JOINT IMPLEMENTATION PROJECT

"Development and improvement of water supply system, drainage system and wastewater treatment of City Communal Enterprise "Mykolaivvodokanal'"

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

Director, VEMA S.A. Switzerland.

(position)

(signature)

Fabian Knodel

(name and patronymic, last name)

PS

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

Director of
CCE "Mykolayivvodokanal"

(position)

(signature)

Vasyl Telpis

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PS

Mykolayiv 2012

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

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Annexes

SECTION A. General description of the project

A.1. Title of the project:

Development and improvement of water supply system, drainage system and wastewater treatment of City Communal Enterprise "Mykolayivvodokanal"

Sectoral Scope:

1. Sector 3 – "Energy demand".
2. Sector 1 – "Energy industries" (renewable - / non-renewable sources).

Version of Project Desing Document: 03
Date: 02/04/2012

A.2. Description of the project:

Purposes of project activity: The project's main purpose is reduction of electric energy consumption by modernization and development of centralized water supply, drainage and wastewater treatment systems. This includes replacement and modernization of pumps, water distribution and drainage networks, installation of frequency regulators, optimization of the technological process of water pumping, introduction of mini hydropower station in the city of Mykolayiv. The implementation of the abovementioned technologies will allow for reduction of greenhouse gas (CO_2) emissions and promote sustainable development of the city.

Table 1. Historical details of development of CCE "Mykolayivvodokanal"

Type of actions	Confirming document	Date
Representatives of CCE "Mykolayivvodokanal" reviewed the following information: - Guidelines for implementation of JI projects, developed by the Danish Energy Agency (May 2003); - Presentation on the development of CDM / JI projects adopted by the Ministry of Environment and Natural Resources of Ukraine (June 2003).		May-June 2003
The owner of the Project decided to implement the JI mechanism for the project, the management of the company made and issued a corresponding decision.	Minutes of the meeting of the management about the intentions to implement the JI project.	06/12/2005

On 06/12/2005 the management board of CCE "Mykolayivvodokanal" made a decision to launch the JI project.
07/11/2011 is the date whereon the Emission Reductions Purchase Agreement relating to the Joint Implementation Project was concluded and signed by VEMA S.A. and CCE "Mykolayivvodokanal".

Description of conditions whereon the project will be implemented. CCE "Mykolayivvodokanal" 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 CCE "Mykolayivvodokanal" for lifting and pumping-over of water, drainage and treatment of wastewater in the baseline period is high. This results in ineffective consumption of energy resources and significant financial costs. The market of this product has been stable for many years. The project implementation will allow for obtaining significant economic and ecological benefits by the citizens of Mykolayiv city.

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

- high energy consumption of production processes;
- poor condition of urban networks. Almost 1.200 km of water supply and 800 km of drainage networks are used in order to ensure water supply and wastewater drainage in the city; a large proportion of them is in catastrophic condition - 33%;
- 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 stations of CCE "Mykolayivvodokanal"					
	Water-supply pumping plants		Drainage pumping plants		Wastewater treatment facilities – aeration stations	
	Baseline volume of pumped water, ths m^3	Baseline consumption of electric energy, MWh	Baseline volume of drained wastewater, ths m^3	Baseline consumption of electric energy, MWh	Baseline volume of treated wastewater, ths m^3	Baseline consumption of electric energy, MWh
2001	417 008.36	66 810.84	164 327.00	16 908.00	106 063.00	8 864.40
2002	274 061.95	65 967.28	108 059.00	14 568.94	95 464.00	8 149.00
2003	209 641.36	59 011.92	73 355.00	13 078.80	70 225.00	7 952.40
2004	169 303.28	53 396.62	48 382.50	10 896.90	28 336.40	7 869.00
2005	152 255.08	51 903.27	40 403.71	10 975.20	27 931.00	7 845.30

Constant deterioration of the equipment, outdated technological schemes, lack of modernization of facilities and water supply, drainage networks in general, lack of new technologies of energy efficient wastewater treatment 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 implementation of minimal repair against the background of total degradation of the technical condition of the water supply, drainage and wastewater treatment 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; 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 group of metering devices;
- modernization of water treatment technology;
- installation of frequency regulators;
- modernization of aerotanks;
- implementation of the mini hydroelectric power plant (MHEPP).

Due to reduction of the amount of consumed electric energy from the power grid of Ukraine used by pumping plants, combustion of fossil fuel for electric energy generation to the grid will be decreased.
Due to the free flow of water at installed turbines, which takes place at main conduits, the transformation of kinetic energy of water into electric energy will take place. The electric energy will be used for the company's own purposes and this will result in reduced use of electric energy from the national grid of Ukraine.
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 CCE "Mykolayivvodokanal" in the following aspects:

- decrease of national economy's dependence on import of energy and increase of country's energy security;
- high rates of labor and health protection;
- improvement of the global ecology state (counteraction in response to global climate change by means of reduction of greenhouse gas (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)	• CCE "Mykolayivvodokanal"	No
Switzerland	• «VEMA S.A.»	No
* Please indicate if the Party involved is a host Party.		

A.4. Technical description of the project:

A.4.1. Location of the project:

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

Figure 1. Location of CCE "Mykolayivvodokanal"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. Ukraine is listed in Annex 1 to the UN FCCC and it is eligible for participation in the Joint Implementation projects.

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

Mykolaiv region is the region in Ukraine. It is located in the South of the country within the Prychornomorsk lowland in the basin of the river Pivdennyi Bug. Its area is 24.6 thousand km ². Regional center is the city of Mykolayiv.

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

Mykolayiv is a city of regional subordination in Ukraine, the administrative center of Mykolayiv region.

Figure 2. City of Mykolayiv and location of CCE "Mykolayivvodokanal"

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

Facilities involved into the project:

- Water supply pumping plants (WSPP) – 18 units, the city of Mykolayiv;
- Drainage pumping plants (DPP) – 14 units, the city of Mykolayiv;
- Wastewater treatment facilities (WWTF): in the villages of Halytsynivka (HWWTF) and Varvarivka (VWWTF), Mykolayiv region;
- Mini hydroelectric power plant – the village of Halytsynivka, Mykolayiv region;
- 1130 km of water supply networks, 793 km of drainage networks, the city of Mykolayiv and Mykolayiv region.

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 at CCE "Mykolayivvodokanal" are the following:

1. PDD elaboration

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

2. Modernization of pumping equipment

CCE "Mykolayivvodokanal" uses horizontal and submerged pumps. A submerged pump is the pump submerged below the level of pumped over fluid. This ensures deep water lifting, quality cooling of pump components and enables to lift water with dissolved oxygen. Horizontal pumps are designed for pumping over of fresh water with the temperature of up to +100°C and they 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 supply 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 3.*

Table 3. 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
D500-63UKhA	500	63	132
D3200-33	3200	33	500
16NDS	2000	21	160

Figure 3. Horizontal double-entry pump of D 3200-33 type

3. Replacement of pumping equipment

One of the main purposes of replacement of pumping equipment is decrease in energy consumption. The main cause 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 4.*

Table 4. Pumps with electric motors of general industrial application

Nominal size of pump unit	Supply (Q), m^3/h	Head (N), m	Engine power (Nd), kW
NK-300-360|370	630-2000	30-80	132-800
MVI5202PN160M			
Wilo TS40H90/5.5			
WILLO TC40-8			
CM125-80-315/4			

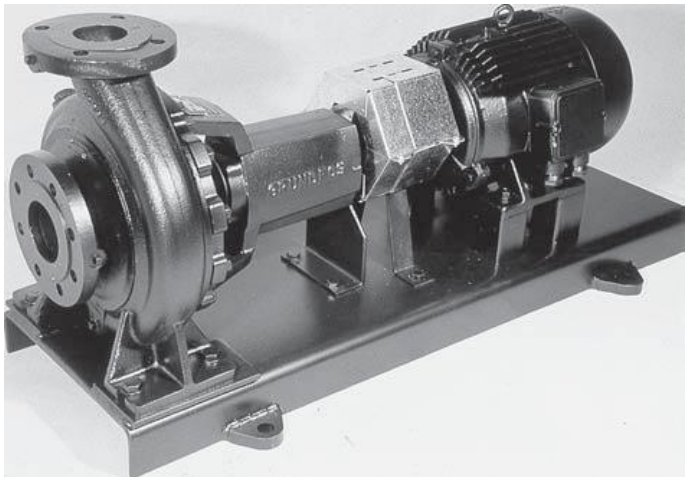

Figure 4. Centrifugal pumps of NK[1] type

4. Optimization of the technological process of water pumping

Operation mode of the water supply pumping plants will be changed into energy efficient due to switching over to gravity-head water conduit.
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. Id est 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). As a result, consumption of electricity decreases, which reduces emissions into the atmosphere.

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 project - pure water) because they allow you to adjust their flow. These are devices of physical control of 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 efficient shut-off and control

[1] *http://www.1nasos.ru/pages/nasos39-33.html*

valves[2] that will greatly improve the level of energy efficiency of water supply and drainage systems (by 5-10% efficiency compared to the old equipment).

Table 5. Characteristics of typical shut-off and control valves to be implemented [3]

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	349-1353	13-184	Grey iron EN-GJL -250

а) *б)* *в)*

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

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 efficient[4] ones. Technically worn out pipes will be replaced by fiberglass[5] and plastic[6] pipes that are characterized by durability (over 50 years), effectiveness in operation and corrosion resistance. Modernization of water supply and drainage systems will allow for decrease in water losses and correspondingly decrease in electric energy consumption for pumping of water 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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[2] *http://www.havvle.ru/index.php*

[3] *http://www.havvle.ru/index.php*

[4] *http://www.infox.ua/projects/fiberglasspipes/*

5 http://www.metallprofil.avcom.in.ua/vodoprovod/flowtite.html

[6] *http://www.aquatherm.ua/main_ua/products/*

Figure 6. FLOWTITE fiberglass pipes

CCE "Mykolayivvodokanal" 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 and drainage networks is provided in Accompanying document *3.*

7. Installation of a new group of metering devices

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

Table 6. Characteristics of metering devices

Type of metering device	Accuracy	Calibration interval	Purpose
SL-761 CO 71[7]	0.5-1.5	 Once per 1-6 years	Electric energy meters
NIK2303 3F5-100A/380V[8]			Electric energy meters
NIK2303Ark2 3F5(60)A			Electric energy meters

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

[8] *http://www.enext.ua/catalog/8287/60077/*

MTK-UA			Water flowmeters
E-125		Once per 4-16 years	Water flowmeter
MWN KBM-YX-20			Water flowmeter
UVR-011[9]			Water flowmeter

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 dependence. The exact data regarding overall improvement of efficiency of water supply, drainage systems will be presented after the monitoring process.

Table 7. Characteristics of frequency regulators

Type of frequency regulator	Power, kW	Producer
Schneider electric[10]	132	France
Danfoss	40	Denmark
pDrive MX	450	Austria

Figure 7. Frequency regulators

[9] *http://lichilnik.com.ua/index.php?option=com_content&view=article&id=293&Itemid=258*

[10] *http://electromotor.com.ua/katalog-tovarov?page=shop.browse&category_id=73*

9. Modernization of aeration system at treatment facilities (aerotanks)

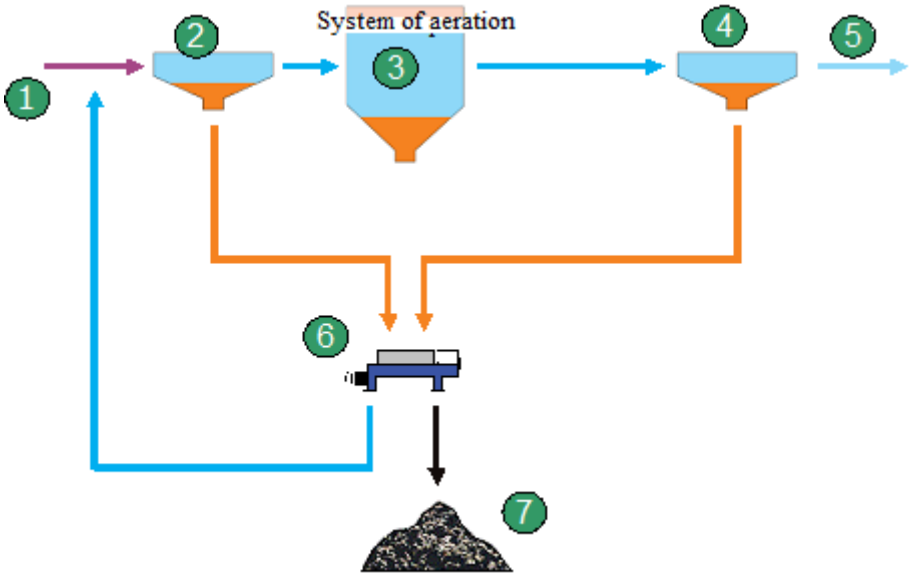

Figure 8. Technological scheme of treatment plants after implementation of the project (modernization of aeration system)
1 – inlet of wastewaters; 2 – primary clarifiers; 3 - aerotanks; 4 – secondary clarifiers; 5 – discharge of treated water into the waters; 6 – mechanical dewatering of raw sludge 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 aerotanks. Here direct contact of wastewaters with organisms of activated sludge alone with availability of right amount of dissolved oxygen takes place. This allows 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 aerotanks.
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 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 aerotanks (aeration system). Aerotanks 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 period of time, and this in turn accelerates aeration process and speeds up the

process of wastewater treatment in general. So airblowers 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;
- Centered airblowers equipped with special directional control equipment at the entrance.

10. Implementation of a mini hydroelectric power plant

Implementation of a mini hydroelectric power plant provides for installation of a turbine of Francis type at main conduits that allows for conversion of the kinetic energy of the water flow into electric energy. The design of turbine of Francis type has hydraulics that ensure the weakest water-hammer effect if the lead-in water pipelines are long. Operation of this equipment in the wastewater system provides for self-cleaning ability of a turbine rotor. Implementation of the mini hydroelectric power plant may in the future ensure energy independence. This is considered in detail in Section D and Accompanying document 1. The turbine of Francis type produced by CINK Hydro-Energy has the following technical characteristics: N = 400 kW (0.4 MW); Q = 1.43 m^3/s; H = 35 m *(Figure 9).*

Ukraine already has experience in implementation of mini hydroelectric power plants at water supply and water drainage companies but it is not a common practice. The cost of mini hydroelectric power plants is the main barrier for implementation of such facilities. Implementation of this measure is impossible without additional external financing, but Ukrainian government doesn't have enough funds for this. Building of mini hydroelectric power plant without additional investments, for example from the sale of ERUs, is very difficult for water supply and water drainage companies in Ukraine.

In the world this practice is very common, so this experience proves that the use of mini hydroelectric power plants helps to solve the problem of improving the power supply of domestic and industrial consumers. At present capacity of existing mini hydroelectric power plants in Europe ranges from 0.076 MW to 150MW. Construction of mini hydroelectric power plants is quite expensive compared to other types of hydropower plants. Here are some of the technical, financial and economic parameters of mini hydroelectric power plants operating in EU countries:

Table 8. Some technical as well as financial and economic parameters of mini hydroelectric power plants operating in the EU countries

Country	Power, MW	Height difference, m	Water consumption, m^3/s	Project cost, USD	Payback period, year
France	0.2	58.0	0.4	50 ths	10
Germany	3.1	2.6	140.0	16 mln	10.4
Greece	3.75	15.0	80.0	41 mln	9.5
Great Britain	0.6	102.0	50.0	100 ths	10

Figure13. Radial-axial turbine of Francis type [11]

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

Table 9. Schedule of the project implementation

№	Project stage	Period
1	PDD elaboration	06/12/2005-31/12/2012
2	Modernization of pumping equipment	06/12/2005-31/12/2012
3	Replacement of pumping equipment	06/12/2005-31/12/2012
4	Optimization of the technological process of water pumping, change of operation modes of pumping plants	06/12/2005-31/12/2012
5	Replacement of shut-off and control valves	06/12/2005-31/12/2012
6	Replacement of water-supply and drainage networks	06/12/2005-31/12/2012
7	Installation of a new group of metering devices	06/12/2005-31/12/2012
8	Installation of frequency regulators	06/12/2005-31/12/2012
9	Modernization of aeration system at treatment plants (aerotanks)	06/12/2005-31/12/2012
10	Implementation of mini hydroelectric power plant	06/12/2005-31/12/2012

Results which will be obtained after implementation of such technologies and measures are given in Accompanying documents 1, 2, 3.
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, drainage and wastewater treatment. 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 CCE "Mykolayivvodokanal" 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 training for the personnel. Technical personnel of the enterprise possesses necessary knowledge and experience for

[11] *http://www.cink-hydro-energy.com/ru/turbina-ossberger?page=francis*

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 CCE "Mykolayivvodokanal" will carry out maintenance of the new equipment in operating mode (operation, scheduled repairs) during the period of the project implementation, and after the project period.

CCE "Mykolayivvodokanal" 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 the JI project the specialists of VEMA S.A. carried out broadened consultations for involved representatives of CCE "Mykolayivvodokanal" 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:

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

In the absence of the proposed project all equipment, including the old equipment that is 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 causes which make the implementation of the project without the mechanism of joint implementation unlikely to happen:

- There are no legislative documents committing CCE "Mykolayivvodokanal" 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 (2006-2007)

	Years
Length of the crediting period	2
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2006	30 413
2007	40 639
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	71 052
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	35 526

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	62 218
2009	63 508
2010	71 352
2011	71 352
2012	74 840
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	343 270
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	68 654

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	74 840
2014	74 840
2015	74 840
2016	74 840
2017	74 840
2018	74 840
2019	74 840
2020	74 840
Total estimated emission reductions over the crediting period	598 720

(tonnes of CO_2 equivalent)	
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	74 840

More detailed information is provided in the Accompanying Document 1.

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

A.5. Project approval by the Parties involved:

A Letter of Endorsement No. 868/23/7 of the project "Development and improvement of water supply system, drainage system and wastewater treatment of City Communal Enterprise "Mykolayivvodokanal" was issued by the State Environmental Investment Agency of Ukraine as on 04/04/2012. After analyzing the project, the PDD and 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 received from the other party-participant of the Joint Implementation project.

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 (JI Guidelines) and paragraphs 23-29 of "Guidance on criteria for baseline setting and monitoring"[12] developed by Joint Implementation Supervisory Committee (JISC) (hereinafter - the "Guidelines"). 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 emissions by sources of greenhouse gases that would have occurred in the absence of the proposed project under the JI Guideline, Appendix B. As none of the approved methodologies for baseline setting and monitoring for CDM 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 of the most plausible alternatives. The alternatives for CCE "Mykolayivvodokanal" 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.
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 the city of Mykolayiv could still continue to operate.

[12] *http: // ji.unfccc.int/Ref/Guida.html*

Despite the fact that the equipment at CCE "Mykolayivvodokanal" exceeded its design service life, its further use is allowed by Energy and Mechanical Service of the company according to the legislation of Ukraine "On Drinking Water and Water Supply"[13]. This practice is widespread in Ukraine.
This alternative is the most plausible 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 greenhouse gas (CO_2) emission reductions.
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, such projects have not become a customary practice in water supply.
When implementing the project the company will face the risks associated with lack of experience in implementation and operation of such equipment as well as risks arising from construction of a mini hydroelectric power plant. In addition, the project implementation requires considerable investment. Economic indicators of the project without the involvement of the JI mechanism will be low compared to alternative options.
Thus, without outward investment this project is unlikely to be implemented, as technical solutions are complex, and the construction and operation of facilities are associated 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 project activities, exclusion of any non-core activities from the project. For example, exclusion of frequency regulation, etc. Economic efficiency of the project depends on a complex implementation of energy-efficient measures, partial implementation of the project will lead to local improvements of the operation 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 14. 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.		•

[13] 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 project activities, the exclusion of any non-core activities from the project, for example, exclusion of frequency control implementation from the project, etc.	•	

Alternative ways of electric energy production

The following is the evaluation of alternative variants that can be considered as an alternative for the project baseline.

Alternative 2.1: Operation of existing equipment without the introduction of alternative sources of electricity.
Alternative 2.2: Installation of a turbine at the main conduits – a mini hydroelectric power plant.
None of the abovementioned alternatives contradicts the legislation of Ukraine.
The detailed analysis of each alternative is stated below.

Alternative 2.1

Continuation of the current situation of obtaining electricity without the introduction of alternative sources of obtaining electricity.
Continuation of the current situation of obtaining electricity from the national grid of Ukraine does not require any significant investment or changes to a scheme of obtaining electricity by other means. Financial costs of the system, which satisfies the demand of CCE "Mykolayivvodokanal" are rising year by year. The equipment, which eventually depletes its energy resource, and inefficient electricity consumption increases GHG emissions. This practice is widespread in Ukraine.
This alternative is most plausible because the company is able to satisfy the customers demand without the project.
Therefore, *Alternative 2.1* can be considered as the most plausible baseline.

Alternative 2.2

Installation of a turbine at the main conduits.
This alternative variant is an acceptable alternative for this company. Installation of a turbine at the main conduits would allow for generation of electric energy for the company's own needs. Thus, the company stops depending on external suppliers; this will protect it from risks connected with uninterrupted electric energy supply, which in turn will reduce electric energy procurement costs.
But such projects are not a customary practice, neither at some plants nor in the country in general.
In the process of the project implementation the company will have to face the risks associated with lack of experience in construction and operation of such equipment. 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 the construction and operation of facilities are connected with difficulties.

Hence, the plausibility of *Alternatives 2.2* implementation (without the JI project) is low, although it will be considered in the investment analysis.

Analysis of the alternatives described above shows that *Alternative 2.1* is the most plausible, and *Alternative 2.2 is* the least plausible.

Table 15. Analysis of the alternatives 2.1-2.2

№ of Alternatives	Alternative	Low plausibility	High plausibility
2.1	Continuation of the current situation of obtaining electricity without the introduction of alternative sources of obtaining electricity		•
2.2	Installation of a turbine at the main conduits	•	

Conclusion

Investment analysis (see Section B.2) showed that the analyzed project implementation alternatives, including *Alternative 1.2* (the project without the involvement of the JI mechanism) and *Alternative 2.2*, could not be considered as the most attractive from a financial point of view. Substantiation of this conclusion is provided in Section B.2.

As a result of evaluation of several alternatives the most plausible of them have 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;

- *Alternative 2.*1 - Continuation of the current situation of obtaining electricity without the introduction of alternative sources of obtaining electricity.

Detailed description of the baseline scenario

The baseline scenario provides for operation of existing equipment of the water supply, drainage and wastewater treatment systems in the city of Mykolayiv, which is characterized by continuing worsening and lowering of effectiveness of the pumping, 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 for joint implementation projects for each year.

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 2006. Implementation of new and modernization of old equipment under the project took place at the end of 2005. With the view of conservative approach, reductions due to these implementations are not considered in the project. Specific electricity consumption in the baseline scenario is calculated, taking into account the fact of its linear increase over time. This happens for several reasons:

- Steady decrease in the efficiency of pumping and treatment equipment over time;
- Steady increase in losses in water supply and drainage networks.

This linear relationship was established with the help of historical data for the period from 2001 to 2005 and by using the method of least squares.

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

Detailed Description of the project scenario

The project scenario provides for modernization of the water supply, drainage and wastewater treatment systems. The project implementation will allow for reduction of electric energy consumption by installing frequency regulators, new pumping equipment, optimization of the technological process of water and wastewater pumping, replacement of water supply and drainage networks.

In addition, a mini hydroelectric power plant is planned to be constructed; the turbine of the mini hydroelectric power plant will allow for generation of electric energy by using differential pressure (free flow of fluid) in case of the turbine installation at the main conduits. This electric energy can also be used instead of electric energy, which was previously bought from the national grid of Ukraine.

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 Accompanying document 1.**

Thus, according to the above described alternatives, 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 for 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) [14].

Modernization

The proposed type of modernization refers to sector 3 "**Energy Demand**". Current CCE "Mykolayivvodokanal" 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 the reduction of greenhouse gas emissions from the national power grid due to modernization of the water supply system in Mykolayiv city: replacement of obsolete pumping units with new and modern ones, replacement of water distribution and drainage networks, implementation of new technologies of water supply and drainage, modernization of the wastewater treatment system.

Table 15. 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 amount of energy 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 and wastewater treatment plants.

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

(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 for increase in 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 grid, where:
(1) increase in efficiency (energy and water) of already existing schemes of water supply	(1) the project activity provides for increase in efficiency (energy and water) of already existing schemes of water supply.
(2) elaboration of new schemes that will replace the old one, which will not be used anymore. This methodology will apply to new scheme only for measurement of capacity (annual volume of supplied water) of old scheme.	
(e) this methodology can not be applied to 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 for 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 ("Baseline methodology for water pumping efficiency improvements").	(f) Specific approach elaborated for this project applies monitoring methodology AM0020 ("Baseline methodology for water pumping efficiency improvements").

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 amount of electric energy for water pumping to the consumers and wastewater drainage from them in project year.
Current operation of the water supply, drainage and wastewater treatment system in the city of Mykolayiv is characterized by continuing worsening and lowering of effectiveness of the pump, water distribution and treatment equipment. Consumption of electric energy in the baseline period is provided in Table 16.

Table 16. Baseline consumption of electric energy

Year	Pumping plants of CCE "Mykolayivvodokanal"		
	Water supply pumping plants	Drainage pumping plants	Wastewater treatment facilities
	Baseline consumption of electric energy, ths kWh		
2001	66 810.84	16 908.00	8 864.40
2002	65 967.28	14 568.94	8 149.00
2003	59 011.92	13 078.80	7 952.40
2004	53 396.62	10 896.90	7 869.00

2005	51 903.27	10 975.20	7 845.30

Detailed information on calculation and baseline data are provided in Accompanying document 1.

Status and compliance of the current water supply system
Current operation of the water supply system in the city of Mykolayiv 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 Accompanying document 2. Current efficiency of these pumps is about 50-60% and it is decreasing every year.

There are two types of water losses at this enterprise: productive and nonproductive; this is a current practice of water supply system exploitation in Ukraine. Such losses include own needs of water supply company (the use of water for preventive maintenance of water supply networks, disinfection and washing of 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[15] 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[16] shall be submitted to the "State agency of water resources of Ukraine"[17]. Existing distribution networks of CCE "Mykolayivvodokanal" are characterized by averaged losses from 40 to 50%.

Calculation of total annual baseline carbon dioxide emissions, which would take place during the baseline year if the water supply, drainage and wastewater treatment system in the city of Mykolayiv remained unchanged, is provided in the Accompanying document 1 (the Baseline). The calculation consists of accurate amount of total CO_2e emissions, which took place during 2006 baseline year.

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

Data/Parameter	EF_y
Data unit	t CO_2e/ MWh
Description	Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid in period *"y"*
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon dioxide emission factor for 2006-2007 were taken in accordance with the Table 8 "Emission factors for the Ukrainian electrical grid 2006-2012" in Annex 2 "Standard emission factors for UEG of Ukraine" to "Ukraine – Assessment of new CEF calculation", verified by TUV SUD Industrie Service GmbH, 17/08/2007[18];. Carbon dioxide emission factors for 2008 were taken from the

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

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

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

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

<table>
<tr><td></td><td>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"[19];
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"; [20]
Carbon dioxide emission factors for 2010 were taken from the Decree of NEIAU №43 dated 28/03/2011p. "On approval of specific carbon dioxide emission factors in 2010"2121; [21]
Carbon dioxide emission factors for 2011 were taken from the Decree of NEIAU №75 dated 12/05/2011p. "On approval of specific carbon dioxide emission factors in 2011" 2221[22]</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td>
<table>
<tr><th>Year</th><th colspan="2">EF_y</th></tr>
<tr><td>2006</td><td colspan="2">0,896</td></tr>
<tr><td>2007</td><td colspan="2">0,896</td></tr>
<tr><th>Year</th><th>EF_y for the 1st class of electricity consumers</th><th>EF_y for the 2nd class of electricity consumers</th></tr>
<tr><td>2008</td><td>1,082</td><td>1,219</td></tr>
<tr><td>2009</td><td>1,096</td><td>1,237</td></tr>
<tr><td>2010</td><td>1,093</td><td>1,225</td></tr>
<tr><td>2011</td><td>1,090</td><td>1,227</td></tr>
</table>
</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>If other carbon dioxide emission factors are adopted for the Ukrainian national power grids, the baseline will be recalculated for any of the reporting years according to the monitoring plan</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>Any comment</td><td>Researches don't take into consideration production of energy by nuclear power plants/
Calculations are made with consideration of and division by classes of electricity consumers.</td></tr>
</table>

Data/Parameter	EF_g
Data unit	t CO_2e/ MWh
Description	Carbon dioxide emission factor for the Ukrainian power grid when electric energy is generated by the mini hydroelectric power plant
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon dioxide emission factors for 2011 were taken from the Decree of NEIAU №75 dated 12/05/2011p. "On approval of specific carbon dioxide emission factors in 2011" 2221[23]
Value of data applied (for ex ante calculations/determinations)	1.090

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

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

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

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

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

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 the Ukrainian national power grids, the baseline will be recalculated for any of the reporting years according to the monitoring plan
QA/QC procedures (to be) applied	N/A
Any comment	Researches don't take into consideration production of energy by nuclear power plants/ According to conservative approach factors for electricity consumers of the 1st class are applied.

Data/Parameter	$EC^{j}_{b,\,w}$	
Data unit	kWh	
Description	Total amount of electric energy, used by water supply system *«w»* in period *"j"*, in the baseline scenario	
Time of determination/monitoring	The parameter was determined before the beginning of the project in 2001-2005 baseline years	
Source of data (to be) used	Data of electricity meters installed at lifting and pumping plants	
Value of data applied (for ex ante calculations/determinations)	Year	$EC^{j}_{b,w}$
	2001	66 810.84
	2002	65 967.28
	2003	59 011.92
	2004	53 396.62
	2005	51 903.27
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02)	
QA/QC procedures (to be) applied	Measurements of regularly calibrated meters.	
Any comment	Data which allow for calculation of the GHG emissions in the project period, information will be archived in paper and electronic forms.	

Data/Parameter	$EC^{j}_{b,\,m}$	
Data unit	kWh	
Description	Total amount of electric energy used by drainage system *«m»*, in period *"j"*, in the baseline scenario	
Time of determination/monitoring	The parameter was determined before the beginning of the project in 2001-2005 baseline years	
Source of data (to be) used	Data of electricity meters installed at drainage pumping plants	
Value of data applied (for ex ante calculations/determinations)	Year	$EC^{j}_{b,m}$
	2001	16 908.00
	2002	14 568.94
	2003	13 078.80

	2004: 10 896.90 2005: 10 975.20
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Consumption of electrical energy is determined with the help of electricity meters
QA/QC procedures (to be) applied	Measurements of regularly calibrated meters.
Any comment	Data which allow for calculation of the GHG emissions in the project period, information will be archived in paper and electronic forms.

Data/Parameter	$EC_{b,t}^{j}$
Data unit	kWh
Description	Total amount of electric energy, used by system of aerotanks *"t"* in period *"j",* in the baseline scenario
Time of determination/monitoring	The parameter was determined before the beginning of the project in 2001-2005 baseline years
Source of data (to be) used	Data of electricity meters installed at wastewater treatment plants
Value of data applied (for ex ante calculations/determinations)	Year: $EC_{b,t}^{j}$ 2001: 8 864.40 2002: 8 149.00 2003: 7 952.40 2004: 7 869.00 2005: 7 845.30
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Consumption of electrical energy is determined with the help of electricity meters
QA/QC procedures (to be) applied	Measurements of regularly calibrated meters.
Any comment	Data which allow for calculation of the GHG emissions in the project period, information will be archived in paper and electronic forms.

Data/Parameter	$EC_{b,g}^{j}$
Data unit	kWh
Description	Total amount of electric energy, generated by the mini hydroelectric power plant, in period *"y",* in the baseline scenario
Time of determination/monitoring	The parameter will be determined in 2012 in the baseline scenario
Source of data (to be) used	According to nameplate data of the mini hydroelectric power plant
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and	According to nameplate data and in a monitoring period the electricity values will be determined with the help of electricity meters

procedures (to be) applied	
QA/QC procedures (to be) applied	Measurements of regularly calibrated meters.
Any comment	Data which allow for calculation of the GHG emissions in the project year, information will be archived in paper and electronic forms.

Data/Parameter	$V^{j}_{b,w}$
Data unit	m^3
Description	Total volume of water pumped by water supply system *«w»* in period *"j"*, in the baseline scenario
Time of determination/monitoring	The parameter was determined before the beginning of the project in 2001-2005 baseline years
Source of data (to be) used	Data of flowmeters installed at lifting and pumping plants
Value of data applied (for ex ante calculations/determinations)	Year: $V^{j}_{b,w}$ — 2001: 417 008.36; 2002: 274 061.95; 2003: 209 641.36; 2004: 169 303.28; 2005: 152 255.08
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02)
QA/QC procedures (to be) applied	Measurements of regularly calibrated meters
Any comment	Data which allow for calculation of the GHG emissions in the baseline scenario, information will be archived in paper and electronic forms.

Data/Parameter	$V^{j}_{b,m}$
Data unit	m^3
Description	Total volume of wastewater pumped by drainage system *«m»* in period *"j"*, in the baseline scenario
Time of determination/monitoring	The parameter was determined before the beginning of the project in 2001-2005 baseline years
Source of data (to be) used	Data of flowmeters (volume of wastewater) installed at drainage pumping plants
Value of data applied (for ex ante calculations/determinations)	Year: $V^{j}_{b,m}$ — 2001: 164 327.00; 2002: 108 059.00; 2003: 73 355.00; 2004: 48 382.50; 2005: 40 403.71
Justification of the choice of data or description of	Data of the company

measurement methods and procedures (to be) applied	
QA/QC procedures (to be) applied	Measurements of regularly calibrated meters
Any comment	Data which allow for calculation of the GHG emissions in the baseline scenario, information will be archived in paper and electronic forms.

Data/Parameter	$V_{b,t}^{j}$
Data unit	m^3
Description	Total volume of wastewater treated by system of aerotanks *«t»* in period *"j"*, in the baseline scenario
Time of determination/monitoring	The parameter was determined before the beginning of the project in 2001-2005 baseline years
Source of data (to be) used	Data of flowmeters (volume of wastewater) installed at wastewater treatment plants
Value of data applied (for ex ante calculations/determinations)	Year: $V_{b,t}^{j}$ 2001: 106 063.00 2002: 95 464.00 2003: 70 225.00 2004: 28 336.40 2005: 27 931.00
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Data of the company
QA/QC procedures (to be) applied	Measurements of regularly calibrated meters
Any comment	Data which allow for calculation of the GHG emissions in the baseline scenario, information will be archived in paper and electronic forms.

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

The 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. These technologies include replacement of old pumps with new, more efficient pumps, frequency regulators installation and upgrading of old water distribution and drainage networks, modernization of aerotanks (aeration system).
Greenhouse gas emission reductions in the project scenario will be achieved by:

- Saving of traditional carbon fossil fuel at power plants, which will reduce CO_{2e} emissions from the national electrical grid;
- Reduction of emissions that are connected with the production of electric energy, which will be substituted in the project scenario with electric energy generated by means of the mini hydroelectric power plant.

Additionality of the project. The additionality of the project activity is demonstrated and assessed by using the "Tool for the demonstration and assessment of additionality»[24] (Version 6.0.0). This manual was elaborated in original for CDM projects, but it may be also applied to JI projects.

STEP 1. Identification of alternatives to the project activity and their consistency with applicable laws and regulations

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

There are three alternatives for this project.

Alternative 1.1 and *Alternative 2.1:* continuation of existing situation (there aren't any project activities or other alternatives), i.e. "business as usual" scenario 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 regarding the period of replacement of pumps, aerotanks and their maximal period of operation. Customary practice is operation of pumps installed in the 1970th or even 1950th-1960th years and earlier, if they underwent technical examination of the authorized body (State Inspectorate of Labor Protection).

Alternative 1.2 and Alternative 2.2: 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.

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

Alternative 1.1 and Alternative 2.1: According to the Ukrainian Law "On drinking water and drinking water supply"[25] entrepreneurial activity in the sphere of supply of drinking water to consumers shall be licensed. There aren't any legislative documents binding CCE "Mykolayivodokanal" to modernize pumping, treatment equipment, and water-distribution networks. In accordance with the law "On drinking water and drinking water supply" 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 in water distribution networks to be made by water distribution organizations. The practice of water loss detection at CCE "Mykolayivodokanal" corresponds to stated standards. Control of adherence to the standards is executed by calculation of water loss in distribution systems once per 10 years.

The project is also consistent with existing regulatory requirements of Ukraine relating to detection of water loss in water distribution networks, and any other existing applicable legislative norms.

[24] *http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf*

[25] *http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=2918-14*

Alternative 1.2 and Alternative 2.2: 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 and Alternative 2.1*. The analysis of consistency with statutory laws and decrees for *Alternative 1.1 and Alternative 2.1* is the same as the one for *Alternative 1.2 and Alternative 2.2*.

Alternative 1.3: Modernization without the JI mechanisms and with exclusion of any non-core measures from the project is consistent with statutory laws and decrees; detailed information about analysis of consistency with the legislation was provided in relation to *Alternative 1.1 and Alternative 2.1*. The analysis of consistency with statutory laws and decrees for *Alternative 1.1 and Alternative 2.1* is the same as the one for *Alternative 1.3*.

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

STEP 2. Investment analysis

Sub-step 2a. Determination of appropriate analysis method

According to the art. 191 of the Civil Code of Ukraine state (communal) fixed prices (tariffs) shall be established for products (services) that are manufactured by business entities-monopolists and are of great social importance for population. In this connection CCE «Mykolayivvodokanal» is not entitled to individually establish the prices (tariffs) for rendered services: water supply and drainage. According to the art. 28 of the Law of Ukraine "On local self-government in Ukraine" executive committees of villages, urban and city councils are entitled to establish the tariffs for personal, communal, transport and other services, including water supply and drainage services. At present CCE «Mykolayivvodokanal» elaborates tariffs for water supply and drainage services, which shall be approved (agreed) afterwards in case of absence of any objections on the part of executive committees.

In connection with applicable Decree of the Cabinet of Ministers of Ukraine #869 dated June 1, 2011 "On provision of unified approach to tariff setting for housing and utility services"[26], reduction of expenses on electric energy for water supply and drainage will not bring any revenue to the enterprise, since according to this Decree reduction of electric energy expenses, results in decrease of tariffs for end consumers. Thus, the enterprise doesn't obtain any additional revenue, and reduction of expenses on electric energy results in decrease of enterprise's revenue due to tariff reduction.

The following steps have been taken according to the additionality tools of the CDM Executive Committee "Tool for the demonstration and assessment of additionality" (revision 6.0.0)[27].

Sub-step 2b

Alternative 1.1 and *Alternative 2.1. Application of simple cost analysis*

The project implementation requires financial resources in addition to existing costs on modernization of the water supply, drainage and wastewater treatment system in the city of Mykolayiv. Additional financial resources of the Project implementation include the cost of: purchase of new pumping equipment, modernization of existing pumps, installation of new frequency regulators, purchase of pipes, preventative maintenance, systematic data collection, etc. Expenses on the implementation and realization of the project Development and improvement of water supply system, drainage system and wastewater treatment of City Communal Enterprise "Mykolayivvodokanal" consist of:

[26] *http://zakon2.rada.gov.ua/laws/show/869-2011-n*

[27] *http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf*

Period	Cost of reconstruction, mln.UAH							
	Modernization of pumping equipment (cutting of pump rotor)	Replacement of pumping equipment	Replacement of shut-off and control valves	Replacement of water supply and drainage networks	Implementation of a new group of metering devices	Implementation of frequency regulators	Modernization of aeration system at treatment facilities (aerotanks)	Implementation of a mini hydroelectric power plant
06/12/2005 - 31/12/2012	1.04	41.7	3.2	55.42	0.26	18.19	9.83	1.92

Equipment used in this project is the best in terms of Efficiency Factor (EF), quality of execution and applied technical solutions among the materials and equipment available in Ukrainian market. Availability of spare parts in Ukraine was an important parameter taken into account in the process of equipment selection.
As a result of current practice all losses of electric energy are borne by end consumers of services rendered by CCE «Mykolayivvodokanal», that is why CCE «Mykolayivvodokanal» doesn't have any incentives to introduce power efficient equipment.
At the moment of beginning of the project old pumping equipment manufactured in the USSR was used at pumping plants of CCE «Mykolayivvodokanal».
Application of the Kyoto mechanisms to this project makes these measures economically viable and is the only way for their implementation.
As emission reductions do not bring any economic benefit to CCE «Mykolayivvodokanal», except for the benefit achieved in the framework of the Joint Implementation Project (JIP), we can make a conclusion that the Project implementation without receiving proceeds in the framework of the JI project is impossible as there appear obstacles for investments.

Alternative 1.2 and Alternative 2.2. Application of investment comparison analysis.
Not applicable. The baseline scenario does not involve any investment.

Alterative 1.3. Application of benchmark analysis
Not applicable. Tariff setting does not take into account the investment component and profitability, so the comparison of such financial indicators as Net Present Value (NPV) and Internal Rate of Return (IRR) is impossible for the alternatives of the project implementation.
Outcome of Sub-step 2b: In connection therewith, it is obvious that this project is economically unattractive without registration of the project as a JI project, which proves additionality of this project.
Therefore Step 2 is satisfied.

Sub-Step 2b. Option 2. Application of investment comparison analysis
N/A

Sub-step 2c. Option 3. Application of benchmark analysis
N/A

Sub-step 2d. Sensitivity analysis
N/A

STEP 3: Barrier analysis

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

Investment barriers

Additional expenses on the project implementation include the cost of:

- Modernization of operating pumping equipment;
- Purchase and introduction of new pumping equipment;
- Purchase and introduction of frequency regulators;
- Purchase and replacement of water supply networks;
- Installation of a new group of metering devices;
- Modernization of aerotanks (aeration system);
- Implementation of a mini hydroelectric power plant.

Investment barriers are connected with the structure of applicable 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.

Only one project is known in the former Soviet countries, where similar technology to the technology proposed in this project is used - modernization of biological treatment plant in Chisinau, Moldova.
In Ukraine (or neighbouring countries with similar level of access to technology and financial resources), there are no similar implemented projects that are not registered as JI / CDM projects.
Ukraine already has the experience in introduction of mini hydroelectric power plants 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, determination, verification, registration, monitoring, etc. is absent.

Sub-step 3b: Demonstration of the fact that the identified barriers would not prevent the implementation of at least one of the alternatives (except for the proposed project activity)
One of the alternatives is the 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 Mykolayiv, there aren't any obstacles for CCE «Mykolayivvodokanal» to further operate the water supply system at the previous level.
Outcome of Sub-step 3b: Identified barriers can prevent the implementation of the proposed project to occur but do not prevent introduction of at least one alternative scenario – continuation of «business as usual» scenario. 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 similar project activities demonstrated absence of similar projects in Ukraine. "Modernization of water supply and drainage system "Luganskvoda Ltd.", «Development and improvement of water supply system, drainage system and wastewater treatment of «Infox Ltd.» branch «Infoxvodokanal», "Development and Upgrade of District Water Supply and Disposal System in Zaporizhzhia City" are similar projects. These projects were implemented by selling emission reduction units.
Absence of financial incentives, described in Step 2 and barriers described in Step 3, relate not only to CCE «Mykolayivvodokanal», but also other companies operating water distribution networks in Ukraine. In this respect existing practice of maintaining equipment in running order represented in the alternative of the baseline 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 Mykolayiv city); that is why water supply companies don't have incentives to implement energy efficiency projects.
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 Mykolayiv.

Sub-step 4b. Discussion of any similar Options that are occurring
N/A

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:

Geographic boundary of the project coincides with the territory of the city of Mykolayiv and Mykolayiv region. CCE "Mykolayivvodokanal" is divided into subdepartments and departments. Water supply system, drainage system and wastewater treatment of CCE "Mykolayivvodokanal" are within the project boundary. Detailed list of facilities is provided in Accompanying document 2.

Sources of greenhouse gases and boundary of the baseline scenario
Activities of CCE "Mykolayivvodokanal" are connected with the following GHG emissions:
• CO_2 emissions as a result of consumption of electric energy generated in the process of fossil fuel combustion at a thermal power plant;
• CO_2 emissions, which occur as a result of consumption of electricity which will be generated by mini hydroelectric power plant.

Table 17. 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 generation of electric energy	CO_2	Included	Source of emissions
	CH_4	Excluded	Is not included for reasons of simplification. Analysis is conservative

to the national power grid; • Emissions, which occur as a result of consumption of electricity which will be generated by mini hydroelectric power plant	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 10)

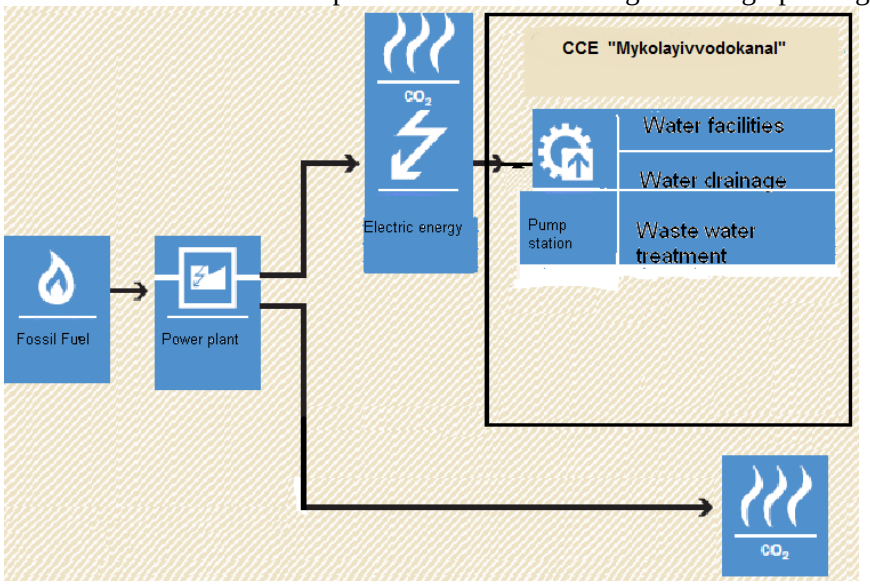

Figure 10. Project boundary for the baseline scenario

Sources of greenhouse gases and boundary of the project scenario:

Activities of CCE "Mykolayivvodokanal" are connected with the following GHG emissions:
• CO_2 emissions as a result of consumption of electric energy generated in the process of fossil fuel combustion at a thermal power plant.
The following table provides an overview of sources of GHG emissions.

Table 18. The table shows an overview of all sources of emissions in the project scenario

Source of emissions	Emissions	Included or excluded	Explanations
Project emissions			
Emissions from power plant(s) in the process of generation of electric energy to 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 project scenario is represented in black rectangle in graphic figure (Figure 11).

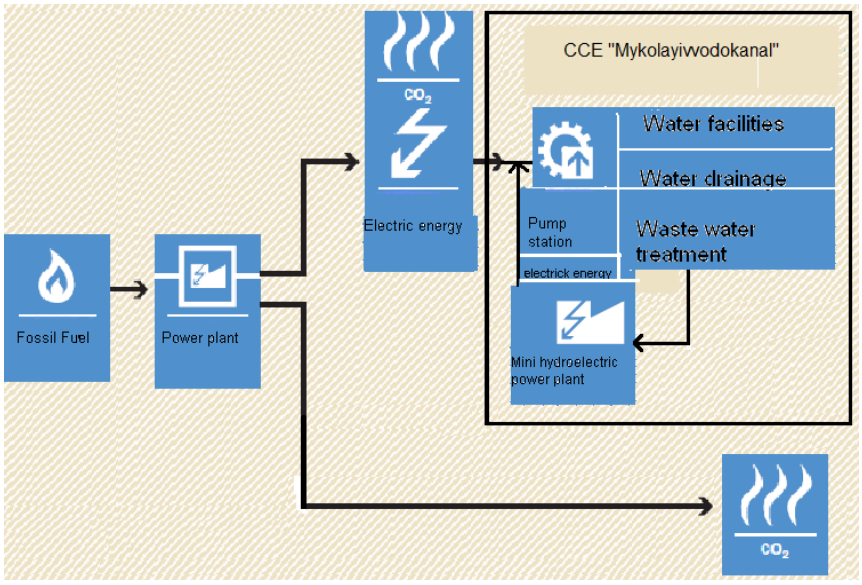

Figure 11. Project boundary for the project scenario

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 amount 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: 31/01/2011
The baseline was set by VEMA S.A., the project developer, and CCE "Mykolayivvodokanal", the owner of the project.

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Fabian Knodel,
Director.
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VEMA S.A. is the project participant (stated in Annex 1).

CCE "Mykolayivvodokanal":
Mykolayiv, Ukraine
Telpis Vasyl Stepanovych
General Director.
Telephone: +38 (0322) 75-34-39,
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e-mail: deli@vodokanal.mk.ua
CCE "Mykolayivvodokanal" - is the project participant (stated in Annex 1).

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Start of project activity: 06/12/2005
On 06/12/2005 members of CCE "Mykolayivvodokanal" made a decision on the launch of the implementation of the JI project at the company.

C.2. Expected operational lifetime of the project:

December 6, 2005– December 31, 2020 (16 years or 180 months).
Real average life-cycle of new equipment for pumps and water distribution networks, equipment for the wastewater treatment system 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 is 15 years.

C.3. Length of the crediting period:

The date on which the first emission reductions are expected to be generated was taken as the starting date of the crediting period, namely January 1, 2006. According to the Kyoto Protocol to the UN Framework Convention on Climate Change duration of the first commitment period is 5 years (from January 1, 2008 to December 31, 2012), i.e. the first emission reduction units will be generated starting from January 1, 2008. The end of the crediting period will be the final date of commitments to the buyer under the purchase and sales contract, under which the project owner must deliver to the buyer approved greenhouse gases anthropogenic emission reductions resulting from this project, namely from January 01, 2013 to December 31, 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, 2006 to December 31, 2020 (15 years or 180 months).

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The choice of the baseline and monitoring are carried out according to requirements of the Guidance on criteria for baseline setting and monitoring with consideration of Decision 9/CMP.1, Appendix «B» «Criteria for baseline setting and monitoring". According to the «Criteria for baseline setting and monitoring" the project developer uses JI specific approach and AM0020 "Baseline methodology for water pumping efficiency improvements" (version 2) to establish monitoring. Collecting of all the key parameters necessary for calculating GHG emissions is executed in accordance with the practice, established at CCE "Mykolayivvodokanal" to measure energy and environmental impact. The monitoring under the project does not require any changes in existing metering system and data collection. All relevant data are calculated and recorded in any case. All leakages were considered and calculated using the conservative approach. They were deemed to be insignificant. See Section E.2. Data of monitoring plan should be kept for at least 2 years after the end of the crediting period.

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

$EC_{b,w}^{j}$	Total amount of electric energy, used by water supply system *«w»* in period *"j"*, in the baseline scenario, kWh
$EC_{b,m}^{j}$	Total amount of electric energy used by drainage system *«m»*, in period *"j"*, in the baseline scenario, kWh
$EC_{b,t}^{j}$	Total amount of electric energy, used by system of aerotanks *"t"* in period *"j",* in the baseline scenario, kWh
$EC_{b,g}^{y}$	Total amount of electric energy, generated by the mini hydroelectric power plant, in period *"y",* in the baseline scenario, kWh
$V_{b,w}^{j}$	Total volume of water pumped by water supply system *«w»* in period *"j"*, in the baseline scenario, m^3
$V_{b,m}^{j}$	Total volume of wastewater pumped by drainage system *«m»* in period *"j"*, in the baseline scenario, m^3
$V_{b,t}^{j}$	Total volume of wastewater treated by system of aerotanks *«t»* in period *"j"*, in the baseline scenario, m^3

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

Data and parameters that are controlled throughout the crediting period:

EF_y	Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid in period *"y"*21, t CO_{2e}/MWh
EF_g	Carbon dioxide emission factor for the Ukrainian power grid when electric energy is generated by the mini hydroelectric power plant, in period *"y"*, t CO_{2e}/MWh
$V^y_{r,w}$	Total volume of water pumped by water supply system *«w»* in period *"y"*, in the project scenario, m^3
$V^y_{r,m}$	Total volume of wastewater pumped by drainage system *«m»* in period *"y"*, in the project scenario, m^3
$V^y_{r,t}$	Total volume of wastewater treated by system of aerotanks *«t»* in period *"y"*, in the project scenario, m^3
$EC^y_{r,w}$	Total amount of electric energy, used by water supply system *«w»* in period *"y"*, in the project scenario, kWh
$EC^y_{r,m}$	Total amount of electric energy used by drainage system *«m»*, in period *"y"*, in the project scenario, kWh
$EC^y_{r,t}$	Total amount of electric energy, used by system of aerotanks *"t"* in period *"y",* in the project scenario, kWh
$EC^y_{r,g}$	Total amount of electric energy, generated by the mini hydroelectric power plant, in period *"y",* in the project scenario, kWh

Table of parameters that will be included in the process of monitoring and verification for 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	$V^y_{r,w}$ Total volume of water pumped by water supply system *«w»* in period *"y"*, in the	Data of flowmeters installed at lifting and pumping plants	m^3	M	Daily	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions

	project scenario							
2-M	$V_{r,m}^{y}$ Total volume of wastewater pumped by drainage system *«m»* in period *"y"*, in the project scenario	Data of flowmeters (volume of wastewater) installed at drainage pumping plants	m^3	M	Daily	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions
3-M	$V_{r,t}^{y}$ Total volume of wastewater treated by system of aerotanks *«t»* in period *"y"*, in the project scenario	Data of flowmeters (volume of wastewater) installed at wastewater treatment plants	m^3	M	Daily	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions
4-M	$EC_{r,w}^{y}$ Total amount of electric energy, used by water supply system *«w»* in period *"y"*, in the project scenario	Data of electricity meters installed at lifting and pumping plants	kWh	M	Monthly	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions
5-M	$EC_{r,m}^{y}$ Total amount of electric	Data of electricity meters installed	kWh	M	Monthly	Data of the company	Information will be archived in	Data which allow for calculation of

	energy used by drainage system *«m»*, in period *"y"*, in the project scenario	at drainage pumping plants					paper and electronic forms	the GHG emissions
6-M	$EC^{y}_{r,t}$ Total amount of electric energy, used by system of aerotanks *"t"* in period *"y"*, in the project scenario	Data of electricity meters installed in wastewater treatment plants	kWh	M	Monthly	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions
7-M	$EC^{y}_{r,g}$ Total amount of electric energy, generated by the mini hydroelectric power plant, in period *"y"*, in the project scenario	Data of electricity meters installed at the mini hydroelectric power plant	kWh	M	Monthly	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions

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

$$E^{y}_{r} = E^{y}_{r,e} + E^{y}_{r,g}, \quad (1)$$

Where:

E_r^y - GHG emissions that occur in period "y" in the project scenario, t CO_{2e};

$E_{r,e}^y$ - GHG emissions, due to electric energy consumption by pumping and treatment equipment in period «*y*» in the project scenario, t CO_2e;

$E_{r,g}^y$ - GHG emissions, due to electric energy consumption that will be substituted with electric energy generated by the mini hydroelectric power plant in period «*y*», in the project scenario, *t* CO_2e;

$[e]$ - electric energy consumption system;

$[g]$ - mini hydroelectric power plant system;

$[y]$ - monitoring period;

$[r]$ - relates to reporting year.

$$E_{r,e}^y = E_{r,w}^y + E_{r,m}^y + E_{r,t}^y, \quad (2)$$

Where:

$E_{r,w}^y$ - GHG emissions due to electric energy consumption by water supply system *"w"* in period «y», in the project scenario, t CO_2e;

$E_{r,m}^y$ - GHG emissions due to electric energy consumption by drainage system *«m»,* in period «y», in the project scenario, t CO_2e;

$E_{r,t}^y$ - GHG emissions due to electric energy consumption by wastewater treatment system (aerotanks) *"t"*, in period «y», in the project scenario, t CO_2e;

$[w]$ - water supply system;

$[m]$ - drainage system;

$[t]$ - system of aerotanks;

$[y]$ - monitoring period;

$[r]$ - relates to reporting year.

GHG emissions due to electric energy consumption by pumping equipment, which is used by water supply system *"w"*

$$E_{r,w}^y = EC_{r,w}^y * EF_y, \quad (3)$$

where:

EF_y - Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid, in period *"y"* , t CO_2e/MWh;

$EC^y_{r,w}$ - total amount of electric energy, that is consumed by water supply system *«w»* in period «*y»* in the project scenario, kWh.;

$[w]$ - water supply system;

$[y]$ - monitoring period;

$[r]$ - relates to reporting year.

GHG emissions, due to consumption of electric energy which is used by drainage system *«m»*

$$E^y_{r,m} = EC^y_{r,m} * EF_y, \quad (4)$$

Where:

EF_y - Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid in period "y", t CO_2e/MWh;

$EC^y_{r,m}$ - total amount of electric energy, that is consumed by drainage system *«m»* in period «*y»* in the project scenario, kWh;

$[m]$ - drainage system;

$[y]$ - monitoring period;

$[r]$ - relates to project year.

GHG emissions due to consumption of electric energy which is used by wastewater treatment system *«t»* (aerotanks)

$$E^y_{r,t} = EC^y_{r,t} * EF_y, \quad (5)$$

where:

EF_y - Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid, in period *"y"* , t CO_2e/MWh;

$EC^y_{r,t}$ - total amount of electric energy, that is consumed by system of aerotanks *«t»* in period «*y»* in the project scenario, kWh.;

$[t]$ - system of aerotanks;

$[y]$ - monitoring period;

$[r]$ - relates to project year.

GHG emissions due to consumption of electric energy which will be generated by the mini hydroelectric power plant

$$E_{r,g}^{y} = EC_{r,g}^{y} * EF_{g}, \quad (6)$$

Where:

$EC_{r,g}^{y}$ - total amount of electric energy generated by plant (mini hydroelectric power plant), in period «y», in the project scenario, kWh;

EF_{g} - Carbon dioxide emission factor for the power grid in Ukraine when electric energy is generated by mini hydroelectric power plant, in period *"y"*, t CO_2e/MWh;

$[g]$ - mini hydroelectric power plant system;

$[y]$ - monitoring period of project scenario;

$[r]$ - relates to project monitoring 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 volume of water pumped by water supply system *«w»* in period *"j"*, in the baseline scenario	Data of flowmeters installed at lifting and pumping plants	m^3	M	Daily	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions
2-B	$V_{b,m}^{j}$ Total volume of wastewater pumped by drainage system *«m»* in period *"j"*, in the baseline scenario	Data of flowmeters (volume of wastewater) installed at drainage pumping plants	m^3	M	Daily	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions
3-B	$V_{b,t}^{j}$ Total volume of wastewater treated by system of aerotanks *«t»* in period *"j"*, in the baseline scenario	Data of flowmeters (volume of wastewater) installed at wastewater treatment plants	m^3	M	Daily	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions

4-B	$EC^{j}_{b,w}$ Total amount of electric energy, used by water supply system *«w»* in period *"j"*, in the baseline scenario	Data of electricity meters installed at lifting and pumping plants	kWh	M	Monthly	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions
5-B	$EC^{j}_{b,m}$ Total amount of electric energy used by drainage system *«m»*, in period *"j"*, in the baseline scenario	Data of electricity meters installed at drainage pumping plants	kWh	M	Monthly	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions
6-B	$EC^{j}_{b,t}$ Total amount of electric energy, used by system of aerotanks *"t"* in period *"j"*, in the baseline scenario	Data of electricity meters installed at wastewater treatment plants	kWh	M	Monthly	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions

7-B	$EC_{b,g}^{y}$ Total amount of electric energy, generated by the mini hydroelectric power plant, in period *"y"*, in the baseline scenario	Data of electricity meters installed at the mini hydroelectric power plant	kWh	M	Monthly	Data of the company	Information will be archived in paper and electronic forms	Data which allow for calculation of the GHG emissions

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

$$E_b^y = E_{b,e}^y + E_{b,g}^y, \quad (7)$$

Where:

$E_{b,e}^y$ - GHG emissions that occur in period *"y"* in the baseline scenario, t CO_{2e};

$E_{b,e}^y$ - GHG emissions, due to electric energy consumption by pumping and treatment equipment in period «*y*» in the baseline scenario, t CO_2e;

$E_{b,g}^y$ - GHG emissions, due to consumption of electric energy that will be substituted with electric energy generated by the mini hydroelectric power plant in the baseline scenario, in period «*y*», *t* CO_2e;

$[e]$ - electric energy consumption system;

$[g]$ - mini hydroelectric power plant system;

$[y]$ - monitoring period;

$[b]$ - relates to the baseline period.

$$E_{b,e}^{y} = E_{b,w}^{y} + E_{b,m}^{y} + E_{b,t}^{y}, \quad (8)$$

Where:

$E_{b,w}^{y}$ - GHG emissions, due to electric energy consumption by water supply system *«w»* in period «*y*», in the baseline scenario, t CO_2e;

$E_{b,m}^{y}$ - GHG emissions, due to electric energy consumption by drainage system *«m»* in period «*y*», in the baseline scenario, t CO_2e;

$E_{b,t}^{y}$ - GHG emissions, due to electric energy consumption by wastewater treatment system *«t»* (aerotanks) in period «*y*», in the baseline scenario, t CO_2e;

$[e]$ - electric energy consumption system;

$[w]$ - water supply system;

$[m]$ - drainage system;

$[t]$ - system of aerotanks;

$[y]$ - monitoring period;

$[b]$ - relates to baseline period.

GHG emissions due to electric energy consumption by pumping equipment, which is used by water supply system *"w"*

$$E_{b,w}^{y} = V_{r,w}^{y} * SEC_{b,w}^{y} * EF_{y}, \quad (9)$$

Where:

$SEC_{b,w}^{y}$ - Specific consumption of electric energy used by water supply system "*w*" in period «*y*», in the baseline scenario, kWh./m^3;

EF_{y} - Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid, in period *"y"*, t CO_{2e}/MWh;

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

$[w]$ - water supply system;

$[y]$ - monitoring period;

$[b]$ - relates to baseline period;

$[r]$ - relates to project period.

Specific electric energy consumption in the baseline scenario is calculated based on the assumption of its linear growth with time. This linear dependence is based on historical data for the period of 2001-2005 by using the method of least squares. Specific electric energy consumption in the baseline scenario in period *"y"* is calculated according to formulae:

$$SEC^{y}_{b,w} = a \cdot y + b, \tag{9.1}$$

$$a = \frac{5\sum_{j}(SEC^{j}_{b,w} \cdot j) - \sum_{j} SEC^{j}_{b,w} \cdot \sum_{j} j}{5\sum_{j} j^2 - (\sum_{j} j)^2}, \tag{9.2}$$

$$b = \frac{\sum_{j} SEC^{j}_{b,w} - a \cdot \sum_{j} j}{5}, \tag{9.3}$$

Where:

$SEC^{y}_{b,w}$ - Specific consumption of electric energy used by water supply system "*w*" in period «*y*», in the baseline scenario, kWh/m^3;

a - linear dependence coefficient;

b - linear dependence coefficient;

$[w]$ - water supply system;

$[j]$ - historical period $j \in \{2001, 2002, 2003, 2004, 2005\}$;

$[5]$ - number of years in historical period;

$[y]$ - monitoring period;

$[b]$ - relates to baseline period.

In these formulae specific consumption in year «*j*» is calculated as follows:

$$SEC^{j}_{b,w} = EC^{j}_{b,w} / V^{j}_{b,w}, \quad (9.4)$$

Where:

$EC^{j}_{b,w}$ - total amount of electric energy, used by water supply system "*w*" in period "*j*", in the baseline scenario, kWh;

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

$[w]$ - water supply system;

$[j]$ - historical period $j \in \{2001, 2002, 2003, 2004, 2005\}$;

$[b]$ - relates to baseline period.

GHG emissions, due to electric energy consumption which is used by drainage system *«m»*

$$E^{y}_{b,m} = V^{y}_{r,m} * SEC^{y}_{b,m} * EF_{y}, \quad (10)$$

Where:

$SEC^{y}_{b,m}$ - Specific consumption of electric energy used by drainage system "*m*" in period «*y*», in the baseline scenario, kWh/m^3;

EF_{y} - Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid, in period *"y"*, t CO_{2e}/MWh;

$V^{y}_{r,m}$ - total volume of wastewater pumped by drainage system *«m»* in period "*y*", in the project scenario, m^3;

$[m]$ - drainage system;

$[y]$ - monitoring period;

$[b]$ - relates to baseline period;

$[r]$ - relates to project period.

Specific electric energy consumption in the baseline scenario is calculated based on the assumption of its linear growth with time. This linear dependence is based on historical data for the period of 2001-2005 by using the method of least squares. Specific electric energy consumption in the baseline scenario in period *"y"* is calculated according to formulae:

$$SEC^{y}_{b,\,m} = a \cdot y + b, \tag{10.1}$$

$$a = \frac{5\sum_{j}(SEC^{j}_{b,m} \cdot j) - \sum_{j} SEC^{j}_{b,m} \cdot \sum_{j} j}{5\sum_{j} j^{2} - (\sum_{j} j)^{2}}, \tag{10.2}$$

$$b = \frac{\sum_{j} SEC^{j}_{b,m} - a \cdot \sum_{j} j}{5}, \tag{10.3}$$

Where:

$SEC^{y}_{b,\,m}$ - Specific consumption of electric energy used by drainage system "*m*" in period «*y*», in the baseline scenario, kWh/m^3;

a - linear dependence coefficient;

b - linear dependence coefficient ;

$[m]$ - drainage system;

$[j]$ - historical period $j \in \{2001, 2002, 2003, 2004, 2005\}$;

$[5]$ - number of years in historical period;

$[y]$ - monitoring period of project scenario;

$[b]$ - relates to baseline period.

In these formulae specific consumption in year «*j*» is calculated as:

$$SEC^{j}_{b,\,m} = EC^{j}_{b,\,m} / V^{j}_{b,\,m}, \tag{10.4}$$

Where:

$EC^{j}_{b,\,m}$ - total amount of electric energy, used by drainage system "*m*" in period "*j*", in the baseline scenario, kWh;

$V^{j}_{b,\,m}$ - total volume of wastewater pumped by drainage system *«m»* in period "*j*", in the baseline scenario, m^3;

$[m]$ - drainage system;

$[j]$ - historical period $j \in \{2001, 2002, 2003, 2004, 2005\}$;

$[b]$ - relates to baseline period.

GHG emissions, due to consumption of electric energy which is used by wastewater treatment system *«t»* (aerotanks)

$$E^{y}_{b,t} = V^{y}_{r,t} * SEC^{y}_{b,t} * EF_{y}, \qquad (11)$$

Where:

$SEC^{y}_{b,\,t}$ - Specific consumption of electric energy used by system of aerotanks "t" in period «*y*», in the baseline scenario, kWh/m^3;

EF_{y} - Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid, in period *"y"*, t CO_{2e}/MWh;

$V^{y}_{r,\,t}$ - total volume of wastewater treated by system of aerotanks *«t»* in period "*y*", in the project scenario, m^3;

$[t]$ - system of aerotanks;

$[y]$ - monitoring period;

$[b]$ - relates to baseline period;

$[r]$ - relates to project period.

Specific electric energy consumption in the baseline scenario is calculated based on the assumption of its linear growth with time. This linear dependence is based on historical data for the period of 2001-2005 by using the method of least squares. Specific electric energy consumption in the baseline scenario in period *"y"* is calculated according to formulae:

$$SEC^{y}_{b,t} = a \cdot y + b, \qquad (11.1)$$

$$a = \frac{5\sum_j (SEC^j_{b,t} \cdot j) - \sum_j SEC^j_{b,t} \cdot \sum_j j}{5\sum_j j^2 - (\sum_j j)^2}, \quad (11.2)$$

$$b = \frac{\sum_j SEC^j_{b,t} - a \cdot \sum_j j}{5}, \quad (11.3)$$

Where:

$SEC^y_{b,t}$ - Specific consumption of electric energy used by system of aerotanks *"t"* in period «*y*», in the baseline scenario, kWh./m^3;

a - linear dependence coefficient;

b - linear dependence coefficient;

$[t]$ - system of aerotanks;

$[j]$ - historical period $j \in \{2001, 2002, 2003, 2004, 2005\}$;

$[5]$ - number of years in historical period;

$[y]$ - monitoring period of project scenario;

$[b]$ - relates to baseline period.

In these formulae specific consumption in year «*j*» is calculated as follows:

$$SEC^j_{b,t} = EC^j_{b,t} / V^j_{b,t}, \quad (11.4)$$

Where:

$EC^j_{b,t}$ - total amount of electric power, used by system of aerotanks *"t"* in period "*j*", in the baseline scenario, kWh;

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

$[t]$ - system of aerotanks;

$[j]$ - historical period $j \in \{2001, 2002, 2003, 2004, 2005\}$;

$[b]$ - relates to baseline period;

GHG emissions due to electric energy consumption which will be generated by the mini hydroelectric power plant in the baseline scenario

$$E_{b,g}^{y} = EC_{b,g}^{y} * EF_{g}, \quad (12)$$

Where:

$EC_{b,g}^{y}$ - total amount of electric energy generated by the plant (the mini hydroelectric power plant), in period «y» in the baseline scenario, kWh;

EF_{g} - Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid when electric energy is generated by mini hydroelectric power plant (according to conservative approach EF is taken for the electricity consumers of the 1st class), t CO_2e/MWh;

$[g]$ - system of mini hydroelectric power plant;

$[y]$ - monitoring period of project scenario;

$[b]$ - relates to baseline monitoring 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:

There are no leakages. 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):

Number of Emission Reduction (ER) Units, t CO_2e:

$$ER^{y} = E_b^{y} - E_r^{y}, \quad (13)$$

where:

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

E_b^y – GHG emissions in period «*y*» in the baseline scenario, t CO_2e;

E_r^y – GHG emissions in period «*y*» in the project scenario, t CO_2e;

$[y]$ - monitoring period;

$[b]$ - relates to baseline period;

$[r]$ - relates to 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:

Major environmental law of Ukraine:
Law of Ukraine "On environmental protection».[28]

According to the environmental section “Environmental Impact Assessment” (EIA) of the project that will be provided during the implementation of the mini hydroelectric power plant, emissions caused by the operation of this equipment should be measured once every 2 years (section "Proposal for establishing maximum permissible emissions"). CCE “Mykolayivvodokanal” will systematically collect data on pollution, which may have a negative impact on the environment. Skilled workers of CCE “Mykolayivvodokanal” will be engaged in monitoring, data collection with meters (electricity meters, flowmeters) and archiving. All data must be kept 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.
1-M 3…M, 1-B…3-B	Low	Meters shall be calibrated according to the national standards by independent authority
4-M…7-M, 4-B…7-B	Low	Meters shall be calibrated according to the national standards by independent authority

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

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

Operational structure includes Supplier's (CCE "Mykolayivvodokanal) operational departments (repair-and-renewal operations, etc.) and personnel for pumping plants operation.
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 established by VEMA S.A., project's developer, and CCE "Mykolayivvodokanal" Ltd., 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 a project participant (Annex 1)

CCE "Mykolayivvodokanal":
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General Director.
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e-mail: deli@vodokanal.mk.ua
CCE "Mykolayivodokanal": - 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 Accompanying document 1. Since in the process of project elaboration volume of supplied water, and consumed electric energy were unknown, the project developers rely on the data known at this stage of calculation, namely baseline volume of supplied water, and total amount of consumed electric energy.

Results of corresponding calculations with application of these formulae are provided in Accompanying document 1. These calculations are based on improvement of equipment efficiency. Identifications of parameters corresponding to these formulae are stated in Accompanying document 1.

Accompanying document 1 contains GHG emission reductions calculation that corresponds to separate technology, used in the JI project.
Accompanying document 1 – Calculation of estimated greenhouse gas emissions.
Accompanying document 2 – Project and monitoring equipment.
Accompanying document 3 – Replacement of water supply and drainage networks.
GHG emission reductions in the project were estimated by means of calculations provided in Accompanying document 1.

Table 19. Estimated project emissions for the period from January 1, 2006 to December 31, 2012

Year	Project emissions (tCO_2 equivalent)
2006	57 028
2007	47 715
2008	59 054
2009	60 099
2010	58 496
2011	58 496
2012	58 496
Total (t CO_2 equivalent)	399 384

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

Year	Project emissions (tCO_2 equivalent)
2013	58 496
2014	58 496
2015	58 496
2016	58 496
2017	58 496
2018	58 496
2019	58 496
2020	58 496
Total (t CO_2 equivalent)	467 968

Detailed information on calculations is provided in the Accompanying document 1.

E.2. Estimated leakage:

There is no expected leakage.

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

Since there are no leakages the sum of E.1 and E.2 will be equal to E.1 (see Tables 21-27).

E.4. Estimated baseline emissions:

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

Table 21. Estimated baseline emissions for the period from January 1, 2006 to December 31, 2012

Year	Estimated baseline emissions (tCO_2 equivalent)
2006	87 441
2007	88 354
2008	121 271
2009	123 607
2010	129 848
2011	129 848
2012	133 336
Total (t CO_2 equivalent)	813 705

Table 22. Estimated baseline emissions for the period from January 1, 2013 to December 31, 2020

Year	Estimated baseline emissions (tCO_2 equivalent)
2013	133 336
2014	133 336
2015	133 336
2016	133 336
2017	133 336
2018	133 336
2019	133 336
2020	133 336
Total (t CO_2 equivalent)	1 066 688

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

Project emission reductions = Baseline emissions - (Project emissions + Estimated leakages).
All results of estimation of project emission reductions are provided in Tables 23-24.

Table 23. Estimated emission reductions for the period from January 1, 2005 to December 31, 2012

Year	Estimated emission reductions (t CO_2 equivalent)
2006	30 413
2007	40 639
2008	62 218
2009	63 508
2010	71 352
2011	71 352
2012	74 840
Total (t CO_2 equivalent)	413 322

Table 24. Estimated emission reductions for the period from January 1, 2013 to December 31, 2020

Year	Estimated emission reductions (t CO_2 equivalent)
2013	74 840
2014	74 840
2015	74 840
2016	74 840
2017	74 840
2018	74 840
2019	74 840
2020	74 840
Total (t CO_2 equivalent)	598 720

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

Table. 25. Table providing results of emission reduction estimation before the first commitment period.

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakages (t CO_2 equivalent)	Estimated baseline emissions (t CO_2 equivalent)	Estimated emission reductions (t CO_2 equivalent)
2006	57 028	0	87 441	30 413
2007	47 715	0	88 354	40 639
Total (t CO_2 equivalent)	104 743	0	175 795	71 052

Table. 26. Table providing results of emission reduction estimation during the first commitment period.

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakages (t CO_2 equivalent)	Estimated baseline emissions (t CO_2 equivalent)	Estimated emission reductions (t CO_2 equivalent)
2008	59 054	0	121 271	62 218

2009	60 099	0	123 607	63 508
2010	58 496	0	129 848	71 352
2011	58 496	0	129 848	71 352
2012	58 496	0	133 336	74 840
Total (t CO_2 equivalent)	294 641	0	637 911	343 270

Table. 27. Table providing results of emission reduction estimation after the first commitment period.

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakages (t CO_2 equivalent)	Estimated baseline emissions (t CO_2 equivalent)	Estimated emission reductions (t CO_2 equivalent)
2013	58 496	0	133 336	74 840
2014	58 496	0	133 336	74 840
2015	58 496	0	133 336	74 840
2016	58 496	0	133 336	74 840
2017	58 496	0	133 336	74 840
2018	58 496	0	133 336	74 840
2019	58 496	0	133 336	74 840
2020	58 496	0	133 336	74 840
Total (t CO_2 equivalent)	467 968	0	1 066 688	598 720

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 and drainage 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"[29] and Art. 14 of the Law of Ukraine "On ecological expertise"[30].
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.
CCE "Mykolayivvodokanal" has all permits, including limits on the formation and disposal of waste, as well as relevant standards in the process of execution of reporting documents on the use of energy resources:

- Permit for special water use;
- The limit on the formation and disposal of waste CCE "Mykolayivvodokanal";
- Form 2-TP (VODHOSP), Report on water use;
- Form 11-MTP, report on the use of fuel, heat and electricity.

In general, the project «Development and improvement of water supply system, drainage system and wastewater treatment of City Communal Enterprise "Mykolayivvodokanal" will have favorable impact on the environment. It is expected that due to decrease in energy consumption by the water supply system (mainly by pumping equipment) CO_2 emissions of from the national power grid of Ukraine will decrease.
Environmental effect will be caused only by dismantled equipment. It is a state property and it will further be stored at the company's storage buildings.

Air environment effect

Air environment effect is absent.

Land use effect

Land/soil use effect is absent.

Environmental effect

Implementation of this project will allow for improvement of level of service for water consumers. Experience of CCE "Mykolayivvodokanal" staff and compliance with regulations on «Drinking water and drinking water supply» will allow for minimization of risks of any accidents during the project implementation.
Transboundary impacts from the project activity according to their definition in the text of "Convention on transboundary long-range pollution", ratified by Ukraine, will not take place.
The Project does not provide for any detrimental effects on the environment.

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

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

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 analyzing environmental impact it is clear that the project does not make any significant negative environmental impact, but rather has a positive effect on the environment. It is expected that due to decrease in electric energy consumption from the national power grid of Ukraine by the water supply system (mainly by pumping equipment) CO_2 emission will decrease.

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, CCE "Mykolayivvodokanal" 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 company[31]. Stakeholders may provide their comments and take part in the discussion of these issues. No comments have been received so far.

[31] *http://www.vodokanal.mk.ua/*

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	CCE "Mykolayivvodokanal"
Street/P.O.Box:	Chygrina Str.
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Postal code:	54055
Country:	Ukraine
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Fax:	+38 (0322) 76-74-07
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URL:	
Represented by:	
Title:	General Director
Salutation:	
Last name:	Telpis
Middle name:	Vasyl
First name:	Stepanovych
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E-mail:	info@vemacarbon.com
URL:	www.vemacarbon.com
Represented by:	
Title:	Director
Salutation:	
Last name:	Knodel
Middle name:	Fabian
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Department:	
Phone (direct):	+41 (76) 346 11 57
Fax (direct):	
Mobile:	
Personal e-mail:	

Annex 2

BASELINE INFORMATION

Key information for baseline setting is stated in the tables provided in section B.2.

Table B.1. Carbon dioxide emission factor for consumption of electricity from the national power grid of Ukraine (EF_y) for 2001-2005

Year	2001	2002	2003	2004	2005
EF_y tCO_2e/MWh	0.976	0.956	0.936	0.916	0.896

For 2006-2007 carbon dioxide emission factors for consumption of electricity from the national power grid of Ukraine are taken according to table 8: "Emission Factors for Ukrainian power grid in 2006-2012" annex 2 "Standardized emission factors for UPG of Ukraine" to the document "Ukraine- Estimation of new CEF calculation", verified by TUV SUD Industrie Service GmbH on 17/08/2007[32]. :

Table B.1. Carbon dioxide emission factors (EF) for consumption of electricity from the national power grid of Ukraine for 2006-2007

Year	2006	2007
EF_y tCO_2e/MWh	0.896	0.896

- 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"[33];
- 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"; [34]
- Carbon dioxide emission factors for 2010 were taken from the Decree of NEIAU №43 dated 28/03/2011p. "On approval of specific carbon dioxide emission factors in 2010"2121; [35]
- Carbon dioxide emission factors for 2011 were taken from the Decree of NEIAU №75 dated 12/05/2011p. "On approval of specific carbon dioxide emission factors in 2011" 2221[36]

Table B.2. Carbon dioxide emission factors (EF) for for consumption of electricity from the national power grid of Ukraine for 2008-2011

Year		2008	2009	2010	2011
EF_y tCO_2e/MWh	The 1st class of electricity consumers	1.082	1.096	1.093	1.090
	The 2nd class of electricity consumers	1.219	1.237	1.225	1.227

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

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

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

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

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

Table B.3. Data and parameters used in the course of baseline setting

Parameter	Unit of measurement	Source of data	Description
EF_y	t CO_2e/MWh	Refer to tables B.1-B.3.	Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid in period *"y"*
EF_g	t CO_2e/MWh	Refer to tables B.1-B.3.	Carbon dioxide emission factor for the Ukrainian power grid when electric energy is generated by the mini hydroelectric power plant, in period *"y"*
$EC^j_{b,\,w}$	kWh	Data of electricity meters installed at lifting and pumping plants	Total amount of electric energy, used by water supply system *«w»* in period *"j"*, in the baseline scenario
$EC^y_{b,\,m}$	kWh	Data of electricity meters installed at drainage plants	Total amount of electric energy used by drainage system *«m»*, in period *"j"*, in the baseline scenario
$EC^y_{b,\,t}$	kWh	Data of electricity meters installed at wastewater treatment plants	Total amount of electric energy, used by system of aerotanks *"t"* in period *"j"*, in the baseline scenario
$EC^j_{b,g}$	kWh	Data of electricity meters installed at the mini hydroelectric power plant	Total amount of electric energy, generated by the mini hydroelectric power plant, in period *"y"*, in the baseline scenario
$V^j_{b,\,w}$	m^3	Data of flowmeters installed at lifting and pumping plants	Total volume of water pumped by water supply system *«w»* in period *"j"*, in the baseline scenario
$V^y_{b,\,m}$	m^3	Data of flowmeters installed at drainage plants	Total volume of wastewater pumped by drainage system *«m»* in period *"j"*, in the baseline scenario
$V^y_{b,\,t}$	m^3	Data of flowmeters installed at treatment plants	Total volume of wastewater treated by system of aerotanks *«t»* in period *"j"*, in the baseline scenario

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 CCE "Mykolayivvodokanal" 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-efficiency equipment. Monitoring will be carried out by means of provision of a detailed layout of the water-supply network pipelines subject to marking of main diameters of the pipeline;
3. Introduction of automatic air valves on water mains for decrease of pressure and improvement of 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.
8. Installation of the mini hydroelectric power plant. Monitoring of new equipment introduction will be conducted by means of the documentation confirming purchase and assembly of new equipment.

Documentation confirming purchase and assembly of new equipment will be archived and kept at CCE "Mykolayivvodokanal" 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:

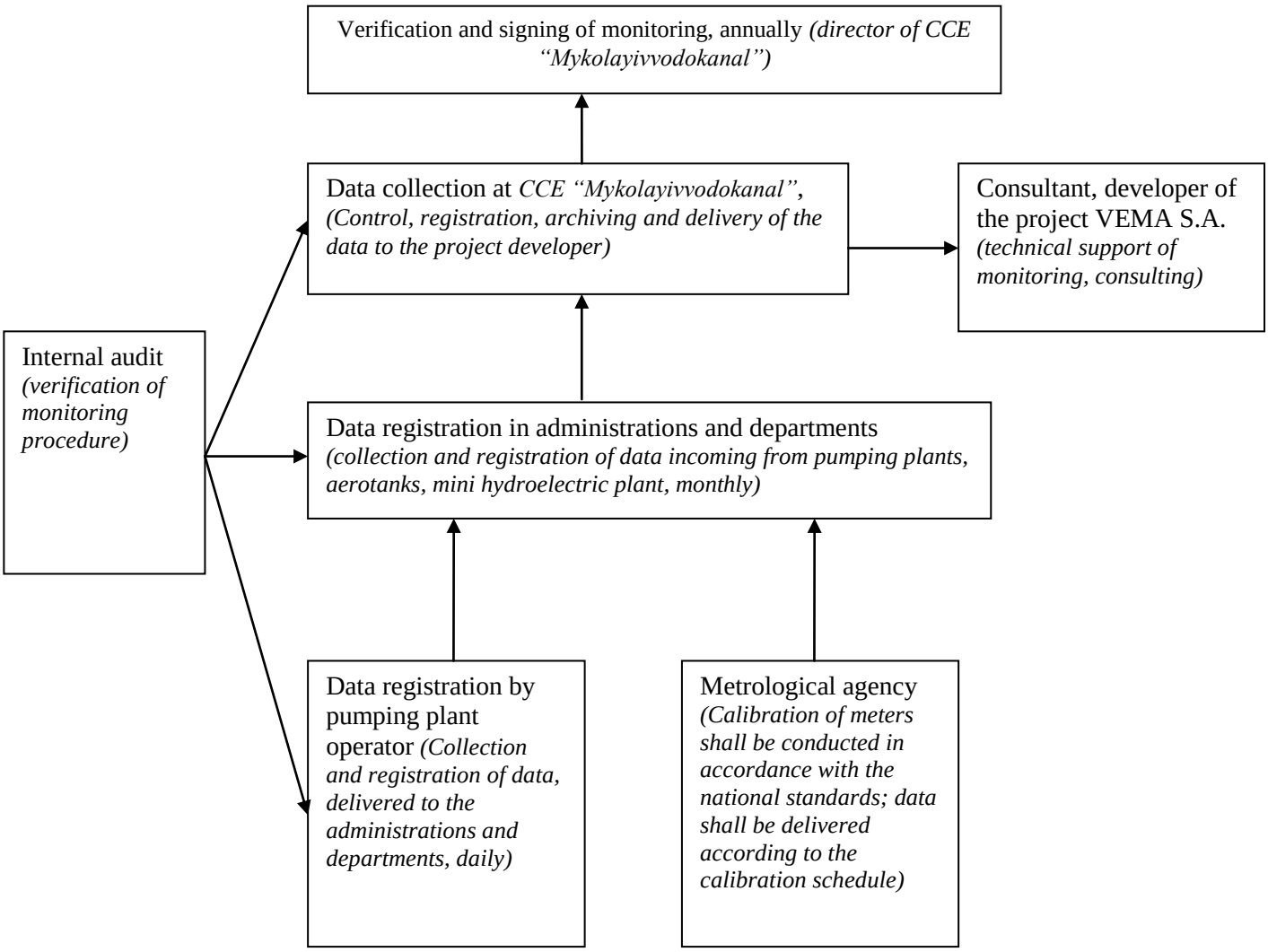

Figure B.1. Structure of monitoring data collection at CCE "Mykolayivvodokanal"

C. Monitoring procedures

Measures for control of electric energy, consumed by CCE "Mykolayivvodokanal":

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 in 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 the devices, which passed state certification, registered under contractual conditions and jointly sealed by the representatives of power supplying organization and CCE "Mykolayivvodokanal" subject to execution of act of sealing). The head of site shall transfer obtained information to the chief power engineer department;

3. "Report on electricity meters readings" shall be made according to the readings of electricity meters of all sites; engineer involved in electric energy bills shall provide this Report to the subscriber department of energy supplying organization;

4. Following the "Report on electricity 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 CCE "Mykolayivvodokanal" for confirmation;

5. The representative of CCE "Mykolayivvodokanal" shall provide approved "Act of supplied electric energy" to the subscriber department of energy supplying organization, wherein he obtains invoices for payment; ("invoice of OJSC "Mykolayivoblenergo for consumed energy, consumer CCE "Mykolayivvodokanal")

6. All payment receipts shall be kept by CCE "Mykolayivvodokanal" in paper form.

Measures for control of supplied water to the consumers at CCE "Mykolayivvodokanal":

1. Metering of water produced from water facilities of CCE "Mykolayivvodokanal" shall be carried out by flow meters located at pumping plants when intaking water;

3. Data shall be taken every hour and fixed in logs of established form PID-11;

4. 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 dispatching department of each production unit;

5. 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. These fact sheets are transferred to corresponding services of management apparatus of CCE "Mykolayivvodokanal";

6. Report 2-TP (vodhosp) shall be submitted to the Mykolayiv Department of Water Resources after its verification by production and technical department as well as sales department of management apparatus. Payment for water, supplied to consumer, shall be made according to this report.

Measures for control of drained wastewater from consumers at CCE "Mykolayivvodokanal":

1. Metering of drained wastewater in the drainage system of CCE "Mykolayivvodokanal" is carried out by means of flowmeters located at drainage pumping plants at the entrance to biological treatment plants. As the volume of wastewater after drainage pumping plants is equal to the volume of wastewater that enters wastewater treatment facilities, it was decided to install flow meters only at the entrance of WWTP (wastewater treatment plant) that track the overall volume of wastewater only once.

2. Data are taken every hour and fixed in logs of established form PID-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 the dispatching service 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. These fact sheets are transferred to corresponding services of management apparatus of CCE "Mykolayivvodokanal";

5. Report 2-TP (vodhosp) shall be submitted to the Mykolayiv Department of Water Resources after its verification by production and technical department as well as sales department of management apparatus on a quarterly basis. Payment for drained wastewater from consumers, shall be made according to this report.

Measures for control of wastewater drained by wastewater treatment plants at CCE "Mykolayivvodokanal":

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

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

3. Data about volume of drained wastewater from wastewater plants shall be transferred every day at 00:00 o'clock to dispatching service 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. These fact sheets are transferred to corresponding services of management apparatus;

5. Report 2-TP (vodhosp) shall be submitted to the Mykolayiv Department of Water Resources after its verification by production and technical department as well as sales department of management apparatus on a quarterly basis. Payment for treated wastewater, shall be made according to this report.

After the implementation of the JI project the following measure for control of electric energy to be generated by CCE "Mykolayivodokanal" after the installation of the mini hydroelectric power plant would be carried out:

1. Current control of electricity meters operation at the mini hydroelectric power plant will be conducted during a settling period (settling month is determined by the conditions of the contract on electric energy supply);

2. On the day stipulated in the contract (as a rule it is the day following the settling month) the chief of the site or his authorized representative shall take the readings of electricity meters (electricity meters are the devices, which have to pass state certification, be registered under contractual conditions and jointly sealed by the representatives of power supplying organization). The head of the site shall transfer obtained information to the chief power engineer department;

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

4. Following the "Report on electricity 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 CCE "Mykolayivodokanal";

5. All information shall be kept in archive of CCE "Mykolayivodokanal" in electronic and paper forms.

D. Calibration of meters

Meters shall be calibrated according to the national standards. Details are provided in the Accompanying document 3.

E. Recording and archiving of data

The person responsible for the joint implementation project, appointed by the project owner, shall monitor data in electronic and paper form. Electronic documents shall be printed and kept.
The Project owner shall keep the copy of the acts of supplied electric energy (originals of the acts shall be kept in subscriber department).
All data and documents in paper form shall be archived and one backup copy shall be handed over to project coordinator.

All data shall be kept during 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 CCE "Mykolayivodokanal" before the beginning of the project activity and during the project period.

Data and parameters of monitoring:

Data/Parameter	$V_{r,w}^{y}$
Data unit	m^3
Description	Total volume of water pumped by water supply system *«w»* in period *"y"*, in the project scenario

Data source	Volume of water that is pumped by lifting and pumping plants
Method of monitoring	Flowmeters installed at water supply pumping plants
Frequency of examination	Daily
Approving documents	Logbook PID-11 form

Data/Parameter	$V^{y}_{r,m}$
Data unit	m^3
Description	Total volume of wastewater pumped by drainage system *«m»* in period *"y"*, in the project scenario
Data source	Volume of wastewater that is pumped by drainage pumping plants
Method of monitoring	Flowmeters installed at drainage pumping plants
Frequency of examination	Daily
Approving documents	Logbook PID-11 form

Data/Parameter	$V^{y}_{r,t}$
Data unit	m^3
Description	Total volume of wastewater treated by system of aerotanks *«t»* in period *"y"*, in the project scenario
Data source	Volume of wastewater that is pumped by wastewater treatment plants
Method of monitoring	Flowmeters installed at wastewater pumping plants
Frequency of examination	Daily
Approving documents	Logbook PID-11 form

Data/Parameter	$EC^{y}_{r,w}$
Data unit	kWh
Description	Total amount of electric energy, used by water supply system *«w»* in period *"y"*, in the project scenario
Data source	Amount of electric energy used by lifting and pumping plants
Method of monitoring	Electricity meters installed at water supply pumping plants
Frequency of examination	Monthly
Approving documents	Act of supplied electric energy

Data/Parameter	$EC^{y}_{r,m}$
Data unit	kWh
Description	Total amount of electric energy used by drainage system *«m»*, in period *"y"*, in the project scenario
Data source	Amount of electric energy used by drainage pumping plants
Method of monitoring	Electricity meters installed at drainage pumping plants
Frequency of examination	Monthly
Approving documents	Act of supplied electric energy

Data/Parameter	$EC^{y}_{r,t}$
Data unit	kWh
Description	Total amount of electric energy, used by system of aerotanks *"t"* in period *"y"*, in the project scenario
Data source	Amount of electric energy used by system of aerotanks

Method of monitoring	Electricity meters installed at treatment plants (aerotanks)
Frequency of examination	Monthly
Approving documents	Act of supplied electric energy

Data/Parameter	$EC^{y}_{r,g}$
Data unit	kWh
Description	Total amount of electric energy, generated by the mini hydroelectric power plant, in period *"y"*, in the project scenario
Data source	Amount of electric energy used by the mini hydroelectric power plant
Method of monitoring	Electricity meters installed at mini hydroelectric power plant
Frequency of examination	Monthly
Approving documents	Act of supplied electric energy

Data/Parameter	EF_y
Data unit	t CO_2e/MWh
Description	Carbon dioxide emission factor for consumption of electricity from the Ukrainian national power grid in period *"y"*21
Data source	Carbon dioxide emission factor for 2006-2007 were taken in accordance with the Table 8 "Emission factors for the Ukrainian electrical grid 2006-2012" in Annex 2 "Standard emission factors for UEG of Ukraine" to "Ukraine – Assessment of new CEF calculation", verified by TUV SUD Industrie Service GmbH, 17/08/2007. 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"[37]; 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 28/03/2011p. "On approval of specific carbon dioxide emission factors in 2010"2121. Carbon dioxide emission factors for 2011 were taken from the Decree of NEIAU №75 dated 12/05/2011p. "On approval of specific carbon dioxide emission factors in 2011" 2221.
Method of monitoring	Confirming documentation of the National Environmental Investment Agency of Ukraine wherein the new values of factors are amended and calculated.
Frequency of examination	Annually
Approving documents	Decree and resolutions of National Environmental Investment Agency of Ukraine

Data/Parameter	EF_g
Data unit	t CO_2e/MWh
Description	Carbon dioxide emission factor for the Ukrainian power grid when electric

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

	energy is generated by the mini hydroelectric power plant (according to conservative approach EF_g is taken for electricity consumers of the 1st class)
Data source	Carbon dioxide emission factor was taket from the Decree of NEIAU №75 dated 12/05/2011. " On approval of values of specific carbon dioxide emissions in 2011 "
Method of monitoring	Confirming documentation of the National Environmental Investment Agency of Ukraine wherein the new values of factors are amended and calculated.
Frequency of examination	Annually
Approving documents	Decree and resolutions of National Environmental Investment Agency of Ukraine