# MONITORING REPORT

**Version 04 dated 03.06.2011**

"**RECONSTRUCTION OF KRAMATORSK HEAT AND POWER PLANT**"

**Monitoring period: 01.01.2010 – 31.12.2010**

**CONTENTS**

## SECTION A. General description of the project activity

### A.1. Brief description of the project activity:

Joint Implementation project "Reconstruction of Kramatorsk heat and power plant"

Sectoral scope:
1: Energy industries (renewable/non-renewable sources)

Monitoring period: 01.01.2010 – 31.12.2010 (including the first and the last day)

The main goal of Joint implementation project "Reconstruction of Kramatorsk heat and power plant" is implementation of measures which will improve fuel consumption efficiency and will reduce own consumption of electric power by the plant, therefore resulting in GHG emissions reduction to the atmosphere.
The project foresees large-scale reconstruction of existing equipment of Kramatorsk HPP. The program of reconstruction of Kramatorsk HPP within Joint implementation includes the following measures:

- Reconstruction of boilers № 7, 9;
- Reconstruction of turbines № 3, 4;
- Reconstruction of cooling tower № 1;
- Frequency controllers' installation;
- Feeding pump replacement №5;
- Hydraulic ash removal modernization;

In addition to this, rehabilitation of district heating system in Kramatorsk is foreseen within JI project. It includes:

- Replacement of old heat pipelines which supply consumers with heat power generated at HPP by new pre-insulated pipes in polyurethane foam cover and pipes with lagging from mineral cotton;
- Replacement of 200 capacitive heat exchangers by plate heat exchangers at substations of the town;
- Major rehabilitation of boiler-rooms with replacement of pipes and valves.

As the result of reconstruction the efficiency of Kramatorsk HPP equipment will increase from 56% of gross efficiency (combined heat and electric capacity with the use of natural gas) to approximately 78% of efficiency with the use of natural gas and 65% of efficiency – with the use of coal. The increase of the equipment efficiency will lead to reduction of the level of fuel consumption. As far as natural gas is more expensive compared to coal, it is considered that fuel savings are to be completely savings of natural gas. This is conservative assumption. Besides, the reduction of own electric power consumption will allow increasing supply of electricity into the grid therefore contributing to additional emission reductions.
The project with the total investment costs over 67 million UAH will give the following benefits:

- Positive effect on the environment;
- Improvement of technical and economic indicators of work of HPP;
- Positive social effect.

Therefore, project implementation will be economically and socially beneficial.
Positive aspects of social and economic effect from the project implementation:

-The national grid of Ukraine and industrial consumers of Kramatorsk are expected to benefit from increased of reliability of power supply by the Kramatorsk HPP;
- Local community and employees of Kramatorsk HPP will benefit from the jobs available on long term prospective due to more reliable work of the enterprise in future*;*

- The industrial and residential consumers of Kramatorsk who will receive a better quality heat supply service.

Positive aspects of project effect on the environment of Kramatorsk:

-as a result of project implementation the amount of fossil fuel (valuable non-renewable source of energy) will be reduced at the process of heat and power energy generation;
- project implementation will reduce greenhouse and toxic gases emissions (carbon dioxide, nitric oxide and carbon monoxide) and prevent further GHG accumulation at the atmosphere what in its turn causes climate change.

According to the data of Kramatorsk HPP as a result of implemented reconstruction of HPP and rehabilitation of heat supply network the following natural gas savings in 2010 occurred:

| | |
|---|---|
| Natural gas savings from HPP reconstruction, ths. $m^3$ | 34 555 |
| Natural gas saving from heat supply network rehabilitation, ths. $m^3$ | 387 |

## A.2. Project Participants

The project participants and Parties involved are presented below in the Table 1 (according to the registered PDD version 2.2).

***Table 1: Project participants***

| Party involved | Legal entity project participants (as applicable) | Please indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Ukraine (Host Party) | "Kramatorskteploenergo" LLC | No |
| Germany (Investor Party) | GreenStream Network GmbH | No |

## A.3. Location of the project activity:

The Project is located in town of Kramatorsk, Donetsk Region, the Eastern part of Ukraine

## A.4. Technical description of the project

Currently there are three cogeneration turbines at Kramatorsk HPP: turbine № 2 of the type PTR-30-90/13 with installed capacity of 30 MW; turbines №3 and №4 of the type PTR-60-90/13 with installed capacity of 60 MW each.
Turbine №2 has been commissioned in 1955; turbines № 3 and № 4 – in 1973 and 1976 respectively. At the moment turbine № 2 has been mothballed and is not used for electric power generation.

There are 8 steam boilers at Kramatorsk HPP, 6 of which are under operation: 2 boilers of type TP-170 (boilers №4 and №5) as well as 4 boilers of the type BKZ-160-100 PT (boilers №№ 6, 7, 8 and 9).

Currently the boilers of the type LMZ (TKZ) 90/100 (№2 and 3) are mothballed. Steam boilers which are under operation are connected to the steam pipelines where the steam is distributed and supplied further to the turbines.

Current state of Kramatorsk HPP equipment is satisfactory and allows operation at least till 2017 inclusive, subject to scheduled repairs and timely technical maintenance.

The scheduled measures will improve the efficiency of fuel consumption and reduce own power consumption.

**1) Reconstruction of turbine PT-60-90/13, station №3**

Heating steam turbine PT-60-90/13 has nominal capacity of 60 MW. It was commissioned in 1973. The project foresees modernization the turbine's condensor. This measure implementation will reduce the pressure of exhausted steam of turbine by 0.01 kgf/cm2. These measures will provide reduction of fuel consumption by 1192 tons of standard fuel1 per year.

**2) Reconstruction of turbine PT-60-90/13, station №4**

Heating steam turbine PT-60-90/13 has nominal capacity of 60 MW. It was commissioned in 1976. The project foresees replacement of control valves. Fuel saving after modernization of turbine will be 1166.5 tons of standard fuel per year (due to achieving of project parameters of steam distribution system).

**3) Reconstruction of BKZ-160-100-PT boiler, station № 7**

Currently the BKZ -160-100-PT № 7 boiler is using mixed fuel as the primary fuel (coal and gas spot lightning) with 76% efficiency. At the moment heavy fuel combustion in the boiler is not possible due to the technical state of the furnace cell's heating surface. It would be possible only if a major reconstruction is done. After the rehabilitation works the efficicency of boiler № 7 will increase to 85% in case of hard fuel combustion, Heating insulation of the boiler's gasproof furnace will be replaced as one of the measures of rehabilitation.

**4) Reconstruction of BKZ-160-100-PT boiler, station №9**

Currently the BKZ -160-100-PT № 7 boiler is using mixed fuel as the primary fuel (coal and gas spot lightning) with 76% efficiency. At the moment heavy fuel combustion in the boiler is not possible due to the technical state of the furnace cell's heating surface. It would be possible only if a major reconstruction is done. After the rehabilitation works the efficicency of boiler № 7 will increase to 85% in case of hard fuel combustion. Heating insulation of the boiler's gasproof furnace will be replaced as one of the measures of rehabilitation. Annual fuel savings achieved after the reconstruction will be 7480.5 t of standard fuel.

**5) Reconstruction of cooling tower №1**

The hot water from cooling equipment flows to water-cooling tower by the pipelines. The system of circulating water supply of Kramatorsk HPP is reverse with two cooling towers (№1, 2). The area of irrigation is 1600 m2. Cooling tower has been commissioned in 1975. Today the cooling tower is under reconstruction. The existing cooling tower №2 can serve the needs of the power plant until at least 2017. Reconstruction of the cooling tower №1 will allow reduction of temperature of cooled water at the exit from cooling tower with the similar other conditions by 4-5 0C.
Use of cooling tower №1 will allow operating with load regimes similar to nominal – 40 MW during the summer period. The operation in this regime is more economically efficient by 4-5% than with the existing regime with loading 20-25 MW when cooling capacities of cooling tower №2 are utilized.
Fuel savings will be 1519 tons of standard fuel per year.

**6) Replacement of feeding electric pump, station №5 PE-150-145-2**

The feeding pump #5 (similarly to the feeding pumps ## 6, 7, 8, 9) takes water from the plant's water collectors – the absorbing collector (6 kgf/cm2) and pumping collector (150 kgf/cm2). Electricity is

supplied to the feeding pump from the distribution equipment of the main distribution unit, and from the 6 kV distribution units which are used for the plant's own needs.
The replacement of feeding pump reduces electricity consumption. During the winter period two pumps PE-270-150 consume the total capacity of 2650 kWh; in case if one PE-270-150 or one PE- 150-145 device is in operation, the total consumed capacity is 2075 kWh. In 2006 according to the annual power plant report the operational time of pumps in the single pump regime was 2400 hours. During the summer the pump PE-270-250 consumes total capacity of 1450 kWh, PE-150-145 consumes the capacity of 825 kWh. Annual operational period, taking into account maintenance stops, is 4200 hours. During the summer period electricity savings are expected to be 2002 MWh.

**7) Modernization of hydraulic ash removal**

As a result of modernization, 4 km-long pipeline (325 mm width) will be constructed replacing the existing dredging pump. Power savings constitute 3894 MWh per year.

**8) Rehabilitation of district heating system in Kramatorsk**

The envisaged rehabilitation of district heating system in Kramatorsk includes the following measures:

*8.1. Replacement of old pipelines by new pipes covered by foamed polyurethane*

The heat supply pipelines replacement will reduce actual heat losses from heat supply pipeline what will result in annual fuel savings of 1161 tons of standard fuel during 2008-2012.

*8.2. Rehabilitation of boiler-rooms with replacement of capacitive heat exchangers by lamellar heat exchangers*

Vapor-water capacitive heat exchangers STD 3068-3071 of six sizes (№ 1, 2, 3, 4, 5, 6) are used in the baseline scenario. These exchangers have changed their capacity during the lifetime. In 2008 capacitive heaters are to be replaced by lamellar at 35 substations. Heat exchangers are working in two stages; two lamellar heat exchangers are to be installed at each substation. During the first stage water is heated by heat carrier, returning from building heating systems (already exhausted of heat) to 30-40 oC. During the second stage the water is heated by heat carrier from pipeline rising the temperature to 50 oC. According to previous data in 2009 it is planned to install 40 heat exchangers,65 heat exchangers in 2010, 60 heat exchangers in 2011. Expected electricity savings after the measure's implementation vary from 50 MWh in 2008 to 2486 MWh in 2011.

*8.3.Major rehabilitation of boiler-rooms with replacement of pipes and valves*

Physically exhausted and partially blocked pipes with hard to remove deposits in piped packages of network heaters are to be replaced by new pipes. Expected results of the measure:
- reduction of hydraulic resistance of boiler-rooms; reduction of electricity consumption for pumping of heat carrier (network water). This measure is expected to provide fuel savings of 48.9 tons of standard fuel per year.
- increase of heat generation by the heater by means of low-potential heat utilization with additional generation of power. This measure implementation is expected to result in fuel savings of 702 tons of standard fuel per year.

No changes into the reconstruction programme are foreseen throughout the whole project lifetime.

## A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

### A.5.1 Baseline methodology

For determination of the baseline the JI specific approach based on approved methodology ACM0002 «Consolidated methodology for grid-connected electricity generation from renewable sources» (version 10) is used.

**A.5.2 Monitoring methodology**

For monitoring of JI project the JI specific approach based on monitoring methodology ACM0002 «Consolidated methodology for grid-connected electricity generation from renewable sources» (version 10) is used.

**A.6. Registration date of the project activity:**

The JI project "Reconstruction of Kramatorsk HPP" has received the Letter of Approval from Ukraine, reference 1469/23/7 dated 04.12.2009. The Letter of Approval from investor country Germany dated 25.03.2010. The JI project has registration number UA1000156.

**A.7. Crediting period of the project activity and related information (start date and choice of crediting period):**

The length of crediting period is 120 months / 10 years of project lifetime

**A.8. Name of responsible person(s)/entity(ies):**

The persons responsible for the preparation of the Kramatorsk HPP monitoring report: the First deputy director, Mr. V.S. Potapenko (management); the Head of Production department Mr. A.M. Gusev (in charge for the report preparation).

## SECTION B. Implementation of the project activity

### B.1. Implementation status of the project activity

The status of implementation, including time table for major project parts is given in the Table 2 below:

***Table 2. Status of implementation (according to the PDD version 2.2)***

| № | Measures | Beginning of design stage | Beginning of construction | Commissioning |
|---|---|---|---|---|
| 1 | Reconstruction of boiler № 7 | – | September 2008 | January 2009 |
| 2 | Reconstruction of boiler № 9 | | April 2008 | November 2008 |
| 3 | Modernization of turbine PT-60-90/13 st. №3 | September 2007 | April 2008 | August 2008 |
| 4 | Modernization of turbine PT-60-90/13 st. №4 | September 2008 | April 2009 | August 2009 |
| 5 | Reconstruction of cooling tower № 1 | May 2006 | June 2008 | September 2008 |
| 6 | Capital repair of boiler-rooms with replacement of tubes and valves | April 2008 | June 2008 | November 2008 |
| 7 | Replacement of capacitive heat exchangers by lamellar - 35 units<br><br>40 units<br>65 units<br>60 units | May 2008<br><br>May 2009<br>May 2010<br>May 2011 | July 2008<br><br>July 2009<br>July 2010<br>July 2011 | November 2008<br><br>November 2009<br>November 2010<br>November 2011 |
| 8 | Replacement of heat supply pipelines by pipelines from polyurethane foam | June 2008 | June 2008<br>2009<br>2010<br>2011<br>2012 | November 2008<br>2009<br>2010<br>2011<br>2012 |
| 9 | Replacement of the feeding pump | - | May 2007 | April 2009 |

Due to lack of finances, there was no replacement of capacitive heat exchangers by lamellar ones in 2010.

In 2010 at HPP there were a number of technical breakdowns. The detailed information as to the technical breakdowns is given in Annex 2.

### B.2. Revision of the monitoring plan

There are no deviations to the registered monitoring plan.

### B.3. Request for deviation applied to this monitoring period

No deviations compared to the registered version of the monitoring plan are expected.

## B.4. Notification of request of approval of changes

There are no changes from the project activity.

## SECTION C. Description of the monitoring system

### C.1. Monitoring and control system

The control and monitoring system is divided into three main parts:

1) Electrical measurement;
2) Heat measurement;
3) Fuel measurement (natural gas, coal).

**Electrical measurement**

For this project the following electrical measurements are necessary: total generated power, power consumption for the own needs of HPP, power supplied to the consumers.

There are 3 commercial electricity meters at the HPP which measure the electricity generated by turbines.
There are more than one hundred technical and commercial electricity meters which measure power supplied to the consumers and consumption for the own needs of HPP.

Generated power and power supplied to the consumers is present in the reports on generation and supply to the grid and in the extracts from registration journal of the HPP as well as in the reports on power distribution.

**Heat measurement**

The HPP is equipped with heat measurement devices, which allow determining the amount of heat supplied to the consumers. The amount of heat generated at the HPP is also present in the journal of heat supplied to the consumers.

Determination of heat economy from heating system reconstruction is executed on the basis of calculation of decrease in thermal energy consumption through restored thermal insulation and reduction of network water consumption. Data on heat supply to the consumers from boiler-rooms is saved in the journal of accounting of heat supplied to the consumers (boiler-rooms' data).

To determine the amount of heat generated by boilers №№ 7, 9 the data on generated steam by these boilers is used. The HPP is equipped by special flow-meters which measure the amount of generated steam by boilers №№ 7, 9.

**Measurement of fuel consumption (natural gas, coal)**

*Measurement of natural gas consumption*

The volume of consumed gas is measured by means of "Universal-02" gas flow meter. The meter's software is intended for transformation of the incoming signals from the gas flow meters, vortex converters of consumption, transformation and measuring of incoming signals from converters of measured pressure and gas temperature, calculation and reduction with accordance to conditions set in GOST 2939-63 (standard conditions) of its volume and volume consumption. "Universal-02" gas flow meter is allowed for serial production and use in Ukraine and is entered into state register under the reference У759-01.
"Universal-02" gas flow meter keeps in its memory the archives of parameters which are combined into hourly and daily archives of energy carriers' consumption, emergency cases and access to the operative memory device with possibility of its transfer to a PC via RS232 or RS485 interfaces for further processing and printing.

Data on quality of natural gas (physical and chemical indicators) are put into the program “Universal-02” manually according to a quality passport or a telephone message (in case of indicators changes) given by Kramatorsk Department of gasification and gas supply.
The supply reports of natural gas, diagrams of fuel and journals of fuel accounting are used for cross-checking the amount of consumed natural gas.

*Measurement of coal*

In 2010 the arrival of coal had been controlled by two scales. The RS-150C13V, which was leased from Novokramatorsk machine building plant (NKMB) controls the compliance of coal arrival with accompanying forms before beginning the unloading. The conveyer scales KNV-2D-2R is used to control the coal consumption.
The scheme of measuring devices location which controls the abovementioned parameters is given below in Figure 1.

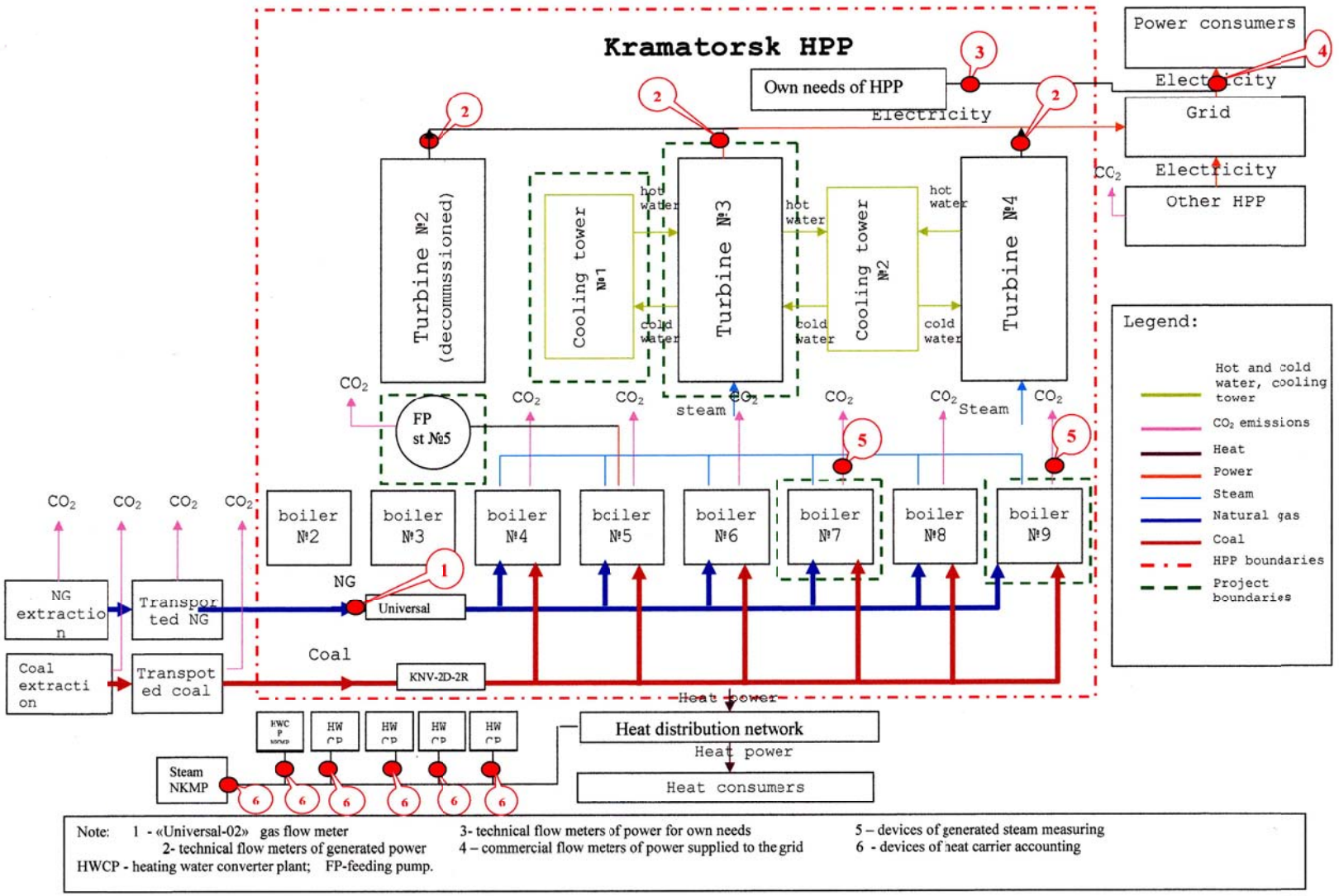


***Figure 1. Scheme of measuring devices location***

## C.2. Information on equipment used

**Electricity measurements**

For this project the measurement of the following electrical parameters are necessary: total generated power, power consumption for own needs of HPP, power supplied to consumers.

*The measurement of generated power*

In Table 3 the data on meters which measure generated power is given.

***Table 3. Data on meters for generated power measurement***

| Serial number | Installed at | Data as of 01.01.2011 | Data as of 01.01.2010 | Difference | Coefficient | Power, kWh |
|---|---|---|---|---|---|---|
| 36132321 | Generator -2 | 0 | 0 | 0 | 480 | 0 |
| 36132304 | Generator -3 | 4811643 | 3296852 | 1514791 | 96 | 145419936 |
| 36130059 | Generator -4 | 4416164 | 2585573 | 1830591 | 96 | 175736736 |

| Serial number | Installed at | Accuracy rate, % | Installation date | Date of last calibration | Date of next calibration | Remarks |
|---|---|---|---|---|---|---|
| 36132321 | Generator -2 | 0.2 | 26.01.2009 | 3rd quarter 2007 | 3rd quarter 2013 | |
| 36132304 | Generator -3 | 0.2 | 26.01.2009 | 3rd quarter 2007 | 3rd quarter 2013 | |
| 36130059 | Generator -4 | 0.2 | 26.01.2009 | 3rd quarter 2007 | 3rd quarter 2013 | |

All accounting meters in the Table 3 were installed as backup meters in 2008. They are in status of commercial use since 26.01.2009. The calibration period of these meters is once every 6 years.

*Measurement of power supplied to consumers*

In the Table 4 data on the balance of power supply is given. The detailed data as to the meters used and their appropriate readings is given in Annex 1. Power consumption for own needs of HPP is calculated as difference between generated power and power supplied to the consumers from the plant buses.

***Table 4. Power supply balance***

| **Parameter** | **2010** |
|---|---|
| Power generation by generators, kWh | 321 156 672 |
| Power supply to the grid and consumers, kWh | 430 112 152 |
| Power consumption from the grid, kWh | 165 045 906 |
| **Total supply from busbars** | **265 066 246** |

**Heat measurement**

Data on measurement devices for heat supplied to the consumers from Kramatorsk HPP is given in the Table 5.

*The measurement of heat supplied to the consumers*

***Table 5. Data on flow meters of heat supplied to consumers***

| Measurement device | Producer (company, country) | Work parameter | Serial number | Accuracy rate % | Installation date | Generated heat, Gcal | Date of last calibration | Date of next calibration | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Additional feeding HWCP №3 SVTU-10M<br><br>Supply HWCP №3 SVTU -10M | Kyiv, Company «Sempal Ko Ltd» | Heat<br><br>Heat | 12018<br><br>14295 | 2,0<br><br>2,0 | 21.11.08<br><br>21.11.08 | 3800<br><br>91875 | 07.05.07<br><br>04.08.08 | 07.05.11<br><br>04.08.12 | The amount of generated heat is received as accumulated result per year |
| Additional feeding HWCP №4 SVTU-10M<br><br>Supply HWCP №4 SVTU-10M | Kyiv, Company «Sempal Ko Ltd» | Heat<br><br>Heat | 11815<br><br>14357 | 2,0<br><br>2,0 | 21.11.08<br><br>21.11.08 | 3197<br><br>62504 | 07.05.07<br><br>04.08.08 | 07.05.11<br><br>04.08.12 | The amount of generated heat is received as accumulated result per year |
| Additional feeding HWCP №5 SVTU-10M<br><br>Supply HWCP №5 SVTU-10M | Kyiv, Company «Sempal Ko Ltd» | Heat<br><br>Heat | 14135<br><br>14262 | 2,0<br><br>2,0 | 21.11.08<br><br>21.11.08 | 6170<br><br>135006 | 24.06.08<br><br>05.08.06 | 24.06.12<br><br>05.08.12 | The amount of generated heat is received as accumulated result per year |
| Additional feeding HWCP №6 SVTU -10M<br><br>Supply HWCP №6 SVTU-10M | Kyiv, Company «Sempal Ko Ltd» | Heat<br><br>Heat | 11757<br><br>14390 | 2,0<br><br>2,0 | 21.11.08<br><br>21.11.08 | 10839<br><br>239347 | 07.05.07<br><br>05.08.08 | 07.05.11<br><br>05.08.12 | The amount of generated heat is received as accumulated result per year |
| Additional feeding HWCP № 2 SVTU-10M | Kyiv, Company «Sempal Ko Ltd» | Heat | 11911 | 2,0 | 21.11.08 | 2094 | 07.05.07 | 07.05.11 | The amount of generated heat is received as accumulated result per year |
| Heat energy supply to NKMP Additional feeding : Leakage | «Spetssystemy» Belorus | Water consumption for additional feeding | 0609009 | 0,4 | 14.12.06 | 79615 | 19.10.10[1] | 19.10.14 | Passport |
| UVR-011 | Kharkiv city, JSC «Tahion» | Network water consumption | 1080 | 1,0 | 14.12.06 | | 09.08.10 | 09.08.12 | Passport |
| TSP-Metran-206<br>TSP-Metran-206 | CJSC PG «Metran» | Temperature of network water | 565545<br>565546 | B<br>B | 14.12.06<br>14.12.06 | | 02.08.10<br>02.08.10 | 02.08.11<br>02.08.11 | Passport<br>Passport |

[1] The boiler № 1 was not in operation within period from 28.09.2010 to 19.10.2010. The heating season of CJSC "NKMP" started from 01.11.2010.

Data on the amount of steam generated by boiler №№ 7, 9 is used for calculation of heat generated by boilers №№ 7, 9. Information on measuring devices for steam generated by boilers №№ 7, 9 is given in the Table 6.

***Table 6. Data on flow meters of steam generated by boiler №№ 7, 9***

| Measurement device | Producer (company, country) | Work parameter | Serial number | Accuracy rate % | Installation date | Data 01.01.2008 | Steam generated by boilers №№7,9 | Date of last calibration | Date of next calibration | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| Boiler №7<br>Secondary<br>RP160-09<br>Primary<br>DM 3583 M | Ukraine, Lviv | Superheated vapour | 1120476<br><br>12048 | 1,0<br><br>1,5 | 10.09.08 | No summator | 546759 | 10.06.10 | 10.06.11 | Passport |
| Boiler №9<br>Secondary<br>RP160-09<br>Primary<br>DM 3583 M | Ukraine, Lviv | Superheated vapour | 2091175<br><br>14176 | 1,0<br><br>1,5 | 15.02.01 | No summator | 609672 | 07.10.10[2] | 07.10.11 | Passport |

**Fuel measurement**

*Natural gas measurement*

Data on "Universal-02" gas flow meter is given in the Table 7.

***Table 7. Data on "Universal-02" natural gas flow meter***

| Measurement device | Producer (company, country) | Work parameter | Serial number | Accuracy rate % | Installation date | Natural gas consumption, ths. m3 | Date of last calibration | Date of next calibration | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Universal-02 | GVP «GREMPIS», Ltd. Vinnitsa Ukraine | Natural gas consumed by boilers | 5672 | 0,2 | 02.09.07 | 61902 | 29.07.09 | 29.07.11 | Passport |

*Coal measurement*

In 2010 the coal consumption had been measured by two scales. Data on RS-150C13V mechanical car scale used for consumed coal measuring is given in Table 8. Data on conveyer scale KNV-2D-2R used for consumed coal measuring is given in Table 9.

***Table 8. Data on RS-150C13V mechanical car scale for measuring of coal amount***

| Measuring device | Producer (company, country) | Work parameter | Serial number | Installation date | Coal consumption, t | Date of last calibration | Date of next calibration |
|---|---|---|---|---|---|---|---|
| RS-150C13V mechanical car scale | Odessa, Ukraine | Coal consumption | 0011 | 12.05.09 | 173030 | 24.11.10[3] | 24.11.11 |

[2] The planned device calibration was appointed on 11.09.2010, the actual calibration was performed 07.10.2010. Within period from 11.09.2010 to 07.10.2010, the devices kit was in general repair. During the repair, the boiler №9 was equipped with the calibrated accounting devices kit from the boiler №7.

[3] Calibration of the mechanical car scale is performed once every 6 months; only last calibration date is specified in the table. Date of previous calibration is 28.05.2010.

***Table 9. Data on conveyer scale KNV-2D-2R for measuring of coal consumption***

| Measuring device | Producer (company, country) | Work parameter | Serial number | Installation date | Coal consumption, t | Date of last calibration | Date of next calibration |
|---|---|---|---|---|---|---|---|
| conveyer scale KNV-2D-2R | Dnipropetrovsk Ukraine | Coal consumption | 09178 | 01.04.09 | 173030 | 03.08.10 | 03.08.11 |

## C.3. Calibration procedure

*For power meters*

Data on calibration of meters used for measuring of total power generation is given in the Table 10.

***Table 10. Data on calibration of electricity meters for total power generation***

| **Parameter** | **Answer (passport data)** |
|---|---|
| Interval between calibrations | 6 years |
| Methodology of procedure of calibration of meters of total power generation | Methodology of Ukrainian Center on standardization and metrology |
| Period of warranty from the producer | 18 months (SL7000) |
| Body responsible for calibration and certification of the measuring equipment | Methodology of Ukrainian Center on standardization and metrology |

Data on calibration of electricity meters used for measuring power consumption for own needs of HPP is given in the Table 11.

***Table 11. Data on calibration of electricity meters used for measuring of power consumed for own needs of HPP***

| **Parameter** | **Answer** (passport data) |
|---|---|
| Interval between calibrations | 6 years |
| Methodology of procedure of calibration of meters of power consumed for own needs | Methodology of Methodology of Ukrainian Center on standardization and metrology |
| Period of warranty from the producer | 18 months (SL7000) |
| Body responsible for calibration and certification of the measuring equipment | Ukrainian Center on standardization and metrology |

Data on calibration of electricity meters used for measuring of power supplied to consumers is given in the Table 12.

***Table 12. Data on calibration of electricity meters used for measuring of power supplied to consumers***

| **Parameter** | **Answer** (passport data) |
|---|---|
| Interval between calibrations | 6 years |
| Methodology of procedure of calibration of meters of power supplied to consumers | Methodology of Ukrainian Center on standardization and metrology |
| Period of warranty from the producer | 18 months (SL7000) |
| Body responsible for calibration and certification of the measuring equipment | Ukrainian Center on standardization and metrology |

*Measuring devices of heat and generated steam*

Data on calibration of flow-meters used for generated steam by boilers №№ 7, 9 is given in the Table 13.

***Table 13. Data on calibration of flow meters used for measuring steam generation by boilers №№ 7, 9.***

| **Parameter** | **Answer** (passport data) |
|---|---|
| Interval between calibrations | 1 year |
| Methodology of procedure of calibration of flow-meters of steam generation | Methodology of State standard |
| Period of warranty from the producer | 1 year |
| Body responsible for calibration and certification of the measuring equipment | Derzhstandartmetrologiya |

Data on calibration of meters for measuring generated heat is given in the Table 14.

***Table 14. Data on calibration of heat meters of generated heat***

| **Parameter** | **Answer** (passport data) |
|---|---|
| Interval between calibrations | 4 years |
| Methodology of procedure of calibration of meters of heat generation | Methodology of calibration testing is ShIMN.407251.003 I2 |
| Period of warranty from the producer | 48 months |
| Body responsible for calibration and certification of the measuring equipment | Derzhstandartmetrologiya |

*Fuel measuring devices*

***Measuring of natural gas amount***

Data on calibration of "Universal-02" natural gas flow meter is given in the Table 15.

***Table 15. Data on calibration on "Universal-02" natural gas flow meter***

| **Parameter** | **Answer** (passport data) |
|---|---|
| Interval between calibrations | 2 years |
| Methodology of procedure of calibration of flow-meters of natural gas consumtion | Methodology of state metrological attestation GREM.02 0000.001-01.01 PMA and guidance on operation |
| Period of warranty from the producer | 18 months |
| Body responsible for calibration and certification of the measuring equipment | Derzhstandartmetrologiya |

***Measuring of coal consumption***

Data on calibration of RS-150C13V mechanical car scale is given in the Table 16.

*Table 16. Data on calibration of RS-150C13V mechanical car scale*

| **Parameter** | **Answer** (passport data) |
|---|---|
| Interval between calibrations | 1 year |
| Methodology of procedure of calibration of meters of coal consumption | Calibration testing is done by balance receiver. |
| Period of warranty from the producer | 15 years |
| Body responsible for calibration and certification of the measuring equipment | Derzhstandartmetrologiya |

## C.4. Involvement of Third Parties

Ukrainian Centre on standardization and metrology was involved as a Third Party.

## C.5. Data collection (accumulated data for whole monitoring period)

The structure of operation and management of the project is given in the PDD in the Figure 2 “Scheme of data collection according to the monitoring plan”.

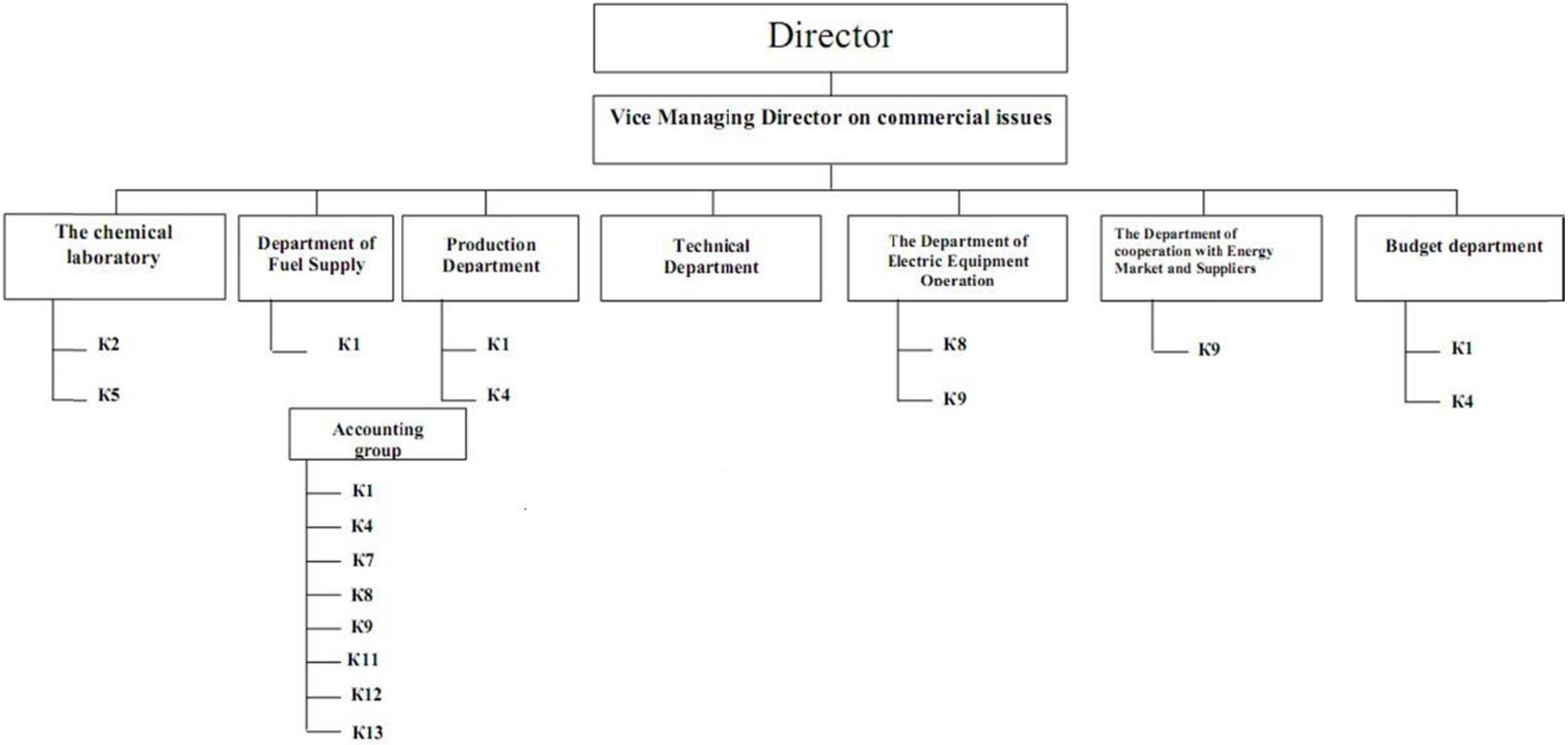


***Figure 2. Data collection for the monitoring***

## SECTION D. Data and parameters

### D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

A number of parameters that are not monitored by the metering equipment are used for the calculations. These parameters are listed below.

| **Data / Parameter:** | $CEF_{coal}$ |
|---|---|
| Data unit: | t C/ TJ |
| Description: | Carbon emission factor for coal (anthracite) |
| Source of data used: | Section 2 of IPCC Guidelines for National Greenhouse Gas Inventories, 1996 (Volume 2 (Energy), page 1.6, table 1-2) |
| Value(s) : | 26.8 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Calculation of the baseline and project scenario emissions |
| Additional comment: | |

| **Data / Parameter:** | $CEF_{natural\ gas}$ |
|---|---|
| Data unit: | t C/ TJ |
| Description: | Carbon emission factor for natural gas |
| Source of data used: | Section 2 of IPCC Guidelines for National Greenhouse Gas Inventories, 1996 (Volume 2 (Energy), page 1.6, table 1-2) |
| Value(s) : | 15.3 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Calculation of the baseline and project scenario emissions |
| Additional comment: | |

| **Data / Parameter:** | $CEF_{electricity}$ |
|---|---|
| Data unit: | kg $CO_2$e/ kWh |
| Description: | Carbon emission factor of the electric grid of Ukraine |
| Source of data used: | State Enviromental Investment Agency of Ukraine, Order # 43 dated 28/03/2011 |
| Value(s) : | 1.067 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Calculation of the baseline and project scenario emissions |
| Additional comment: | |

## D.2. Data and parameters monitored

Parameters monitored for the calculation of the project scenario emissions are presented below in the Table 17. Parameters monitored for the calculation of the project scenario emissions are presented below in the Table 18.

***Table 17. Data collected in order to monitor emissions under the project scenario***

| **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** |
|---|---|---|---|---|---|---|---|---|
| **K1** | Coal consumption | Meter of consumed fuel, diagram, Journal of registration data of consumed fuel | Tons | M | Monthly | 100% | Electronic/ paper | The primary data source weighting of coal on the weighbridge; secondary data source is the fuel diagram. |
| **K2** | Net calorific value of coal | Report of the Supplier, analytical report of chemical analysis laboratory | kcal/kg | E | Monthly | 100% | Electronic/ paper | In the invoices of fuel supplier, report of chemical analysis laboratory |
| **K4** | Natural gas consumption | Meter of consumed fuel, diagram, Journal of registration | Ths. $m^3$ | M | Monthly | 100% | Electronic/ paper | Fuel consumption by boilers is the main data which allows calculation of GHG emissions in the reporting year |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | data of consumed fuel | | | | | | |
| **К5** | Net calorific value of natural gas | Report of the Supplier, analytical report of chemical analysis laboratory | kcal/kg | E | Monthly | 100% | Electronic/ paper | In the passport of fuel from fuel supplier |
| **К7** | Power generation | Meters of Kramatorsk HPP, balance data | kWh | M, C | Monthly | 100% | Electronic/ paper | Annual report |
| **К8** | Own Electricity consumptio n | Meters of KramatorskHPP, calculation of consumed amount | kWh | M, C | Monthly | 100% | Electronic/ paper | Annual report |
| **К9** | Power supplied to customers (to the grid) | Meters of Kramatorsk HPP, balance data | kWh | M, C | Monthly | 100% | Electronic/ paper | Annual report |
| **К11** | Steam generation | Meters of Kramatorsk HPP | Gcal | M | Annually | 100% | Electronic/ paper | Annual report |
| **К12** | Heat supplied to consumers | Meters of Kramatorsk HPP, balance data | Gcal | M, C | Annually | 100% | Electronic/ paper | Annual report |
| **К13** | Length of the heat pipes | Reports | m | M, C | Annually | | Electronic/ paper | Annual report |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | replaced by pipes in poliurethane foam in the year y | | | | | | | |

***Table 18. Data collected in order to monitor emissions under the baseline scenario***

| **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** |
|---|---|---|---|---|---|---|---|---|
| **K1** | Coal consumption | Meter of consumed fuel, diagram, Journal of registration data of consumed fuel | Tons | M | Monthly | 100% | Electronic/ paper | The primary data source weighting of coal on the weighbridge; secondary data source is the fuel diagram. |
| **K2** | Net calorific value of coal | Report of the Supplier, analytical report of chemical analysis laboratory | kcal/kg | E | Monthly | 100% | Electronic/ paper | In the invoices of fuel supplier, report of chemical analysis laboratory ) |
| **K4** | Natural gas consumption | Meter of consumed fuel, diagram, | Ths. $m^3$ | M | Monthly | 100% | Electronic/ paper | Fuel consumption by boilers is the main data which allows calculation of GHG emissions in the reporting year |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Journal of registration data of consumed fuel | | | | | | |
| **К5** | Net calorific value of natural gas | Report of the Supplier, analytical report of chemical analysis laboratory | kcal/kg | E | Monthly | 100% | Electronic/ paper | In the passport of fuel from fuel supplier |
| **К7** | Power generation | Meters of Kramatorsk HPP, balance data | kWh | M, C | Monthly | 100% | Electronic/ paper | Annual report |
| **К8** | Own Electricity consumptio n | Meters of KramatorskHPP, calculation of consumed amount | kWh | M, C | Monthly | 100% | Electronic/ paper | Annual report |
| **К9** | Power supplied to customers (to the grid) | Meters of Kramatorsk HPP, balance data | kWh | M, C | Monthly | 100% | Electronic/ paper | Annual report |
| **К11** | Steam generation | Meters of Kramatorsk HPP | Gcal | M | Annually | 100% | Electronic/ paper | Annual report |
| **К12** | Heat supplied to consumers | Meters of Kramatorsk HPP, balance data | Gcal | M, C | Annually | 100% | Electronic/ paper | Annual report |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **K13** | Length of the heat pipes replaced by pipes in poliurethane foam in the year y | Reports | m | M, C | Annually | | Electronic/ paper | Annual report |

## D.2.1 Accuracy level of the measurement equipment

### Accuracy level of the measurement equipment

Every type of measurement equipment has its defined accuracy level. As a rule, this level is low. The accounting for inaccuracies at the HPP is regulated by the 'Instruction on the rules for commercial accounting of electricity', which is an integral part of the current agreement between the members of the Wholesale electricity market of Ukraine. The inaccuracy level of the electricity measurement devices is kept below 0.5%.
The measurement equipment used for commercial accounting of Kramatorskteploenergo LLC are in compliance with the accuracy level mentioned above. The accuracy of the fuel volumes received by Kramatorskteploenergo LLC is stated in the relevant certificates provided by the supplier; the forms of these certificates are agreed between the consumer, suppliers and with the State Enterprise Derzhstandartmetrologiya (based in Donetsk and Dnipropetrovsk). For the natural gas measurements the accuracy level is 1%, for the hard fuel – 1.5%.
Therefore, the acceptable level of the inaccuracy of the measurements, for which no correction is necessary within the calculations provided below, is set.

## D.2.2 Quality assurance and quality control measures

**Documented procedures and management plan**

*Roles and responsibilities*

The general project management is done by the General Director of Kramatorsk HPP and the First Deputy Director. The Director manages and coordinates activity of all departments. Every parameter is monitored by the respective department headed by the Head of the department.

The organizational structure of the data collection at Kramatorsk HPP is presented above in the Section C.

**Training**

With the purpose of operation of modernized equipment of Kramatorsk HPP the studying of 6 people of operational personnel of Kramatorskteploenergo LLC was done at the boiler equipment of the type BKZ-220 of Chernihiv HPP. The cost of training is UAH 21 000.

**Internal audit and control measures**

A system of technical tools 'KTS Energiya' is used at Kramatorsk HPP as the main internal control instrument. The system is managed by the department of information technologies and communication. The data is collected with the minimum range of 5 minutes for each technological parameter. The system archives the information collected and keeps the archived data for at least one year. The data is collected by the accounting group of the production department.

**Information on the social and environmental impacts of the project**

As a result of the project implementation, the local community and the employees of Kramatorsk HPP will have secure workplaces for the long-term perspective, due to the stable operation of the plant. The consumption of the fossil fuels for heat and power generation will be reduced. The project's implementation will lead to reduction of greenhouse gas and other toxic gases (such as carbon monoxide and nitrogen oxides) emission to the atmosphere. Reducing the amount of greenhouse gas emissions would allow to prevent their further accumulation in the atmosphere and therefore contribute to the climate change mitigation.

## D.3. Data and parameters used to calculate leakage emissions

Leakages are not foreseen.

## D.4. Other relevant data and parameters

**External data (type of data, source, access)**

In accordance with PDD the following external data were used in the project in 2010.

| Parameter | Source | Access |
|---|---|---|
| Net calorific value of coal | Report of the Supplier | Fuel supplier certificates are kept at Kramatorskteploenergo LLC |
| Carbon emission factor for coal | IPCC Guidelines for National Greenhouse Gas Inventories (Volume 2 (Energy), 1996) | Publicly available |
| Net calorific value of natural gas | Report of the Supplier. | Fuel supplier certificates are kept at Kramatorskteploenergo LLC |
| Carbon emission factor for natural gas | IPCC Guidelines for National Greenhouse Gas Inventories (Volume 2 (Energy), 1996) | Publicly available |
| Carbon emission factor of the electric grid of Ukraine | Carbon emission factor for national grid of Ukraine is given in Order # 43 dated 28/03/2011, issued by State Enviromental Investment Agency of Ukraine | Publicly available |

## SECTION E. Emission reductions calculation

### E.1. Baseline emissions calculation

The following formula is used for calculating the baseline emissions at Kramatorsk HPP (***BEy)***:

$$BEy = BEFC,elec,y + BEelectricity,y + BE_{heat\_ex}$$

where:

***BEFC,elec,y*** – baseline emissions from the fuel combusted at the power plant for heat and power production in the absence of project measures, t $CO_2$. Emissions from different fuel types are calculated by multiplying the amount of the fuel of the type '*i*' by the carbon emission factor (t $CO_2$ / t (1000 $m^3$)) for the fuel I consumed during the year *y*.

***BEelectricity,y*** – baseline emissions from the grid electricity to be replaced due to the project implementation at the power plant, t $CO_2$.

$BE_{heat\_ex}$ – baseline emissions from electricity consumption by the boilers, where the heat exchangers are to be replaced, t $CO_2$.

Baseline emissions for the scenario of absence of the project measures are given in the Table 19 below.

***Table 19. Baseline emissions, t $CO_2e$***

| **Year** | **2010** |
|---|---|
| **Baseline emissions, t $CO_2e$** | 376 642 |

### E.2. Project emissions calculation

Project emissions ($E_p$) are calculated by the following formula:

$$E_p = PEFC,elec,y + PE_{heat\_ex}$$

where:

$PE_{FC,elec,y}$ – project emissions from the actual fuel consumed by the power plant for the heat and power production (savings from heat distribution network rehabilitation are not taken into account), t $CO_2$.

$PE_{heat\_ex}$ – project emissions from electricity consumption by the boiler rooms where the heat exchangers are to be replaced, t $CO_2$.
The emissions after implementation of the project measures are presented below in Table 20.

***Table 20. Project emissions, t $CO_2e$***

| **Year** | **2010** |
|---|---|
| **Emissions, t $CO_2e$** | 353 022 |

### E.3. Leakage calculation

No leakage is expected within the project.

## E.4. Emission reductions calculation / table

Emission reductions due to the project implementation are calculated as the difference between the baseline and the project emissions.

Emission reductions due to the project implementation are given in the Table 21 below.

***Table 21. Emission reductions***

| **Year** | **2010** |
|---|---|
| Emission reductions resulting from HPP modernization, t $CO_2e$ | 22 894 |
| Emission reductions resulting from modernization of heat supply systems, t $CO_2e$ | 726 |
| **Total emission reductions, t $CO_2e$** | **23 620** |

## E.5. Comparison of actual emission reductions with estimates in the PDD

Comparison of actual emission reductions with estimates in the registered PDD is given in the Table 22 below

***Table 22. Comparison of emission reductions***

| **Item** | **Values applied in ex-ante calculation of the registered PDD** | **Actual values reached during the monitoring period** |
|---|---|---|
| **Emission reductions ($tCO_2e$)** | **67 782** | **23 620** |

Compared to reductions estimated in the registered PDD, project emission reductions have decreased by 45 689 $tCO_2e$

## E.6. Remarks on difference from estimated value in the PDD

The amount of generated electric and heat power in the baseline and project scenario pointed in the registered PDD has been changed. It happened because during the PDD development the expected data for 2010 has been given, which differs from actual data in 2010. In the Table 23 actual data on heat and power generation in 2010 is given.

***Table 23. Heat and power generation for baseline scenario for the project***

| **Item** | **2010** |
|---|---|
| Power generation, MWh | 321 157 |
| Heat generation, Gcal | 580 599 |

**Annex 1. Data as to the meters of measurement of power supplied to consumers**

| Serial number | Installed at | Data as of 01.01.2011 | Data as of 01.01.2010 | Difference | Coefficient | Power, kWh | Notes |
|---|---|---|---|---|---|---|---|
| ***a) Power supply (Total: 430 112 152 kWh)*** | | | | | | | |
| 01073888 | Section LIP 1 | 12795 | 0 | 12795 | 132 | 1 688 940 | |
| 01073888 | Section LIP 1 | 63544 | 25505 | 38039 | 132 | 5 021 148 | Reprogramming |
| 01076223 | Section LIP 2 | 24737 | 0 | 24737 | 132 | 3 265 284 | |
| 01076223 | Section LIP 2 | 112322 | 73826 | 38496 | 132 | 5 081 472 | Reprogramming |
| | Section LIP 2 | | | | | 6 540 | Shortage |
| 01083013 | Section Druzhkovka 1 | 16453 | 0 | 16453 | 132 | 2 171 796 | |
| 01083013 | Section Druzhkovka 1 | 187254 | 73250 | 114004 | 132 | 15 048 528 | Reprogramming |
| 01054389 | Section Druzhkovka 2 | 29480 | 0 | 29480 | 132 | 3 891 360 | |
| 01054389 | Section Druzhkovka 2 | 116019 | 50513 | 65506 | 132 | 8 646 792 | Reprogramming |
| | Section Druzhkovka 2 | | | | | 6 016 | Shortage |
| 01076236 | Section Kujbisheva 1 | 116121 | 0 | 116121 | 88 | 10 218 648 | |
| 01082976 | Section Kujbisheva 1 | 380455 | 120816 | 259639 | 88 | 22 848 232 | Replacement |
| 01076228 | Section Kujbisheva 2 | 137227 | 0 | 137227 | 66 | 9 056 982 | |
| 01076228 | Section Kujbisheva 2 | 217581 | 0 | 217581 | 66 | 14 360 346 | Reprogramming |
| 01083001 | Section Kujbisheva 2 | 3810019 | 3743340 | 66679 | 66 | 4 400 814 | Replacement |
| | Section Kujbisheva 2 | | | | | 2 112 | Shortage |
| | Section Kujbisheva 2 | | | | | 11 401 | Shortage |
| 01166656 | Section NKMZ-110 | 2134662 | 1695179 | 439483 | 66 | 29 005 878 | |
| 01166657 | PGV-3 | 1136835 | 624494 | 512341 | 132 | 67 629 012 | |
| | PGV-3 | | | | | 16 600 | Shortage |
| 36132295 | Section ShSMV | | | 0 | 1320 | 0 | Maintenance |
| 36118861 | Section LEP-1 35 kV | 222651 | 149220 | 73431 | 140 | 10 280 340 | |
| 36118862 | Section LEP-1 35 kV | 289628 | 201382 | 88246 | 140 | 12 354 440 | |
| 1146216 | Section Drozhzhevoj 1 | 25570 | 6316 | 19254 | 3,6 | 69 314 | |
| 36118833 | Section Drozhzhevoj 2 | 243 | 243 | 0 | 24 | 0 | |
| 01030346 | Section CRP 1 | 262812 | 261416 | 1396 | 72 | 100512 | Replacement |
| 38118775 | Section CRP 1 | 13240 | 12797 | 443 | 72 | 31896 | |
| 01030369 | Section CRP 4 | 987715 | 918987 | 68728 | 72 | 4948416 | Replacement |
| 36118851 | Section CRP 4 | 207782 | 192378 | 15404 | 72 | 1109088 | |
| 01030353 | Section Jel. pech'10 | 440561 | 244222 | 196339 | 72 | 14136408 | Replacement |
| 36118771 | Section Jel. pech'10 | 669778 | 638726 | 31052 | 72 | 2235744 | |
| 01030367 | Section RP1 ceh 11 | 430060 | 374249 | 55811 | 72 | 4018392 | Replacement |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 36118781 | Section RP1 ceh 11 | 84088 | 71602 | 12486 | 72 | 898992 | |
| 01030368 | Section Pidstancija 11 | 425778 | 378044 | 47734 | 72 | 3436848 | Replacement |
| 36118802 | Section Pidstancija 11 | 97574 | 87971 | 9603 | 72 | 691416 | |
| 01030365 | Section Pidstancija 9 | 580365 | 540029 | 40336 | 96 | 3872256 | Replacement |
| 36118813 | Section Pidstancija 9 | 160620 | 137375 | 23245 | 96 | 2231520 | |
| 01030352 | Section Pidstancija 17 | 314356 | 313873 | 483 | 72 | 34776 | Replacement |
| 36118752 | Section Pidstancija 17 | 107609 | 106862 | 747 | 72 | 53784 | |
| 01030361 | Section Pidstancija 8-1 | 555809 | 555635 | 174 | 72 | 12528 | Replacement |
| 36118803 | Section Pidstancija 8-1 | 101314 | 101170 | 144 | 72 | 10368 | |
| 01030355 | Section Pidstancija 3-1 | 129282 | 120582 | 8700 | 72 | 626400 | Replacement |
| 36118823 | Section Pidstancija 3-1 | 44973 | 43343 | 1630 | 72 | 117360 | |
| 01030364 | Section CRP 2 | 803409 | 646301 | 157108 | 72 | 11311776 | Replacement |
| 36118842 | Section CRP 2 | 373828 | 353588 | 20240 | 72 | 1457280 | |
| 01030372 | Section Pidstancija 6 | 94404 | 76217 | 18187 | 72 | 1309464 | Replacement |
| 36118841 | Section Pidstancija 6 | 24833 | 24833 | 0 | 72 | 0 | |
| 01030366 | Section Kompressornaja 1 | 675679 | 611916 | 63763 | 72 | 4590936 | Replacement |
| 36118863 | Section Kompressornaja 1 | 210950 | 201678 | 9272 | 72 | 667584 | |
| 01030362 | Section Pidstancija 7 | 607568 | 577885 | 29683 | 72 | 2137176 | Replacement |
| 36118853 | Section Pidstancija 7 | 36776 | 36776 | 0 | 72 | 0 | |
| 01030371 | Section Pidstancija 3-2 | 388125 | 260228 | 127897 | 72 | 9208584 | Replacement |
| 36118843 | Section Pidstancija 3-2 | 217042 | 197507 | 19535 | 72 | 1406520 | |
| 01030354 | Section Pidstancija 5 | 259661 | 237850 | 21811 | 72 | 1570392 | Replacement |
| 36118811 | Section Pidstancija 5 | 52340 | 48251 | 4089 | 72 | 294408 | |
| 01030356 | Section Pidstancija 8-2 | 981725 | 897972 | 83753 | 72 | 6030216 | Replacement |
| 36118781 | Section Pidstancija 8-2 | 332085 | 315323 | 16762 | 72 | 1206864 | |
| 01030359 | Section Jel. pech'6 | 913801 | 773782 | 140019 | 90 | 12601710 | Replacement |
| 36118842 | Section Jel. pech'6 | 514142 | 490700 | 23442 | 90 | 2109780 | |
| 01030345 | Section RP 25 | 529849 | 506858 | 22991 | 180 | 4138380 | Replacement |
| 36118793 | Section RP 25 | 92364 | 85521 | 6843 | 180 | 1231740 | |
| 01161590 | RP 70 | 2495475 | 1243167 | 1252308 | 7,2 | 9016617,6 | |
| 01030348 | Section of process water pump 4 | 758154 | 758154 | 0 | 12 | 0 | Replacement |
| 36118822 | Section of process | 123907 | 123907 | 0 | 12 | 0 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | water pump 4 | | | | | | |
| 01030357 | Section of process water pump 5 | 145874 | 58852 | 87022 | 18 | 1566396 | Replacement |
| 36118812 | Section of process water pump 5 | 228894 | 215364 | 13530 | 18 | 243540 | |
| 01030344 | Section Skvazhina 20 | 1455856 | 118908 | 1336948 | 0,4 | 534779 | |
| 36125811 | Heating water pump #1 | 2839955 | 897672 | 1942283 | 0,9 | 1748055 | |
| 36125802 | Heating water pump #2 | 2729294 | 1477714 | 1251580 | 1,2 | 1501896 | |
| 36125828 | Heating water pump #3 | 1774995 | 949482 | 825513 | 1,8 | 1485923 | |
| 36125815 | Heating water pump #4 | 423535 | 268167 | 155368 | 7,2 | 1118650 | |
| 36125803 | Heating water pump #5 | 828140 | 534941 | 293199 | 1,2 | 351839 | |
| 36125804 | Heating water pump #6 | 854197 | 520063 | 334134 | 1,2 | 400961 | |
| 36125826 | Heating water pump #7 | 2305663 | 905859 | 1399804 | 1,2 | 1679765 | |
| 36125827 | Heating water pump #9 | 848009 | 231527 | 616482 | 1,8 | 1109668 | |
| 36125813 | Heating water pump #10 | 1693129 | 1679192 | 13937 | 1,2 | 16724 | |
| 36125818 | Heating water pump #11 | 2308514 | 922449 | 1386065 | 1,2 | 1663278 | |
| 36125816 | Heating water pump #12 | 3002584 | 1842209 | 1160375 | 1,8 | 2088675 | |
| 36125812 | Heating water pump #13 | 2816335 | 1689199 | 1127136 | 1,8 | 2028845 | |
| 36125817 | Heating water pump #14 | 615785 | 424329 | 191456 | 1,8 | 344621 | |
| 36125814 | Heating water pump #15 | 3754246 | 2002924 | 1751322 | 1,8 | 3152380 | |
| 36125820 | Heating water pump #16 | 1574020 | 958022 | 615998 | 1,8 | 1108796 | |
| 36125819 | Heating water pump #17 | 1876498 | 1295552 | 580946 | 1,8 | 1045703 | |
| 36118511 | Feedwater pump #1 | 564361 | 521430 | 42931 | 0,03 | 1288 | |
| 36118531 | Feedwater pump #2 | 2129840 | 1423020 | 706820 | 0,03 | 21205 | |
| 36115851 | Feedwater pump #3 | 10098847 | 6222413 | 3876434 | 0,03 | 116293 | |
| 36118476 | Feedwater pump #4 | 0 | 0 | 0 | 0,03 | 0 | |
| 36118521 | Feedwater pump #6 | 4155653 | 4123017 | 32636 | 0,03 | 979 | |
| 36118501 | Feedwater pump #7 | 5440869 | 3561843 | 1879026 | 0,04 | 75161 | |
| 36118481 | Feedwater pump #8 | 4360615 | 3853587 | 507028 | 0,03 | 15211 | |
| 36118506 | Feedwater pump #1 | 9630793 | 3359501 | 6271292 | 0,03 | 188139 | |
| 36118534 | Feedwater pump makeup demineralizer #2 | 25206688 | 16669170 | 8537518 | 0,03 | 256126 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 36118541 | Feedwater pump makeup demineralizer #3 | 6366542 | 5419196 | 947346 | 0,03 | 28420 | |
| 36118486 | K N B #1 | 103 | 99 | 4 | 0,04 | 0 | |
| 36118533 | K N B #2 | 35611 | 33 | 35578 | 0,04 | 1423 | |
| 36118491 | K N B #3 | 11418777 | 5049109 | 6369668 | 0,04 | 254787 | |
| 36118561 | K N B #4 | 2999554 | 1425154 | 1574400 | 0,04 | 62976 | |
| 36118544 | K N B #5 | 9376468 | 6331440 | 3045028 | 0,04 | 121801 | |
| 36118555 | K N B #6 | 1604302 | 884564 | 719738 | 0,04 | 28790 | |
| 36118553 | K N B #7 | 9725888 | 7308451 | 2417437 | 0,04 | 96697 | |
| 36118545 | K N B #8 | 2021823 | 2010917 | 10906 | 0,04 | 436 | |
| 36118536 | K N B #9 | 15788229 | 9776750 | 6011479 | 0,04 | 240459 | |
| 36118496 | K N B #10 | 6885260 | 2462508 | 4422752 | 0,04 | 176910 | |
| 01136239 | Section NIIPTMash 1 | 1840555 | 1840555 | 0 | 7,2 | 0 | |
| 01136221 | Section NIIPTMash 2 | 0 | 0 | 0 | 720 | 0 | |
| 01136264 | Section NIIPTMash 3 | 1584890 | 1217218 | 367672 | 12 | 4412064 | |
| 01146357 | Section NIIPTMash 4 | 622793 | 207461 | 415332 | 12 | 4983984 | |
| 53002442 | JSC “Novij Mir” | 108388 | 27514 | 80874 | 0,2 | 16175 | |
| 53064228 | Chiller #2 (backup) | 237255 | 0 | 237255 | 0,16 | 37961 | |
| 0191723 | Modul-Invest | 8843 | 1378 | 7465 | 0,1 | 747 | |
| 01146232 | LLC “Urozhay” | 4239287 | 2910963 | 1328324 | 2,4 | 3187978 | |
| 36148143 | Amstor-1 | 2016327 | 904118 | 1112209 | 1,2 | 1334651 | |
| 36148144 | Amstor-2 | 1671945 | 736877 | 935068 | 1,8 | 1683122 | |
| 4848598 | LLC “Astelit” | 284696 | 142946 | 141750 | 0,1 | 14175 | |
| 36660 | UMC-1 | 14796845 | 8524342 | 6272503 | 0,01 | 62725 | |
| 36601 | UMC-2 | 6971830 | 4677409 | 2294421 | 0,01 | 22944 | Replacement |
| 0385629 | UMC-2 | 8792 | 111 | 8681 | 0,1 | 868 | |
| 4848601 | CSC “Kyivstar GSM” | 768115 | 530980 | 237135 | 0,1 | 23714 | |
| 01113967 | JSC “SKMZ” | 1737239 | 1737239 | 0 | 7,2 | 0 | |
| 01146326 | Otd.Socgorod 1 | 265869 | 0 | 265869 | 7,2 | 1 914 257 | |
| 01146326 | Otd.Socgorod 1 | 862082 | 103082 | 759000 | 7,2 | 5 464 800 | Reprogramming |
| 01136130 | Otd.Socgorod 2 | 410402 | 0 | 410402 | 7,2 | 2 954 894 | |
| 01136130 | Otd.Socgorod 2 | 1179488 | 272849 | 906639 | 7,2 | 6 527 801 | Reprogramming |
| 01136198 | Otd.Socgorod 3 | 342444 | 0 | 342444 | 7,2 | 2 465 597 | |
| 01136198 | Otd.Socgorod 3 | 4774000 | 3918602 | 855398 | 7,2 | 6 158 866 | Reprogramming |
| 01136102 | Otd.Socgorod 4 | 332142 | 0 | 332142 | 7,2 | 2 391 422 | |
| 01136102 | Otd.Socgorod 4 | 4218982 | 3361230 | 857752 | 7,2 | 6 175 814 | Reprogramming |
| 01136179 | Otd.Socgorod 5 | 170390 | 0 | 170390 | 12 | 2 044 680 | |
| 01136179 | Otd.Socgorod 5 | 2127320 | 1757428 | 369892 | 12 | 4 438 704 | Reprogramming |
| 01136190 | Otd.Socgorod 7 | 153739 | 0 | 153739 | 12 | 1 844 868 | |
| 01136190 | Otd.Socgorod 7 | 1893091 | 1502655 | 390436 | 12 | 4 685 232 | Reprogramming |
| 01136094 | Otd.Socgorod 8 | 140078 | 0 | 140078 | 12 | 1 680 936 | |
| 01136094 | Otd.Socgorod 8 | 1888734 | 1561883 | 326851 | 12 | 3 922 212 | Reprogramming |
| 4848597 | Otd.Boks 1 | 9446 | 6724 | 2722 | 20 | 54440 | |
| 4848599 | Otd.Tunnel | 14314 | 10038 | 4276 | 1 | 4276 | |

***b)Power consumption from the grid (Total: 165 045 906 kWh)***

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 01073888 | Delivery to plant buses from pr. | 114645 | 0 | 114645 | 132 | 15 133 140 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | LIP 1 | | | | | | |
| 01073888 | Delivery to plant buses from pr. LIP 1 | 463890 | 158614 | 305276 | 132 | 40 296 432 | Reprogramming |
| 01076223 | Delivery to plant buses from pr. LIP 2 | 76406 | 0 | 76406 | 132 | 10 085 592 | |
| 01076223 | Delivery to plant buses from pr. LIP 2 | 433881 | 118210 | 315671 | 132 | 41 668 572 | Reprogramming |
| | Delivery to plant buses from pr. LIP 2 | | | | | 12 110 | Shortage |
| 01083013 | Delivery to plant buses from pr. Druzhkovka 1 | 63490 | 0 | 63490 | 132 | 8 380 680 | |
| 01083013 | Delivery to plant buses from pr. Druzhkovka 1 | 237554 | 107590 | 129964 | 132 | 17 155 248 | Reprogramming |
| 01054389 | Delivery to plant buses from pr. Druzhkovka 2 | 43166 | 0 | 43166 | 132 | 5 697 912 | |
| 01054389 | Delivery to plant buses from pr. Druzhkovka 2 | 260734 | 64406 | 196328 | 132 | 25 915 296 | Reprogramming |
| | Delivery to plant buses from pr. Druzhkovka 2 | | | | | 7 276 | Shortage |
| 01076236 | Delivery to plant buses from pr. Kujbisheva 1 | 0 | 0 | 0 | 88 | 0 | |
| 01082976 | Delivery to plant buses from pr. Kujbisheva 1 | 0 | 0 | 0 | 88 | 0 | Replacement |
| 01076228 | Delivery to plant buses from pr. Kujbisheva 2 | 0 | 0 | 0 | 66 | 0 | |
| 01076228 | Delivery to plant buses from pr. Kujbisheva 2 | 0 | 0 | 0 | 66 | 0 | Reprogramming |
| 01083001 | Delivery to plant buses from pr. Kujbisheva 2 | 65835 | 65835 | 0 | 66 | 0 | Replacement |
| 2821188 | Delivery ShSMV | | | 0 | 1320 | 0 | Maintenance |
| 36118832 | Delivery PGV 1 JSC NKMZ | 159807 | 151164 | 8643 | 24 | 207432 | |
| 71001641 | Delivery PGV 1 JSC NKMZ | 176207 | 155948 | 20259 | 24 | 486216 | |

**Annex 2. Detailed information as to the technical breakdowns during 2010**

In 2010 at HPP there were a number of technical breakdowns:

09.02.2010 Boiler # 7 was switched off by the boiler drum level protection system due to the damage of the front waterwall central panel tubes and the rear waterwall tubes caused by internal corrosion.

15.03.2010 Boiler # 9 was switched off by personnel (using KAOT emergency switch) due to sharp level lowering in the boiler drum which resulted from the damage of the front waterwall tube caused by internal corrosion.

19.04.2010 Boiler # 8 was switched off by the boiler drum level protection system due to the damage of the front waterwall tube caused by external corrosion. Turbo generator # 3 was stopped by personnel (using KAOT emergency switch) in connection with no-steam regime.

3.06.2010 Boiler # 8 was switched off by the boiler drum level protection system due to the damage of the rear waterwall tube caused by internal corrosion. Turbo generator # 4 was stopped by personnel (using KAOT emergency switch) in connection with no-steam regime.

21.06.2010 Boiler # 8 was switched off by the boiler drum level protection system due to damage of the front waterwall tube caused by internal corrosion under continuous service. Turbo generator # 4 was stopped by personnel (using KAOT emergency switch) in connection with no-steam regime.

9.08.2010 Boiler #7 was stopped by operating personnel (using KAOK emergency switch) because of leakage in the gland seal of the feed valve. The damage resulted from the valve stem mechanical wear caused by its continuous service. Turbo generator # 3 was stopped by personnel (using KAOT emergency switch) in connection with no-steam regime.

17.08.2010 Turbo generator # 3 was stopped by operating personnel (using KAOT emergency switch) because of turbine condensate pipeline leakage. The damage resulted from continuous service of the pipe stopper. Boiler # 6 was stopped by personnel using KAOK emergency switch.

31.08.2010 Boiler #9 was switched off by the emergency stop protection of two smoke-exhausters due to de-energizing of the switchgear section #9 (6kV) which resulted from short-circuit in the mill exhaust fan 9A section. The short-circuit was caused by break of the protective shutter mount. Turbo generator # 3 was stopped by operating personnel (using KAOT emergency switch) in connection with no-steam regime.

16.10.2010 Boiler # 8 was switched off by the boiler drum level protection system due to the damage of the rear waterwall tube caused by internal corrosion.

3.11.2010 The operating personnel switched off the boiler # 9 (using KAOK emergency switch) in connection with level lowering in the boiler drum caused by the waterwall tube disruption. The damage resulted from internal corrosion. Turbo generator # 4 was stopped by personnel (using KAOT emergency switch) because of steam shortage.

1.12.2010 Boiler # 7 was switched off by personal (using KAOT emergency switch) in connection with sharp level lowering in the boiler drum caused by the front waterwall tube damage which resulted from the tube cracking.

7.12.2010 Boiler # 6 was switched off by the boiler drum level protection system due to the damage of the left side waterwall tube caused by internal corrosion.

8.12.2010 Boiler # 7 was switched off by the boiler drum level protection system due to the damage of the right side waterwall tube caused by internal corrosion.

21.12.2010 Boiler # 6 was switched off by the boiler drum level protection system due to the damage of the front waterwall tube caused by internal corrosion.

27.12.2010 Boiler # 8 was switched off by the boiler drum level protection system due to the damage of the rear waterwall tube caused by internal corrosion.