped over by drainage system *m* in period *y* of the project scenario, 1000 m^3;

$[m]$ - drainage system;

$[y]$ - monitoring period;

$[b]$ - baseline period;

$[r]$ - project period.

Specific electricity consumption in the baseline scenario is calculated, taking into account the assumption of its linear increase in course of time. This linear dependence is based on historical data for the period from 1998 to 2004 using the method of least squares. Specific electricity consumption in the baseline scenario is determined by the formula:

$$SEC_{b,m}^{y} = a \cdot y + b, \qquad \text{(D.12)}$$

$$a = \frac{7\sum_j (SEC_{b,m}^{j} \cdot j) - \sum_j SEC_{b,m}^{j} \cdot \sum_j j}{7\sum_j j^2 - (\sum_j j)^2} \,, \qquad \text{(D.13)}$$

$$b = \frac{\sum_j SEC_{b,m}^{j} - a \cdot \sum_j j}{7} \,, \qquad \text{(D.14)}$$

where:

$SEC_{b,m}^{y}$ - specific electricity consumption by water drainage system *m* in period *y* of the baseline scenario, MWh/m^3;

a - coefficient of linear dependence;

b - coefficient of linear dependence;

$[m]$ - drainage system;

$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;

$[7]$ - number of years in the historical period;

$[y]$ - monitoring period;

$[b]$ - baseline period.

Specific consumption in *j* year is determined as:

$$SEC_{b,m}^{j} = EC_{b,m}^{j} / V_{b,m}^{j}, \quad (D.15)$$

where:

$EC_{b,m}^{j}$ - total electricity consumption by water drainage system *m* in period *j* in the baseline scenario, MWh;

$V_{b,m}^{j}$ - total volume of wastewater pumped over by drainage system *m* in period *j* of the baseline scenario, 1000 m^3;

$[m]$ - system of sludge drainage to sludge fields;

$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;

$[b]$ - baseline period.

GHG emissions, due to electricity consumption by air tank system *t* in period *y*

$$BE_{b,t}^{y} = V_{r,t}^{y} * SEC_{b,t}^{y} * EF_{CO_2,ELEC,y}, \quad (D.16)$$

where:

$SEC^{y}_{b,t}$ - specific electricity consumption by air tank system *t* in period *y* in the baseline scenario, MWh/1000 m^3;

$EF_{CO_2,ELEC,y}$ - specific carbon dioxide emission factors from electricity consumption from the national power grid of Ukraine in period *y*, t CO_2e/MWh;

$V^{y}_{r,t}$ - total volume of wastewater purified by air tank system *t*, in the period *y* of the project scenario, 1000 m^3;

$[t]$ - air tank system;

$[y]$ - monitoring period;

$[b]$ - baseline period;

$[r]$ - project period.

Specific electricity consumption in the baseline scenario is calculated, taking into account the assumption of its linear increase in course of time. This linear dependence is based on historical data for the period from 1998 to 2004 using the method of least squares. Specific electricity consumption in the baseline scenario is determined by the formula:

$$SEC^{y}_{b,t} = a \cdot y + b, \quad \text{(D.17)}$$

$$a = \frac{7\sum_{j}(SEC^{j}_{b,t} \cdot j) - \sum_{j} SEC^{j}_{b,t} \cdot \sum_{j} j}{7\sum_{j} j^2 - (\sum_{j} j)^2}, \quad \text{(D.18)}$$

$$b = \frac{\sum_{j} SEC^{j}_{b,t} - a \cdot \sum_{j} j}{7}, \quad \text{(D.19)}$$

where:

$SEC^{y}_{b,t}$ - specific electricity consumption by air tank system *t* in period *y* of the baseline scenario, MWh/1000 m^3;

a - coefficient of linear dependence;

b - coefficient of linear dependence;

$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;

$[7]$ - number of years in the historical period;

$[y]$ - monitoring period;

$[b]$ - baseline period.

Specific consumption in *j* year is determined as:

$$SEC_{b,t}^{j} = EC_{b,t}^{j} / V_{b,t}^{j},$$ (D.20)

where:

$EC_{b,t}^{j}$ - total electricity consumption by air tank system *t* in period *j* in the baseline scenario, MWh;

$V_{b,t}^{j}$ - total volume of wastewater treated by aerotank system *t* in period *j* of the baseline scenario, 1000 m^3;

$[t]$ - air tank system;

$[j]$ - historical period $j \in \{1998, 1999, 2000, 2001, 2002, 2003, 2004\}$;

$[b]$ - baseline period.

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:

No leakage. Dynamic baseline (based on data collected for monitoring) excludes all possible leakages.

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

No leakage is expected.

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

No leakage is expected.

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):

Emission Reduction Units (ERU), t CO_2e:

$$ER^{y} = BE_b^y - PE_r^y, \qquad (D.21)$$

where:

ER^{y} - emission reduction units, t CO_2e;

BE_b^y - GHG emissions in period y in the baseline scenario, t CO_2e;

PE_r^y - GHG emissions in period y in the project scenario, t CO_2e;

$[y]$ - monitoring period;

$[b]$ - baseline period;

$[r]$ - project period.

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:

Main ecological Law of Ukraine:
Law of Ukraine "On environmental protection"[44]
CE "Dniprovodokanal" will systematically collect data on pollution, which may have a negative impact on the environment. Skilled workers of CE "Dniprovodokanal" will be engaged in monitoring, meter's data collection (electricity meters, flow meters) and archiving (See F.1.).
All data should be stored for 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.
D.1.1.1 та D.1.1.3.: 1-M 3…M, 1-B…3-B	Low	Meters shall be calibrated according to the national standards by independent authority (refer to Annex 3).
D.1.1.1 та D.1.1.3.: 4-M…7-M, 4-B…7-B	Low	Meters shall be calibrated according to the national standards by independent authority (refer to Annex 3).

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

[44] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1264-12

Operational structure includes Supplier's (CE "Dniprovodokanal") operational departments (repair-and-renewal operations, etc.) and personnel for pumping plants operation. See Figure 3.B.1., Annex 3.
Management structure includes administration departments of the Supplier and specialists – developers of the project (VEMA S.A.).
Detailed operational structure and management structure is provided in the Annex 3.

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

The monitoring plan is determined by VEMA S.A., project's developer, and CE "Dniprovodokanal", supplier of the project.

VEMA S.A.:
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Fabian Knodel,
Director.
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Fax: +41 (76) 346-11-57
e-mail: info@vemacarbon.com
VEMA S.A. is the project participant (stated in Annex 1).

CE "Dniprovodokanal"
Dnipropetrovsk, Ukraine
Kostiantyn Orel, Deputy Director
Phone: +38(056) 744-64-60 e-mail:
e-mail: Vodokanal@dp.ukrtel.net, Dniprovodokanal@optima.com.ua
CE "Dniprovodokanal" is a project participant (Annex 1).

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Since it is impossible to apply methodological calculations described in Section D (Project monitoring plan) for preliminary estimation of project emission reductions, specific formulae were elaborated and used for preliminary estimation of project emission reductions, stated in Supporting Document 1.
Results of corresponding calculations with application of these formulae are given in Supporting Documents 1, 2, 3. These calculations are based on improvement of equipment efficiency. Identifiers of parameters corresponding to these formulae are stated in Supporting Documents 1, 2, 3.

Supporting Document 1 – Calculation of estimated greenhouse gases emissions.
Supporting Document 2 – Replacement and modernization of water supply system pumping plants.
Supporting Document 3 – Replacement and modernization of water supply networks.
GHG emission reductions were estimated in the project by means of the following calculations (See Supporting Document 1).

Table 18. Estimated project emissions before the first commitment period (2005-2007)

	Years
Length of the crediting period	3
Year	Estimate of annual project emissions in tonnes of CO_2 equivalent
2005	146 972
2006	142 041
2007	135 567
Total estimated project emissions over the crediting period (tonnes of CO_2 equivalent)	424 580
Annual average project emissions over the crediting period (tonnes of CO_2 equivalent)	141 527

Table 19. Estimated project emissions during the first commitment period (2008-2012)

	Years
Length of the crediting period	5
Year	Estimate of annual project emissions in tonnes of CO_2 equivalent
2008	165 360
2009	154 279
2010	144 050
2011	129 573
2012	129 573
Total estimated project emissions over the crediting period (tonnes of CO_2 equivalent)	722 835
Annual average project emissions over the crediting period	144 567

(tonnes of CO_2 equivalent)	

Table 20. Estimated project emissions after the first commitment period (2013-2020)

	Years
Length of the crediting period	8
Year	Estimate of annual project emissions in tonnes of CO_2 equivalent
2013	129 573
2014	129 573
2015	129 573
2016	129 573
2017	129 573
2018	129 573
2019	129 573
2020	129 573
Total estimated project emissions over the crediting period (tonnes of CO_2 equivalent)	1 036 584
Annual average project emissions over the crediting period (tonnes of CO_2 equivalent)	129 573

Detailed information on calculations is provided in Supporting Documents 1, 2, 3.

E.2. Estimated leakage:

No leakages are expected.

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

Since no leakage is expected, the sum of E.1 and E.2 equals E.1 (see Table 18-20).

E.4. Estimated baseline emissions:

For preliminary estimation of project emission reductions specific formulae stated in Supporting Document 1 were elaborated and applied.

Table 21. Estimated baseline emissions before the first commitment period (2005-2007)

	Years
Length of the crediting period	3
Year	Estimate of annual baseline emissions in tonnes of CO_2 equivalent
2005	200 514
2006	214 706
2007	215 769
Total estimated baseline emissions over the	630 989

crediting period (tonnes of CO_2 equivalent)	
Annual average baseline emissions over the crediting period (tonnes of CO_2 equivalent)	210 330

Table 22. Estimated project emissions during the first commitment period (2008-2012)

	Years
Length of the crediting period	5
Year	Estimate of annual baseline emissions in tonnes of CO_2 equivalent
2008	279 956
2009	261 782
2010	247 613
2011	213 982
2012	213 982
Total estimated baseline emissions over the crediting period (tonnes of CO_2 equivalent)	1 217 315
Annual average baseline emissions over the crediting period (tonnes of CO_2 equivalent)	243 463

Table 23. Estimated baseline emissions after the first commitment period (2013-2020)

	Years
Length of the crediting period	8
Year	Estimate of annual baseline emissions in tonnes of CO_2 equivalent
2013	213 982
2014	213 982
2015	213 982
2016	213 982
2017	213 982
2018	213 982
2019	213 982
2020	213 982
Total estimated baseline emissions over the crediting period (tonnes of CO_2 equivalent)	1 711 856
Annual average baseline emissions over the crediting period (tonnes of CO_2 equivalent)	213 982

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

Project emission reductions = Baseline emissions - (Project emissions + Estimated leakage)
The results of emission reductions calculation are provided in Tables 24-26 below.

Table 24. Estimated emission reductions before the first commitment period (2005-2007)

	Years
Length of the crediting period	3
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2005	53 542
2006	72 665
2007	80 202
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	206 409
Annual average estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	68 803

Table 25. Estimated emission reductions for 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	114 596
2009	107 503
2010	103 563
2011	84 409
2012	84 409
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	494 480
Annual average estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	98 896

Table 26. Estimated emission reductions after 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	84 409
2014	84 409
2015	84 409
2016	84 409
2017	84 409

2018	84 409
2019	84 409
2020	84 409
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	675 272
Annual average estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	84 409

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

Table 27. Estimated emission reductions before the first commitment period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2005	146 972	0	200 514	53 542
2006	142 041	0	214 706	72 665
2007	135 567	0	215 769	80 202
Total (tonnes of CO_2 equivalent)	424 580	0	630 989	206 409

Table 28. Estimated emission reductions over the first commitment period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2008	165 360	0	279 956	114 596
2009	154 279	0	261 782	107 503
2010	144 050	0	247 613	103 563
2011	129 573	0	213 982	84 409
2012	129 573	0	213 982	84 409
Total (tonnes of CO_2 equivalent)	722 835	0	1 217 315	494 480

Table 29. Estimated emission reductions after the first commitment period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2013	129 573	0	213 982	84 409
2014	129 573	0	213 982	84 409
2015	129 573	0	213 982	84 409
2016	129 573	0	213 982	84 409
2017	129 573	0	213 982	84 409
2018	129 573	0	213 982	84 409
2019	129 573	0	213 982	84 409
2020	129 573	0	213 982	84 409
Total (tonnes of CO_2 equivalent)	1 036 584	0	1 711 856	675 272

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:

Modernization of pumping plants, replacement of water supply networks are not the objects of particular environmental hazard and are not subject to state examination in accordance with Resolution # 554 as of July 27, 1995 "A list of activities and objects of high environmental hazard" [45] and Art. 14 of the Law of Ukraine "On ecological expertise"[46].

Project documentation for the implementation of the mini hydroelectric power plant (according to state building codes of Ukraine A.2.2-1-2003), which includes environmental impact assessment (EIA) is under development and will be provided during the implementation period.

CE "Dniprovodokanal" has all permits, including limits on the formation and disposal of waste, as well as relevant standards in execution of reporting documents on the use of energy resources:

- Permit for special water use;
- The limit on the formation and disposal of waste CE "Dniprovodokanal";
- Form 2-TP (VODHOSP), report on water use;
- Form 11-MTP, report on fuel, heat and electricity consumption;
- Laboratory attestation certificate of sanitary and epidemiological control of water quality in Dnipropetrovsk of CE "Dniprovodokanal".

In general, the project "Development and improvement of water supply system, drainage system and wastewater treatment in Dnipropetrovsk city" will have positive impact on the environment. It is expected that due to decrease in energy consumption by the water-supply system, drainage system, wastewater system (mainly pumping equipment) the emission of CO_2 from the national power grid of Ukraine will be decreased.

Environmental effect will be caused only by dismantled equipment. It is a state property and it will further be stored at the company's warehouses.

Impact on air environment

Impact on air environment is absent.

Impact of land use

Impact on land/soil use is absent.

Impact on the environment

Implementation of this project will allow for improvement of service level for water consumers. Experience of CE "Dniprovodokanal" staff and compliance with regulations on "Drinking water and drinking water supply" will allow for minimization of any accidents risks during the project implementation.

[45] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=554-95-%EF

[46] http://www.ic-chernobyl.kiev.ua/nd/zu/z_45.htm

Transboundary impacts from the project activity according to their definition in the text of "Convention on transboundary long-range pollution",[47] ratified by Ukraine, will not take place.
The Project does not assume any detrimental effects on the environment.

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

As mentioned above, when making assessment of environmental impact it is clear that the project does not make any significant negative environmental impact, but rather has a positive impact on the environment. However, CE "Dniprovodokanal" constantly informs the community on implementations and modernizations being implemented or planned, as well as their implementation stages, at the company's web-site. Stakeholders can comment on it and take part in discussions [48]. No negative comments have been received. It is expected that due to decrease in consumption of energy from the national power grid of Ukraine by the water-supply systems (mainly pumping equipment) the emission of CO_2 will be decreased.

[47] *http://zakon2.rada.gov.ua/laws/show/995_223*

[48] *http://dniprovodokanal.dp.ua/*

SECTION G. Stakeholders' comments

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

Since the project activities do not imply any negative environmental impact and negative social effect, special public discussions were not necessary. However, CE "Dniprovodokanal" constantly informs the public about the implementations and modernization that are implemented or planned to be implemented, and the stages of their implementation at the official website of the Dnipropetrovsk Municipal Administration. Stakeholders may provide their comments and take part in the discussion of these issues. No comments have been received from the Stakeholders so far.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation	CE "Dniprovodokanal"
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Website	http://dniprovodokanal.dp.ua/
Represented by	
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Salutation	
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Salutation	
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Middle name	-
First name	Fabian
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Fax (direct)	
Cell phone	
Personal e-mail	

Annex 2

BASELINE INFORMATION

Table 2-1. Data and parameters used in the course of baseline setting

Parameter	Unit of measurement	Source of data	Description
$EF_{CO_2,ELEC,y}$	t CO_2e/MWh	Refer to tables A2-1-A2-4	Carbon dioxide emission factor for the electricity grid of Ukraine for each commitment period. The first commitment period: 2008-2012
$EC^{j}_{b,\ w}$	MWh	Data of electricity meters installed at water supply pumping plants	Total quantity of electric energy, necessary for water transportation to consumers by water supply system
$EC^{y}_{b,\ m}$	MWh	Data of electricity meters installed at treatment plants	Total quantity of electric energy necessary for transportation of wastewater by the drainage system
$EC^{y}_{b,\ t}$	MWh	Data of electricity meters installed at pumping plants	Total quantity of electric energy consumed by the system of air tanks
$V^{j}_{b,\ w}$	1000 m^3	Data of flow meters installed at pumping station	Total volume of pumped water to consumers by water supply system
$V^{y}_{b,\ m}$	1000 m^3	Data of flow meters installed at drainage plants	Total volume of wastewater pumped by the drainage system
$V^{y}_{b,\ t}$	1000 m^3	Data of flow meters installed at treatment plants	Total volume of wastewater treated by the system of air tanks

Annex 3

MONITORING PLAN

Detailed information about the monitoring may be considered in the following way:

A. Technical description of the project
Measures implemented to increase efficiency of CE "Dniprovodokanal" consist in the following:

1. Old pumps characterized by low efficiency will be replaced by the pumps with the efficiency of 81-89%. Modernization or replacement of the equipment at pumping plants will be fixed in the acts of commissioning and documentation confirming purchase and assembly of new equipment;
2. Optimization of the water pumping technological process. Transfer of workload from pumping plants with old equipment to the pumping plants with high-efficient equipment. Monitoring will be carried out by means of provision of a detailed layout of the water-supply network pipelines and marking of main diameters of the pipeline;
3. Introduction of automatic air valves on water mains to decrease pressure and improve water and wastewater plant capacity. Monitoring of new equipment implementation will be carried out by means of the documentation confirming purchase and assembly of new equipment;
4. Replacement of water-supply networks. Modernization or replacement of pipes will be fixed in the acts of commissioning;
5. Installation of a new group of metering devices. Monitoring of new equipment introduction will be conducted by means of the documentation confirming purchase and assembly of new equipment;
6. Installation of frequency regulators. Monitoring of new equipment introduction will be conducted by means of the documentation confirming purchase and assembly of new equipment;
7. Modernization and replacement of aeration system. Monitoring of new equipment introduction will be conducted by means of the documentation confirming purchase and assembly of new equipment; modernization of old equipment – by acts of commissioning.

Documentation confirming purchase and assembly of new equipment will be archived and kept by CE "Dniprovodokanal" during two years after delivery of emission reduction units generated by the project.

B. Control of monitoring organization

Structure of monitoring data collection is the following:

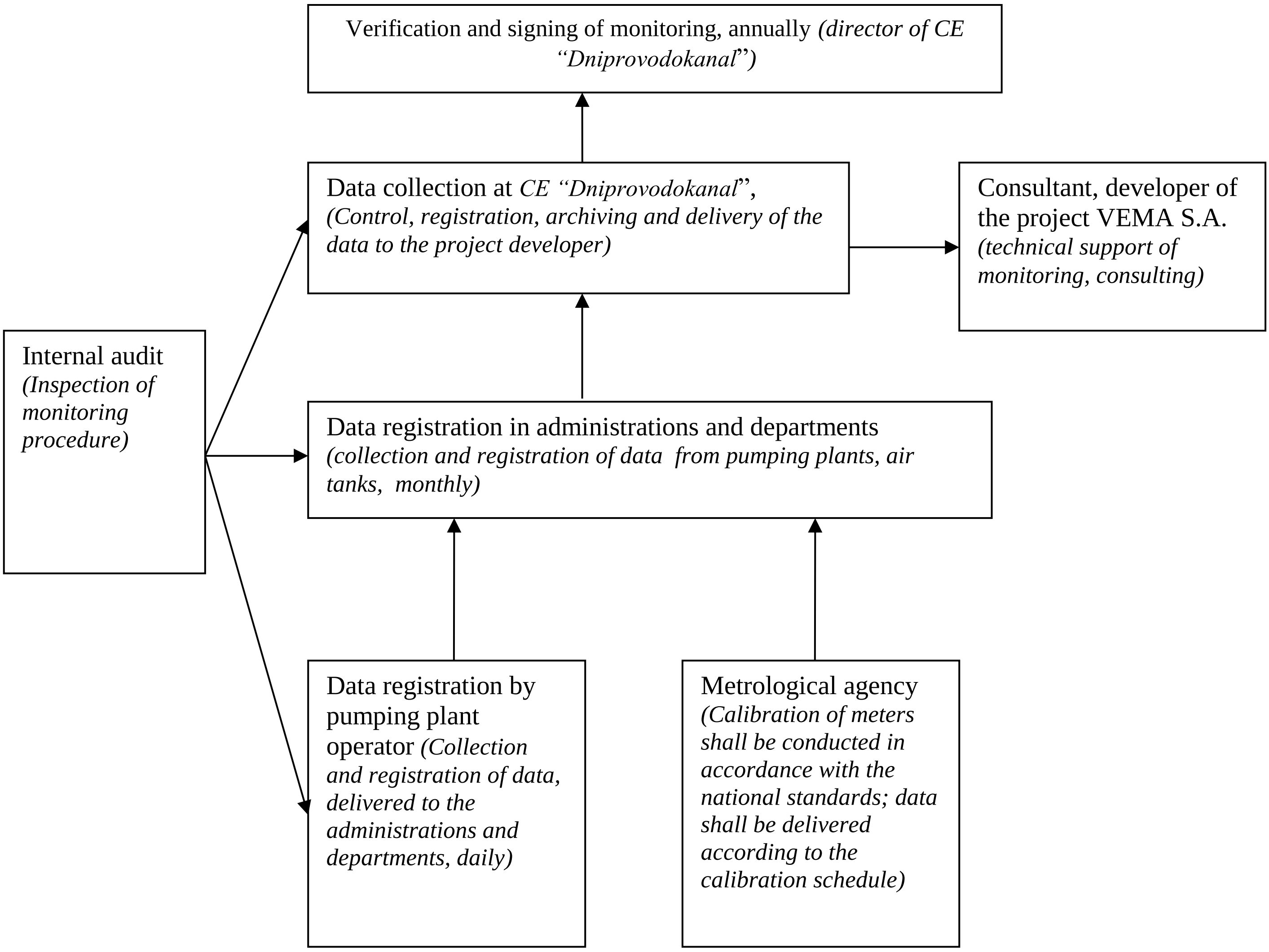

Figure 3.B.1. Structure of monitoring data collection at CE "Dniprovodokanal"

C. Monitoring procedures

Measures for control of electric energy, consumed by CE “Dniprovodokanal”:

1. Current control of electric energy meters operation is conducted during settling period (settling month is determined by the conditions of the contract on electric energy supply);

2. On the day stipulated by the contract (as a rule it is 00 hours 00 minutes on the 1st day of month following the settling month) the chief of site or his authorized representative shall take the readings of electric energy meters (electric energy meters are devices, which passed state certification, are registered under contractual conditions and jointly sealed by the representatives of power supplying organization and CE “Dniprovodokanal” subject to execution of sealing act). The head of site shall transfer obtained information to the chief power engineer department;

3. “Report on electric energy meters readings” shall be made according to the readings of electric energy meters of all sites; an engineer who deals with electric energy bills shall provide this Report to the subscriber department of energy supplying organization;

4. Relying on the “Report on electric energy meters readings” subscriber department of energy supplying organization shall make the “Act of supplied electric energy”, approved by the company’s round seal and transfer it to the department of CE “Dniprovodokanal” for confirmation;

5. The representative of CE “Dniprovodokanal” shall provide approved “Act of supplied electric energy” to the subscriber department of energy supplying organization, wherein he obtains invoices for payment; (invoice of CE “Dniprovodokanal” for consumed energy, consumer CE “Dniprovodokanal”)

6. All payment receipts shall be kept by “CE “Dniprovodokanal” in paper form.

Measures for control of water supplied to the consumers at CE “Dniprovodokanal”:

1. Metering of water produced from water facilities of CE “Dniprovodokanal” shall be carried out by flow meters located at pumping plants during water inlet;
2. Readings shall be taken every hour and fixed in logs of established form POD-11;
3. Data about volume of water lifted from the second lifting plant for previous twenty-four hours shall be transferred every day at 00:00 o’clock to control department of each production unit;
4. Persons responsible for statistical reporting under the form 2-TP (vodhosp) shall draw up the fact sheets on the basis of dispatching record of taken water before 10th day of every month that are transferred to corresponding services of management personnel of CE “Dniprovodokanal”
5. Report 2-TP (vodhosp) shall be submitted quarterly, every six months and annually to the Dnipropetrovsk Department of Water Resources after its verification by production and technical department and sales department of management personnel. Payment for water, supplied to consumer, shall be made according to this report.

Measures for drained wastewater from consumers control at CE “Dniprovodokanal”:

1. Metering of drained wastewaters in the drainage system of CE “Dniprovodokanal” is carried out by means of flow meters located at drainage pumping plants of wastewater pumping. Readings are taken every hour and fixed in logs of established form POD-11;

2. Data about volume of water lifted from the second lifting plant for previous twenty-four hours shall be transferred every day at 00:00 o’clock to the monitoring service department of each production unit;
3. Persons responsible for statistical reporting under the form 2-TP (vodhosp) shall draw up the fact sheets on the basis of dispatching record of drained wastewater before 10th day of every month that are transferred to corresponding services of management apparatus;
4. Report 2-TP (vodhosp) shall be submitted to the Dnipropetrovsk Department of Water Resources after its verification by production and technical department and sales department of management apparatus on a quarterly basis. Payment for drained wastewater from consumers, shall be made according to this report.

Measures for wastewater drained by wastewater treatment plants metering control at CE “Dniprovodokanal”:

1. Metering of drained wastewaters that require full biological treatment is carried out by means of flow meters located at the entrance to wastewater treatment plants.

2. Readings are taken every hour and fixed in logs of established form POD-11;

3. Data about volume of drained wastewater from wastewater plants shall be transferred every day at 00:00 o’clock to control department of each production unit;
4. Persons responsible for statistical reporting under the form 2-TP (vodhosp) shall draw up the fact sheets on the basis of dispatching record of drained wastewater before 10th day of every month that are transferred to corresponding services of management apparatus;
5. Report 2-TP (vodhosp) shall be submitted to the Dnipropetrovsk Department of Water Resources after its verification by production and technical department and sales department of management apparatus on a quarterly basis. Payment for treated wastewater, shall be made according to this report.

D. Calibration of meters

Meters shall be calibrated according to the national standards. Details are provided in Supporting Document 3.

E. Recording and archiving of data

The person responsible for the joint implementation project, appointed by the owner of the project, shall monitor data in electronic and paper form. Electronic documents shall be printed and kept.
The owner of the project shall keep the copy of the acts of supplied electric energy (original of the acts shall be kept by subscriber department).
All data and documents in paper form shall be archived and one backup copy shall be transferred to project coordinator.
All data shall be kept within 2 years after delivery of emission reduction units generated by the project.

F. Trainings

Employees of VEMA S.A. will consult the persons responsible for monitoring elaboration at CE "Dniprovodokanal" before the beginning of the project activity and during the project period.

Data and parameters of monitoring:

Data/Parameter	V_w
Data unit	1000 m^3
Description	Total volume of pumped water to consumers by water supply system
Data source	Volume of water that is pumped by water supply pumping plants
Method of monitoring	Flow meters installed at water supply pumping plants
Frequency of verification	Daily
Documentary evidence	Logbook POD-11 form

Data/Parameter	V_m
Data unit	1000 m^3
Description	Total volume of wastewater pumped by drainage system
Data source	Volume of wastewater that is pumped by drainage pumping plants
Method of monitoring	Flow meters installed at drainage pumping plants
Frequency of verification	Daily
Documentary evidence	Logbook POD-11 form

Data/Parameter	V_t
Data unit	1000 m^3
Description	Total volume of wastewater treated by the system of air tanks
Data source	Volume of wastewater that is pumped by wastewater pumping plants
Method of monitoring	Flow meters installed at wastewater pumping plants
Frequency of verification	Daily
Documentary evidence	Logbook POD-11 form

Data/Parameter	EC_w
Data unit	MWh
Description	Quantity of electric energy, necessary for water transportation by water supply pumping plants
Data source	Quantity of electric energy used by water supply pumping plants
Method of monitoring	Electricity meters installed at water supply pumping plants
Frequency of verification	Monthly

Documentary evidence	Act of supplied electric energy

Data/Parameter	EC_m
Data unit	MWh
Description	Quantity of electric energy, necessary for wastewater transportation by drainage pumping plants
Data source	Quantity of electric energy used by drainage pumping plants
Method of monitoring	Electricity meters installed at drainage pumping plants
Frequency of verification	Monthly
Documentary evidence	Act of supplied electric energy

Data/Parameter	EC_t
Data unit	MWh
Description	Quantity of electric energy, necessary for wastewater treatment by system of air tanks
Data source	Quantity of electric energy used by system of air tanks
Method of monitoring	Electricity meters installed at treatment plants (air tanks)
Frequency of verification	Monthly
Documentary evidence	Act of supplied electric energy

Data/Parameter	$EF_{CO_2,ELEC,y}$
Data unit	t CO_2e/MWh
Description	Specific carbon dioxide emission factor for the Ukrainian electrical grid
Data source	Research data of Global Carbon B.V. Carbon dioxide 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"; Carbon dioxide emission factors for 2009 were taken from the Decree of NEIAU #63 dated 15/04/2011 "On approval of specific carbon dioxide emission factors in 2009"; Carbon dioxide emission factors for 2010 were taken from the Decree of NEIAU #43 dated 28/03/2011 "On approval of specific carbon dioxide emission factors in 2010" Carbon dioxide emission factors for 2011 were taken from the Decree of NEIAU #75 dated 12/05/2011 "On approval of specific carbon dioxide emission factors in 2011
Method of monitoring	Confirming documentation of the State Environmental Investment Agency of Ukraine wherein the new values of factors are amended and calculated.
Frequency of verification	Annually
Documentary evidence	Decree and resolutions of the State Environmental Investment Agency of Ukraine