JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
Version 01 - in effect as of: 15 June 2006

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title of the project:

“Energy Efficiency Programme at the plants of LLC firm “Astarta-Kyiv”.

The sectoral scope of the project is scope (4) Manufacturing Industries.

Version 2.2, July 28th, 2011.

A.2. Description of the project:

LLC firm "Astarta-Kyiv" (Astarta) is an agri-industrial holding and one of the leading companies in the Ukrainian sugar sector. From 2004 to 2007 Astarta has been one of the Top-5 Ukrainian sugar producers.

Astarta’s operations are focused on the production and sale of sugar made from sugar beets, sugar by-products and related services. Astarta has leased 91,000 hectares of land to grow their own sugar beets as well as other crops and raise cattle. Astarta owns 2 trading companies (sugar and crops) and 34 production units, including 2 sugar mills where the proposed JI project is to be executed.

This project is being conducted at two sugar beet processing plants under ownership and operation of the project company; Astarta. The project activity is comprised of various energy efficiency improvements being implemented at each of the Astarta locations. The sugar plants are located in the town of Bilyky and the village of Zhdanivka, within Ukraine.

The proposed JI project is aimed at the reduction of the emissions of carbon dioxide from the two main sources:

(1) The combustion of fossil fuel and
(2) Decomposition of limestone within the calcination process (as well as reduction emissions from coal combustion from the calcination process).

Overall the project aims at reducing anthropogenic emissions by reducing the energy requirements of the plant’s operation as well as introducing measures which lead to a reduced need for the calcination of limestone; through increased juice purity.

The start date of the project has been identified as (28/12/2006). Each plant is operated by utilizing heat and power produced onsite at a Combined Heat and Power (CHP) Plant. The CHP Plants are powered exclusively by natural gas and are operated to supply the plants with the necessary electricity and heat needed to power the sugar production process. Prior to the implementation of the project, the plants operate using commonly available technologies available in Ukraine. These technologies, which produce sugar from sugar beet with average to efficiency values, are in line with common practice in Ukraine.

The baseline scenario consists of continuing to operate the sugar facilities at their pre-project state. Equipment utilized prior to the beginning of the project could continue operation, with normal maintenance, throughout the crediting period. Therefore the plants would continue normal operation with no investment scheme proposed throughout the crediting period. For further information on baseline setting, please refer to Section B.

As discussed, the project scenario is aimed at saving/reducing the need for electricity and heat consumption, as well as decreasing the limestone-based clarifying agent required for sugar production. All savings in electricity and heat directly correlate to a reduced need for natural gas consumption at the CHP generating units. Maximizing the use of energy resources, by optimizing the heat scheme of the plants will reduce the CHP natural gas consumption. Reductions will also result from lower quantities of natural gas being consumed to dry pressed pulp; as increased pressing ability in the project result in lower moisture content in the pressed pulp. Furthermore, increased purity of the pressed juice will result in a lower need for the purification via lime-milk usage. (Lime-milk is the term given for the products of the calculation process (lime) and water; producing a milk-like lime liquid). By reducing the lime-milk required for sugar production the plants will reduce the corresponding coal and limestone firing required to produce the clarifying agent.

The project scenario will result in the plants running at much higher efficiency levels. This is due to the implementation of energy efficiency technologies at each of the sugar plants. Astarta will put into operation deep-pressing pulp presses to increase juice purity and decrease water content in the pressed pulp. Hot pulp juice will be recycled into the diffusion system increasing both the reuse of thermal energy and the capture of sugar. Moreover, 50% less energy is spent to dry the pulp for use as animal feed. In addition, Astarta will install vacuum pans with mechanical circulators and chamber filters for suspension pressing. It is also making the lime-carbonic purification process more carbon-efficient. A number of smaller technical measures are also being implemented, including; heat insulation, frequency converters, juice preheating using low-potential energy resources and reconstruction of the automation of the thermal power station. For further details please refer to detailed descriptions of measures within section A.4.2.

Summary of the history of the JI project (incl. the JI component)

Since 2006, Astarta has been developing their Energy Saving Programme. This voluntary program is aimed at increasing the efficiency of Astarta's sugar plants through introducing technologies which reflect the best available processing techniques. The possibility of generating ERUs has always been a key factor for Astarta[1] and it was discussed at the very early stage of the programme development.

The intention for making a JI project was raised in the IPO Prospectus and published in the 2006 Annual Report. Further to this 2006 decision, a full blown analysis was conducted in early 2007, in response to the company's acceptance of an energy efficiency program. Detailed emission reduction estimates were derived through a report developed by a team of researchers from the National University of Food Technologies and during the Energy Audit commissioned by EBRD and performed by the energy consulting company MWH of Italy.

The European Bank for Reconstruction and Development (EBRD) can only finance projects that have a transitional impact, and one such impact is the project's ability to reduce GHG emissions. Potential carbon credits have been an important consideration throughout the investment project development cycle and one of the factors for the EBRD's decision to approve the loan. In parallel to this, in 2008, the Multilateral Carbon Credit Fund established by EBRD and European Investment Bank (EIB) agreed to buy a substantial portion of carbon credits from the Astarta's plants.

[1] MWH Report; Energy Audit at Astarta Sugar Mills, Ukraine; June, 2007

A Project Idea Note and Letter of Endorsement (LOE) application for Astarta was submitted to the Ukrainian Designated Focal Point (DFP), the National Environmental Investment Agency (NEIA), on January 28, 2009. The LOE was issued through NEIA on February 27th 2009 (LOE #174/23/7)[2].

A.3. Project participants:

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 Party)	LLC firm "Astarta-Kyiv"	No
Netherlands, Spain, Switzerland	Stichting Carbon Finance (SCF)	No

A.4. Technical description of the project:

A.4.1. Location of the project:

The proposed Astarta energy efficiency programme is to be executed at two sugar plants located in Poltava Oblast and Vinnytsia Oblast regions of Ukraine Kobeliatsky and Zhdanivsky sugar plants.

Figure 1: Location of the Project

A.4.1.1. Host Party(ies):

[2] Please refer to supporting documentation number 11 (LOE)

Ukraine

A.4.1.2. Region/State/Province etc.:

Poltava Oblast and Vinnytsia Oblast

A.4.1.3. City/Town/Community etc.:

Town of Bilyky, Kobelyatsky rayon, Poltavska oblast

Village of Zhdanivka, Khmilnytsky rayon, Vinnytska oblast

A.4.1.4. Detail of physical location, including information allowing the unique identification of the project (maximum one page):

The sugar plants are located at the following specific locations

Kobeliatsky Sugar Plant:

Town of Bilyky, Kobelyatsky rayon, Poltavska oblast

Coordinates: 49.145402, 34.213829

Zhdanivsky Sugar Plant:

Village of Zhdanivka, Khmilnytsky rayon, Vinnytska oblast:

Coordinates: 49*37' 33", 27*53'31"

A.4.2. Technology(ies) to be employed, or measures, operations or actions to be implemented by the project:

As described, the project activity is a combination of various energy efficiency improvements. Each individual technology installed at the sugar plant will reduce the plant's energy (or processing) requirements compared to the baseline situation. Consequently all measures installed improve energy efficiency and decrease the need for electricity and energy consumption.

It should be noted that the individual technologies installed at the two sugar plants are slightly different at each plant.

This section details the individual measures comprising the efficiency program, listed separately for each of the sugar plants. Correspondingly, calculations and baseline efficiency setting has been completed on a site-by-site basis for transparency purposes, as required by the guidance methodology. Listing individual measures, by plant, allows for the opportunity to describe how each directly affects the energy efficiency at the plant.

It should be noted that Astarta intends to increase the volumes of the processed beets over the crediting period, regardless of project implementation. It is therefore herein explicitly stated that the pre-project equipment is able to, and would, process all beet volumes listed in Table 1, including slight increases in volume over 2009-2011. The expected mass of beet production at both Astarta sugar plants for the upcoming years is provided in the table below.

Table 1: Forecasted Beet Production[3]

Year	Beets processed, (tonnes)
2008	563,396
2009	695,000
2010	780,000
2011	829,000
2012	870,000
2013	870,000
2014	870,000
2015	870,000
2016	870,000
2017	870,000

Fully described details of each individual measure installed in 2007 and 2008 and further planned measures from 2009-2012 can be found below.

Kobeliatsky Plant Technologies

(1) Replacement of Vertical Presses with horizontal Deep Pulp Presses (2007)

The pulp presses are utilized during the final stage of the sugar diffusion process. Pulp presses take the combined slices of sugar beet and hot water mixture and separate this mixture into pure raw juice and pulp. The water and pulp mixture is pressed and the sugary water is returned to the diffusion process and the pressed pulp is removed for drying; where it is sold as animal feed. With the old presses Astarta obtained pressed pulps with 8% dry substance. With the new horizontal deep pulp presses Astarta is able to receive up to 30% dry substance, an increase of 22%. The mantling of new pulp presses was implemented by Small Private Enterprice "Omis", Private Enterprise "Promin" and Poltavaspetsmontazh, LLC.

Increased pressing ability results in a number of energy saving advantages. First, and most significant, is the direct reduction of natural gas used to dry the pressed pulp. Reduced water content in the pulp allows for faster drying and lower natural gas usage in the drying oven. Alternate benefits of new presses are the increased purity in the sugar juice. Increased purity results in lower need for lime milk addition which, in turn, reduces emissions from the calcination process as less limestone and coal is consumed. Furthermore, increased pressing ability increased the juice that is returned to the diffusion process; which results in less clean water being added to the initial stages of diffusion. As less clean water is added, there is also reduced need for electricity to power water pumps. In addition, decreased water addition

[3] Supporting Document 4, ERU Calculations

also results in less of a need for the evaporation procedure; a highly energy intensive process which uses natural gas.

Frequency converters have been installed with the pulp presses to help control the speed and operation of screws. By installing frequency converters the quantity of electricity used to power the pulp presses has been reduced. The reduction in electricity results in a decreased load on the CHP Plant which in turn results in decreased combustion of natural gas for the purpose of electricity production. In total 3 Converters were installed at the entering point of each of the deep presses electrical input. The use of frequency converters also regulates the number of rotations the presses complete which, in turn, correlates to the level of dry material that remains after pressing. By increasing the pressing, there is reduced water content in the pressed pulp and subsequently less need for pulp drying, as discussed earlier. Gas savings from this measure will reduce consumption by an estimated 3.5 m^3 of gas per tonne of beet processed[4].

(2) Installation of pre-limer, implementation of suspension flow-back scheme after first carbonation (2007)

As part of the purification process both CaO and CO_2 are added to remove non-sugar particulates from the juice. To introduce CaO into the process it must first be dissolved into solution. Prior to the project activity, CaO was combined with clean water; as water was added to the products of the calcination process. Through this measure of the project, the use of sweet washing water is utilized in lieu of clean water. Aside from the environmental benefit of saving the consumption of fresh water; utilizing waste flow from the first carbonation process also adds energy efficiency benefits to the plant. The installation works were implemented by Poltavaspetsmontazh, LLC.

CaO is only slightly soluble in water, and has a much higher solubility in sucrose based liquids; as saccharose ions are formed instead of hydroxyl ions[5]. See the chart below for common solubility levels. By using a sucrose liquid, Astarta can gain a higher level of concentration of CaO solution as opposed to using clean water. By using sweet washing water and increasing concentration, the overall volume of liquid required is reduced while still maintaining the desired concentration of CaO in solution. This reduced liquid content results in less heat energy requirement during the evaporation process. Gas savings from this measure will reduce consumption by an estimated 0.5 m^3 of gas per tonne of beet processed[4].

Sucrose g/100ml	Solubility of CaO g/100ml
0	0.09
1.5	0.08
3	0.10
6	0.15

Figure 2: Sucrose solubility levels[6]

(3) Heat insulation of the heat-exchange equipment. Modernization of the heat scheme (2007)

[4] Information provided by Astarta, please refer to supporting documentation 1

[5] Energy Audit At Kobelyatsky sugar factory, Ukraine Prepared for EBRD, MWH, October 2008

[6] Energy Audit At Kobelyatsky sugar factory, Ukraine Prepared for EBRD, MWH, October 2008

Heat is required in the sugar making process for a number of important functions. Heat is used to evaporate the sugar liquid into thick syrup, used to heat diffusion water to help in sugar transfer into water as well as a number of other important factors. Heat is currently provided to the sugar production process from the onsite CHP plant. Currently the retention and conservation of heat is not well regarded at the Astarta plants and large quantities of insulation require replacement in order to increase the thermal retention of the plants.

This project measure focuses on retaining heat and conserving the energy embodied in the various processes of sugar production. By reducing heating losses, there will be less of a requirement to produce heat for important beet processes. The following are specific actions undertaken to retain and recycle heat:

- Pipes above 90^{o}C are covered by 40-60 mm thick Polyurethane insulation material
- Replaced old silicate cotton insulation
- Change to the method of heating the sugar juice

Poltavaspetsmontazh, LLC, Small Collective Enterprise "Phenix Ltd", Small Private Enterprise "Omis" and Private Enterprise "Promin" implemented the insulation of heat-exchange equipment and modernization of the heating scheme.

The following figure illustrates the importance of insulation of pipes and details the heat loss for various pipe diameters and pressures. By using proper insulation on piping above 50^{o}C Astarta can save up to 90% of energy losses as well as ensuring proper steam pressure at plant equipment.[7]

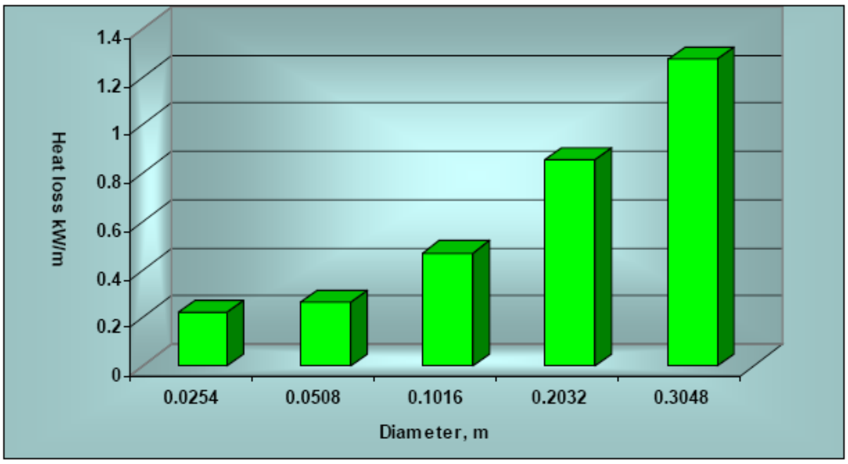

Figure 3: Heat Losses per 1 meter of un-insulated steam line at 4 bar (kW/m)[8]

[7] MWH Energy Audit, pg 45

[8] MWH Energy Audit, pg 46

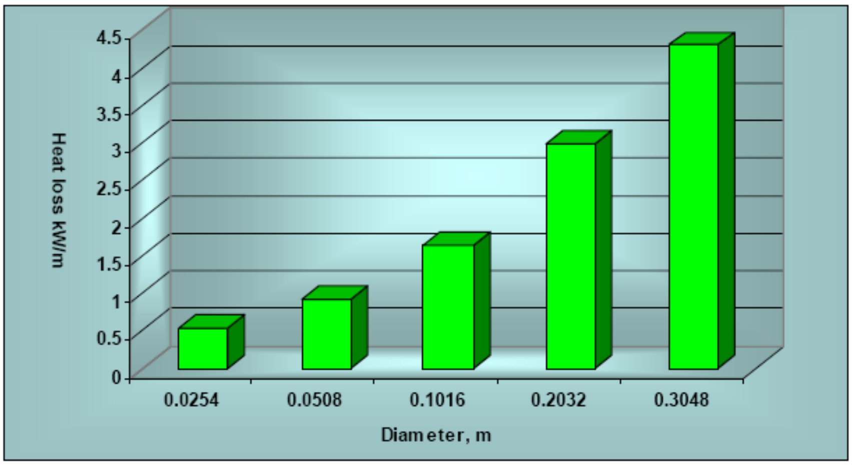

Figure 4: Heat Losses per 1 meter of un-insulated steam line at 40 bar (kW/m)[9]

A change was also introduced to recycle waste heat from various components in the plant. By recycling this waste heat back into the main process stages the formerly wasted heat will now be utilized; reducing the overall need for supplemental heating.

The pressure and temperature profile of the steam has also been optimized to increase heat transfer potential. This involves a move from higher potential to a lower potential steam value: based on the relationship between temperature and pressure. Thus by optimizing the potential of the steam, heat is transferred in a more efficient manner and less demand is placed on the CHP Plant and will result in approximately 0.53m^3 of gas savings per tonne of beet processed[4].

(4) Installation of Frequency Converters (2007-2008)

Frequency converters have been installed to help control the speed and operation of pumps within the Kobeliatsky plant. The installation of frequency converters was implemented by Poltavaspetsmontazh, LLC over the years of 2007-2008. As a result of this measure the quantity of electricity used to power equipment has been reduced. The reduction in electricity results in a decreased load on the CHP Plant which results in decreased combustion of natural gas for the purpose of electricity production. Gas savings from installing frequency converters will reduce consumption by an estimated 0.25 m^3 of gas per tonne of beet processed[4].

Table 2: Frequency Converters Installed at Kobeliatsky

number	Quantity	Installed capacity, kW	Company producer	Transported product
1.	1	75	«Danfoss»	Draft from diffusion number 1
2.	1	75	«Danfoss»	Draft from diffusion number 2
3.	1	75	«Danfoss»	Pump for raw juice pumping
4.	2	55	«Danfoss»	Pulp press water pumps for diffusion devices
5.	4	200	«Danfoss»	Pulp presses «Babbini»
6.	2	132	«ABB»	Beets slicers

[9] MWH Energy Audit, pg 46

7.	1	200	«Danfoss»	Pumps for juice with coal defecator
8.	1	37	«Danfoss»	Pumps for II carbonated juice slurry
9.	1	55	«Danfoss»	Pumps of returning of non-filtrated juice
10.	1	160	«Danfoss»	Drafts for juice before evaporating station
11.	1	160	«Danfoss»	Pumps for juice with 3A for 1A corpus of evaporation station
12.	1	55	«Danfoss»	Pumps for syrup with compensator
13.	1	15	«Danfoss»	Pumps for massecuite pumping to crystallizer
14.	1	10	«Danfoss»	Pulp screw for drying
15.	1	2	«Danfoss»	Dozer of pelletizer «Granteh»
16.	1	3	«Danfoss»	Dozer of pelletizer «KAHL»
17.	1	3	«Simens»	Dozer of pelletizer «KAHL»
18.	2	3	«Mitsubishi»	Feeder of stone of gas kiln

(5) Replacement of pumps (2007)

Replacing old and inefficient pumps is another method of reducing the energy requirement of the sugar plant. Pumps currently in operation at the plants are often old and very inefficient. By switching to modern, new, pumping systems the various processes such as juice, water and lime milk pumping will be modernized and subsequently save energy during their operation. The new pumps were installed by Private Enterprise "Promin", Small Private Enterprise "Yava" and Private Enterprise "Budmontazh Ch S"

Savings from this aspect of the project will result in electricity savings which, in turn, affect the operation of the CHP Plant and will decrease the overall natural gas consumption rate by approximately 0.20 m^3 of gas per tonne of beet processed[4]. For a complete list of pump installations, please refer to supporting documentation 3.

(6) Replacement of A-centrifugals (2007)

Centrifugals are used to separate the sugar crystals from the overall liquid. Before the modernization of the centrifugals Astarta utilized energy-intensive, locally produced, Ukrainian equipment for their processes. The machines used before modernization was the Ukrainian model FPN 1251-L-07. These devices held very low capacity and efficiency. In short, sugar liquor required several passes through the old centrifugals in order to extract the sugar crystals. Furthermore, this increased processing also required the addition of supplemental fresh water.

In 2007 four old centrifugals FPN 1251-L-07 were replaced by four centrifugals BMA manufactured by German company. Installation of new centrifugals was implemented by Poltavaspetsmontazh, LLC and JSC "Donetsk Engineering Group".

This centrifugal was a large improvement over the past technology as it required fewer passes of the liquor which resulted in reduced the energy required to extract the sugar crystals from the liquor. Furthermore the capacity of the centrifugal increased over the previous model, which resulted in fewer cycles being completed.

These increased energy savings were due to improved utilization of frequency converters in the new units. Due to these savings Astarta is able to reduce the energy need by up to 30%-40% from the original process and save approximately 0.8 m^3 of gas per tonne of beet processed.[4]

(7) Modernization of the scheme for pulp drying and pulp granulating departments (2007)

Pulp drying process is conducted to transform the pressed pulp into animal feed and other useful products. This process is depicted in Figure 5. Currently the pulp drying process uses approximately 70kWh/tonne pellet which is estimated to be reduced by 30% due to modernization of the drying process[10].

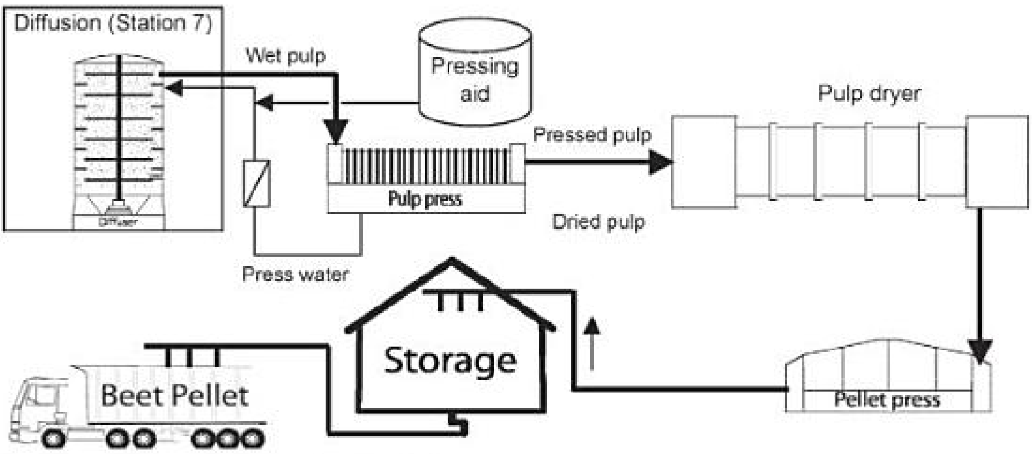

Figure 5: Pulp processing, including pelletizing process[11]

In the past, two 110 kWh polish granulators and one Ukrainian 90 kWh were used to transform the pressed pulp into animal feed. As part of the project, two German KAHL granulators with a total power of 250 kWh were purchased, with one used as a backup to the first. In addition to purchase of two new granulators, modifications were made to the conveyer which distributes the pulp to increase productivity and two Holland refrigerants manufactured by Bűhler, installed in 2008.

One of the major energy uses in this process is the cooling of the dried pulp. As part of the project activity, a new Holland manufactured cooling system is being implemented with an operating capacity of 10 tonnes per hour. This is double the production capacity of the old Ukrainian unit which was able to process only 5 tonnes per hour.

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[10] Energy Audit At Kobelyatsky sugar factory, Ukraine Prepared for EBRD, MWH, October 2008

[11] Asadi, Mosen. *Beet-Sugar Handbook*. Wiley-Interscience; A John Wiley & Sons, Inc., Publication. 2006. pg. 180.

Further to reducing energy requirements, the new units will operate with fewer shut downs. This is an important improvement over the previous system; as a significant amount of fuel is required during the start up phases of the granulation department. The improvement in cooling devices, and reduction in shut down and start ups, will significantly reduce energy requirement by approximately 2.2 m^3 of natural gas per tonne of beet processed[4].

(8) Automation of the purification station (2007)

Automation of the purification system resulted in a large change to the defecation station. The installation of automation was implemented by daughter enterprise "Sahavtomat-inzh". The defecation station is the first stage of juice purification, in which lime and CO_2 are added to the juice. The previous equipment consisted of a horizontal pre-defecator which often leaked and required stoppage of the plant. Stoppage of the entire plant resulted in a large increase of fuel use due to initial fuel needed every time the plant needed to be restarted. Leakages lead to reduced sugar production, increasing the overall specific gas consumption of the plant. In addition, the previous defecation station produced a poor quality of juice and limited the production capacity to 4,800 tonnes of beet per day. New equipment is a vertical system which has eliminated all the problems created by the past horizontal system.

Modernization of the existing saturators and defecator at the hot stage of main dejection also increased capacity of the defecation station up to 4,500 tonnes of beets per 24 hours[4]. Increased capacity combined with elimination of sugars lost to leakage increases overall sugar production thus reducing the overall specific natural gas consumption for production, reducing the natural gas consumption at the CHP plant. Elimination of stoppage also reduces the overall natural gas consumption that was previously needed for stop and start-up of the plant due to technical failure at the defecation station. The modernization of this process will lead to a savings of 0.22 m^3 of natural gas per tonne of beet processed[4].

(9) Installation of beet slicers "PUTSH" (2008)

Beet slicers have the simple function of cutting the whole beets into smaller units called cossettes. The new beet slicers to be installed at the Kobeliatsky plant will result in significant savings over the previous slicers. These new Putsch slicers (model TSM 2200-22-600) were installed to replace the old model A2PRB-24 units which operated using centrifugal method of slicing.

The Putsch slicers' installation, implemented by JSC "Kremenchuk Repair-installation Enterprise", Daughter Enterprise "Ukrtatnaftaservis", Private Enterprise "Promin" and JSC "Donetsk Engineering Group", result in a shift to a drum slicing process from the previous method of centrifugal slicing. Drum slicing is noted to have an advantage of 20-30% higher efficiency over centrifugal slicing[12]. Figure 6 shows the new technology. This installation is expected to save 1.2 m^3 of gas per tonne of beet processed through the increase in operating efficiency[4].

[12] Asadi, Mosen. *Beet-Sugar Handbook*. Wiley-Interscience; A John Wiley & Sons, Inc., Publication. 2006. pg. 148.

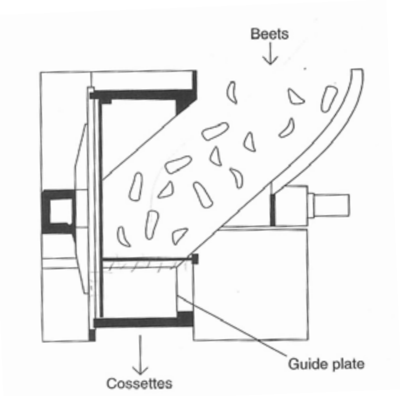

Figure 6: Drum Beet Slicer[13]

(10) Reconstruction of the 1st and 2nd carbonatation decanters (2008)

Carbonation is part of the purification process where suspended CaO molecules react with CO_2 to form $CaCO_3$. This process produces precipitation within the juice which captures sugar impurities within the precipitate formed. A series of carbonation processes are performed in order to remove all of the impurities.

Two old decanters of 2-nd carbnonatation were dismantled. Two new decanters of 2-nd carbonatation were mantled at the new place by Private Enterprise "Montazhservis", Blok-Tsukor, LLC and Private Enterprise "Budmontazh Ch S". One decanter of 1-st carbonatation was mantled in place of two old decanters of 2-nd carbonatation.

Overall, the effect of the new equipment is an increased productivity level which results in a reduced specific energy consumption rate per tonne of beets processed. In addition, this process improves the quality of the juice by improving impurity removal. These new sedimentation tanks are expected to save 0.55 m^3 of gas per tonne of beet processed[4].
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(11) Installation of A and C- centrifugals (2008)

Centrifugals are used in the sugar making process to separate sugar crystals from the mother liquor in one of the final stages of sugar production. This process is conduced with the use of a centrifugal; which spins the syrup mixture at high rates as to obtain separation. The efficiency of these devices is important as they consume high quantities of energy to operate. The old A-centrifugals at the Kobeliatsky plant consisted of eight FPN-1251- L-07 and four BMA-1250. The old C-centrifugals, two ACWW-1000, were replaced by two BMA 2300.

In 2008, seven Silver Weibull centrifugals 1350 units were installed by Private Enterprise "Montazhservis"; one unit operating as a backup. The centrifugals were manufactured by Swedish company Silver Weibull in 1987. These new A-centrifugals have an increased batch capacity which results in higher volumes of mother liquor being processed for the same quantity of fuel use; resulting in lower specific fuel consumption. The new Silver Weibull units also have the ability to produce electricity during shut down phases of operation; further reducing the overall load on the CHP plant.

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[13] Asadi, Mosen. *Beet-Sugar Handbook*. Wiley-Interscience; A John Wiley & Sons, Inc., Publication. 2006. pg. 147.

Implemented Measures at Kobeliatsky

Year	Kobeliatsky sugar plant	Details of new equipment that is planned to be Installed (Description, Manufacture Make and Model)
2007		
1	Replacement of Vertical Presses with horizontal Deep Pulp Presses	Refer to section above for further details
2	Installation of pre-limer, implementation of suspension flow-back scheme after first carbonation	Refer to section above for further details
3	Heat insulation of the heat-exchange equipment. Modernization of the heat scheme	Refer to section above for further details
4	Installation of Frequency Converters	Refer to section above for further details
5	Replacement of pumps	Refer to section above for further details
6	Replacement of A-centrifugals	Refer to section above for further details
7	Modernization of the scheme for pulp drying and pulp granulating departments	Refer to section above for further details
8	Automation of the purification station	Refer to section above for further details
2008		
1	Installation of beet slicers "PUTSH"	Refer to section above for further details
2	Reconstruction of the 1st and 2nd carbonatation decanters	Refer to section above for further details
3	Installation of A and C- centrifugals	Refer to section above for further details
4	Installation of Frequency Converters	Refer to section above for further details

Table 3: Further measures to be installed at the Kobeliatsky sugar plant

Year	Kobeliatsky sugar plant	Details of new equipment that is planned to be Installed (Description, Manufacture Make and Model)
2009		
1	Installation of plate heat-exchangers ALFA-LAVAL	Installation of plate heat-exchangers ALFA-LAVAL before evaporation station has influenced gas consumption. It has been reduced by 1,58m³/t of sugar beets
2	Use of sweet-water for lime slaking	Implementation of sweet-water remove scheme for lime slaking will reduce gas consumption because less water adds to the juice at vacuum filters.

3	Heating of A and B-molasses by secondary steam	Heating of run-offs by extra steam and ammonia condensate reduces the consumption of exhausted steam decreasing the consumption of fuel by 1,2m³/t of sugar beets.
4	Increase of raw juice draft from 116% to 112% (to sugar beets)	Increase of draft from diffuser reduces the quantity of water to be evaporated out of juice.
Estimated Gas Savings (2009)		*5.10 (m^3 gas/t beet)*
2010		
1	Installation of A -vacuum pans (with forced circulation), heating of vacuum pans by the third vessel of the evaporation station	Complete use of condensate and pan vapor heat, installation of A-vacuum pans (with forced circulation) have reduced specific gas consumption by 2,1m³/t of sugar beets. Vacuum pans are heated by extra steam of the second and third vessel of the evaporation station.
2	Replacement of vacuum filters by filter presses	Replacement of vacuum-filters by filter presses allows to reduce gas consumption by 0,38m³ (caused by of energy savings). As well as quantity of water to be added to the juice will be decreased.
Estimated Gas Savings (2010)		*3.20 (m^3 gas/t beet)*
2011		
1	Installation of film evaporators, heating of vacuum pans by the forth vessel	Complete use of condensate and pan vapor heat, as well as vacuum pans heating by steam of the forth vessel reduce specific gas consumption.
Estimated Gas Savings (2011)		*1.50 (m^3 gas/t beet)*
2012		
1	Modernization of B and C-vacuum pans (with forced circulation)	Complete use of condensate and pan vapor heat and heating of B and C-vacuum pans by steam of the forth vessel reduce specific gas consumption.
Estimated Gas Savings (2012)		*0.80 (m^3 gas/t beet)*

**gas savings values estimated by Astarta Staff*

Zhdanivsky Plant Technologies

(1) Modernization of Vertical Presses department (2007)

The pulp presses are utilized during the final stage of the sugar diffusion process. Pulp feeds to pulp presses where raw juice is partially separated. Pulp is pressed and sweet pressed pulp water returns to diffusion process. Pressed pulp is removed for drying; where it is sold as animal feed. With the old way Astarta obtained pressed pulps with 8% dry substance. With the new technology of vertical pressing, Astarta is able to receive 12% dry substance.

Increased pressing ability results in a number of energy saving advantages. The most significant is the increasing of purity of sugar diffusion juice as well as the drier pulp yield. Increased purity results in lower need for lime milk addition which, in turn, reduces emissions from the calcination process as less limestone and coal is consumed while drier pulp product results in a reduced need to consume natural gas for the pulp drying process.

Specific measures installed as part of this modernization will include the following:

- Pulp catcher with a press
- Pulp press water tank - pump SOT - 100 (2 pieces)
- Tank after pulp catcher, pumps SOT 30 (2 pieces)
- Shell and tube heater - F=20 m²

The modernization measures were implemented by the specialists of Zhdanivskiy sugar plant. Furthermore, increased pressing results in less clean water added to the sugar process. Reducing the need for clean water addition results in less need electricity to power water pumps. Total savings for the installation of these measures is approximately 2.76 m^3 of gas savings per tonne of beet processed[14].

(2) Modernization of the washing department (2007)

The beet washing station is one of the first stages in processing of the sugar beets. Upon arrival to the plant, beets are washed to remove any soil, grass, weeds and clay that may come in with the beets. This is an important stage of production because any of this material that enters the production process lowers the purity of the raw juice and increases the time and materials needed for juice purification.

Modernization of the washing department included a number of improvements to the old equipment implemented by Tehmontazh-center, LLC. The old equipment did not wash beets very effectively or remove non-beet 'green mass' aspects in the water. The new equipment also has incorporated an advanced stone catcher to remove stones and prevent them from dulling the knives. The new washer increases productivity while minimizing stoppage time of production (for repair and recapture of previously lost beets). By reducing stoppage time, the plants are able to have constant beet production and eliminate unnecessary natural gas usage during stoppage time. This, in turn, reduces the overall specific consumption of the plants over the production period. Specific installations include:

- Classifiers - 3 pieces,
- Screw for beet tails transportation - 2 pieces,
- Belt conveyers of beet tails -2 pieces
- Washing plan; Sh1PMD-3, water separator, rinser No. 1, rinser No.2,
- Wire belt
- Pump KTS-520 (2 pieces),
- Pump KTS-420 (2 pieces)

Overall, the new washer creates purer raw juice as less of the waste materials enter the production process. Cleaner juice results in less lime milk being needed in the purification stations. This reduces emissions from calcination of limestone and burning of coal. Specific gas savings from these measures will amount to approximately 0.1 m^3 of gas per tonne of beet processed[14].

(3) Replacement of syrup filters (2007)

Syrup filters are used to remove particulates and contaminates within the sugar juice. Old filtering equipment filtered low density juice with minimal efficiency, high energy consumption and often lead to

[14] Information provided by Astarta; Refer to supporting documentation 1

trace contaminates being left within the filtered juice. This inefficient process required frequent re-filtering to ensure that all contaminates were removed.

The old filter presses could process a juice density of approximately 62-65% dry substance; requiring in many cases that the syrup be diluted (through the addition of water) to meet the low density allowance. The new filers are 5 piece bag filtration units manufactured in Odessa, Ukraine, and are able to process syrup with a much higher density (of approximately 70-72% dry matter). The installation of new filters was implemented by the specialists of Zhdanivskiy sugar plant. The resulting ability to process higher density syrup results in a signification decrease of water consumption and subsequently leads to significant savings in the evaporation stages of processing. Overall the new filters will allow a savings of 0.1 m^3 of gas per tonne of beet processed[14].

(4) Usage of condensate, made from juice steam, for preparation of the feed-water for sugar extraction at the diffuser stage (2007)

Before implementation of the project, fresh water was the only source of water being introduced into the diffuser. With installation of the deep pulp presses, as discussed earlier, water supply is now shared between fresh water and pressed juice returning to the diffuser process. Further to these two sources of water, condensate has now been harnessed as a third means of introducing water into the diffuser stage. Added benefits from adding water from steam condensate are three fold;

1. Benefit from heat recycling; as condensate water is introduced at high temperatures
2. Reduced reliance on fresh water supply

The above-mentioned improvements were implemented by the plant specialists.
These combined advantages will lead to a gas savings of approximately 0.64 m^3 per tonne beet processed[14]

(5) Installation of heat exchangers for heating molasses after the first crystallation process (2007)

This measure is aimed at heating the molasses and reducing the direct input required from the CHP plant. Previously steam from the CHP with high potential was used to heat molasses. This process change will see Zhdanivsky utilize the waste heat from the condensate process.

The heat exchangers replacement, implemented by the plant specialists, significantly reduces the required heat production of the CHP plant. Savings from the utilization of this waste heat for this process will result in approximately 0.40 m^3 of gas savings per tonne of beet processed[14]

(6) Modernization of the lime kiln with partial replacement of cladding (2007)

Lime kilns are used to produce CaO (lime) and CO_2 from the raw material limestone. CaO and CO_2 are both required during the purification process to remove impurities within the sugar juice. The process of changing limestone to CaO is commonly referred to as the *calcination* process, during which heat is added to the chemical components of $CaCO_3$ (and $MgCO_3$) to cause the following reaction.

$$\mathbf{CaCO_3 + heat = CaO + CO_2}$$

To complete this reaction, coal is used as a primary fuel source within the lime kilns. By modernizing the lime kiln implemented by Tehnotsukor, LLC less coal fuel is required to create the above reaction, as the process of calcination becomes more effective. Consequently there is a savings of combustion emissions; as less coal is combusted to produce CaO and CO_2. Modernization of the lime kiln has been completed through a number of means, as described below.

Change in limestone and coal feed system and overall lime milk preparation system

A second major change to the kiln system is the upgrade to a new loading system for coal and limestone. Prior to the project activity, the cover on the kiln was required to be removed for the addition of new limestone and coal. This cap removal allowed for the direct release of heat as well as kiln gasses, which include; CO_2 as well as the emissions resulting from coal combustion.

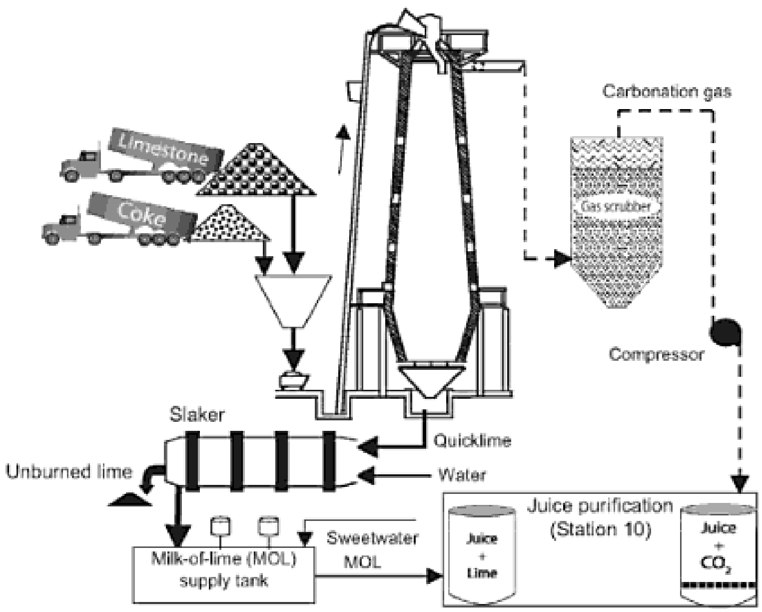

Figure 7: Flow Diagram of Lime milk and carbonation-gas Production[15]

Within the project scope, a device has been introduced to eliminate the direct release of heat and emissions through the implementation of a new kiln cover system. The new sluice (or lock) cover device now requires the limestone and coal to passes through a locking system which has been designed to eliminate the ability of kiln gas to escape. This, in turn, prevents the direct release of emissions and heat and results in savings for the project. The renovation of limestone and coal feed system and lime milk preparation system was implemented by Tehnotsukor, LLC.

These changes not only eliminate direct releases but also result in increased purity of the lime milk. Purity of the lime increases through better burning of the overall kiln system. High purity milk results in

[15] Asadi, Mosen. *Beet-Sugar Handbook*. Wiley-Interscience; A John Wiley & Sons, Inc., Publication. 2006. pg. 196.

less milk being required per tonne of beet processed; as a lower quantity of higher quality milk is added. Savings for this change along with the limestone and coal system amount to approximately 0.45 m^3 of gas per tonne of beet processed[14]

Modernization of the Lime Unloading System

The third modernization measure of the lime kiln, implemented by Tehnotsukor, LLC, refers to the unloading of the lime product. Before, the lime unloading system resulted in uneven unloading of the final lime product from the furnace and operation was conducted in an inefficient manner. New unloading equipment, or 'unloading table', allows for even unloading from all sections of the kiln and has increased the capacity by approximately 2,500 tonnes per day[16]. This results in significant energy savings and results in even unloading of lime from the furnace. The secondary benefit of allowing oxygen to now evenly pass into the furnace system also results in increasing the combustion efficiency of the calcination process. Changes to this aspect of the kiln are expected to produce coal savings of 0.19 kg per tonne of beet processed and limestone saving of 2.8 kg per tonne of beet processed.[14]

(7) Replacement of the brick lining and heat insulation of lime kiln (2008)

One of the primary changes to the lime kilns will be the replacement of the internal brick lining. Old kiln lining was replaced by higher quality brick, which resulted in a change from plain and inefficient clay bricks, to new bricks made from chrome-magnesite material. Kiln bricks that retain the high heat of the furnace process increase efficiency by reducing the fuel input required to maintain the proper internal temperature of the kiln furnace. The replacement was implemented by Tehnotsukor, LLC.

[16] Information provided by Astarta. Refer to supporting documentation number 2.

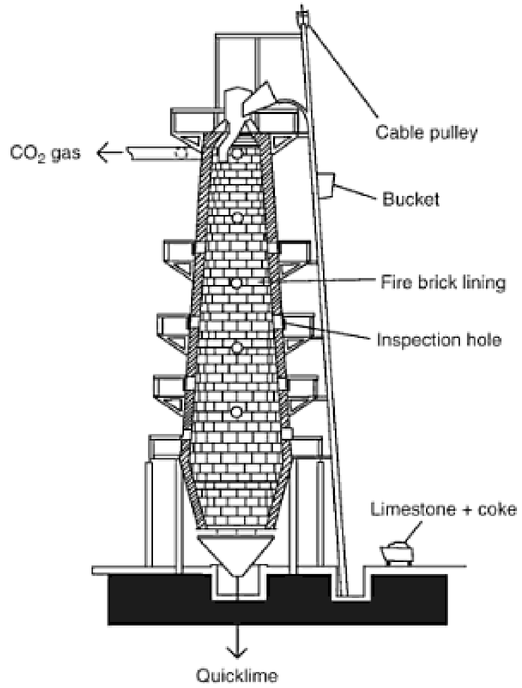

Figure 8: Lime Kiln[17]

By changing the kiln insulation brick they will save approximately 0.3 kg of coal per tonne of beet processed[14]

(8) Improving of transportation system of diffusion and heat exchange equipment at the heating scheme of diffusion (2008)

The diffuser is utilized to mix the sliced beet particles with heated water. This process facilitates the diffusion of sugar from the beet into the water solution. Contact time between the beet and water mixture as well as overall temperature is controlled to ensure maximum diffusion of sugar into the liquid.
The slices are supplied by the scheme of pre-scalder and diffusion juice is taken for pre-defecation from the one hand. At three places at the center the circulating heat juice is given (instead of pulp and diffusion water). From other side the juice slices (instead of wet pulp) are taken away.

[17] Asadi, Mosen. *Beet-Sugar Handbook*. Wiley-Interscience; A John Wiley & Sons, Inc., Publication. 2006. pg. 202

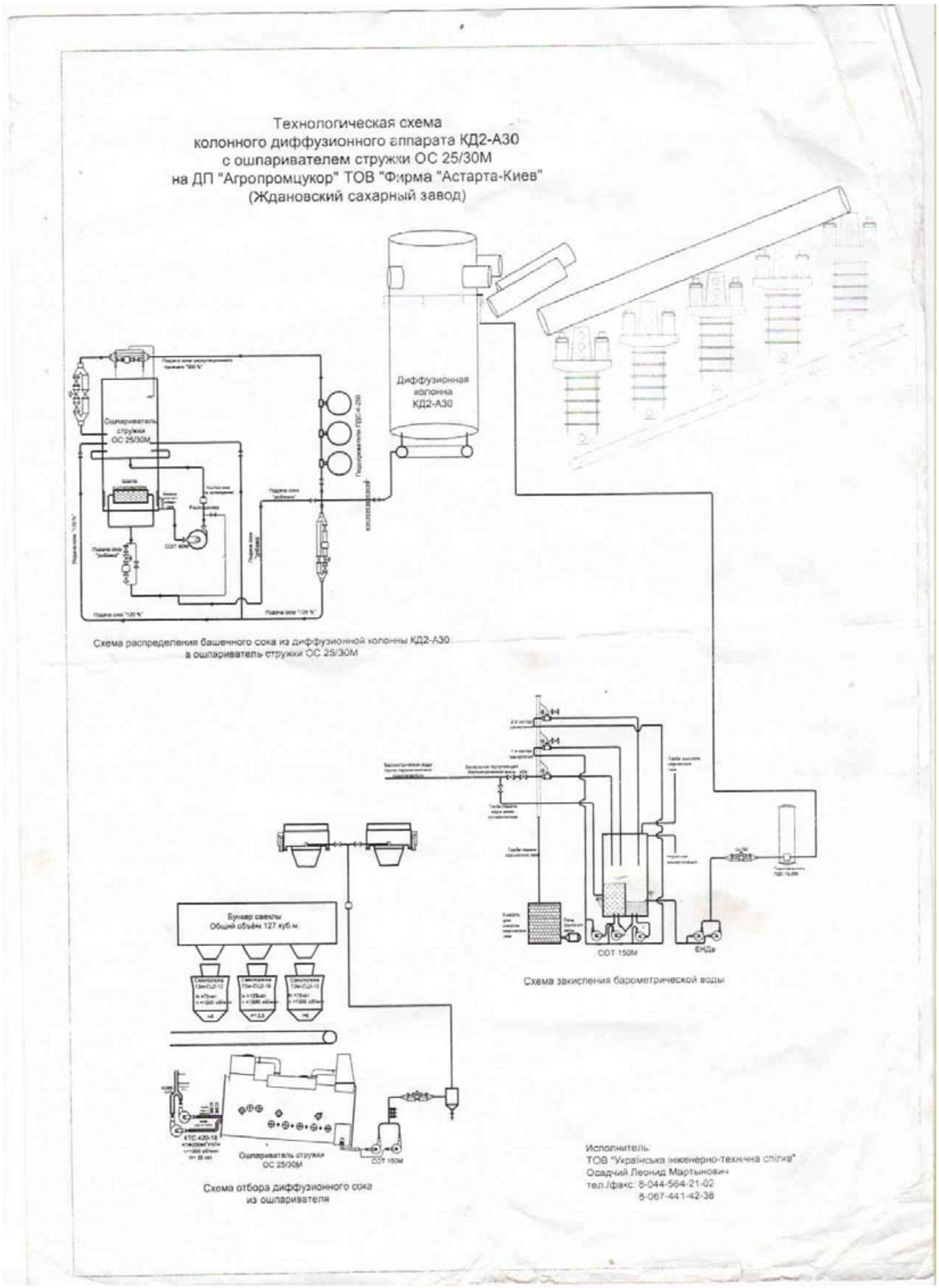

Figure 9: Technological scheme of columned diffuser КD2-A30 with pre-scalder OS 25/30M

In 2008, the transportation system of diffusion was improved by plant specialists. Furthermore, heat exchange equipment at the heating scheme of diffusion will be improved to allow for the heating of the cossettes before addition into the diffuser. This results in direct heating of both the cossettes and the diffusion water (juice). The cossettes will be heated to 65-70^{o}C using waste heat taken from the 'Pre-scalder' (also known as the cossette mixer). Overall, the recycling of previously wasted heat will result in approximate savings of 0.10 m^3 of gas per tonne of beet by reducing the overall need for steam production[14.]

(9) Replacement of vacuum pans with mechanical stirrers and complete automation system (2008)

Vacuum pans are used within the sugar making process to crystallize sugar from the super-saturated sugar liquor. This process is done under the presence of a vacuum and is used to extract the sugar crystals from the mother liquor. With the installation of mechanical stirrers, Astarta will add a number of direct and indirect energy improvements to its process.

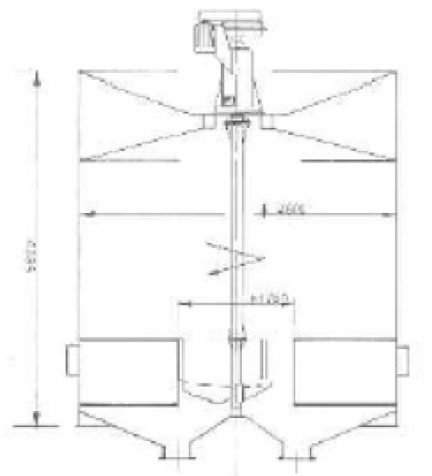

Figure 10: Mechanical Stirrer in Vacuum Pans[18]

Three vacuum pans Zh4PVA were installed by TMA, LLC. With the addition of mechanical stirrers, the vacuum pans operate at increased efficiency; as the whole mass is set in motion during the final stages of boiling. The stirrers also allow the vacuum pans to yield a higher sugar content from the liquor; as they can tolerate higher sugar concentrations within the saturated syrup. This process results in higher sugar yields and decreases the energy usage per quantity of sugar obtained. The increased efficiency can also result in a savings of 25% of steam consumption as well as direct natural gas savings[19]. Savings from the installation of stirrers for this process will result in approximately 1.85 m^3 of gas savings per tonne of beet processed[14]

(10) Decreasing of energy consumption by implementation of a new heat system (2008)

Heating system includes all process relating to heating at the sugar plant, including primarily the evaporation and heating systems at the plant. There are 5 main evaporation stations in use at the Zhdanivsky plant, as depicted in Figure 11.

[18] MWH Energy Audit, pg. 43

[19] MWH Energy Audit, pg. 42

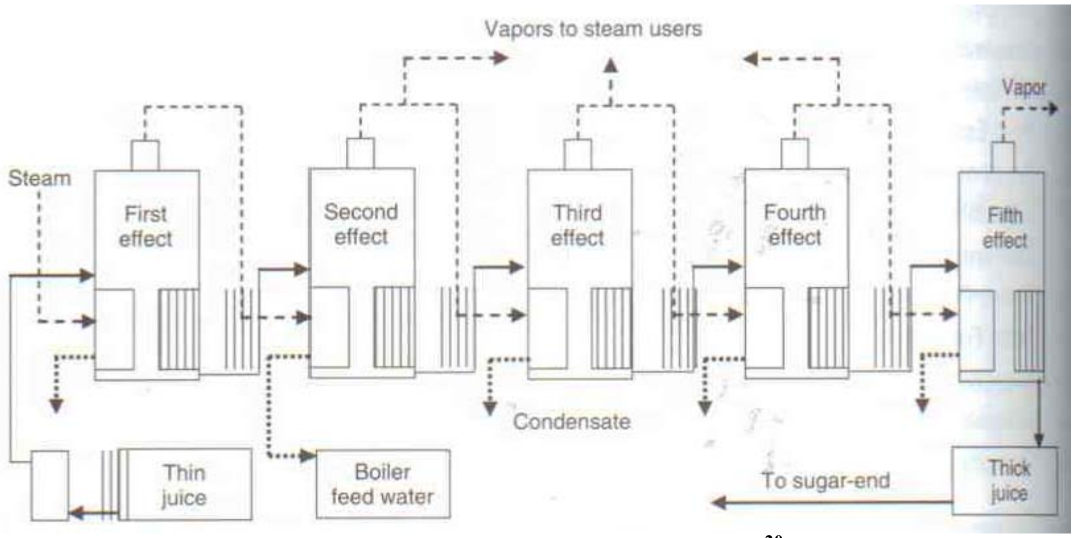

Figure 11: Five effect evaporation station[20]

The replacement of the heating scheme, implemented by plant specialists, makes the use of condensates heat that was previously wasted. This heat is now recycled at least twice are now used as a secondary heating source for earlier stages of evaporation. Higher usage of the condensate heat as condensate heat is now utilized at each stage of the evaporation units. Improvement of steam distribution system at evaporation station has given the possibility to stabilize syrup density and increase it from 58% to 69% of dry substances[21]. This heat scheme change results in 2.8 m^3 of gas savings per tonne of beet processed; as there is substantially less heat required to complete the evaporation process[14]

(11) Implementation of the automation system for monitoring steam consumption and its optimal distribution (2008)

Modernization of the steam consumption controls will allow for accurate and timely distribution of the produced steam. By atomizing the distribution of steam, the sugar plant will ensure waste heat is avoided and the CHP plant does not over-consume fuel to produce unneeded energy. The installation of automation system for monitoring steam consumption and its optimal distribution will ensure direct and correct delivery of heat to the various processes within the sugar plant. Before automation of the system, heat and steam were set manually. Manual operation resulted in delays of steam distribution, and often led to over production of steam to ensure processes were properly heated. The automation system was installed by Daughter Enterprise "Energooblik" and Scientific Production Enterprise "Grempis", LLC The automation system will directly affect the CHP Plant, as steam will now be produced on a requirement basis, as opposed to a controlled level. Specific installations are as follows:

- Installation of differential pressure sensors (Metran)
- Temperature sensors - 2 pieces
- Frequency conversion units BPO- 32 5 pieces
- Heat sensors "Universal" designed by Grempis

[20] Asadi, Mosen. *Beet-Sugar Handbook*. Wiley-Interscience; A John Wiley & Sons, Inc., Publication. 2006. pg.298

[21] Information Provided by Astarta Plant Experts

These measures have provided the monitoring of steam consumption for evaporation station as well as for other industrial needs of the plant (including exhausted steam consumption). These measures will result in approximately 0.1 m^3 per tonne of beet processed[14]

Implemented Measures at Zhdanivsky

Year	Zhdanivsky sugar plant	Details of new equipment that is planned to be Installed (Description, Manufacture Make and Model)
2007		
1	Modernization of Vertical Presses department	Refer to section above for further details
2	Modernization of the washing department	Refer to section above for further details
3	Replacement of syrup filters	Refer to section above for further details
4	Usage of condensate, made from juice steam, for preparation of the feed-water for sugar extraction at the diffuser stage	Refer to section above for further details
5	Installation of heat exchangers for heating molasses after the first crystallation process	Refer to section above for further details
6	Modernization of the lime kiln with partial replacement of cladding	Refer to section above for further details
2008		
1	Replacement of the brick lining and heat insulation of lime kiln	Refer to section above for further details
2	Improving of transportation system of diffusion and heat exchange equipment at the heating scheme of diffusion	Refer to section above for further details
3	Replacement of vacuum pans with mechanical stirrers and complete automation system	Refer to section above for further details
4	Decreasing of energy consumption by implementation of a new heat system	Refer to section above for further details
5	Implementation of the automation system for monitoring steam consumption and its optimal distribution	Refer to section above for further details

Table 4: Further measures to be installed at the Zhdanovsky sugar plant

Year	Zhdanovsky sugar plant	Details of new equipment that is planned to be Installed (Description, Manufacture Make and Model)
2009		
1	Installation of centrifugals of 1st product BMA -3 units	Centrifugals BMA (3 units). Reduction of electric load to generator what leads to fuel consumption reduction for electricity generation.
2	Installation of additional pan of 3-A hull F-1800 m2 with modernization of heating scheme	Evaporation pan F=1800 to 3-A pan. Transfer of evaporation device to 5-hull one. Reallocation of steam extraction will give the ability to increase the rate of evaporation, effectively use steam of last hulls VU, implementation of 2 -stage scheme of heating of feeding water for diffusion pan with using of heat of massecute steams and steam of 5-th hull VU.
3	Capital maintenance of envelope of boiler number 2, replacement of pipes of side water walls and down comers of boiler number 3	Replacement of economizer of boiler number 2, side water walls, envelope of side water walls and economizer; boiler number 3-replacement of down comers, rear water wall. Repair of envelope will allow to reduce infiltrations at the tract of boiler, increase boiler efficiency and reduce specific fuel consumption per 1 Gcal of heat
4	Heat isolation of heating and technological equipment	Isolation of evaporation pan with mineral cotton and silver paper, repair of isolation of pipelines with juice, syrup and steam within evaporation device. It will allow reducing heat to the environment - therefore reducing fuel consumption for additional heating of the product.
5	Installation of frequency converters to the engines of juice for production and evaporation device	Frequency converters -2 units, at the pumps- the juice for production and juice to the corpus 3-A. It will provide main regulation of pump operation, reduce electric loading and reduce of fuel consumption for electric power generation.
6	To make the diffusion juice by the value 116%, modernization of scheme of pulp drying water	Installation of heater F=20 м² for heating of pulp pressing water, replacement of pumps SOT-30 by SVN-40/40- 2 units Supply of regular feeding of diffusion device by pulp drying water, reduction of diffusion juice pumping, reduction of water anti-damping and reduction of fuel to its additional evaporation.
7	Replacement of heaters of juice in front of evaporation station by lamellar	Heat exchangers produced by "Alfa- Laval" (2 units). It provides heating of juice before going to 3-A corpus VU. Increasing of pans efficiency (100% of the surface is used for evaporation), steam consumption reduction for juice heating in hull which leads to fuel consumption reduction.
8	Modernization of scheme of gas accounting according to the requirements of State Standards	Installation of additional detecting element of pressure drop "Sapfir" 1 unit, installation of sharpen straight area before and after diaphragm of accounting according to new State Standard. Installation of detecting element to lower pressure drop will give the ability to reduce the value of zone of uncertainty from 1605 m³ to 477 m³/h. This will supply more qualified accounting of actually consumed gas.
9	Implementation of scheme of giving of	Receiver- 1 unit, collector -1 unit, pump SOT-30 2 units, level sensor - 2 units, level regulator -2 units, damper valves- 3 units. It

	wash of vacuum filters to lime suppressing modernization of scheme for gas supply to the boiler of 1st saturation	will allow reduction of water with water milk. This will reduce fuel consumption previously needed for additional evaporation.
10	Installation of jet heaters	Lamellar heat-exchangers produced by "Alfa- Laval" -2 units. It provides stable heating of under heated jets in vacuum pans, reduces water at the boiling process on the jets and it leads to fuel consumption reduction for boiling of devices of 1 -2 product
Estimated Gas Savings (2009)		*8.21 (m^3 gas/t beet)*
2010		
1	Installation of 2 pulp dryers	Pulp dryers = 2 units. It will provide quality pressing out of pulp, additional amount pulp drying water. It will allow to reduce barometric water, reduce pumping of diffusion juice for production and as a result reduction of water thereby increasing the quality of juice and will result in a reduction of total fuel consumption for evaporation of additional water.
2	Installation of frequency converters to engines	Frequency converters- 2 units at the pumps, juice for 1st saturation and juice to the collector before evaporation station. Reduction of electric load due to rational use of engines capacity and main regulation of flow, which will lead to fuel reduction for power generation.
3	Replacing oshparyvatelya	New unit will allow reduction in tonnage of juice to production process. This will allow the use of massecute steams for heating of defeco-saturation juice. It will reduce steam takeoff with VU and fuel consumption to VU.
4	Partial heat isolation of heating and technological equipment	Isolation of oshparivatelya, pipelines of juice and water within oshparivatelya, rehabilitation of isolation of pipelines of juice, syrup and steam pipelines within defeco-saturation. Heat insulation will allow to reduce losses of heat from consumer to the environment what will allow to avoid additional costs for heating of product and reduce fuel consumption.
Estimated Gas Savings (2010)		*2.34 (m^3 gas/t beet)*
2011		
1	Installation of 2 filter presses	Press filter - 2 units. Reduction of water supply, reduction of attenuated juices from diffusion till evaporating device, reduction of steam amount for additional evaporation and thus, for fuel.
2	Installation of 2 FC to engines	Frequency converters - 2 units, at pumps the juice for 2 saturation and feeding water for diffusion. It will provide slow regulation of pump operation, reduction of electric load and reduction of fuel consumption for power generation.
3	Replacement of pipes, screens and pipes of the boiler number 1	Replacement of pipes of side water walls, envelopes of side water walls, down comers, steam pipelines. Increasing of efficiency of boiler due to reducing of losses into the environment, reduction of air leak by the tract and reduction of costs for generation of 1 Gcal of heat.
4	Partial heat isolation of heating and	Isolation of press filters of pipelines of juice and water within press filters, repair of isolation of pipelines for juice, syrup and steam

	technological equipment	pipelines within filtration station. It will allow heat losses from consumer to the environment what will reduce additional losses for product heating and in such a way reduce fuel consumption.
Estimated Gas Savings (2011)		*2.04 (m^3 gas/t beet)*
2012		
1	Installation of vertical crystallizers	Crystallizers- 2 units. It will provide the quality of massecute of 2-nd crystallization, increase sugar production. Reduce power consumption for operation of crystallizers to compare with mixing machines what leads to fuel consumption reduction for power generation.
2	Installation of 2 frequency converters to engines	Frequency converters- 2 units at the pumps of condensate. It will provide slow regulation of pump operation, reduction of electric load and in such a way reduction of fuel consumption for power generation.
3	Replacement of centrifugals of 2nd product	Centrifugals (BMA) -4 units. Improving of sugar quality, reduction of losses in molasses. Reduction of electric load to generator as a result of fuel consumption for power generation.
4	Installation of vacuum-pans of 2nd product with circulator 3 units	Vacuum-pans - 3 units BMA with circulators. Improving of heat transfer, optimization of process of boiling by means of automation of process, reduction of water at the process of boiling, reduction of period of boiling in pan, using of steam with lower potential and reduction of steam consumption to evaporation station and reduction of fuel consumption,
Estimated Gas Savings (2012)		*2.50 (m^3 gas/t beet)*

**gas savings values estimated by Astarta Staff*

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

By adopting the project technology, Astarta will raise its energy efficiency up to Western European standards. While the technology is well-known in Western Europe, it clearly goes beyond the prevailing practice in Ukraine and is not required by law[22].

At present, there are no laws, regulations or any other governmental decrees in the Ukraine that require the reduction of energy resources usage by introducing energy efficiency measures in the sugar sector. Development and implementation of the modernization measures at the Astarta's plants fully depend on the initiative and decisions being made by the company's management, as well as the company's financial standing. At the same time, the modernization measures aimed at the reduction of energy resource usage at the Astarta's plants meet the priorities established by the government in the Ukraine's Energy Strategy until 2030 approved in March of 2006.

The project uses state-of-the-art technologies which results in significantly better performance than any commonly used technologies in Ukraine. These technologies are manufactured by famous European

[22] Institute for Economic Research and Policy Consulting. "Working Paper; Restructuring of the sugar sector in Ukraine". http://www.ier.kiev.ua. (Refer to supporting documentation 10).

manufacturers as BMA (Germany), Babbini (Italy), Maguin (France), Silverweibul (Sweden), etc. The installation of these technologies sets higher standards for beets processing and sugar production than what was available prior to the implementation of the project. More specifically, these technologies are anticipated to result in energy efficiency improvements that are double the average energy efficiency improvements in Ukrainian sugar plants[23]. It is not anticipated that the project technologies will be substituted for more efficient technologies throughout the project period. All new technologies replacing original equipment will remain in operation throughout the crediting period. As mentioned, the installation of project technologies will have sufficient energy efficiency results. Natural gas and coal consumption will be reduced due to new technologies installation.

The existing equipment of the two sugar plants can meet the market demand at least until the end of the crediting period, provided normal maintenance is performed on the regular basis. Most of Astarta's domestic competitors are using equipment and technology very similar to Astarta's pre-project situation. Therefore, by investing in significant technical upgrades Astarta assumes an increased risk of technical failure and production disruption. This risk is elevated because Astarta has chosen to purchase higher efficiency used equipment.

Economic efficiency of the project is calculated on the basis of cumulative natural gas savings per one tonne of beet processed. Reductions in natural gas used for power, steam and heat production provided by implementation of modernization measures are estimated taking into account the following:

- Replacement of the existing equipment by modern energy efficient equipment (design and actual performance of the more efficient equipment is compared with technical characteristics of the old equipment to be replaced);
- Changes in the heat and technological schemes aimed at more efficient use of secondary thermal resources;
- Installation of more advanced automated control systems.

Additional Training Requirements:

Implementation of modernization measures at the Kobeliatsky and Zhdanivsky plants, including instalment of more advanced equipment and organizational improvement, necessitate training of plants' managers, technical specialists and workers.

In 2007-2008, training programs in occupational health and safety were delivered to engineering personnel and workers at each of the two plants: at Kobeliatsky plant - by Kremenchug educational organization, 60 people were trained; at Zhdanivsky 125 people were trained. In 2009-2010, training of plants' personnel in this area continues.

To ensure that purchased equipment is installed and operate properly, outside experts were brought to Astarta to help local engineers and workers get familiarized with the new technologies. A technical expert from France was hired by Astarta while a local firm "Ukrservisavtomatica" was involved in setting up the automation systems and training of the personnel.

Proof of Engineering Best Practices

[23] Materials of Scientific-Technical Conferences of Sugar Producers of Ukraine, Kyiv, "Tsukor of Ukraine", 2005-2009.

The modernization program was developed by plant and engineering specialists from Astarta managing company along with technical specialists and consultants from Ukrainian and European engineering companies. The modernization planning consisted of a general engineering design scheme of the energy efficiency program. This required detailed consultations with reputable Ukrainian companies such as "Teplokom", "Sate" and TMA. Further to the Ukrainian engineering firm consultations, Astarta also retained qualified European consultants from Check Republic, Italy, France, Germany, to ensure the energy efficiency program being implemented was in fact a proper reflection of current best practices.

A.4.3.1. Estimated amount of emission reductions over the crediting period:

Table 5: Emission Reductions – Kyoto Crediting Period[24]

	Years
Length of the crediting period:	5
Year	Estimate of annual of emission reductions (tonnes of CO_2-equivalent)
2008	27 696
2009	33 053
2010	40 121
2011	54 383
2012	59 064
Total estimated amount of emission reductions over the crediting period (tonnes of CO_2-equivalent)	214 317
Annual average emission reductions over the crediting period,(tonnes of CO_2-equivalent)	42 863

Table 6: Emission Reductions – Post -Kyoto Crediting Period[25]

	Years
Length of the crediting period:	5
Year	Estimate of annual of emission reductions (tonnes of CO_2-equivalent)

[24] Supporting Document 4 - ERU Calculations

[25] Supporting Document 4 - ERU Calculations

2013	59 064
2014	59 064
2015	59 064
2016	59 064
2017	59 064
Total estimated amount of emission reductions over the crediting period (tonnes of CO_2-equivalent)	295 320
Annual average emission reductions over the crediting period,(tonnes of CO2-equivalent)	59 064

A.5. Project approval by the Parties involved:

A Project Idea Note and Letter of Endorsement (LOE) application was submitted to the Ukrainian Designated Focal Point (DFP), the National Environmental Investment Agency (NEIA), on January 28, 2009. The LOE was then issued through NEIA on February 27th 2009 (LOE #174/23/7)[26].

When the project has completed the determination process, the PDD and determination report will be submitted to SEIA in order to obtain the required Letters of Approval from the Ukrainian DFP. Upon determination the project will be presented to the DFPs of the Netherlands and Spain in order to receive Investor Country Letters of Approval.

[26] Refer to supporting documentation 11 - LOE

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

Baseline selection has been determined and justified by following Annex B of the JI Guidelines and the "Guidance on criteria for baseline setting and monitoring"[27] , version 02 developed by the JISC. From these guidance documents the JI Specific approach was selected for baseline setting. The procedure of most available scenario definition and additionality assessment is given below in Section B.2.

Project boundaries

The project boundary should include greenhouse gases sources which are under control of project participants and deal with proposed project activities.

The project boundary has been applied to the geographic location of both the Kobeliatsky and Zhdanivsky Plants with all equipment. The detailed description of project boundaries is given in the Section B.4.

Baseline scenario

Baseline scenario foresees further use of existing equipment with undertaking of planned maintenance and renovation works without sufficient capital expenditures. The baseline scenario is described in Section B.2.

The only emissions taken into account in accordance with baseline scenario are CO_2 emissions generated due to fossil fuel combustion and decomposition of limestone within the calcination process to provide sugar production. Carbon oxide capture in the process of juice purification is not taken into account. This is a conservative approach.

The specific JI approach uses historical data on fossil fuels and resources consumption to determine specific consumption per unit of manufactured product. Calculation of specific consumption of fuel and resources is based on historical data for 3 years before the project start. 1 tone of produced sugar is the unit of manufactured product. The baseline scenario foresees the same quantity of processed beets as project scenario. Taking into account that the final sugar production depends upon not only beets processing technology, but also upon the sugar content in sugar beets, the approach foresees exclusion of defined effect. The conversion factor of sugar yield to the project level is used for this. The actual (ex post) data on sugar production and sugar content in beets is used to determine baseline emissions.

Remaining lifetime of equipment

If the proposed energy efficiency programme is not implemented, Astarta's existing equipment at all sugar plants is able to continue normal operation at least until the end of the crediting period, provided that normal maintenance work is done on a regular basis, as typically required.

[27] Guidance on criteria for baseline setting and monitoring. Version 02. Available at UNFCCC JI website: http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

Table 7: Key information and data used to establish the baseline

Data/Parameter	$SBC_{hist,y,i}$
Data unit	t
Description	The mass of beets processed in project year y at plant i
Time of determination/monitoring	Once
Source of data (to be) used	Appropriate data collected as part of JI project
Value of data applied (for ex ante calculations/determinations)	Kobeliatskiy sugar plant 2004 162,646 2005 139,929 2006 387,990 Zhdanivskiy sugar plant 2004 113,416 2005 114,425 2006 165,180
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project
QA/QC procedures (to be) applied	Kobeliatskiy Plant: The accounting of sugar beets is executed by an automated weighting meter which consists of tenso-metric automated scales (4 units) with carrier power of 60 tonnes. The scales are calibrated once a year. Level of Uncertainty: 20kg, Low Zhdanovsky Plant: The sugar beets are weighed using scale: SVEDA VBA 3-1000. Control flow meter readings are taken every 10 days. State calibration of automated scales is done once per year in DP "Vinnytskiy DCSMS". Control check is executed every day by means of sampling weights. Level of Uncertainty: 20kg, Low
Any comment	

Data/Parameter	$SP_{hist,y,i}$
Data unit	T
Description	Sugar quantity in 2004-2006 at plant i
Time of determination/monitoring	Once

Source of data (to be) used	Appropriate data collected as part of JI project
Value of data applied (for ex ante calculations/determinations)	Kobeliatskiy sugar plant: 2004 – 17,020 2005 – 15,322 2006 – 48,983 Zhdanivskiy sugar plant 2004 – 13,519.0 2005 – 15,394.0 2006 – 21,332.4
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project
QA/QC procedures (to be) applied	Uncertainty level: Low
Any comment	

Data/Parameter	$SPB_{hist,y,i}$
Data unit	%
Description	Sugar content in sugar beets in accordance with baseline in 2004-2006 at plant i
Time of determination/monitoring	Once
Source of data (to be) used	Appropriate data collected as part of JI project
Value of data applied (for ex ante calculations/determinations)	Kobeliatskiy sugar plant 2004 – 14.23 2005 – 16.2 2006 – 15.85 Zhdanivskiy sugar plant 2004 – 15.22 2005 – 16.52 2006 – 16.12
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project calculation
QA/QC procedures (to be) applied	Uncertainty level: Low
Any comment	

Data/Parameter	$FC_{coal,hist,y,i}$

<table>
<tr><td>Data unit</td><td>t</td></tr>
<tr><td>Description</td><td>Coal consumption at the historical period (2004-2006) at plant i</td></tr>
<tr><td>Time of determination/monitoring</td><td>Once</td></tr>
<tr><td>Source of data (to be) used</td><td>Appropriate data collected as part of JI project</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td>Kobeliatskiy sugar plant:
<table>
<tr><td>2004</td><td>695.0</td></tr>
<tr><td>2005</td><td>746.0</td></tr>
<tr><td>2006</td><td>1717</td></tr>
</table>
Zhdanivskiy sugar plant:
<table>
<tr><td>2004</td><td>242</td></tr>
<tr><td>2004*</td><td>387</td></tr>
<tr><td>2005</td><td>688.1</td></tr>
<tr><td>2006</td><td>846.0</td></tr>
</table>
* Coking coal</td></tr>
<tr><td>Justification of the choice of data or description of measurement</td><td>Required data collected as part of JI project</td></tr>
<tr><td>QA/QC procedures
(to be) applied</td><td>Kobeliatskiy sugar plant:

Kobeliatsky Plant:
The mechanical scale used to weigh coal is: RS-100C13V inventory number 7331. The scale has a carrying capacity of 100 tonnes. State calibration is performed once every 6 months. Test calibration is conducted once every two months. Review and checks are done by using of sampling weights of 4th rank with total mass of 80 t. The results of state calibrations, reviews and checks are put into the technical passport of the scales.
Level of Uncertainty: <100 kg, which is low compared to the carrying capacity of 100 tonnes

Zhdanovsky Plant:
The mechanical scale used to weigh coal is: RS-100C13V inventory number 7331. The scale has a carrying capacity of 100 tonnes. State calibration is performed once every 6 months. Test calibration is conducted once every two months.. Review and checks are done by using of sampling weights of 4th rank with total mass of 80 t. The results of state calibrations, reviews and checks are put into the technical passport of the scales.
Level of Uncertainty: <100 kg, , which is low compared to the carrying capacity of 100 tonnes</td></tr>
<tr><td>Any comment</td><td></td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>$FC_{NG,hist,y,i}$</td></tr>
<tr><td>Data unit</td><td>ths. m^3</td></tr>
<tr><td>Description</td><td>Natural gas consumption for historical period (2004-2006) at plant i</td></tr>
<tr><td>Time of determination/monitoring</td><td>Once</td></tr>
<tr><td>Source of data (to be) used</td><td>Appropriate data collected as part of JI project</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td>Kobeliatskiy sugar plant
<table><tr><td>2004</td><td>10,298.2</td></tr><tr><td>2005</td><td>7,587.4</td></tr><tr><td>2006</td><td>19,331.3</td></tr></table>Zhdanivskiy sugar plant
<table><tr><td>2004</td><td>7,258.5</td></tr><tr><td>2005</td><td>6,721</td></tr><tr><td>2006</td><td>8,690</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurement</td><td>Required for baseline emissions of JI project calculation</td></tr>
<tr><td>QA/QC procedures
(to be) applied</td><td>Kobeliatskiy Plant: Natural gas consumption of the plant and the beet dryer are recorded.

$FC_{NG\ m\ (i)\ plant}$:The accounting of natural gas consumed for production process is done by the meter for measuring of gas volume consumption and amount named "OE-22DM (inventory number 08503000006). The meter can measure data on a momentary, hourly, daily, monthly, off-nominal or emergency cases of gas consumption. Consumption data is sent via radio signal to a computer where it is stored and can be printed on user's request. Calibration of the meter is done at least once every 2 years. The calibrations are executed by the representatives of gas supplier (JSC "Poltavagas") before and during the season (September-March).

Level of Uncertainty: 0.50%, Low

$FC_{NG\ m\ (i)\ dryer}$: The natural gas consumed at the pulp drying kilns is done by a measuring device named "Leader" (inventory number 006503000136). The meter can measure data on a momentary, hourly, daily, monthly, off-nominal or emergency cases of gas consumption. Consumption data is sent by a cable line to a computer where it is stored and can be printed on user's request. Calibration is undertaken by SE "Poltavastandardmetrology" once per year before the sugar season. Calibration by State Committee of Ukraine on</td></tr>
</table>

	standardization, metrology and certification is undertaken twice in 2 year. Level of Uncertainty: 0.50%, Low Zhdanovsky Plant: Natural gas consumption of the plant and the beet dryer are recorded. $FC_{NG\ m\ (i)\ plant}$: The accounting of natural gas consumed for production process is done by an automated measuring-management meter named "UNIVERSAL-01" (inventory number 1810). The meter can measure data on a momentary, hourly, daily, monthly, off-nominal or emergency cases of gas consumption. Consumption data is sent via radio signal to a computer where it is stored and can be printed on user's request. Calibration of the meter is done at least once every 2 years The calibrations are executed by the representatives of gas supplier (JSC "Vinnytsyagas") before and during the season (September-March). Level of Uncertainty: 0.50%, Low
Any comment	

Data/Parameter	$LC_{hist,y,i}$
Data unit	t
Description	Coal consumption at the historical period (2004-2006) at plant i
Time of determination/monitoring	Once
Source of data (to be) used	Appropriate data collected as part of JI project
Value of data applied (for ex ante calculations/determinations)	Kobeliatskiy sugar plant 2004: 9,242 2005: 9,119 2006: 10,128 Zhdanivskiy sugar plant 2004: 6,988 2005: 7,989 2006: 9,602
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project calculation
QA/QC procedures (to be) applied	*Kobeliatskiy sugar plant:* The mechanical scale used to weigh limestone is: RS-100C13V inventory number 7331. The scale has a carrying capacity of 100 tonnes. State calibration is performed once every 6 months. Test calibration is conducted once every two months. Review and checks are done by using of sampling

	weights of 4th rank with total mass of 80 t. The results of state calibrations, reviews and checks are put into the technical passport of the scales. Level of Uncertainty: <100 kg, which is low compared to the carrying capacity of 100 tonnes Zhdanovsky Plant: The mechanical scale used to weigh coal is: RS-100C13V inventory number 7331. The scale has a carrying capacity of 100 tonnes. State calibration is performed once every 6 months. Test calibration is conducted once every two months.. Review and checks are done by using of sampling weights of 4th rank with total mass of 80 t. The results of state calibrations, reviews and checks are put into the technical passport of the scales. Level of Uncertainty: <100 kg, , which is *low* compared to the carrying capacity of 100 tonnes
Any comment	

Data/Parameter	EF_{NG}
Data unit	t CO_2 /TJ
Description	Carbon emissions factor for natural gas
Time of determination/monitoring	Annually
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value of data applied (for ex ante calculations/determinations)	56.1
Justification of the choice of data or description of measurement	Required for emission calculations.
QA/QC procedures (to be) applied	Emission factors reviewed to be in line with national or international fuel standards Level of Uncertainty: Low
Any comment	

Data/Parameter	$NCV_{NG,hist,y,i}$
Data unit	kcal/m^3
Description	Net calorific value of natural gas at historical period in year y at plant i
Time of determination/monitoring	Once
Source of data (to be) used	Natural gas supplier

Value of data applied (for ex ante calculations/determinations)	Kobeliatskiy sugar plant 2004 8,851 2005 9,026 2006 8,943 Zhdanivskiy sugar plant 2004 8,109.3 2005 8,148 2006 8,126
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project calculation
QA/QC procedures (to be) applied	Data is provided by the natural gas supplier on a monthly basis. Values are checked for appropriateness against the default range of values provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Level of Uncertainty: Low
Any comment	

Data/Parameter	EF_{coal}
Data unit	t CO_2/TJ
Description	The carbon emission factor for coal
Time of determination/monitoring	Annually
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value of data applied (for ex ante calculations/determinations)	98.3 tCO_2/TJ
Justification of the choice of data or description of measurement	Required for emission calculations.
QA/QC procedures (to be) applied	Data variables reviewed to be in line with national or international fuel standards Level of Uncertainty: Low
Any comment	

Data/Parameter	$NCV_{coal\ hist,y,i}$
Data unit	kcal/kg
Description	Net calorific value of coal at historical period in year y at plant i
Time of determination/monitoring	Once
Source of data (to be) used	Coal supplier

Value of data applied (for ex ante calculations/determinations)	Kobeliatskiy sugar plant 2004 6,965 2005 6,995 2006 7,130 Zhdanivskiy sugar plant 2004 7,142 2005 7,650 2006 7,810
Justification of the choice of data or description of measurement	Required for emissions calculation
QA/QC procedures (to be) applied	Data is provided by the coal supplier on a monthly basis. Values are checked for appropriateness against the default range of values provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Level of Uncertainty: Low
Any comment	

Data/Parameter	CC_{coke}
Data unit	%
Description	Carbon content in coke
Time of determination/monitoring	Monthly
Source of data (to be) used	TU U 322-00190443-114-96 «Blast-furnace coke»
Value of data applied (for ex ante calculations/determinations)	81,4%
Justification of the choice of data or description of measurement	Required for emissions calculation
QA/QC procedures (to be) applied	Data is provided by the coke supplier on a monthly basis. Values are checked for appropriateness against the range of values provided in TU U 322-00190443-114-96 “Coke for blast furnaces”. Level of Uncertainty: Low
Any comment	

Data/Parameter	$FC_{coke,y,i}$
Data unit	t
Description	Coke consumption at historical period in year y at plant i
Time of determination/monitoring	Once
Source of data (to be) used	Coke supplier

Value of data applied (for ex ante calculations/determinations)	387
Justification of the choice of data or description of measurement	Required for emissions calculation
QA/QC procedures (to be) applied	Level of Uncertainty: Low
Any comment	

Data/Parameter	EF_{CaCO3}
Data unit	t CO_2/t $CaCO_3$
Description	The carbon emission factor for $CaCO_3$
Time of determination/monitoring	Annually
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value of data applied (for ex ante calculations/determinations)	Stoichiometric emission factor; 0.43971 t CO2/CaCO3
Justification of the choice of data or description of measurement	Required for emission calculations.
QA/QC procedures (to be) applied	Emission factors are checked annually Level of Uncertainty: Low
Any comment	

Data/Parameter	$CaCO_{3\ hist,y,i}$
Data unit	Fraction $CaCO_3$/RM
Description	The percent of $CaCO_3$ in raw material limestone in year y at plant i
Time of determination/monitoring	Once
Source of data (to be) used	Limestone Supplier
Value of data applied (for ex ante calculations/determinations)	Kobeliatskiy sugar plant 2004: 0.970 2005: 0.973 2006: 0.972 Zhdanivskiy sugar plant 2004: 0.9725 2005: 0.97 2006: 0.968
Justification of the choice of data or description of measurement	Required for emission calculations.

QA/QC procedures (to be) applied	This data is provided by the limestone supplier with every shipment. Level of Uncertainty: Low
Any comment	

Data/Parameter	EF_{MgCO3}
Data unit	t CO_2/t $MgCO_3$
Description	Carbon emission factor for $MgCO_3$
Time of determination/monitoring	Once
Source of data (to be) used	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value of data applied (for ex ante calculations/determinations)	Stoichiometric emissions factor: 0.52197 $tCO_2/tMgCO_3$
Justification of the choice of data or description of measurement	Required for emission calculations.
QA/QC procedures (to be) applied	Emissions factors are checked annually Level of Uncertainty: Low
Any comment	

Data/Parameter	$MgCO_{3\ hist,y,i}$
Data unit	Fraction $MgCO_3$/RM
Description	The percent of $MgCO_3$ in the raw material limestone in year y at plant i
Time of determination/monitoring	Once
Source of data (to be) used	Limestone Supplier
Value of data applied (for ex ante calculations/determinations)	Kobeliatskiy sugar plant 2004 – 0.0119 2005 – 0.0125 2006 – 0.0125 Zhdanivskiy sugar plant 2004 – 0.0125 2005 – 0.0125 2006 – 0.0125
Justification of the choice of data or description of measurement	Required for emission calculations.
QA/QC procedures (to be) applied	This data is provided by the limestone supplier with every shipment. Level of Uncertainty: Low
Any comment	

The list of data for regular monitoring for baseline determination are given in the table D 1.1.1.3

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the JI project:

As per the "Guidelines for Users of the JI PDD Form", version 04; an approach must be selected to determine the baseline and monitoring parameters of the project. For this project a JI specific approach was selected, as discussed in section B.1. To further extend the application of the JI Specific approach, and to comply with paragraph 2(c), of Annex 1, of the 'Guidance on Criteria for baseline setting and monitoring'**Ошибка! Закладка не определена.** version 02, a full additionality assessment has been preformed, as per below.

As described in detail within section A.4.2, the project introduces a number of energy efficiency measures at the two Astarta sugar plant locations. Of these measures, each specifically addresses an improvement at the sugar plant, and consequently improves the overall operation of the facility.

These efficiency measures can affect the anthropogenic emission releases in a variety of ways. First and foremost, natural gas and coal consumption is greatly reduced, resulting in significant savings of direct GHG releases. Furthermore, savings in electricity and heat result in a decreased load placed on the CHP Plant. These savings result in further natural gas savings and improve the overall operation of the facility. Thirdly, the improvements to the lime kiln directly affect the operating efficiency of the lime milk production process. This, in turn, results in decreased emissions from the calcination process as improvements result in fewer direct emission releases as well as lower fuel combustion requirements.

Overall these energy efficiency measures reduce the quantity of anthropogenic emissions generated at the sugar facilities. Simply put, introducing modernization measures results in more optimized performance and lower need to combust and consume energy.

Indication of the approach applied to demonstrate the additionality of the project

Additionality of the project is demonstrated by following a JI-specific approach. Approach (a) in paragraph 2 of the Annex I to the "Guidance on Criteria for Baseline Setting and Monitoring (Version 2)" has been selected. According to the approach, additionality can be proven by providing "traceable and transparent information showing that the baseline was identified on the basis of conservative assumptions, that the project scenario is not part of the identified baseline scenario and that the project will lead to reductions of anthropogenic emissions by sources or enhancements of net anthropogenic removals by sinks of GHGs."[28]

To demonstrate that the project is not a plausible baseline scenario without being registered as a JI project, a four-step process is undertaken:

(1) **Identification of investment alternatives**: It is demonstrated that the project company Astarta does not have another investment alternative to achieve the same production of Sugar

[28] The document is available at http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

(2) **Investment Analysis**: It is demonstrated that the project does not meet the benchmark for profitability. The investment analysis conforms to the CDM Executive Board's Guidance on the Assessment of the Investment Analysis (version 3).[29]

(3) **Barrier Analysis**: It is demonstrated that the project faces technological barriers regarding technology upgrades and installation difficulty

(4) **Common Practice Analysis**: It is demonstrated that at the time of decision-making there were no similar project activities operational in Ukraine.

These four steps closely follow the key steps of the CDM Additionality Tool. In keeping with the JI-specific approach chosen above, the Tool is not applied in its entirety. By contrast, the steps are selectively applied in order to demonstrate that the project is not part of the baseline. The emission reductions are being monitored according to the monitoring plan established in Section D of this document.

(1.0) Identification of Alternatives to the Project

In section B.1 the baseline was established using a JI specific approach and the ability to apply aspects of approved CDM methodologies; as per "Guidance on criteria for baseline setting and monitoring"**Ошибка! Закладка не определена.** version 02, paragraph 11.

To this end, AMS.II.D was applied for baseline setting as all other parameters of the methodology are followed and applicable. In applying this baseline setting method, following the JI specific approach, other requirements of the AMS.II.D method are also followed to conform to the requirements of conservativeness. Therefore, alternatives to identify the baseline situation were not applicable in section B.1 due to the application of prescribed baseline as outlined in AMS.II.D.

For analysis of other investment opportunities to the project, alternatives are discussed here as part of the Additionality proof. Logical alternatives to the project are:

a.	**Project scenario without ERU sale**:	The proposed project activity without being registered as a JI project
b.	**New Equipment Purchases**:	All equipment upgrades completed with new equipment
c.	**Baseline Scenario**	Continuation of current equipment and practice

(1.1) Analysis of Alternatives to the Project

a. **Project without ERU sale**:

[29] The document is available at http://cdm.unfccc.int/EB/051/eb51_repan58.pdf

The project scenario without the sale of ERUs would have reduced financial viability compared to the project scenario. This creates a significant financial barrier to implementation of alternative ‘a’. The main financial barrier of reduced funding for the project is seen as a limiting factor for project implementation, as alternative ‘a’ becomes not profitable without the sale of ERUs. Thus, alternative ‘a’ is seen to have barriers to implementation, and would not proceed before the project case.

b. **New Equipment Purchases**:

The proposed project activity involves a number of energy efficiency measures being implemented at both the Kobeliatsky and Zhdanivsky plants. As discussed in the previous sections, the project activity involves equipment upgrades being comprised of mostly used equipment. Alternative ‘b’ includes purchasing strictly new equipment, as a possible alternative to the project case.

The availability and high cost of new equipment are both strong barriers to implementation of alternative ‘b’. Thus, the project case is more likely to become the investment project before alternative ‘b’; as the high cost and availability of new equipment would prevent this alternative from moving forward before the project case.

c. **Baseline Scenario**:

The proposed baseline scenario, as described in section B.1, is the continuation of current operations with existing equipment. As described earlier, this alternative is possible as all existing equipment can maintain operation throughout the crediting period. The baseline does not involve an energy efficiency program and is therefore not equivalent to the proposed project scenario.

(1.2) Conclusion

Continuation of current equipment and practice is the only plausible baseline scenario. The scenario "New Equipment" has been eliminated because it is less attractive than the project without being registered as a JI project.

***(2.0)* Investment Analysis**

The investment analysis of the project has been implemented in compliance with the “Tool for the Demonstration and Assessment of Additionality” (Version 05.2), Annex: “Guidance on the Assessment of Investment Analysis (version 02)”. The most current revision, i.e. “Guidelance on the Assessment of Investment Analysis” (Version 03) of December 4, 2009 was also taken into consideration.

Project IRR benchmark analysis was determined as relevant for the presented project. Since the energy efficiency measures are implemented independently at different plants, economic effect (IRR) of energy saving is assessed separately for each plant. Project nominal IRR (adjusted for inflation) of the modernization measures at the Zhdanivsky plant was determined to be 10.44% without the sale of

ERUs and 23.86% with the sale of ERUs[30] The sale of carbon credits raises the IRR by 13.42% and therefore has a significant financial impact on profitability of the project. Project nominal IRR of the modernization measures at the Kobeliatsky plant was determined to be 10.69 % without the sale of ERUs and 18.46% with the sale of ERUs.

The key assumptions for the investment analysis are the following:

1. The analysis is based on the relevant information available at the time of the investment decision; which was made in the fourth quarter of 2006. The analysis is implemented in constant prices presented in foreign currency (Euros). The official average exchange rate for 2006 is applied to the calculation of income from the sale of ERUs and to the conversion of source financial data presented in Hryvnias : 1 Euro = 6.34 UAH.[31]

The assessment period is not limited to the proposed crediting period of the JI activity but extended to 11 years reflecting the substantial period of expected operation of the investment activity. The assessment period begins in 2007 and ends in 2017, i.e. is more than 10 years as required by the Guidance on the Assessment of Investment Analysis. An 11-year assessment period for the investment analysis was chosen due to the fact that the most expensive pieces of the equipment purchased by the Astarta's plants are formerly used including those of 25-30 years old. For example, deep presses Babbini installed at the Kobeliatsky plant were manufactured in 1981 and 1985 years. Centrifuges Silver Weibul SW-2250 and BMA-1250 were manufactured in 1987 (Kobeliatsky plant) and 1982 and 1989 (Zhdanivsky plant). The fair residual asset value is calculated and included into a 2017 cash inflow.

2. The annual project effect is estimated as a differential of cumulative natural gas saving and capital expense calculated in fixed comparable prices of 2006; an average natural gas price per 1000 m^3 without VAT paid in 2006 was 94.32€ at the Zhdanivsky plant and 99.70€ at the Kobeliatsky plant.

3. Residual asset value of the newly installed equipment is calculated on the basis of its total (including purchase, installation and commissioning) initial cost and estimated operational lifetime, and added to the cash flow in the last year of the assessment period

4. The cost of financing expenditures (i.e. loan interest payment) is not included in the calculation of the project IRR.

5. IRR adjustment for inflation is based on the generally accepted approach.[32] Inflation rate assumed in the nominal IRR calculations is 2.20%, i.e. the average Eurozone inflation rate for 2006. [33]

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[30] Supporting documentation 4 – ERU Calculation

[31] Web site of the National Bank of Ukraine:

http://bank.gov.ua/Engl/STATIST/ses_e.htm

[32] "Discounted Cash Flow Analysis Methodology and Discount Rates" by Lawrence Devon Smith – online resource: http://www.cim.org/mes/pdf/VALDAYLarrySmith.pdf

[33] http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&language=en&pcode=tsieb060&tableSelection=1&footnotes=yes&labeling=labels&plugin=1

The IRR benchmark can be calculated on the basis of without risk investment rate and risk factor adjustment. In November 2006, the Ukraine's government issued ten-year Eurobonds for $1 billion at the yield rate of 6.58% per annum.[34] Therefore, the required rate of return, not including project specific risks, can be estimated as 6.58%. Due to the lack of the data for the similar projects in the country, the risk factor adjustment may be identified only on the basis of expert opinion. Following the conservative approach towards risk estimation proposed by the official Methodological Recommendations on Evaluation of Investment Projects Efficiency of June 21, 1999 N BK adopted in Russia[35], the risk factor can be estimated as 8%. Thus, based on conservative risk estimate and without risk factor the IRR benchmark amounts to 15.11% (1.0658*1.08 -1.0).

The calculated nominal project IRR without the sale of Emission Reduction Units at the Zhdanivsky plant is 10.44%, i.e. below the benchmark. The sale of Emission Reduction Units makes the project more profitable with the increased nominal IRR of 23.86% which is above the benchmark. The calculated nominal project IRRs at the Kobeliatsky plant are: 10.69% without the sale of EURs and 18.46% with the sale of ERUs. Note that for the both plants the nominal project IRRs without the sale of ERUs do not exceed the benchmark IRR of 15.11%.

The sensitivity analysis was prepared with three variables: the gas price increased by 10% (sensitivity 1), the capital expenses changed by + 10% and -10% (sensitivity 2 and 3), and the processed beet volumes changed by +10% and -10% (sensitivity 4 and 5). The nominal project IRRs without the sale of ERUs for the Zhdanivsky plant are: 14.26% (sensitivity 1), 6.70% (sensitivity 2), 15.10% (sensitivity 3), 6.79% (sensitivity 4) and 14.26% (sensitivity 5).[36] The nominal project IRRs without the sale of ERUs for the Kobeliatsky plant are: 12.80% (sensitivity 1), 8.42% (sensitivity 2), 13.32% (sensitivity 3), 8.52% (sensitivity 4), 12.80% (sensitivity 5). Therefore, the nominal project IRR without the sale of ERUs in each and every scenario for the Zhdanivsky and Kobeliatsky plants remains below the benchmark rate of 15.11% while the sale of ERUs results in the increase of the IRR to the level above the benchmark rate.

(2.2) Conclusion

Therefore, based on the investment analysis, the project is additional.

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[34] http://news.kievukraine.info/2006/12/analysts-dub-govt-bond-deals-as-non.html

[35] There is no similar officially adopted methodology in the Ukraine.

[36] Supporting documentation number 4: ERU calculations (including financial analysis)

(3.0) <u>Barrier Analysis</u>

(3.1) Technological Barrier

Modernization measures implemented at the Astarta's plants are based on the installation of the operating equipment produced by reputable European manufacturers. Although this equipment is in good working condition and has a proven energy efficiency record, the installation and usage of the equipment at the Astarta's plants are faced by some significant technological issues. The modernized technological processes need to be attached to and synchronized with "old" technological processes. For example, the installation of Maguin and Putsch slicers set up the higher standards for beets washing and even for beets growing which now require application of modern agro-technical methods. A second example can be seen with the installation of new pulp presses; as the advent of return of pulp-press water also requires new synchronization measures with 'old' equipment, as installation of up-to-date automation systems were required. Furthermore, an increase in mechanical loads requires modernization of diffusion systems. Technological control becomes even more important and should be based on modern monitoring devices and laboratory equipment.

Another issue is associated with the maintenance and repair of the purchased equipment including the supply of spare parts which can only be purchased abroad. Deep pulp presses purchased by the Astarta's plants were manufactured by the firm "Babbini" in the eighties. As a result, spare parts for the presses are often being taken out of production and not available. The plants specialists also face difficulties with understanding technical documentation written in foreign languages. Furthermore, some pieces of equipment are delivered with incomplete technical documentation/manuals which create difficulties in their installation, usage and maintenance. As a result of these technological barriers, Astarta is forced to hire foreign specialists for the installation of equipment and training of local personnel to ensure that the purchased equipment work properly.

As an example, the installation of deep pulp presses Babbini (4 units) at Kobeliatsky plant required new concrete foundations and steel-work designed by "Ukrsakharproekt".[37] The presses were purchased in November-December of 2006, however, they were installed and set in operation almost a year later when construction of the new foundations was completed. Introducing of KAHL granulators required new granule elevator and conveyer. Setting up of KAHL granulators was carried out by KAHL technical specialists. Beets slicers Putsch were purchased in 2008 and, to set them in operation, a retrofit of the beets workshop was designed by "Ukrgiprosakhar" and completed. Setting up the automation systems and training of the personnel were implemented by "Ukrservisavtomatica". Centrifugals Silver Weibell was installed in 2008 and their setting in operation required 2 new jigging conveyers made in Finland and other additional equipment as well as assistance of the technical specialist from Sweden.

In general, as recognized by the company's senior management, the installation and setting of purchased equipment in operation has become more challenging and time-consuming than it was anticipated.

(3.2) Financing Barrier

Energy efficiency projects are typically associated with high transaction costs for the planning, implementation and monitoring phases. In Astarta's case, this is even more pronounced due to the large number of measures in two different locations. Without the sale of carbon credits, this is a serious barrier

[37] Letter by Director of Kobeliatsky plant, November 13, 2009

for attracting commercial investment. Technical assistance from EBRD in form of an energy audit was instrumental to lower the barrier.

The possibility of generating ERUs has always been a key factor for Astarta[38], and they have discussed this at a very early stage of project development. The possibility to make this a JI project was already raised in the IPO Prospectus and the 2006 Annual Report. Detailed emission reduction estimates were derived in early 2007 by a team of researchers from the National University of Food Technologies and during the Energy Audit commissioned by EBRD and performed by the energy consultant MWH.

Finally, the project depends critically on EBRD financing as long-term financing is presently not readily available in Ukraine in the amount and on the terms required by Astarta. Although Astarta has been utilizing a number of local banks, the loans they have been able to obtain are either working capital credit lines or limited medium term loans. As a result, EBRD's decision making is directly relevant to the Additionality case. EBRD can only finance projects that have a transitional impact, and one such impact is the project's ability to reduce GHG emissions. The project is consistent with the Bank's Energy Policy which calls on the Bank to "prioritize projects … on the basis of their contribution to improved energy efficiency"[39] and to "support investments in the modernization of energy-intensive industries"[39]. From the time the EBRD first considered financing the loan, the CO_2-saving potential of this investment has been an important consideration, and the execution of a carbon transaction will likely be an important benchmark to monitor the transitional impact of the project. Typically EBRD does not become engaged in subsidized industries. To date, the Bank has never provided any long term financing to the sugar sector in the Bank's countries of operation due to substantial protection of the industry that is typical for beet producing countries. The strong energy efficiency aspect, the potential for a carbon credits transaction and the associated demonstration effect have therefore been instrumental in making this a viable project for the Bank.

Since October 2008, due to the financial crisis in the Ukraine, local commercial banks have reduced financing of practically all sectors of the economy and the following trends have been observing in the country's financial sector:

1. Crediting rates both in hryvnas and hard currency increased noticeably.

2. Long-term investment financing has become impossible: credit resources are very expensive and loans can only be obtained up to 12 months.

3. The National Bank of the Ukraine increased security reserve standards for commercial banks. Following this and in order to protect their financial security, banks introduced a few times higher demands for assets which can be used as security deposit.

At present, to ensure that the modernization measures at the Astarta's plants are highly efficient, the company's management develops and implements a series of other investment projects including those in adjacent agricultural subdivisions aimed at improving quality of sugar beets. Some of these projects were not envisaged when a decision about the modernization program was made and require unanticipated investments. The company is currently negotiating loan agreements with four banks - Pravex, UkrSotsbank, Universal and Unicredit. The annual crediting rates proposed by the banks for loans in Ukrainian hryvnyas are from 24 to 30% and the hypothecation value is twice higher than the loan

[38] MWH Report; Energy Audit at Astarta Sugar Mills, Ukraine; June, 2007

[39] EBRD energy efficiency policy

value[40]. The proposed crediting conditions clearly demonstrate a high level of risks associated with these projects and create a serious financial barrier to their implementation.

(3.3) Social Barrier: Training of Personnel

Implementation of modernization measures at the Kobeliatsky and Zhdanivsky plants, including instalment of more advanced equipment and organizational improvement necessitate training of plants' managers, technical specialists and workers.

In 2007-2008, training programs in occupational health and safety were delivered to engineering personnel and workers at each of the two plants: at Kobeliatsky plant - by Kremenchug educational organization, 60 people were trained; at Zhdanivsky 125 people were trained. In 2009, training of plants' personnel in this area continues.

As described within the technological barriers analysis, outside experts were brought to Astarta to help overcome these technological barriers to implementation. As mentioned, a technical expert from France was hired while a local firm "Ukrservisavtomatica" was involved in setting up the automation systems and training of the personnel.

These barriers combine to provide additional justification as to the additionality of this project. Based on the substantial barriers to project implementation, including; financial, investment, technological, training and prevailing practice it is concluded that the project is additional.

(3.4) Conclusion

Therefore, based on the substantial technical, financial and social barriers analysis, the project is additional.

(4.0) Prevailing Practice Barrier

The measures installed to improve energy efficiency in this project go above the current trends in the Ukrainian sugar industry[41]. There are currently no regulations in place for energy efficiency projects in the Ukraine; energy efficiency programs are dependant on individual company initiatives.

Most beet refineries in the Ukraine currently use power-consuming technology developed in the 1980's and depreciated equipment[42]. In addition to this, the low quality of repair works and the lack of technological discipline result in uneven sugar production processes and sugar plants' shutdown. The low level of automation does not allow for precise control of technological parameters and increases an influence of human factor. Below are specific examples outlining the current prevailing practise in sugar beet technology within Ukraine; in each case, energy efficiency measures at Astarta have gone beyond the prevailing case.

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[40] Supportive evidence provided by the company's financial department.

[41] Institute for Economic Research and Policy Consulting. "Working Paper; Restructuring of the sugar sector in Ukraine". http://www.ier.kiev.ua. (Refer to supporting documentation 10).

[42] Letter by the National Association of Sugar Producers of Ukraine, August 28, 2009

1. Only 10% of sugar producing plants (including Astarta) have been modernizing technology to the European technological level (among 70 operational plants in 2008).
2. Most beet refineries use vertical presses "GH-2"produced in the former German Democratic Republic which provide maximum16% of dry substance content in pressed pulp. The installation of Babbini deep pulp presses at the Astarta's plants achieve 26-32% dry substance.
3. Common equipment for filtering first carbonated juice includes sedimentation tanks, vacuum filters, disc-shaped filters and cartridge filters. Only 10-12 refineries, including Astarta and Tsukrovyk, have installed filter presses to improve efficiency.
4. For the crystallization processes, most beet refineries use vacuum machines of periodic operation without circulators. Vacuum machines of periodic operation are only installed at 5-7 Ukrainian sugar refineries and there are no sugar refineries in the Ukraine with vacuum machines of continuous operation installed.
5. Only 2-3 sugar companies in the Ukraine have modernized evaporating equipment, while most companies maintain older, less energy efficient equipment in working order[43].

In comparison to current technologies used in the sugar refining business in the Ukraine, it is clear that Astarta technologies installed in the project go above and beyond that of common practice[41].

The above demonstrates that the prevailing practice would be to continue to operate existing equipment and not improve energy performance to western European standards. A comparison of energy consumption trends presented at the annual conferences of sugar producers of Ukraine highlights that the typical energy efficiency improvement for sugar plants in the Ukraine is about 4% per year[44]. For the Astarta plants, the average energy efficiency improvement from 2004 to 2008 was 3% per year. With the implementation of the modernization program the Astarta plants are anticipating an 8% per year energy efficiency improvement during the crediting period (to 2012)[45]. This demonstrates that the Astarta projects are overcoming the prevailing practice barrier to be able to implement this project.

The distinctive feature of the modernization program being implemented by Astarta is that the program includes a series of comprehensive measures aimed at improving energy efficiency including: new technology and equipment, introducing of up-to-date automation systems and training of the personnel.

Typically, overcoming the prevailing practice barrier requires that staff be retrained in the operation of new equipment, that management provide encouragement (financial or otherwise) to pursue the energy efficiency improvement over the current practice and that the perception barriers of the staff towards the new equipment and procedures be overcome.

(4.1) Conclusion

Therefore, based on the above proof, the project is not common practice and is therefore additional.

(5.0) Result

As shown with in all sections of additionality assessment; identification of investment alternatives, Investment analysis, Barrier analysis and Common practice analysis, the project is additional.

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[43] Information provided by Astarta. Refer to supporting documentation 9

[44] Materials of Scientific-Technical Conferences of Sugar Producers of Ukraine, Kyiv, "Tsukor of Ukraine", 2005-2009.

[45] Supporting Document 4, EUR calculations.

B.3. Description of how the definition of the project boundary is applied to the project:

Project boundaries

Project boundaries include all emissions sources controlled by project owner. Following this definition, the project boundary has been applied to the geographic location of both the Kobeliatsky and Zhdanivsky Plants. The project boundaries include each of the plants completely with all equipment (Fig. 12). The project includes modernization of beets processing and pulp drying. Both beet processing and pulp drying operations are included. The main energy consumption is direct fossil fuel combustion in the existing steam boilers, the pulp drying facilities and the lime kiln. In addition to the fuel combustion emissions, emissions of CO_2 from the decomposition of lime during the sugar production process are taken into account. Emissions of other greenhouse gases, such as methane and N_2O from fuel combustion were not taken into account. This is a conservative assumption.

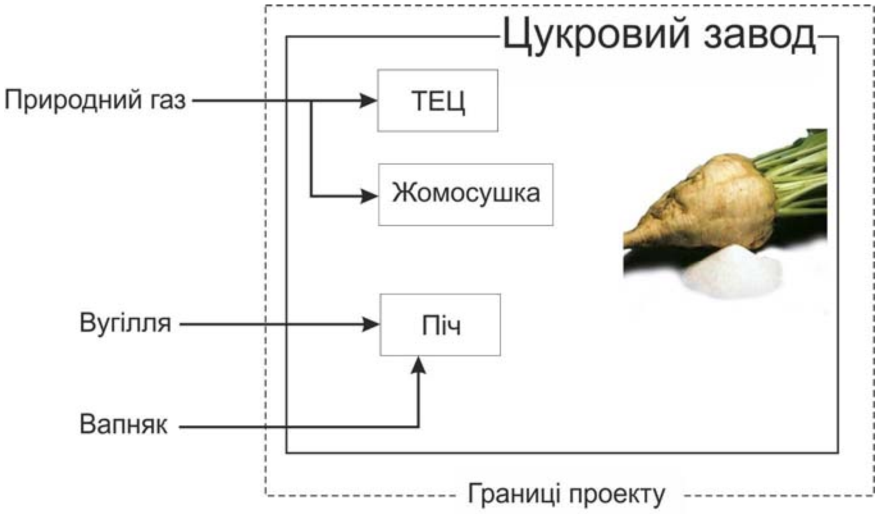

Figure 12. Project boundaries

No leakage was identified outside of the project boundary.

From the above figures, the following tables briefly describe each identified potential source of GHG emissions.

Table 8. Emissions sources and greenhouse gases emissions included and excluded in project boundaries

	Source	Gas	Included	Description
Baseline scenario	Emissions as a result of natural gas combustion in boilers of CHP	CO_2	Yes	CO_2 is the main source of emissions
		CH_4	No	Insufficient source. This is conservative approach.
		N_2O	No	Insufficient source. This is conservative approach.
	Emissions as a result of natural gas combustion in pulp drier	CO_2	Yes	CO_2 is the main source of emissions
		CH_4	No	Insufficient source. This is conservative approach.

		N_2O	No	Insufficient source. This is conservative approach.
	Emissions as a result of coal combustion in the lime kilns	CO_2	Yes	CO_2 is the main source of emissions
		CH_4	No	Insufficient source. This is conservative approach.
		N_2O	No	Insufficient source. This is conservative approach.
	Emissions as a result of limestone consumption in the lime kilns	CO_2	Yes	CO_2 is the main source of emissions
		CH_4	No	Insufficient source. This is conservative approach.
		N_2O	No	Insufficient source. This is conservative approach.
Project boundaries	Emissions as a result of natural gas combustion in boilers of CHP	CO_2	Yes	CO_2 is the main source of emissions
		CH_4	No	Insufficient source
		N_2O	No	Insufficient source
	Emissions as a result of natural gas combustion in pulp drier	CO_2	Yes	CO_2 is the main source of emissions
		CH_4	No	Insufficient source
		N_2O	No	Insufficient source
	Emissions as a result of coal combustion in the lime kilns	CO_2	Yes	CO_2 is the main source of emissions
		CH_4	No	Insufficient source
		N_2O	No	Insufficient source
	Emissions as a result of limestone consumption in the lime kilns	CO_2	Yes	CO_2 is the main source of emissions
		CH_4	No	Insufficient source
		N_2O	No	Insufficient source

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

This baseline is set by the PDD developer, GreenStream Network, 16/10/2009, on behalf of Astarta. GreenStream Network is not a participant of the project.

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SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

2007 will form the first year of project implementation. 2008 will be the first year to claim reductions; specifically resulting from the efficiency measures installed in 2007.

Baseline emissions will be determined from the averaged emissions of the old technology during 2004, 2005 and 2006 to ensure business as usual emission rates are identified by using averaging of the baseline conditions.

C.2. Expected operational lifetime of the project:

For all proposed investments, the operational lifetime of the project will be ten years (120 months); 2008-2012 within the Kyoto crediting period and 2013-2017 post-Kyoto period.

All equipment at the sugar plants could maintain operation, with regular maintenance, throughout the entire operational lifetime of the project.

C.3. Length of the crediting period:

January 2008 – December 2012 (5 Years or 60 months) and January 2013 - December 2017 (5 years or 60 months)

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The JI Specific approach to establishing the monitoring plan has been selected. 'Guidance on criteria for baseline setting and monitoring'Ошибка! Закладка не определена..

The monitoring methodology specifically asks that in the case of replacement, modification and retrofit measures, for the purpose of energy efficiency, the monitoring shall consist of:

a) Documenting the specifications of the equipment replaced;
b) Metering the energy use of the industrial or mining and mineral production facility, processes or the equipment affected by the project activity;
c) Calculating the energy savings using the metered energy obtained from subparagraph (b).

A detailed description has already been provided of the equipment to be replaced (see section A.4.2).

At each of the plants there are fossil fuel and limestone consumption is measured; (1) Natural gas to generate heat, (2) limestone consumption (3) coal[46]* to generate heat at the calcination of limestone.

Natural gas is metered at the entrance to the sugar plant. This monitoring includes all natural gas used onsite; including the two main uses; (1) at the CHP plant and (2) dryers of the pressed pulp. Records of total gas consumption are calibrated and verified directly by the gas supplier, and are provided to the plants on a monthly basis. All electricity that is used to power the sugar manufacturing process is produced at the plants CHP Plant. There is no external electricity purchased from the grid to power equipment or processes within the boundary of the project activity[47], therefore all electricity is metered through the energy

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[46] Please note that Coking Coal was only used to supplement coal fuel requirements during the 2004 campaign at the Zhdanivsky Plant. Coking Coal has never been used at the Kobeliatsky. For simplification of PDD discussion; all fuel used in kilns for production of lime milk (including coking coal usage at Zhdanivsky in 2004) is referred to as simply 'Coal'. Calculation of emissions at the Zhdanivsky plant, in the baseline year 2004, incorporates separate calculation and reporting for both Coking coal and coal, using separate emission factors as applicable. Summation of these fuel usages for 2004 is clearly presented.

[47] Please refer to supporting documentation.

provided by the natural gas consumed at the CHP plant to create electricity. Coal is monitored separately during (periodic) delivery at each facility. Therefore, the only energy inputs into the 2 production plants are natural gas and coal[46] consumption.

Since efficiency gains from the technological improvements occur throughout the production process, the best approach to monitoring energy consumption and the resulting emission reductions achieved through efficiency gains is by using an analysis of energy inputs to production volumes. The steps of the monitoring process can therefore be described as:

- Meter the energy inputs (natural gas, coal, coke) into the plants
- Measure the production volumes (tonnes of sugar)
- Calculation of specific emissions from each source per produced unit in the baseline scenario taking into account sugar content
- Calculation of total emissions amount in the baseline scenario.

As discussed, the guidance methodology further prescribes that energy use within the project boundary must be directly measured and recorded. This requirement is met by using natural gas consumption data, measured and verified directly by the natural gas provider. Natural gas consumption is also measured for specific processes by technical metres for such processes as pulp drying. Coal consumption is measured by weighing machines that weigh each mass of coal prior to being burned in the kiln. Through these records, energy consumption volumes can be properly calculated and recorded, as required. These certified records are used to calculate emission reductions, ensuring accurate calculations in accordance with the methodology. To distinguish between energy reductions based on project activity and energy reductions based on changes to energy efficiency, as required by the methodology, calculations are done on a per tonne of beet processed basis, per plant.

Details on required parameters for monitoring:

Fossil Fuels:
To calculate emissions from fossil fuels (the only energy source in the project) the method suggests the use of IPCC default values for emission factors. Emission factors of 56.1, 98.3 tonnes of CO_2 released per terra joule energy for natural gas, coal respectively were retrieved from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*[48]. Coke emissions are calculated using the carbon content in coke using approved values provided in TU U 322-00190443-114-96

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[48] IPCC. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy, Chapter 2: Stationary Combustion, Table 2.2 Default Emission Factors for Stationary Combustion in the Energy Industry Pg. 2.16 (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf)

"Coke for blast furnaces". Emission factors of 0.43971 and 0.52197 tonnes of CO_2 released per tonne of calcium carbonate and magnesium carbonate, respectively, burned during the burning of limestone were also retrieved from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*[49].

D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. $FC_{NG,y,i}$	*Natural gas consumption*	*Astarta*	m^3	*M*	Monthly	100%	*Electronic and Paper*	
2. $EF_{NG,y}$	*Carbon emissions factor for natural gas*	*IPCC*	$t\ CO_2/TJ$	*C*	Annually	100%	*Electronic*	*56.1* tCO_2/TJ
3. $NCV_{NG,y,i}$	*Net calorific value of natural gas*	*Supplier's certificate*	kJ/m^3	*M*	Monthly	100%	*Electronic and Paper*	
4. $FC_{Coal,y,i}$	*Coal consumption*	*Astarta*	*t*	*M*	Daily	100%	*Electronic / Paper*	
5. $EF_{Coal,y}$	*Carbon emissions factor for coal*	*IPCC*	$T\ CO_2/TJ$	*C*	*Annually*	100%	*Electronic*	*98.3* tCO_2/TJ
6. $NCV_{Coal,y,i}$	*Net calorific value of coal*	*Supplier's certificate*	*kJ/kg*	*M*	*Monthly*	100%	*Electronic / Paper*	
7. $LC_{y,i}$	*Limestone*	*Astarta*	*t*	*M*	*Monthly*	100%	*Electronic /*	

[49] IPCC. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use, Chapter 2: Mineral Industry Emissions, Table 2.1 Formulae, Formula Weights, and Common Contents of Carbonate Species Pg. 2.7 (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_2_Ch2_Mineral_Industry.pdf)

	consumption						*Paper*	
8. EF_{CaCO3}	*Carbon emissions factor*	*IPCC*	$t\ CO_2/t\ CaCO_3$	*C*	*Annually*	100%	*Electronic*	Stoichiometric emissions factor *0.43971*
9. EF_{MgCO3}	*Carbon emissions factor*	*IPCC*	$t\ CO_2/t\ MgCO_3$	*C*	*Annually*	100%	*Electronic*	Stoichiometric emissions factor *0.52197*
10. $CaCO_{3\ y,i}$	*Percent of* $CaCO_3$ *in raw*	*Limestone supplier*	-	*M*	*Monthly*	100%	*Electronic / Paper*	
11. $MgCO_{3\ y,i}$	*Percent of* $MgCO_3$ *in raw*	*Limestone supplier*	-	*M*	*Monthly*	100%	*Electronic / Paper*	

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

The following formulas were used to calculate and/or estimate the emissions resulting from the project scenario.

Formula Used in the Project Determination

$$PE_{y,i} = PE_{Calc,y,i} + PE_{NG,y,i} + PE_{Coal,y,i} \quad (1)$$

Де

$PE_{y,i}$ is the project carbon emissions in project year y at plant i (t CO_2)
$PE_{NG\,y,i}$ is the project carbon emissions from natural gas consumption in project year y at plant i (t CO_2)
$PE_{Coal,y,i}$ is the project carbon emissions from coal consumption in project year y at plant i (t CO_2)
$PE_{Calcin,y,i}$ project carbon emissions from calcination of limestone in project year y at plant i (t CO_2)

Natural gas consumption

$$PE_{NG,y,i} = FC_{NG,y,i} \cdot NCV_{NG,y,i} \cdot EF_{NG,y}, \quad (2)$$

де

$FC_{NG,y,i}$ natural gas consumption for sugar plants needs, Nm^3;

$EF_{NG,y}$ carbon emissions factor for natural gas consumption (t CO_2 / TJ);
$NCV_{NG,y,i}$ Net calorific value of natural gas, TJ/m^3.

Coal consumption

$$PE_{Coal,y,i} = FC_{Coal,y,i} \cdot NCV_{Coal,y,i} \cdot EF_{CO_2,Coal,y}, \quad (3)$$

where

$FC_{Coal,y,i}$ coal consumption for sugar plants needs, t

$EF_{Coal,y}$ carbon emissions factor for coal (t CO_2 / TJ);
$NCV_{Coal,y,i}$ Net calorific value of coal, (TJ/t).

Calcination:
Emissions resulting from the calcination of limestone have been calculated based on the IPCC Tier 3 Methodology for lime production under *Chapter 2: Mineral Industry Emissions*[50]. The Tier 3 method is an input-based carbonate approach to calculating carbon emissions from the calcination process; basing the calculations on the raw material, limestone, as opposed to the amount of CaO produced.

The Tier 3 method for calculating calcination-based emissions uses plant-specific data from the type and composition of raw material consumed, and is seen as the most applicable method to the Astarta facilities (based on their current recording practice). Currently raw material inputs for lime production are recorded in a credible manor, with certificates being provided directly from the limestone supplier. These certified records are provided on a yearly basis and include the mass of limestone delivered as well as its specific chemical composition.

The tier 3 method for calcination also prescribes that calculations assume that the degree of calcination achieved during the burning of limestone is 100%, resulting in a fraction of calcination achieved for each carbonate (F_i) of 1.00. The method also stipulates that the correction factor, (F_d), for lime kiln dust (LKD) is set at 1.00; cancelling out the correction for uncalcined carbonate remaining in LKD. This is because vertical shaft kilns, used to burn limestone in the project, generate very small amounts of LKD, making the correction factor for LKD negligible, as outlined in the methodology. Both of these requirements have been followed within the limestone calculations for the Astarta project.

$$PE_{Calc,y,i} = LC_{y,i} \cdot CaCO_{3,y,i} \cdot EF_{CaCO_3} + LC_{y,i} \cdot MgCO_{3,y,i} \cdot EF_{MgCO_3} , \quad (4)$$

where:

$PE_{Calc,y,i}$ is the project carbon emissions from calcination of limestone in project year y at plant i (t CO_2)
EF_{CaCO3} emissions factor for $CaCO_3$ (t CO_2/ t $CaCO_3$)
$CaCO_{3\ y,i}$ is the percent of $CaCO_3$ in the raw material limestone in project year y at plant i

[50] IPCC. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3: Industrial Processes and Product Use, Chapter 2: Mineral Industry Emissions, Section 2.3: Lime Production Pg 2.21 (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_2_Ch2_Mineral_Industry.pdf)

$LC_{y,i}$ is the mass of raw material limestone burned in the kiln in project year y at plant i (t)
EF_{MgCO3} is the carbon emission factor for $MgCO_3$ ($tCO_2/tMgCO_3$)
$MgCO_{3\,y,i}$ is the percent of $MgCO_3$ in the raw material limestone in project year y at plant i

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
12. $SP_{y,i}$	*Sugar production*	*Astarta*	*t*	*M*	Monthly	100%	*Electronic/ Paper*	
13. $SPB_{y,i}$	*Average sugar content in sugar beets in year y*	*Astarta*	*%*	*M*	Monthly	100%	*Electronic / Paper*	

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

The following formulas were used to calculate and/or estimate the emissions resulting from the baseline scenario.

Formula Used in the Baseline Determination

$$BE_{y,i} = BE_{NG,y,i} + BE_{Coal,y,i} + BE_{Calc,y,i} \quad (5)$$

де

$BE_{y,i}$ is the baseline carbon emissions in year y at plant i (tCO_2)
$BE_{NG,y,i}$ is the baseline carbon emissions from natural gas consumption in year y at plant i (tCO_2)
$BE_{Coal,y,i}$ is the baseline carbon emissions from coal consumption in year y at plant i (t CO_2)
$BE_{Calcin,y,i}$ is the baseline average carbon emissions from calcination of limestone in year y at plant i (t CO_2)

Emissions from natural gas consumption

$$BE_{NG,y,i} = SNG_{Hist,i} \cdot SP_{BL,y,i} \quad (6)$$

де

$SNG_{Hist,i}$ specific carbon emissions from natural gas consumption at historical period at plant i (tCO_2/t of sugar)
$SP_{BL,y,i}$ baseline sugar production in year y at plant i (t of sugar)

Specific carbon emissions from natural gas consumption for historical period:

$$SNG_{Hist,i} = \frac{FC_{NG,Hist,i} \cdot EF_{NG} \cdot NCV_{NG,Hist,i}}{SP_{Hist,i}} \quad (7)$$

де

$FC_{NG,Hist,i}$ natural gas consumption for historical period at plant i (Nm^3);
EF_{NG} carbon emissions factor natural gas (t CO_2 / TJ);
$NCV_{NG,Hist,i}$ average net calorific value for historical period at plant i (TJ/m^3);
$SP_{Hist,i}$ sugar production for historical period at plant i (t).

Sugar production by baseline scenario in year y differs from actual taking into account sugar content factor

$$SP_{BL,y,i} = SP_{y,i} \frac{SPB_{BL,i}}{SPB_{y,i}} \quad (8)$$

де

$SP_{y,i}$ sugar production in year y at plant i (t);
$SPB_{BL,i}$ average sugar content in sugar beets for historical period at plant i (%);
$SPB_{y,i}$ average sugar content in sugar beets in year y at plant i (%).

The emissions from coal and limestone consumption are calculated with the same way

$$BE_{Coal,y,i} = SC_{Hist,i} \cdot SP_{BL,y,i} \quad (9)$$

Where

$SC_{Hist,i}$ specific carbon emissions from coal consumption for historical period at plant i (tCO_2/t of sugar)

$$SC_{Hist,i} = \frac{FC_{Coal,Hist,i} \cdot EF_{Coal} \cdot NCV_{Coal,Hist,i} + FC_{Coke,Hist,i} \cdot CC_{Coke} \cdot \frac{44}{12}}{SP_{Hist,i}} \quad (10)$$

where

$FC_{Coal,Hist,i}$ coal consumption for historical period at plant i (t);
EF_{Coal} carbon emissions factor for coal (t CO_2 / TJ);
$NCV_{Coal,Hist,i}$ average net calorific value for historical period at plant i (TJ/t);

$FC_{Coke,Hist,i}$ coke consumption for historical period at plant i (t);
CC_{Coke} carbon content in coke;
44/12 re-calculation factor of carbon mass into the mass of carbon gas (t CO_2/t C).

$$BE_{Calc,y,i} = SLC_{Hist,i} \cdot SP_{BL,y,i} \quad (11)$$

where

$SLC_{Hist,i}$ specific carbon emissions from limestone consumption at historical period at plant i (t CO_2/t of sugar)

$$SC_{Hist,i} = \frac{LC_{Hist,i} \cdot CaCO_{3,Hist,i} \cdot EF_{CaCO_3} + LC_{Hist,i} \cdot MgCO_{3,Hist,i} \cdot EF_{MgCO_3}}{SP_{Hist,i}} \quad (12)$$

where

$LC_{Hist,i}$ limestone consumption at historical period at plant i (t);
$CaCO_{3\ y,i}$ percent of $CaCO_3$ in raw at historical period at plant i;
$MgCO_{3\ y,i}$ percent of $MgCO_3$ in raw at historical period at plant i.

D. 1.2. Option 2 – Direct monitoring of emission reductions from the project (values should be consistent with those in section E.):

This section has been intentionally left blank. Please refer to option 1, section D.1.1, for information regarding parameters and formula used.

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

This section has been intentionally left blank. Please refer to option 1, section D.1.1, for information regarding parameters and formula.

D.1.3. Treatment of leakage in the monitoring plan:

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

The leakages beyond the project boundaries are not determined.

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

Formula used for Determination of the Emission Reductions

Emissions reductions are calculated by formula:

$$ER_{y,i} = BE_{y,i} - PE_{y,i} - LE_{y,i} \qquad (13)$$

where

ER_y = emissions reduction in year y, t CO_2e;
BE_y = greenhouse baseline emissions in year y, t CO_2e;
PE_y = project emissions in year y, t CO_2e;
LE_y = emissions from leakages in year y, t CO_2e;

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

D.2. 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.

QA/QC procedures have been introduced in line with the project implementation. QA/QC procedures will ensure proper handling of collected data as well as establishing disciplined recording and calibration procedures. The following tables outline the procedures required for proper management of the project information at each plant, as described by data requirements. Thus, the above table has been created, by location, as to increase transparency of the quality assurance and quality control measures of this project. Details of the quality assurance and quality control procedures are provided below.

Kobeliatsky QA/QC Procedures

Table 12: Kobeliatsky QA/QC Procedures

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. $FC_{NG,y,i}$	0,50% Low	The accounting of natural gas consumed for production process is done by the meter for measuring of gas volume consumption and amount named "OE-22DM[iz]" (inventory number 08503000006). The meter can measure data on a momentary, hourly, daily, monthly, off-nominal or emergency cases of gas consumption. Consumption data is sent via radio signal to a computer where it is stored and can be printed on user's request. Calibration of the meter is done at least once every 2 years. The calibrations are executed by the representatives of gas supplier (JSC "Poltavagas") before and during the season (September-March). The natural gas consumed at the pulp drying kilns is done by a measuring device named "Leader" (inventory number 006503000136). The meter can measure data on a momentary, hourly, daily, monthly, off-nominal or emergency cases of gas consumption. Consumption data is sent by a cable line to a computer where it is stored and can be printed on user's request. As this meter is not commercial, calibration of meter is not done.
3. $NCV_{NG,y,i}$	Low	Records are provided by the gas supplier on a monthly basis
7. $LC_{y,i}$	<100 kg Low	The mechanical scale used to weigh limestone is: RS-100C13V inventory number 7331. The scale has a carrying capacity of 150 tonnes. State calibration is performed once every 6 months, while test calibration is conducted once every two months. The results of state calibrations and review-checking are put into the technical passport of the scales.
10. $CaCO_{3\ y,i}$	Low	This data is provided by the limestone supplier with every shipment.
11. $MgCO_{3\ y,i}$	Low	This data is provided by the limestone supplier with every shipment.
4. $FC_{Coal,y,i}$	<100 kg Low	The mechanical scale used to weigh coal is: RS-100C13V inventory number 7331. The scale has a carrying capacity of 100 tonnes. State calibration is performed once every 6 months. Test calibration is conducted once every two months. Review and checks are done by using of sampling weights of 4th rank with total mass of 80 t. The results of state calibrations, reviews and checks are put into the technical passport of the scales.
6. $NCV_{Coal,y,i}$	Low	This data is provided by the coal supplier with every shipment.

12. $SP_{y,i}$	Low	Produced sugar is scaled by bags accounting system SUM-232. The calibration is undertaken by Kremenchuk Center of Standardization and Metrology. The calibration frequency is undertaken once a year. Uncertainty level is +/- 40 g. Sugar is put into the bags with help of weigh hopper – SVEDA. Uncertainty level +/-40 g, calibration frequency is once a year. The calibration is undertaken by Kremenchuk Center of Standardization and Metrology.
13. $SPB_{y,i}$	Low	Sugar content in sugar beets determination is undertaken by semi-automated line ULS-1. Sugar content in sugar beets is undertaken by cold digestion method.

Zhdanovsky QA/QC Table

Table 13: Zhdanovsky QA/QC Table

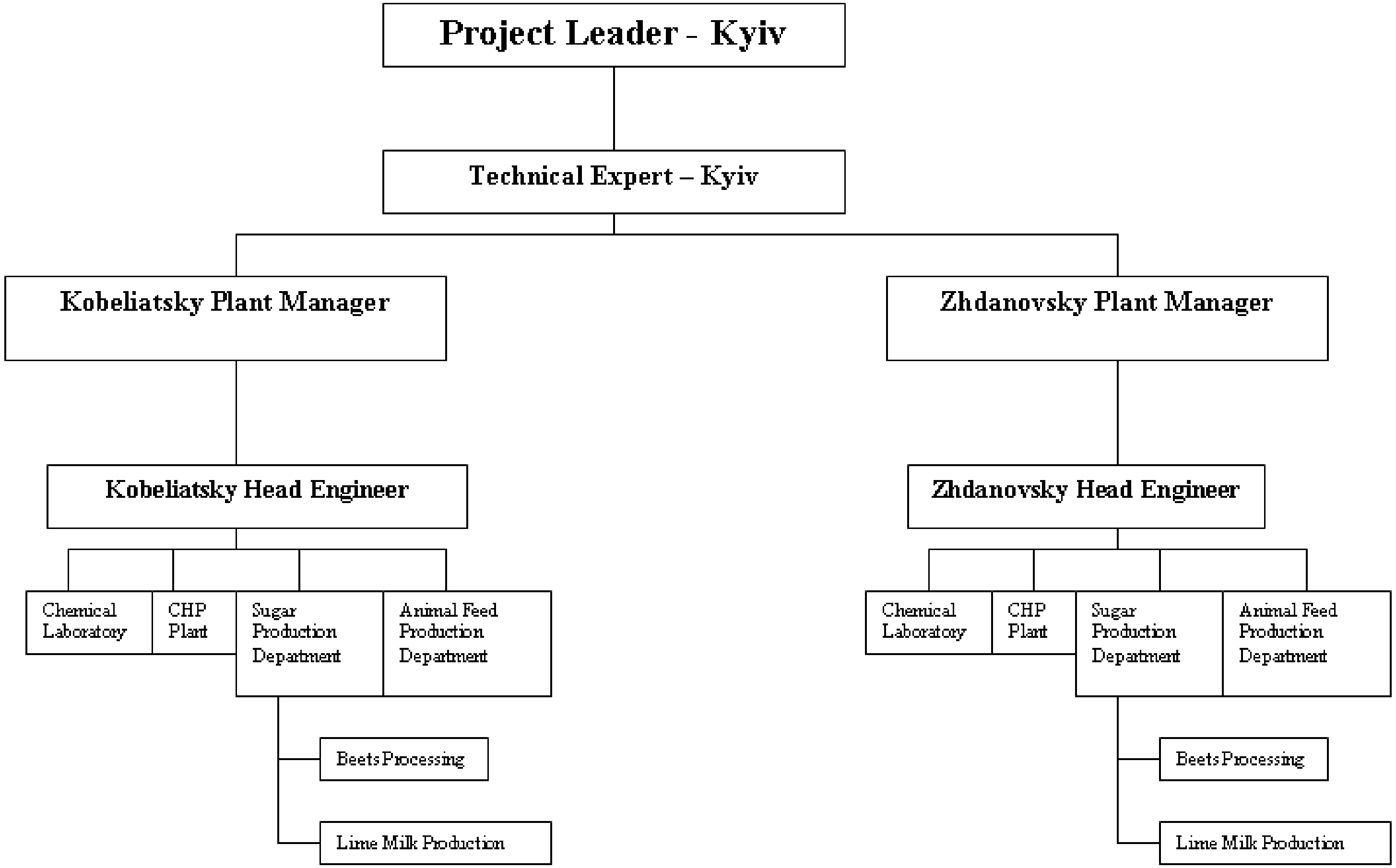
Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1. $FC_{NG,y,i}$	0,50% Low	The accounting of natural gas consumed for production process is done by an automated measuring-management meter named "Universal-01" (inventory number 1810). The meter can measure data on a momentary, hourly, daily, monthly, off-nominal or emergency cases of gas consumption. Consumption data is sent via radio signal to a computer where it is stored and can be printed on user's request. Calibration of the meter is done at least once every 2 years The calibrations are executed by the representatives of gas supplier (JSC "Vinnytsyagas") before and during the season (September-March
3. $NCV_{NG,y,i}$	Low	Data is provided by the gas supplier on a monthly basis.
7. $LC_{y,i}$	<100 kg Low	The mechanical scale used to weigh limestone is: RS-100C13V inventory number 7331. The scale has a carrying capacity of 100 tonnes. State calibration is performed once every 6 months, while test calibration is conducted once every two months. The results of state calibrations and review-checking are put into the technical passport of the scales

10. $CaCO_{3\ y,i}$	Low	This data is provided by the limestone supplier with every shipment.
11. $MgCO_{3\ y,i}$	Low	This data is provided by the limestone supplier with every shipment.
4. $FC_{Coal,y,i}$	<100 kg Low	The mechanical scale used to weigh coal is: RS-100C13V inventory number 7331. The scale has a carrying capacity of 100 tonnes. State calibration is performed once every 6 months. Test calibration is conducted once every two months. Review and checks are done by using of sampling weights of 4th rank with total mass of 80 t. The results of state calibrations, reviews and checks are put into the technical passport of the scales.
6. $NCV_{Coal,y,i}$	Low	This data is provided by the coal supplier with every shipment.
12. $SP_{y,i}$	Low	Produced sugar is scaled by bags accounting system SOM. Calibration frequency is once a year. Sugar is put into the bags with help of weigh hopper –VBA-1-50. Uncertainty level is average. Calibration frequency is once a year.
13. $SPB_{y,i}$	Low	Sugar content in sugar beets determination is undertaken by semi-automated line ULS-1. Sugar content in sugar beets is undertaken by cold digestion method.

D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:

Management of sugar production is completed on a site-by-site basis with a plant manager and technical lead overseeing each plant. However, the overall operational control of the plants is managed through the head office in Kyiv, Ukraine. The head office of the project company oversees and prescribes the site management and operational practices that are adhered to at each of the individual facilities. Thus, directors and technical leads at each plant must adhere to the practices outlined by the head office. This allows for direction to come from head office for each of the sugar plants. The main contact at the head office in Kyiv is Mr. Igor Rylik, Project Leader, Sugar Production Department.

Astarta has confirmed that the management of the JI project will be lead through the head office in Kyiv. The head office will coordinate with both Kobeliatsky and Zhdanivsky to ensure that proper monitoring and documentation retention is completed. Records collected at the individual sites will be sent to the head office for retention, and quality assurance and quality control measures have been introduced to ensure accurate management of the JI project is completed. Please refer to the following organizational chart for details regarding the management structure in place for the JI project.


Project Leader - Kyiv
Technical Expert – Kyiv
Kobeliatsky Plant Manager
Zhdanovsky Plant Manager
Kobeliatsky Head Engineer
Zhdanovsky Head Engineer
Chemical Laboratory
CHP Plant
Sugar Production Department
Animal Feed Production Department
Beets Processing
Lime Milk Production
Chemical Laboratory
CHP Plant
Sugar Production Department
Animal Feed Production Department
Beets Processing
Lime Milk Production

D.4. Name of person(s)/entity(ies) establishing the monitoring plan:

This monitoring plan is set by the PDD developer, GreenStream Network, 16/10/2009, on behalf of Astarta. GreenStream Network is not a participant of the project.

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SECTION E. Estimation of greenhouse gas emission reductions

If the proposed energy efficiency programme is not implemented, Astarta's existing equipment at both sugar plants is able to continue normal operation at least until the end of 2017, provided that normal maintenance work is done on a regular basis. In the upcoming years it is expected that the domestic demand for sugar will grow steadily. In order to meet the market demand, Astarta intends to increase the volumes of the processed sugar beets. The expected volume of beet produced at Astarta agriculture is provided in Table 14 below.

The existing equipment at both sugar plants can be operated throughout the crediting period. The existing equipment also allows for the increase in processing that is expected until 2017.

Table 14: Expected Beet Production Volume[45]

Year	Beet Production (tonne Beet)
2008	563,396
2009	695,000
2010	780,000
2011	829,000
2012	870,000
2013	870,000
2014	870,000
2015	870,000
2016	870,000
2017	870,000

**Assumed 2012 production levels will remain consistent through 2013-2017*

The CO_2 emissions from natural gas combustion in the boilers of the sugar plants were considered in the calculations. Emissions of other greenhouse gases, such as methane and N_2O from fuel combustion were not taken into account. This is a conservative assumption. In addition to the fuel combustion emissions, emissions of CO_2 from the decomposition of lime during the sugar production process are taken into account. Parameters used for the calculation are summarized below.

E.1. Estimated project emissions:

Table 15: Project Scenario Emissions [45]

Year	Estimate of Annual Emissions (tonne CO_2)
2008	75 157
2009	63 695
2010	73 226
2011	99 783
2012	103 366
2013	103 366
2014	103 366
2015	103 366
2016	103 366
2017	103 366

E.2. Estimated leakage:

Not applicable, as per section D.1.3.

E.3. The sum of E.1. and E.2.:

Since no leakage has been identified, the project emissions remain:

Table 16: Project Emissions[45]

Year	Estimate of Annual Project Emissions (tonne CO_2)
2008	75 157
2009	63 695
2010	73 226
2011	99 783
2012	103 366
2013	103 366
2014	103 366
2015	103 366
2016	103 366
2017	103 366

E.4. Estimated baseline emissions:

The results of CO_2 emissions calculations are presented in the Table below.

Table 17: Baseline scenario emissions[45]

Year	Estimate of Annual Emissions (tonne CO_2)
2008	102 853
2009	96 748
2010	113 347
2011	154 166
2012	162 430
2013	162 430
2014	162 430
2015	162 430
2016	162 430
2017	162 430

E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

The emission reductions generated by the proposed JI project are calculated as the difference between emissions in the baseline scenario and emissions in the project scenario. There was no leakage identified outside the project boundaries. The emission reductions are presented in the Table below. The average annual emission reduction volume is more than 50,964 t CO_2e/a.

Table 18: Emission Reductions from the Project [45]

Year	Estimate of Annual Emissions (tonne CO_2)
2008	27 696
2009	33 053
2010	40 121
2011	54 383
2012	59 064
2013	59 064
2014	59 064
2015	59 064
2016	59 064
2017	59 064
Total estimated amount of emission reductions over the crediting period, (tonnes of CO_2-equivalent)	509 637
Annual average emission reductions over the crediting period,(tonnes of CO_2-equivalent)	50 964

E.6. Table providing values obtained when applying formulae above:

Table 19: Summary of values - Kyoto Crediting Period[45]

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2008	75,157	N/A	102,853	27,696
2009	63,695	N/A	96,748	33,053
2010	73,226	N/A	113,347	40,121
2011	99,783	N/A	154,166	54,383
2012	103,366	N/A	162,430	59,064
Total (tonnes of CO_2 equivalent)	415,227	N/A	629,544	214,317

Table 20: Summary of values - Post Kyoto Crediting Period[45]

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2013	103,366	N/A	162,430	59,064
2014	103,366	N/A	162,430	59,064
2015	103,366	N/A	162,430	59,064
2016	103,366	N/A	162,430	59,064
2017	103,366	N/A	162,430	59,064
Total (tonnes of CO_2 equivalent)	516,830	N/A	812,150	295,320

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

The sugar plants produce more waste products than sugar, pulp and molasses combined[51].
Air pollutants fall into three categories: gases; particulate matter (including opacity) and odour. Most of the polluting gases emitted from beet-sugar facilities are the result of steam generation, internal combustion engine operation, beet-pulp drying, lime production, non-condensable gas venting from evaporators, and wastewater treatment. Most of the particulate matters (tiny solid particles suspended in air) in beet-sugar facilities are created by steam generation, coal handling, sugar handling, and beet-pulp drying and handling. Most of the offensive odours are generated by spoiled beets, beet-pulp drying, and wastewater treatment.

Beet-sugar producers always have to discharge water into the environment because sugar beets are 75% water. Most of the water evaporated when producing sugar is condensed to recover the energy of the steam; resulting in the final waste product being in liquid form (after the condensation process).

Beet-sugar producers also generate a variety of solid waste products, including dirt, wastewater sledges, rocks, weeds, beet pieces, discarded beets, discarded beet pulp, limekiln waste, precipitated calcium carbonate(carbonation-lime residue), used oil, laboratory wastes, discarded process chemicals, scrap metal, paper scrap, and coal ash. Most of the solids are not harmful but harmful components can leach out of them and spread through the environment.

Air Pollution Control at the Astarta's Sugar Plants

[51] Asadi, Mosen. *Beet-Sugar Handbook*. Wiley-Interscience; A John Wiley & Sons, Inc., Publication. 2006. pg. 564.

Air pollution is a major environmental concern of the Ukraine's sugar industry including Astarta-. The national legislation has established maximum permissible emission standards for the following air pollutants being emitted by sugar plants: nitrogen dioxide, carbonic oxide, sulphurous anhydride, ammonia, sugar dust particular matters, wooden dust, scraping metal dust, ash, ferric oxide, calx, calcium hydrate.

In addition to these standards, regional departments of the Ukraine's Ministry of ecology and natural resources in some cases establish special standards for sugar facilities depending on their particular operating features. For example, special standards for the Kobeliatsky plant include: sulphuric acid, and manganese and its compounds.

In compliance with the national legislation and regulation, sugar plants collect and record data on air pollution emission on a regular basis. In addition, national certified organizations occupied with specialized laboratories take test measurements of air pollution emissions once a quarter during beets processing season.

Regional department of the Ministry of ecology and natural resources represented by the Vinnitsa laboratory takes test measurements at Zhdanivsky plant and a certified organization "PromEcoService" located in the city of Poltava does the same at Kobeliatsky plant. Results of test measurements are recorded in reports issued by the organizations mentioned above. The most recent reports available at Zhdanivsky plant (2003-2008) and Kobeliatsky plant (2005, 2007 and 2008) confirm that actual air pollution emissions at the plants are within the standards.

The shortest distances between the Astarta's plants and the Ukraine's state border are: 180 kilometers between Zhdanivsky plant and Moldavia; 270 kilometers between Kobeliatsky plant and Russia. The plants do not have negative transboundary pollution impacts on the territories of neighbouring foreign countries.

Due to the nature of the modernization measures being implemented at the plants, the national legislation does not require environmental impact assessments. However, according to the national construction norms and rules, the plants obtained permits from relevant regulatory agencies. The modernization measures at Zhdanivsky plant were reviewed and approved by the Vinnitsa regional department of the Ministry of ecology and natural resources and the Khmelnitsky sanitary-epidemiological service.

Water Management at the Astarta's Sugar Plants

Water management in the sugar industry is regulated by the Water Code of Ukraine and relevant national regulations. Annual Water Balance is a main planning tool used by sugar plant's management to forecast the amounts of fresh water in-take, total water usage and wastewater discharge. Water Balance is compiled by Engineer-Ecologist under the supervision of Deputy Chief Engineer on the basis of water usage norms developed by auditing company hired by plant. These norms are based on a series of governmental regulatory documents such as Industry's Norms for Technological Design of Beet-Sugar Plants. Water Balance is submitted to Regional Environmental Protection Department subordinated to the Ukraine's Ministry of Environmental Protection for review and approval. In case of approval, the Department issues Water Usage Permit which sets up the limits to fresh water in-take from surface and underground water sources, total water usage including recycling and wastewater discharge to fields of filtration. Both the Zhdanivsky and Kobeliatsky plants have valid Water Usage Permits issued by respectively the Vinnitsia and Poltava Regional Environmental Protection Departments. Water in-take amounts measured by water meters and calculated values of waste water discharges at plant are recorded and monitored by Engineer-Ecologist. Compliance of actual data with Water Balance and Water Usage Permit is controlled by the State Ecological Inspection (in Poltava and Vinnitsia region respectively) subordinated to the Ukraine's Ministry of Environmental Protection as well as the Poltava/Vinnitsia Regional Department of Water Resources under the Ukraine's Water Management Committee. On-site inspections are conducted according to the inspection plan and casually. Annual Report on water use is submitted to the Regional Environmental Protection Department, Regional Department of Water Resources and State Tax Inspection in Poltava/Vinnitsia region. Each year, prior to the launching of beets processing campaign, sugar plants undergo a comprehensive inspection implemented by the regulatory agencies including the Poltava/Vinnitsia Regional Environmental Protection Department which take into account inspections's certificates of the State Ecological Inspection. The start-up certificate is issued if only all criteria established by the state regulations including those relating to water usage are met.

Solid Waste Management at the Astarta's Sugar Plants

Waste Management at beet plants is regulated by the Ukraine's Law on Solid Wastes and Cabinet of Ministers Decree #1218 "On approval of order for the development, review and approval of waste generation and disposal limits" of 03.08.1998. The annual forecasted quantities of specific solid wastes generated at plant are calculated by plant's Engineer-Ecologist or hired auditing company. Relevant documents are submitted to the Regional Environmental Protection Department for review and approval. In case of approval, the Department issues Permit for Waste Generation and Disposal. Both Zhdanivsky and Kobeliatsky plants have valid Permits issued by respectively the Vinnitsia and Poltava Environmental Protection Departments as well as agreements with companies involved in waste utilization. A particular attention is paid to hazardous wastes and their recycling. Source bookkeeping documents relating to waste generation and disposal include agreements with companies-utilizers, quantities of utilized wastes by types and information about waste storages sites at plant. The State Ecological Inspection in Poltava/Vinnitsia region carries out annually planned and casual on-site inspections in order to control execution of the Ukrainian waste management regulations and compliance with Permits for Waste Generation and Disposal. A valid inspection's certificate is mandatory for plant's continuing operation. Annual Report on wastes generation and disposal is submitted to the Poltava/Vinnitsia Regional Environmental Protection Department and State Statistics Committee in Poltava/Vinnitsia region.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to supporting documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Due to the nature of the modernization measures being implemented at the plants, the national legislation does not require environmental impact assessment. The planned modernization measures do not include a new construction or rehabilitation of the existing facilities and, in compliance with the Ukraine's Law on Ecological Expert Assessment #46/95 of 09.02.1995, are not subject to environmental impact assessment.

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

Modernization programs being implemented at Zhdanivsky and Kobeliatsky plants were presented to and approved by local authorities: Zhdanivka Village Council and Bilyky Town Council. Due to the nature of the modernization measures being implemented, public consultations are not required by Ukraine's national legislation and, therefore, have not been conducted. Information about Modernization program planned at Kobeliatsky plant was published in the newspaper when the application for permit regarding air pollution emissions was submitted to the regional department of the Ministry of ecology and natural resources.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

ID number	Data variable	Data unit	2008	2009	Source of data	Comment
B7	EF_{NG}	tCO_2/TJ	56.1	56.1	IPCC	*56.1 tCO_2/TJ*
B9	$CONV_{energy}$	TJ/kcal	4.1868 E-09	4.1868 E-09	International Energy Agency	*4.1868 E-09 TJ/kcal*
B10	$NCV_{NG\ m\ (i)}$	$Kcal/m^3$	8932 - Kob. 8129- Zhd	8933 - Kob. 8129- Zhd	Natural Gas Supplier International Energy Agency	*average*
B11	$BP_{y\ (i)}$	tonnes	379054 - Kob. 184342 - Zhd	460000 - Kob. 235000 - Zhd	Astarta	
B13	EF_{coal}	tCO_2/TJ	98.3	98.3	IPCC	*98.3 tCO_2/TJ*
B15	$NCV_{coal\ m\ (i)}$	kcal/kg	7029 - Kob. 7534 - Zhd	7030 - Kob. 7534 - Zhd	Coal Supplier	
B17	CC_{coke}	*%*	*81.4*	*81.4*	*Certificate from the coke supplier*	*81.4% - In accordance with TU U 322-00190443-114-96 «Coke for blast furnaces »*
B20	EF_{CaCO3}	$tCO_2/tCaCO_3$	0.43971	0.43971	IPCC[52]	*Stoichiometric emission factor; 0.43971 $tCO_2/CaCO_3$*
B23	EF_{MgCO3}	$tCO_2/tMgCO_3$	0.52197	0.52197	IPCC[52]	*Stoichiometric emission factor; 0.52197 $tCO_2/MgCO_3$*

Annex 3

MONITORING PLAN

Please refer to Section D.

[52] Table 2.1 from http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_2_Ch2_Mineral_Industry.pdf