

MONITORING PLAN

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A. Description of monitoring plan chosen

The Project involves four different interventions:

- SP1 - Reconstruction of thermal and heating furnaces;
- SP2 - Installation of a new vacuum system (Vacuum Degasser (VD));
- SP3 - Installation of arc ladle furnace;
- SP4 - Modernization of press equipment.

These interventions will involve savings of different energy sources, mainly of electricity and natural gas. The energy consumption at the EMSS depends on the steel production, which could be different from EMSS previsions. In particular there are productions that have to be considered:

- The production of electro steel in [tonnes/m];
- The production of vacuumed steel in [tonnes/m];
- The production level of each of the 26 reconstructed thermal and heating furnaces in [tonnes/m];

The specific energy consumption can be measured in terms of electricity and natural gas, divided by the production of steel and steel details.

The total energy and total GHG emissions can be evaluated directly from these consumptions, but a comparison with the baseline – and thus a global evaluation of GHG reductions – can not be done without taking into account the production levels.

Data can be collected by means of electric power meters and gas flow meters at each of the plants where improvements will take place; the monitoring plan will depend on direct measurements.

The project emissions are mainly emissions of CO₂ from the burning process of natural gas and emissions lied to electricity generation elsewhere on the Ukrainian electricity system. There is an insignificant quantity of methane emissions (assessed as insignificant and excluded from supervision) and emissions from nitrous oxide released during the natural gas burning process. These quantities are insignificant, because:

- the technology employed for the burning process is state-of-art one and there is not unburned quantity of natural gas in the flue gases;
- the quantity of nitrous oxide in the flue gases released during the burning process will be lower than in the existing situation.

Additionally, to the natural gas quantity feed for burning, there is a quantity of emissions from methane, from natural gas leakages during its delivery through the gas pipeline. These indirect greenhouse emissions are assessed by the delivered natural gas parameters through the incorporate gas pipelines and their length, using standard assessments for the specific leakages and emissions factors. These indirect greenhouse emissions are not taken into account. Given the fact the project will lead to lower leakages, the monitored emission reductions are conservative.

Considering the project scope, the following data/parameters need to be monitored:

- Natural gas consumed by the reconstructed furnaces, in thousand Nm³;
- The production level of each of the 26 reconstructed thermal and heating furnaces, in tonnes;
- The production of electro steel, in tonnes;
- The production of vacuumed steel, in tonnes;
- Electricity consumed by the new vacuum system (VD), in MWh;
- Electricity consumed by the ladle furnace, in MWh;
- Electricity consumed by the new pumps of the 15,000 tonnes press, in MWh.

There is a monitoring model, expressing the specific requirements. Such model is prepared under MS-Excel. The model requirements are to enter the monitored parameters as an input data, so it will automatically calculates simultaneously the project and the baseline emissions, for each year after the project commissioning.

The electronic worksheets should be filled with information by the project manager and also the inspecting personnel, through the whole operational lifetime of the project related to the crediting period.

The baseline emissions relate to the energy consumption that would have occurred when operating the existing infrastructure (baseline scenario) assuming that the same volume of products would be produced as monitored in the project scenario. The specific energy consumption for each subproject is fixed ex-post by taking the average specific energy consumption of the years 2002- 2006. With the formulae given below the baseline CO₂ emissions are calculated.

B. Monitoring of the emissions in the project scenario and the baseline scenario

B.1. Monitoring of the emissions in the project scenario

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	PE_y , project emissions of all four interventions	Monitoring of GHG emissions in year y (all four interventions)	tCO ₂	c	monthly	100%	Electronic and paper	
2	PE_{sp1} , project emissions of subproject 1	Monitoring of GHG emissions in year y from subproject 1	tCO ₂	c	monthly	100%	Electronic and paper	
3	PE_{sp2} , project emissions of subproject 2	Monitoring of GHG emissions in year y from subproject 2	tCO ₂	c	monthly	100%	Electronic and paper	
4	PE_{sp3} , project emissions of subproject 3	Monitoring of GHG emissions in year y from subproject 3	tCO ₂	c	monthly	100%	Electronic and paper	
5	PE_{sp4} , project emissions of subproject 4	Monitoring of GHG emissions in year y from subproject 4	tCO ₂	c	monthly	100%	Electronic and paper	

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6 - 31	$NG_{tf,y}$ quantity of NG, used by the 26 reconstructed furnaces	Measuring devices of the thermal shop	1,000 nm3	m/c	monthly	100%	Electronic and paper	Measuring devices include gas flow meters, and pressure and temperature meters providing data for calculation of nm3 of gas where applicable.
32	LCV_{NG} , Low Calorific Value of the NG	Supplier of the NG	MWh/1000n m3	c	monthly	100%	Electronic and paper	
33	EF_{NG} , emission factor of the NG burning process	IPCC 2006	tCO2/MWh	c	fixed value	100 %	Electronic	
34	EL_{VD} , electricity consumed by the new vacuum system (VD)	Measuring devices of VD	MWh	c	monthly	100%	Electronic and paper	
35	$EF_{el,y}$ emission factor of the Ukrainian grid for reducing project	See Annex 4	tCO2/MWh	c	fixed ex-ante	100 %	Electronic and paper	= 0.896 tCO2/MWh

36	EL_{LF} , Electricity consumed by the ladle furnace	Measuring devices of ladle furnace	MWh	c	monthly	100%	Electronic and paper	
37	EL_{EAF} , Electricity consumed by the EAFs	Measuring devices of EAFs	MWh	c	monthly	100%	Electronic and paper	
38	EL_{PR} , electricity consumed by the new pumps of the 15,000 tonnes press	Measuring devices of the press equipment	MWh	c	monthly	100%	Electronic and paper	

The annual project emissions are done by the equation:

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

Where:

PE_y - are the annual project emissions for the year y (ID1), [tCO₂];

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

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

$$PE_{sp1} = \sum_{i=1}^{i=n} \left(\sum_{1}^{26} NG_{f,i} * LCV_{NG,i} * EF_{NG} \right) \quad (Equation 2)$$

Where:

PE_{sp1} - is the sum of project emissions of subproject 1 from each month of the monitoring period , [tCO₂];

$NG_{f,i}$ - is the volume of NG, used by the 26 reconstructed furnaces in the month i, [1000 nm³];

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

EF_{NG} - is the emission factor of the NG burning process, [tCO₂/MWh].

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

$$PE_{sp2} = \sum_{i=1}^n (EL_{VD,i} * EF_{el}) \quad (Equation 3)$$

Where:

PE_{sp2} - is the sum of project emissions of subproject 2 from each month of the monitoring period, [tCO₂];

$EL_{VD,i}$ - is the electrical consumption of the new VD in the month i, [MWh];

EF_{el} - is the calculated emission factor of the Ukrainian grid, [tCO₂/MWh].

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

$$PE_{sp3} = \sum_{i=1}^n ((EL_{LF,i} + EL_{EAF,i}) * EF_{el}) \quad (Equation 4)$$

Where:

PE_{sp3} - is the sum of project emissions of subproject 3 from each month of the monitoring period, [tCO₂];

$EL_{LF,i}$ - is the electrical consumption of the new ladle furnace in the month i, [MWh];

$EL_{EAF,i}$ - is the electrical consumption of the electric arc furnace in the month i, [MWh];

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

$$PE_{sp4} = \sum_{i=1}^n (EL_{PR,i} * EF_{el,y}) \quad \text{(Equation 5)}$$

Where:

PE_{sp4} - is the sum of project emissions of subproject 4 from each month of the monitoring period, [tCO₂];

$EL_{PR,i}$ - is the electrical consumption of the new pumps of the 15,000 tonnes press in the month i, [MWh].

B.2. Monitoring of the emissions in the baseline scenario

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment
39	BE_y , baseline emissions of all four interventions	Monitoring of GHG emissions in year y (all four interventions)	tCO ₂	c	monthly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.4
40	BE_{sp1} , baseline emissions of subproject 1	Monitoring of GHG emissions in year y from subproject 1	tCO ₂	c	monthly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.4
41	BE_{sp2} , baseline emissions of subproject 2	Monitoring of GHG emissions in year y from subproject 2	tCO ₂	c	monthly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.4

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42	BE_{sp3} , baseline emissions of subproject 3	Monitoring of GHG emissions in year y from subproject 3	tCO ₂	c	monthly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.4
43	BE_{sp4} , baseline emissions of subproject 4	Monitoring of GHG emissions in year y from subproject 4	tCO ₂	c	monthly	100%	Electronic and paper	Calculated using the formulae in Section D.1.1.4
44-69	$SPNG_{tf}$, the baseline ex- ante specific NG consumption of the 26 reconstructed furnaces	Baseline information	1000nm ³ /t steel	c	once	100%	Electronic and paper	
70-95	$PRST_{tf}$, 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	m	monthly	100%	Electronic and paper	
96	SPH_{VD} , the baseline ex ante specific heat consumption of the old VD	Baseline three years information	MWh/t	c	once	100%	Electronic and paper	
97	$PRVS_{VD}$, the production volume of vacuumed steel	Measuring devices of the VD	Tonnes	m	monthly	100%	Electronic and paper	

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98	<i>EB_{DHC}</i> , efficiency of the steam boilers at the DHC	DHC	-	c	yearly	100%	Electronic and paper	
99	<i>EF_{Coal}</i> , emission factor for local (anthracite) coal burning	IPCC 2006	tCO ₂ /MWh	c	fixed value	100%	Electronic	IPCC 2006 default value = 0.353 tCO ₂ /MWh
100	<i>SPEL_{VD}</i> , baseline ex ante specific electrical consumption of the old VD	Baseline information	MWh/t	c	once	100%	Electronic and paper	
101	<i>EF_{el,y}</i> , emission factor of the Ukrainian grid for reducing project	See Annex 4	tCO ₂ /MWh	c	fixed ex- ante	100%	Electronic and paper	= 0.896 tCO ₂ /MWh
102	<i>SPEL_{ES}</i> , baseline ex ante specific consumption of electricity per tone of electro steel	Baseline three years information	MWh/t	c	once	100%	Electronic and paper	
103	<i>PRES</i> , the production volume of electro steel	Measuring devices of the electro steel shop	Tonnes	m	monthly	100%	Electronic and paper	

104	T_{pp} , Working hours of the press	Workshop's registry	hours	m	monthly	100%	Paper	
105	EL_{mot} , installed capacity of the press' serving motors before reconstruction	Project design documentation	MW	c	fixed value	100%	Electronic and paper	It was 24 motors, 500kW each. So, EL_{MOT} =12MW

The annual baseline emissions are done by the equation:

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

Where:

BE_y - are the annual baseline emissions for the year y (ID39), [tCO₂];

BE_{spi} - are the annual baseline emissions from each subproject, from SP1 to SP4.

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

$$BE_{sp1} = \sum_1^{26} \left(\sum_{i=1}^n (SPNG_{tf} * PRST_{tf} * LCV_{NG} * EF_{NG}) \right) \quad (Equation 7)$$

Where:

BE_{sp1} - is the sum of baseline emissions of subproject from each month of the monitoring period, [tCO₂];

$SPNG_{tf}$ - is the baseline ex-ante specific NG consumption of the 26 reconstructed furnaces, [1000nm³/t steel];

$PRST_{tf}$ - is the production steel level of each of the 26 reconstructed thermal and heating furnaces in the month i, [tonnes].

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

$$BE_{sp2} = \sum_{i=1}^n (SPH_{VD} * PRVS_{VD,i} * EB_{DHC} * EF_{Coal} + SPEL_{VD} * PRVS_{VD,i} * EF_{el,y}) \quad (Equation 8)$$

BE_{sp2} - is the sum of baseline emissions of subproject 2 from each month of the monitoring period, [tCO₂];

SPH_{VD} - is a baseline ex ante specific heat consumption of the old VD, [MWh/t];

$PRVS_{VD,i}$ - is the monthly production volume of vacuumed steel, [t];

EB_{DHC} - is the efficiency of the steam boilers at the DHC;

EF_{Coal} - is the emission factor for local (anthracite) coal burning, [tCO₂/MWh];

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

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

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

$$BE_{sp3} = \sum_{i=1}^n (SPEL_{ES} * PRES_i * EF_{el,y}) \quad (Equation 9)$$

Where:

BE_{sp3} - is the sum of baseline emissions of subproject 3 from each month of the monitoring period, [tCO₂];

$SPEL_{ES}$ - is the baseline ex ante specific consumption of electricity per tone of electro steel, [MWh/t steel];

$PRES_i$ - is the monthly production volume of electro steel, [t].

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

$$BE_{sp4} = \sum_{i=1}^n (T_{pp} * EL_{MOT} * EF_{el,y}) \quad (\text{Equation 10})$$

Where:

BE_{sp4} - is the sum of baseline emissions of subproject 4 from each month of the monitoring period, [tCO₂];

T_{pp} - is a working hours of the press in the month i, [h];

EL_{MOT} - is the press’ serving motors before reconstruction, [MW].

B.3. Description of formulae used to estimate emission reductions for the project

The annual emission reduction is done by the equation:

$$ER_y = BE_y - PE_y, \quad (\text{Equation 11})$$

Where:

BE_y - Baseline emissions;

PE_y - Project emissions;

C. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored

Data (Indicate table and ID number)	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1-5	Low	These data are calculation of project emissions
6-31	Low	The natural gas meters will be calibrated once in 3 years
32	Low	The data will be provided by local gas supplier
33	Low	This is IPCC 2006 default value
34	Low	The electricity meters will be calibrated once in 3 years
35	Low	This is fixed ex ante value
36-38	Low	The electricity meters will be calibrated once in 4 or 6 years (depends on meter type)
39-43	Low	These data are calculation of baseline emissions

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44-69	Low	These data are baseline ex-ante specific NG consumption of the 26 reconstructed furnaces
70-95	Low	The scales will be will be calibrated once per year
96	Low	The data are baseline ex ante specific heat consumption of the old VD
97	Low	The scales will be will be calibrated once per year
98	Low	The data will be provided by DHC
99	Low	This is IPCC 2006 default value
100	Low	These data are baseline ex ante specific electrical consumption of the old VD
101	Low	This is fixed ex ante value
102	Low	These data are baseline ex ante specific consumption of electricity per tone of electro steel
103	Low	The scales will be will be calibrated once per year
104	Low	These data are logging in a special registry book
105	Low	These data are baseline ex ante installed electrical capacity of the press' serving motors