FIRST PERIODIC JI MONITORING REPORT

Version 3.1
16 November 2009

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SECTION A. General Project activity information

A.1 Title of the project activity:

"Improvement of the Energy efficiency at Energomashspetsstal (EMSS), Kramatorsk, Ukraine".

A.2. JI registration number:

JI 0104

A.3. Short description of the project activity:

The project activity consists of the energy efficiency measures at the premises of EMSS by the implementation of four subprojects:

Subproject 1. Reconstruction of thermal and heating furnaces – there are 35 thermal and heating furnaces in operation in different shops at the premises of EMSS. The main goal of this subproject is the reduction of the natural gas (NG) consumption on 26 of these furnaces by commissioning of new automated NG burners (this enables to maintain the required temperature inside of the furnace) and by implementation of new thermal insulation for the walls, front doors and roofs of the furnaces.

Subproject 2. Installation of a new vacuum system – Installation of a new vacuum system for the vacuumed steel production. The old vacuum system used heat and electricity. The reconstructed vacuum system uses only electricity.

Subproject 3. Installation of an arc ladle furnace – New arc ladle furnace is installed for the steel production. This means that the part of the process of the steel preparation doing in the ladle from which the steel will be cast into the forms. As a result there is reduction of the electricity consumption.

Subproject 4. Modernization of press equipment – Replacing the old pump system, serving the 15,000 ton press, with a new one, more effective pump system. The number of old pumps is 24 (with 500 kW installed capacity each), and the number of new pumps will be 11 (with 800 kW installed capacity each).

A.4. Monitoring period:

- Monitoring period starting date: 01.01.2008 at 00:00;
- Monitoring period closing date: 31.12.2008 at 24:00.

A.5. Methodology applied to the project activity (incl. version number):

A.5.1. Baseline methodology: The "Guidance on criteria for baseline setting and monitoring", issued by the Joint Implementation Supervisory Committee allows using approved methodologies of the CDM. The PDD, determined by an AIE, used a JI project specific approach to establish baseline scenario.

A.5.2. Monitoring methodology: A JI-specific monitoring approach was developed for this project in line with the "Guidance on criteria for baseline setting and monitoring". The resulting Monitoring Plan was determined as part of the determination process.

A.6. Status of implementation including time table for major project parts:

The project implementation schedule has faced some delays:

- SP1. Heating and thermal furnaces were commissioned with delay compared to the schedule. One of the furnaces (namely, heating furnace #18) was put into operation ahead of schedule;
- SP2. A new vacuum system was put into operation at end of the February 2008 only. That is why ERs of this subproject have been generated since March of 2008;
- SP4. Press was commissioned at the end of August 2008. So, emission reductions for this subproject were generated since September 2008.

Activity	**Date of start up according to PDD**	**Date of start up actual**
Subproject 1. Reconstruction of thermal and heating furnaces		
Thermal #1, Thermal workshop	2006	2006
Thermal #2, Thermal workshop	2006	2006
Thermal #9, Thermal workshop	2006	2006
Thermal #10, Thermal workshop	2006	2006
Thermal #30, Forge Press workshop	April 2008	May 2008
Thermal #18, Forge Press workshop	July 2008	December 2008
Heating #7, Forge Press Workshop	July 2008	October 2008
Heating #8, Forge Press Workshop	2007	2007
Heating #9, Forge Press Workshop	2007	2007
Heating #10, Forge Press Workshop	2007	February 2008
Subproject 2. Installation of a new vacuum system	May 2007	February 2008
Subproject 3. Installation of an arc ladle furnace	April 2007	April 2007
Subproject 4. Modernization of press equipment	December 2007	August 2008

Table 1: Status of implementation (according to PDD)

A.7. Intended deviations or revisions to the determined PDD:

There are no deviations to the determined PDD.

A.8. Intended deviations or revisions to the determined monitoring plan:

There are no deviations to the determined monitoring plan.

A.9. Changes since last verification:

Not applicable

A.10. Person(s) responsible for the preparation and submission of the monitoring report:

OJSC "Energomashspetsstal"

- Alexander Masyuk, Deputy Chief Engineer

Global Carbon B.V.

- Lennard de Klerk, Director
- Oleg Bulany, Senior JI Consultant

SECTION B. Key monitoring activities according to the monitoring plan for the monitoring period stated in A.4.

Key monitoring activities for each subproject could be described as follows.

Subproject 1. Reconstruction of thermal and heating furnaces. Each reconstructed furnace has a natural gas flow meter with pressure and temperature sensors in order to calculate normal cubic meters of natural gas burned in the furnace. Information from flow meters, pressure and temperature sensors are transmitting to the control and monitoring computer system. The computer system calculates natural gas consumption into normal cubic meters since the end of 2008. So, recalculating from m^3 to the Nm^3 was done manually (see Table 10) based on standardized methodology. All information about technological process is saved continuously. The archiving period for the log files is at least one year. Information that corresponds to the natural gas consumption in 2008 has been burned on CDs. These CDs are stored until the end of crediting period plus two years.

Every half-finished product that processes through the furnaces has his own unique certificate. This certificate reflects all operations performed on the product and the weight on the exit of every workshop. So, the weight of half-finished products, that proceed through each furnace, could be easily monitored. Information from the certificates is saved in the log books in order to simplify the monitoring process.

A report including natural gas consumption and weight of half finished products is generating on a monthly basis. The report is signing by Head of Energy Saving Department, Head of corresponding workshop and approved by Chief Engineer.

Every furnace has specific natural gas consumption factor. This factor is using for the daily basis meter's checking procedure. In case specific natural gas consumption is deviate from the factor, furnace is shutting down for the checking procedures.

The flowcharts of the natural gas supplying system with the metering points are presented in the following figures.

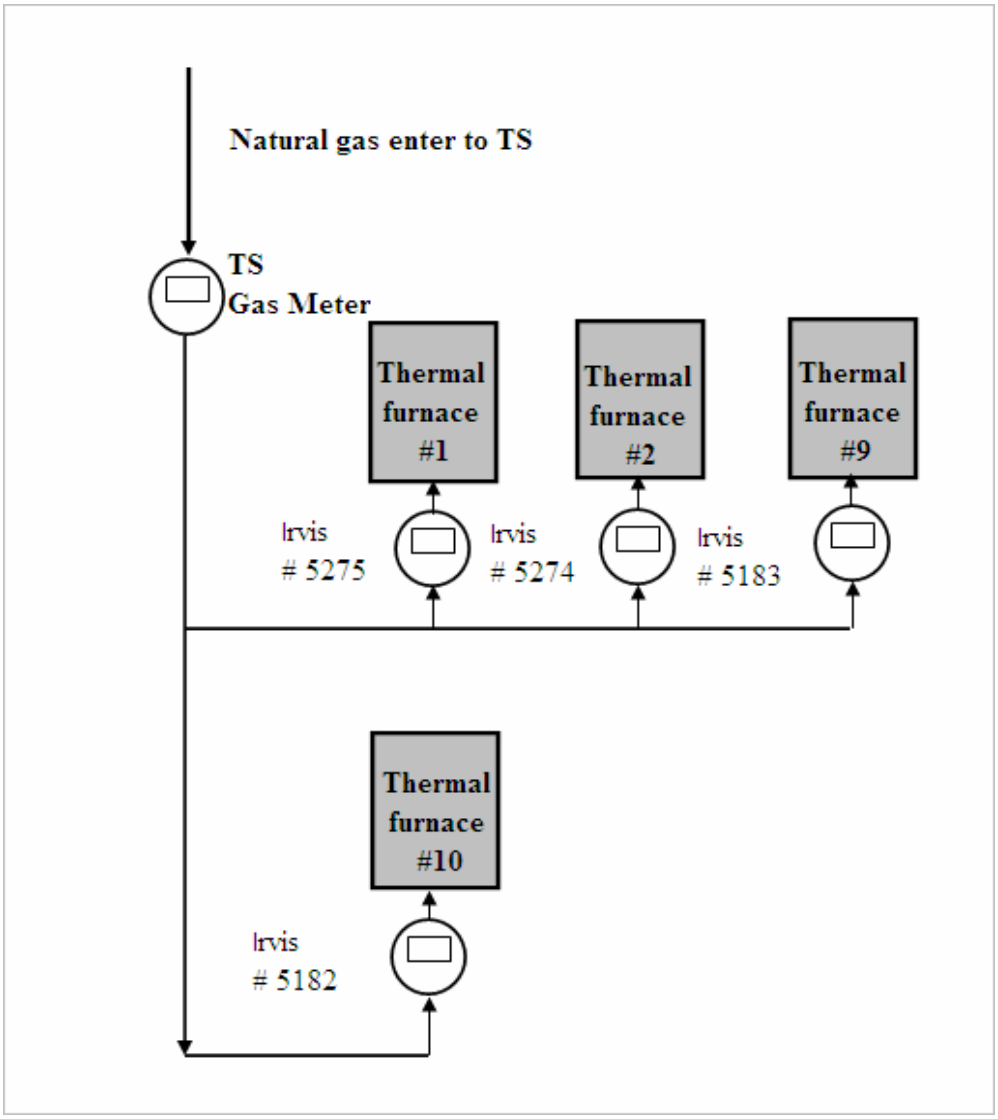


Figure 1. Natural gas metering system at the thermal workshop (TS)

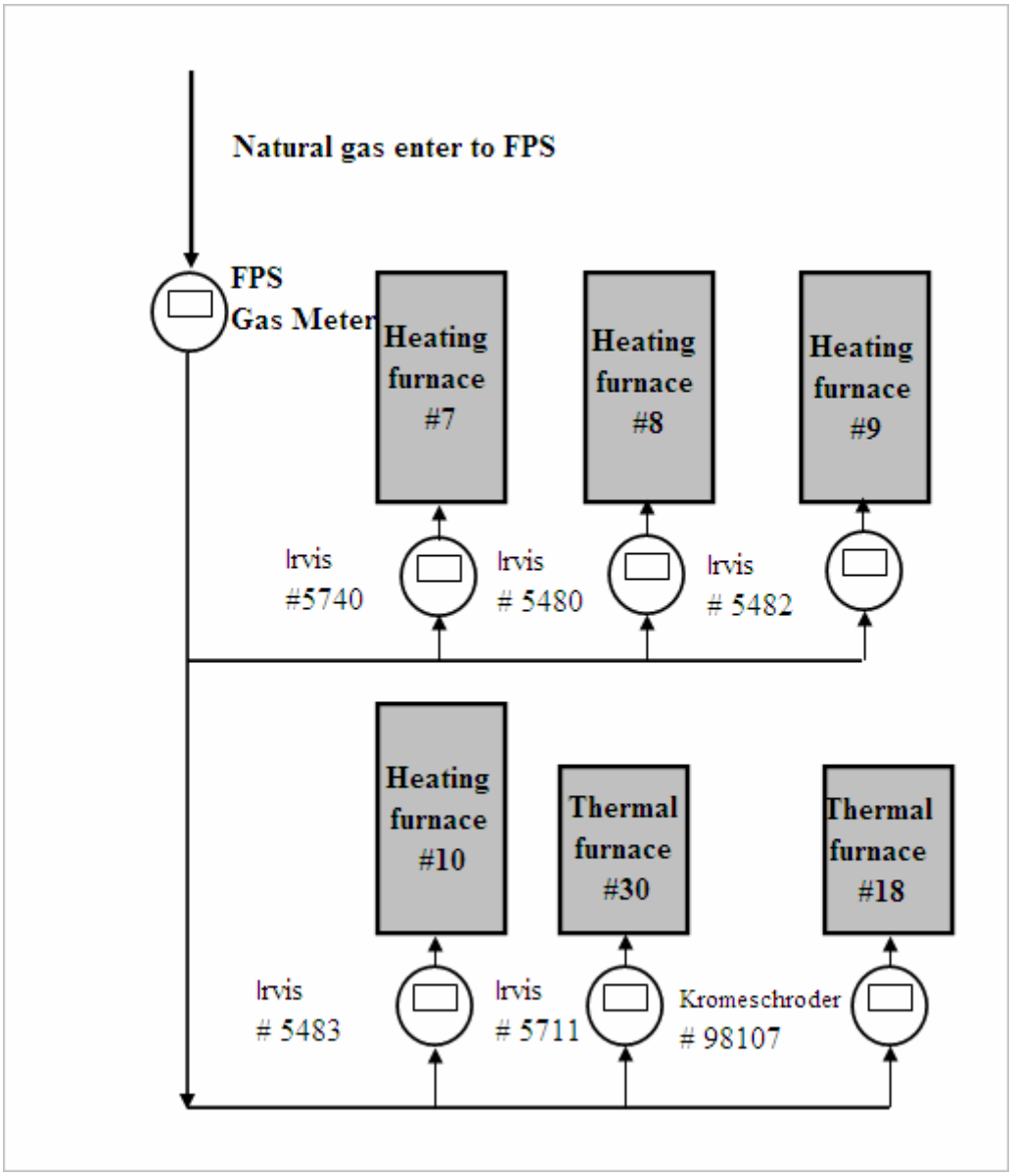


Figure 2. Natural gas metering system at Forge Press workshop (FPS)

Subproject 2. Installation of a new vacuum system.
Electricity that is consumed during the vacuum process is metered by meters, dedicated especially for this system. Information from meters is coming to the control and monitoring computer system of the vacuumator. A computer system records information about every vacuumation session, including melt passport, time and electricity consumption. The archiving period for the log files is at least one year. Information that corresponds to the electricity consumption in 2008 has been burned on CDs. These CDs are stored until the end of crediting period plus two years.

The vacuumator has a specific electricity consumption factor. In case the electricity consumption is deviating from the factor, the facility is shutting down to perform troubleshooting procedures.

The steel to the vacuum degasser (VD) coming either from ladle furnace (LF) or from the electric arc furnace (EAF) in special ladle. Each ladle with liquid steel has unique certificate of melt. The following figure presents the electricity supplying system to the VD with metering points.

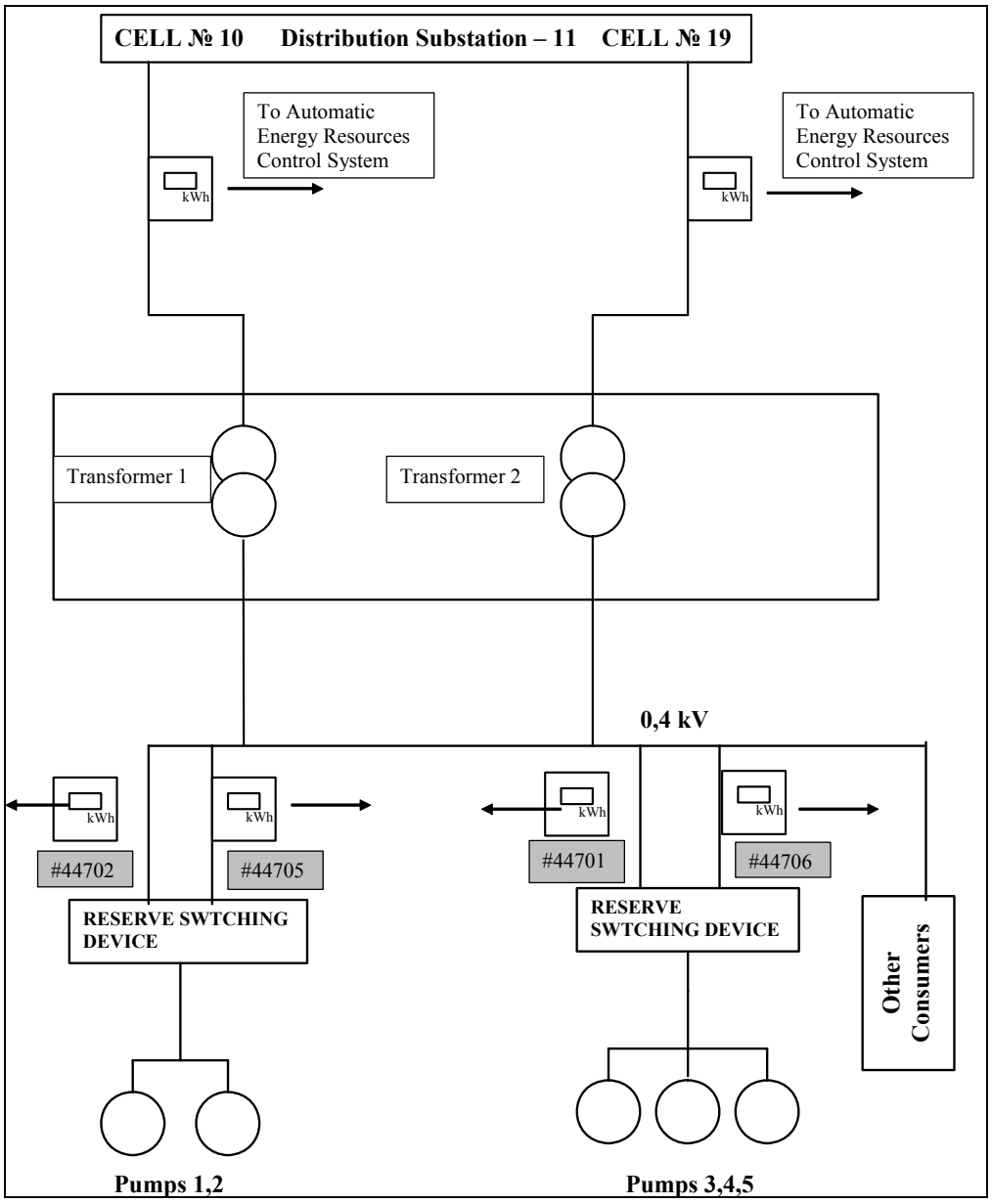


Figure 3. Electricity metering system at VD

Subproject 3. Installation of an arc ladle furnace.
LF is a comprehensive solution for high quality steel melting has been installed in the Steel Making Workshop (SMW). The main electricity consumers of the SMW are powered by the following scheme.

Close Distribution Unit (CDU) #1,2 are electricity powering points for the EAFs (EAF50 #1, EAF100 #3, EAF100 #5 and EAF12) and LF. CDUs are powering from Transformers (T1, and T2) and Autotransformers (AT1 and AT2). EAFs and LF could be powered from any of the Transformers or Autotransformers. Commercial electricity meters are installed on each of the Transformers and Autotransformer. Cross-checking of the meters is performed by the following formulae:

$$\sum(AT1+ AT2 +T1 + T2) - \sum(EAF50\ \#1 + EAF100\ \#3 + EAF100\ \#5+ EAF12+LF) \leq 1.5\%$$

In case difference is more than 1.5%, verification of meters is performed. The defective meter is substituted within one day.

The data from electricity meters concerning electricity consumption is transmitted to the control and monitoring computer system continuously. The computer system records information about each melt process, including melt certificate. This certificate includes information about the number of EAF where steel was melted, steel content, amount of electricity consumed during melting and weight of steel. The archiving period for the log files is at least one year. All melt certificates for the year 2008 has been burned to CDs. These CDs are stored until the end of crediting period plus two years.

The following figure presents electricity supplying system with metering points.

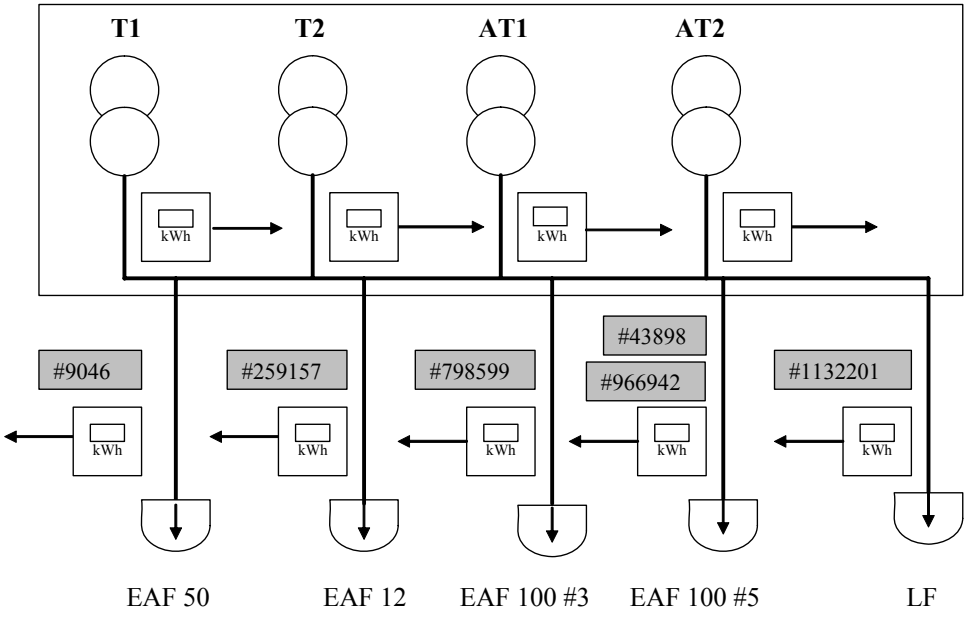


Figure 4. Electricity metering system at EAFs and LF

Subproject 4. Modernization of press equipment.
Serving motors of the press pump station are powered from the 6kV line. Substation 110/6 kV has two transformers. Each transformer has a commercial electricity meter. There are some addition consumers on the 6kV line. The check of meters is performed using the following formulae:

$\sum(Tp1+Tp2) - \sum(Consumers+Pump\ Station) \leq 1.5\%$

In case difference is more than 1.5%, verification of meters is performing. Defective meter is substituted within one day.

All data concerning electricity consumption is transmitted to the control and monitoring computer system. The press has a special registry log book, where working time of press is logged, among other data. The following figure presents electricity supplying system of the press with metering points.

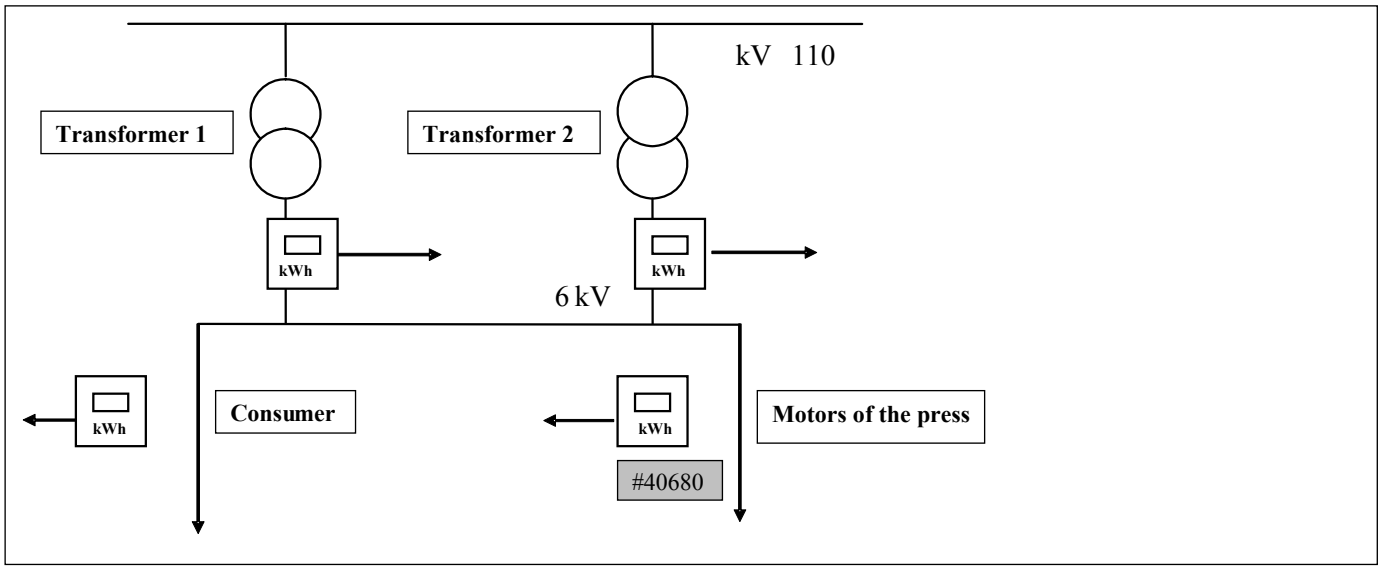


Figure 5. Electricity metering system at press

The control and monitoring system can be divided into an electrical part, a gas part and steel weight part.

Electrical measurements
For the purpose of monitoring the emission reductions the following parameters are measured:

- Electricity consumption at EAFs;
- Electricity consumption at LF;
- Electricity consumption at VD;
- Electricity consumption at press' pump station.

Natural gas measurements
For the purpose of monitoring the emission reductions the following parameters are measured:

- Natural gas consumption, temperature and pressure at ten reconstructed heating and thermal furnace.

Steel weight measurement
For the purpose of monitoring the emission reductions the following parameters are measured:

- Weight of steel proceeded through the LF;
- Weight of steel proceeded through the VD;
- Weight of half-finished products proceeded through reconstructed heating and thermal furnaces.

B.1. Monitoring equipment types

1. Electricity meters "Energia -9"
2. Electricity meters "SA ZU-I670M"
3. Electricity meters "EuroAlfha"
4. Natural gas flow meters "IRVIS - K - 300"
5. Natural gas flow meter "Kromeschroder"
6. Natural gas temperature meters "TSMU 274-05"
7. Natural gas temperature meters "TSPU - 205"
8. Natural gas pressure meters "Metran 100 DI"
9. Natural gas pressure meter "Metran 55Ex Da"
10. Weighing machine "ErMack-Vk1rk-10"
11. Weighing machine "ErMack-Vk1rk-20"
12. Weighing machine "ErMack-Vk1rk-50"

13. Weighing machine "ErMack-Vk1rk-80"
14. Weighing machine "02VPT-200MC"

B.1.2. Table providing information on the equipment used (incl. manufacturer, type, serial number, date of installation, date of last calibration, information to specific uncertainty, need for changes and replacements):

The control and monitoring system can be divided into an electrical part, a natural gas part and a steel weight part.

Electrical measurements

For the purpose of monitoring the emission reductions the following parameters are measured:

- Electricity consumption at EAFs;
- Electricity consumption at LF;
- Electricity consumption at VD;
- Electricity consumption at press' pump station.

ID of the meter	Measuring parameter	Work parameter	Type	Serial number	Level of accuracy	Date of installation	Electricity consumed 1.01.2008-31.12.2008	Date of last calibration	Date of next calibration.	Remarks
EL1	Electricity consumption at EAF50	MWh	Energia 9	9046	0.2%	2007	42390.586	27.05.2003	27.05.2009	
EL2	Electricity consumption at EAF100 #3	kWh	SA ZU-I670M	798599	2%	2003	804.7	14.01.2008	14.01.2012	
EL3	Electricity consumption at EAF100 #5	kWh	SA ZU-I670M	966942	2%	2003	278.6	12.09.2006	12.09.2010	There was the major overhaul of the EAF100 #5 in 2008. This meter was dismantled during overhaul.
EL4	Electricity consumption at EAF100 #5	kWh	Energia 9	43898	0.2%	10.08.2008	214.193	31.01.2008	30.01.2014	This meter has been installed during overhaul of the EAF.
EL5	Electricity consumption at LF	kWh	EuroAlfha	1132201	0.5%	2007	374.603	25.09.2006	25.09.2012	
EL6	Electricity consumption at VD	kWh	Energia 9	44701	0.2%	2008	437.671	28.02.2008	28.02.2012	
EL7	Electricity consumption at VD	kWh	Energia 9	44702	0.2%	2008	39.121	28.02.2008	28.02.2012	

ID of the meter	Measuring parameter	Work parameter	Type	Serial number	Level of accuracy	Date of installation	Electricity consumed 1.01.2008-31.12.2008	Date of last calibration	Date of next calibration.	Remarks
EL8	Electricity consumption at VD	kWh	Energia 9	44705	0.2%	2008	58.232	28.02.2008	28.02.2012	
EL9	Electricity consumption at VD	kWh	Energia 9	44706	0.2%	2008	546.838	28.02.2008	28.02.2012	
EL10	Electricity consumption at press	kWh	Energia 9	40680	0.2%	26.08.2008	89.389	09.2006	09.2012	

Table 2: List of electric meters

Electric current provided to the EAFs and LF has so high parameters (more then 5A), that could not be measured directly. The current parameters decreased through the transformers and measured. The following table presents list of transformers using in the electric current measuring.

ID of transformer	Transforming parameter	Work parameter	Type	Serial number	Level of accuracy	Transformation factor	Date of last calibration	Date of next calibration
TR1	Current at EAF50	A	TPOL-35	11	0.5%	600/5	13.05.2009	13.05.2013
TR2	Current at EAF50	A	TPOL-35	37	0.5%	600/5	13.05.2009	13.05.2013
TR3	Voltage at EAF50	V	ZNOM-35	1138121	0.5%	35000/100	13.05.2009	13.05.2013
TR4	Voltage at EAF50	V	ZNOM-35	1138211	0.5%	35000/100	13.05.2009	13.05.2013
TR5	Voltage at EAF50	V	ZNOM-35	1120877	0.5%	35000/100	13.05.2009	13.05.2013
TR6	Current at EAF100 #3	A	TPOL-35	113	0.5%	600/5	13.05.2009	13.05.2013
TR7	Current at EAF100 #3	A	TPOL-35	13	0.5%	600/5	13.05.2009	13.05.2013
TR8	Voltage at EAF100 #3	V	ZNOM-35	854859	0.5%	35000/100	13.05.2009	13.05.2013
TR9	Voltage at EAF100 #3	V	ZNOM-35	854965	0.5%	35000/100	13.05.2009	13.05.2013
TR10	Voltage at EAF100 #3	V	ZNOM-35	849517	0.5%	35000/100	13.05.2009	13.05.2013
TR11	Current at EAF100 #5	A	TPOL-35	351	0.5%	1000/5	13.05.2009	13.05.2013
TR12	Current at EAF100 #5	A	TPOL-35	458	0.5%	1000/5	13.05.2009	13.05.2013
TR13	Voltage at EAF100 #5	V	ZNOM-35	1284276	0.5%	35000/100	13.05.2009	13.05.2013
TR14	Voltage at EAF100 #5	V	ZNOM-35	1355405	0.5%	35000/100	13.05.2009	13.05.2013

ID of transformer	Transforming parameter	Work parameter	Type	Serial number	Level of accuracy	Transformation factor	Date of last calibration	Date of next calibration
TR15	Voltage at EAF100 #5	V	ZNOM-35	1213200	0.5%	35000/100	13.05.2009	13.05.2013
TR16	Current at LF	A	TPU 7051	5105040894	0.5%	500/5	13.05.2009	13.05.2013
TR17	Current at LF	A	TPU 7051	5105040895	0.5%	500/5	13.05.2009	13.05.2013
TR18	Current at LF	A	TPU 7051	5105040896	0.5%	500/5	13.05.2009	13.05.2013
TR19	Voltage at LF	V	ZNOM-35	1168572	0.5%	35000/100	13.05.2009	13.05.2013
TR20	Voltage at LF	V	ZNOM-35	1427592	0.5%	35000/100	13.05.2009	13.05.2013
TR21	Voltage at LF	V	ZNOM-35	1279988	0.5%	35000/100	13.05.2009	13.05.2013
TR22	Current at VD	A	T-0.66-1	21387	0.5%	600/5	13.05.2009	13.05.2013
TR23	Current at VD	A	T-0.66-1	19132	0.5%	600/5	13.05.2009	13.05.2013
TR24	Current at VD	A	T-0.66-1	21526	0.5%	600/5	13.05.2009	13.05.2013
TR25	Current at VD	A	T-0.66-1	83614	0.5%	600/5	13.05.2009	13.05.2013
TR26	Current at VD	A	T-0.66-1	21837	0.5%	600/5	13.05.2009	13.05.2013
TR27	Current at VD	A	T-0.66-1	19100	0.5%	600/5	13.05.2009	13.05.2013
TR28	Current at VD	A	T-0.66-1	19687	0.5%	600/5	13.05.2009	13.05.2013
TR29	Current at VD	A	T-0.66-1	21888	0.5%	600/5	13.05.2009	13.05.2013
TR30	Current at press	A	TPLM-10	03051	0.5%	1500/5	13.05.2009	13.05.2013
TR31	Voltage at press	V	NTMI-6-66-UZ	412	0.5%	6000/100	13.05.2009	13.05.2013

Table 3: List of transformers

Natural gas measurements

For the purpose of monitoring the emission reductions the following parameters are measured:

- Natural gas consumption at ten reconstructed heating and thermal furnace.

ID of meter	Measuring parameter	Work parameter	Type	Serial number	Level of accuracy	Date of installation	NG consumed 1.01.2008-31.12.2008	Date of last calibration	Date of next calibration
NG1	Consumption of the NG at thermal furnace #1, TS	m^3	IRVIS - K - 300	5274	1%	01.2007	1042218	05.03.2008	05.03.2010
NG2	Consumption of the NG at thermal furnace #2, TS	m^3	IRVIS - K - 300	5275	1%	01.2007	942240	05.03.2008	05.03.2010
NG3	Consumption of the NG at thermal furnace #9, TS	m^3	IRVIS - K - 300	5182	1%	01.2006	471098	05.03.2008	05.03.2010
NG4	Consumption of the NG at thermal furnace #10, TS	m^3	IRVIS - K - 300	5183	1%	01.2006	399720	05.03.2008	05.03.2010
NG5	Consumption of the NG at thermal furnace #7, FPS	m^3	IRVIS - K - 300	5740	1%	10.2008	504914	08.02.2008	08.02.2010
NG6	Consumption of the NG at thermal furnace #8, FPS	m^3	IRVIS - K - 300	5480	1%	12.2007	1090192	20.02.2009	20.02.2011
NG7	Consumption of the NG at thermal furnace #9, FPS	m^3	IRVIS - K - 300	5482	1%	12.2007	1808234	20.02.2009	20.02.2011
NG8	Consumption of the NG at thermal furnace #10, FPS	m^3	IRVIS - K - 300	5483	1%	12.2007	1634327	20.02.2009	20.02.2011
NG9	Consumption of the NG at thermal furnace #30, FPS	m^3	IRVIS - K - 300	5711	1%	05.2007	682350	17.10.2007	17.10.2009
NG10	Consumption of the NG at thermal furnace #18, FPS	m^3	Kromeschroder DM 650 Z150-40	98107	1.5%	03.2008	35287	24.03.2008	24.03.2010

Table 4: List of natural gas meters

Natural gas meters measuring gas flow in the m^3. To convert measuring value to Nm^3, temperature and pressure meters are used. The following tables present temperature and pressure meters.

ID of meter	Measuring parameter	Work parameter	Type	Serial number	Level of accuracy	Date of installation	Date of last calibration	Date of next calibration
TP1	Temperature of the NG at thermal furnace #1, TS	Cº	TSMU 274-05	655358	0.5%	09.2008	16.09.2008	16.09.2009
TP2	Temperature of the NG at thermal furnace #2, TS	Cº	TSMU 274-05	655355	0.5%	09.2008	16.09.2008	16.09.2009
TP3	Temperature of the NG at thermal furnace #9, TS	Cº	TSMU 274-05	655359	0.5%	09.2008	14.07.2008	14.07.2009
TP4	Temperature of the NG at thermal furnace #10, TS	Cº	TSMU 274-05	655363	0.5%	09.2008	14.07.2008	14.07.2009
TP5	Temperature of the NG at thermal furnace #7, FPS	Cº	TSMU 274-05	655354	0.5%	09.2008	14.07.2008	14.07.2009
TP6	Temperature of the NG at thermal furnace #8, FPS	Cº	TSMU 274-05	655362	0.5%	09.2008	14.07.2008	14.07.2009
TP7	Temperature of the NG at thermal furnace #9, FPS	Cº	TSPU - 205	8360	0.008t	09.2008	23.09.2008	23.09.2009

TP8	Temperature of the NG at thermal furnace #10, FPS	Cº	TSPU - 205	8362	0.008t	09.2008	23.09.2008	23.09.2009
TP9	Temperature of the NG at thermal furnace #30, FPS	Cº	TSPU - 205	8365	0.008t	09.2008	23.09.2008	23.09.2009
TP10	Temperature of the NG at thermal furnace #18, FPS	Cº	TCMU – 274-05	655360	0.008t	07.2008	14.07.2008	14.07.2009

Table 5: List of temperature meters

ID of meter	Measuring parameter	Work parameter	Type	Serial number	Level of accuracy	Date of installation	Date of last calibration	Date of next calibration
PR1	Pressure of the NG at thermal furnace #1, TS	kPa	Metran 100 DI	274538	0.5%	01.2007	5.12.2008	5.12.2009
PR2	Pressure of the NG at thermal furnace #2, TS	kPa	Metran 100 DI	275890	0.5%	01.2007	5.12.2008	5.12.2009
PR3	Pressure of the NG at thermal furnace #9, TS	kPa	Metran 100 DI	241764	0.5%	01.2006	25.05.2009	26.05.2010
PR4	Pressure of the NG at thermal furnace #10, TS	kPa	Metran 100 DI	241763	0.5%	01.2006	25.05.2009	26.05.2010
PR5	Pressure of the NG at thermal furnace #7, FPS	kPa	Metran 100 DI	422353	0.5%	10.2008	29.08.2008	29.08.2009
PR6	Pressure of the NG at thermal furnace #8, FPS	kPa	Metran 100 DI	376707	0.5%	12.2007	9.03.2009	9.03.2010
PR7	Pressure of the NG at thermal furnace #9, FPS	kPa	Metran 100 DI	000088	0.5%	12.2007	2.04.2009	2.04.2010
PR8	Pressure of the NG at thermal furnace #10, FPS	kPa	Metran 100 DI	000087	0.5%	12.2007	10.02.2009	10.02.2010
PR9	Pressure of the NG at thermal furnace #30, FPS	kPa	Metran 100 DI	387352	0.5%	05.2007	18.02.2009	18.02.2010
PR10	Pressure of the NG at thermal furnace #18, FPS	kPa	Metran 55 Ex DA	461211	0.25%	05.2008	19.05.2009	19.05.2010

Table 6: List of pressure meters

Steel weight measurement

For the purpose of monitoring the emission reductions the following parameters are measured:

- Weight of steel proceeded in the Electro Steel Melting Workshop;
- Weight of half-finished products proceeded through reconstructed heating and thermal furnaces.

ID of weighing machine	Measuring parameter	Work parameter	Type	Serial number	level of accuracy	Date of installation	Date of last calibration	Date of next calibration
WM1	Weight of half-finished products of FPS	t	ErMack-Vk1rk-10	0115047	6kg	2005	11.12.2008	11.12.2009
WM2	Weight of half-finished products of TS	t	ErMack-Vk1rk-20	205122	15kg	2005	30.01.2009	30.01.2010
WM3	Weight of half-finished products of TS	t	ErMack-Vk1rk-50	506149	60kg	2006	11.12.2008	11.12.2009
WM4	Weight of half-finished products of FPS	t	ErMack-Vk1rk-80	806148	150kg	2006	11.12.2008	11.12.2009
WM5	Weight of steel melted at LF	t	01VKT-200M	222	2kg	2007	20.11.2008	20.11.2009

Table 7: List of weighting machines

B.1.3. Calibration procedures

For Electricity Meters:

QA/QC procedures	Body responsible for calibration and certification
Calibration interval of such meters is 4 years for the meters produced before 01.01.1988 and 6 years for the meters produced after 01.01.1988.	Ukrainian Centre for Standardization and Metrology

For Natural Gas Meters

QA/QC procedures	Body responsible for calibration and certification
Calibration interval of such meters is 2 years.	Ukrainian Centre for Standardization and Metrology

For temperature meters

QA/QC procedures	Body responsible for calibration and certification
Calibration interval of such meters is 1 year.	Ukrainian Centre for Standardization and Metrology

For pressure meters

QA/QC procedures	Body responsible for calibration and certification
Calibration interval of such meters is 1 year.	Ukrainian Centre for Standardization and Metrology

For weighting machines:

QA/QC procedures	Body responsible for calibration and certification
Calibration interval of such meters is 1 year.	Ukrainian Centre for Standardization and Metrology

For transformers:

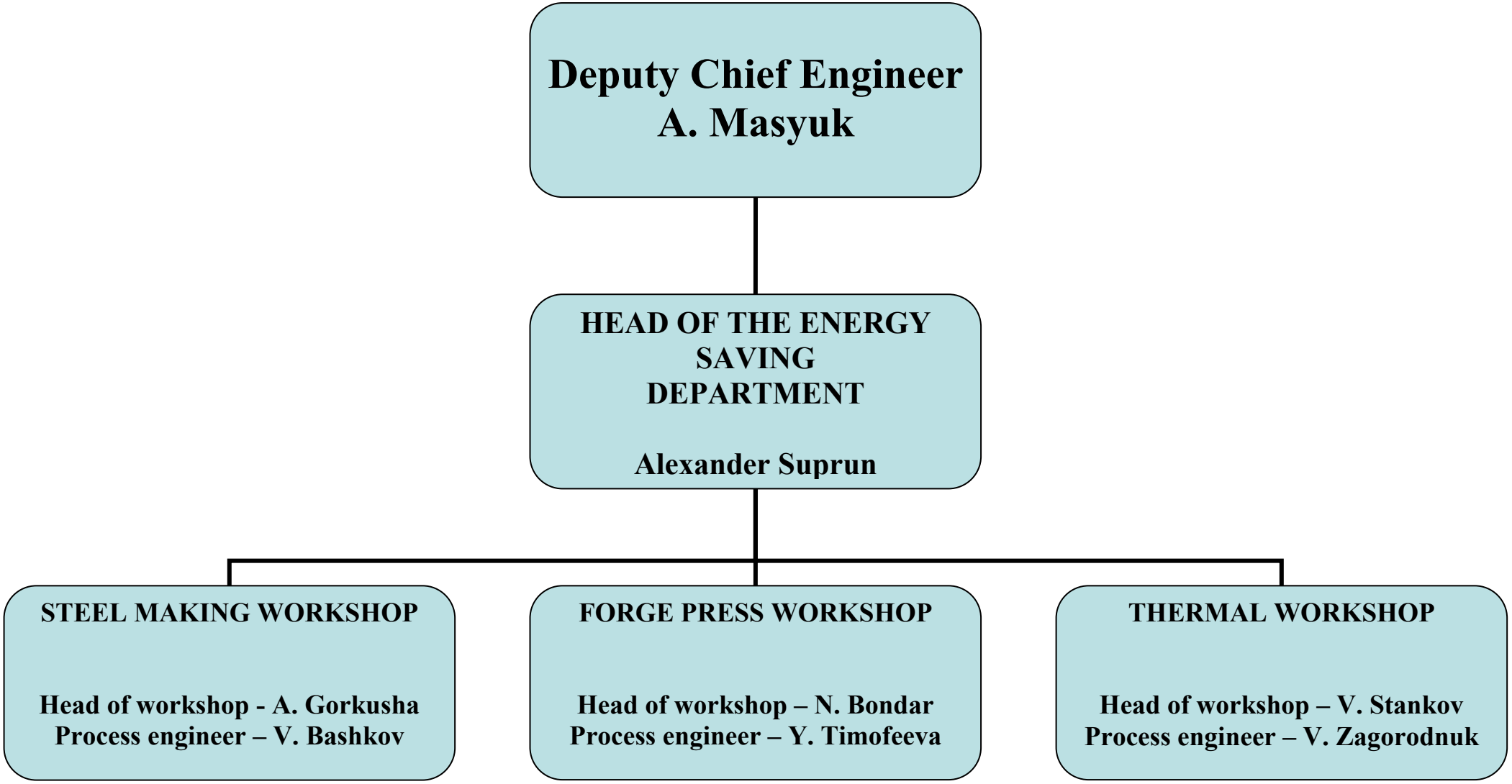
QA/QC procedures	Body responsible for calibration and certification
Calibration interval of such meters is 4 years.	Ukrainian Centre for Standardization and Metrology

B.1.4. Involvement of Third Parties:

Ukrainian Centre for Standardization and Metrology.

B.2. Data collection (accumulated data for the whole monitoring period):

The operational and management structure of the project see PDD**,** *Flowchart D.3.1: Responsibilities within the monitoring team.*


Deputy Chief Engineer
A. Masyuk
HEAD OF THE ENERGY SAVING DEPARTMENT
Alexander Suprun
STEEL MAKING WORKSHOP
Head of workshop - A. Gorkusha
Process engineer – V. Bashkov
FORGE PRESS WORKSHOP
Head of workshop – N. Bondar
Process engineer – Y. Timofeeva
THERMAL WORKSHOP
Head of workshop – V. Stankov
Process engineer – V. Zagorodnuk

B.2.1. List of fixed default values and ex-ante baseline factors:

Data variable	Source of data	Data unit	Comment
EF_{NG}, emission factor of the NG burning process	IPCC 2006	tCO2/MWh	IPCC 2006 default value = 0.202 tCO2/MWh.
$EF_{el,y}$, emission factor of the Ukrainian grid for reducing project	See Annex 4 of PDD	tCO2/MWh	= 0.896 tCO2/MWh

Table 8: Project fixed default values

Data variable	Source of data	Data unit	Comment
EF_{Coal}, emission factor for local (anthracite) coal burning	IPCC 2006	tCO2/MWh	IPCC 2006 default value = 0.353 tCO2/MWh
$EF_{el,y}$, emission factor of the Ukrainian grid for reducing project	See Annex 4	tCO2/MWh	= 0.896 tCO2/MWh

Table 9:Baseline fixed default values

Data variable	Source of data	Data unit	Comment
$SPNG_{tf}$, the baseline ex-ante specific NG consumption of the 26 reconstructed furnaces	Baseline information	1000nm3/t steel	See PDD, Table A2.1 for more detailed information
SPH_{VD}, the baseline ex ante specific heat consumption of the old VD	Baseline three years information	MWh/t	See PDD, Table A2.2 for more detailed information
$SPEL_{VD}$, baseline ex ante specific electrical consumption of the old VD	Baseline information	MWh/t	=0.000028 MWh/t steel
$SPEL_{ES}$, baseline ex ante specific consumption of electricity per tone of electro steel	Baseline three years information	MWh/t	See PDD, Table A2.3 for more detailed information
EL_{MOT}, installed capacity of the press' serving motors before reconstruction	Project design documentation	MW	It was 24 motors, 500kW each. So, EL_{MOT} =12MW

Table 10:Baseline ex-ante factors

B.2.2. List of variables:

The list of variables was defined in the PDD (Section D) in order to calculate ERs in a proper way. Some of variables could not be monitored directly, so data from the meters should be adjusted by appointed correction factors. The following table establishes the link between data from the meters and corresponding variables.

Data variable	Data unit	Method of calculation	Meters used for calculation
$NG_{tf,y}$, quantity of NG, used by the 26 reconstructed furnaces	1,000 Nm^3	$NG_{tf,y} = m^3 \times \frac{P \times T_N}{P_N \times T \times K \times 1000}$, Where: m^3 = volume of NG at working condition, m^3; P = pressure of NG at working condition, MPa; TN = 293.15K; PN = 0.101325MPa; T = (273.15 + t) temperature of NG at working condition, K; K = 0.9998 factor of compressibility of NG.	m^3 = (NG1,…, NG10); (see Table 5) P = (PR1,…, PR10); (see Table 7) t = (TP1,…, TP10). (see Table 6)
EL_{VD}, electricity consumed by the new vacuum system (VD)	MWh	$EL_{VD} = \frac{EL \times K_{TR}}{1000}$, Where: EL = electricity consumption, monitored at VD, kWh; K_{TR} = 600/5 transformation factor, (see Table 4, TR22,…,TR29).	EL= (EL6+EL7+EL8+EL9) (see Table 3)
EL_{LF}, Electricity consumed by the ladle furnace	MWh	$EL_{LF} = \frac{EL \times K_{TR,current} \times K_{TR,voltage}}{1000}$, Where: EL = electricity consumption, monitored at LF, kWh; $K_{TR,current}$ = 500/5, transformation factor of current transformer, (see Table 4, TR16, TR17, TR18); $K_{TR,voltage}$ = 35000/100, transformation factor of voltage transformer, (see Table 4, TR19, TR20, TR21);	EL=EL5 (see Table 3)

EL_{EAF}, Electricity consumed by the EAFs	MWh	$EL_{EAF} = EL_{EAF50} + EL_{EAF100\#3} + EL_{EAF100\#5}$, With $EL_{EAF50} = EL_{50}$, $EL_{EAF100\#3} = \frac{EL_{100\#3} \times K_{TR100\#3,current} \times K_{TR100\#3,voltage}}{1000}$, $EL_{EAF100\#5} = \frac{EL_{100\#5} \times K_{TR100\#5,current} \times K_{TR100\#5,voltage}}{1000}$, Where: EL_{EAF50} = electricity consumption, monitored at EAF50, MWh; $EL_{EAF100\#3}$ = electricity consumption, monitored at EAF100#3, kWh; $K_{TR100\#3,current}$ = 600/5, transformation factor of current transformer, (see Table 4, TR6, TR7); $K_{TR100\#3,voltage}$ = 35000/100, transformation factor of voltage transformer, (see Table 4, TR8, TR9, TR10); $EL_{EAF100\#5}$ = electricity consumption, monitored at EAF100#3, kWh; $K_{TR100\#5,current}$ = 600/5, transformation factor of current transformer, (see Table 4, TR11, TR12); $K_{TR100\#5,voltage}$ = 35000/100, transformation factor of voltage transformer, (see Table 4, TR13, TR14, TR15);	EL_{EAF50} = EL1 (see Table 3) $EL_{EAF100\#3}$ = EL2 (see Table 3) $EL_{EAF100\#5}$ = (EL3 + EL4) (see Table 3)
EL_{PR}, electricity consumed by the new pumps of the 15,000 tonnes press	MWh	$EL_{PR} = \frac{EL \times K_{TR,current} \times K_{TR,voltage}}{1000}$, Where: EL = electricity consumption, monitored at press, kWh; $K_{TR,current}$ = 1500/5, transformation factor of current transformer, (see Table 4, TR30); $K_{TR,voltage}$ = 6000/100, transformation factor of voltage transformer, (see Table 4, TR31).	EL = EL10 (see Table 3)

Table 11:Project measurable variables

Baseline emissions variables to be measured:

Data variable	Source of data	Data unit	Method of calculation	Meters used for calculation
$PRST_{tf}$, the production level of each of the 26 reconstructed thermal and heating furnaces	Measuring devices of the thermal shop and forge and press shop	Tonnes	$PRST_{tf}$ is a result of direct measurement (weighing) of the of half-finished products proceeded through each furnace	WM1-WM4
$PRVS_{VD}$, the production volume of vacuumed steel	Measuring devices of the VD	Tonnes	$PRVS_{VD}$ is a result of direct measurement (weighing) of the steel proceeded through VD	WM5
PRES, the production volume of electro steel	Measuring devices of the electro steel shop	Tonnes	*PRES* is a result of direct measurement (weighing) of the steel proceeded through LF	WM5
T_{pp}, working hours of press	Server at energy saving department	hours	T_{pp} is the sum from registry log book records	Registry log-book on press

Table 12:Baseline measurable variables

B.2.3. Data concerning GHG emissions by sources of the project activity:

Variable	Description	Unit	Value
$NG_{tf,y,1}$	Natural gas consumption at thermal furnace #9,TS	1000Nm^3	522.530
$NG_{tf,y,2}$	Natural gas consumption at thermal furnace #10,TS	1000Nm^3	442.509
$NG_{tf,y,3}$	Natural gas consumption at thermal furnace #1,TS	1000Nm^3	1 151.877
$NG_{tf,y,4}$	Natural gas consumption at thermal furnace #2,TS	1000Nm^3	1 047.585
$NG_{tf,y,5}$	Natural gas consumption at heating furnace #10,FPS	1000Nm^3	1 868.677
$NG_{tf,y,6}$	Natural gas consumption at heating furnace #9,FPS	1000Nm^3	2 081.678
$NG_{tf,y,7}$	Natural gas consumption at heating furnace #8,FPS	1000Nm^3	1 250.958
$NG_{tf,y,8}$	Natural gas consumption at heating furnace #7,FPS	1000Nm^3	604.300
$NG_{tf,y,9}$	Natural gas consumption at thermal furnace #30,FPS	1000Nm^3	777.823

Variable	Description	Unit	Value
$NG_{tf,y,10}$	Natural gas consumption at thermal furnace #18,FPS	$1000Nm^3$	424.59
EL_{VD}	Electricity consumption by new VD	MWh	129.792
EL_{LF}	Electricity consumption by LF	MWh	12 869.347
EL_{EAF}	Electricity consumption by EAFs	MWh	83 641.696
EL_{PR}	Electricity consumption by the new pumps of the press	MWh	1 608.629

Table 13: Data collected in the project scenario

B.2.4.Data concerning GHG emissions by sources of the baseline:

Variable	Description	Unit	Value
$PRST_{tf,1}$	Half finish products production at thermal furnace #9,TS	Tonnes	4 218
$PRST_{tf,2}$	Half finish products production at thermal furnace #10,TS	Tonnes	4 478
$PRST_{tf,3}$	Half finish products production at thermal furnace #1,TS	Tonnes	10 722
$PRST_{tf,4}$	Half finish products production at thermal furnace #2,TS	Tonnes	9 151
$PRST_{tf,5}$	Half finish products production at heating furnace #10,FPS	Tonnes	10 032
$PRST_{tf,6}$	Half finish products production at heating furnace #9,FPS	Tonnes	9 557
$PRST_{tf,7}$	Half finish products production at heating furnace #8,FPS	Tonnes	8 678
$PRST_{tf,8}$	Half finish products production at heating furnace #7,FPS	Tonnes	3 749
$PRST_{tf,9}$	Half finish products production at thermal furnace #30,FPS	Tonnes	3 840
$PRST_{tf,10}$	Half finish products production at thermal furnace #18,FPS	Tonnes	391
$PRVS_{VD}$	Vacuumed steel production at VD	Tonnes	72 556
EBDHC	efficiency of the steam boilers at the DHC	%	88.5
PRES	Steel production at LF	Tonnes	105 304.125
T_{PP}	Working time of the motors on press	Hours	1 192.5

Table 14: Data collected in the baseline scenario

B.2.5.Data concerning leakage:

PDD did not identify any leakage, therefore this section is not applicable.

B.2.6.Data concerning environmental impacts:

The project improved efficiency of use of natural gas, electricity and heat at the enterprise and thus leaded to decrease of harmful emissions.

B.3.Data processing and archiving (incl. software used):

Subproject 1. Reconstruction of thermal and heating furnaces. Information from flow meters, pressure and temperature sensors are transmitting to the control and monitoring computer system. All information about technological process is saved continuously. The archiving period for the log files is at least one year. Information that corresponds to the natural gas consumption in 2008 has been burned on CDs. These CDs are stored until the end of crediting period plus two years.
Every half-finished product that process through the furnaces has his own unique certificate. This certificate reflects all operations performed on the product and the weight on the exit of every workshop. So, the weight of half-finished products that proceed through each furnace could be easily monitored. Information from the certificates is saved in the log books in order to simplify the monitoring process.
A report including natural gas consumption and weight of half finished products is generating on a monthly basis. The report is signing by Head of Energy Saving Department, Head of corresponding workshop and approved by Chief Engineer.

Subproject 2. Installation of a new vacuum system. Information from meters is coming to the control and monitoring computer system of vacuumator. A computer system records information about every vacuumation session, including melt passport, time and electricity consumption. The archiving period for the log files is at least one year. Information that corresponds to the electricity consumption in 2008 has been burned on CDs. These CDs are stored until the end of crediting period plus two years.

Subproject 3. Installation of an arc ladle furnace. The data from electricity meters concerning electricity consumption is transmitted to the control and monitoring computer system continuously. The computer system records information about each melt process, including melt certificate. This certificate includes information about the number of EAF where steel was melted, steel content, amount of electricity consumed during melting and weight of steel. The archiving period for the log files is at least one year. All melt certificates for the year 2008 has been burned to CDs. These CDs are stored until the end of crediting period plus two years.

Subproject 4. Modernization of press equipment.
All data concerning electricity consumption is transmitted to the control and monitoring computer system. The press has a special registry log book, where working time of press is logged, among other data. The following figure presents electricity supplying system of the press with metering points.

B.4. Special event log:
There are no special events took place within the monitoring period.

SECTION C. Quality assurance and quality control measures

C.1. Documented procedures and management plan:

C.1.1. Roles and responsibilities:

The general management of the monitoring team is implemented by the Deputy Chief Engineer of the EMSS through supervising and coordinating activities of his subordinates, such as the head of Energy Saving Department, the head of Steel Making Shop, Press-Forging Shop and Thermal Shop. On-site day-to-day (operational) management is implemented by the heads of corresponding shops. The technological process data is logged into the PCs continuously. The PCs at reconstructed furnaces, LF, VD, etc., have not only monitoring but control functions as well. Keeping the PCs in a working condition is a responsibility of the Department of the automated control systems.

All data necessary for the CO_2 emission reductions calculation is collected in the Energy Saving Department. The head of the Energy Saving Department is making calculations on a monthly basis[1]. The general supervision of the monitoring system is executed by the Deputy Chief Engineer.

For this monitoring period the names of the personnel involved is as follows:

- Deputy Chief Engineer: A. Masyuk
- Head of Energy Saving Department: A. Suprun
- Head of the Steel Making Shop: A. Gorkusha
- Head of the Press-Forging Shop: N. Bondar
- Head of the Thermal Shop: V. Stankov

C.1.2. Trainings:

All contracts for the equipment supplying include chapter describing personnel training. Training is providing by equipment producers.

C.2. Involvement of Third Parties:

The Ukrainian Centre for Standardization and Metrology is a Third Party involved.

C.3. Internal audits and control measures:

CO_2 emission reductions calculations are performing on the monthly basis by the head of the Energy Saving Department. All energy sources flows (such as electricity and natural gas) are logged on the server in the Energy Saving Department. Hence the head of Department checks the correctness of measurements by the indirect calculations.

C.4. Troubleshooting procedures:

Every day the Energy Saving Department reports to the Chief Engineer about energy resources consumption by EMSS. That report is the result of analyzing of the data logging on a dedicated server. In case of any meter failure, data discrepancy will be found within one day. The meter will be substitute by working one. CO_2 emissions reduction will be calculated by cross-checking method for the period of malfunctioning.

[1] See MS Excel sheet (MR_EMSS_ver1.0_en_28May2009.xls)

SECTION D. Calculation of GHG emission reductions

D.3.1. Project emissions:

The annual project emissions are calculated by the equation:

$$PE_y = \sum_{i=1}^{i=4} PE_{spi} \; ; \qquad (Equation\ 1)$$

Where:

PE_y - are the annual project emissions for the year *y*, [tCO_2];

PE_{spi} - are the annual project emissions from each subproject, from SP1 to SP4;

The annual project emissions [tCO2/y] from SP1 are:

$$PE_{sp1} = NG_{tf,y} * LCV_{NG} * EF_{NG} \; ; \qquad (Equation\ 2)$$

Where:

PE_{sp1} - is the project emissions of subproject 1 in year *y* , [tCO_2];

$NG_{tf,y}$ - is the annual quantity of NG, used by the 26 reconstructed furnaces (see Table 7), [1000 nm3];

LCV_{NG} - is the lower calorific value of the NG , [MWh/1000nm3];

EF_{NG} - is the emission factor of the NG burning process (see Table 3), [tCO2/MWh].

The annual project emissions [tCO2/y] from SP2 are:

$$PE_{sp2} = EL_{VD} * EF_{el,y} \; ; \qquad (Equation\ 3)$$

Where:

PE_{sp2} - is the project emissions of subproject 2 in year *y*, [tCO_2];

EL_{VD} - is the annual electrical consumption of the new VD (see Table 7), [MWh];

$EF_{el,y}$ - is the calculated emission factor of the Ukrainian grid (see Table 3), [tCO2/MWh].

The annual project emissions [tCO2/y] from SP3 are:

$$PE_{sp3} = (EL_{LF} + EL_{EAF}) * EF_{el,y} \; ; \qquad (Equation\ 4)$$

Where:

PE_{sp3} - is the project emissions of subproject 3 in year *y*, [tCO_2];

EL_{LF} - is the annual electrical consumption of the new ladle furnace (see Table 7), [MWh];

EL_{EAF} - is the annual electrical consumption of the electric arc furnace (see Table 7), [MWh];

The annual project emissions [tCO2/y] from SP4 are:

$$PE_{sp4} = EL_{PR} * EF_{el,y} \; ; \qquad (Equation\ 5)$$

Where:

PE_{sp4} - is the project emissions of subproject 4 in year *y*, [tCO_2];
EL_{PR} - is the annual electrical consumption of the new pumps of the 15,000 tones press (see Table 7), [MWh].

	2008
Project emissions	**[tCO2e]**
Subproject 1. Reconstruction of thermal and heating furnaces	18 671
Subproject 2. Installation of a new vacuum system	116
Subproject 3. Installation of an arc ladle furnace	86 474
Subproject 4. Modernization of press equipment	1 441
Total 2008	**106 702**

Table 15: Project emissions

D.3.2. Baseline emissions:

$$BE_y = \sum_{i=1}^{i=4} BE_{spi};$$ (*Equation 6*)

Where:
BE_y - are the annual baseline emissions for the year *y*, [tCO_2];
BE_{spi} - are the annual baseline emissions from each subproject, from SP1 to SP4.

The annual baseline emissions for SP1 [tCO2/y] are:

$$BE_{sp1} = SPNG_{tf} * PRST_{tf} * LCV_{NG} * EF_{NG};$$ (*Equation 7*)

Where:
BE_{sp1} - is the baseline emissions of subproject 1 in year *y*, [tCO_2];
$SPNG_{tf}$ - is the baseline ex-ante specific NG consumption of the 26 reconstructed furnaces (see PDD, Table A2.1), [1000nm3/t steel];
$PRST_{tf}$ - is the annual production steel level of each of the 26 reconstructed thermal and heating furnaces (see Table 8), [tonnes].

The annual baseline emissions for SP2 [tCO2/y] are:

$$BE_{sp2} = SPH_{VD} * PRVS_{VD} \div EB_{DHC} * EF_{Coal} + SPEL_{VD} * PRVS_{VD} * EF_{el,y};$$ (*Equation 8*)

Where:
BE_{sp2} - is the baseline emissions of subproject 2 in year *y*, [tCO_2];
SPH_{VD} - is a baseline ex ante specific heat consumption of the old VD (see PDD, Table A2.2), [MWh/t];
$PRVS_{VD}$ - is the annual production volume of vacuumed steel (see Table 8), [tonnes];
EB_{DHC} - is the efficiency of the steam boilers at the DHC (see Table 8);
EF_{Coal} - is the emission factor for local (anthracite) coal burning (see Table 4), [tCO2/MWh];

$SPEL_{VD}$ - is a baseline ex ante specific electrical consumption of the old VD (see Table 4), [MWh/t];

$EF_{el,y}$ - is the calculated emission factor of the Ukrainian grid (see Table 4), [tCO2/MWh].

The annual baseline emissions for SP3 [tCO2/y] are:

$$BE_{sp3} = SPEL_{ES} * PRES * EF_{el,y} ; \quad (Equation\ 9)$$

Where:

BE_{sp3} - is the baseline emissions of subproject 3 in year *y*, [tCO_2];

$SPEL_{ES}$ - is the baseline ex ante specific consumption of electricity per tone of electro steel (see PDD, Table A2.3), [MWh/t steel];

$PRES$ – is the annual production volume of electro steel (see Table 8), [t].

The annual baseline emissions for SP4 [tCO2/y] are:

$$BE_{sp4} = T_{pp} * EL_{MOT} * EF_{el,y} ; \quad (Equation\ 10)$$

Where:

BE_{sp4} - is the baseline emissions of subproject 4 in year *y*, [tCO_2];

T_{pp} - is a working hours of the press (see Table 8), [h];

EL_{MOT} - is the press' serving motors before reconstruction (see Table 4), [MW].

	2008
Baseline emissions	**[tCO2e]**
Subproject 1. Reconstruction of thermal and heating furnaces	80 922
Subproject 2. Installation of a new vacuum system	33 656
Subproject 3. Installation of an arc ladle furnace	97 183
Subproject 4. Modernization of press equipment	12 822
Total 2008	**224 584**

Table 16: Baseline emissions

D.3.3. Leakage:

Not Applicable

D.3.4. Summary of the emissions reductions during the monitoring period:

	2008
Emission Reductions	**[tCO2e]**
Subproject 1. Reconstruction of thermal and heating furnaces	62 252
Subproject 2. Installation of a new vacuum system	33 540
Subproject 3. Installation of an arc ladle furnace	10 709
Subproject 4. Modernization of press equipment	11 380
Total 2008	**117 881**

Table 17: Emission Reductions