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Technical Upgrade of OJSC Dniprovsky Integrated Iron and Steel Works named after Dzerzhynsky by Installation of Two Billet Continuous Casting Machines and Two Ladle Furnaces

UA1000280, Track 1

Annual Monitoring Report

Version 2 dated 5th of June 2012
Monitoring period: 1st January 2012 – 31st March 2012

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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;
CCM – Continuous Casting Machines;
LF – Ladle Furnaces;
ISD – Industrial Union of Donbass;
GHG – Greenhouse gases;
NEIA – National Environmental Investment Agency of Ukraine;
QMS – Quality Management System;
CHP – Combined Heat and Power.

1. Project summary

In an attempt to strengthen competitiveness of steelmaking process and reduce load on the environment, including through reduction of greenhouse gas (GHG) emissions into atmosphere, management of DIISW and ISD decided to upgrade the Plant's process cycle by introducing two ladle furnaces (LF 1 and LF 2) and two new seven-strand billet continuous casting machines (CCM 1 and CCM 3).

The project technology envisages that steel molten in converters are dressed in the new two LFs where ferroalloys and other required additives are fed. LFs additionally consume electricity compared to the baseline scenario, however they allow for shorter Furnace Process time and lower temperatures LD-Converters. Generally, energy saving in LD-Converters, as the result of LFs implementation, leads to reduction of overall energy intensity and stabilization of the furnace process. Thus, out-of-furnace treatment (secondary steelmaking) of steel at LFs saves time, energy, and produces higher quality steel on a consistent basis.

The project technology also envisages that steel treated at LFs are fed into new seven-strand billet CCMs allowing direct square billet production. This, compared to the baseline scenario, leads to lower amount of clippings and energy saving.

The figure below presents the generic diagram of the core steelmaking process adopted in the project.

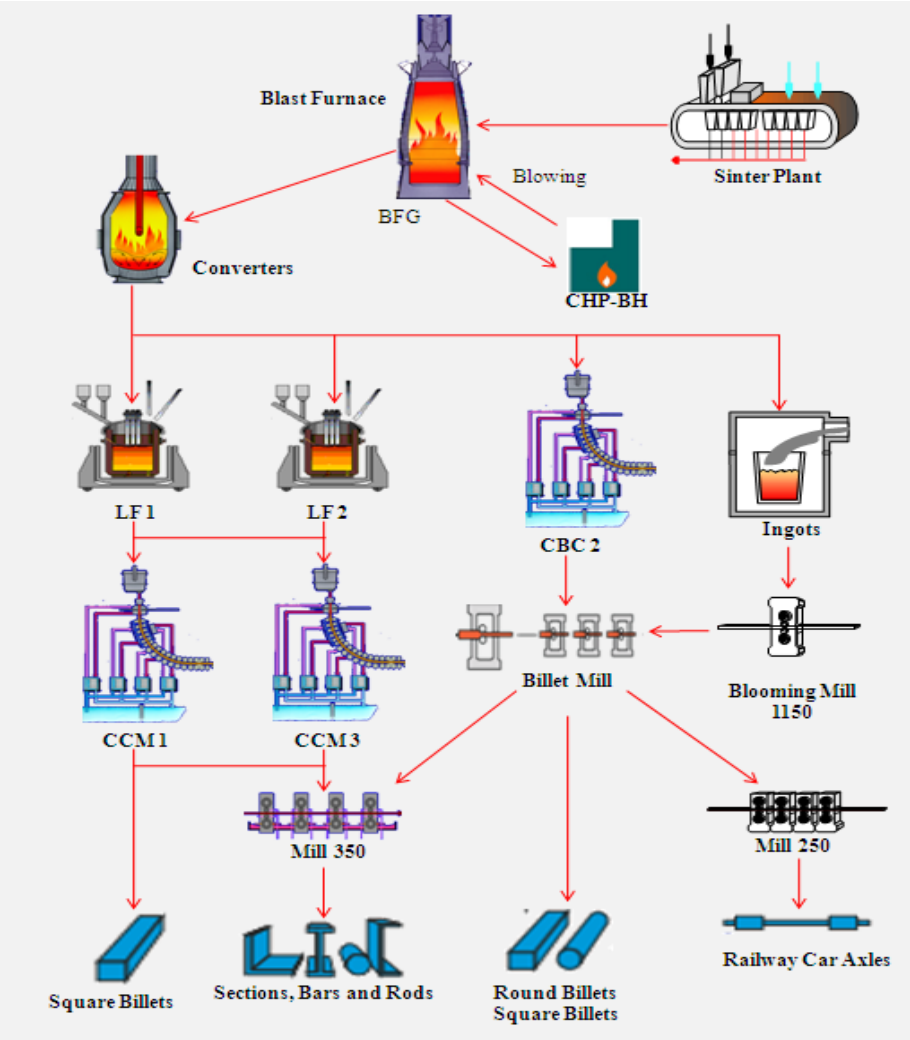

Figure 1. DIISW steelmaking process flow diagram under the project line scenario

The goal of the JI Project is to achieve steel production with lower energy consumption per unit of output through reduction of furnace process time in LD-Converters as the result of introduction of LFs and stabilization of casting process in new CCMs, which would inter alia yield significant reduction of GHG emissions into the atmosphere (mainly CO_2).

The baseline and monitoring of emission reductions for the proposed project were identified and justified following the Annex B to the JI Guidelines[1] and the JISC Guidance on Criteria for Baseline Setting and Monitoring[2].

The baseline scenario was determined based on JI-specific approach and refers to the DIISW project-specific conditions and parameters as they are described in the PDD.

A two-step approach is used to identify and chose the baseline scenario for the project:

1. Identifying and listing alternatives to the project activity on the basis of conservative assumptions and taking into account uncertainties.

2. Identifying the most plausible alternatives considering relevant sectoral policies and circumstances, such as economic situation in the steel sector in Ukraine and other key factors that

[1] Decision 9/CMP.1 Conference of the Parties serving as the Meeting of the Parties of the Kyoto protocol 30th of March 2006.
[2] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf.

may affect the baseline. The baseline is identified by screening of the alternatives based on the technological and economic considerations for the project developer, as well as best technologies and practices in Ukrainian steel industry at the time of the investment decision.

Monitoring plan developed for this specific project is consistent with the assumptions and procedures adopted for the baseline. This monitoring approach requires measurement of variables and parameters necessary to quantify the baseline emissions and project emissions in a conservative and transparent way.

2. Project participants and responsible entity for monitoring report development

The project received the Letter of Approval (LoA) from the Government of Ukraine, acting through State Environmental Investment Agency of Ukraine (# 2077/23/7 dated 08/08/2011) and from the State of the Netherlands, acting through the Ministry of Economic Affairs, Agriculture and Innovation and its implementing agency "NL Agency" (# 2011JI28 dated 05/07/2011).

Insignificant deviation in comparison with the PDD was caused by the fact that in PDD Spain was indicated as the country of project participant (because Endesa Carbono S.L. is registered in Spain) and the LoA from the foreign government was issued by the State of the Netherlands.

The reason for such deviation is that usually European companies have several accounts in different national registries all around the world. Endesa Carbono S.L. has its account also in national registry of the State of the Netherlands and is authorized by the government to acquire emission reduction units. Therefore Endesa Carbono S.L. has received letter of approval by the State of the Netherlands legal entity.

Table 1. Parties involved

Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host Country)	PJSC Dniprovsky Integrated Iron and Steel Works named after Dzerzhynsky (DIISW)	No
The Netherlands	Endesa Carbono S.L.	No

Project participants:

Organisation:	PJSC Dniprovsky Integrated Iron and Steel Works named after Dzerzhynsky
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Represented by:	Mr Vasyl Vasylyovych Vovchak
Title:	Director

3. Crediting period

Starting date of the project is 5th of April 2007.

The crediting period[3] starts on 01/10/2008 as is indicated in the last version of project design document. The crediting period lasts on 31/12/2020, and its total duration is 12 years and 3 months, including:

- The 1st commitment period: 01/10/2008 – 31/12/2012 (4 years and 3 months);
- Period following the 1st commitment period: 01/01/2013 – 31/12/2020 (8 years and 0 months).

Extension of the crediting period beyond 2012 is subject to the host Party approval.

[3] Starting date of the project operation (when the first ERU were generated) is 1st of October 2008.

4. Status of the project pursuant to the monitoring period

Emission reductions during the period from 1st of January 2012 till 31st of March 2012 were achieved by implementation of the following measures:

Table 2. Status of project implementation

#	Measures	2007	2008	2009	2010	2011	2012
1.	Implementation of CCM 1						
2.	Implementation of LF 1						
3.	Implementation of CCM 3						
4.	Implementation of LF 2						

Construction of CCM 1 was started in August 2007 and was completed in November 2008. First commissioning casting processes on CCM 1 had been conducted during August-September and commercial operation of equipment started from the 1-st of October 2008, thereafter first volumes of square billets were produced in the fourth quarter of 2008. According to the State Committee Protocol acceptance of finished object into operation is dated 16.12.2008.

Implementation of LF 1 was started in April 2007 and was completed in June 2009 (according to the Protocol on object readiness for setting into operation dated 07.09.2009).

Implementation of CCM 3 was started in May 2009 (according to the Protocol on object readiness for setting into operation dated 28.01.2011) and was completed in January 2011.

Implementation of LF 2 was started in August 2008 (according to the Permit for construction works # 76 dated 22.08.2008) and is at the stage of commercial tests from the beginning of 2012.

During the considered monitoring period such facilities as CCM 1, CCM 3 and LF 1 were operational.

5. Formulas of emission reductions calculations

Project emissions

PE = Project Emissions

$PE_i = TCPI_{p,i} + TCFP_{p,i} + TCCR_{p,i} + TCBPN_{p,i}$ (1)

where:
$TCPI_{p,i}$ = total embodied CO_{2e} of pig iron entering into the project, t CO_{2e} (project case)
$TCFP_{p,i}$ = total CO_{2e} in the furnace process, t CO_{2e} (project case)
$TCCR_{p,i}$ = total CO_{2e} in the casting process, t CO_{2e} (project case)
$TCBPN_{p,i}$ = total CO_{2e} in the balance of production processes, t CO_{2e} (project case)

$_p$ = project case
$_i$ = regular data registration interval

Step 1. Pig iron

$TCPI_{p,i} = (TCFCPI_{p,i} + TCEPI_{p,i} + TCIPI_{p,i})$ (2)

where:

$TCFCPI_{p,i}$ = total CO_{2e} from fuel consumption in producing pig iron, t CO_{2e}
$TCEPI_{p,i}$ = total CO_{2e} from electricity consumption in producing pig iron, t CO_{2e}
$TCIPI_{p,i}$ = total CO_{2e} from inputs into pig iron, t CO_{2e}

$$TCFCPI_{p,i} = \sum_{1}^{fpi} \left(Q_{fpi,p,i} \times EF_{f,p} \right) \quad (3)$$

where:

$fpi_{p,i}$ = number of fuels used in making pig iron
$Q_{p,i}$ = quantity of fuel fpi used (1000 m^3)
$EF_{f,p}$ = tonnes of CO_{2e} per 1000 m^3 of each fuel

$TCEPI_{p,i} = ECPI_{p,i} * EF_{e,p}$ (4)

where:

$ECPI_{p,i}$ = electricity consumed in producing pig iron, MWh
$EF_{e,p}$ = emission factor for electricity, t CO_{2e}/MWh in the relevant period

$TCIPI_{p,i} = TCFIO_{p,i} + TCEIO_{p,i} + TCRAPI_{p,i} + TCOIPI_{p,i}$ (5)

where:

$TCFIO_{p,i}$ = total CO_{2e} from fuel used to prepare iron ore, t CO_{2e}
$TCEIO_{p,i}$ = total CO_{2e} from electricity consumption in preparing iron ore, t CO_{2e}

$TCRAPI_{p,i}$ = total CO_{2e} from reducing agents, t CO_{2e}
$TCOIPI_{p,i}$ = total CO_{2e} from the other consumed inputs, t CO_{2e}

$$TCFIO_{p,i} = \sum_{1}^{fio} Q_{fio,p,i} \times EF_{f,p} \quad (6)$$

where:

$fio_{p,i}$ = number of fuels used in preparing iron ore
$Q_{p,i}$ = quantity of fuel fio used (1000 m^3)
$EF_{f,p}$ = tonnes of CO_{2e} per 1000 m^3 of each fuel

$TCEIO_{p,i} = ECIO_{p,i} * EF_{e,p}$ (7)

where:

$ECIO_{p,i}$ = electricity consumed in preparing iron ore, MWh
$EF_{e,p}$ = emission factor for electricity, t CO_{2e}/MWh in the relevant period

$$TCRAPI_{p,i} = \sum_{1}^{rapi} Q_{rapi,p,i} \times EF_{ra,p} \quad (8)$$

where:

$rapi_{p,i}$ = number of reducing agents in pig iron production
$Q_{rapi,p,i}$ = quantity of each reducing agent rapi used (tonnes)
$EF_{ra,p}$ = emission factor for reducing agent, t CO_{2e}/tonne in the relevant period

$$TCOIPI_{p,i} = \sum_{1}^{oipi} Q_{oipi,p,i} \times EF_{oi,p} \quad (9)$$

where:

$oipi_{p,i}$ = number of the other inputs in pig iron production
$Q_{oipi,p,i}$ = quantity of each other input oipi used (tonnes)
$EF_{oi,p}$ = emission factor for the other inputs, t CO_{2e}/tonne in the relevant period

Step 2. Furnace process

$TCFP_{p,i} = TCFCFP_{p,i} + TCECFP_{p,i} + TCIFP_{p,i}$ (10)

where:

$TCFCFP_{p,i}$ = total CO_{2e} from fuel consumption in furnace process, t CO_{2e}
$TCECFP_{p,i}$ = total CO_{2e} from electricity consumption in furnace process, t CO_{2e}
$TCIFP_{p,i}$ = total CO_{2e} from inputs into furnace process, t CO_{2e}

$$TCFCFP_{p,i} = \sum_{1}^{ffp} Q_{ffp,p,i} \times EF_{f,p} \quad (11)$$

where:

$ffp_{p,i}$ = number of fuels used in the furnace process
$Q_{p,i}$ = quantity of fuel ffp used (1000 m^3)
$EF_{f,p}$ = tonnes of CO_{2e} per 1000 m^3 of each fuel

$$TCECFP_{p,i} = ECFP_{p,i} * EF_{e,p} \quad (12)$$

where:

$ECFP_{p,i}$ = electricity consumed in the furnace process, MWh
$EF_{e,p}$ = emission factor for electricity, t CO_{2e}/MWh in the relevant period

$$TCIFP_{p,i} = (TCRAFP_{p,i} + TCOIFP_{p,i}) \quad (13)$$

where:

$TCRAFP_{p,i}$ = total CO_{2e} from reducing agents entering furnace process, t CO_{2e}
$TCOIFP_{p,i}$ = total CO_{2e} from the other inputs entering furnace process, t CO_{2e}

$$TCRAFP_{p,i} = \sum_{1}^{rafp} \left(Q_{rafp,p,i} \times EF_{ra,p} \right) \quad (14)$$

where:

$rafp_{p,i}$ = number of reducing agents entering furnace process
$Q_{rafp,p,i}$ = quantity of each reducing agent rafp used (tonnes)
$EF_{ra,p}$ = emission factor for reducing agent, t CO_{2e}/tonne in the relevant period

$$TCOIFP_{p,i} = \sum_{1}^{oifp} \left(Q_{oifp,p,i} \times EF_{oi,p} \right) \quad (15)$$

where:

$oifp_{p,i}$ = number of the other inputs entering furnace process
$Q_{oifp,p,i}$ = quantity of each other input oifp used (tonnes)
$EF_{oi,p}$ = emission factor for the other inputs, t CO_{2e}/tonne in the relevant period

Step 3. Casting

$$TCCR_{p,i} = TCFCR_{p,i} + TCECR_{p,i} \quad (16)$$

where:

$TCFCR_{p,i}$ = total CO_{2e} from fuel consumption in square billet casting, t CO_{2e}
$TCECR_{p,i}$ = total CO_{2e} from electricity consumption in square billet casting

$$TCFCR_{p,i} = \sum_{1}^{fcr} \left(Q_{fcr,p,i} \times EF_{f,p} \right) \quad (17)$$

where:

$fcr_{p,i}$ = number of fuels used in the casting

$Q_{p,i}$ = quantity of each fuel fcr used (1000 m^3)
$EF_{f,p}$ = tonnes of CO_{2e} per 1000 m^3 of each fuel

$TCECR_{p,i} = ECCR_{p,i} * EF_{e,p}$ (18)

where:

$ECCR_{p,i}$ = electricity consumed in square billet casting, MWh
$EF_{e,p}$ = emission factor for electricity, t CO_{2e}/MWh in the relevant period

Step 4. Balance of process needs

$TCBPN_{p,i} = TCFCBPN_{p,i} + TCEBPN_{p,i}$ (19)

where:

$TCFCBPN_{p,i}$ = total CO_{2e} from fuel consumption for balance of process needs of project activity, t CO_{2e}:
$TCEBPN_{p,i}$ = total CO_{2e} from electricity consumption for balance of process needs of project activity, t CO_{2e}:

$$TCFCBPN_{p,i} = \sum_{1}^{fbpn} (Q_{fbpn,p,i} \times EF_{f,p}) \quad (20)$$

where:

$fbpn_{p,i}$ = number of fuels used in producing secondary energy used for balance of process needs
$Q_{p,i}$ = quantity of each fuel fbpn used (1000 m^3)
$EF_{f,p}$ = tonnes of CO_{2e} per 1000 m^3 of each fuel

$TCEBPN_{p,i} = (ECBPN_{p,i} – ECSG_{p,i}) * EF_{e,p}$ (21)

where:

$ECBPN_{p,i}$ = electricity used for production of secondary energy used for the balance of process needs (MWh)
$ECSG_{p,i}$ = self-generated electricity used in the project activity (MWh)
$EF_{e,p}$ = emission factor for electricity, t CO_{2e}/MWh in the relevant period

Baseline emissions

BE = Baseline Emissions

$BE_i = TCPI_{b,i} + TCFP_{b,i} + TCCR_{b,i} + TCBPN_{b,i}$ (22)

where:
$TCPI_{b,i}$ = total embodied CO_{2e} of pig iron entering into the project, t CO_{2e}
$TCFP_{b,i}$ = total CO_{2e} in the furnace process, t CO_{2e}
$TCCR_{b,i}$ = total CO_{2e} in the casting/rolling, t CO_{2e}
$TCBPN_{b,i}$ = total CO_{2e} in the balance of production processes, t CO_{2e}

$_b$ = baseline
$_i$ = regular data registration interval

Step 1. Pig iron

$TCPI_{b,i} = (TCFCPI_{b,i} + TCEPI_{b,i} + TCIPI_{b,i})$ (23)

where:

$TCFCPI_{b,i}$ = total CO_{2e} from fuel consumption in producing pig iron, t CO_{2e}
$TCEPI_{b,i}$ = total CO_{2e} from electricity consumption in producing pig iron, t CO_{2e}
$TCIPI_{b,i}$ = total CO_{2e} from inputs into pig iron, t CO_{2e}

$$TCFCPI_{b,i} = \sum_{1}^{fpi} \left(Q_{fpi,b,i} \times EF_{f,b} \right) \quad (24)$$

where:

$fpi_{b,i}$ = number of fuels used in making pig iron
$Q_{b,i}$ = quantity of fuel fpi used (1000 m^3)
$EF_{f,b}$ = tonnes of CO_{2e} per 1000 m^3 of each fuel

$TCEPI_{b,i} = ECPI_{b,i} * EF_{e,b}$ (25)

where:

$ECPI_{b,i}$ = electricity consumed in producing pig iron, MWh
$EF_{e,b}$ = emission factor for electricity, t CO_{2e}/MWh in the relevant period

$TCIPI_{b,i} = TCFIO_{b,i} + TCEIO_{b,i} + TCRAPI_{b,i} + TCOIPI_{b,i}$ (26)

where:

$TCFIO_{b,i}$ = total CO_{2e} from fuel used to prepare iron ore, t CO_{2e}
$TCEIO_{b,i}$ = total CO_{2e} from electricity consumption in preparing iron ore, t CO_{2e}
$TCRAPI_{b,i}$ = total CO_{2e} from reducing agents, t CO_{2e}
$TCOIPI_{b,i}$ = total CO_{2e} from the other consumed inputs, t CO_{2e}

$$TCFIO_{b,i} = \sum_{1}^{fio} \left(Q_{fio,b,i} \times EF_{f,b} \right) \quad (27)$$

where:

$fio_{b,i}$ = number of fuels used in preparing iron ore
$Q_{b,i}$ = quantity of fuel fio used (1000 m^3)
$EF_{f,b}$ = tonnes of CO_{2e} per 1000 m^3 of each fuel

$TCEIO_{b,i} = ECIO_{b,i} * EF_{e,b}$ (28)

where:

$ECIO_{b,i}$ = electricity consumed in preparing iron ore, MWh
$EF_{e,b}$ = emission factor for electricity, t CO_{2e}/MWh in the relevant period

$$TCRAPI_{b,i} = \sum_{1}^{rapi} (Q_{rapi,b,i} \times EF_{ra,b}) \quad (29)$$

where:

$rapi_{b,i}$ = number of reducing agents in pig iron production
$Q_{rapi,b,i}$ = quantity of each reducing agent rapi used (tonnes)
$EF_{ra,b}$ = emission factor for reducing agent, t CO_{2e}/tonne in the relevant period

$$TCOIPI_{b,i} = \sum_{1}^{oipi} (Q_{oipi,b,i} \times EF_{oi,b}) \quad (30)$$

where:

$oipi_{b,i}$ = number of the other inputs in pig iron production
$Q_{oipi,b,i}$ = quantity of each other input oipi used (tonnes)
$EF_{oi,,b}$ = emission factor for the other inputs, t CO_{2e}/tonne in the relevant period

Step 2. Furnace process

$TCFP_{b,i} = TCFCFP_{b,i} + TCECFP_{b,i} + TCIFP_{b,i}$ (31)

where:

$TCFCFP_{b,i}$ = total CO_{2e} from fuel consumption in furnace process, t CO_{2e}
$TCECFP_{b,i}$ = total CO_{2e} from electricity consumption in furnace process, t CO_{2e}
$TCIFP_{b,i}$ = total CO_{2e} from inputs into furnace process, t CO_{2e}

$$TCFCFP_{b,i} = \sum_{1}^{ffp} (Q_{ffp,b,i} \times EF_{f,b}) \quad (32)$$

where:

$ffp_{b,i}$ = number of fuels used in the furnace process
$Q_{b,i}$ = quantity of fuel ffp used (1000 m^3)
$EF_{f,b}$ = tonnes of CO_{2e} per 1000 m^3 of each fuel

$TCECFP_{b,i} = ECFP_{b,i} * EF_{e,b}$ (33)

where:

$ECFP_{b,i}$ = electricity consumed in the furnace process, MWh
$EF_{e,b}$ = emission factor for electricity, t CO_{2e}/MWh in the relevant period

$TCIFP_{b,i} = (TCRAFP_{b,i} + TCOIFP_{b,i})$ (34)

where:

$TCRAFP_{b,i}$ = total CO_{2e} from reducing agents entering furnace process, t CO_{2e}
$TCOIFP_{b,i}$ = total CO_{2e} from the other inputs entering furnace process, t CO_{2e}

$$TCRAFP_{b,i} = \sum_{1}^{rafp} \left(Q_{rafp,b,i} \times EF_{ra,b} \right) \quad (35)$$

where:

$rafp_{b,i}$ = number of reducing agents entering furnace process
$Q_{rafp,b,i}$ = quantity of each reducing agent rafp used (tonnes)
$EF_{ra,b}$ = emission factor for reducing agent, t CO_{2e}/tonne in the relevant period

$$TCOIFP_{b,i} = \sum_{1}^{oifp} \left(Q_{oifp,b,i} \times EF_{oi,b} \right) \quad (36)$$

where:

$oifp_{b,i}$ = number of the other inputs entering furnace process
$Q_{oifp,b,i}$ = quantity of each other input oifp used (tonnes)
$EF_{oi,,b}$ = emission factor for the other inputs, t CO_{2e}/tonne in the relevant period

Step 3. Casting/Rolling

$TCCR_{b,i} = TCFCR_{b,i} + TCECR_{b,i}$ (37)

where:

$TCFCR_{b,i}$ = total CO_{2e} from fuel consumption in square billet casting/rolling, t CO_{2e}
$TCECR_{b,i}$ = total CO_{2e} from electricity consumption in square billet casting/rolling

$$TCFCR_{b,i} = \sum_{1}^{fcr} \left(Q_{fcr,b,i} \times EF_{f,b} \right) \quad (38)$$

where:

$fcr_{b,i}$ = number of fuels used in the casting/rolling
$Q_{b,i}$ = quantity of each fuel fcr used (1000 m^3)
$EF_{f,b}$ = tonnes of CO_{2e} per 1000 m^3 of each fuel

$TCECR_{b,i} = ECCR_{b,i} * EF_{e,b}$ (39)

where:

$ECCR_{b,i}$ = electricity consumed in square billet casting/rolling, MWh
$EF_{e,b}$ = emission factor for electricity, t CO_{2e}/MWh in the relevant period

Step 4. Balance of process needs

$TCBPN_{b,i} = TCFCBPN_{b,i} + TCEBPN_{b,i}$ (40)

where:

$TCFCBPN_{b,i}$ = total CO_{2e} from fuel consumption for balance of process needs of project activity, t CO_{2e}:
$TCEBPN_{b,i}$ = total CO_{2e} from electricity consumption for balance of process needs of project activity, t CO_{2e}:

$$TCFCBPN_{b,i} = \sum_{1}^{fbpn} (Q_{fbpn,b,i} \times EF_{f,b}) \quad (41)$$

where:

$fbpn_{b,i}$ = number of fuels used in producing secondary energy used for balance of process needs
$Q_{b,i}$ = quantity of each fuel fbpn used (1000 m^3)
$EF_{f,b}$ = tonnes of CO_{2e} per 1000 m^3 of each fuel

$$TCEBPN_{b,i} = (ECBPN_{b,i} - ECSG_{b,i}) * EF_{e,b} \quad (42)$$

where:

$ECBPN_{b,i}$ = electricity used for production of secondary energy used for the balance of process needs (MWh)
$ECSG_{b,i}$ = self-generated electricity used in the project activity (MWh)
$EF_{e,b}$ = emission factor for electricity, t CO_{2e}/MWh in the relevant period

Emission reductions

$$ER_i = BE_i - PE_i \quad (43)$$

where:

ER = Emission Reductions
BE = Baseline Emissions
PE = Project Emissions

6. Parameters monitored according to monitoring plan

For the purpose of calculating GHG emission reduction units achieved by the project during the first quarter of 2012 the carbon emission factor for electricity consumption is based on the Order of the National Environmental Investment Agency of Ukraine (NEIA) № 75[4] dated 12/05/2011.

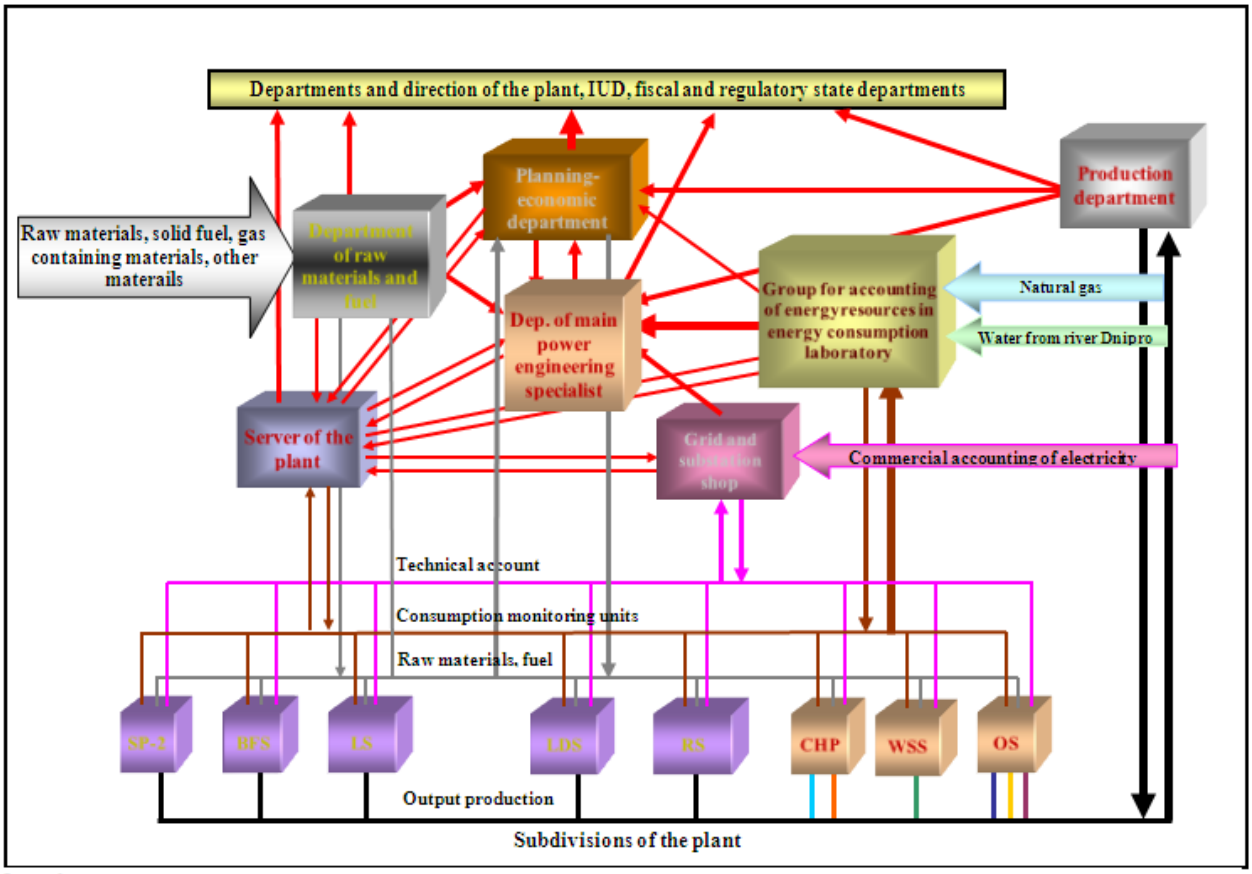
In accordance with mentioned above decree issued by NEIA for the 1st – class electricity consumers the carbon emission factor for electricity consumption is equal to 1,090 kg CO_2/kWh.

The utilization 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[5], 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[6].

The Schematic drawing of information preparation and supply system, which are used in this monitoring report, is presented below.

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



Legend:
SP-2 - Sinter plant; BFS - Blast furnace shop; LS - Lime shop; LDS - LD Converter shop; RS - Rolling shop; CHP - Combined heat and power (blowing, electricity and heat power production); WSS - water supply shop (pump over of technical and circulating water); OS - oxygen shop (oxygen, compressed air, nitrogen, argon production).

Figure 2. The Schematic drawing of information preparation and supply system

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:

Table 3. Colors that are used in the tables

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	

Table 4. Project emissions

ID number	Data variable	Units	01/01/2012 – 31/03/2012
P-1	Total CO_2 in the project scenario (PE)	Tonnes CO_{2e}	1 654 056
P-2	Total steel output in the project scenario (TSO_p)	Tonnes	631 360
P-3	Total embodied CO_{2e} of Pig Iron entering into the project ($TCPI_{p,i}$)	Tonnes CO_{2e}	1 472 473

P-4	Total Pig Iron Input into Steel Making Process ($TPII_p$)	Tonnes	594 186
P-5	Total CO_{2e} from fuel consumption in producing Pig Iron ($TCFCPI_{p,i}$)	Tonnes CO_{2e}	85 373
P-6	Quantity of each fuel (fpi_p) used in making Pig Iron ($Q_{fpi,p}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	45 099
P-7	Emission factor for each fuel $EF_{f,p}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)[7]	Tonnes CO_{2e}/1000 m^3	1,89301
P-8	Total CO_{2e} from electricity consumption in producing Pig Iron ($TCEPI_{p,i}$)	Tonnes CO_{2e}	3 559
P-9	Electricity Consumed in producing Pig Iron ($ECPI_p$)	MWh	3 265,12
P-10	Emissions factor for electricity ($EF_{e,p}$)[8]	Tonnes CO_{2e}/MWh	1,090
P-11	Total CO_{2e} from Inputs into Pig Iron ($TCIPI_{p,i}$)	Tonnes CO_{2e}	1 383 540
P-12	Total CO_{2e} from fuel used to prepare iron ore ($TCFIO_{p,i}$)	Tonnes CO_{2e}	5 095
P-13	Quantity of each fuel (fio_p) used in Sintering ($Q_{fio,p}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	2 692
P-14	Emission factor for each fuel $EF_{f,p}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
P-15	Total CO_{2e} from electricity consumption in preparing iron ore ($TCEIO_{p,i}$)	Tonnes CO_{2e}	23 112
P-16	Electricity Consumed in Sintering ($ECIO_p$)	MWh	21 203
P-17	Emissions factor for electricity ($EF_{e,p}$)	Tonnes CO_{2e}/MWh	1,090
P-18	Total CO_{2e} from Reducing Agents in Pig Iron Production ($TCRAPI_p$)	Tonnes CO_{2e}	1 315 448
P-19	Quantity of each reducing agent ($rapi_p$) in Pig Iron Production ($Q_{rapi,p}$)	Tonnes	
	Reducing agent (coke)	Tonnes	321 623
	Reducing agent (anthracite)	Tonnes	41 231
P-20	Emission factor of each reducing agent, $EF_{ra,p}$	Tonnes CO_{2e}/Tonne	

[7] 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.

[8] According to the Order of the NEIA # 75 dated 12.05.2011 http://www.neia.gov.ua/nature/doccatalog/document?id=127498.

	Emission factor (coke)[9]	**Tonnes CO_{2e}/Tonne**	**3,754**
	Default emission factor (anthracite)[10]	**Tonnes CO_{2e}/Tonne**	**2,62**
P-21	**Total CO_{2e} from other inputs ($TCOIPI_p$)**	**Tonnes CO_{2e}**	**39 885**
P-22	**Quantity of each other input ($oipi_p$) in Pig Iron Production ($Q_{oipi,p}$)**	**Tonnes**	
	Limestone	**Tonnes**	**73 440**
	Dolomite	**Tonnes**	**9 072**
	Pellets	**Tonnes**	**108 150**
P-23	**Emission factor of each other input, $EF_{oi,p}$**	**Tonnes CO_{2e}/Tonne**	
	Default emission factor (limestone)[11]	**Tonnes CO_{2e}/Tonne**	**0,44**
	Default emission factor (dolomite)[12]	**Tonnes CO_{2e}/Tonne**	**0,477**
	Default emission factor (pellets)[13]	**Tonnes CO_{2e}/Tonne**	**0,03**
P-24	**The total CO_{2e} emissions from the furnace process ($TCFP_{p,i}$)**	**Tonnes CO_{2e}**	**48 595**
P-25	**Total CO_{2e} from fuel consumption in Furnace Process ($TCFCFP_{p,i}$)**	**Tonnes CO_{2e}**	**4 498**
P-26	**Quantity of each fuel (ffp_p) used in furnace process ($Q_{ffp,p}$)**	**1000 m^3**	
	Natural gas (NG)	**1000 m^3**	**2 376**
P-27	**Emission factor for each fuel $EF_{f,p}$**	**Tonnes CO_{2e}/1000 m^3**	
	Natural gas (NG)	**Tonnes CO_{2e}/1000 m^3**	**1,89301**
P-28	**Total CO_{2e} from electricity consumption in Furnace Process ($TCECFP_{p,i}$)**	**Tonnes CO_{2e}**	**29 408**
P-29	**Electricity consumed in the furnace process ($ECFP_p$)**	**MWh**	**26 980**

[9] Emission factor for coke is based on actual carbon content of coke and default 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, Table 4.1 *Default CO_{2e} emission factors for coke production and iron and steel production*, page 4.25 (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_4_Ch4_Metal_Industry.pdf).

[10] Emission factor for anthracite is based on carbon content which is in accordance with 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 on net calorific value which in accordance with 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).

[11] Emission factor for limestone is 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).

[12] Emission factor for dolomite is 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] Emission factor for pellets is in accordance with 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3 Industrial Processes and Product Use, Chapter 4 Metal Industries Emissions, Table 4.1 *Default CO_{2e} emission factors for coke production and iron and steel production*, page 4.25 (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_4_Ch4_Metal_Industry.pdf).

P-30	Emissions factor for electricity ($EF_{e,p}$)	Tonnes CO_{2e}/MWh	1,090
P-31	Total CO_{2e} from Inputs into Furnace Process measured ($TCIFP_{p,i}$)	Tonnes CO_{2e}	14 689
P-32	Total CO_{2e} from Reducing Agents in the furnace process ($TCRAFP_p$)	Tonnes CO_{2e}	14 580
P-33	Quantity of each reducing agent ($rafp_p$) in the furnace process ($Q_{rafp,p}$)	Tonnes	
	Reducing agent (coke)	Tonnes	3 801
	Reducing agent (coal electrodes)	Tonnes	86
P-34	Emission factor of each reducing agent, $EF_{ra,p}$	Tonnes CO_{2e}/Tonne	
	Emission factor (coke)	Tonnes CO_{2e}/Tonne	3,754
	Default emission factor (coal electrodes)[14]	Tonnes CO_{2e}/Tonne	3,6
P-35	Total CO_{2e} from other inputs in the furnace process ($TCOIFP_p$)	Tonnes CO_{2e}	109
P-36	Quantity of each other input ($oifp_p$) in the furnace process ($Q_{oifp,p}$)	Tonnes	
	Pellets	Tonnes	3 625
	Dolomite	Tonnes	0
P-37	Emission factor of each other input, $EF_{oi,p}$	Tonnes CO_{2e}/Tonne	
	Default emission factor (pellets)	Tonnes CO_{2e}/Tonne	0,03
	Default emission factor (dolomite)	Tonnes CO_{2e}/Tonne	0,477
P-38	The total tonnes CO_{2e} from the square billet casting ($TCCR_{p,i}$)	Tonnes CO_{2e}	6 886
P-39	Total CO_{2e} from fuel consumption in square billet casting ($TCFCR_{p,i}$)	Tonnes CO_{2e}	1 624
P-40	Quantity of each fuel (fcr_p) used in casting ($Q_{fcr,p}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	858
P-41	Emission factor for each fuel $EF_{f,p}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
P-42	Total CO_{2e} from electricity consumption in square billet casting ($TCECR_{p,i}$)	Tonnes CO_{2e}	5 262
P-43	Electricity Consumed in casting ($ECCR_p$)	MWh	4 828
P-44	Emissions factor for electricity ($EF_{e,p}$)	Tonnes CO_{2e}/MWh	1,090

[14] Emission factor for coal electrodes is in accordance with Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Reference Manual (Volume 3), Chapter 2 (Industrial Processes), Table 2-12, page 2.26 (http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch2ref2.pdf).

P-45	Total tones of CO_2 related to the balance of process need of energy required for the project activity ($TCBPN_{p,i}$)	Tonnes CO_{2e}	126 103
P-46	Total CO_{2e} from fuel consumption for balance of process needs of project activity ($TCFCBPN_{p,i}$)	Tonnes CO_{2e}	21 455
P-47	Quantity of each fuel ($fbpn_p$) used for balance of process needs ($Q_{fbpn,p}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	11 334
	Coke oven gas (COG)	1000 m^3	0
P-48	Emission factor for each fuel $EF_{f,p}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
	Coke oven gas (COG)	Tonnes CO_{2e}/1000 m^3	0,79824
P-49	Total CO_{2e} from electricity consumption for balance of process needs of project activity ($TCEBPN_{p,i}$)	Tonnes CO_{2e}	104 647
P-50	Electricity Consumed for balance of process needs ($ECBPN_p$)	MWh	96 007
P-51	Self-generated electricity used in the project activity ($ECSG_p$)	MWh	0
P-52	Emissions factor for electricity ($EF_{e,p}$)	Tonnes CO_{2e}/MWh	1,090

Table 5. Baseline emissions

ID number	Data variable	Units	01/01/2012 – 31/03/2012
B-1	Total CO_{2e} in the baseline scenario (BE)	Tonnes CO_{2e}	2 005 506
B-2	Total Steel Output (TSO_b) (Baseline)	Tonnes	708 105
B-3	Total CO_{2e} due to the production of Pig Iron ($TCPI_{b,i}$)	Tonnes CO_{2e}	1 661 089
B-4	Total Pig Iron Input into Steel Making Process ($TPII_b$)	Tonnes	670 298
B-5	Total CO_{2e} from fuel consumption in producing Pig Iron ($TCFCPI_{b,i}$)	Tonnes CO_{2e}	96 309
B-6	Quantity of each fuel (fpi_b) used in making Pig Iron ($Q_{fpi,b}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	50 876
B-7	Emission factor for each fuel $EF_{f,b}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
B-8	Total CO_{2e} from electricity consumption in producing Pig Iron ($TCEPI_{b,i}$)	Tonnes CO_{2e}	4 015
B-9	Electricity Consumed in producing Pig Iron ($ECPI_b$)	MWh	3 683
B-10	Emissions factor for electricity ($EF_{e,b}$)	Tonnes CO_{2e}/MWh	1,090

B-11	Total CO_{2e} from Inputs into Pig Iron ($TCIPI_{b,i}$)	Tonnes CO_{2e}	1 560 765
B-12	Total CO_{2e} from fuel used to prepare iron ore ($TCFIO_{b,i}$)	Tonnes CO_{2e}	5 748
B-13	Quantity of each fuel (fio_b) used in Sintering ($Q_{fio,b}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	3 036
B-14	Emission factor for each fuel $EF_{f,b}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
B-15	Total CO_{2e} from electricity consumption in preparing iron ore ($TCEIO_{b,i}$)	Tonnes CO_{2e}	26 072
B-16	Electricity Consumed in Sintering ($ECIO_b$)	MWh	23 919
B-17	Emissions factor for electricity ($EF_{e,b}$)	Tonnes CO_{2e}/MWh	1,090
B-18	Total CO_{2e} from Reducing Agents in Pig Iron Production ($TCRAPI_b$)	Tonnes CO_{2e}	1 483 951
B-19	Quantity of each reducing agent ($rapi_b$) in Pig Iron Production ($Q_{rapi,b}$)	Tonnes	
	Reducing agent (coke)	Tonnes	362 821
	Reducing agent (anthracite)	Tonnes	46 513
B-20	Emission factor of each reducing agent, $EF_{ra,b}$	Tonnes CO_{2e}/Tonne	
	Emission factor (coke)	Tonnes CO_{2e}/Tonne	3,754
	Default emission factor (anthracite)	Tonnes CO_{2e}/Tonne	2,62
B-21	Total CO_{2e} from other inputs ($TCOIPI_b$)	Tonnes CO_{2e}	44 994
B-22	Quantity of each other input ($oipi_b$) in Pig Iron Production ($Q_{oipi,b}$)	Tonnes	
	Limestone	Tonnes	82 847
	Dolomite	Tonnes	10 234
	Pellets	Tonnes	122 003
B-23	Emission factor of each other input, $EF_{oi,b}$	Tonnes CO_{2e}/Tonne	
	Default emission factor (limestone)	Tonnes CO_{2e}/Tonne	0,44
	Default emission factor (dolomite)	Tonnes CO_{2e}/Tonne	0,477
	Default emission factor (pellets)	Tonnes CO_{2e}/Tonne	0,03
B-24	The total CO_{2e} emissions from the furnace process ($TCFP_{b,i}$)	Tonnes CO_{2e}	37 512
B-25	Total CO_{2e} from fuel consumption in Furnace Process ($TCFCFP_{b,i}$)	Tonnes CO_{2e}	5 045
B-26	Quantity of each fuel (ffp_b) used in furnace process ($Q_{ffp,b}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	2 665
B-27	Emission factor for each fuel $EF_{f,b}$	Tonnes CO_{2e}/1000 m^3	

	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
B-28	Total CO_{2e} from electricity consumption in Furnace Process ($TCECFP_{b,i}$)	Tonnes CO_{2e}	16 339
B-29	Electricity consumed in the furnace process ($ECFP_b$)	MWh	14 990
B-30	Emissions factor for electricity ($EF_{e,b}$)	Tonnes CO_{2e}/MWh	1,090
B-31	Total CO_{2e} from Inputs into Furnace Process measured ($TCIFP_{b,i}$)	Tonnes CO_{2e}	16 128
B-32	Total CO_{2e} from Reducing Agents in the furnace process ($TCRAFP_b$)	Tonnes CO_{2e}	16 006
B-33	Quantity of each reducing agent ($rafp_b$) in the furnace process ($Q_{rafp,b}$)	Tonnes	
	Reducing agent (coke)	Tonnes	4 264
	Reducing agent (coal electrodes)	Tonnes	0
B-34	Emission factor of each reducing agent, $EF_{ra,b}$	Tonnes CO_{2e}/Tonne	
	Emission factor (coke)	Tonnes CO_{2e}/Tonne	3,754
	Default emission factor (coal electrodes)	Tonnes CO_{2e}/Tonne	3,6
B-35	Total CO_{2e} from other inputs in the furnace process ($TCOIFP_b$)	Tonnes CO_{2e}	122
B-36	Quantity of each other input ($oifp_b$) in the furnace process ($Q_{oifp,b}$)	Tonnes	
	Pellets	Tonnes	4 065
	Dolomite	Tonnes	0
B-37	Emission factor of each other input, $EF_{oi,b}$	Tonnes CO_{2e}/Tonne	
	Default emission factor	Tonnes CO_{2e}/Tonne	0,03
	Default emission factor	Tonnes CO_{2e}/Tonne	0,477
B-38	The total tonnes CO_{2e} from the square billet casting/rolling process ($TCCR_{b,i}$)	Tonnes CO_{2e}	134 603
B-39	Total CO_{2e} from fuel consumption in square billet casting/rolling ($TCFCR_{b,i}$)	Tonnes CO_{2e}	68 618
B-40	Quantity of each fuel (fcr_b) used in casting/rolling ($Q_{fcr,b}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	36 248
B-41	Emission factor for each fuel $EF_{f,b}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
B-42	Total CO_{2e} from electricity consumption in square billet casting/rolling ($TCECR_{b,i}$)	Tonnes CO_{2e}	65 985
B-43	Electricity Consumed in casting ($ECCR_b$)	MWh	60 537
B-44	Emissions factor for electricity ($EF_{e,b}$)	Tonnes CO_{2e}/MWh	1,090
B-45	Total tones of CO_2 related to the balance of process need of energy required for the project activity ($TCBPN_{b,i}$)	Tonnes CO_{2e}	172 302

B-46	Total CO_{2e} from fuel consumption for balance of process needs of project activity ($TCFCBPN_{b,i}$)	Tonnes CO_{2e}	24 224
B-47	Quantity of each fuel ($fbpn_b$) used for balance of process needs ($Q_{fbpn,b}$)	1000 m^3	
	Natural gas (NG)	1000 m^3	12 797
	Coke oven gas (COG)	1000 m^3	0
B-48	Emission factor for each fuel $EF_{f,b}$	Tonnes CO_{2e}/1000 m^3	
	Natural gas (NG)	Tonnes CO_{2e}/1000 m^3	1,89301
	Coke oven gas (COG)	Tonnes CO_{2e}/1000 m^3	0,79824
B-49	Total CO_{2e} from electricity consumption for balance of process needs of project activity ($TCEBPN_{b,i}$)	Tonnes CO_{2e}	148 078
B-50	Electricity Consumed for balance of process needs ($ECBPN_b$)	MWh	135 851,01
B-51	Self-generated electricity used in the project activity ($ECSG_b$)	MWh	0
B-52	Emissions factor for electricity ($EF_{e,b}$)	Tonnes CO_{2e}/MWh	1,090

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 data regarding emission reductions are given in the next chapter.

7. Emission reductions calculation

Following table shows emission reductions through the project[15]:

Table 6. Emission reductions through the project

	01/01/2012 – 31/03/2012
Baseline Emissions (BE), t CO_{2e}	**2 005 506**
Project Emissions (PE), t CO_{2e}	**1 654 056**
Emission Reductions, t CO_{2e}	**351 450**

The amount of emission reductions that were actually generated during 1-st quarter of 2012 are lower than those stated in the PDD (444 950 tonnes of CO_{2e}) because of the following reasons. The reason for this is that baseline and project line scenarios were developed according to the scenario of perspective plan of steel production growth, which unfortunately has not justified due to the crisis of 2008-2011.

[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.

8. Measures to ensure the accuracy of the results

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[16] version. The QMS covers the whole of the Plant's production process[17]. Furthermore, an OHSAS 18001:2007 industrial safety management system and an ISO 14001:2004 environmental management system were implemented in 2009[18]. Compliance audits for the above standards are performed on an annual basis. In addition, the Plant has a number of other certificates[19], 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.

All the equipment used for monitoring purposes is in line with national legislative requirements and standards. The documented instructions to operate the facilities are stored at working places. Verification and calibration of equipment are conducted at the plant in accordance with in STP 230-35-07 Metrological Support of Measuring Equipment. List of monitoring equipment is provided in Annex 1. The data cross check as well as internal audits and corrective actions are taken as defined in STP 230-18-03 *Quality Management System Internal Audits* and according to the standards ISO 9001:2008, ISO 14001 and OHSAS 18001.

[16] http://www.dmkd.dp.ua/system/files/u21/sert.jpg

[17] Certificates were issued by UkrSEPRO (# UA 2.008.06119 dated 21/06/2011) and TÜV THÜRINGEN (TIC 15 100 127865 dated 31/01/2012).

[18] 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).

[19] Relevant information may be provided upon request.

9. 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.

Table 7. Responsibilities for monitoring

Responsibility	Specialist Responsible
Overall project responsibility	Technical director
Overall responsibility for Monitoring Report	Head of Technical Department
Data for Converters, LFs, Casting and CCMs	Converter Shop Manager
Data for Blooming Mill, Billet Mill, and Structural Mill	Mills Supervisor
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*[20].

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 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).

[20] The instructions have been developed in accordance with ISO 9001:2008 requirements. They secure accuracy of all the measurements done using monitoring equipment.

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).

Data is collected into electronic database of DIISW as well as in paper format. Data is further compiled in (i) day-to-day records, (ii) quarterly records, and (iii) annual records. All records are finally stored in Planning-economic department.

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

DIISW has organized appropriate staff training to operate the project equipment. With the project equipment introduction the workers had the opportunity to update their working skills, stimulated by the permanent educational theoretical and practical courses at the Steel Plant.

Annex 1. The list of monitoring equipment

#	Explanation	Type of monitoring equipment	Serial number	Frequency of verification (calibration)	Date of last verification (calibration)	Uncertainty level of data
1	2	3	4	5	6	7
P-2 B-2	Scales for weighing steel output	Т 675 П 200	0030	Once a year	04.2011	±100kg
P-2 B-2	Scales for weighing steel output	2372ВВ-150Е/2С	72	Once a year	05.2011	(4-25) t ±50 kg (25-100) t ±100kg (100-150)t±150kg
P-2 B-2	Scales for weighing steel output	СВ 150000ВМ2	04071037	Once a year	07.2011	(2-25)t ±50 kg (25-100)t ±100 kg > 100 t ±150 kg
P-4 B-4	Scales for weighing pig iron	2390ВВ-200Е/1С	90	Once a year	10.2011	(10-25) t ±50 kg (25-100)t ±100 kg (100-200)t±150 kg
P-6 B-6	BF-1m Natural gas consumption meter	Сапфир-М	02619588	Once in 2 years	04.2010	0,25%
P-6 B-6	BF-1m Natural gas pressure meter	Сапфир –М	03484802	Once in 2 years	06.2010	0,25%
P-6 B-6	BF-1m Natural gas consumption meter	Сапфир –М	03981694	Once in 2 years	04.2010	0,25%
P-6 B-6	BF-1m Natural gas pressure meter	Сапфир –М	02800644	Once in 2 years	02.2012	0,25%
P-6 B-6	BF-8 Natural gas consumption meter	Сапфир- М	03850732	Once in 2 years	07.2010	0,25%
P-6 B-6	BF-8 Natural gas pressure meter	Сапфир- М	03393821	Once in 2 years	04.2010	0,25%
P-6 B-6	BF-8 Natural gas consumption meter	Сапфир- М	03831731	Once in 2 years	02.2012	0,25%
P-6 B-6	BF-8 Natural gas pressure meter	Сапфир – М	03483807	Once in 2 years	07. 2010	0,25%
P-6 B-6	BF-9 Natural gas consumption meter	Метран-100	66737	Once a year	03.2012	0,25%
P-6 B-6	BF-9 Natural gas pressure meter	Метран-100	65430	Once a year	03.2012	0,25%
P-6 B-6	BF-9 Natural gas consumption meter	Метран-100	133425	Once a year	09.2011	0,25%

Р-6 В-6	BF-9 Natural gas pressure meter	Метран-100	135282	Once a year	06.2011	0,25%
Р-6 В-6	BF-12 Natural gas consumption meter	Сафир –М	10612957	Once in 2 years	07.2010	0,25%
Р-6 В-6	BF-12 Natural gas pressure meter	АИР-20	31275	Once a year	07.2011	0,25%
Р-6 В-6	BF-12 Natural gas consumption meter	Сапфир –М	07173694	Once in 2 years	07.2010	0,25%
Р-6 В-6	BF-12 Natural gas pressure meter	Сапфир –М	03493886	Once in 2 years	07.2010	0,25%
Р-9 В-9	Electric substation of Blast-furnace shop					
	Electricity meter #9	И670	130180	Once in 2 years	10.2010	2,0%
	Electricity meter #10	И670	068744	Once in 2 years	12.2010	2,0%
	Electricity meter #11	ИТ	111336	Once in 2 years	04.2010	2,5%
	Electricity meter #12	ЕвроАльфа	01132780	Once in 8 years	02.2006	0,5S%
	Electricity meter #13	ЕвроАльфа	01132784	Once in 8 years	IV 2006	0,5S%
	Electricity meter #14	ЕвроАльфа	01132775	Once in 8 years	IV 2006	0,5S%
	Electricity meter #15	ЕвроАльфа	01132773	Once in 8 years	IV 2006	0,5S%
	Electricity meter #16	ЕвроАльфа	01132770	Once in 8 years	IV 2006	0,5S%
	Electricity meter #17	ЕвроАльфа	01132767	Once in 8 years	02.2006	0,5S%
	Electricity meter #18	ЕвроАльфа	01132769	Once in 8 years	IV 2006	0,5S%
	Electricity meter #19	ЕвроАльфа	01132774	Once in 8 years	02.2006	0,5S%
	Electricity meter #20	ЕвроАльфа	01132789	Once in 8 years	IV 2006	0,5S%
	Electricity meter #21	ЕвроАльфа	01132791	Once in 8 years	IV 2006	0,5S%
	Electricity meter #22	ЕвроАльфа	01132768	Once in 8 years	IV 2006	0,5S%
	Electricity meter #23	ЕвроАльфа	01132786	Once in 8 years	IV 2006	0,5S%
	Electricity meter #24	И670	193791	Once in 2 years	03.2012	2,0%

	Electricity meter #26	И670	361580	Once in 2 years	05.2011	2,0%
	Electricity meter #27	И670	304986	Once in 2 years	05.2011	2,0%
	Electricity meter #28	И681	655731	Once in 2 years	05.2011	2,0%
	Electricity meter #29	И670	905679	Once in 2 years	02.2011	2,0%
Р-13 **В-13**	Sinter plant Natural gas consumption meter	Сафир М Сафир М	03939733 03639990	Once in 2 years Once in 2 years	04.2011 01.2012	0,25% 0,25%
Р-13 **В-13**	Sinter plant Natural gas pressure meter		08397518	Once in 2 years	04.2011	0,25%
Р-13 **В-13**	Sinter plant Natural gas pressure meter	Сапфир 2М	33822	Once a year	02.2012	0,25%
Р-16 **В-16**	Electric substation of Sinter plant					
	Electricity meter #1	И670М	365718	Once in 2 years	11.2011	2,0%
	Electricity meter #2	И670	736250	Once in 2 years	10.2010	2,0%
	Electricity meter #3	ИТ	113199	Once in 2 years	08.2011	2,5%
	Electricity meter #4	И670М	429768	Once in 2 years	11.2011	2,0%
	Electricity meter #5	И670Д	619098	Once in 2 years	09.2010	2,0%
	Electricity meter #6	И670М	946661	Once in 2 years	11.2011	2,0%
	Electricity meter #7	И670	130888	Once in 2 years	11.2011	2,0%
	Electricity meter #8	ЕвроАльфа	01132785	Once in 8 years	02.2006	0,5S%
Р-16 **В-16**	Electric substation of Lime shop					
	Electricity meter #69	И43	192130	Once in 2 years	10.2011	2,0%
	Electricity meter #70	И670	473710	Once in 2 years	07.2010	2,0%
	Electricity meter #71	И670	552166	Once in 2 years	06.2011	2,0%
	Electricity meter #72	И670	584132	Once in 2 years	07.2010	2,0%
Р-19 **В-19** **Р-22** **В-22** **Р-33**	Scales for weighing coke and anthracite	2370ВВ-150Е/2С	70	Once a year	11.2011	(4-25) t ±50 kg (25-100) t ±100 kg (100-150)t±150 kg

B-33						
P-19 **B-19** **P-22** **B-22** **P-33** **B-33**	Scales for weighing coke and anthracite	2329ВВ-50 Е/1Д	29	Once a year	11.2011	(10-70) t ±0,5% (70-200) t ±0,5%
P-26 **B-26**	Furnace process Natural gas consumption meter	Эромер - 126	652	Once in 2 years	06.2010	0,1%
P-26 **B-26**	Furnace process Natural gas consumption meter	А 542	31154	Once a year	08.2011	0,5%
P-26 **B-26**	Furnace process Natural gas consumption meter	А 542	76552	Once a year	11.2011	0,5%
P-26 **B-26**	Furnace process Natural gas consumption meter	А 542	76567	Once a year	01.2012	0,5%
P-29 **B-29**	Electric substation LD-Converter shop					
	Electricity meter #41	И670	192117	Once in 2 years	06.2010	2,0%
	Electricity meter #42	И670	376504	Once in 2 years	05.2010	2,0%
	Electricity meter #43	И670	565029	Once in 2 years	09.2011	2,0%
	Electricity meter #44	И670	172404	Once in 2 years	10.2011	2,0%
	Electricity meter #45	И670	422588	Once in 2 years	10.2011	2,0%
	Electricity meter #46	И670	095571	Once in 2 years	02.2011	2,0%
	Electricity meter #47	И670	172822	Once in 2 years	02.2011	2,0%
	Electricity meter #48	И670	906102	Once in 2 years	10.2011	2,0%
	Electricity meter #49	И670	656952	Once in 2 years	02.2011	2,0%
	Electricity meter #50	И670М	329704	Once in 2 years	01.2011	2,0%
	Electricity meter #51	И670	709003	Once in 2 years	11.2010	2,0%
	Electricity meter #52	LZQM	510557	Once in 6 years	08.2009	0,5%
	Electricity meter #53	LZQM	510559	Once in 6 years	08.2009	0,5%
P-36 **B-36**	Scales for weighing limestone, dolomite and pellets	Т 675 П 200	0084	Once a year	07.2011	< 50 t ±100kg (50-200) t ±150kg

Р-40 В-40	Casting/Rolling Natural gas consumption meter	А 542	47050	Once a year	12.2011	0,5%
Р-40 В-40	Casting/Rolling Natural gas consumption meter	А 542	90812	Once a year	07.2011	0,5%
Р-40 В-40	Casting/Rolling Natural gas consumption meter	А 542	78438	Once a year	12.2011	0,5%
Р-40 В-40	Casting/Rolling Natural gas consumption meter	Сапфир 22ДД	841346	Once a year	10.2011	0,25%
Р-40 В-40	Casting/Rolling Natural gas consumption meter	Метран 100ДИ-1150	415920	Once a year	07.2011	0,2%
Р-40 В-40	Casting/Rolling Natural gas consumption meter	Метран 100ДД	439273	Once a year	10.2011	0,2%
Р-40 В-40	Casting/Rolling Natural gas consumption meter	ДМ 3583 М	51417	Once a year	04.2011	1,8%
Р-43 В-43	Electric substation Casting/Rolling shop					
	Electricity meter #54	И670	306034	Once in 3 years	10.2011	2,0%
	Electricity meter #55	И670М	367107	Once in 2 years	02.2012	2,0%
	Electricity meter #56	И670	626945	Once in 2 years	02.2012	2,0%
	Electricity meter #57	И670М	365024	Once in 2 years	02.2012	2,0%
	Electricity meter #58	ЭЛСТЕР	01176869	Once in 6 years	04.2010	2,0%
	Electricity meter #59	И670	330501	Once in 2 years	02.2011	2,0%
	Electricity meter #60	И670	143450	Once in 2 years	02.2011	2,0%
	Electricity meter #61	ИТ	014952	Once in 2 years	03.2011	2,5%
	Electricity meter #62	ИТ	106631	Once in 2 years	12.2010	2,5%
	Electricity meter #63	ИТ	112404	Once in 2 years	11.2010	2,5%
	Electricity meter #64	ИТ	107843	Once in 2 years	05.2010	2,5%
	Electricity meter #65	ИТ	478712	Once in 2 years	06.2010	2,5%
	Electricity meter #66	ИТ	110251	Once in 2 years	04.2011	2,5%
	Electricity meter #67	И672	919194	Once in 2 years	06.2011	2,0%
	Electricity meter #68	И672	044728	Once in 2 years	07.2011	2,0%

	Electricity meter #73	И43	717973	Once in 2 years	11.2010	2,0%
	Electricity meter #74	И670	428564	Once in 2 years	11.2010	2,0%
	Electricity meter #75	И670	904962	Once in 2 years	02.2012	2,0%
	Electricity meter #76	И670М	690664	Once in 2 years	02.2012	2,0%
	Electricity meter #77	И672М	864972	Once in 2 years	03.2012	2,0%
	Electricity meter #78	И672	003220	Once in 2 years	03.2012	2,0%
	Electricity meter #79	И681	655957	Once in 2 years	12.2011	2,0%
	Electricity meter #80	И670	156892	Once in 2 years	01.2012	2,0%
	Electricity meter #81	И687	219078	Once in 2 years	01.2011	2,0%
	Electricity meter #82	И670	740734	Once in 2 years	05.2010	2,0%
	Electricity meter #83	И670	691911	Once in 2 years	05.2010	2,0%
	Electricity meter #84	И670	754699	Once in 2 years	08.2010	2,0%
	Electricity meter #85	ЦЭ6805В	4151992	Once in 6 years	08.2006	2,0%
	Electricity meter #86	И670	306372	Once in 2 years	09.2011	2,0%
	Electricity meter #87	И670	079300	Once in 2 years	03.2011	2,0%
	Electricity meter #88	И670М	063322	Once in 2 years	03.2011	2,0%
	Electricity meter #89	И670	566577	Once in 2 years	03.2010	2,0%
	Electricity meter #90	И670	690636	Once in 2 years	08.2010	2,0%
	Electricity meter #91	ЦЄ6805В	44152216	Once in 6 years	III 2006	0,5%
	Electricity meter #92	И670М	771057	Once in 2 years	08.2010	2,0%
	Electricity meter #93	И670М	366503	Once in 2 years	12.2011	2,0%
	Electricity meter #94	И670М	866520	Once in 2 years	12.2011	2,0%
	Electricity meter #95	И670М	532002	Once in 2 years	12.2010	2,0%
	Electricity meter #96	ЦЭ6805В	44152114	Once in 6 years	III 2006	0,5%

	Electricity meter #99	ЦЭ6805В	45075871	Once in 6 years	III 2006	0,5%
	Electricity meter #101	ИТ	236783	Once in 2 years	06.2010	2,5%
	Electricity meter #102	И196	983512	Once in 2 years	07.2010	2,0%
	Electricity meter #103	И196	613258	Once in 2 years	07.2010	2,0%
	Electricity meter #104	И196	036832	Once in 2 years	04.2010	2,0%
	Electricity meter #105	ЦЭ6805В	44152116	Once in 6 years	III 2006	0,5%
Р-47 В-47	CHP Natural gas consumption meter	Сапфир	517758	Once a year	09.2011	0,25%
Р-47 В-47	CHP Natural gas consumption meter	Метран	316871	Once a year	08.2011	0,25%
Р-50 В-50	Electric substation of Water supply shop					
	Electricity meter #106	И670	095716	Once in 2 years	07.2010	2,0%
	Electricity meter #107	ИТ	691814	Once in 2 years	03.2010	2,5%
	Electricity meter #108	И670Д	363453	Once in 2 years	06.2011	2,0%
	Electricity meter #109	И670	127301	Once in 2 years	07.2010	2,0%
	Electricity meter #110	И670	771697	Once in 2 years	07.2010	2,0%
	Electricity meter #111	И43	006194	Once in 2 years	12.2010	2,0%
	Electricity meter #112	И43	047260	Once in 2 years	04.2011	2,0%
	Electricity meter #113	И687	355820	Once in 2 years	05.2011	2,0%
	Electricity meter #114	И670	146522	Once in 2 years	05.2010	2,0%
	Electricity meter #115	И670М	366136	Once in 2 years	05.2010	2,0%
	Electricity meter #116	И670М	644511	Once in 2 years	08.2010	2,0%
	Electricity meter #117	И670М	643487	Once in 2 years	08.2010	2,0%
	Electricity meter #118	И670	793273	Once in 2 years	08.2010	2,0%
	Electricity meter #119	И670	350061	Once in 2 years	08.2010	2,0%

	Electricity meter #120	И43	237322	Once in 2 years	08.2011	2,0%
	Electricity meter #121	И43	155427	Once in 2 years	10.2011	2,0%
	Electricity meter #122	И670М	130498	Once in 2 years	07.2010	2,0%
	Electricity meter #123	И670	649492	Once in 2 years	02.2012	1,0%
	Electricity meter #124	И670	193831	Once in 2 years	01.2011	2,0%
	Electricity meter #125	И670М	011918	Once in 2 years	08.2011	2,0%
	Electricity meter #126	И670	303419	Once in 2 years	06.2010	2,0%
	Electricity meter #127	ИТ	690221	Once in 2 years	11.2011	2,5%
	Electricity meter #128	И670	233827	Once in 2 years	04.2010	2,0%
	Electricity meter #129	И670М	096018	Once in 2 years	04.2010	2,0%
	Electricity meter #130	И670	305171	Once in 2 years	02.2012	2,0%
	Electricity meter #131	И670	377759	Once in 2 years	11.2010	2,0%
	Electricity meter #132	И670	188830	Once in 2 years	06.2011	2,0%
	Electricity meter #133	И670	192034	Once in 2 years	06.2011	2,0%
	Electricity meter #136	И670	605102	Once in 2 years	02.2012	2,0%
	Electricity meter #137	И670	082160	Once in 2 years	05.2010	2,0%
	Electricity meter #138	И670М	095620	Once in 2 years	10.2011	2,0%
	Electricity meter #139	И670М	506019	Once in 2 years	08.2010	2,0%
Р-50 В-50	Electric substation of Oxygen shop					
	Electricity meter #142	И670	754749	Once in 2 years	12.2010	2,0%
	Electricity meter #143	И43	201587	Once in 2 years	10.2011	2,0%
	Electricity meter #145	И670	143541	Once in 2 years	02.2012	2,0%
	Electricity meter #146	И670М	157116	Once in 2 years	08.2010	2,0%
	Electricity meter #147	И670	233755	Once in 2 years	01.2012	2,0%

	Electricity meter #148	И670М	036772	Once in 2 years	01.2012	2,0%
	Electricity meter #149	И670	062944	Once in 2 years	01.2012	2,0%
	Electricity meter #150	И670Д	619944	Once in 2 years	04.2010	2,0%
	Electricity meter #151	И670	919610	Once in 2 years	03.2012	2,0%
	Electricity meter #152	ЕТ	8876	Once in 6 years	09.2006	0,5%
	Electricity meter #153	ЕТ	8875	Once in 6 years	09.2006	0,5%
Р-50 В-50	Electric substation of Gas shop					
	Electricity meter #166	И670	690556	Once in 2 years	08.2011	2,0%
	Electricity meter #167	И670	168047	Once in 2 years	08.2011	2,0%
	Electricity meter #168	И670	232756	Once in 2 years	03.2011	2,0%
	Electricity meter #169	И670	134849	Once in 2 years	09.2010	2,0%
	Electricity meter #170	И670	672417	Once in 2 years	02.2012	2,0%
	Electricity meter #171	И670	712689	Once in 2 years	03.2011	2,0%
	Electricity meter #172	И670М	021916	Once in 2 years	12.2011	2,0%
Р-50 В-50	Electric substation of CHP					
	Electricity meter #154	И670	069187	Once in 2 years	09.2011	2,0%
	Electricity meter #155	И670	374202	Once in 2 years	03.2012	2,0%
	Electricity meter #156	ИТ	313176	Once in 2 years	11.2010	2,5%
	Electricity meter #157	И670	115317	Once in 2 years	10.2011	2,0%
	Electricity meter #158	И670	754589	Once in 2 years	10.2011	2,0%
	Electricity meter #159	И670	233380	Once in 2 years	12.2009	2,0%
	Electricity meter #160	И670	306278	Once in 2 years	12.2010	2,0%
	Electricity meter #161	И670	793115	Once in 2 years	07.2010	2,0%
	Electricity meter #162	И670	681225	Once in 2 years	11.2010	2,0%

	Electricity meter #163	И670	603211	Once in 2 years	11.2010	2,0%
	Electricity meter #164	И670	350258	Once in 2 years	03.2012	2,0%