Developed by	Approved by
Director V. Vovchak _____ (signature and L.S.)	Director general M. Zavgorodniy _____ (signature and L.S.)

Revamping of sintering and blast-furnace production at OJSC "Dniprovsky Integrated Iron and Steel Works named after Dzerzhynsky"

UA1000274, Track 1

Annual Monitoring Report

Version 2 dated 20th of March 2012
Monitoring period: 1st January 2011 – 31st December 2011

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List of abbreviations

DIISW - PJSC «Dniprovsky Integrated Iron and Steel Works named after Dzerzhynsky»;
AIE – Accredited independent entity;
JI – Joint Implementation;
BF – Blast Furnaces;
SP – Sinter Plant;
FER – Fuel and Energy Resources.

1. Project summary

The proposed Joint Implementation project[1] considers complex resource-saving effect related with implementation of new SP and BF#4, gradual reconstruction of the remaining BFs ##8, 9, 12 and 1M with application of state of the art technologies and equipment. Also, project activity envisages technological improvements in the process of sintering and pig iron production.

The project measures and activities that have been and will be implemented at DIISW (concerning pig iron production process) lead to increase of SP and BFs productivity, reduction of specific coke, other fuel and materials consumption and, therefore, reduction of GHG emissions.

2. Status of the project pursuant to the monitoring period

Emission reductions during the period of 1st January 2011 to 31st December 2011 were achieved by implementation of the following measures:

#	Measures	2004	2005	2006	2007	2008	2009	2010	2011
1	**Technological improvements of the BFs operation:** - improvement of blast furnace coke quality; - decreasing the silicon content in the pig iron; - decreasing the BFs idle times and downtime; - partial substitution of the limestone by lime; - improvement of the quality of agglomerate.								
2	**Renewal and reconstruction of BF#1M**								
3	**Implementation of a new oxygen plant AKAp 40/53-4**								
4	**Modernization of the sintering process:** - improvements of solid fuel burning process, which is part of the sintering charge; - increase of the level of steel waste utilization; - implementation of the state-of-the-art dust suppression and gas purification facilities; - optimization of limestone decomposition reaction;								

[1] The letter of approval was received from the Government of the Netherlands (Ministry of Economic Affairs, reference: 2011JI15 of 10.05.2011).

	- improvement of natural gas burning process, which is supplied to burners for the ignition of sintering charge; - improvements of chemical composition of sinter charge; - reduction of fine fraction content in agglomerate.								

The following measures: *technological improvements of the BFs operation* and *modernization of the sintering process* are implemented from the beginning of the proposed project activity till 2020 (during the whole project lifetime).

3. Parameters monitored according to the monitoring plan

During the project activity the total pig iron production, fuel and energy resource consumption at the plant are being monitored. The baseline of the project is based on historical data of fuel and energy resources consumption for pig iron production at DIISW during the period of 01/01/1999 – 31/12/2003.

During the year 2011 the carbon emission factor for electricity consumption is based on the Order of the National environmental investment agency of Ukraine № 75[2] dated 12/05/2011. In accordance with mentioned above decree issued by NEIA for the 1st – class electricity consumers the carbon emission factor equal to 1,090 $kgCO_{2e}$/kWh.

The use of the emission factor for the 1st-class electricity consumers is justified by the resolution of National Electricity Regulatory Commission of Ukraine № 1052 of 13 August 1998[4], according to the resolution the 1st – class electricity consumers are the consumers, who:
1) receive electricity from electricity supplier at the point of sale of electricity with the degree of voltage 27.5 kV and above;
2) connected to the power rails of power plants (except hydroelectric, which produce electricity periodically), as well as to power rails of substations of the electricity grid with voltage of 220 kV and above, regardless voltage level at the point of sale of electricity by the power supplier to consumer;
3) is the industrial enterprise with average monthly rate of electricity consumption - 150 million kWh and above for the technological needs of production, regardless of the voltage level at the point of sale of electricity by the power supplier to consumer.

Based on the information stated above, DIISW refers to the 1st – class electricity consumers[5].

[2] http://www.neia.gov.ua/nature/doccatalog/document?id=127498.
[4] http://energetik.org.ua/node/90.
[5] The following information is proved by electricity supply agreements.

All data, used in this chapter, are based on information, confirmed by DIISW documents. This information is available to the AIE, also regarding the interconnection with the baseline and project line tables, presented below.

Colors that are used in the tables are described below:

Project line	Baseline
Name of each indicator	Name of each indicator
Volume of FER consumption	Volume of FER consumption
Emission factor for FER	Emission factor for FER
Volume of CO_2 emissions	
Blank cell	

The emission factors for natural gas, coke and anthracite are identified in the following way:

1) Emission factor for natural gas consumption is based on fixed calorific value of natural gas which is in accordance with DIISW average historical data. Calorific value of natural gas is at the level of 8100 kcal/m^3.

2) In order to calculate emission factor for coke due to its production and consumption based on actual carbon content, the following formula was used:

$EF_{ra} = (C_{coke} * 44/12) + 0,56$

where:

EF_{ra} – emission factor for coke, tonnes CO_{2e}/tonne of coke;
C_{coke} – carbon content of coke, %;
0,56 – CO_{2e} emission factor for coke production, tonnes CO_{2e}/tonne of coke produced.

The carbon content of coke is calculated by the following formula:

$C_{coke} = 100 – (C_{ash} + C_{sulphur} + C_{volatile\ matters})$

where:

C_{ash} – ash content of coke, %;
$C_{sulphur}$ – sulfur content of coke, %;
$C_{volatile\ matters}$ – volatile matters content of coke, %.

3) In order to follow conservativeness of the approach, taking into account that various ranks of anthracite are consumed under the project activity in different technological processes and also because it is complicated to calculate actual weighted average of anthracite net calorific value, the carbon emission factor for anthracite is based on carbon

content of anthracite which is in accordance with IPCC 1996 data[6] and on net calorific value of anthracite which in accordance with IPCC 2006 data[7].

Project line

Classification number	Data variable	Unit	2011
P-1	Total CO_{2e} in the project scenario (PE_i)	Tonnes CO_{2e}	9 109 539
P-2	Total CO_{2e} from Pig Iron ($TCPI_{p,i}$)	Tonnes CO_{2e}	8 121 686
P-3	Total Pig Iron Output ($TPII_{p,i}$)	Tonnes	3 090 363
P-4	Total CO_{2e} from fuel consumption in producing Pig Iron ($TCFCPI_{p,i}$)	Tonnes CO_{2e}	446 620
P-5	Quantity of each fuel (fpi_p) used in making Pig Iron ($Q_{fpi,p,i}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	235 931
P-6	Emission factor of each fuel $EF_{f,p}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)[8]	Tonnes CO_{2e}/1000 m^3	1,89301
P-7	Total CO_{2e} from electricity consumption in producing Pig Iron ($TCEPI_{p,i}$)	Tonnes CO_{2e}	269 920
P-8	Electricity Consumed in producing Pig Iron ($ECPI_{p,i}$)	MWh	247 633
P-9	Emissions Factor for Electricity Consumption $EF_{f,p}$[9]	Tonnes CO_{2e}/MWh	1,090
P-10	Total CO_{2e} from Inputs into Pig Iron ($TCIPI_{p,i}$)	Tonnes CO_{2e}	7 405 147
P-11	Total CO_{2e} from fuel used to prepare Iron Ore ($TCFIO_{p,i}$)	Tonnes CO_{2e}	29 550
P-12	Quantity of each fuel (fio_p) used in Sintering ($Q_{fio,p,i}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	15 610
P-13	Emission factor of each fuel $EF_{f,p}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
P-14	Total CO_{2e} from electricity consumption in preparing iron ore ($TCEIO_{p,i}$)	Tonnes CO_{2e}	120 011
P-15	Electricity Consumed in Sintering ($ECIO_{p,i}$)	MWh	110 102
P-16	Emissions Factor for Electricity Consumption $EF_{f,p}$	Tonnes CO_{2e}/MWh	1,090
P-17	Total CO_{2e} from Reducing Agents in Pig Iron Production ($TCRAPI_{p,i}$)	Tonnes CO_{2e}	6 946 245
P-18	Quantity of each reducing agent ($rapi_p$) in Pig Iron Production ($Q_{rapi,p,i}$)	Tonnes	
	Reducing agent (coke)	Tonnes	1 747 522

[6] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reference Manual (Volume 2), Chapter 1 (Energy), Table 1-1 (continued), page 1.13 - http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref1.pdf.

[7] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Chapter 1 Introduction, Section 1.4.2 *Emission Factors,* Table 1.2, page 18 - http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf.

[8] Emission factor for natural gas is based on Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reference Manual (Volume 2), Chapter 1 (Energy), Table 1-1 (continued), page 1.13 (http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref1.pdf) and fixed net calorific value of natural gas which is in accordance with DIISW average historical data.

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

	Reducing agent (anthracite)	**Tonnes**	166 155
P-19	**Emission factor of each reducing agent, $EF_{ra,p}$**	**Tonnes CO_{2e}/Tonne**	
	Default emission factor (coke)[10]	**Tonnes CO_{2e}/Tonne**	3,7258
	Default emission factor (anthracite)[11]	**Tonnes CO_{2e}/Tonne**	2,62
P-20	**Total CO_{2e} from other inputs ($TCOIPI_{p,i}$)**	**Tonnes CO_{2e}**	**309 341**
P-21	**Quantity of each other input ($oipi_p$) in Pig Iron Production ($Q_{oipi,p,i}$)**	**Tonnes**	
	Limestone	**Tonnes**	584 967
	Dolomite	**Tonnes**	58 675
	Pellets	**Tonnes**	798 926
P-22	**Emission factor of each other input, $EF_{oi,p}$**	**Tonnes CO_{2e}/Tonne**	
	Default emission factor (limestone)[12]	**Tonnes CO_{2e}/Tonne**	0,44
	Default emission factor (dolomite)[13]	**Tonnes CO_{2e}/Tonne**	0,477
	Default emission factor (pellets)[14]	**Tonnes CO_{2e}/Tonne**	0,03
P-23	**Total tonnes of CO_{2e} related to the balance of process need of energy required for the project activity ($TCBPN_{p,i}$)**	**Tonnes CO_{2e}**	**987 852**
P-24	**Total CO_{2e} from fuel consumption for balance of process needs of project activity ($TCFCBPN_{p,i}$)**	**Tonnes CO_{2e}**	**124 973**
P-25	**Quantity of each fuel ($fbpn_p$) used for balance of process needs ($Q_{fbpn,p,i}$)**	**1000 m^3**	
	Natural gas (NG)	**1000 m^3**	66 018
P-26	**Emission factor of each fuel $EF_{f,p}$**	**Tonnes CO_{2e}/1000 m^3**	
	Natural gas (NG)	**Tonnes CO_{2e}/1000 m^3**	1,89301
P-27	**Total CO_{2e} from electricity consumption for balance of process needs of project activity ($TCEBPN_{p,i}$)**	**Tonnes CO_{2e}**	**862 880**
P-28	**Electricity Consumed for balance of process needs ($ECBPN_{p,i}$)**	**MWh**	791 633
P-29	**Emissions Factor for Electricity Consumption $EF_{f,p}$**	**Tonnes CO_{2e}/MWh**	1,090

Baseline

[10] Emission factor for coke consumption is based on actual carbon content of coke and emission factor for coke production which is in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3 Industrial Processes and Product Use, Chapter 4 Metal Industries Emissions, Section 4.2.2.3 *Choice of Emission Factors*, Table 4.1, page 4.25 (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_4_Ch4_Metal_Industry.pdf).

[11] Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reference Manual (Volume 2), Chapter 1 (Energy), Table 1-1 (continued), page 1.13 - http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref1.pdf. and 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Chapter 1 Introduction, Section 1.4.2 *Emission Factors,* Table 1.2, page 18 - http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf.

[12] In accordance with Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reference Manual (Volume 3), Chapter 2 (Industrial Processes), Section 2.5.2 *Emissions estimation methodology for CO_2*, page 2.10 (http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch2ref1.pdf).

[13] In accordance with Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reference Manual (Volume 3), Chapter 2 (Industrial Processes), Section 2.5.2 *Emissions estimation methodology for CO_2*, page 2.10 (http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch2ref1.pdf).

[14] In accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3 Industrial Processes and Product Use, Chapter 4 Metal Industries Emissions, Section 4.2.2.3 *Choice of Emission Factors*, Table 4.1, page 4.25 (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_4_Ch4_Metal_Industry.pdf).

Classification number	Data variable	Unit	2011
			1999-2003 (baseline)
B-1	Total CO_{2e} in the baseline scenario (BE_i)	Tonnes CO_{2e}	40 156 593
B-2	Total CO_{2e} from Pig Iron ($TCPI_{b,i}$)	Tonnes CO_{2e}	34 315 386
B-3	Total Pig Iron Output ($TPII_{b,i}$)	Tonnes	12 160 278
B-4	Total CO_{2e} from fuel consumption in producing Pig Iron ($TCFCPI_{b,i}$)	Tonnes CO_{2e}	1 684 024
B-5	Quantity of each fuel (fpi_b) used in making Pig Iron ($Q_{fpi,b,i}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	889 601
B-6	Emission factor of each fuel $EF_{f,b}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
B-7	Total CO_{2e} from electricity consumption in producing Pig Iron ($TCEPI_{b,i}$)	Tonnes CO_{2e}	885 967
B-8	Electricity Consumed in producing Pig Iron ($ECPI_{b,i}$)	MWh	812 814
B-9	Emissions Factor for Electricity Consumption $EF_{f,b}$	Tonnes CO_{2e}/MWh	1,090
B-10	Total CO_{2e} from Inputs into Pig Iron ($TCIPI_{b,i}$)	Tonnes CO_{2e}	31 745 396
B-11	Total CO_{2e} from fuel used to prepare Iron Ore ($TCFIO_{b,i}$)	Tonnes CO_{2e}	232 381
B-12	Quantity of each fuel (fio_b) used in Sintering ($Q_{fio,b,i}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	122 757
B-13	Emission factor of each fuel $EF_{f,b}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
B-14	Total CO_{2e} from electricity consumption in preparing iron ore ($TCEIO_{b,i}$)	Tonnes CO_{2e}	780 147
B-15	Electricity Consumed in Sintering ($ECIO_{b,i}$)	MWh	715 731
B-16	Emissions Factor for Electricity Consumption $EF_{f,b}$	Tonnes CO_{2e}/MWh	1,090
B-17	Total CO_{2e} from Reducing Agents in Pig Iron Production ($TCRAPI_{b,i}$)	Tonnes CO_{2e}	28 951 553
B-18	Quantity of each reducing agent ($rapi_b$) in Pig Iron Production ($Q_{rapi,b,i}$)	Tonnes	
	Reducing agent (coke)	Tonnes	7 500 315
	Reducing agent (anthracite)	Tonnes	384 305
B-19	Emission factor of each reducing agent, $EF_{ra,b}$	Tonnes CO_{2e}/Tonne	
	Default emission factor (coke)	Tonnes CO_{2e}/Tonne	3,7258
	Default emission factor (anthracite)	Tonnes CO_{2e}/Tonne	2,62
B-20	Total CO_{2e} from other inputs ($TCOIPI_{b,i}$)	Tonnes CO_{2e}	1 781 315
B-21	Quantity of each other input ($oipi_b$) in Pig Iron Production ($Q_{oipi,b,i}$)	Tonnes	
	Limestone	Tonnes	2 063 162
	Dolomite	Tonnes	1 699 180
	Pellets	Tonnes	2 100 503

B-22	**Emission factor of each other input, $EF_{oi,b}$**	**Tonnes CO_{2e}/Tonne**	
	Default emission factor (limestone)	**Tonnes CO_{2e}/Tonne**	0,440
	Default emission factor (dolomite)	**Tonnes CO_{2e}/Tonne**	0,477
	Default emission factor (pellets)	**Tonnes CO_{2e}/Tonne**	0,030
B-23	**Total tonnes of CO_{2e} related to the balance of process need of energy required for the project activity ($TCBPN_{b,i}$)**	**Tonnes CO_{2e}**	**5 841 207**
B-24	**Total CO_{2e} from fuel consumption for balance of process needs of project activity ($TCFCBPN_{b,i}$)**	**Tonnes CO_{2e}**	**1 208 402**
B-25	**Quantity of each fuel ($fbpn_b$) used for balance of process needs ($Q_{fbpn,b,i}$)**	**1000 m^3**	
	Natural gas (NG)	**1000 m^3**	638 349
B-26	**Emission factor of each fuel $EF_{f,b}$**	**Tonnes CO_{2e}/1000 m^3**	
	Natural gas (NG)	**Tonnes CO_{2e}/1000 m^3**	1,89301
B-27	**Total CO_{2e} from electricity consumption for balance of process needs of project activity ($TCEBPN_{b,i}$)**	**Tonnes CO_{2e}**	**4 632 805**
B-28	**Electricity Consumed for balance of process needs ($ECBPN_{b,i}$)**	**MWh**	4 250 280
B-29	**Emissions Factor for Electricity Consumption $EF_{f,b}$**	**Tonnes CO_{2e}/MWh**	1,090
B-30	**Total CO_{2e} per 1 tonne of Pig Iron produced ($TCPTPIP_b$)**	**Tonnes CO_{2e}/1 t. of Pig Iron Produced**	**3,302**

B-1	**Total CO_2 in the baseline scenario (BE_i) in 2011**	**Tonnes CO_2**	**10 205 232**

The calculations of GHG emission reductions, indicated in the tables, are based on the real data of FER consumption both for baseline and project line, according to the methodology. The information regarding emission reductions data are given in the next chapter.

Calculation of emission reductions is based on conservative assumptions, which can be proved by the following facts:
- the price of natural gas in the baseline period was lower than in the project line period. That's why there were no substitutions of natural gas by coal as it was in project line period. As a result, such substitution decreased the total amount of emission reductions;
- the quality of iron-bearing materials in project line period sometimes was lower in comparison with the baseline period. That was the reason of the total amount of emission reductions decrease.

No leakages are generated within proposed project activity.

4. Emission reductions calculations

The emission reductions[15], examined in this monitoring report, were generated during the whole monitoring period. The monitoring was based on actual data (mentioned in the reporting documents) of output production and FER consumption under the project line and baseline scenarios as it is required by the JI Project Design Document (PDD).

	2011
Baseline Emissions, t CO_{2e}	**10 205 232**
Project Emissions, t CO_{2e}	**9 109 539**
Emission Reductions, t CO_{2e}	**1 095 693**

The amount of emission reductions that was actually generated during the year 2011 was lower than it was expected in PDD because of the following reasons. First of all, taking into account that during this monitoring period the quality of raw materials and other inputs consumed under the project activity was low, the actual level of specific fuel and energy resources consumption per unit of output was a bit higher than it was expected in PDD. Secondly, taking into account that such measures as technological improvements of the BFs operation and modernization of the sintering process were not fully implemented as planned, it has also influenced on decrease of actual volumes of emission reductions in comparison with estimations in PDD.

5. Measures to ensure the accuracy of the results

The monitoring of JI project indicators at DIISW is realized on regular basis where the system of data collection on FER consumption is being used. The data needed for the monitoring of the project is collected during the process of normal equipment use. The production facilities of the plant are equipped with the measuring devices such as scales, meters and gas, water, steam, electricity consumption meters[16]. The monitoring of the project formed an organic part of routine monitoring of manufacturing process. This allows receiving data regarding the project continuously.

The quality assurance procedures are based on the Plant's ISO 9001:2001 quality management system (QMS), which was further upgraded to the more recent ISO 9001:2008[17] version[18]. The QMS covers the whole of the Plant's production process. Furthermore, an OHSAS 18001:2007 industrial safety management system and an ISO

[15] Project and baseline emissions (which are provided in this chapter) are rounded to the whole figure (1t) and are based on calculations which are demonstrated in the attached excel file. The file is provided to the verifier.
[16] The list of monitoring equipment is provided in Annex 1 of this monitoring report.
[17] http://www.dmkd.dp.ua/system/files/u21/sert.jpg.
[18] Certificates were issued by UkrSEPRO (# UA 2.008.06119 dated 21/06/2011) and TÜV THÜRINGEN (TIC 15 100 127865 dated 31/01/2012).

14001:2004 environmental management system were implemented in 2009[19]. Compliance audits for the mentioned above standards are performed in accordance with regulatory documents of DIISW "Guidance on quality management systems" and "Standard on internal audits". The bureau of standardized certification is responsible for management, realization and storage of audits data. The audits are conducted on monthly basis in accordance with schedule developed at the beginning of each year by the group of accredited auditors of the bureau of standardized certification. The person responsible for appropriate implementation of the audits is the Chief of technological control of the plant. In addition, the Plant has a number of other certificates[20], which proof the project monitoring quality assurance.

During this monitoring period, planned audits on compliance to the standards of ISO 9001:2008, ISO 14001 and OHSAS 18001 (according to the schedule) were conducted. These audits certified the level of accordance of the proved processes to the criteria of standard. The protocols of conducted audits were provided to the verifiers.

Best available techniques are used in order to minimize uncertainties. Uncertainties are generally low - typically below 2% for all parameters that are or will be monitored. All the equipment used for monitoring purposes is in line with national legislative requirements and standards and also with ISO 9001:2001 standards. Details are given in STP 230-35-07 *Metrological Support of* Measuring *Equipment*. The data will be cross checked as well as internal audits and corrective actions are taken as defined in STP 230-18-03 *Quality Management System Internal Audits*.

Taking into account that the list of monitoring equipment was not in accordance with this monitoring period, the project developer has revised and updated it. The list of monitoring equipment is now in accordance with this specific monitoring period. Revision and update of the monitoring equipment was done by taking into account the following reasons:

1) some monitoring equipment were sent on scheduled or unscheduled verifications/calibrations and were replaced by another monitoring equipment (same type but other serial number);
2) some monitoring equipment were removed from the data accounting and data accounting was conducted on other equipment;
3) after the monitoring equipment were removed from one accounting spot and after verifications/calibrations were conducted, the monitoring equipment were installed at the other accounting spot for data accounting;
4) monitoring equipment were changed on another and sent in order to conduct repairing works;
5) the list of monitoring equipment was improved in comparison with the list for the previous monitoring period by taking into account all inaccuracies that were made in the past.

[19] Relevant certificates were issued by TÜV THÜRINGEN (# TIC 15 116 10202 dated 02/03/2010 and # TIC 15 104 10697 dated 02/03/2010, respectively).
[20] Relevant information may be provided upon request.

All facts of monitoring equipment substitution are reflected in the internal journals of monitoring equipment substitution. The journal was checked by the verifiers during conducted site-visit.

In case of having problems with certain monitoring equipment, the accounting system is organized in such way that allows double checking of all the data. Ultimately all information can be proven by independent invoices from the third parties.

6. Roles and obligations

Control over consumption of energy resources, input material and production is monitored by a separate unit of the steel mill (Unit for Control and Automation) with a help of different meters all operating in accordance to the national standards of Ukraine and documented in Guiding Metrological Instructions of DIISW. Responsibilities for monitoring are defined in the table below.

Responsibility	**Specialist Responsible**
Overall project responsibility	Chief Engineer
Overall responsibility for Monitoring Report	Technical Department Head
Data for Blast Furnaces	Blast Furnace Shop Manager
Data for Sinter Plant	Sinter Plant Manager
Data for balance of process needs	Head of CHP, Deputy Chief Energy Specialist

The monitoring procedures and responsibilities at DIISW are regulated by STP 230-35-07 *Metrological Support of Measuring Equipment* and national standards, including:
1) *Metrological Product Quality Assurance* (RMI-I-19.0.1-07);
2) Metrological Due Diligence of Documentation (RMI-I-19.0.2-07) and STP 11.02-00 *Organisation and Performance of Metrological Due Diligence of Standards and Technical Documentation;*
3) *Management of Metering Devices* (RMI-I-19.1.1-07).

The procedures for calibration of all monitoring equipment are described in RMI-I.19.0.1-07 and RMI-I.19.1.1-07.

Control of metering process and requirements to metrological support of metering equipment is assured as provided in DSTU 3921.1-1999 (ISO 10012-1:1992) *Requirements to Quality Assurance of Metering Equipment* and DSTU 3921.2- 2000 (ISO 10012-2:1997) *Quality Assurance by Means of Metering Equipment*[21].

The Chief Metrological Specialist (Head of I&C Department) is in charge for maintenance of the monitoring equipment and installations as well as for their accuracy required by

[21] The instructions have been developed in accordance with ISO 9001:2001 requirements. They secure accuracy of all the measurements done using monitoring equipment.

paragraphs 2.1.1, 3.1.1, 7.1 of the Regulation PP 229-Э-056-863/02-2005 *On Metrological Services of the Iron Works*, STP 230-35-07 *Metrological Support of Measuring Equipment*, *Guideline on Plant Metrology Department*, and I.19.0.1-07. In case of defect discovered in the monitoring equipment the actions of the personnel are determined by STP 230-35-07 *Metrological Support of Measuring Equipment*, *Guideline on Plant Metrology Department*, and I.19.0.1-07 (p.5.4.4).

The measurement of the parameters included into the monitoring plan of the project is envisaged by the provisions of the STP 230-35-07 *Metrological Support of Measuring Equipment*, *Guideline on Plant Metrology Department*, and I.19.0.1-07 (paragraph 5.3.2).

The measurements are conducted on continuous basis and automatically according to the STP 230-35-07 Metrological Support of Measuring Equipment and I-19.1.1-07 (p. 5.4).

The data required to be monitored under the proposed JI project was routinely collected within the normal operations of the DIISW. Together with this data collection was an integral part of routine monitoring. Data was compiled in (i) day-to-day records, (ii) quarterly records, and (iii) annual records. Data were collected in the electronic database of PJSC "DIISW" and in printed documents. All records were finally stored in Planning Department.

The results of the measurements are being used by relevant services and technical personnel of the Steel Mill.

The direction of DIISW has organized appropriate staff training to operate the project equipment. With the project equipment introduction the workers of DIISW had the opportunity to update their working skills, stimulated by the permanent educational theoretical and practical courses at the Steel Plant. In the reporting period the following trainings were conducted[22]:

- The course on retraining of personnel in the Blast Furnace shop;
- The course on retraining and professional development of personnel in the Sinter Plant;
- The course on professional development of personnel in the Chief power engineering department together with other seminars related.

[22] The confirming documents are available upon request.

Annex 1: The list of monitoring equipment

Classification number	Explanation	Type of monitoring equipment	Serial number	Frequency of verification (calibration)
1	2	3	4	5
P-3 **B-3**	Scales for weighing pig iron	2390BB-200E/1C	90	Once a year
P-5 **B-5**	BF-1m Natural gas consumption meter	Сапфир-М	02619588	Once in 2 years
P-5 **B-5**	BF-1m Natural gas pressure meter	Сапфир –М	03484802	Once in 2 years
P-5 **B-5**	BF-1m Natural gas consumption meter	Сапфир –М	03981694	Once in 2 years
P-5 **B-5**	BF-1m Natural gas pressure meter	Сапфир –М	02800644	Once in 2 years
P-5 **B-5**	BF-8 Natural gas consumption meter	Сапфир- М	03850732	Once in 2 years
P-5 **B-5**	BF-8 Natural gas pressure meter	Сапфир- М	03393821	Once in 2 years
P-5 **B-5**	BF-8 Natural gas consumption meter	Сапфир- М	03831731	Once in 2 years
P-5 **B-5**	BF-8 Natural gas pressure meter	Сапфир – М	03483807	Once in 2 years
P-5 **B-5**	BF-9 Natural gas consumption meter	Метран-100	66737	Once a year
P-5 **B-5**	BF-9 Natural gas pressure meter	Метран-100	65430	Once a year

P-5 **B-5**	BF-9 Natural gas consumption meter	Метран-100	133425	Once a year
P-5 **B-5**	BF-9 Natural gas pressure meter	Метран-100	135282	Once a year
P-5 **B-5**	BF-12 Natural gas consumption meter	Сафир –М	10612957	Once in 2 years
P-5 **B-5**	BF-12 Natural gas pressure meter	АИР-20	20-31275	Once a year
P-5 **B-5**	BF-12 Natural gas consumption meter	Сапфир –М	07173694	Once in 2 years
P-5 **B-5**	BF-12 Natural gas pressure meter	Сапфир –М	03493886	Once in 2 years
P-8 **B-8**	Electric substation of Blast-furnace shop			
	Electricity meter #9	И670	130180	Once in 2 years
	Electricity meter #10	И43	068744	Once in 2 years
	Electricity meter #11	ИТ	111336	Once in 2 years
	Electricity meter #12	ЕвроАльфа	01132780	Once in 6 years
	Electricity meter #13	ЕвроАльфа	01132784	Once in 6 years
	Electricity meter #14	ЕвроАльфа	01132775	Once in 6 years
	Electricity meter #15	ЕвроАльфа	01132773	Once in 6 years
	Electricity meter #16	ЕвроАльфа	01132770	Once in 6 years
	Electricity meter #17	ЕвроАльфа	0112774	Once in 6 years
	Electricity meter #18	ЕвроАльфа	01132769	Once in 6 years

	Electricity meter #19	ЕвроАльфа	01132774	Once in 6 years
	Electricity meter #20	ЕвроАльфа	01132789	Once in 6 years
	Electricity meter #21	ЕвроАльфа	01132791	Once in 6 years
	Electricity meter #22	ЕвроАльфа	01132768	Once in 6 years
	Electricity meter #23	ЕвроАльфа	01132786	Once in 6 years
	Electricity meter #24	И670	193791	Once in 2 years
	Electricity meter #26	И670	361580	Once in 2 years
	Electricity meter #27	И670	304986	Once in 2 years
	Electricity meter #28	И670	655731	Once in 2 years
	Electricity meter #29	И670	905679	Once in 2 years
P-12 **B-12**	Sinter plant Natural gas consumption meter	Сафир М Сафир М	03939733 03639990	Once in 2 years Once in 2 years
P-12 **B-12**	Sinter plant Natural gas pressure meter		08397518	Once in 2 years
P-12 **B-12**	Sinter plant Natural gas pressure meter	Сапфир 2М	33822	Once a year
P-15 **B-15**	Electric substation of Sinter plant			
	Electricity meter #1	И670	233541	Once in 2 years
	Electricity meter #2	И670	736250	Once in 2 years
	Electricity meter #3	ИТ	113199	Once in 2 years
	Electricity meter #4	И670	429768	Once in 2 years
	Electricity meter #5	И670	232818	Once in 2 years
	Electricity meter #6	И670	946661	Once in 2 years

	Electricity meter #7	И670	130888	Once in 2 years
	Electricity meter #8	ЕвроАльфа	01132785	Once in 6 years
P-15 B-15	Electric substation of Lime shop			
	Electricity meter #69	И43	192130	Once in 2 years
	Electricity meter #70	И670	473710	Once in 2 years
	Electricity meter #71	И670	552166	Once in 2 years
	Electricity meter #72	И670	584132	Once in 2 years
P-18 B-18	Scales for weighing coke and anthracite	2370ВВ-150Е/2С	70	Once a year
P-18 B-18	Scales for weighing coke and anthracite	2329ВВ-50 Е/1Д	29	Once a year
P-21 B-21	Scales for weighing limestone, dolomite and pellets	2370ВВ-150Е/2С	70	Once a year
P-21 B-21	Scales for weighing limestone, dolomite and pellets	2329ВВ-50 Е/1Д	29	Once a year
P-25 B-25	CHP Natural gas consumption meter	Сапфир	517758	Once a year
P-28 B-28	Electric substation of Water supply shop			
	Electricity meter #106	И670	095716	Once in 2 years
	Electricity meter #107	ИТ	691814	Once in 2 years
	Electricity meter #108	И670Д	363453	Once in 2 years

	Electricity meter #109	И670	273014	Once in 2 years
	Electricity meter #110	И670	771697	Once in 2 years
	Electricity meter #111	И670	006144	Once in 2 years
	Electricity meter #112	И43	047260	Once in 2 years
	Electricity meter #113	И670	355820	Once in 2 years
	Electricity meter #114	И670	146522	Once in 2 years
	Electricity meter #115	И670	366136	Once in 2 years
	Electricity meter #116	И670М	644511	Once in 2 years
	Electricity meter #117	И670М	643487	Once in 2 years
	Electricity meter #118	И670	793273	Once in 2 years
	Electricity meter #119	И670	350061	Once in 2 years
	Electricity meter #120	И43	237322	Once in 2 years
	Electricity meter #121	И670	155427	Once in 2 years
	Electricity meter #122	И670М	130498	Once in 2 years
	Electricity meter #123	И670	649492	Once in 2 years
	Electricity meter #124	И670	193831	Once in 2 years
	Electricity meter #125	И670М	011918	Once in 2 years
	Electricity meter #126	И670	303419	Once in 2 years
	Electricity meter #127	ИТ	690221	Once in 2 years
	Electricity meter #128	И670	233827	Once in 2 years
	Electricity meter #129	И670М	096018	Once in 2 years
	Electricity meter #130	И670	305171	Once in 2 years

	Electricity meter #131	И670	377759	Once in 2 years
	Electricity meter #132	И670	188830	Once in 2 years
	Electricity meter #133	И670	192034	Once in 2 years
	Electricity meter #136	И670	157142	Once in 2 years
	Electricity meter #137	И670	082160	Once in 2 years
	Electricity meter #138	И670М	095620	Once in 2 years
	Electricity meter #139	И670М	506019	Once in 2 years
Р-28 В-28	Electric substation of Oxygen shop			
	Electricity meter #142	И670	754749	Once in 2 years
	Electricity meter #143	И670	201587	Once in 2 years
	Electricity meter #145	И670	869032	Once in 2 years
	Electricity meter #146	И670М	157116	Once in 2 years
	Electricity meter #147	И670	233755	Once in 2 years
	Electricity meter #148	И670М	036772	Once in 2 years
	Electricity meter #149	И670М	062944	Once in 2 years
	Electricity meter #150	И670	6199445	Once in 2 years
	Electricity meter #151	И670	919610	Once in 2 years
	Electricity meter #152	ЕТ	8876	Once in 6 years
	Electricity meter #153	ЕТ	8875	Once in 6 years
Р-28 В-28	Electric substation of Gas shop			
	Electricity meter #166	И670	690556	Once in 2 years

	Electricity meter #167	И670	154625	Once in 2 years
	Electricity meter #168	И670	232756	Once in 2 years
	Electricity meter #169	И670	134849	Once in 2 years
	Electric substation of CHP			
	Electricity meter #154	И670	079187	Once in 2 years
	Electricity meter #155	И670	374202	Once in 2 years
	Electricity meter #156	ИТ	313176	Once in 2 years
	Electricity meter #157	И670	115317	Once in 2 years
	Electricity meter #158	И670	754589	Once in 2 years
	Electricity meter #159	И670	923320	Once in 2 years
	Electricity meter #160	И43	30678	Once in 2 years
	Electricity meter #161	И670	130468	Once in 2 years
	Electricity meter #162	И670	722744	Once in 2 years
	Electricity meter #163	И670	603211	Once in 2 years
	Electricity meter #164	И670	366162	Once in 2 years