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 upgrade of district water supply and disposal system in Zaporizhzhia city"

Sectoral Scopes:
3. Energy demand.

Date – 05/09/2011.

Version of Project Design Document: 02

A.2. Description of the project :

Goals of the project activity: Major goal of the project is to reduce electricity consumption by way of improving the district water supply and disposal system in Zaporizhzhia city. The improvements shall include replacement, rehabilitation and upgrades of water distributing networks and water disposal networks as well as installation of frequency controllers, new metering instruments and optimization of the engineering process for water pumping. Reduced electricity consumption shall provide for the reductions of greenhouse gas emission (t CO_2e and N_2O). The project's mission is to facilitate sustainable development of Zaporizhzhia city through energy-saving technologies implementation.

The historical detaiiles of "Vodokanal" MU development. The Municipal Utility "Vodokanal" is among the oldest enterprises in the city. It has a great history and long-term traditions. "Vodokanal" MU was established in 1993 pursuant to the order # 1375 of 03.09.1993 issued by the executive committee of Zaporizhzhia City Council of People's Deputies.

The first centralized water supply system in Zaporizhzhia (formerly Olexandrivsk) city was commissioned in June 1894. The water supply systems on the right and left banks of the Dnieper River were included into the list of operating ones in 1928.

Water suppliers always thought about water quality. Therefore, water treatment facilities with first lift pumping stations were commissioned under the water supply system in 1937 (Dnieper Water Station – DWS-1). The Dnieper Water Station on the right bank of the Dnieper River was commissioned in 1970 (DWS-2).

Construction of the sewerage system started in 1933. The Central Treatment Facilities (CTF-1) on the left bank of the Dnieper River were commissioned in 1957; and the Central Treatment Facilities on the right bank (CTF-2) were commissioned in 1976.

Nowadays, Zaporizhzhia Municipal Utility "Vodokanal" supplies drinking water to people, enterprises and organizations of Zaporizhzhia, being a central city of the region, and of the three rural areas adjacent to it: Zaporizkyi, Novomykolaivskyi and Vilnianskyi.

Current Zaporizhzhia water supply system includes two water supply stations for drinking water treatment, 3 water intake facilities, 2522.5 km of water supply networks and 27 pumping stations. The two water stations, DWS-1 and DWS-2, daily ensure treatment of 400,000 cubic meters of drinking water and supply it to consumers.

The centralized sewerage system is separated. It simultaneously accepts wastewater from residential areas, community offices, organizations as well as (partially) from municipal utilities and industrial enterprises of the city. The city sewerage system consists of a set of complex engineering structures including 46 pumping stations and two stations for comprehensive biological treatment of wastewater daily processing up to

200,000 cubic meters of wastewater. Total length of the networks and collectors is 923.97 km, diameter of the pipes ranges between 150 and 2,000 mm.

“Vodokanal” MU is provided with all types of transport, energy and engineering supplies, it possesses a developed industrial infrastructure and qualified personnel, maintains constructive links with scientific and research institutions. As per its performance targets, “Vodokanal” MU in Zaporizhzhia is among the largest water suppliers in Ukraine. The average registered number of “Vodokanal” MU personnel amounts to 3433 individuals.

a) Actual situation before the project start

Unsatisfactory technical condition of water supply and disposal systems in the city of Zaporizhzhia, continuous wearing of equipment and outdated engineering processes result in the increased water losses and inefficient electricity consumption during the water transfer process.

Without the Joint Implementation Project (JI Project), the volumes of water losses within the water supply and disposal system of “Vodokanal” MU would increase and the energy consumption needed to transport a unit of water volume would also increase (due to wear of equipment).

b) Baseline scenario

The baseline scenario is considered as “business as usual” scenario including implementation of minimal repairs against the background of general deterioration of technical condition of the water supply and disposal system.

There are no barriers in case this Baseline scenario is implemented (there are no investment barriers, since the scenario does not require involvement of additional investments; and there are no technological barriers, because equipment is operated by qualified personnel, who do not require additional training). The scenario reflects practice typical of Ukraine.

c) Project scenario

The project envisages upgrading of pumping equipment – 14 pc., installation of about 90 new pumping units, replacement of water supply and disposal lines – 11 km, installation of a new measurement instruments cluster – 114 pc., installation of frequency controllers – 18 pc., other energy-saving activities.

After a complete implementation of the project, 87.9 thousand MWh*hour of electricity shall be saved annually. Due to a reduced consumption of electricity used by pumping stations and consumed from the Ukrainian power grid, combustion of the fossil fuel required to generate electricity for the power grid shall decrease, hence reducing emission of greenhouse gasses.

The project envisages greenhouse gases (GhGs) emission reductions due to:

- Upgrades of pumping equipment;
- Replacement of high-power pumps by new, more power efficient ones;
- Optimization of the engineering process for water pumping;
- Replacement of water supply and disposal networks;
- Installation of a new cluster of measurement instruments;
- Installation of frequency controllers.
-

After a complete implementation of the project, the estimated annual project emission reductions of GHGs, i.e. CO_2, shall amount to 101.1 thousand tones per year if compared to the “business-as-usual” option or to the baseline scenario.

The project may contribute to sustainable development of “Vodokanal” MU in terms of the following:

- reduced dependability of the national economy on energy resources import and improved level of the national energy security;
- improved quality of water supply services;

- high rates of health and safety factors;
- improved state of the world ecology (counteraction to respond the global climate change by way of reducing emissions of carbon dioxide into the atmosphere);
- addressed problem of continuous water supply to consumers.

This shall take place after the implementation of the project, when water supply and disposal services become more efficient.

Analysis of the project activity’s similarity has demonstrated that there are no similar projects in Ukraine.

A.3. Project participants:

Party involved	Legal body – Project Participant	Kindly indicate if the Party involved wishes to be considered as Project participant (Yes/No)
Ukraine (Host party)	“Vodokanal” MU	No
Estonia	OŰ Biotechnoloogia	No

A.4. Technical description of the project :

A.4.1. Location of the project :

The project is located in Zaporizhzhia Region, in the south-east of Ukraine (Fig. 1).

Fig. 1. Map of Ukraine

A.4.1.1 Host Party(ies):

The project is located within the territory of Ukraine.

Ukraine is an East European state, which has ratified the Kyoto Protocol to the UN Framework Convention on Climate Change on 04 February 2004. Ukraine is on the list of Annex 1 countries and meets the requirements for participation in Joint Implementation projects.

A.4.1.2 Region/State/Province etc.:

Zaporizhzhia Region is located in the south-east of Ukraine. It mainly occupies the left-bank lower reaches of the Dnieper River basin. Its center is the city of Zaporizhzhia. On the north and on the north-west it borders on Dnipropetrivsk Region, on the west it borders on Kherson Region, and on the east it borders on Donetsk Region; and on the south it is washed by the Sea of Azov, which coast line is over 300 km within the bounds of the Region. It extends from the north to the south for 208 km, and from the west to the east for 235 km. The Region occupies the territory of 27.18 thousand sq. km and 4.5% of Ukraine's area.

The climate in Zaporizhzhia Region is moderate continental It is hot in summer, and there is little snow in usually warm winter. The climate is characterized by a clear dryness. Average temperature in July is +23 ^{o}C and in January it is -4 ^{o}C. There are 225 sunny days during a year on average, the annual precipitation amounts to 448 mm.

A.4.1.3 City/Town/Community etc.:

The city of Zaporizhzhia

Fig.2. Map of Zaporizhzhia region.

A.4.1.4. Detail of physical location, including information allowing the unique identification of the project:

The list of water supply and disposal facilities within "Vodokanal" MU infrastructure included into the project are presented in Table 1:

#	Address of Pumping Station
1	DWS #1 - the town of Pidporozhnianka, 23 Vuzlova St.
2	DWS #2 - the town of Velykyi Lug, 39 Naberezhna St.
3	Shop #1 (includes "Khortytska" PS in 11-b Zhukova St., "Inturyst" PS in 2 Tsentralnyi Bvld, "Sotsmisto" PS in 3-a Kamyanohirska St.)
4	Shop #2 (includes "Levanevska" PS in 3-zh Srtartova St., "Kosmichna" PS in 102-b Kosmichna St., "Lakhti" PS in 144-a Lenina Pass, "Zaliznychna" PS in 11/2 Instytutska St., "TsTP-4" PS in 18-a Pivnichnokiltseva St., "TsTP-9" PS in 43-a Chumachenka St.).
5	Shop #3 (includes "Shevchenko" PS in 91 Ivanova St., "8 Bereznia" PS in 28-b 8-Bereznia St., "Chervona" PS in 3-b Chervona St., "Omelchenko" PS in 32-v 8-Bereznia St., , "Mokra" PS in 91-a Voienbud St., "Aeroport" PS in 2-b Donetske Road, "Pivdenna" PS in Teplychne village, 9 Zustrichnyi Lane).
6	Shop #4 (includes "Pavlo-Kychkas" PS in 61 Molodizhna St., "Skvortsova" PS in 2-b Skvortsova St., "Istorychna" PS in 73 Istorychna St., "Volniansk" PS in Volniansk town).
7	Shop #5 (includes "Balabyno" PS in 238 Urytskoho St. in Balabyno town, "Kushugum" PS in Kushugum town, "Lezheno" PS in Lezhen village, "Lukashevo" PS in Lukashevo village).
8	SPS # 1 – 2g Ukrainska St.
9	SPS # 2 – 2a Chapaieva St.
10	SPS # 3 – 111 A.Ushakova St.
11	SPS # 4 – 40 Sotsialistychna St.
12	SPS # 6 – 42 Radhospna St.

13	SPS # 7 – 1b Bielinskoho St.
14	SPS # 8 – 46 Dymytrova St.
15	SPS # 9 – 8 Teplychna St.
16	SPS # 10 – 24 Kustanaiska St.
17	SPS # 11 – 28-a Lobanovskoho St.
18	SPS # 12 – 5 Yeniseiska St.
19	SPS # 14 - Law Academy, 113 Pivnichne Shosse St.
20	SPS # 16 - Khortytsia Island, 27 Naukove Mistechko St.
21	SPS # 21 – 35 Raketna St.
22	SPS # 22 – 11b Doblesna St.
23	SPS # 23 – 44 Trehubova St.
24	SPS # 24 – 17a Burevisnyka St.
25	SPS # 25 – 1 Donetska St.
26	SPS # 28 – 7 Voronezka St.
27	SPS # 29 – Novoslobidka village, 1b Zaliznychna St.
28	SPS # 30 – 7 Avtozavodska St.
29	SPS # 32 – 6a Progresyvna St.
30	SPS # 33 – Hrabar village location, in the field.
31	SPS # 34 – Location of Silicate brick plant, 113-b Pivnichne Road.
32	SPS # 35 – Teplychne village, “Mokrianka”, 15 Zustrichnyi Lane.
33	SPS # 36 – Teplychne village, “Mokrianka”, Verkhoianska St.
34	SPS # 37 – 93 Startova St., Military community.
35	SPS # 46 – Novomylolaivka town, 123 Yanysheva St.

Table 1. Water supply and disposal facilities of “Vodokanal” MU

A.4.2. Technology to be employed by the project:

The activities that shall be implemented with the objective to increase effectiveness of water supply ensured by “Vodokanal” MU include the following:

1. Upgrades of pumping equipment.

The enterprise entitled “Vodokanal” MU operates horizontal pumps and submersible pumps. A submersible pump is a device which is immersed lower than pumped liquid level. This ensures lifting of the liquid from a deep depth and high-quality cooling of pump assemblies, secures lifting of water with dissolved gas. The pumps are installed in boreholes and in shaft wells. Horizontal pumps are designed to pump fresh water with the temperature up to +100 ^{o}C, the pumps are used to ensure water supply to centers of population and industrial enterprises. The project envisages replacement of seals that prevent leakage of water from the pumps, this will improve operation of the pumps, pump impeller cutoff. Exit edge of an impeller is subject to grinding lengthwise, thus increasing reference area of the impeller canals in a circumferential direction.

Also, the project envisages recovery of the geometry of the pump items damaged due to corrosion and cavitation, with further polymer coating of all surfaces that come in contact with water.

The accomplished experiments demonstrated that an 11.7% increase of disposal area (with the highest performance value) ensured an output increase equal to 16.7% (with unchanged power and pressure of a pump). Replacement of barrels on a pump's shaft adds to the pumps' operating efficiency due to a pump protection from water impact. As a result of recovering the geometry of pump items, a pump flow part shall be secured in terms of corrosion and cavitation, and the increase of a pump performance shall amount to 7-12%.

2. Replacement of pumping equipment.

Outdated pumps with low efficiency of 50-60% shall be replaced by the pumps having an efficiency of 81-89%. Engineering specifications for the new pumps to be installed are presented in Table 2.

Nominal size of pumping unit	Pump parameters			Motor drive parameters			Dimensions of pumping unit, mm	Weight, kg
	Q, m^3/hour	H, m	Positive suction head, m	Type	Q, m^3/hour	H, m	L x B x H	
Pump SDBH 300/350	1600-1900	60	6	ASVA-TM	300	1480	110x1400	3650
Pump SDBH 300/350	1600-1900	60	6	ASVA-TM	300	1480	110x1400	3650
Pump SDBH 300/350	1600-1900	60	6	ASVA-TM	300	1480	110x1400	3650
Pump SDBH 300/350	1600-1900	60	6	ASVA-TM	300	1480	110x1400	3650
Pump D 2000/21	2000	21	6	4AMH315M643	160	975	2215x1275x300	1630
Pump D 2000/21	2000	21	6	4AMH315M643	160	975	2215x1275x300	1630
Submersible pump GNOM 53/10	53	10	6	**	4	2900	385x786	82
Pump TsMK 16/27	16	27	6	**	3	2900	320x720	85
Pump TsMK 16/27	16	27	6	**	3	2900	320x720	85
Pump TsNGS 60-66	60	66	6	**	18.5	2950	1026x500x500	209
Pump TsNGS 60-66	60	66	6	**	18.5	2950	1026x500x500	209
Pump KhM50-32-148 K5	25	20	6	AUP100S2	4	3000	500x250x250	38
Pump KhM 50-32-148 K5	25	20	6	AUP100S2	4	3000	500x250x250	38
Pump KhM 50-32-148 K5	25	20	6	AUP100S2	4	3000	500x250x250	38
Pump KhM 50-32-148 K5	25	20	6	AUP100S2	4	3000	500x250x250	38
Pump ENKOR 700	600	10	6	JU80994	0.75	1450	610x914x305	58
Pump ENKOR 700	600	10	6	JU80994	0.75	1450	610x914x305	58
Pump ENKOR 700	600	10	6	JU80994	0.75	1450	610x914x305	58
Pump ENKOR 700	600	10	6	JU80994	0.75	1450	610x914x305	58
Pump ENKOR 700	600	10	6	JU80994	0.75	1450	610x914x305	58
Pump ENKOR 700	600	10	6	JU80994	0.75	1450	610x914x305	58
Submersible pump GNOM 10/10	10	10	*	**	0.75	2900	236x445	22
Submersible pump GNOM 10/10	10	10	*	**	0.75	2900	236x445	22
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150

Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Flow-control pump Scepex 1-12Bn	260-1650	6	6	IP55	1.1	1450	470x850x250	150
Pump X 80-50-200K	50	50	6	4AM160S2	15	2900	1270x514x540	355
Pump SDA 350/450	2100	50	6	ASFATM-002	331	1450	2806x1380x1609	3827
Pump SDA 350/450	2100	50	6	ASFATM-002	331	1450	2806x1380x1609	3827
Pump SDA 350/450	2100	50	6	ASFATM-002	331	1450	2806x1380x1609	3827
Pump MHN 804	13	42.5	6	**	1.5	2900	240x260x500	17
Pump MHN 804	13	42.5	6	**	1.5	2900	240x260x500	17
Pump MHN 804	13	42.5	6	**	1.5	2900	240x260x500	17
Pump MHN 804	13	42.5	6	**	1.5	2900	240x260x500	17
Pump D3200-75-2	3200	75	6.5	CD2-85-37	500	1000	2015x1000x1595	4150
Pump AD-2500-62-2	2500	62	6	CD2-85-57-6	630	750	1870x900x1435	2870
Pump D 1600-90A	1325	55	2.9	A03 355M 8У3	200	985	2870x1640x1230	3220
Pump D2500-62	1800	34	5.5	A114-8M	250	735	3500x2080x1500	5020
Pump DB Weir 150/200	350	25	4.5	ASHE-FA001	32.7	1475	740x1567x884	780
Pump SDB Weir 150/200	350	25	4.5	ASHE-FA001	32.7	1475	740x1567x884	780
Pump SR 400 ES	2100	45	6	Gib/220-1	539	1000	3640x1370x2018	7218
Pump SR 400 ES	2100	45	6	Gib/220-1	539	1000	3640x1370x2018	7218
Pump SR 400 ES	2100	45	6	Gib/220-1	539	1000	3640x1370x2018	7218
Pump SR 300 ES	1000	45	6	Ag0037-031	269	1500	2665x1228x1030	2618
Pump SR 300 ES	1000	45	6	Ag0037-031	269	1500	2665x1228x1030	2618

Pump SR 300 ES	1200	35	6	ASHA-TK001	250	1550	2665x1228x1030	2618
Pump SR 300 ES	1200	35	6	ASHA-TK001	250	1550	2665x1228x1030	2618
Pump SR 300 ES	1050	55	6	ASF-TM001	221	1500	2665x1228x1030	2618
Pump SR 300 ES	1050	55	6	ASF-TM001	221	1500	2665x1228x1030	2618
Pump Flygt CZ 3231.665	800	32	6	**	105	1500	1940x1770x1250	1200
Pump Flygt CZ 3231.665	800	32	6	**	105	1500	1940x1770x1250	1200
Pump Flygt CZ 3300-462	420	32.8	6	**	54	1500	1820x1230x1860	998
Pump Flygt CZ 3300-462	420	32.8	6	**	54	1500	1820x1230x1860	998
Pump SR 300 ES	1100	75	6	Ag0037-031	322	1500	2665x1228x1030	2618
Pump SR 300 ES	1100	75	6	Ag0037-031	322	1500	2665x1228x1030	2618
Pump SR 200 ES	500	95	6	ASF-TM001	220	1500	2712x1080x1000	2330
Pump SR 200 ES	500	95	6	ASF-TM001	220	1500	2712x1080x1000	2330
Pump Flygt 323/665	665	35	6	**	85	1500	1940x1770x1250	1200
Pump Flygt 323/665	665	35	6	**	85	1500	1940x1770x1250	1200
Pump Flygt CL 3251	40	30	6	**	11	1500	961x680x350	300
Pump Flygt CL 3251	40	30	6	**	11	1500	961x680x350	300
Pump HOMA GRP36D	27.7	56	6	**	3.7	1500	505x655x350	44
Pump HOMA GRP36D	27.7	56	6	**	3.7	1500	505x655x350	44
Pump 2CM100-65-250/2A	95	62	3.5	**	37	2900	1450x305x513	340
Pump 2CM100-65-250/2A	95	62	3.5	**	37	2900	1450x305x513	340
Pump 2CM 80-50-200-/2A	45	43	6	**	11	2900	1206x305x480	231
Pump SD 160/45	160	45	6	4AM200M4D	32	1450	1900x745x600	745

* - For submersible pump circuit (positive suction, pumping) is absent.
** - For pumping units monobloc engine type (type it) is not provided (missing).

Table 2. General purpose industrial motor drive pumping units.

Fig.3. Pump KhM5050-32-148 K5

Fig.4. Pump TsNGS 60-66.

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Fig.5. Pump SR 400 ES

Fig. 6 Pump MHN 804

Fig. 7. Flow-control pump Scepex 1-12Bn.

Fig.8. Submersible pump GNOM 53/10

Fig.9. Pump D 2000/21

Fig.10. Pump TsMK 16/27

Fig.11. Pump SD 160/45

3. Optimization of the engineering process for water pumping.

The engineering process for water pumping shall be subject to optimization, i.e. in some sectors water shall be supplied directly to a consumer, while by-passing reservoirs. The load shall be changed over from the pumping stations with the outdated equipment to pumping stations with highly efficient equipment.

4. Replacement of water supply and disposal networks.

The rehabilitation of water supply and disposal networks shall ensure reduced electricity consumption due to exhaustive consumption of water, changed pressure in the network ensuring optimum operation mode of the pumps.

5. Installation of a new cluster of measurement instruments.

A new cluster of measurement instruments shall be installed with the objective to control monitoring and registration of water and electricity consumption.

Type of equipment	**Manufacturer's Websites**
Heating energy and water meter (SICh-Uzv)	www.rodnik.com.ua
Water meter (UVR-011)	www.energo.kh.ua
Water meter (IRKA)	www.vodomer.com.ua
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter A1805RAL-P43B	www.elster.ru
Electricity meter A1805RAL-P43B	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter CA4Уи672M	www.ielektrik.ru
Electricity meter CA4Уи672M	www.ielektrik.ru
Electricity meter SL7000	www.energoportal.net
Electricity meter AV-RAL-P14B-4	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter SL7000	www.energoportal.net
Electricity meter SA4Ui672M	www.ielektrik.ru
Electricity meter SL7000	www.energoportal.net
Electricity meter SL7000	www.energoportal.net
Electricity meter NIK2303 ARP1	www.nik.net.ua
Electricity meter A1140RAL-BW-4T	www.elster.ru
Electricity meter A1140RAL-BW-4T	www.elster.ru
Electricity meter STK3-0,5Q2E3M	www.telecard.odessa.ua
Electricity meter A1140RAL-BW-4T	www.elster.ru
Active energy meter SAZU-5009	www.ielektrik.ru
Reactive-energy meter SP4Ui689	www.ielektrik.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui673M	www.ielektrik.ru

Electricity meter STK3-0,5Q2E3M	www.telecard.odessa.ua
Electricity meter STK3-0,5Q2E3M	www.telecard.odessa.ua
Electricity meter NIK2303ARP1T	www.nik.net.ua
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui673M	www.ielektrik.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4i678	www.ielektrik.ru
Electricity meter STK3-10BU	www.telecard.odessa.ua
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Electricity meter Delta 8010-08	www.mytel.dp.ua
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter Delta 8010-06	www.mytel.dp.ua
Electricity meter Delta 8010-06	www.mytel.dp.ua
Electricity meter NIK 2303APK1	www.nik.net.ua
Electricity meter A1140RAL-BW-4T	www.elster.ru
Electricity meter EA05RAL-P3B-4	www.elster.ru
Electricity meter EA05RAL-P3B-4	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Electricity meter NIK2303APП1	www.nik.net.ua
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui672M	www.ielektrik.ru
Electricity meter NIK 2303APП1T	www.nik.net.ua

Active energy meter SA4Ui672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui 672M	www.ielektrik.ru
Active energy meter SA4Ui 672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui 672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter NIK2303 HPK1	www.nik.net.ua
Active energy meter SA4U-196	www.ielektrik.ru
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Active energy meter SA4Ui 672M	www.ielektrik.ru
Electricity meter STK3-10Q2H4M	www.telecard.odessa.ua
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter SL7000	www.energoportal.net
Electricity meter SL7000	www.energoportal.net
Active energy meter SA4Ui 672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui 672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4-5001	www.ielektrik.ru
Electricity meter STK3-10Q2H6M	www.telecard.odessa.ua
Electricity meter STK3-10Q2H6M	www.telecard.odessa.ua
Electricity meter STK3-10Q2H6M	www.telecard.odessa.ua
Active energy meter SA4Ui 672M	www.ielektrik.ru
Electricity meter Delta 8010-08	www.mytel.dp.ua
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter STK3-10Q2H4.K4t	www.telecard.odessa.ua
Active energy meter SA4Ui 672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Electricity meter NIK2303	www.nik.net.ua
Electricity meter STK3-10Q2H6M	www.telecard.odessa.ua
Active energy meter SO-5000	www.ielektrik.ru
Electricity meter NIK2303АРП1	www.nik.net.ua
Electricity meter NIK2303АРП1	www.nik.net.ua
Electricity meter STK1-10К510St	www.telecard.odessa.ua
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Electricity meter A1805RAL-P4G-DW-4	www.elster.ru
Active energy meter SA4Ui 672M	www.ielektrik.ru
Electricity meter SR4Ui673M	www.ielektrik.ru
Active energy meter SA4Ui 672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui 672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA4Ui 672M	www.ielektrik.ru

Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Electricity meter STK1-10K5210St	www.telecard.odessa.ua
Active energy meter SA4Ui 672M	www.ielektrik.ru
Reactive-energy meter SR4Ui 673M	www.ielektrik.ru
Active energy meter SA-199	www.ielektrik.ru
Electricity meter STK1-10K5210St	www.telecard.odessa.ua
Electricity meter SL7000	www.energoportal.net
Electricity meter SL7000	www.energoportal.net
Active energy meter SA4Ui 672M	www.ielektrik.ru
Electricity meter NIK2303ARP1	www.nik.net.ua
Electricity meter Delta 8010-06	www.mytel.dp.ua
Active energy meter SA4Ui 672M	www.ielektrik.ru
Electricity meter EA05CLP2C-3	www.elster.ru
Electricity meter STK-1	www.telecard.odessa.ua
Active energy meter SA4-5001	www.ielektrik.ru
Electricity meter A1140RAL-BW-4T	www.elster.ru
Active energy meter SA4-195	www.ielektrik.ru
Active energy meter SA4Ui 672M	www.ielektrik.ru
Active energy meter SA4Ui 672M	www.ielektrik.ru
Electricity meter STK3-10AN7K4t	www.telecard.odessa.ua
Active energy meter SA4-i678	www.ielektrik.ru
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter A1140RAL-BW-4T	www.elster.ru
Electricity meter STK3-10Q2H6Mt	www.telecard.odessa.ua
Electricity meter NIK2102-02	www.nik.net.ua
Electricity meter NIK2303ARP1	www.nik.net.ua
Electricity meter SL7000	www.energoportal.net
Active energy meter SA4Ui 672M	www.ielektrik.ru
Electricity meter STK3-10AH7K4t	www.telecard.odessa.ua
Active energy meter SO-i446	www.ielektrik.ru
Active energy meter SO-449	www.ielektrik.ru
Electricity meter NIK2102-02	www.nik.net.ua
Electricity meter STK3-10AH7K4t	www.telecard.odessa.ua

Table 3. Websites of instrument gages' manufacturers.

6. Introduction of frequency controllers.

Introduction of frequency regulation with regard to motor drives of water supply pumps shall considerably reduce electricity consumption. The controllers shall make it possible to change power of the motor drives depending on a supplied load, both during a day, when water consumption varies, and during a year.

Type of frequency controllers	**Manufacturer's Websites**
VLT 6400 «Danfoss»	www.vlt-drives.com.ua/RU/home.xtml
VLT 6550 «Danfoss»	www.vlt-drives.com.ua/RU/home.xtml
VLT 6072 «Danfoss»	www.vlt-drives.cjm.ua/RU/home.xtml
VLT FC «Danfoss»	www/vlt-drives.com.ua/RU/home.xtml
Pch-TTPR – 250 – 6k – 50 -1141 – UKhL 4	www.zpr.com.ua
"Apator Control"	www.acontrol.com.pl
VLT 2800 "Danfoss"	www.vlt-drives.com.ua/RU/home.xtml

Table 4. Websites of frequency controllers' manufacturers.

The general schedule of implementing the above activities is as follows:

#	Project stage	Period
1	Upgrades of pumping equipment	10/2004 -12/2006
2	Replacement of pumping equipment	10/2004 - 06/2011
3	Optimization of engineering processes for water pumping	05/2006 - 12/2012
4	Replacement of water supply and disposal networks	04/2005- 06/2010
5	Installation of a new measurement instruments cluster	05/2004 - 05/2011
6	Introduction of frequency controllers	10/2004 - 12/2009

Table 5. Project implementation schedule.

The results that shall be obtained ater implementation of these technologies and activities are presented in Supporting document 3.

31/12/2012 is the completion date of the project activity.

The enterprise entitled "Vodokanal" MU maintains annual calculations of water losses in the network. Routine replacements are identified based on these calculations. In case water loss within a sector does not exceed a standard water loss, the enterprise has no obligations as for routine replacement of a pipeline. Replacement of pipelines within the project framework is not a part of maintenance (emergencies, routine replacements). Replacement of pipelines shall be performed in the sectors, where planned water losses are still not exceeded, though are in unsatisfactory condition.

Cutting-edge, time-tested techniques in the water supply and water disposal domain are implemented under the project. They will yield a significantly enhanced effectiveness. The general economic situation suggests a very low probability of substituting the project-proposed techniques by more efficient ones over the nearest 20-30 years.

As far as the first commitment period of 2008-2012 is concerned, there are absolutely no risks of substituting the project-proposed techniques by more efficient ones over the period.

Since main activities of "Vodokanal" MU shall not be changed over the period of the Joint Implementation (JI) project performance, special training of personnel is not required. Technical personnel of the enterprise have necessary knowledge and experience to perform the project activities and repairs of the equipment stipulated in the design.

In case new equipment is used (the equipment not used by the enterprise before), a manufacturer shall be obliged to conduct personnel trainings.

Special maintenance is not required for the new equipment subject to installation. The "Vodokanal" MU personnel shall ensure maintenance of new equipment under normal operating conditions (operation, routine repairs) during the project implementation period and after it.

"Vodokanal" MU ensures retraining of its personnel pursuant to the requirements established by the Health and Safety Regulations. Health and Safety Department is operating at the enterprise. It is responsible for professional development and training of personnel.

During the JI project development, experts of JSC "OBLTEPLOCOMUNENERGO" carried out enhanced consulting of the involved representatives of "Vodokanal" MU. The consulting was focused on collection of the necessary data based on the Project Monitoring Plan.

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

The project activity, including replacement, rehabilitation and upgrades of pumping units, rehabilitation and replacement of water distribution and disposal networks, as well as installation of frequency controllers shall ensure increased energy efficiency within Zaporizhzhia water supply and disposal system in such a way that it shall supply equal quantity of water and/or transport equal volume of wastewater while consuming less electricity. Saving of traditional carbon dioxide organic fuel at power plants shall result in reduction of CO_2 emissions generated by the national power grid.

In case the proposed project is not implemented, all the equipment, including outdated ineffective though operable units, shall operate in the usual mode for a long term and no emission reductions shall take place. According to Ukrainian Law “On drinking water and drinking water supply”[1], business activities for drinking water supply and rendering services to consumers are subject to licensing. There are no legislative documents committing the enterprise (“Vodokanal” MU) to upgrade pumping equipment and water-distribution networks.

The estimated project emission reductions over the period before 01 January 2008 (during 2005-2007) are envisaged to be at the level of 108684 t CO_2. The estimated project emission reductions over the first commitment period since 01 January 2008 till 31 December 2012 are envisaged to be at the level of 505801 t CO_2. The estimated project emission reductions over the period following the first commitment period, starting since 01 January 2013 and till 31 December 2030 included, are envisaged to be 1819224 t CO_2. Consequently, the estimated project emission reductions during the whole crediting period amount to 2433709 t CO_2.

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

The date of 01 January 2005 was selected to be the starting date of the crediting period. 31 December 2012 is the end of the crediting period. Consequently, duration of the crediting period shall be 8 years/96 months. If the Kyoto Protocol is prolonged after the first commitment period ends, the project crediting period shall be prolonged for 18 years/216 months more (01 January 2013 – 31 December 2030). Taking into account the period preceding to the crediting period, the crediting period and the period after its expiration, the total crediting period shall amount to 26 years/312 months.

During the project implementation, the following emission reductions shall be achieved at each stage of the project:

	Years
Duration of crediting period	3
Years	**Estimated annual emission reductions in tones of t CO_2 equivalent**
2005	22196
2006	37216
2007	49272
Total estimated emission reductions during the early crediting period (**tones of CO_2 equivalent**)	**108684**
Average annual estimated emission reductions during the early crediting period (**tones of CO_2 equivalent**)	**36228**

Table 6. Volume of estimated emission reductions in a period till 01 January 2008 (2005-2007).

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

	Years
Duration of crediting period	5
Years	**Estimated annual emission reductions in tones of t CO_2 equivalent**
2008	100813
2009	107763
2010	94987
2011	101170
2012	101068
Total estimated emission reductions during the first commitment period (tones of CO_2 equivalent)	**505801**
Average annual estimated emission reductions during the first commitment period (tones of CO_2 equivalent)	**101160**

Table 7. Volume of estimated emission reductions over the first commitment period.

	Years
Duration of crediting period	18
Years	**Estimated annual emission reductions in tones of t CO_2 equivalent**
2013	101068
2014	101068
2015	101068
2016	101068
2017	101068
2018	101068
2019	101068
2020	101068
2021	101068
2022	101068
2023	101068
2024	101068
2025	101068
2026	101068
2027	101068
2028	101068
2029	101068
2030	101068
Total estimated emission reductions during the period that follows the first commitment period (tones of CO_2 equivalent)	**1819224**
Average annual estimated emission reductions during the period that follows the first commitment period (tones of CO_2 equivalent)	**101068**

Table 8. Volume of estimated emission reductions after the first commitment period.

Refer to Supporting document 3 for details.

Refer to Section E for the description of formulas used to preliminary estimate the emission reductions.

A.5. Project approval by the Parties involved:

17/08/2011 – State Environmental Investment Agency of Ukraine issued the Letter of Endorsement (#2203/23/7of 17/08/2011) for this JI project.
As per the procedure, the Parties' Endorsement Letters shall be issued after the project goes through the determination procedure.
After Determination Report is obtained from the Certified Independent Body, the project documentation shall be submitted to the National Environmental Investment Agency of Ukraine to obtain a Letter of Approval. The second Letter of Approval shall be received from the other party of project participants.

SECTION B. Baseline

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

The project activity refers to the “Energy demand” category. The current activities of “Vodokanal” MU are characterized by continuous deterioration of water supply and disposal system and high ineffective consumption of electricity. The reason of such a situation is a lack of funds needed for new technologies’ buildup and implementation.

The project activity is targeted at reduction of the GHGs emissions produced by the national power grid due to upgrades in Zaporizhzhia water supply network, replacement of old pumping units by new modern ones, replacement of water distribution and disposal networks, introduction of new water supply techniques.

The proposed project applies the specific approach for joint implementation projects basing on baseline methodology of Clean Development Mechanism approved by the Executive Committee of United Nations Framework Convention on Climate Change:
AM0020 "Baseline methodology for water pumping efficiency improvements"[2], Version 02 Valid from 02 Nov 07 onwards.

Methodology AM0020, version 02 dated 02.11.2007, was used for the preliminary estimation and preliminary assessment of the project emissions over the period since 01 January 2008 (2005-2007) and during the first commitment period till 2010 included, as formulas of this Methodology include accurate measures of electricity consumption and volumes of water supplied to the system.

For preliminary calculations and estimate project emissions for the project during 2011-2012 years and after the first commitment period (2013-2030), a specific approach based on extrapolation methodology, wherein values of estimated figures in future periods are calculated based on exploration of their dynamics over previous periods. The specific approach applied under the project ensures an opportunity to estimate electricity consumption required to pump water in a project year.

Application of Methodology AM0020 (version 02) dated 02.11.2007	Project activities
This methodology is applicable to project activities that:	
(a) seek to reduce GHG emissions by explicitly reducing the amount of energy required to deliver a unit of water to end-users in municipal water utilities;	(a) the project activities envisage reducing the amount of energy required to deliver water to end-users in municipal water utilities.
(b) improve energy efficiency in the overall water pumping, including reducing technical losses and leaks as well as the energy efficiency of the pumping scheme, which consume electricity from the electricity grid, where:	(b) the project activities envisage improvement of energy efficiency in the overall water pumping system, including reducing technical losses and leaks, as well as the energy efficiency of the pumping schemes, which consume electricity from the electricity grid
(1) the efficiency (water and energy) of existing schemes is being improved.	(1) the project activities envisage improvement of the efficiency (water and energy) of existing water supply and disposal schemes.

2 http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_K96TMFSTMHPPDMHSR8A5R3SJHLG32F

(2) a new scheme is being developed to completely replace the old scheme, which will no longer be used. This methodology will apply to the new scheme only up to the measured delivery capacity (annual amount of delivered water) of the old scheme.	
(e) this methodology is not applicable to project activities cases where entirely new schemes are built to augment existing capacity. This will ensure that only emissions reductions up to the existing capacity of the system will be considered.	(e) the project activities envisage improving efficiency (water and energy) of existing water supply schemes.
(f) this methodology shall be used in conjunction with the approved monitoring methodology AM0020 ("Monitoring methodology for water pumping efficiency improvements").	(f) The specific approach developed for this project applies AM0020 monitoring methodology ("Monitoring methodology for water pumping efficiency improvements").

Table 9. Application of AM0020 (version 02) dated 02.11.2007 methodology

The baseline shall be studied for each year, when sale of emission reduction takes place, in order to ensure adjustment of water delivered by the water distribution networks and impacting the baseline. Refer to Section D.1 for details.

There were three different versions of the Baseline scenario, which were discussed before this project started.

The first version of the Baseline scenario was "business as usual", which provided for implementation of minimum repairs against the background of total degradation of the water supply network. There are no barriers in case this Baseline scenario is implemented (there are no investment barriers, since this scenario does not require involvement of additional investments, and there are no technological barriers, as the equipment is operated by qualified personnel, who do not require additional training). The scenario reflects the practice typical of Ukraine.

The second version of Baseline scenario envisaged rehabilitation without the Joint Implementation mechanism. In such a case, both barriers exist, i.e. the investment barrier (since this scenario requires substantial additional investments, has a rather long payback period and high risks, that is why it is not investment-attractive) plus the technological barrier (since use of new modern equipment would require additional retraining of personnel). Rehabilitation of equipment seeking for efficiency improvement is not a customary practice in Ukraine.

The third Baseline scenario version focused on excluding any secondary activities from the project implementation process, for example, exclusion of frequency control from the project, etc. However, a conclusion was made that it would decrease economic attractiveness of the project and would extend the project's payback period.

Hence, the first version was selected for the Baseline scenario.

Status and applicability of the existing water supply and disposal network

Current operating activities of Zaporizhzhia water supply and disposal network is based on the pumping equipment manufactured in Ukraine or in Russia and including K 20/30, 10F12A, 12NDS, SM 125-80-315/4, D4000/95A, FG216/24, TsNS200-45 and some other types. Refer to Supporting document 1 (Pumps) for details.

There are the following two types of water losses at "Vodokanal" MU: productive and nonproductive; actual operational practice of water supply networks in Ukraine. These losses include in-house needs of a water supply enterprise (water used for preventive maintenance of water supply networks, disinfection and washing of engineering structures and leakage therefrom, etc.). The water losses mainly include water leakage from a water supply network. The enterprise must annually make theoretical (estimations pursuant to the "Procedure for industry-specific technological standards for drinking water use at water supply and disposal enterprises of Ukraine"[3]) and actual calculations of water losses in a water delivery system. The calculation data shall be submitted in form of a report[4] to the Statistics Department[5]. The existing distribution networks of "Vodokanal" MU are characterized by the losses ranging between 25 and 68%.

Refer to Supporting document 2 (Networks) for details.

Formation of the Baseline scenario

Current operation of Zaporizhzhia water supply and disposal system is characterized by long-term deterioration in the operation of pumping and water distribution equipment and continuous degradation of its efficiency. In the meantime, on-the-spot repairs increase the efficiency, thus to a large extent ensuring compensation of the degradations and equalize level of annual total emissions (Baseline) over the years.

The operational level may be represented by annual electricity consumption. Installation of new equipment units and rehabilitation of the old ones were carried out within the project framework in late 2004. From the conservative point of view, reductions caused by these project activities are not taken into account; the year of 2004 was chosen for the Baseline calculations. Electricity consumption in the baseline year is presented in Table 10.

"Vodokanal" MU	Baseline electricity consumption, thous. kWh*hour
"Vodokanal" MU pumping stations	120223,24

Table 10. Baseline electricity consumption

Refer to Supporting document 3 for details.

GHGs emissions included into the baseline scenario:
CO_2 emissions due to electricity generation for the national power grid.

Ukraine has a united power grid. Therefore, an average value of Carbon dioxide emission factor(CEF) is applied to electricity generation. The Carbon dioxide emission factors(CEF) for 2005-2007 were obtained from the data table "Emission Factors for Ukrainian power grid" in the document entitled "Ukraine - assessment of new calculation of CEF" verified by TUV SUD Industrie Service GmbH on 17.08.2007[6].

The emission factors for electricity consumption(CEF) for 2008-2011 were obtained from regulatory documents of Ukrainian legislation, namely from the orders "On approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011.
For the 2013-2030 commitment period of years the carbon dioxide emission factors (EF) in the project was conservative by default and corresponds to the value of this indicator in 2011.

In case other carbon dioxide emission factors for electricity consumption will be approved for Ukrainian national power grids, the baseline shall be re-calculated for any reporting year in accordance with the monitoring plan.

Calculations of the total annual baseline carbon dioxide emissions, which would occur during the baseline year if the water supply and disposal network in Zaporizhzhia remained unchanged, are presented in

3 http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=z1557-04%20
4 Reporting document Form #1 – water supply

5 http://zp.ukrstat.gov.ua/
6 http://www.neia.gov.ua/nature/doccatalog/document?id=116936

Supporting document 3. They include accurate amount of total CO_2 emissions, which occurred during the baseline year of 2004, plus additional emissions, which shall be decreased after the energy-saving measures implementation.

The key data to determine the baseline are presented in the tables below:

Data / Parameter	$\mathbf{EF}_{CO2,ELEC}$
Data unit	t CO_2e/ MWh*hour
Description	Carbon dioxide emission factor for electricity consumption for Ukrainian power grid
Time of determination/ monitoring	Once, at the beginning of the project.
Data source (to be) used	1) Research data of Global Carbon B.V. 2) Orders "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011.
Data values (for ex-ante calculations /determinations)	0.896, 1.219, 1.237, 1.225.
Justification of data choice or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	N/A
Comments	The research has not taken into account the electricity generated at nuclear power plants

Data / Parameter	$\mathbf{M^3}_{wb}$
Data unit	m^3
Description	Total volume of water supplied to consumers within the water supply system during the baseline year.
Time of determination/ monitoring	Determined before the project has begun in the baseline year of 2004.
Data source (to be) used	Readings of the flow meters installed at lifting stations.
Data values (for ex-ante calculations /determinations)	122096150
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	$\mathbf{kWh}_{wb}$
Data unit	kWh*hour
Description	Total amount of electricity needed to deliver water to consumers during the baseline year.
Time of determination/ monitoring	Once, at the beginning of the project, in the baseline year of

	2004.
Data source (to be) used	Readings of the electricity meters installed at pumping stations.
Data values (for ex-ante calculations /determinations)	88365120
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	$\mathbf{M^3_{i,\,wr}}$
Data unit	m^3
Description	Total volume of water delivered to consumers within "i" water supply system during a project year.
Time of determination/ monitoring	Daily
Data source (to be) used	Readings of the electricity meters installed at pumping stations.
Data values (for ex-ante calculations /determinations)	N/A
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in a project year; the data shall be archived electronically and on paper.

Data / Parameter	$\mathbf{M^3_{vb}}$
Data unit	m^3
Description	Total amount of wastewater transported by the water disposal system during the baseline year.
Time of determination/ monitoring	Determined before the project has begun in the baseline year of 2004.
Data source (to be) used	Readings of the flow meters installed at sewerage stations.
Data values (for ex-ante calculations /determinations)	55768000
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	**kWh_{vn}**
Data unit	kWh*hour
Description	Total amount of electricity required for the water disposal system to transport wastewater during the baseline year.
Time of determination/ monitoring	Determined before the project has begun in the baseline year of 2004.
Data source (to be) used	Readings of the electricity meters installed at pumping stations.
Data values (for ex-ante calculations /determinations)	31858120
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	**$M^3_{i,vr}$**
Data unit	m^3
Description	Total volume of wastewater transported by "i" water disposal system during a project year.
Time of determination/ monitoring	Daily
Data source (to be) used	Readings of the flow meters installed at sewerage stations.
Data values (for ex-ante calculations /determinations)	N/A
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in a project year; the data shall be archived electronically and on paper.

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

Anthropogenic emissions of greenhouse gases in the project scenario shall be reduced due to the comprehensive upgrades of pumping and water distributing equipment by means of introducing the techniques proposed for the project activity and described above. The latter shall include replacement of old pumps by new, more effective ones, installation of frequency controllers and rehabilitation of old water distribution and disposal networks.

Additionality of the project.

Additionality of the project activity is demonstrated and assessed below, using "Tool for the demonstration and assessment of additionality"[7] (Version 05.2). This tool was originally developed for CDM projects, however it may be also used for JI projects. This tool was applied pursuant to the operating instructions proposed in a partially similar methodology "Methodology of baseline and monitoring AM0020".

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

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

There are three alternatives for this project (discussed in Section B.1).

Alternative 1: The first alternative is to prolong actually existing conditions (no project activity or other alternatives), i.e. "business as usual" scenario involving implementation of minimum repairs against the background of total degradation of the water supply and disposal system.

It is noteworthy that the local legislation, which regulates periodicity of pumps' replacement and maximum term of their operation, does not exist. Customary practice is operation of the pumps installed in the seventies and even sixties-fifties and earlier, if they conform to the requirements of technical expert assessment carried out by the authorized authority (State Labor Inspectorate).

Alternative 2: The second alternative is to implement rehabilitation (the proposed project activity) without the Joint Implementation mechanism.

Alternative 3: The third alternative is to reduce project activity and exclude secondary activities from the project, for example, exclude introductions of frequency control from the project, etc.

Outcome of Step 1a: The three realistic alternative scenario(s) to the project activity were identified.

Sub-step 1b: Consistency of alternative scenarios with the effective laws and regulations.

Alternative 1: According to Ukrainian Law "On drinking water and drinking water supply"[8], business activities for drinking water supply and consumers' servicing subject to licensing. There are no legislative documents committing the enterprise "Vodokanal" MU to upgrade pumping equipment as well as water supply and disposal networks. In accordance with Ukrainian Law "On drinking water and drinking water supply"[5], the enterprise must only maintain operable condition of the system and eliminate occurring accidents. The current practice of detecting and eliminating water loss corresponds to all effective laws and regulations of Ukraine. The legislation accepts water losses. As far as water distribution organizations are concerned, regulations establish only periodicity for calculating water loss from water distribution networks. The practical activities of "Vodokanal" MU aimed at water loss detection correspond to the regulations described above. Control of adherence to the regulations is executed by way of calculating water losses through distribution systems once per 10 years.

The project also conforms to the effective Ukrainian regulatory requirements concerning detection of water loss in water distribution networks, as well as to all other applicable mandatory legislative norms.

Alternative 2: Rehabilitation without JI mechanisms application is consistent with mandatory laws and decrees; the detailed information on conformity of the analysis with the legislation was developed for Option 1, which is similar to the conformity of Option 2 with mandatory laws and decrees.

Alternative 3: Rehabilitation without JI mechanisms application and exclusion of secondary activities out of the project is consistent with mandatory laws and decrees; the detailed information on the analysis of conformity with the legislation was developed for Option 1, which is similar to the conformity of Option 3 with mandatory laws and decrees.

7 http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

8 http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=2918-14

Outcome of Step 1b: Under such conditions, all the scenarios are in compliance with mandatory legislation and regulations.

Hence, Step 1 is passed.

Step 2 - Investment analysis

Sub-step 2a: Determine appropriate analysis method.
According to Art. 191 of the Civil Code of Ukraine, state (communal) fixed prices shall be established for the products (services) that are of crucial social importance for population and are manufactured by monopolistic business entities. Therefore, "Vodokanal" MU has no right to independently form prices (rates) for its services, i.e. water supply and disposal. According to Art. 28 of Ukrainian Law "On local self-government in Ukraine", executive committees of village, town and city councils are entitled to establish the rates for household, communal, transport and other services, including water supply and disposal services. Currently, "Vodokanal" MU develops the water supply and disposal services rates that are subject to further approval (agreement), in case the local self-government authorities have no objections. Due to the effective Procedure for water supply and disposal rates[9] formation, reducing the amount of electricity needed to ensure water supply shall not generate any revenue for the enterprise, since as per the above Procedure reduction of electricity expenses results in reduced prices for end users. Thus, the enterprise shall not obtain additional revenues, and reduction of electricity expenses results in a decrease of the enterprise's revenue due to the reduction of rates.

The following steps have been done according to the additionality tools of the CDM Executive Committee – "Tool for the demonstration and assessment of additionality" (revision 05.2)[10].

Sub-step 2b: Option I. Apply simple cost analysis

Implementation of the project shall require the costs additional to the existing costs for the rehabilitation of water supply and disposal system in the city of Zaporizhzhia. The additional project costs include the costs of: purchase of new pumping equipment, rehabilitation of operating pumps, installation of new frequency controllers, purchase of pipes, etc. The expenses on introduction and implementation of the project "Development and upgrade of district water supply and disposal system in Zaporizhzhia city" include:

- expenses on energy-saving activities (replacement, rehabilitation and upgrades of pumps) Euro 3025.30 thous. (including consulting, personnel training, other activities – Euro 438.51 thous.);

- expenses on rehabilitation of water supply and disposal network - Euro 1423.68 thous.;

Total expenses on the project amount to Euro 4448.98 thous. (Refer to Annex 4 for details).

In terms of efficiency factor, quality of operation and applied engineering solutions, the equipment to be used under this project is the best of the materials and equipment available on the market of Ukraine. Availability of spare parts in Ukraine was an important parameter when selecting the equipment.

As a result of current practice, all electricity losses shall be borne by end consumers, and "Vodokanal" MU has no motives to implement energy-saving equipment.

At the moment of the project start, "Vodokanal" MU pumping stations operated the old pumping equipment manufactured in the USSR.

Application of the Kyoto Protocol mechanisms under this project makes the above activities economically beneficial, and this is the only opportunity to implement them.

As emission reductions do not bring any economic benefit to "Vodokanal" MU, except for the benefit to be formed under the Joint Implementation (JI) Project, we conclude that implementation of the Project is

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9 http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=959-2006-%EF

10 http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

impossible without obtaining a revenue within the framework of the JI project, since some barriers for investments appear.

Outcome of Step 2b.
The abovementioned information demonstrates that this project is economically unattractive without a JI project registration, thus proving additionality of the project.

Hence, Step 2 is passed.

Step 3: **Barrier analysis**

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

Investment barrier.

Additional expenses on implementation of the project include the costs of:

Upgrades of existing pumping equipment;
Purchase and implementation of new pumping equipment;
Purchase and implementation of frequency controllers;
Purchase and replacement of water supply and disposal networks;
Installation of a new cluster of measurement instruments.

The investment barriers are connected with the structure of existing water supply and disposal rates, which are regulated by the state and do not include amortization and investment needs of water suppliers. Such a situation results in a continuous lack of funds and impossibility to carry out timely capital repairs, ensure operation of equipment, make investments into upgrades and development of water supply infrastructure.

Technological barriers.

1. Due to financial problems, repairs were not performed in full of late, they mainly secured operable state of equipment, and economic results were often not taken into consideration. At the same time, many equipment units needs to be replaced. Implementation of new pumps implies availability of operations staff with an appropriate level of qualification. Training of personnel is required to overcome the barrier.

Organizational barriers.

There is no experience in JI projects management, including conduction of international negotiations, validation, verification, registration, monitoring, etc.

Outcome of Step 3a: The identified barriers may interfere with implementation of the proposed project, as well as of other alternative scenarios, i.e. rehabilitation without JI mechanisms and cut of the project activities with an exclusion of any secondary activities from the project implementation process.

Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives:

One of the alternatives is proceeding with “business as usual”. Since the barriers identified above directly relate to the investments into upgrades of the water supply and disposal system in the city of Zaporizhzhia, “Vodokanal” MU does not have any barriers to further operate the water supply and disposal system at the previous level.

Outcome of Step 3b: The identified barriers cannot prevent implementation of at least one of the alternative scenarios, i.e. continuation of “business as usual”.

Hence, Step 3 is passed.

Step 4: Common practice analysis

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

Analysis of the project activity's similarity demonstrated that there is no similar projects in Ukraine. The absence of financial motivation described in Step 2 and the barriers described in Step 3 refer not only to "Vodokanal" MU, but also to other companies operating water supply and disposal networks in Ukraine. In this regard, the current practice of maintaining operable state of equipment, which is presented in the option of initial conditions chosen for this Project, is customary in Ukraine. Due to the current practice, all electricity losses shall be borne by end consumers; and water supply companies do not have motivation to implement energy-saving projects.

Generally, pumping equipment and networks similar to the ones in Zaporizhzhia city are operated throughout Ukraine.

Outcome of Step 4a: Since there are no similar projects in Ukraine, there is no need to analyze similar project activities.

Conclusion
With due regard to the analysis above, we may conclude that the project is an additional one.

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

Geographical boundaries of the project coincide with territory of Zaporizhzhia city. The project boundary includes the entire "Vodokanal" MU water supply and disposal system.

Sources of greenhouse gases and boundaries of the project:

The project boundary and the expanded project boundary for the baseline scenario and for the project scenario are presented in a black rectangle and in the rectangle shown as a dashed line in diagrams 12 and 13.

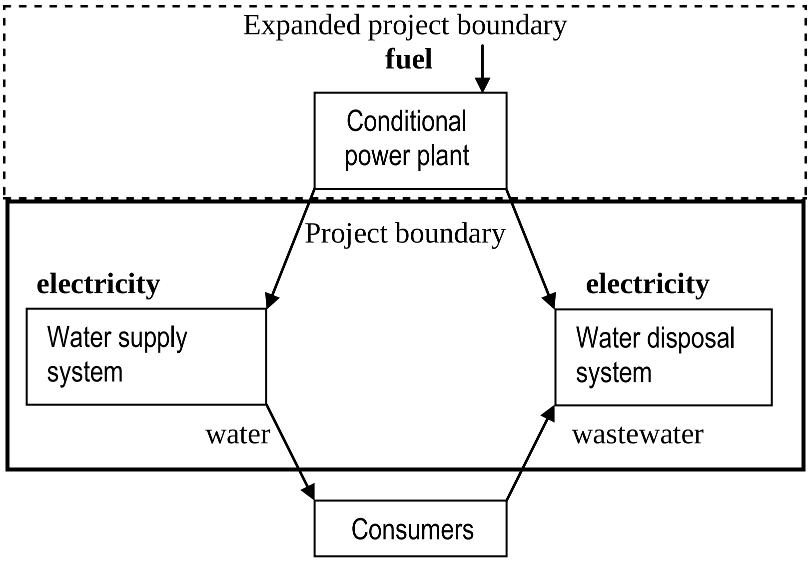

Fig. 12. Diagram of the project boundary in the baseline scenario.

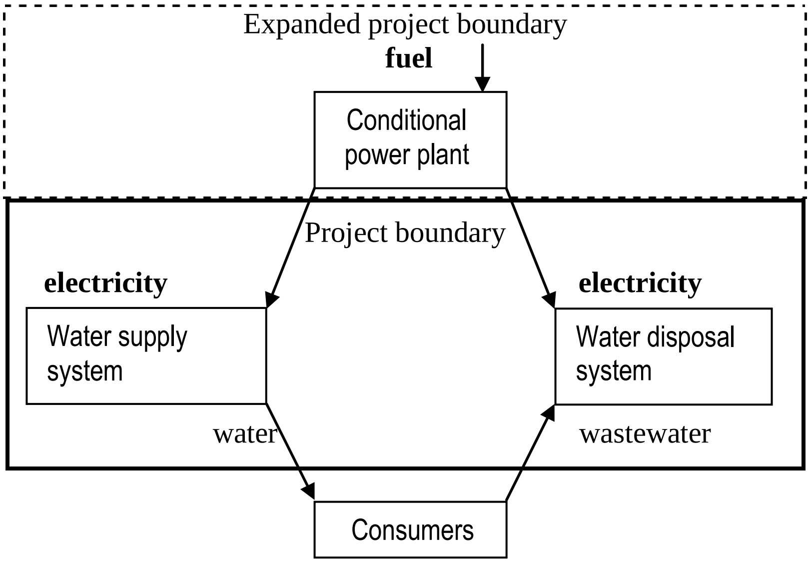

Fig. 13. Diagram of the project boundary in the project scenario.

The project boundary for the baseline and project scenarios includes CO_2 emissions caused by generation of electricity to the united power grid in the amount consumed by the pumps that ensure water transfer and are subject to energy-saving activities implementation. Therefore, the whole “Vodokanal” MU water supply and disposal system is included into the project boundary. The expanded project boundary includes a conditional power plant using fossil fuel to generate and supply electricity to the national power grid and to meet the needs of “Vodokanal” MU.

The table below demonstrates overview of all emissions sources in the baseline and project scenarios.

Scenario	Source of emissions	Emissions	Included or excluded	Clarifications
Local emissions				
Baseline	Emissions of power plant(s) during generation of electricity for the national power grid	CO_2	Included	Main source of emissions
		CH_4	Excluded	Excluded for the purpose of simplification. Conservative analysis
		N_2O	Excluded	Excluded for the purpose of simplification. Conservative analysis
		NO_x	Excluded	NO_x is not a directacting greenhouse gas
		CO	Excluded	CO is not a directacting greenhouse gas
Project	Emissions of power plant(s) during generation of electricity for the national power grid	CO_2	Included	Main source of emissions
		CH4	Excluded	Excluded for the purpose of simplification. Conservative analysis
		N_2O	Excluded	Excluded for the purpose of simplification. Conservative analysis
		NO_x	Excluded	NO_x is not a directacting greenhouse gas
		CO	Excluded	CO is not a directacting greenhouse gas

Indirect extraneous leakages of CO_2, CH_4, N_2O caused by fuel extraction and transportation were excluded. The leakages are not under the project developer's control (estimation of the leakages quantity is impossible), hence 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 formation: 25/07/2011
The baseline was estimated by the project developer JSC "Oblteplocomunenergo" and the project owner MU "Vodokanal":

JSC "OBLTEPLOCOMUNENERGO" -Legal body
Chernigiv, Ukraine
Yaroslav Y.Bechko
Economist of VPZGD
Tel./ Fax (+380462) 676-406
e-mail: oblteplokomunenergo@ukr.net

JSC "OBLTEPLOCOMUNENERGO" is not a project participant.

"Vodokanal" MU -Legal body
Zaporizhzhia, Ukraine
Volodymyr A. Bychykhin
Director General
Tel./ Fax +38 (061)2222401
info@vodokanal.zp.ua

"Vodokanal" MU - is a project participant.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Starting date of the project activity: 12/01/2004.

A working group to implement the activities aimed at development and improvement of the district water supply and disposal system in Zaporizhzhia city within the framework of the JI Project implementation was established on 12 January 2004.

Supporting document 4 includes the meeting minutes of the working group to implement the activities aimed at development and improvement of the district water supply and disposal system in Zaporizhzhia city within the framework of the JI Project implementation (dated 12 January 2004).

C.2. Expected operational lifetime of the project:

Minimum: 20 years/240 months (formal operational lifetime of new equipment for pumping stations, water supply and disposal networks). The actual average lifetime of new equipment for the pumps and water delivery networks is estimated to be up to 30-40 years, which is confirmed by the equipment certificates. Therefore, the estimated lifetime of the project shall exceed 30 years. Following the principle of conservatism, an operational lifetime was chosen for further calculations, as well as the corresponding crediting period of 26 years/312 months (2005-2030).

C.3. Length of the crediting period:

The starting date of the crediting period was chosen to be the date, when generation of the first emission reduction units is anticipated, i.e. 01 January 2005. The end of the crediting period shall be on 31 December, 2012. Consequently, duration of the crediting period shall amount to 8 years/96 months. If the Kyoto Protocol is prolonged after the first commitment period, the project crediting period will be prolonged for 18 years/216 months (01 January 2013 – 31 December 2027). Taking into account the period preceding to the crediting period, the crediting period and the period after its expiration, the total crediting period shall amount to 26 years/312 months.

SECTION D. Monitoring Plan:

D.1. Description of monitoring plan chosen:

Indicator of the project accomplishment

The most objective and cumulative factor demonstrating whether the emissions reduction actually occurred is electricity saving. It may be defined as the difference between the baseline electricity consumption and consumption of electricity after implementation of the project. If pumps consume electricity on the project level, then all other indicators, such as operational efficiency of new pumps and water loss in the water distribution networks, shall be corresponding.

Verification of the project accomplishment indicators

"Vodokanal" MU shall record and retain data on electricity and water purchased for water supply in the form of electricity and purchased water bills. Information on the electricity saved and water purchased shall be attached to the monitoring reports with all appropriate documentation and historical details on the Supplier's purchase of electricity and water.

Verification of emission reduction units and baseline scenario

A specific approach using AM0020 (version 02) dated 02.11.2007 methodology was applied to develop the project monitoring plan.

The project activities envisage improved efficiency of energy uses within the water transfer system, inclusive of decreased technical losses and water leakages, as well as improved efficiency of pump systems consuming electricity from the power grid. Consequently, application of Methodology AM0020 (version 02) dated 02.11.2007 is fully compliant with the standard engineering procedures used for water supply systems.

The period of JI project monitoring includes 8 years/96 months (01 January 2005 – 31 December 2012). In case the Kyoto Protocol is prolonged, the monitoring period shall be prolonged for 18 years/216 months more (01 January 2013 – 31 December 2030). Taking into account the period preceding to the crediting period, the crediting period and the period after its expiration, the total crediting period shall amount to 26 years/312 months. Consequently, the total period of JI project monitoring shall include 26 years/312 months.

The data, which shall be required to ensure the monitoring and determination/verification, shall be retained during the two years following the latest transmission of ERU under the project. Supporting document 5 includes the "Vodokanal" MU Order on the procedure for monitoring data retention.

Quantity of emission reduction units (ER), t CO_2e:

$$ER = E^b - E^r \qquad (1)$$

E^b and E^r – GHGs emissions that occur as a result of electricity consumption needed to ensure water supply and disposal during the baseline and reported years, correspondingly, t CO_2e;

[$_b$] index is referred to the baseline year;
[$_r$] index is referred to a reported year.

GHGs emissions that occur as a result of electricity consumption by the pumping equipment used in the water supply system:

$E^{wb} = M^3_{wr} * PPER * EF$ (2)
$E^{wr} = kWh_{wr} * EF$ (3)

where:
PPER- pre-project efficiency factor, kWh*hour/m^3;

EF- carbon dioxide emission factors(EF) for Ukraine during “y” year of 2005-2007 obtained from the document entitled “Ukraine - assessment of new calculation of CEF” verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled “On approval of indices for carbon dioxide specific emissions” issued by the National Environmental Investment Agency of Ukraine in 2008-2011.

kWh_{wr} - total amount of electricity required to transport water to consumers within the water supply system during a project year, kWh*hour;
M^3_{wr} - total volume of water supplied to consumers within the water supply system during a project year, m^3.

[$_b$] index is referred to the baseline year;
[$_r$] index is referred to a reported year.

$PPER = kWh_{wb} / M^3_{wb}$ (4)

kWh_{wb} - total amount of electricity required to transport water to consumers within the water supply system during the baseline year, kWh*hour;

M^3_{wb} – total volume of water supplied to consumers within the water supply system during the baseline year, m^3;
[$_b$] index is referred to the baseline year;

$kWh_{wr} = \sum kWh_{wr,i}$ (5)
$kWh_{wr,i}$ - total amount of electricity required to transport water to consumers within “i” water supply system during a project year, kWh*hour;

[$_i$] index – independent water supply system;
[$_r$] index is referred to a reported year.

$M^3_{wr} = \sum M^3_{i, wr}$ (6)
$M^3_{i, wr}$ - volume of water supplied to consumers within "i" water supply system during a project year, m^3;

[$_i$] index – independent water supply system;
[$_r$] index is referred to a reported year.

GHGs emissions that occur as a result of electricity consumption by the pumping equipment used in the water disposal system:

$E^{vb} = M^3_{vr} * PPER * EF$ (7)
$E^{vr} = kWh_{vr} * EF$ (8)

where:
PPER- pre-project efficiency factor, kWh*hour/m^3;

EF- carbon dioxide emission factors(EF) for Ukraine during "y" year of 2005-2007 obtained from the document entitled "Ukraine - assessment of new calculation of CEF" verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled "On approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011;

kWh_{vr} – Total amount of electricity required to transport wastewater within the water disposal system during a project year, kWh*hour;
M^3_{vr} - Total volume of wastewater transported by the water disposal system during a project year, m^3.

[$_b$] index is referred to the baseline year;
[$_r$] index is referred to a reported year.

$PPER = kWh_{vb} / M^3_{vb}$ (9)

kWh_{vb} - total amount of electricity required to transport wastewater within the water disposal system during the baseline year, kWh*hour;

M^3_{vb} - total volume of wastewater transported by the water disposal system during the baseline year, m^3;
[$_b$] index is referred to the baseline year;

$kWh_{vr} = \sum kWh_{vr,i}$ (10)
$kWh_{vr,i}$ - total amount of electricity required to transport wastewater within "i" water disposal system during a project year, kWh*hour;

[$_i$] index – independent water disposal system;
[$_r$] index is referred to a reported year.

$$M^3_{vr} = \sum M^3_{i,\,vr} \qquad (11)$$

$M^3_{i,\,vr}$ - volume of wastewater transported by "i" water disposal system during a project year, m^3;

[$_i$] index – independent water disposal system;
[$_r$] index is referred to a reported year.

The data and parameters that are not subject to control over the entire crediting period, though are estimated once and are available at the stage of PDD development: total volume of water supplied to consumers during the baseline year, m^3 (M^3_{wb}), total volume of wastewater transported by the water disposal system during the baseline year m^3 (M^3_{vb}), total amount of electricity required to transport water to consumers during the baseline year, kWh*hour (kWh_{wb}), total amount of electricity required to transport wastewater during the baseline year, kWh*hour (kWh_{vb}), carbon dioxide emission factors(EF) for Ukraine during "y" year of 2005-2007. The data were obtained from the document entitled "Ukraine - assessment of new calculation of CEF" verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011.

The data and parameters that are not subject to control over the entire crediting period, though are estimated once and are not available at the stage of PDD development: N/A.

The data and parameters that are subject to control over the entire crediting period: volume of water supplied to consumers within "i" water supply system during a project year, m^3 ($M^3_{i,wr}$), volume of wastewater transported by "i" water disposal system during a project year, m^3 ($M^3_{i,vr}$), amount of electricity kWh*hour required to transport water to consumers within "i" water supply system during a project year ($kWh_{wr,i}$), amount of electricity kWh*hour required to transport wastewater within "i" water disposal system during a project year, ($kWh_{vr,i}$).

Table of parameters that shall be included into the process of monitoring and verification of ERUs calculation and are presented in Sections **D.1.1.1 and D.1.1.3**

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

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

Data / Parameter	**$EF_{CO2,ELEC}$**
Data unit	t CO_2e/ MWh*hour
Description	Carbon dioxide emission factor for electricity consumption for Ukrainian power grid
Time of determination/ monitoring	Once, at the beginning of the project.
Data source (to be) used	1) Research data of Global Carbon B.V.[8] 2) Orders "on approval of the indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011.
Data values (for ex-ante calculations /determinations)	0.896, 1.219, 1.237, 1.225.
Justification of data choice or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	N/A
Comments	The research has not taken into account the electricity generated at nuclear power plants

Data / Parameter	**$M^3_{i,wr}$** **M-1**
Data unit	m^3
Description	Total volume of water supplied to consumers within "i" water supply system during a project year.
Time of determination/ monitoring	On a daily basis
Data source (to be) used	Readings of the flow meters installed at lifting stations.
Data values (for ex-ante calculations /determinations)	N/A
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions during the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	**$kWh_{wr,i}$** **M-2**
Data unit	kWh*hour
Description	Total amount of electricity needed to deliver water to consumers within "i" water supply system during a project year.
Time of determination/ monitoring	On a monthly basis
Data source (to be) used	Readings of the electricity meters installed at pumping stations.
Data values (for ex-ante calculations /determinations)	N/A
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	**$M^3_{i, vr}$** **M-3**
Data unit	m^3
Description	Total volume of wastewater transported by "i" water disposal system during a project year.
Time of determination/ monitoring	Daily
Data source (to be) used	Readings of the flow meters installed at sewerage stations.
Data values (for ex-ante calculations /determinations)	N/A
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	**$kWh_{vr,i}$** **M-4**
Data unit	kWh*hour
Description	Amount of electricity required to transport wastewater in "i" water disposal system during a project year.
Time of determination/ monitoring	Monthly
Data source (to be) used	Readings of the electricity meters installed at pumping stations.
Data values (for ex-ante calculations /determinations)	N/A
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

According to the effective legislation, all metering devices in Ukraine shall meet the requirements established in appropriate standards and shall be regularly calibrated (usually once per year, for some equipment – once per 2 or 3 years).

In case metering devices are damaged, they shall be replaced or repaired as soon as possible. Such cases shall be described in the monitoring reports.

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

GHGs emissions that occur as a result of electricity consumption by the pumping equipment used in the water supply system:

$$E^{wr} = kWh_{wr} * EF \quad (12)$$

E^{wr} - CO_2 emissions that occur as a result of electricity consumption for water supply in a project year, t CO_2e;

where:

EF - carbon dioxide emission factors(EF) for Ukraine during “y” year of 2005-2007 obtained from the document entitled “Ukraine - assessment of new calculation of CEF” verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled “on approval of indices for carbon dioxide specific emissions” issued by the National Environmental Investment Agency of Ukraine in 2008-2011;

kWh_{wr} - total amount of electricity required to transport water to consumers during a project year, kWh*hour;

[$_r$] index is referred to a reported year.

$kWh_{wr} = \sum kWh_{wr,i}$ (13)

$kWh_{wr,i}$ - amount of electricity required to transport water to consumers within “i” water supply system during a project year, kWh*hour;

[$_i$] index – independent water supply system;
[$_r$] index is referred to a reported year.

GHGs emissions that occur as a result of electricity consumption by the pumping equipment used in the water disposal system:

$E^{vr} = kWh_{vr} * EF$ (14)

E^{vr} - CO_2 emissions that occur as a result of electricity consumption for water disposal in a project year, t CO_2e;

where:

EF- carbon dioxide emission factors(EF) for Ukraine during “y” year of 2005-2007 obtained from the document entitled “Ukraine - assessment of new calculation of CEF” verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled “On approval of indices for carbon dioxide specific emissions” issued by the National Environmental Investment Agency of Ukraine in 2008-2011;

kWh_{vr} – total amount of electricity required to transport wastewater during a project year, kWh*hour;

[$_r$] index is referred to a reported year.

$kWh_{vr} = \sum kWh_{vr,i}$ (15)

$kWh_{vr,i}$ - amount of electricity required to transport wastewater within "i" water disposal system during a project year, kWh*hour;

[$_i$] index – independent water disposal system;
[$_r$] index is referred to a reported year.

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

Data / Parameter	$EF_{CO2,ELEC}$
Data unit	t CO_2e/ MWh*hour
Description	Carbon dioxide emission factor for electricity consumption for Ukrainian power grid
Time of determination/ monitoring	Once, at the beginning of the project.
Data source (to be) used	1) Research data of Global Carbon B.V. [8] 2) Orders "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011.
Data values (for ex-ante calculations /determinations)	0.896, 1.219, 1.237, 1.225.
Justification of data choice or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	N/A
Comments	The research has not taken into account the electricity generated at nuclear power plants

Data / Parameter	M^3_{wb}
Data unit	m^3
Description	Total volume of water supplied to consumers within the water supply system during the baseline year.
Time of determination/ monitoring	Determined before the project has begun in the baseline year of 2004.

Data source (to be) used	Data of flow meters installed at lifting stations.
Data values (for ex-ante calculations /determinations)	122096150
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	$\mathbf{kWh}_{wb}$
Data unit	kWh*hour
Description	Total amount of electricity required to transport water to consumers during the baseline year.
Time of determination/ monitoring	Once, at the beginning of the project, in the baseline year of 2004.
Data source (to be) used	Readings of electricity meters installed at pumping stations.
Data values (for ex-ante calculations /determinations)	88365120
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	$\mathbf{M^3_{i, wr}}$
Data unit	m^3
Description	Total volume of water delivered to consumers within “i” water supply system during a project year.
Time of determination/ monitoring	Daily

Data source (to be) used	Readings of electricity meters installed at pumping stations.
Data values (for ex-ante calculations /determinations)	N/A
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in a project year; the data shall be archived electronically and on paper.

Data / Parameter	$\mathbf{M^3_{vb}}$
Data unit	M^3
Description	Total amount of wastewater transported by the water disposal system during the baseline year.
Time of determination/ monitoring	Determined before the project has begun in the baseline year of 2004.
Data source (to be) used	Readings of flow meters installed at sewerage stations.
Data values (for ex-ante calculations /determinations)	55768000
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	$\mathbf{kWh_{vb}}$
Data unit	kWh*hour
Description	Total amount of electricity required for the water disposal system to transport wastewater during the baseline year.
Time of determination/ monitoring	Determined before the project has begun in the baseline year of

	2004.
Data source (to be) used	Readings of electricity meters installed at pumping stations.
Data values (for ex-ante calculations /determinations)	31858120
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Data / Parameter	$\mathbf{M^3_{i, vr}}$
Data unit	m^3
Description	Total volume of wastewater transported by “i” water disposal system during a project year.
Time of determination/ monitoring	Daily
Data source (to be) used	Readings of flow meters installed at sewerage stations.
Data values (for ex-ante calculations /determinations)	N/A
Justification of data choice or description of measurement methods and procedures (to be) applied	Methodology AM0020 (version 02) dated 02.11.2007.
QA/QC procedures (to be) applied	Measurements are taken by the meters subject to regular calibration.
Comments	Data that allow calculating GHGs emissions in a project year; the data shall be archived electronically and on paper.

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

GHGs emissions that occur as a result of electricity consumption by the pumping equipment used in the water supply system:

$$E^{wb} = M^3_{wr} * PPER * EF \quad (16)$$

where:
PPER- pre-project efficiency factor, kWh*hour/m^3;
EF- carbon dioxide emission factors(EF) for Ukraine during "y" year of 2005-2007 obtained from the document entitled "Ukraine - assessment of new calculation of CEF" verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011;

$M^3{}_{wr}$ - total volume of water supplied to consumers within the water supply system during a project year, m^3.

[$_b$] index is referred to the baseline year;
[$_r$] index is referred to a reported year.

$$PPER = kWh_{wb} / M^3{}_{wb} \quad (17)$$

kWh_{wb} - total amount of electricity required to transport water to consumers within the water supply system during the baseline year, kWh*hour;

$M^3{}_{wb}$ - total volume of water supplied to consumers within the water supply system during the baseline year, m^3;
[$_b$] index is referred to the baseline year;

$$M^3{}_{wr} = \sum M^3{}_{i,wr} \quad (18)$$

$M^3{}_{i,wr}$ - volume of water supplied to consumers within "i" water supply system during a project year, m^3;

[$_i$] index – independent water supply system;
[$_r$] index is referred to a reported year.

GHGs emissions that occur as a result of electricity consumption by the pumping equipment used in the water disposal system:

$$E^{vb} = M^3{}_{vr} * PPER * EF \quad (19)$$

where:
PPER- pre-project efficiency factor, kWh*hour/m^3;

EF- carbon dioxide emission factors(EF) for Ukraine during “y” year of 2005-2007 obtained from the document entitled “Ukraine - assessment of new calculation of CEF” verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders “on approval of indices for carbon dioxide specific emissions” issued by the National Environmental Investment Agency of Ukraine in 2008-2011;

M^3_{vr} - total volume of wastewater transported by the water disposal system during a project year, m^3

[$_b$] index is referred to the baseline year;
[$_r$] index is referred to a reported year.

$$PPER = kWh_{vb} / M^3_{vb} \quad (20)$$

kWh_{vb} - total amount of electricity required to transport wastewater within the water disposal system during the baseline year, kWh*hour;

M^3_{vb} - total volume of wastewater transported by the water disposal system during the baseline year, m^3;
[$_b$] index is referred to the baseline year;

$$M^3_{vr} = \sum M^3_{i,vr} \quad (21)$$

$M^3_{i,vr}$ - volume of wastewater transported by “i” water disposal system during a project year, m^3;

[$_i$] index – independent water disposal system;
[$_r$] index is referred to a reported year.

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. Estimation of leakage in the monitoring plan:

There are no leakages. The dynamic baseline (based on the 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 leakages 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 leakages 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 equivalent):

GHGs emission reductions under the project were estimated using the following formulas:

$$ER = E^b - E^r \quad (22)$$

ERU - emission reduction units, t CO_2e;
E^r – project emissions, t CO_2e;
E^b - baseline emissions, t CO_2e.

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:

Implementation of this Project envisages replacement of pumping equipment and water distribution networks. "Deficiency acts"[11], shall be executed for the equipment subject to decommissioning (pumps, motor drives, steel pipes). The dismantled equipment shall be handed over to Zaporizhzhia City Council for further use as recyclable materials. In accordance with Ukrainian legislation "On system of collecting, sorting, transportation, processing and utilization of commercial waste (packages) and solid domestic waste"[12], the enterprise shall not monitor utilization of solid waste".

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.
M-1	Low	Measuring instruments are calibrated in accordance with the national standards
M-2	Low	Measuring instruments are calibrated in accordance with the national standards
M-3	Low	Measuring instruments are calibrated in accordance with the national standards
M-4	Low	Measuring instruments are calibrated in accordance with the national standards

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

The operational structure includes operational departments of the Supplier ("Vodokanal" MU) and operations personnel of pumping stations.
The management structure includes administration departments of the Supplier and experts-designers of the project (JSC "OBLTEPLOCOMUNENERGO").

[11] conclusion of the commission that included "Vodokanal" MU personnel and a representative of Zaporizhzhia City Council, the "Deficiency acts" are stored and archived at the enterprise.

[12] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=408-99-%EF

The detailed operational structure and management structure are presented in Annex 3.

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

The monitoring plan is established by the project developer JSC "Oblteplocomunenergo" and MU "Vodokanal", the project owner:

JSC “OBLTEPLOCOMUNENERGO” -Legal body
Chernigiv, Ukraine
Yaroslav Y.Bechko
Economist of VPZGD
Tel./ Fax (+380462) 676-406
e-mail: oblteplokomunenergo@ukr.net

“Vodokanal” MU -Legal body
Zaporizhzhia, Ukraine
Volodymyr A. Bychykhin
Director General
Tel./ Fax +38 (061)2222401
info@vodokanal.zp.ua

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

The specific formulas stated in Section D were used to perform preliminary estimation of the project emissions during the period before 01 January 2008 (2005-2007) and during the first commitment period up to 2010 included (The project monitoring plan).

To estimate project emissions for the project in 2011-2012 and after the first commitment period were used specific formulas that are based on extrapolation methodology by which conclusions about the meaning of forecasting performance in future periods are made by studying their dynamics in prior periods.The specific formulas for estimating the project emissions after the first commitment period are presented in Section E.1.

Results of the corresponding calculations that were made using these formulas and general impact of the activities implementation are presented in Supporting document 3.

The following formulas were used to estimate the project emissions, which occurred under the project as a result of electricity consumption by pumping equipment used in the water supply system, within the period before 01 January 2008 (2005-2007) and during the first commitment period till 2010 included:

$E^{wr} = kWh_{wr} * EF$

where:

EF- carbon dioxide emission factors(EF) for Ukraine during "y" year of 2005-2007 obtained from the document entitled "Ukraine - assessment of new calculation of CEF" verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2010;

kWh_{wr} - total amount of electricity required to transport water to consumers during a project year, kWh*hour; [$_r$] index is referred to a reported year.

$kWh_{wr} = \sum kWh_{wr,i}$

$kWh_{wr,i}$ - amount of electricity required to transport water to consumers within "i" water supply system during a project year, kWh*hour;

[$_i$] index – independent water supply system;
[$_r$] index is referred to a reported year.

The following formulas were used to estimate the project emissions, which occurred as a result of electricity consumption by pumping equipment used in the water supply system, within the period of 2011-2012 under the project:

$$kWh_{cwr} = \frac{1}{t} \sum_{i=t-n+1}^{t} xi \qquad (23)$$

where:

kWh_{cwr} - average of electricity required to transport water to consumers during a project year, kWh*hour;
t - amount of electricity consumption under the water supply system (value of the latest reported year), kWt*hour;
n - surveyed interval for time series of the value of electricity consumption within the water supply system (3 years);
xi - indicator of the surveyed value for electricity consumption within the water supply system during “i” year, m^3.

$E^{wr} = kWh_{cwr} * EF$

where:

EF- carbon dioxide emission factor(EF) for Ukraine in 2011 obtained from the regulatory document of Ukrainian legislation, namely from the order entited “On approval of indices for carbon dioxide specific emissions” issued by the National Environmental Investment Agency of Ukraine in 2011.
The value of carbon dioxide emission factor(EF) for Ukraine in 2012 under the project was estimated to be at the level of this value in 2011;

kWh_{cwrr} – average electricity consumption required to transport water to consumers during a project year, kWh*hour;

[$_r$] index is referred to a reported year.

$kWh_{cwr} = \sum kWh_{cwr,i}$

$kWh_{cwr,i}$ - average electricity consumption required to transport water to consumers within “i” water supply system during a project year, kWh*hour;

[$_i$] index – independent water supply system;
[$_r$] index is referred to a reported year.

Since long-term planning (forecasting) of a project emissions level during future periods may drastically mispresent actual values of project emissions in 2013-2030, the estimated value for the electricity consumption within the water supply system and carbon dioxide emission factor(EF) under the project with regard to a corresponding commitment period was determined using a conservative method and on default it corresponds to the latest year’s level of the first commitment period.

The following formulas were used to estimate the project emissions, which occurred under the project as a result of electricity consumption by pumping equipment used in the water disposal system, within the period before 01 January 2008 (2005-2007) and during the first commitment period till 2010 included:

$E^{Vr} = kWh_{Vr} * EF$

where:

EF- carbon dioxide emission factors(EF) for Ukraine during “y” year of 2005-2007 obtained from the document entitled “Ukraine - assessment of new calculation of CEF” verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled “on approval of indices for carbon dioxide specific emissions” issued by the National Environmental Investment Agency of Ukraine in 2008-2010;

kWh_{vr} – total amount of electricity required to transport wastewater during a project year, kWh*hour;

[$_r$] index is referred to a reported year.

$kWh_{vr} = \sum kWh_{vr,i}$
$kWh_{vr,i}$ - amount of electricity required to transport wastewater within “i” water disposal system during a project year, kWh*hour;

[$_i$] index – independent water disposal system;
[$_r$] index is referred to a reported year.

The following formulas were used to estimate the project emissions, which occur under the project as a result of electricity consumption by pumping equipment used in the water disposal system within the period of 2011-2012:

$$kWh_{cvr} = \frac{1}{t} \sum_{i=t-n+1}^{t} xi \qquad (24)$$

where:

kWh_{cvr} - average of electricity required to transport wastewater during a project year, kWh*hour;
t - amount of electricity consumption under the water disposal system (value of the latest reported year), kWt*hour;
n - surveyed interval for time series of the value of electricity consumption within the water disposal system (3 years);
xi - indicator of the surveyed value for electricity consumption within the water disposal system during “i” year, m^3.

$E^{vr} = kWh_{cvr} * EF$

where:

EF - carbon dioxide emission factor(EF) for Ukraine in 2011 obtained from the regulatory document of Ukrainian legislation, namely from the order entitled “on approval of indices for carbon dioxide specific emissions” issued by the National Environmental Investment Agency of Ukraine in 2011. The value of carbon dioxide emission factor(EF) for Ukraine in 2012 under the project was estimated to be at the level of this value in 2011;

kWh_{cvr} - average electricity consumption required to transport wastewater during a project year, kWh*hour;

[$_r$] index is referred to a reported year.

$kWh_{cvr} = \sum kWh_{cvr,i}$

$kWh_{cvr,i}$ - average electricity consumption required to transport wastewater within "i" water disposal system during a project year, kWh*hour;

[$_i$] index – independent water disposal system;
[$_r$] index is referred to a reported year.

Since long-term planning (forecasting) of a project emissions level during future periods may drastically mispresent actual values of project emissions in 2013-2030, the estimated value for the electricity consumption within the water disposal system and carbon dioxide emission factor(EF) under the project with regard to a corresponding commitment period was determined using a conservative method and on default it corresponds to the latest year's level of the first commitment period.

Year	Project emissions (t CO_2 equivalent)
2005	93305
2006	72915
2007	63798
Total (т CO_2 equivalent)	230018

Table 11. Estimated project emissions in the period before 01 January 2008 (2005-2007)

Year	Project emissions (t CO_2 equivalent)
2008	55214
2009	42687
2010	37878
2011	45286
2012	41856
Total (т CO_2 equivalent)	222921

Table 12. Estimated project emissions in the period from 01 January 2008 to *31 December 2012*

Year	Project emissions (t CO_2 equivalent)
2013	41856
2014	41856
2015	41856
2016	41856
2017	41856
2018	41856
2019	41856
2020	41856
2021	41856
2022	41856

2023	41856
2024	41856
2025	41856
2026	41856
2027	41856
2028	41856
2029	41856
2030	41856
Total (т CO_2 equivalent)	753408

Table 13. Estimated project emissions in the period from 01 January 2013 to 31December 2030

Refer to Supporting document 3 for the detailed information on calculations.

E.2. Estimated leakage:

No leakages expected.

E.3. Sum E.1 and E.2.:

Since there shall be no leakages, sum E.1 and E.2 shall be equal to E.1 (refer to Tables 11-13).

E.4. Estimated baseline emissions:

The specific formulas stated in Section D were used to perform preliminary estimation of the baseline emissions under the project in the period before 01 January 2008 (2005-2007) and during the first commitment period up to 2010 included (The project monitoring plan).

To estimate baseline emissions for the project in 2011-2012 and after the first commitment period were used specific formulas that are based on extrapolation methodology by which conclusions about the meaning of forecasting performance in future periods are made by studying their dynamics in prior periods. The specific formulas for estimation of baseline emissions under the project after the first commitment period are presented in Section E.4.

Results of the corresponding calculations that were made using these formulas and general impact of the activities implementation are presented in Supporting document 3.

The following formulas were used to estimate the baseline emissions, which occurred under the project as a result of electricity consumption by pumping equipment used in the water supply system, within the period before 01 January 2008 (2005-2007) and during the first commitment period till 2010 included:

$E^{wb} = M^3_{wr} * PPER * EF$

where:

PPER- pre-project efficiency factor, kWh*hour/m^3;

EF- carbon dioxide emission factors(EF) for Ukraine during “y” year of 2005-2007 obtained from the document entitled “Ukraine - assessment of new calculation of CEF” verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled “on approval of indices for carbon dioxide specific emissions” issued by the National Environmental Investment Agency of Ukraine in 2008-2010;

M^3_{wr} - total volume of water supplied to consumers within the water supply system during a project year, m^3.

[$_b$] index is referred to the baseline year;
[$_r$] index is referred to a reported year.

$PPER = kWh_{wb} / M^3_{wb}$

kWh_{wb} – total amount of electricity required to transport water to consumers within the water supply system during the baseline year, kWh*hour;

M^3_{wb} – total volume of water supplied to consumers within the water supply system during the baseline year, m^3;
[$_b$] index is referred to the baseline year;

$M^3_{wr} = \sum M^3_{i, wr}$
$M^3_{i, wr}$ - volume of water supplied to consumers within "i" water supply system during a project year, m^3;

[$_i$] index – independent water supply system;
[$_r$] index is referred to a reported year.

The following formulas were used to estimate the baseline emissions, which occur under the project as a result of electricity consumption by pumping equipment used in the water supply system within the period of 2011-2012:

$$M^3_{cwr} = \frac{1}{t} \sum_{i=t-n+1}^{t} xi \qquad (25)$$

where:

M^3_{cwr} - average of water volume supplied to consumers within the water supply system during a project year, m^3;
t - transported water volume (value of the latest reported year), m^3;
n - surveyed interval for time series of the value for transported water volume (3 years);
xi - indicator of the surveyed value for transported water volume during "i" year, m^3.

$$E^{wb} = M^3_{cwr} * PPER * EF \qquad (26)$$

where:
PPER- pre-project efficiency factor, kWh*hour/m^3;

EF- carbon dioxide emission factor(EF) for Ukraine in 2011 obtained from the regulatory document of Ukrainian legislation, namely from the order entitled "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2011.

The value of carbon dioxide emission factor (EF) for Ukraine in 2012 under the project was estimated to be at the level of this value in 2011.

M^3_{cvr} – average volume of water supplied to consumers within the water supply system during a project year, m^3.

[$_b$] index is referred to the baseline year;
[$_r$] index is referred to a reported year.

$PPER = kWh_{wb} / M^3_{wb}$

kWh_{wb} – total amount of electricity required to transport water to consumers within the water disposal system during the baseline year, kWh*hour;

M^3_{vb} – total volume of water supplied to consumers within the water supply system during the baseline year, m^3;
[$_b$] index is referred to the baseline year;

$M^3_{cwr} = \sum M^3_{i, cwr}$
$M^3_{i, cwr}$ - average transported water volume within "i" water supply system during a project year, m^3;

[$_i$] index – independent water supply system;
[$_r$] index is referred to a reported year.

Since long-term planning (forecasting) of the baseline emissions level during future periods may drastically mispresent actual values of baseline emissions in 2013-2030, the estimated value for the volume of water supplied to consumers and carbon dioxide emission factor(EF) under the project with regard to a corresponding commitment period was determined using a conservative method and on default it corresponds to the latest year's level of the first commitment period.

The following formulas were used to estimate the baseline emissions, which occurr under the project as a result of electricity consumption by pumping equipment used in the water disposal system, within the period before 01 January 2008 (2005-2007) and during the first commitment period till 2010 included:

$E^{vb} = M^3_{vr} * PPER * EF$

where:
PPER – pre-project efficiency factor, kWh*hour/m^3;

EF- carbon dioxide emission factors for electricity consumption(EF) for Ukraine during "y" year of 2005-2007 obtained from the document entitled "Ukraine - assessment of new calculation of CEF" verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2010;

M^3_{vr} – total volume of wastewater transported by the water disposal system during a project year, m^3;

[$_b$] index is referred to the baseline year;

[$_r$] index is referred to a reported year.

PPER = kWh $_{vb}$/ M^3_{vb}

kWh $_{vb}$ – total amount of electricity required to transport wastewater within the water disposal system during the baseline year, kWh*hour;

M^3_{vb} - total volume of wastewater transported by the water disposal system during the baseline year, m^3;
[$_b$] index is referred to the baseline year;

$M^3_{vr} = \sum M^3_{i, vr}$
$M^3_{i, vr}$ - volume of wastewater transported by "i" water disposal system during a project year, m^3;

[$_i$] index – independent water disposal system;
[$_r$] index is referred to a reported year.

The following formulas were used to estimate the baseline emissions, which occur under the project as a result of electricity consumption by pumping equipment used in the water disposal system within the period of 2011-2012:

$$M^3_{cvr} = \frac{1}{t} \sum_{i=t-n+1}^{t} xi \qquad (27)$$

where:

M^3_{cvr} - average of wastewater volume transported by the water disposal system during a project year, m^3;
t - wastewater volume (value of the latest reported year), m^3;
n - surveyed interval for time series of the value for wastewater volume (3 years);
xi - indicator of the surveyed value for wastewater volume during "i" year, m^3.

$$E^{vb} = M^3_{cvr} * PPER * EF \qquad (28)$$

where:
PPER- pre-project efficiency factor, kWh*hour/m^3;

EF- carbon dioxide emission factor(EF) for Ukraine in 2011 obtained from the regulatory document of Ukrainian legislation, namely from the order entitled "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2011.
The value of carbon dioxide emission factor(EF) for Ukraine in 2012 under the project was estimated to be at the level of this value in 2011.

M^3_{cvr} – average wastewater volume transported by the water disposal system during a project year, m^3;

[$_b$] index is referred to the baseline year;
[$_r$] index is referred to a reported year.

$PPER = kWh_{vb} / M^3_{vb}$

kWh_{vb} – total amount of electricity required to transport wastewater within the water disposal system during the baseline year, kWh*hour;

M^3_{vb} - total volume of wastewater transported by the water disposal system during the baseline year, m^3;
[$_b$] index is referred to the baseline year;

$M^3_{cvr} = \sum M^3_{i, cvr}$
$M^3_{i, cvr}$ - average wastewater volume transported by "i" water disposal system during a project year, m^3;

[$_i$] index – independent water disposal system;
[$_r$] index is referred to a reported year.

Since long-term planning (forecasting) of the baseline emissions level during future periods may drastically mispresent actual values of baseline emissions in 2013-2030, the estimated value for the volume of transported wastewater and carbon dioxide emission factor(EF) under the project with regard to a corresponding commitment period was determined using a conservative method and on default it corresponds to the latest year's level of the first commitment period.

Year	Estimated baseline emissions (t CO_2 equivalent)
2005	115501
2006	110131
2007	113070
Total (т CO_2 equivalent)	338702

Table 14. Estimated baseline emissions in the period before 01 January 2008 (2005-2007)

Year	Estimated baseline emissions (t CO_2 equivalent)
2008	156027
2009	150450
2010	132865
2011	146456
2012	142924
Total (т CO_2 equivalent)	728722

Table 15. Estimated baseline emissions in the period from 01 January 2008 to *31 December 2012.*

Year	Estimated baseline emissions (t CO_2 equivalent)
2013	142924
2014	142924
2015	142924
2016	142924
2017	142924
2018	142924
2019	142924
2020	142924
2021	142924

2022	142924
2023	142924
2024	142924
2025	142924
2026	142924
2027	142924
2028	142924
2029	142924
2030	142924
Total (т CO_2 equivalent)	2572632

Table 16. Estimated baseline emissions in the period from 01 January 2013 to 31December 2030.

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

Project emission reduction = Baseline emissions - (Project emissions + Estimated leakages). (29)
Tables 17-19 demonstrate the overall results of the project emissions estimations.

Year	Estimated emission reductions (t CO_2 equivalent)
2005	22196
2006	37216
2007	49272
Total (т CO_2 equivalent)	108684

Table 17. Estimated emission reductions in the period before 01 January 2008 (2005-2007)

Year	Estimated emission reductions (t CO_2 equivalent)
2008	100813
2009	107763
2010	94987
2011	101170
2012	101068
Total (т CO_2 equivalent)	505801

Table 18. Estimated emission reductions in the period from 01 January 2008 to *31 December 2012.*

Year	Estimated emission reductions (t CO_2 equivalent)
2013	101068
2014	101068
2015	101068
2016	101068
2017	101068
2018	101068
2019	101068
2020	101068
2021	101068
2022	101068

2023	101068
2024	101068
2025	101068
2026	101068
2027	101068
2028	101068
2029	101068
2030	101068
Total (т CO_2 equivalent)	1819224

Table 19. Estimated emission reductions in the period from 01 January 2013 to 31December 2030.

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

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakage (t CO_2 equivalent)	Estimated baseline emissions (t CO_2 equivalent)	Estimated emission reductions (t CO_2 equivalent)
2005	93305		115501	22196
2006	72915		110131	37216
2007	63798		113070	49272
Total (т CO_2 equivalent)	230018		338702	108684

Table 20. Table including the estimated results for the emission reductions in the period before 01 January 2008 (2005-2007)

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakage (t CO_2 equivalent)	Estimated baseline emissions (t CO_2 equivalent)	Estimated emission reductions (t CO_2 equivalent)
2008	55214		156027	100813
2009	42687		150450	107763
2010	37878		132865	94987
2011	45286		146456	101170
2012	41856		142924	101068
Total (т CO_2 equivalent)	222921		728722	505801

Table 21. Table including the estimated results for emission reductions during the first commitment period.

Year	Estimated project emissions (t CO_2 equivalent)	Estimated leakage (t CO_2 equivalent)	Estimated baseline emissions (t CO_2 equivalent)	Estimated emission reductions (t CO_2 equivalent)
2013	41856		142924	101068
2014	41856		142924	101068
2015	41856		142924	101068
2016	41856		142924	101068
2017	41856		142924	101068
2018	41856		142924	101068

2019	41856		142924	101068
2020	41856		142924	101068
2021	41856		142924	101068
2022	41856		142924	101068
2023	41856		142924	101068
2024	41856		142924	101068
2025	41856		142924	101068
2026	41856		142924	101068
2027	41856		142924	101068
2028	41856		142924	101068
2029	41856		142924	101068
2030	41856		142924	101068
Total (т CO_2 equivalent)	753408		2572632	1819224

Table 22. Table including the estimated results for emission reductions after the first commitment period.

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:

Pursuant to the Ukrainian legislative framework "On natural environment protection"[13] and "STRUCTURE AND CONTENT OF THE MATERIALS ON ENVIRONMENTAL IMPACTS ASSESSMENT DURING DESIGN AND CONSTRUCTION OF ENTERPRISES, BUILDINGS AND STRUCTURES"[14], "Vodokanal" MU is not obliged to develop Environmental Impacts Assessment for this project type.

The only environmental impact is the dismantled equipment, which shall further be used as recyclable materials.

Implementation of this project will facilitate improvements in servicing the water consumers. Experience of "Vodokanal" MU personnel and adherence to the standard "On drinking water and drinking water supply"[5] provide for minimization of emergencies' occurrence probability during the project progress.

Pursuant to the definition in the text of "Convention on Long-range Transboundary Air Pollution" that has been ratified by Ukraine, there shall be no transboundary impacts produced by the project activity.

Implementation of the Project does not provide any detrimental effects on the environment. "Vodokanal" MU has authorizations for "Special use of water".

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:

Impact on water environment

No impact on water environment.

Impact on air environment

No impact on air environment.

Impact on land-use.

No impact on land and soils use.

[13] http://zakon.rada.gov.ua/cgi-biMaws/main.cgi7nreF1264-12

[14] http://www.budinfo.com.Ua/dbn/8.htm

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 impacts and negative social effects, special public discussions were not necessary. Consultations with Stakeholders were conducted during the meetings of local authorities.

Stakeholders provided no comments.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Represented by:	
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Salutation:	
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Middle name:	Anatoliiovych
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Represented by:	
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Annex 2

BASELINE INFORMATION

The tables below present the key information to define the baseline:

Parameter	**$EF_{CO2,ELEC}$**
Unit	t CO_2e/ MWh*hour
Description	Carbon dioxide emission factor for electricity consumption for the Ukrainian power grid
Data source (to be) used	1) Research data of Global Carbon B.V. [8] 2) Orders "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011.
Comments	The research has not taken into account the electricity generated at nuclear power plants

Parameter	**M^3_{wb}**
Unit	m^3
Description	Total volume of water supplied to consumers within the water supply system during the baseline year.
Data source (to be) used	Data of flow meters installed at lifting stations.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Parameter	**$M^3_{i,\ wr}$**
Unit	m^3
Description	Total volume of water delivered to consumers within "i" water supply system during a project year.
Data source (to be) used	Readings of the flow meters installed at lifting stations.
Comments	Data that allow calculating GHGs emissions in a project year; the data shall be archived electronically and on paper.

Parameter	**kWh_{wb}**
Unit	kWh*hour
Description	Total amount of electricity required to transport water to consumers during the baseline year.
Data source (to be) used	Readings of the electricity meters installed at pumping stations.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Parameter	$\mathbf{M^3_{vb}}$
Unit	m^3
Description	Total amount of wastewater transported by the water disposal system during the baseline year.
Data source (to be) used	Readings of the flow meters installed at sewerage stations.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Parameter	$\mathbf{M^3_{i,\ vr}}$
Unit	m^3
Description	Total volume of wastewater transported by "i" water disposal system during a project year.
Data source (to be) used	Readings of the flow meters installed at sewerage stations.
Comments	Data that allow calculating GHGs emissions in a project year; the data shall be archived electronically and on paper.

Parameter	$\mathbf{kWh_{vb}}$
Unit	kWh*hour
Description	Total amount of electricity required to transport wastewater within the water disposal system during the baseline year.
Data source (to be) used	Readings of the electricity meters installed at pumping stations.
Comments	Data that allow calculating GHGs emissions in the baseline year; the data shall be archived electronically and on paper.

Annex 3

MONITORING PLAN

The detailed information on monitoring may be presented in the following way:

A. Technical description of the project

The activities that are implemented to increase "Vodokanal" MU efficiency are as follows:

- Outdated pumps with low efficiency of 50-60% shall be replaced by the pumps having the efficiency of 81-89%. Rehabilitation, upgrades or replacement of the equipment shall be registered in commissioning certificates and in the documentation confirming purchase and installation of new equipment;

- Optimization of the engineering process for water pumping. Load shall be transferred from the pumping stations with outdated equipment to the pumping stations equipped with high-performance equipment. The monitoring shall be ensured by way of submitting a detailed layout of the water supply system's pipelines, where basic diameters of the pipeline shall be marked;

- Replacement of water supply and disposal networks. Rehabilitation or replacement of pipes shall be registered in the commissioning certificates;

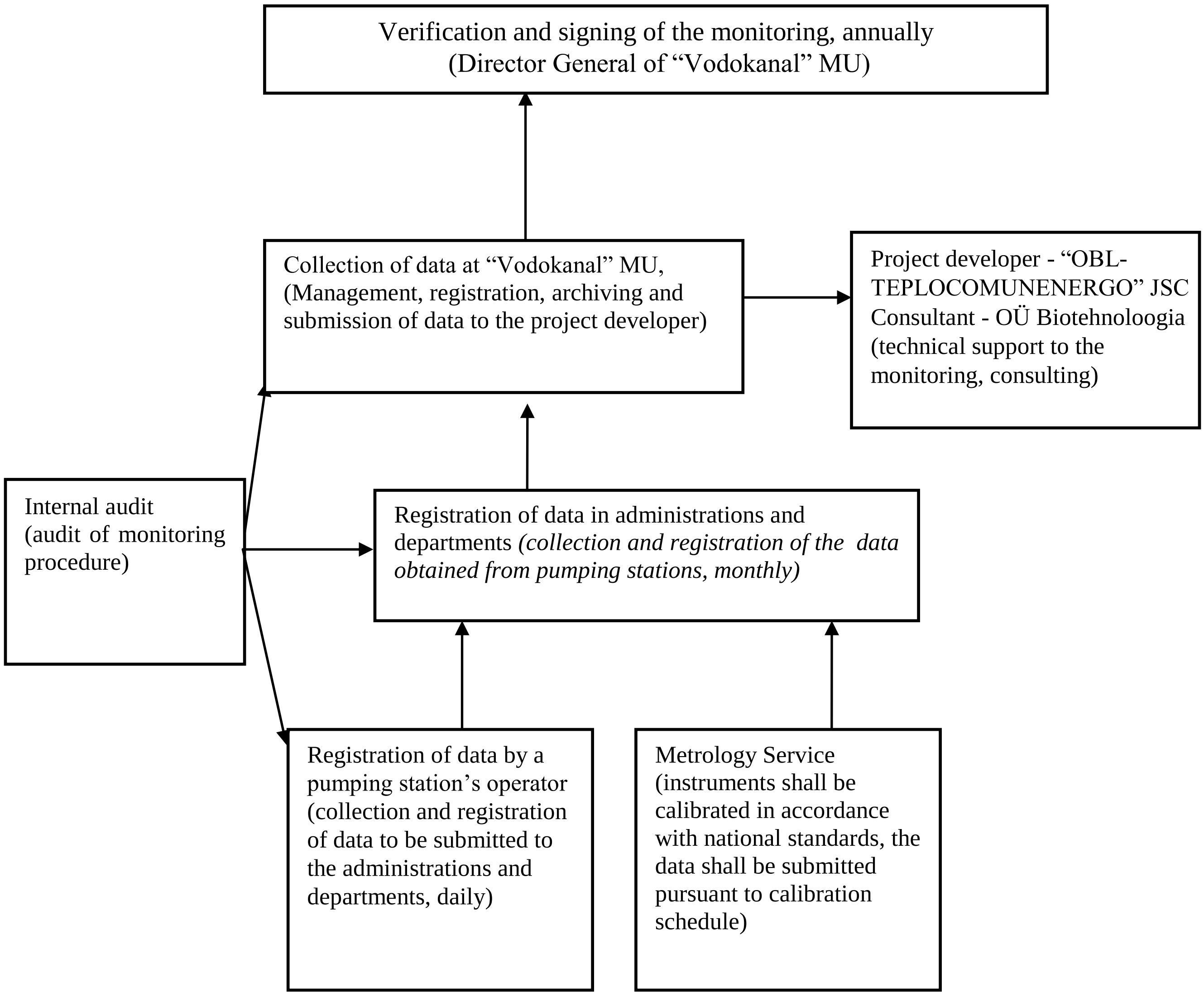
- Installation of a new cluster of measurement instruments. Introduction of new equipment shall be monitored by means of the documentation confirming purchase and installation of new equipment;

- Introduction of frequency controllers. tion of new equipment shall be monitored by means of the documentation confirming purchase and installation of new equipment;

The documentation confirming purchase and installation of new equipment shall be archived and retained at "Vodokanal" MU during two years following transmission of the emission reduction units generated by the project.

B. Control over organization of the monitoring

The structure of collecting the the monitoring data is as follows:
Project Management Director, performs "Vodokanal". Director manages and coordinates the activities of all departments. For each option corresponds to a separate department headed by the head of department (the Department).
Manager JI deputy head of the technical management of the MU "Vodokanal" Mr Vladimir Tkachuk, monitors and examines the adequacy of mechanisms for data collection and reliability parameters of the monitoring plan and other information about the project.



C. Monitoring procedures

The control procedures for electricity consumption by "Vodokanal" MU:

- On-line control of electricity instruments' operation is ensured over the billing period (a billing month shall be stipulated in the terms and conditions of electricity supply agreement);

- On the date that is established in the agreement (usually, at 00 hours 00 minutes on the 1st day of the month following a billing month), a site supervisor or his authorized representative shall take the readings of calculation electricity meters (calculation electricity meters shall be the devices that passed a state-level attestation, were accepted for calculation under the agreement's terms and conditions, and were sealed jointly by the electricity supplier's representatives and by "Vodokanal" MU and a sealing certificate was executed). The site supervisor shall submit the obtained information to the chief power engineer's department;

- A report on electricity consumption shall be developed based on the readings obtained from electricity meters at all the sites; the engineer in charge of electricity bills shall submit the report to the energy supplier's subscriber department;

- Basing on the electricity consumption report, the energy supplier's subscriber department shall execute a "CERTIFICATE of the electricity supplied", approve it by its official round seal and submit the certificate to a "Vodokanal" MU subdivision for approval;

- A "Vodokanal" MU representative shall submit the approved "CERTIFICATE of the electricity supplied" to the energy supplier's subscriber department and then get bills there;

- All the bills shall be kept by "Vodokanal" MU archive in a paper form.

The "Vodokanal" MU control procedures for water supply to consumers:

- The water extracted from "Vodokanal" MU water bodies shall be recorded by flow meters that are installed at the pumping stations ensuring lifting of water from boreholes;

- The readings shall be taken every hour and registered in the logs of PID-11standard form;

- Every day at 00:00, the data on water volume lifted from lifting stations during the previous 24 hours shall be submitted to the operations control services of every subdivision;

- Basing on the records on water produced that are maintained by operations control services, the individuals responsible for statistical reporting pursuant to form #1-water supply, form #1-sewerage shall execute appropriate fact sheets before the 10th day of each month and submit them to appropriate administrative services of "Vodokanal" MU;

- Reports #1-water supply, #1-sewerage shall be annually submitted to the Statistics Department.

D. Calibration of measuring instruments

Measuring instruments are calibrated in accordance with the national standards.

E. Recording and archiving of data

The individual responsible for the joint implementation project and appointed by the project's owner shall ensure monitoring of data in electronic and paper form. Electronic documents shall be printed and retained .

The project's owner shall keep a copy of the certificates on electricity supplied (the original certificates shall be kept by the subscriber department.

All paper copies of data and documents shall be archived, and one backup copy shall be submitted to the project's coordinator).

All data shall be retained during two years after the transmission of emission reduction units generated by the project.

F. Training

Prior to a start of the project activity and over the entire project period, employees of OÜ Biotehnoloogia shall consult the individuals responsible for ensuring the monitoring at "Vodokanal" MU.

Total emission reductions

Formula 1 – Quantity of emission reduction (ER) units	
	$ER = E^b – E^r$
	E^b and E^r - GHGs emissions that occur as a result of electricity consumption required for water supply and disposal in the baseline year and in a reported year, correspondingly, t CO_2e; [$_b$] index is referred to the baseline year; [$_r$] index is referred to a reported year.

Project emissions

Formula 3 - Annual project emissions (E^{wr}) in the water supply system	
	$E^{wr} = kWh_{wr} * EF$
	where: EF - carbon dioxide emission factors (EF) for Ukraine during "y" year of 2005-2007 obtained from the document entitled "Ukraine - assessment of new calculation of CEF" verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011;

	kWh_{wr} – total amount of electricity required to transport water to consumers in the water supply system during a project year, kWh*hour; [$_r$] index is referred to a reported year.

Formula 5 - Total amount of electricity required to transport water to consumers during "y" year of the project scenario, kWh*hour.	
	$kWh_{wr} = \sum kWh_{wr,i}$
	$kWh_{wr,i}$ - amount of electricity required to transport water to consumers within "i" water supply system during a project year, kWh*hour; [$_i$] index – independent water supply system; [$_r$] index is referred to a reported year.

Formula 8 - Annual project emissions (E^{wr}) in the water disposal system	
	$E^{wr} = kWh_{vr} * EF$
	where: EF- carbon dioxide emission factors(EF) for Ukraine during "y" year of 2005-2007 obtained from the document entitled "Ukraine - assessment of new calculation of CEF" verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011; kWh_{vr} – total amount of electricity required to transport wastewater within the water disposal system during a project year, kWh*hour; [$_r$] index is referred to a reported year.

Formula 10 – Total amount of electricity required to transport wastewater within the water disposal system during "y" year of the project scenario, kWh*hour;	
	$kWh_{vr} = \sum kWh_{vr,i}$

	$kWh_{vr,i}$ - amount of electricity required to transport wastewater within "i" water disposal system during a project year, kWh*hour; [$_i$] index – independent water disposal system; [$_r$] index is referred to a reported year.

Baseline emissions

Formula 2 - Annual baseline emissions (E^{wb}) in the water supply system	
	$E^{wb} = M^3_{wr} * PPER * EF$
	PPER- pre-project efficiency factor, kWh*hour/m^3; EF - carbon dioxide emission factors(EF) for Ukraine during "y" year of 2005-2007 obtained from the document entitled "Ukraine - assessment of new calculation of CEF" verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011; $M^3{}_{wr}$ – total volume of water supplied to consumers within the water supply system during a project year, m^3. [$_b$] index is referred to the baseline year; [$_r$] index is referred to a reported year.

Formula 4 – Pre-project efficiency factor, kWh*hour/m^3 within the water supply system	
	$PPER = kWh_{wb} / M^3{}_{wb}$
	kWh_{wb} - total amount of electricity required to transport water to consumers within the water supply system during the baseline year, kWh*hour; $M^3{}_{wb}$ – total volume of water supplied to consumers within the water supply system during the baseline year, m^3; [$_b$] index is referred to the baseline year.

Formula 6 – Total volume of water supplied to consumers during the baseline year, m^3	
	$M^3_{wr} = \sum M^3_{i,\,wr}$

	$M^3_{i, wr}$ - volume of water supplied to consumers within "i" water supply system during a project year, m^3; [$_i$] index – independent water supply system; [$_r$] index is referred to a reported year.

Formula 7 - Annual baseline emissions (E^{wb}) in the water disposal system	
	$E^{wb} = M^3_{vr} * PPER * EF$
	PPER- pre-project efficiency factor, kWh*hour/m^3; EF - carbon dioxide emission factors(EF) for Ukraine during "y" year of 2005-2007 obtained from the document entitled "Ukraine - assessment of new calculation of CEF" verified by TUV SUD Industrie Service GmbH on 17.08.2007 and from regulatory documents of Ukrainian legislation, namely from the orders entitled "on approval of indices for carbon dioxide specific emissions" issued by the National Environmental Investment Agency of Ukraine in 2008-2011; M^3_{vr} - total volume of wastewater transported by the water disposal system during a project year, m^3; [$_r$] index is referred to a reported year.

Formula 9 – Pre-project efficiency factor, kWh*hour/m^3 within the water disposal system	
	$PPER = kWh_{vb} / M^3_{vb}$
	kWh_{vb} - total amount of electricity required to transport water within the water supply system during the baseline year, kWh*hour; M^3_{vb} - total volume of wastewater transported by the water disposal system during the baseline year, m^3; [$_b$] index is referred to the baseline year.

Formula 11 - Total volume of wastewater transported during the baseline year, m^3;	
	$M^3_{vr} = \sum M^3_{i, vr}$
	$M^3_{i, vr}$ - volume of wastewater transported by "i" water disposal system during a project year, m^3; [$_i$] index – independent water disposal system; [$_r$] index is referred to a reported year.