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

CONTENTS

SECTION A. General description of the project

A.1. Title of the project:

Energy Efficiency Programme at the plants of LLC "Agricultural Produce Organization" Tsukrovyk Poltavschyny"

The project activity belongs to the sectoral scope[1] (3) Energy demand.

Version 2.4 dated July 12 2012

A.2. Description of the project:

LLC ""Agricultural Produce Organization" Tsukrovyk Poltavschyny" (Tsukrovyk) is an agri-industrial holding and one of the leading companies in the Ukrainian sugar sector. From 2004 to 2007 Tsukrovyk has been one of Top-5 Ukrainian sugar producers. Tsukrovyk's operations are focused on the production and sale of sugar made from sugar beets, sugar by-products and related services. Tsukrovyk has leased 91,000 hectares of land to grow their own sugar beets as well as other crops and raise cattle. Tsukrovyk owns 2 trading companies (sugar and crops) and 34 production units, including the 3 of 5 sugar mills where the JI project is to be executed.

This project is being conducted at three sugar beet processing plants under ownership and operation of the project company; Tsukrovyk. The project activity is comprised of various energy efficiency improvements being implemented at each of the three sugar plants. The sugar plants are located in the towns of Globyno, Veseliy Podil and Yareski within Poltava oblast, Ukraine.

Limited Liability Company ""Agricultural Produce Organization" Tsukrovyk Poltavschyny" is located at 38034, Poltava region, Shyshaky district, Yareski village, Novatoriv street, 24. Code of the object in accordance with EDRPOU (National State Registry of Ukrainian Enterprises and Organizations) – 30811110.

Type of activities of LLC "APO "Tsukrovyk Poltavshchyny"" in accordance with KVED (Foreign Economic Activity Code):
15.83.0 Sugar production
70.20.0 Rent of own realty
45.21.1 Buildings construction
51.22.0 Wholesale of flowers and other plants
51.51.0 Wholesale of fuel
51.55.0 Wholesale of chemical products.

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).

[1] The sectoral scope is based on the list of sectors and sources contained in Annex A of Kyoto Protocol. The project activity belongs to the sectoral scope (3) Energy Demand because it will reduce the demand of energy.

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 (02/11/2006). 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 beet processing equipment. 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 practise 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 required at the CHP generating units. Maximizing the use of waste energy resources by optimizing the heat scheme of the evaporation system will also 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 calcination 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 'projectline' 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. Tsukrovyk 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, Tsukrovyk 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, 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, Tsukrovyk has been developing Energy Saving Programme. This voluntary program is aimed at increasing the efficiency of Tsukrovyk'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 Tsukrovyk[2] and it was discussed at the very early stage of the programme development.

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

The intention for making a JI project was raised in the Initial Public Offering (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 this 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 credit has 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 Tsukrovyk's plants.

A Project Idea Note and Letter of Endorsement (LOE) application for Tsukrovyk 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 №173/23/7)[3].

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 "Agricultural Produce Organization" Tsukrovyk Poltavschyny	No
Netherlands, Spain, Switzerland	Stitching Carbon Finance (SCF)	No

A.4. Technical description of the project:

A.4.1. Location of the project:

The proposed energy efficiency programme of LLC "Agricultural Produce Organization" Tsukrovyk Poltavschyny" (Tsukrovyk) is to be executed at three sugar plants located in Poltava region of Ukraine: Globinsky , Veselopodilskiy and Yareskivskiy sugar plants.

[3] Please refer to supporting documentation number 11 (LoE)

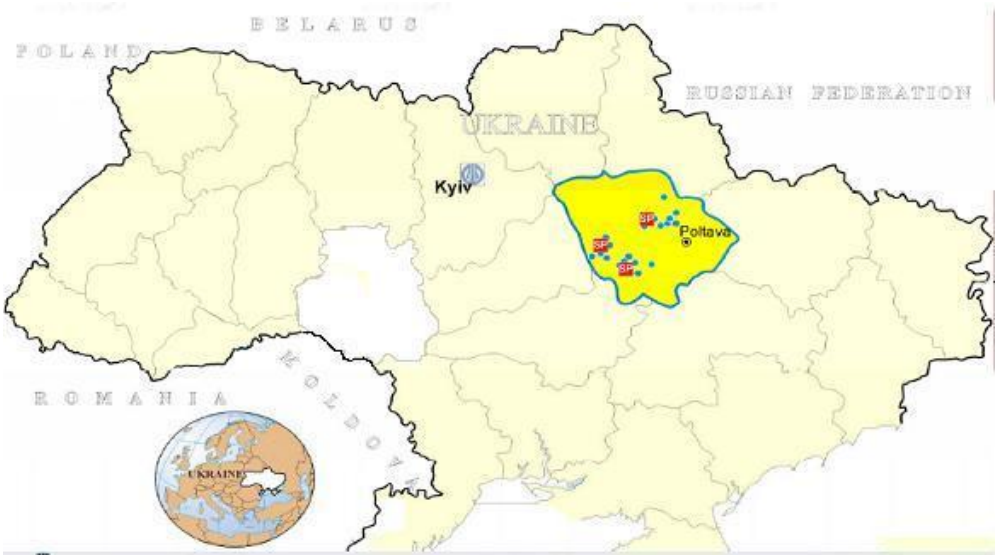


Figure 1: Location of the Project

A.4.1.1. Host Party(ies):

Ukraine

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

Poltava Oblast

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

Globyno, Veseliy Podil and Yareski.

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

Globinsky:	49.2427, 33.1322
Veselopodilskiy:	49.3615, 33.1156
Yareskivskiy:	49.5011, 33.5558

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 specifics of the technologies installed at the three sugar plants are slightly different at each plant. These differences have been listed individually to showcase their specific contributions to the emission reduction activity. Technologies are therefore listed by plant, and year. 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 the opportunity to describe how each directly affects the energy efficiency at the plant.

It should be noted that Tsukrovyk intends to increase the volumes of the processed sugar 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 all three Tsukrovyk sugar plants for the upcoming years is provided in the table below.

Table 1: Forecasted Beet Production[4]

Year	Beets processed, (tonnes)
2008*[5]	849,676
2009	724,000
2010	782,000
2011	797,000
2012	797,000
2013	797,000
2014	797,000
2015	797,000
2016	797,000
2017	797,000

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

Globinsky Sugar Plant Technologies

(1) Purchase and installation of deep pulp presses Babbini (3 pieces) (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 pulp press water and pulp. The pulp is pressed and the pulp press water is returned to the diffusion process. The pressed pulp is removed for drying; where it is sold as animal feed. The old presses used at Tsukrovyk facilities were model number PSJN-68-5 units manufactured by Bolohovskiy machinery plant, having a capacity of 1500 tonnes of beets per day. With the old presses Tsukrovyk obtained pressed pulps with 8% dry substance. 3 new deep pulp presses have been installed with the model number P-18, manufactured by the firm Babbini based in Italy with a capacity of 1500 tonnes of beets per day. With the new horizontal deep pulp presses Tsukrovyk is able to receive up to 30% dry substance.

[4] Supporting Document 4 – ERU Calculations

*[5] Note 2008 value includes production at Veselopodilskiy Plant, which will no longer operate past 2008

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 will reduce natural gas consumption in the drying oven. Alternate benefits of new presses are the increased purity in the diffusion 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.

Reducing the need for clean water addition results in less need electricity to power water pumps, as well as increases the recovery of sugar from the beet. In addition, decreased water addition also results in less of a need for the evaporation procedure; a highly energy intensive process. As a result of these improved processes, natural gas savings from installation of three new deep presses are 0.89 m^3 gas/tonne beet or a natural gas savings of 140,000 m^3 gas/year[6].

(2) Purchase and implementation of beet slicers Maguin (2 pieces) (2007)

Beet slicers have the simple function of cutting the whole beets into smaller parts called cossettes. The new drum-type beet slicers installed at the Globinsky plant will result in significant savings over the previous centrifugal method of slicing. These new Maguin CRT2000x600x60 slicers from France were installed to replace the old T2M SC2B-16-4 units produced by Smelyanskiy centrifugal slicers that were in operation.

This installation of Maguin slicers results 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 slicing[7]. Figure 2 shows the new technology. This installation is expected to save 0.67 m^3 of gas per tonne of beet processed through the increase in operating efficiency[6].

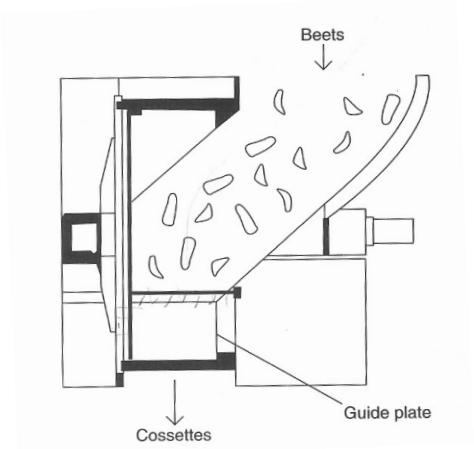


Figure 2: Maguin Beet Slicer[8]

[6] Information provided by Tsukrovyk, Please refer to supporting documentation No. 1.

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

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

(3) Modernization of condensate scheme removal (from evaporator) (2007)

During the evaporation process, filtered juice is heated to evaporate excess water obtaining syrup with high content of dry substances and reducing crystallization time. Previously, equipment developed by the Union Scientific Research Institute of the Sugar Industry with a capacity of 3000 tonnes of beets per 24 hours was used for the condensate removal. With the use of this equipment, exhaust steam from the evaporation station was used ineffectively and heat energy from this steam was lost. Four of the six sectional condensate collectors were modernized by Ukrsahproect, Cherkassy. The new design and engineering allows for heat recovery from the steam and condensate to be used as a secondary energy resource to heat the juice. Capacity of the modernized condensate collectors is 4,500 tonnes of beets per 24 hours. Further development to the equipment was completed by Ektas Ltd. in 2008 to produce additional fuel savings.

The main energy savings from this measure come from the capture and use of previously wasted heat energy. Use of heat from the evaporated steam to heat the juice during the several evaporation processes reduces the need for supplemental steam production. In addition, the new equipment has increased the capacity by 1500 tonnes of beets per 24 hours; allowing for higher production with equivalent energy consumption. Final natural gas savings for this measure after development by Ektas Ldt. are 0.3 m^3 gas/tonne beets, resulting in approximately 47,000 m^3 natural gas savings per year[6.]

(4) Insulation of the heat-exchange equipment and steam pipelines (services) (2007)

Heat is required in the sugar making process for a number of important functions. Heat is used to evaporate the water and obtain the thick syrup, used to heat feeding water for diffusion process as well as a number of other important processes. Heat is provided as a result of steam production process from the onsite CHP plant. Currently the retention and conservation of heat is well regarded as task of prime importance at the Tsukrovyk plants.

This project aspect 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. Overall 740m^2 of t-30mm polyurethane foam was added to insulate pipes, condensers, steam pipes, condensate collectors. The insulation was manufactured by Antares of Sevastopol. By insulating the pipes and condensers Tsukrovyk will be able to reduce gas consumption by approximately 0.10 m^3/tonne of beet processed; or approximately 15,000 m^3 per year[6].

The following figures illustrate the importance of insulation of pipes and detail the heat loss for various pipe diameters and pressures. By using proper insulation on piping above 50^{o}C Tsukrovyk can save up to 90% of energy losses as well as ensuring proper steam pressure within this section of the plant[9].

[9] MWH Energy Audit, pg 45

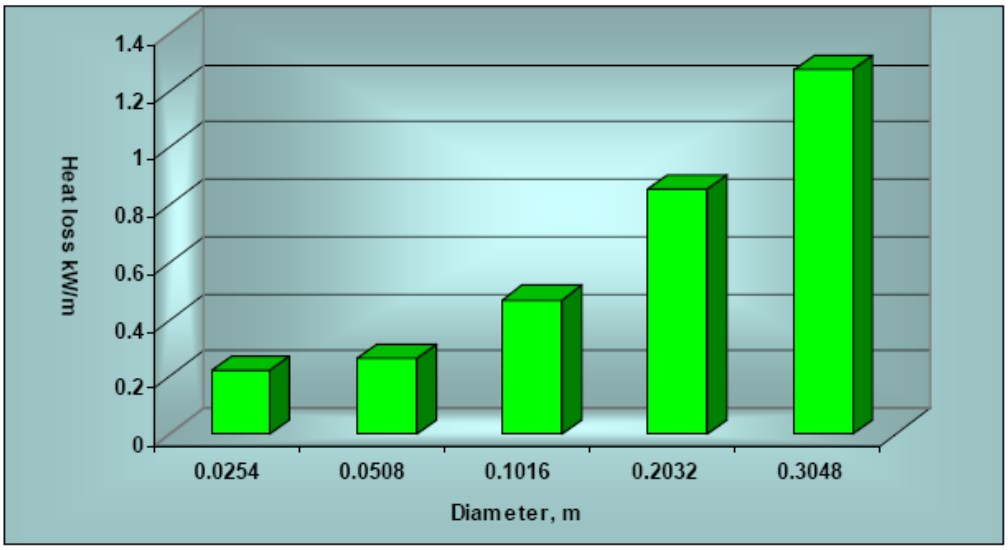


Figure 3: Heat Losses per 1 meter of uninsulated steam line at 4 bar (kW/m)[10]

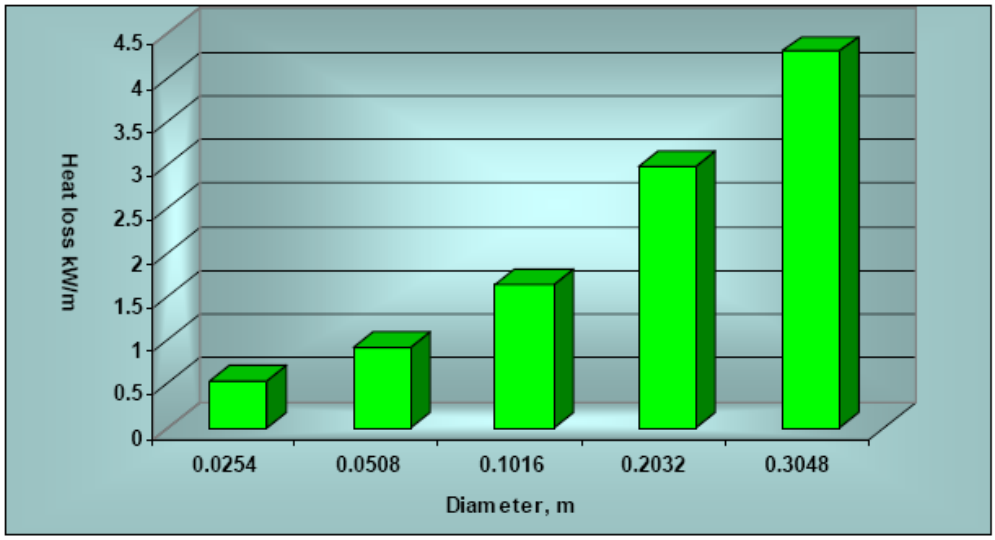


Figure 4: Heat Losses per 1 meter of un-insulated steam line at 40 bar (kW/m)[11]

(5) Replacement of the economizers (2007)

Economizers are used to ensure heat is reused and maintained within the sugar plant and increase the efficiency of the boiler. By replacing economizers, Globinsky sugar plant is able to ensure maximum heat retention within the plant. Economizers are utilized specifically to exchange heat in the boiler. According to MWH estimations, for every 1% increase in economizer efficiency about 50,000 m^3 of natural gas can be saved at the Globinsky plant[12]. By increasing the heat retention at the site, the CHP plant will be required to produce less heat through the steam production process and correspondingly will result in decreased natural gas consumption. Energy savings are a result of the replacement of the

[10] MWH Energy Audit, pg 46

[11] MWH Energy Audit, pg 46.

[12] MWH Energy Audit, pg 48.

economizers' surface in the steam boilers, model BGM-35M number 2, number 3, number 4. Energy savings due to this replacement are 0.06 m^3 gas/ tonne beet, which resulted in 10,000 m^3 gas savings in 2007.

(6) Purchase and installation of 4 centrifuges BMA-1250 (2008)

Centrifuges are used in the sugar making process to separate sugar crystals from the inter-granular liquor in one of the final stages of sugar production. This process is conduced with the use of a centrifuge which spins the syrup mixture at high turnovers as to obtain separation, refer to Figure 5. The efficiency of these devices is important as they consume large amount of energy to operate. The old equipment consisted of 5 machines from Sumy Scientific Production Union, model number FPN-1251 T. These units were replaced with 4 new centrifuges, the first product BMA-1250 of Germany.

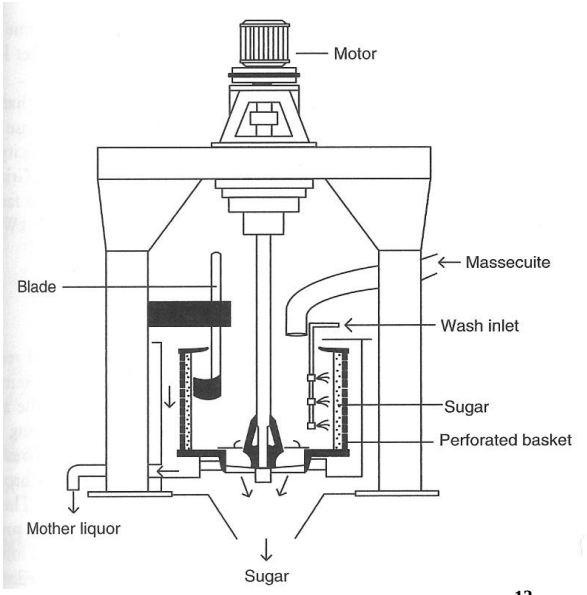


Figure 5: A typical batch centrifuge [13]

The new centrifuges, along with operating more efficiently and requiring fewer cycles, also have the ability to generate power during stoppage. This supplemental electricity generation is able to offset the power requirements of the CHP Plant and helps to achieve the estimated 0.68m^3/tonne of beet savings for this measure. Overall the installation of the four new centrifuges will result in approximately 18,000 m^3 of natural gas savings per year[6].

(7) Purchase and installation of 4 frequency converters (2008)

Frequency converters have been installed to help control the speed and operation of pumps within the Globinsky sugar plant. The quantity of electricity used to power equipment has been reduced due to installing frequency converters. 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.

Four frequency converters have been installed at four different locations. The first frequency converter, a Danfoss VLT AQUA Drive PC201P200 from Germany with a capacity of 200 kW was installed at the beet lifting station. The second, a Danfoss VLT AQUA Drive PC202P160 from Germany with a capacity

[13] Asadi, Mosen. *Beet-Sugar Handbook*. Wiley-Interscience; A John Wiley & Sons, Inc., Publication. 2006. pg. 425.

of 160 kW was installed to regulate the rate of deviation of pulp pressing by dry substances content. The third converter installed is a Danfoss VLT FT301 P45 from Germany with a capacity of 45 kW, which was installed at the screw for pulp unloading DC-12. The last converter installed is a Danfoss VLT5032PT 5C20S with a capacity of 43 kW, at the station where syrup is sent to the further preparation before the vacuum devices installed for pumping of the syrup from evaporation station. .

Operational control at the beet lifting station allows for adjustment of the pumps' turnovers and electricity usage based on the mass of incoming beets, reducing wasted energy when a smaller load of beets arrives. Control of the speed of pumps' turnovers at the syrup pumping allows for adjustment in flow for stabilizing of dry substances content through the production process at a specific time. This allows for less electricity to be used as the system does not need to be run continuously at maximum speed. Installation of frequency converters is estimated to have a natural gas savings of 0.06 m^3 gas/tonne beets or 15,000 m^3 gas in 2008[6].

(8) Insulation of the heat-exchange equipment and steam pipelines (2008)

Further to the heat insulation that was conducted in 2007, in 2008 further insulation to the heat exchange equipment was installed to reduce heat loss. In total 1200m^2 of t-30mm polyurethane foam, manufactured by BIC Ltd. of Dnepropetrovsk, was used to steam pipes as well as insulate 9 of the current heat exchangers.
In addition to the insulation, 4 new heat exchangers were installed to further recycle heat within the plant. Heat exchangers were installed at the following locations of the heating scheme (see Figure 6 for depiction of evaporation process, and station locations):

1. *Installed at the heating of defecation juice. Juice steam from 4thevaporation station, for use at 2st group of heating;*
2. *Condensate from evaporation station;*
3. *Water heating for diffusion process; steam from the 4-th unit of evaporation station;*
4. *Second stage-heating of water for steam diffusion of 5th unit of evaporation station.*

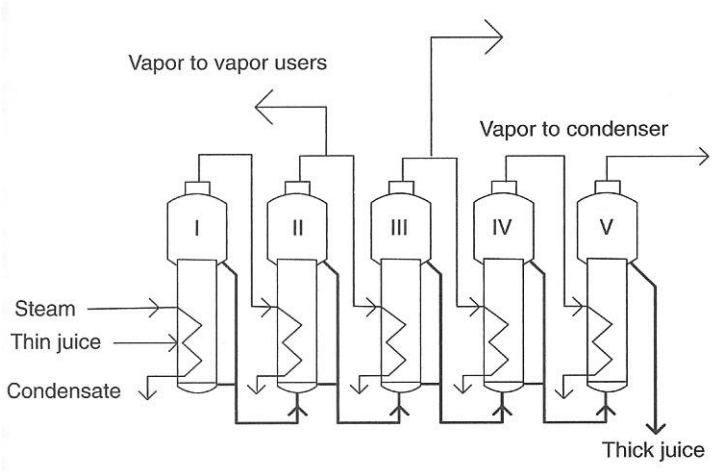


Figure 6: Five effect evaporation station[14]

Heat exchangers equipment is all shell and tube heat exchanges, designed by Ekstas. The addition of this further insulation in combination with the introduction of four new heat exchangers will result in approximately 0.21m^3/tonne beet processed or a total of 55,000m^3 savings per year[6].

[14] Asadi, Mosen. *Beet-Sugar Handbook*. Wiley-Interscience; A John Wiley & Sons, Inc., Publication. 2006. pg. 303

(9) Automation of condensate collecting process (2008)

This measure is the second phase of the 2007 installation (modernization of the condensate remover scheme (from evaporation station); measure number 4 above). In 2007, condensate collectors were modernized to effective use of the heat energy at the process of steam to be used to heat the juice. The energy from this steam was previously used ineffectively. In 2008, further stages were made to automate the condensate collection process and subsequently increase the heat savings of the above mentioned measure number 4. Further savings are realized in 2008 through modernization of heating system and installation works, as well as the purchase of equipment and a processor VIPA, Germany. Automation of the new equipment allows obtaining the supplementary energy savings as the process is now controlled with a high degree of precision; based on technological parameters of production rather than manual control.

Automation results in the reduction of energy consumption of the units, by increasing of accuracy of regulation processes. Installation of the automated system results in energy savings of approximately 0.4 m^3 gas/tonne beet (0.1m^3 gas/tonne beet greater than savings without the automated system) and an approximate savings of 105,000 m^3 in 2008[6].

(10) Replacement of heating surface of evaporation station (2008)

Evaporation devices are used in the sugar making process to heat the juice to boiling temperatures; to vapour the water within the mixture. By boiling off sugar solution, the remaining volume becomes more concentrated as it turns into thick sugar syrup. By replacing the heating surface of the evaporators, there is an increased heat transfer between the steam and the sugar liquid. This increased efficiency allows for the rapid heating of the sugar solution and effective water evaporation. Correspondingly this increased heat efficiency results in a lower energy requirement of the overall evaporation process. Lower energy requirements result in less use of steam from the CHP plant which further relates to decreased levels of natural gas consumption.
The area of section replaced will remain the same at 1000 m^2 of surface area with the length of pipes of 3 650 mm, which is being changed. The increased efficiency of the new heating surface will result in a gas savings of approximately 0.11m^3 of natural gas per tonne of beet processed or annual savings of 30,000 m^3 per year6. Figure 7 shows an example of the tubular heat exchange equipment that will be replaced.

Figure 7: Heat exchange equipment surface[15]

[15] Picture taken at Tsukrovyk Plant

(11) Modernization of the vacuum condensation plant (2008)

The condensation units produce the vacuum needed by the vacuum devices during the crystallization process. Two additional injectors and steam contact economizers with the model number PKP-200 designed by Ectos, (Ectos) Kyiv and with a capacity of 4,500 tonnes of beets per 24 hours have been installed in the vacuum condensation plant to increase efficiency. In addition to installation of these injectors, a new system of regulating water and vapour has also been installed. The new injectors and vapour regulators will reduce the consumption of fresh water and improve vapour utilization in the plant. These results in reducing the energy are important for water pumping and increased the energy extracted from the waste steam. Modernization of the vacuum condensation plant provides approximate energy savings of 0.27 m^3 gas/tonne of beets, saving 70,000 m^3 natural gas in 2008.

(12) Automation of the diffuser and purification station (2008)

The diffuser is utilized to mix the sliced beet particles, cossettes, with heated water. This process provides 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.

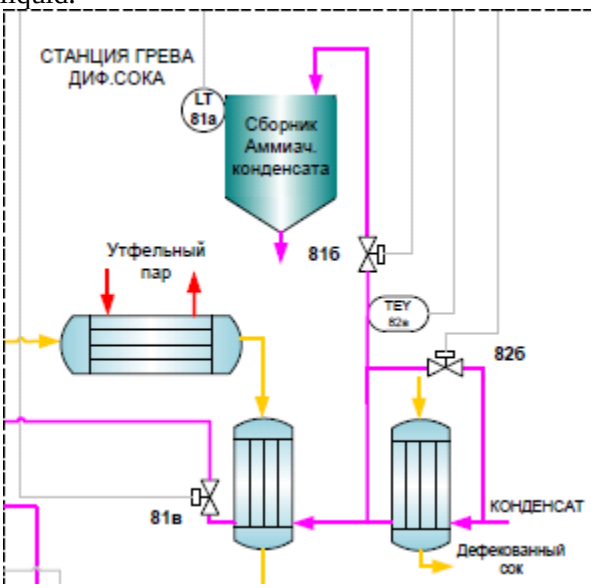


Figure 8: Diffusion juice heating station

The old equipment used was a processor manufactured by Schneider. Automation of the diffuser and purification station included installation works and installation of the purchased equipment: stop valves and a processor VIPA of Germany. The new automation of the diffuser allows for control of the volume of water and ratio to beet cossettes. In addition, control of the lime milk in the purification system is automated.

Automation of these two systems leads to energy savings by eliminating excess use of water and lime milk. By controlling the ratio of water to cossettes Tsukrovyk ensures an accurate amount of water which in turn provides maximum solubility of sugar into solution without the addition of excess water which would need to be evaporated later. As a result, more beet processed means less natural gas used per tonne of production and less natural gas is used later on to evaporate off the water.

The new automation also creates a constant, rhythmic production of juice so equipment throughout the production process can operate at a constant, full, capacity. Without automation, non-rhythmic

production occurred resulting in equipment running at less than optimal capacity. Automation of the diffuser ensures that the addition of lime milk is optimal; thereby eliminating excess production of limestone and coal that was used during non-uniform juice flow. Overall, automation of the diffuser and purification system reduces natural gas consumption by 0.32 m^3 gas per tonne of beets, saving approximately 85,000 m^3 natural gas in 2008[6].

(13) Diffuser department modernization (design) (2008)

Further to the diffuser *automation*, as described above, energy savings will also be realized in the diffusion process through the *mechanical* modernization of the diffuser unit. Overall there have been a number of mechanical changes to the diffusion device to increase its capacity, including:

a. Installation of a condensate collector DC-12, manufactured in Poland.
b. Heater of feeding water to the diffusion
c. Pump installation manufactured by firm SAER of Italy, NCB-100-400-NB
d. Installation of pulp conveyer
e. Diffusion juice heater
f. Replacement of electric motors including driving unit of the diffuser by more efficient
g. Increasing strength of transporting system of the diffuser.

These retrofits lead to the ability to increase the speed of loading and efficiency of operation, therefore increasing the production rate. Modernization of the diffuser also included installation of a heater for the circulating juice and the change in diameter of the pulp conveyer system from 900 mm to 1,000 mm. Increased strength and operation of the mixing blades within the diffuser has also been applied along with above mentioned automation system.

The majority of energy savings due to the mechanical modernization of the diffuser comes from an increase in production using the same volume of natural gas, thus reducing the specific gas consumption per tonne of beet processed. The newly installed motors increase the speed at which the diffuser can process beets, with the new motors processing 3,161 tonnes of beet per day and very little change in volume of natural gas from the previously operating motors which were able to process 2,950 tonnes of beet per day. Overall these combined mechanical changes will add an additional 0.40 m^3 of natural gas savings per tonne of beet processed[6].

(14) Modernization of the water cooling tower (2008)

The water cooling tower cools recycled water from the plant to be used in the condenser unit. The colder the water is, the more efficient the condenser unit can operate. The old injectors were able to reduce the water temperature by 20°C. The injectors were replaced and a second fan was purchased; a 2VG50 fan manufactured by the Moscow fan plant. The new system reduces the water temperature by 33°C. The fan was also installed to create forced circulation in the injectors and improve overall performance of the unit.

Natural gas savings are achieved because the condenser can now operate more efficiently and there is a reduced need to pump large quantities of water to the condensing unit as now a lower quantity of cooler water is utilized. Modernization of the water cooling tower produces natural gas savings of 0.09 m^3 gas/tonne of beets, or 25,000 m^3 saved in 2008[6].

Table 2: Further measures to be installed at the Globinsky sugar plant

Year	Globinsky sugar plant	Details of new equipment Planned to be Installed (Description, Manufacture Make and Model)
2009		
1	The heat technological equipment and piping was insulated using modern insulation materials	The heat technological equipment and piping was insulated using modern insulation materials
2	Use of sweet-water effluent (water solution with low sugar content from vacuum-filters) for lime slaking was implemented.	Use of sweet-water effluent (water solution with low sugar content from vacuum-filters) for lime slaking was implemented.
3	The diffuser DC-12 was repaired, the drive power cables of electric motors were replaced	The diffuser DC-12 was repaired, the drive power cables of electric motors were replaced
4	General repair of boiler BQM-35M number 4 was implemented, the overheated steam collector and burners (12 pieces) were replaced, all necessary spare parts to renovate de-aerators were purchased	General repair of boiler BQM-35M number 4 was implemented, the overheated steam collector and burners (12 pieces) were replaced, all necessary spare parts to renovate de-aerators were purchased
Estimated Gas Savings (2009)		*2.4 (m^3 gas/t beet)*
2010		
1	Implementation of a new automation system to boil massecuite using heavy syrup without water and juice feeding	Automation of the first product. Project by "Sahavtomat" Ing. Shortening of time used for massecuite boiling due to the increase of juice's CB by 3%.
2	Use of condensers heat from vacuum pans to heat juice and molasses	Installment of lamellar economizers, 2 units. Usage of condensates' heat.
3	Automation of steam boilers BGM-35M	Microprocessor-based automation. Increase of coefficient of efficiency by 0.6 and accident-free operations.
Estimated Gas Savings (2010)		*1.1 (m^3 gas/t beet)*
2011		
1	Fitting out of existing vacuum pans of the first, second and third crystallization by new vacuum pans with forced circulation of massecuite	Installment vacuum pans with mechanical circulators made by the firm TMA. Possibility of syrup boiling with - 70% under lower steam potentials.
2	Reconstruction of vapour station, feeding of juice to 3A-vessel, heating of vacuum-pans of the first, second and third crystallization by 3A vessel juice steam	Modernization of heating scheme. Project by "Ektas Ltd.", Kyiv. Increase of steam's repetition factor. Shortening of time used for massecuite boiling.
Estimated Gas Savings (2011)		*2.2 (m^3 gas/t beet)*
2012		
1	Reconstruction of vacuum condenser station with separate barometric condensers to condensate pan vapour from vacuum pans of the first, second and third crystallization and evaporation	Project by the firm "Ektas Ltd." Shortening of the time used for massecuite boiling due to improved discharge with the possibility to use massecuite's steam for heating of diffusion juice

2	Improvement of technological scheme, installation of high-effective clarification and filtration equipment (purchase of filter presses), reduction of products quantity at different stages of technological process	Installment of two filter presses "Larox" S=146 m2. Increase of juice's for boiling by 0.2%.
3	Use of ammoniac condenser heat for heating raw juice	Project by the firm "Ektas Ltd". Usage of condensates' heat.
4	Use of pan vapour heat for heating raw juice	Economizer with usage of heat of massecuite's steam by the firm "Ektas Ltd." Kyiv. Usage of secondary heat carriers.
Estimated Gas Savings (2012)		*1.7 (m^3 gas/t beet)*

**estimates of gas savings preformed by Tsukrovyk Staff*

Yareskivskiy Sugar Plant Technologies

(1) Implementation of deep pulp presses P-18, 3 pieces (2007)

The pulp presses are utilized during the final stage of the sugar diffusion process. Pulp presses take the combined exhausted slices and hot water mixture and separate this mixture into pure raw juice and pulp. The exhausted slices and hot water 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. Before the project, the Yareskivskiy plant used three SP-1000 presses and four GH-2 presses manufactured by Zangerhausen of Germany. With the old presses Tsukrovyk obtained pressed pulps with 8% dry substance. For the project, three P-18 presses manufactured by BABBINI of Italy were installed. With the new horizontal deep pulp presses Tsukrovyk is able to receive up to 30% dry substance.

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. Reducing the need for clean water addition results in less need electricity to power water pumps, as well as increases the recovery of sugar from the beet. In addition, decreased water addition also results in less of a need for the evaporation procedure; a highly energy intensive process. As a result of the new pulp presses, the Yareskivskiy plant has achieved natural gas savings of 191 m^3 gas/tonne dry pulp[16].

(2) Replacement of disk filters by filters EATON (2007)

Syrup filters are used to remove particulates and contaminates within the sugar juice. Prior to the project the plant used 6 disc shaped filters, model DF-150 manufactured by Pivnenkovksy plant of Ukraine. The old filters have been re-directed to the test filtration of sulfized juice. Old filtering equipment filtered juice with minimal efficiency, high energy consumption and often lead to trace contaminates being left within the filtered juice. This inefficient process required frequent re-filtering to ensure that all

[16] Refer to supporting documentation 1.

contaminates were removed. Old syrup filters use filter elements with fabric which provide a light lower than 100 microns[17].

New EATON syrup filters will both increase efficiency and purity. By increasing efficiency the new presses will require less electricity to effectively operate. Increased purity will also benefit the sugar making process by reducing the filtering duration as well as providing pure final syrup. A further benefit of the new filters is their ability to process higher density syrup, thus eliminating the need to dilute the syrup (with water) before filtration; as was required by the old filters. By eliminating unnecessary water addition the overall process is improved as the excess water no longer needs to be evaporated in future stages of operation. Gas savings expected from installing EATON disk filters is approximately 2.37 m^3 per tonne of beet processed[16].

[17] MWH Energy Audit

(3) Diffuser modernization (2007)

As discussed, the diffuser is utilized to mix the sliced beet particles, cossettes, with heated water. This process provides the diffusion of sugar from the beet into the water solution.

The modernization of the diffuser unit is comprised of a number of process upgrades, including;

a. Installation of a condensate collector DC-12, manufactured in Poland
b. Pulp press water economizer
c. Modernization of pumps track
d. Installation of pulp conveyer manufactured by firm SAER of Italy, NCB-100-400-NB
e. Heater of pulp press water
f. Installation of new diffuser motors
g. General maintenance and increasing of transporting system of the diffuser.

These retrofits lead to the ability to increase the speed of loading and efficiency of operation, therefore increasing the production rate. Modernization of the diffuser also included installation of a heater for the circulating juice. Increased strength and operation of the transporting system within the diffuser has also been applied along with above mentioned automation system.

The majority of energy savings due to the mechanical modernization of the diffuser comes from an increase in production using the same volume of natural gas, thus reducing the specific gas consumption per tonne of beet processed. The newly installed motors increase the speed at which the diffuser can process beets, with the new motors processing 3161 tonnes of beet per day and very little change in volume of natural gas from the previously operating motors which were able to process 2950 tonnes of beet per day. Overall these combined mechanical changes will save 0.40 m^3 of natural gas savings per tonne of beet processed[16].

(4) Increasing system capacity of defecation and saturation station (2007)

The defecation and saturation station is the first stage of juice purification, in which lime and CO_2 are added to the juice to remove any impurities. The old equipment consisted of a vertical 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. In addition, the previous defecation station produced a poor quality of juice and limited the production capacity to 2 800 tonnes of beet per day. New equipment is a vertical system which has eliminated all the problems created by the past vertical 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. Increased capacity combined with elimination of fuel lost due to stoppage time, increases the overall beet processing efficiency thus reducing the overall specific natural gas consumption required for sugar production. Elimination of stoppages 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 and saturation station. The modernization of this process will lead to a savings of 4.5 m^3 of natural gas per tonne of beet processed[16].

(5) Implementation of frequency converters (2007)

Frequency converters have been installed to help control the speed and operation of pumps and fans within the Yareskivskiy sugar plant. By installing frequency converters 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 in turn results in decreased combustion of natural gas for the purpose of electricity production. Savings from these installations will result in approximately 1 kWh reduction per tonne of beet processed relating to 0.99 m^3 of natural gas savings per tonne of beet processed[16].

Table 3: Frequency Converters (2007)

number	Location of Frequency Converter Installation	Controlling Parameter	Electricity Required (kWh)	Year of Installation
1	Raw juice pumps	Level of juice in diffuser	55	2007
2	Defecated juice pumps	Consumption of defecated juice	160	2007
3	Juice pump (No. 1) to 3-A unit of evaporation station	Level in 3-A vapour Vessel	55	2007
4	Juice pump (No.1) to first unit of evaporation station	Level in first vapour vessel	55	2007
5	Juice pump (No.1) after 4-th unit of evaporation station	Level in 4^{th} vapour vessel	37	2007
6	Pump for recycling water	Water consumption for condenser	320	2007
7	Pulp Press number 1	Number of Rotations of Pulp Press	160	2007
8	Pulp Press number 2	Number of Rotations of Pulp Press	160	2007
9	Pulp Press number 3	Number of Rotations of Pulp Press	160	2007
10	Pulp press water pump	Level in pulp pump water tank	37	2007

(6) Replacement of dried pulp pelletizers (2007)

Pulp processing is a complex process that is necessary to turn the waste products from beet-sugar production into useful by products. Currently pulp pelletizers are utilized to transform the raw dried pulp into distinct pellets that are subsequently utilized for animal feed. The entire pulp processing process is outlined within the following Figure 9.

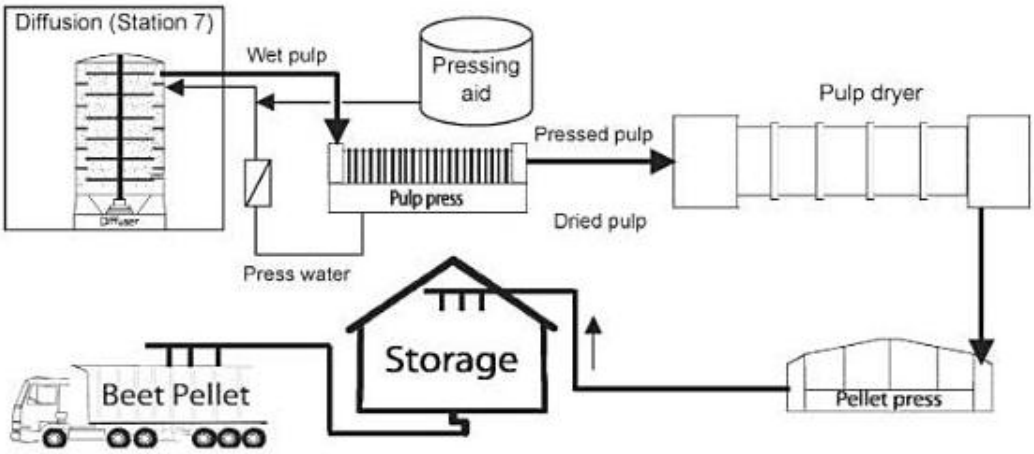


Figure 9: Pulp processing, including pelletizing process[18]

By replacing the pulp pelletizing devices, the Yareskivskiy plant improved the energy efficiency. The obsolete equipment consists of two granulators from Poland with a capacity of five tonnes of beet per hour (each). These units have been dismantled and replaced by two KAHL 45-1250 granulators manufactured by AMANDUS KAHL HAMBURG of Germany, with a capacity of ten tonnes of beet per hour (each). Reduced electricity consumption and increased processing ability are shown below in Table 4. Reduction of the overall specific electricity consumption reduces the consumption of natural gas at the CHP plant to produce electricity and will save approximately 4.8 kWh per tonne of granulated pulp[16].

Table 4: Energy Savings in the pellitizing department[19]

	Old Equipment	**New Equipment**
Electricity Consumption (kWh)	220	200
Processing Ability (tonnes)	6	10
Specific Electricity Consumption (kWh/tonne pellet)	36	20

(7) Replacement of calciner lining by chrome-magnesite (2007)

The calciners 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 calciners. After modernizing the calciner at the Yareskivskiy Plant, less coal fuel is required to create the above reaction, as the

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

[19] Information provided by Tsukrovyk

process of calcination becomes more effective. Consequently there is a savings of combustion emission; as less coal is combusted to produce CaO and CO_2.

By replacing the kiln brick, the kiln will be able to retain a higher overall temperature; increasing the retention of heat and improving the calcination process. As shown within Calciner, the brick replaced with this measure is located in the burning portion of the kiln. By retaining more heat, and creating a more efficient process, Yareskivskiy plant will reduce the required combustion of coal that is needed to produce lime milk. Savings from this measure are estimated at between 0.5-0.8 kg of coal per tonne of beet processed[16].

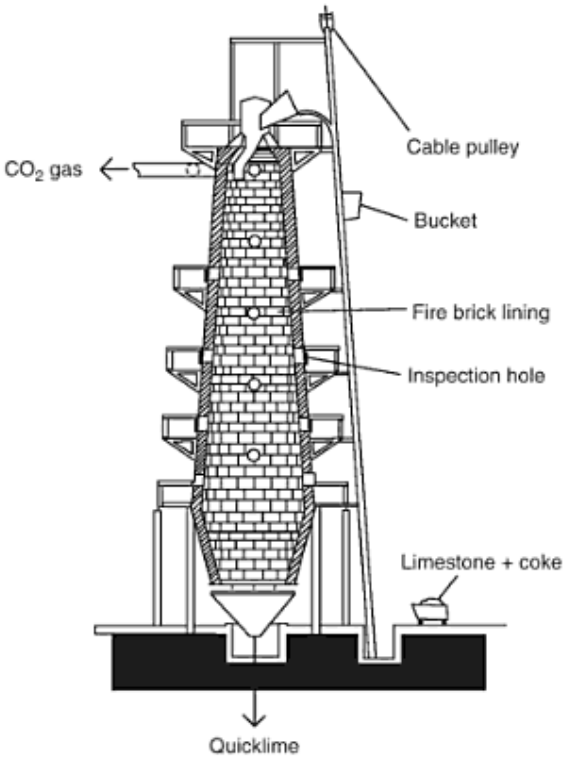


Figure 10: Calciner[20]

Although the combustion gasses resulting from the calcination process are collected and fed into the purification stage, not all consumed during purification as some emissions from calcination are released. These inevitable direct releases of gas from the calcination process will be reduced through the modernization of the lime kilns.

(8) Implementation of filter press (suspension filtration)(2008)

Filter presses are utilized to extract beet from filtration precipitation that have been removed from the sugar juice after the addition of limemilk. After primary chemical treatment, precipitation particles are removed in the form of suspension. These large waste particulates are formed through the addition of CaO and diffusion of CO_2 gasses obtained in the calcination process. Obtained suspension is necessary to remove from the juice and neutralize at the filter-presses.

Filters presses have been introduced to improve the sugar extraction, and increase energy efficiency over the previous process. The old filtration system consisted of three vacuum filters manufactured in the

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

Czech Republic, each with a filtration area of 40m^2. The new system is comprised of two filter presses manufactured by LAROX of Finland, each with a filtration area of 140m^2. Overall, the new filters have a filtration area 160m^2 greater than that of the previous filters, speeding up the filtration process.
Overall the filter presses operate more efficiently and allow extracting a greater quantity of sugar. These savings result in 3.07 m^3 of natural gas per tonne of beet processed[16].

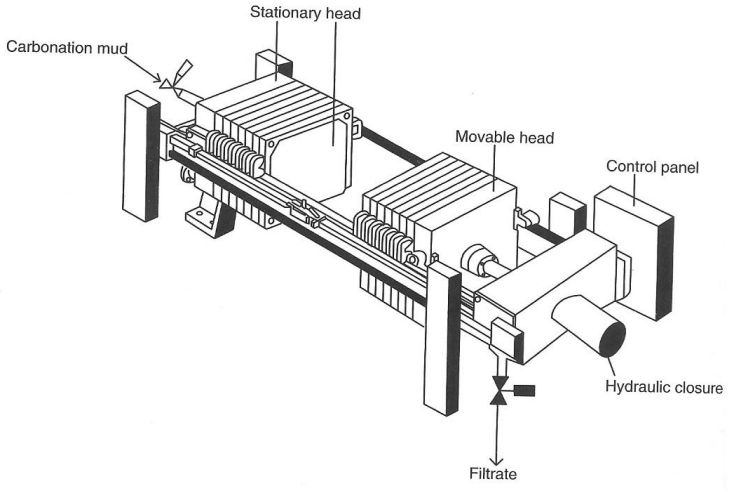


Figure 11: Typical Filter Press

(9) Installation of frequency converters (2008)

Further frequency converters were installed in 2008 to continue to improve the plants operating efficiency. Details of the frequency converters installed in 2008 are provided in the following table. Savings from these installations will result in approximately 1 kWh reduction per tonne of beet processed relating to 0.99 m^3 of natural gas savings per tonne of beet processed[16].

Table 5: Frequency Converters (2008)

number	Location of Frequency Converter Installation	Controlling Parameter	Electricity Required (kWh)	Year of Installation
1	Juice pump (No. 2) to the unit of evaporation station	Level in the unit of evaporation station	55	2008
2	Juice pump (No.2) to the 1-st unit of evaporation station	Level in first vapour vessel	55	2008
3	Syrup Pump after evaporation station	Level in 4th vapour vessel	37	2008
4	Juice pump for second carbonatation	Juice consumption	55	2008
5	Pump for suspension for press filters	Slurry Consumption	200	2008
6	Water pump for press filters	Water consumption	55	2008
7	Filtrate pump	Filtrate level	37	2008

(10) Installation of 2 beet slicers Maguin (2008)

Beet slicers have the simple function of cutting the whole beets into smaller parts called cossettes. The new beet slicers installed at the Yareskivskiy plant will result in significant savings over the previous slicers. These new Maguin CRT2000x600x60 slicers from France installed to replace the old T2M SC2B-16-4 units produced by Smelyanskiy centrifugal slicers that were in operation.

First of all, installation of Maguin slicers results in a shift to a drum slicing method to compare with previous method of centrifugal slicing. Drum slicing is noted to have an advantage of 20-30% higher efficiency over centrifugal slicing[21]. Figure 12 shows the new technology. This installation is expected to save 0.60 m^3 of gas per tonne of beet processed through the increase in operating efficiency[16].

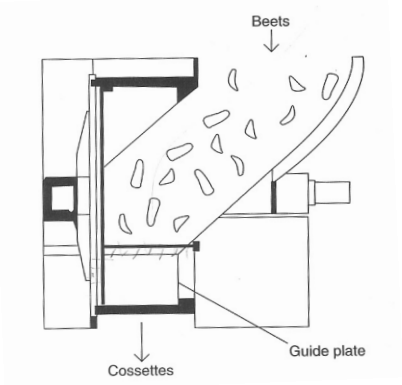


Figure12: Maguin Beet Slicer[22]

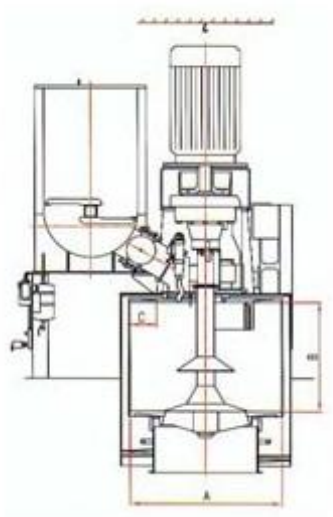
(11) Centrifuges SILVER WEIBUL SW-2250 (2 pieces) (2008)

Centrifuges 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 centrifuge; which operates with high rates as to obtain effect. The efficiency of these devices is important as they consume high quantities of energy to operate.

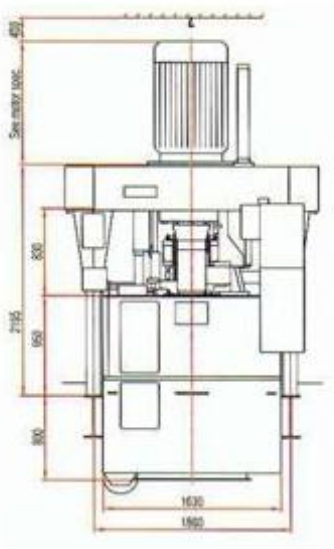
[21] Asadi, Mosen. *Beet-Sugar Handbook*. Wiley-Interscience; A John Wiley & Sons, Inc., Publication. 2006. pg. 148.

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

Figure 13: SILVER WEIBUL SW-2250[23]



Basket dimensions



Installation measurements

Model		Basket dimensions			D	E	F	Max. Speed rpm	Geometric Charge (kg)	Practical Charge (kg)	Bottom Cover Type
		A	B	C							
SW-2250/E	mm	1800	1200	263	875	2050	2300	960	2250	2475	P**
	inches	71	47 1/4	10 3/8							

Figure 14: New technology specifications[24]

[23] http://www.silver-weibull.se/stand.html

[24] http://www.silver-weibull.se/stand.html

Before the project, the plant operated three centrifuges, model FPN-1251L-2 manufactured by the Frunze plant of Sumy, Ukraine. The Silver Weibull SW-2250 has significant advantages over the previous system, as it operates with much lower energy requirements while still operating in the batch process. Specific details of the new device are provided above. The new unit is able to generate electricity during stoppage, a feature the old centrifuges did not have, and meaning that under the project less energy is needed at the centrifuging. The capacity of the old centrifuges was one tonne of syrup per batch whereas production is increased at the new centrifuges with a capacity of 2.5 tonnes with approximately the same fuel consumption; resulting in a reduction of the overall specific consumption. Installation of the new centrifugals at Yareskivskiy is planned to save 1.5 kWh/tonne beet processed resulting in a gas savings of 1.45 m^3 per tonne of beets[16].

(12) Modernization of the scheme for pulp granulating departments (2008)

Pulp granulation is the process of taking dried pulp and pressing it into uniform pellet form. Pulp pellets are then primarily used as animal feed. Pulp entering the granulation department is still quite hot from the drying process. One of the major energy uses in this process is the cooling of the dried pulp. As part of the project activity, a new German manufactured cooling system was implemented with an operating capacity of 10 tonnes per hour. This is double the production capacity of the old Ukrainian cooler which was able to process only 5 tonnes per hour.

Further to reducing energy requirements, the new German coolers operate with fewer shut downs. This is an important improvement over the previous system; as significant amounts of fuel use are required during the start up of the granulation department. The improvement in cooling devices, and reduction in shut down and start ups, will significantly reduce energy requirement by approximately 1.23 m^3 of natural gas per tonne of beet processed[16].

Table 6: Further measures to be installed at the Yareskivskiy sugar plant

Year	Yareskivskiy sugar plant	Details of new equipment planned to be Installed (Description, Manufacture Make and Model)
2009		
1	Reduction of diffusion juice consumption from 116 to 105% was implemented.	Measure of organizational nature which doesn't require any additional equipment. Implemented by Yareskivskiy sugar plant.
2	The measure on improving of massecuite uploading process for power consumption reduction at the steaming of pan was implemented	Existing vacuum devices are equipped by additional pipelines and closing (shutoff) armature. Implemented by Yareskivskiy sugar plant.
3	Excluding of water pumping to A-vacuum pan was implemented.	Automation system of vacuum devices of the first product is equipped with more advanced algorithm of massecuite boiling with additional circuits for regulating temperature of massecuite boiling. Implemented by "Viol-2", Kyiv, Ukraine
4	The use of exhausted steam for heating of residential and industrial building was stopped	Heating of production facilities and amenity rooms is switched to use of condensate. Implemented by Yareskivskiy sugar plant.
5	Heating of syrup and molasses tanks using juice steam of the first vessel was implemented	Pipelines of exhaust steam directed to product workshop will be re-directed to juice's steam at the first body of evaporation plant. Implemented by Yareskivskiy sugar plant.

6	The heat insulation of equipment and pipelines was improved.	Thermal insulation of pipelines and equipment will be implemented with use of modern thermal insulation materials which do not contain asbestos. Implemented by Yareskivskiy sugar plant.
Estimated Gas Savings (2009)		*4.7 (m^3 gas/t beet)*
2010		
1	Rehabilitation of heating system, station of filtration of juice of the 1st saturation, reduction of the amount of defecation juice	Five-body evaporation plant will replace four-body plant along with use of existing evaporation devices made by Smeliansky machine-building plant, Ukraine; sedimentation tanks of the first saturation are replaced by modern filters-thickeners; instead o
Estimated Gas Savings (2010)		*3.2 (m^3 gas/t beet)*
2011		
1	Replacement of dryer of white sugar	Existing sugar dryer made by the firm "Tsecop", Poland, has a capacity of 500 tonnes of sugar per 24 hours. It is intended to replace existing dryer with modern one which has improved thermal technical characteristics and dust catching system.
Estimated Gas Savings (2011)		*1.5 (m^3 gas/t beet)*
2012		
1	Rehabilitation of crystallizing of department of final product	Modernization of vacuum devices of the second and third products through installation of circulators and automated mechanisms. Installation of vertical crystallizers. Replacement of centrifuges FPI 1321K-01 made at the Frunze plant, Sumy, Ukraine by more modern BMA K-2300, 2 units
Estimated Gas Savings (2012)		*2.5 (m^3 gas/t beet)*

**estimates of gas savings preformed by Tsukrovyk Staff*

Veselopodilskiy Sugar Plant Technologies

(1) Purchase and implementation of vertical crystallizer (including frequency converter) (2007)

The crystallization process is utilized to form sugar crystals from the massecuite syrup. These sugar crystals are then removed from suspension with the use of the centrifuge. A new vertical crystallizer with 150 m^3 capacity has been installed to replace the old horizontal massecuite crystallisers YM-53/1; which had 8 stages. The new vertical unit was manufactured but Yagotynsky machine shop in 2006. The switch from horizontal process to a vertical process increases the crystalline formation and result in higher sugar yields. By increasing the sugar yield the specific consumption of natural gas will decrease compared to the old horizontal crystalliser operation; as more sugar is able to be extracted from the massecuite.

Implementation of a frequency converter will further reduce specific consumption of energy. Overall savings from this measure are expected to save 0.22 m3 /tonne beet processed[25].

[25] Information provided by Tsukrovyk. Please refer to supporting documentation No.1

(2) Mantling of four deep pulp presses with flow-back of pulp press water for diffusion device feeding (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 pulp press water and pulp. The water and pulp mixture is pressed and the press pulp is returned to the diffusion process. The press pulp is removed for drying after which it is sold as animal feed. The old presses used at Veselopodilskiy facilities were model number PSZhN-68-800 units manufactured by Bolohovskiy machinery plant. With the old presses Veselopodilskiy obtained pressed pulps with 8% dry substance. 4 new deep pulp presses have been installed with the model number P-18, manufactured by the firm Babbini of Italy. With the new horizontal deep pulp presses Veselopodilskiy is able to receive up to 30% dry substance in the pulp.

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. Reducing the need for clean water addition results in less need electricity to power water pumps, as well as increases the recovery of sugar from the beet. In addition, decreased water addition also results in less of a need for the evaporation procedure; a highly energy intensive process. As a result of these improved processes, natural gas savings from installation of three new deep presses are 4.20 m^3 gas/tonne beet[25].

(3) Improvement and automation of diffuser, vacuum station and defecation and saturation (2007)

Automation of these systems leads to energy savings by eliminating excess use of water and lime milk. By controlling the ratio of water to cossettes the accurate amount of water is provided which in turn determines maximum solubility of sugar into solution without the addition of excess water which would need to be evaporated later. As a result, an decrease in beet processing time means less natural gas used per tonne of production and less natural gas is used later on to evaporate off the water.

The new automation also creates a constant, rhythmic production of juice so equipment throughout the production process can operate at a constant, full, capacity. Without automation, non-rhythmic production occurred resulting in equipment running at less than optimal capacity. Automation of the diffuser ensures that the addition of lime milk is uniform; thereby eliminating excess production of limestone and coal that was used during non-uniform juice volumes. Overall, automation of the diffuser and purification system reduces natural gas consumption by 0.34 m^3 gas/tonne of beets[25].

(4) Major repairs of the diffuser (including frequency converter) (2007)

Further to the diffuser *automation*, as described above, energy savings will also be realized in the diffusion process through the *mechanical* modernization of the diffuser unit. Overall there have been a number of mechanical changes to the diffusion device to increase its operating efficiency, including;

h. Increased plant capacity has been increased to 3300 tonnes of sugar beet per day
i. Replacement of transportation system
j. Anticorrosive covering
k. Installation of frequency converter – Lenze 55 kW

l. Installation of new motors

These retrofits lead to the ability to increase the speed of loading and efficiency of operation, therefore increasing the production rate. Modernization of the diffuser also included installation of a heater for the circulating juice and the change in diameter of the screw of the pulp from 900 mm to 1000 mm. Increased strength and operation of the transporting system within the diffuser has also been applied along with above mentioned automation system.

The majority of energy savings due to the mechanical modernization of the diffuser comes from an increase in production using the same volume of natural gas, thus reducing the specific gas consumption per tonne of beet processed. The newly installed motors increase the speed at which the diffuser can process beets, with the new motors processing 3300 tonnes of beet per day over the old system. Overall these combined mechanical changes will add an additional 0.20 m^3 of natural gas savings per tonne of beet processed above that of the automation improvements[25].

(5) Insulation of the heat-exchange equipment (2007)

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 beet processing process from the onsite CHP plant. Currently the retention and conservation of heat is not well regarded at the Tsukrovyk plants.

This project aspect focuses on retaining heat and conserving the energy embodied in the various processes of beet processing. 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 at the Veselopodilskiy plant:

- 200 m^2 of polyurethane insulation was installed

The following figures illustrate the importance of insulation of pipes and detail the heat loss for various pipe diameters and pressures. By using proper insulation on piping above 50^oC Tsukrovyk can save up to 90% of energy losses as well as ensuring proper steam pressure at plant equipment[26]. Fitting of insulation at the Veselopodilskiy site will result in approximately 0.30 m^3 of gas per tonne of beet processed[25]. Please refer to Figure 3 and Figure 4 above for further details of the potential savings from pipe insulation.

(6) Modernization of the automation system for lime kilns number 1 and number 2 (2008)

Lime kilns operate through the addition of coal and limestone into the kiln. Once added to the kiln, coal acts as the primary fuel source to drive the chemical reaction of calcination. Figure 15 illustrates this process.

[26] MWH Energy Audit, pg 45

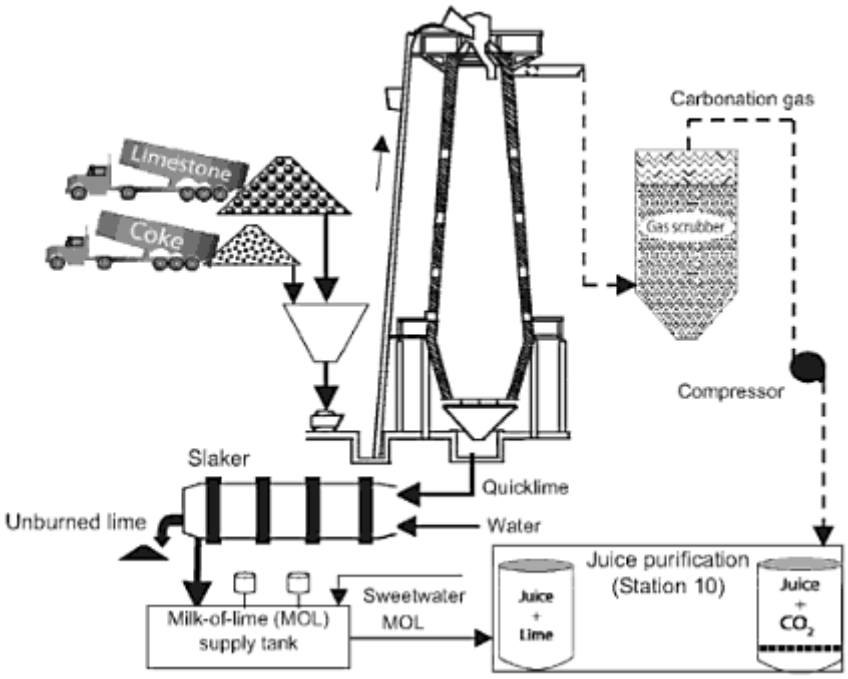


Figure 15: Flow Diagram of Limemilk and carbonation-gas Production[27]

Modernization of the automation system involves the installation of equipment, installation of strain gauges on scales as well as computerization of the management system. These changes result in increased accuracy of dosage which lead to coal and lime savings by reducing of addition of lime and coal excess. Saving realized from this improvement will total approximately 0.2 kg of coal savings per tonne of beet processed[25].

(7) Installation of frequency converters (2008)

Frequency converters have been installed to help control the turning number, productivity and operation of pumps and fans within the sugar plant. The quantity of electricity used for pumps operation has been reduced due to installing of frequency converters. 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. Veselopodilskiy plant installed "Danfoss"18kW (3 piece) frequency converter as well as "Danfoss" 4kW - 1 piece, converter. The installation of frequency converters is expected to save 0.16 m^3 of gas per tonne of beet processed[25].

(8) Replacement of the second carbonated juice decanter (2008)

Second carbonation is the process by which further gas (CO_2) is added to the juice during the second stage of the purification process. The secondary addition of CO_2 facilitates the additional adsorption of un-sugars on the precipitation of $CaCO_3$ and removal of calcic saline. The new carbonation tank, with a capacity of 4 000 tonnes, will increase filter juice abilities, therefore increasing purity of the juice by removing a higher degree of un-sugars and calcic saline. All this will also greatly reduce the production of treacle during crystallization.

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

Higher juice purity results in a greater sugar yield which subsequently reduces the specific gas consumption of the plant. This installation will also increase the production capacity by 1000 tonnes over the old equipment and will lead to an overall savings of 0.20 m^3 of natural gas per tonne of beet processed[25].

Further measures to be installed at the Veselopodilskiy sugar plant

There are no planned measures for the Veselopodilskiy plant past 2008. This plant will be closed for the 2009 campaign as well as the foreseeable future (after the 2008 season). Measures installed within 2007 and 2008 did result in emission savings for this plant during the 2008 operation. These savings have been quantified, and included, as described. However, no further investment is planned for this facility. Beet volumes going to the Veselopodilskiy plant will be moved to other facilities for processing.

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:

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 will conduct series of energy efficiency measures aims at 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. Consequently, the emissions of carbon dioxide will be reduced.

By adopting the project technologies, Tsukrovyk 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[28].

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 Tsukrovyk'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 Tsukrovyk'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 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[29]. 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 at the three 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 Tsukrovyk's domestic competitors are using equipment and technology very similar to Tsukrovyk's pre-project situation. Therefore, by investing in significant technical upgrades Tsukrovyk sufficiently reduces the risk of technical failure and production disruption. This risk is decreased because Tsukrovyk has chosen to purchase higher efficiency used equipment.

Implementation of modernization measures at Globinsky, Yareskivskiy and Veselopodilskiy plants, including instalment of more advanced equipment and organizational measures necessitate training of plants' managers, technical specialists and workers. In 2007-2008, training programs in occupational

[28] 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).

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

health and safety were delivered to engineering personnel and workers at each of the three plants: at Globinsky plant - by Kremenchug educational organization, 60 people were trained; at Yareskivskiy – by Poltava educational centre, 125 people were trained; and at Vesepodilsky plant – also by Poltava educational centre, 65 people were trained. In 2009 training of plants' personnel in this area continues. 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.

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

Table 7: Emission Reductions – Kyoto Crediting Period

	Years
Length of the crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	36,321
2009	37,432
2010	45,982
2011	50,334
2012	52,177
Total estimated amount of emission reductions over the crediting period (tonnes of CO_2-equivalent)	222,246
Annual average emission reductions over the crediting period,(tonnes of CO_2-equivalent)	44,449

Table 8: Emission Reductions – Post -Kyoto Crediting Period

	Years
Length of the crediting period:	5
Year	Estimate of annual of emission reductions (tonnes of CO_2-equivalent)
2013	52,177
2014	52,177
2015	52,177
2016	52,177
2017	52,177
Total estimated amount of emission reductions over the crediting period (tonnes of CO_2-equivalent)	260,885
Annual average emission reductions over the crediting period,(tonnes of CO_2-equivalent)	52,177

A.5. Project approval by the Parties involved:

A Project Idea Note and Letter of Endorsement (LOE) application for Tsukrovyk 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 №173/23/7)[30].
The LoE was issued for OJSC "Agricultural Produce Organization "Tsukrovyk Poltavshchyny"". On 19.10.2011 OJSC "Agricultural Produce Organization "Tsukrovyk Poltavshchyny"" was renamed to LLC "Agricultural Produce Organization "Tsukrovyk Poltavshchyny"" in accordance with Poltava District Court Order (Act № 2a-1670/7753/11).

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 in order to receive Investor Country Letters of Approval.

SECTION B. Baseline

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

Baseline selection has been determined and justified by following the Appendix B of JI Guideline[31] and the "Guidance on Criteria for Baseline Setting and Monitoring (version 03)"[32] developed by the JISC. From these guidance documents the JI-specific approach with the availability to select and apply elements or combinations of approved CDM methodologies, as appropriate and an approach taken in comparable JI cases were selected for baseline setting. The paragraph 11 of the JI Guidance[30] further explains that project that select a JI-specific approach may use selected elements or combinations of approved CDM baseline and monitoring methodologies or approved CDM methodological tool.
In accordance with Paragraph 9(a) of the "Guidance on criteria for baseline setting and monitoring (version 03)" it is used JI-specific approach regarding baseline setting and monitoring. The baseline alternatives are as follow:

a. The proposed project activity without being registered as a JI project

   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.

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

[31] JI Guideline refers to the group of JI regulation available at: http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=2

[32] Guidance on criteria for baseline setting and monitoring. Version 03. Available at UNFCCC JI website: http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

b. The equipment upgrades completed with new equipment

The proposed project activity involves a number of energy efficiency measures being implemented at each of the Globinsky, Yareskivskiy and Veselopodilskiy 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.

c. Continuation of current equipment and practice

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.

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 'a' because the high cost and availability of new equipment would prevent this alternative from moving forward before the project case.

In accordance with Paragraph 25 of the "Guidance on criteria for baseline setting and monitoring (version 03)" the baseline shall be established taking into account relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector, etc.

The following key factors that affect a baseline shall be taken into account:

a) Sectoral reform policies and legislation

Sugar sector is regulated by a number of Laws of Ukraine, a few regulations of the Cabinet of Ministers, scientific-technical sectoral programs in field of sugar production sector etc. All the governmental regulations are given at the internet site of National Association of Sugar Producers of Ukraine - http://sugarua.com/ua/legislative_base.

b) Economic situation/growth and socio-demographic factors in the relevant sector as well as resulting predicted demand. Suppressed and/or increasing demand that will be met by the project can be considered in the baseline as appropriate (e.g. by assuming that the same level of service as in the project scenario would be offered in the baseline scenario)

It is assumed that the level of sugar production and demand is influenced by the project. Being a leader of sugar market the company produces 16% of all sugar amounts in Ukraine. High quality sugar, large amount of sugar at the plants' storages and good logistics make the company a leader of sugar market in Ukraine. Taking into account the fact that it is difficult to find such sugar production company in Ukraine, the absence of the project would influence sugar market.

c) Availability of capital (including investment barriers)

In spite the capital is available, a high country investment risks make new equipment introduction in Ukraine unprofitable. More information on the barriers is given in section B.2, Barrier Analysis.

d) Local availability of technologies/techniques, skills and know-how and availability of best available technologies/techniques in the future

In Ukraine a European and Ukrainian technologies are available. Main European manufacturers are BMA (Germany), Babbini (Italy), Maguin (France), Silverweibul (Sweden), etc. Technical specialists and consultants from Ukrainian and European engineering companies could give the consults in field of sugar production technologies. The most reputable Ukrainian companies are "Teplokom", "Sate" and TMA. It is also possible to invite European consultants from Italy, France, Germany, etc.

e) Fuel prices and availability

In accordance with Tsukrovyk data the natural gas prices in 2004-2006 were the following:
2004 - 412.18 UAH/ths. m^3
2005 - 478.34 UAH/ths. m^3
2006 - 675.00 UAH/ths. m^3.

In accordance with Tsukrovyk data the coal prices in 2004-2006 were the following:
2004 – 364.96 UAH/t
2005 – 374.87 UAH/t
2006 - 393.20 UAH/t.

Natural gas and coal are quite available in Ukraine. Natural gas is mostly imported from the Russian Federation. Therefore, prices for fuels produced in Ukraine are expected to be lower than world price.

f) National and/or subnational expansion plans for the energy sector, as appropriate

«Energy strategy of Ukraine by 2030» № 145-r dated March 15-th 2006 was approved by the Cabinet of Ministers. Its main state program shows the most effective ways of energy complex development. The Strategy proposes energy saving technologies implementation, increasing of own oil, gas, coal and natural gas extraction as well as use of renewable sources of energy.

Energy saving in Ukraine is regulated by the Law of Ukraine "On energy saving" dated 01.07.1994 № 74/94 BP. This Law describes the main principles of energy saving such as:

- combination of methods of economic stimulation and financial responsibility with the purpose of fuel and energetic resources rationale use;
- popularization of economic, ecological and social advantages of energy saving;
- increasing of knowledge level in this field.

g) National and/or subnational forestry or agricultural policies, as appropriate.

In 2004 the Law of Ukraine "On state support of agriculture in Ukraine" was adopted. The sugar was included into the list of state price regulation objects.

In accordance with "Guidance on criteria for baseline setting and monitoring (version 03)" the baseline is established in a transparent manner with regard to the choice of approaches, assumptions, methodologies, parameters, data sources and key factors. Uncertainties are taken into account and mentioned in Section D.2, i.e. QA/QC Procedures for the plants.

Various measures have been conducted to lead to the baseline with the less uncertainties and the conservative assumption. For instance, the forecast of sugar production is based on the average sugar/beet rations during 2004-2006. Another example is the estimated project investment cost was very conservative. As presented in Table 12, the realised project investment cost is much higher than the estimation when the investment decision was made in 2006.

More elaboration of the exclusion of baseline alternative (a) and (b) is given in Section B.2. As a conclusion of baseline determination, the baseline scenario of the project is the baseline alternative (c), i.e. continuation of current equipment and practice.

Project boundaries

The project boundary is the physical, geographical site of the project facilities, production process, and the equipment that are affected by the project activity. The project boundary should include greenhouse gases sources which are under control of project owner and deal with the proposed project activities.

The project boundary has been applied to the geographic location of Yareskivskiy, Globinskiy and Veselopodilskiy Plants with all equipments. The detailed description of project boundaries is given in the Section B.3.

Baseline scenario

The baseline scenario is the continuation of current equipment and practice. 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 the combustion of natural gas and coal and the decomposition of limestone within the calcination process to provide sugar production.

The JI-specific approach uses historical data on fossil fuels, i.e. natural gas and coal, 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, Tsukrovyk'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.

Table 9: 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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Sugar plants reports

Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004: 283,785 2005: 256,890 2006: 342,992 Globinskiy sugar plant 2004: - 2005: - 2006: 144,201 Veselopilskiy sugar plant 2004: 123,910 2005: 158,236 2006: 200, 471
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project
QA/QC procedures (to be) applied	Yareskivskiy Plant: The sugar beets are weighed using tenso-metric automated scales (4 units) with carrier power of 60 t. State calibration of automated scales is done once per year. Level of Uncertainty: Low Globinskiy Plant: The sugar beets are weighed using automated scales: AC-30t number 7654, AC-60 t number 2878, AC-60t number 6968, AC-30t number 7659, AC-60t number 7907, AC-60t number 4847, and AC-60 t number 4249. Level of Uncertainty: Low Veselopodilskiy Plant: The sugar beets from the field are weighed with the use of automated weight measuring device (AVK) which includes tenso-metric truck scales (4 units) with carrying capacity of 60 t. Level of Uncertainty: 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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Sugar plants reports

Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant: 2004 34,537 2005 35,993 2006 47,610 Globinskiy sugar plant 2004 - 2005 - 2006 17,885 Veselopodilskiy sugar plant 2004 14,082 2005 20,825 2006 24,827
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project
QA/QC procedures (to be) applied	Yareskivskiy sugar plant: Produced sugar is scaled by bags accounting system SUM-232. The calibration is undertaken by plant specialists once a year. Sugar is put into the bags with help of weigh hopper DVS-301. Calibration is undertaken by plant specialists once a year. State check is undertaken by State Enterprise "Poltavastandartmetrologiya". Uncertainty level: Low Globinskiy sugar plant: Produced sugar is scaled by bags accounting system SUM-232. Calibration is undertaken by plant specialists once a year. Check is undertaken by Kremenchuk branch of SE "Poltava Regional Center of Standardization, Metrology and Certification" once a year. Sugar is put into the bags with help of weigh hopper – SVEDA LTD. Calibration is undertaken by plant specialists once a year. Check is undertaken by Kremenchuk branch of SE "Poltava Regional Center of Standardization, Metrology and Certification" once a year. Uncertainty level: Low Veselopodilskiy sugar plant: Sugar is put into the bags with help of weigh hopper DVS-301. Calibration is undertaken by plant specialists once a year. State check is undertaken by Kremenchuk branch of SE «Poltava Regional Scientific-Technical Center of Standardization, Metrology and Certification». Uncertainty level: Low
Any comment	

Data/Parameter	$SPB_{hist,y,i}$
Data unit	%

<table>
<tr><td>Description</td><td>Sugar content in sugar beets in accordance with baseline in 2004-2006 at plant i</td></tr>
<tr><td>Time of determination/monitoring</td><td>Determined only once and available already at the stage of determination regarding the PDD</td></tr>
<tr><td>Source of data (to be) used</td><td>Sugar plants reports</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>Yareskivskiy sugar plant
<table><tr><td>2004</td><td>15.34</td></tr><tr><td>2005</td><td>17.35</td></tr><tr><td>2006</td><td>16.39</td></tr></table>
Globinskiy sugar plant
<table><tr><td>2004</td><td>-</td></tr><tr><td>2005</td><td>-</td></tr><tr><td>2006</td><td>15.71</td></tr></table>
Veselopodilskiy sugar plant:
<table><tr><td>2004</td><td>14.81</td></tr><tr><td>2005</td><td>16.89</td></tr><tr><td>2006</td><td>15.69</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>Yareskivskiy sugar plant:
Sugar content in sugar beets is measured by semi-automatic line ULS-1. The calibration is undertaken by SE “Poltavastandartmetrologiya” once a year. The calibration is undertaken by SATER once a year. Sugar content is measured by cold digestion method.
Uncertainty level: Low

Globinskiy sugar plant:
Sugar content in sugar beets is measured by semi-automatic line ULS-1. The calibrations and checks are undertaken by SE “Poltavastandartmetrologiya” once a year. Sugar content is measured by cold digestion method.
Uncertainty level: Low

Veselopodilskiy sugar plant:
Sugar content in sugar beets is measured by semi-automatic line ULS-1. The calibrations and checks are undertaken once a year by SE «Poltava Regional State –Technical Center of Standardization, Metrology and Certification».
Uncertainty level: Low</td></tr>
<tr><td>Any comment</td><td></td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>$FC_{coal,hist,y,i}$</td></tr>
<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>Determined only once and available already at the stage of determination regarding the PDD</td></tr>
<tr><td>Source of data (to be) used</td><td>Sugar plants reports</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>Yareskivskiy sugar plant:
<table><tr><td>2004</td><td>1,671</td></tr><tr><td>2005</td><td>1,759</td></tr><tr><td>2006</td><td>1,976</td></tr></table>
Globinskiy sugar plant:
<table><tr><td>2004</td><td>-</td></tr><tr><td>2005</td><td>-</td></tr><tr><td>2006</td><td>877.4</td></tr></table>
Veselopodiskiy sugar plant:
<table><tr><td>2004</td><td>858</td></tr><tr><td>2005</td><td>1,133</td></tr><tr><td>2006</td><td>1,237</td></tr></table></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>Yareskivskiy Plant:
The mechanical scale used to weigh coal is: RS-150C13V inventory number 7331. The scale has a carrying capacity of 150 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: Low

Globinsky Plant:
Coal is weighed using mechanical carriage scales: 5044ES150 DS24V, plant number 866/1118. The scale has a carrying capacity of 150 t.
State calibration is performed once every 6 months. Test calibration is performed once every two months. The results of state calibrations, reviews and checks are put into the technical passport of the scale. The recent calibrations were conducted on 01.06.2010, 01.12.2009, 19.09.2010. The recent test calibrations were implemented on 01.06.2010, 03.08.2010 and 29.09.2010. The calibrations are done by Scales Calibration Road Inspection RPZF.
Level of Uncertainty: Medium</td></tr>
</table>

	Veselopodilskiy Plant: Railroad cars and trucks with coal are weighed at this plant Weighting of railroad cars with coal is done with the use of mechanical track scales (model VO-2002) inventory number 05302000743 with carrying capacity of 150 tonnes. These scales belong to the railway station. Veselopodilskiy of Southern railway. State calibration is conducted once every six months; test calibration is conducted once every two months. Tests are conducted with the use of exemplary weights of the fourth grade with a total mass of 80 tonnes. Results of state and test calibrations are recorded in the scale's technical passport. Calibrations are conducted by Kremenchuk branch of State Enterprise "Poltavastandartmetrologiya". The most recent calibration was conducted in August of 2008. Level of Uncertainty: Low
Any comment	

Data/Parameter	$FC_{NG,hist,y,i}$
Data unit	ths. m^3
Description	Natural gas consumption for historical period (2004-2006) at plant i
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Sugar plants reports
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004: 14,125 2005: 13,862 2006: 16,831 Globinskiy sugar plant 2004: - 2005: - 2006: 8,099.5 Veselopodilskiy sugar plant 2004: 3,550 2005: 8,688 2006: 10,635
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project calculation
QA/QC procedures (to be) applied	Yareskivskiy Plant: Natural gas consumption of the plant and the beet dryer are recorded. The accounting of natural gas consumed for production

	process is done by an automated measuring-management meter named "LIDER" (inventory number 1-873). 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). Globinsky Plant: The accounting of natural gas consumed for the production process is done by an automated system at base of MK named "LIDER VG-1", serial number 1-187. The main functions of the metering device are: measuring data on a momentary, hourly, daily and monthly gas consumption, off-nominal and emergency cases, printout of reports (by request of user). Monthly records and billing for gas consumption are taken from this metering device, and is certified by the gas supplier. State calibration of the meter is performed not less than once in 2 years (certificates number 16-04/2418 11.06.08, number 16-04/2395 24.06.08, number 16-04/2396 from 24.06.08, number 16-04/2397 from 24.06.08). The most recent calibration was conducted on 03.08.2010. Calibration is conducted periodically before the beginning, and during the gas consumption season (September-March). The calibrations are done by the representatives of gas supplier (JSC "Poltavagas"). Veselopodilskiy Plant: Accounting of natural gas used for the production process is done by the measuring-management meter "FLOUTEC-TM-VR-1" inventory number 05302000679. Main functions of the device are: measuring of data on a momentary, hourly, daily and monthly gas consumption basis, contingency and emergency situations, printout of reports (upon request of user), exchange of information with PC by radio channel using a mobile connection. State calibration is conducted not less than once every two years. Test calibration is conducted periodically before and during gas consumption season (September -March). Calibrations are conducted by representatives of gas supplier (JSC "Kremenchukgas"). The most recent calibration was conducted in August of 2008.
Any comment	

Data/Parameter	$LC_{hist,y,i}$
Data unit	t

<table>
<tr><td>Description</td><td>Limestone consumption at the historical period (2004 -2006) at plant i</td></tr>
<tr><td>Time of determination/monitoring</td><td>Determined only once and available already at the stage of determination regarding the PDD</td></tr>
<tr><td>Source of data (to be) used</td><td>Sugar plants reports</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>Yareskivskiy sugar plant:
<table><tr><td>2004</td><td>20,859</td></tr><tr><td>2005</td><td>18,708</td></tr><tr><td>2006</td><td>23,017</td></tr></table>
Globinskiy sugar plant:
<table><tr><td>2004</td><td>-</td></tr><tr><td>2005</td><td>-</td></tr><tr><td>2006</td><td>11,009</td></tr></table>
Veselopodilskiy sugar plant:
<table><tr><td>2004</td><td>9,024</td></tr><tr><td>2005</td><td>12,947</td></tr><tr><td>2006</td><td>15,043</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>Yareskivskiy Plant:
The mechanical scale used to weigh limestone is: RS-150C13V inventory number 7331. The scale has a carrying capacity of 150 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: Low

Globinsky Plant:
The mechanical scale used to weigh limestone is: 5044ES150 DS24V, plant number 866/1118. 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. The recent calibrations were conducted on 01.12.2009, 01.06.2010, 19.09.2010. The recent test calibrations were implemented on 01.06.2010, 03.08.2010 and 29.09.2010. The calibrations are done by Scales Calibration Road Inspection RPZF.
Level of Uncertainty: Low

Veselopodilskiy Plant:
Limestone is weighed using mechanical track scales (model VO-2002) with a carrying capacity of 150 tonnes. Inventory number of the scales is 05302000743. The scales belong to the railway station Veselopodilskiy of Southern Railway.</td></tr>
</table>

	State calibration is performed once every six months; test calibration is conducted once every two months. Tests are conducted with the use of exemplary weights of the fourth grade with a total mass of 80 tonnes. Results of state and test calibrations are recorded in the scale's technical passport. Calibrations are conducted by Kremenchuk branch of State Enterprise "Poltavastandartmetrologiya". The most recent calibration was conducted in August of 2008.
Any comment	

Data/Parameter	EF_{NG}
Data unit	t CO_2 /TJ
Description	Carbon emissions factor for natural gas
Time of determination/monitoring	Monitored annually throughout the crediting period
Source of data (to be) used	Section P2.5.1.3, Table P2.8 (p.437), National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2010[33]
Value of data applied (for ex ante calculations/determinations)	2004: 55.66 2005: 55.70 2006: 55.81 2008: 55.62 2009: 55.73 2010: 55.62
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	In accordance with National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2010, the carbon content in natural gas is 15.18 t C/TJ which equals to 55.66 tCO_2/TJ (15.18* 44/12) – for 2004; 15.19 t C/TJ which equals to 55.70 tCO_2/TJ (15.19* 44/12) – for 2005; 15.22 t C/TJ which equals to 55.81 tCO_2/TJ (15.22* 44/12) – for 2006; 15.17 t C/TJ which equals to 55.62 tCO_2/TJ (15.17* 44/12) – for 2008 and 2010; 15.20 t C/TJ which equals to 55.73 tCO_2/TJ (15.2* 44/12) – for 2009.

[33] The document can be downloaded from: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Natural gas supplier
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004 8,321 2005 8,280 2006 8,513 Globinskiy sugar plant 2004 7,204 2005 7,100 2006 6,910 Veselopodilskiy sugar plant 2004 8,334 2005 8,373 2006 8,312
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	Monitored annually throughout the crediting period
Source of data (to be) used	Section P2.5.3, Table P2.15 (P.444), National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2010[34]

[34] The document available at:
http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

Value of data applied (for ex ante calculations/determinations)	2004: 101.2 2005: 100.1 2006: 99.73 2008-2010: 92.77
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	In accordance with National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2010, the carbon content in coal is: 27.6 t C/TJ which equals to 101.2 t CO_2/TJ (27.6* 44/12) in 2004; 27.3 t C/TJ which equals to 100.1 t CO_2/TJ (27.3* 44/12) in 2005; 27.2 t C/TJ which equals to 99.73 t CO_2/TJ (27.2* 44/12) in 2006; 25.3 t C/TJ which equals to 92.77 t CO_2/TJ (25.3* 44/12) in 2008-2010;

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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Coal supplier
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004: 7,204 2005: 7,100 2006: 6,910 Globinskiy sugar plant 2004: - 2005: - 2006: 7,230 Veselopodilskiy sugar plant 2004: 7,010 2005: 7,010 2006: 9,610
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	EF_{CaCO3}
Data unit	t CO_2/t $CaCO_3$
Description	The carbon emission factor for $CaCO_3$
Time of determination/monitoring	Monitored annually throughout the crediting period
Source of data (to be) used	Section 4.8.2 (P.116), National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2009[35]
Value of data applied (for ex ante calculations/determinations)	Stoichiometric emission factor; 0.44 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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Limestone Supplier
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004 0.9730 2005 0.9721 2006 0.9690 Globinskiy sugar plant 2004 - 2005 - 2006 0.972 Veselopodilskiy sugar plant

[35] The document available at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php

	2004 0.9730 2005 0.9721 2006 0.9725
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	Monitored annually throughout the crediting period
Source of data (to be) used	Section 4.8.2 (P.116), National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2009
Value of data applied (for ex ante calculations/determinations)	Stoichiometric emissions factor: 0.522 t CO_2/t$MgCO_3$
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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Limestone Supplier
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004 0.0125 2005 0.0121 2006 0.0111 Globinskiy sugar plant 2004 - 2005 - 2006 0.0125 Veselopodilskiy sugar plant

	2004	0.0125
	2005	0.0121
	2006	0.0110
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		

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:

Indication of the approach applied to demonstrate the additionality of the 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 and an approach taken in comparable JI cases were selected for baseline setting, 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 version 03", 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 three Tsukrovyk 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 calciner 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 result in more optimized performance and lower the need to combust natural gas and consume energy.

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

Step 1: Identification of alternatives to the project activity consistent with current law and regulations

Sub-step 1a: Define alternatives to the project activity

For analysis of other investment opportunities to the project, alternatives are discussed here as part of the Additionality proof. Logical alternatives to the project, as same as described in Section B.1, are:

a. The proposed project activity without being registered as a JI project

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. The equipment upgrades completed with new equipment

The proposed project activity involves a number of energy efficiency measures being implemented at eacho of the Globinsky, Yareskivskiy and Veselopodilskiy 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.

c. Continuation of current equipment and practice

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.

Sub-step 1b: Consistency with mandatory law and regulation

All the three alternatives are consistent with mandatory law and regulation. The proposed JI project activity is the voluntary investment activity.

However, 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. The scenario "New Equipment" has been eliminated because it is less attractive than the project without being registered as a JI project.

Step 2: Investment analysis

The investment analysis will determine whether the proposed project activity is not the most economically or financially attractive, or economically or financially feasible without the revenue form Emission Reduction Sales.

Sub-step 2a: Determine appropriate analysis method

Among the simple cost analysis, investment comparison analysis and benchmark analysis, the benchmark analysis is determined to be the appropriate analysis method. The simple cost analysis is applicable for the project that generates no financial or economic benefits other than carbon related income. The project activity will have the indirect income by the saving of the use of nature gas. Thus, the benchmark analysis is applied in the investment analysis.

Sub-step 2b: Option III. Apply benchmark analysis

According to the "Guidelines on the Assessment of Investment Analysis (version 05)", the appropriate benchmark for a project IRR shall be the local commercial lending rates or weighted average cost of capital (WACC). WACC is selected to be the benchmark in the project activity. WACC can be calculated as follows:

WACC = Share of Equity * Cost of Equity + Share of Debt * Cost of Debt

The structure of financing refers to the default structure given by paragraph 18 of Guideline, which is 50% debt and 50% equity. The cost of equity consists of the risk-free investment return rate and risk factor adjustment. The 2006 Ukrainian bond rate is considered to be appropriate as the risk-free investment return rate. According to the National bank of Ukraine, the OVDP yields fluctuated in the narrow range between 9.0% and 9.4%, average being 9.2%. 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[36], the risk factor can be estimated as 8%. Thus, the cost of equity is 17.2%. The cost of debt is deemed to be 13.9%, the lending interest rate of Ukraine in 2007[37]. Thus, WACC which is proper for the project's investment climate is calculated to be 15.55%.

The financial analysis of the project activity applies the inputs that do not account for inflation, thus, the calculation result of Project IRR does not consider the impact of inflation. Consequently, WACC shall be adjusted to eliminate the impact from inflation. The more exact formula of relation of real rate, nominal rates and inflation is proposed as follows[38],:

$$i_n = (1 + i_r) * (1 + \pi) - 1$$

where:

i_r = Real Interest Rate
i_n = Nominal Interest Rate
π = Expected and Planned Inflation Rate.

Inflation rate assumed in the real IRR calculations is 2.20%, i.e. the 2007 forecast by IMF WEO.[39] The value of 13.06%, i.e. (1+15.55%)/(1+2.20%)-1, shall be employed as the benchmark to be compared with the project IRR.

Sub-step 2c: Calculation and comparison of financial indicator

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

[37] Lending interest rate is the rate charged by banks on loans to prime customers. The data is given by WorldBank, available at: http://data.worldbank.org/indicator/FR.INR.LEND

[38] Page 5, "Discounted Cash Flow Analysis Methodology and Discount Rates" by Lawrence Devon Smith – online resource: http://www.cim.org/mes/pdf/VALDAYLarrySmith.pdf

[39] Page 188, World Economic Outlook (April 2006), available at: http://www.imf.org/external/pubs/ft/weo/2006/01/pdf/weo0406.pdf

The investment analysis of the project has been implemented in compliance with the "Tool for the Demonstration and Assessment of Additionality (Version 06.0.0)" and the "Guidelines on the Assessment of Investment Analysis (version 05)" .

Since the energy efficiency measures are implemented independently at different plants, economic effect (IRR) of energy saving is assessed separately for each plant. The Veselopodilskiy plant was planned to be decommissioned after the 2008 season and, for this reason, was not included in the assessment because of the very negative investment return.

The key assumptions for the investment analysis are listed as follows:

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.[40]

2. 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 "Guidelines on the Assessment of Investment Analysis (version 05)". 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 Tsukrovyk's plants are formerly used including those of 25-30 years old. For example, deep presses Babbini installed at the Globinsky plant were manufactured in 1980-1982 years; two of the three similar presses installed at the Yareskivskiy plant were manufactured in 1983. The fair residual asset value is calculated and included into a 2017 cash inflow.

3. Annual project effect is estimated as a differential of cumulative natural gas saving and capital expense calculated in constant comparable prices of 2006; an average natural gas price per 1000 m^3 without VAT paid in 2006 was 99.81€ at the Globinsky plant and 91.07€ at the Yareskivskiy plant.

4. Residual asset value of the newly installed equipment is calculated on the basis of the total expenses relating to purchase, installation and commissioning of the equipment and its operational lifetime, and added to the cash inflow in the last year of the assessment period (2017).

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

As a summary of investment analysis, Table 10 presents the project IRR of each plant in the condition without and with Emission Reduction Sales. The Emission Reduction Sales will help Glogynsky Plant eliminate the financial barrier. For Yareskivskiy Plant and Veselopodilskiy Plant, the investment will generate sufficient return even with the help of JI. However, the energy saving actions in three plants were initiated as a whole package. The better investment retune from Globynsky plant will consolidate the investment decision of the project developer and help another two plants. Thus, the conclusion of addtionality is reliable that the project activity is not financially attractive without the Emission Reduction Sales.

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

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

Table 10: Investment analysis

	Project IRR without Emission Reduction Sales	Project IRR with Emission Reduction Sales
Yareskivskiy Plant	0.75%	8.98%
Globynsky Plant	8.82%	25.39%
Veselopodilskiy Plant	Very negative	Very negative[41]
Benchmark (Adjusted WACC)	13.06%	

Sub-step 2d: Sensitivity analysis

To prove the robustness of the investment analysis, a sensitivity analysis is conducted with variables of the price of nature gas, the capital expense and the sugar production. Each parameter will vary in a range between -10% - 10%. The result of sensitivity analysis is presented in Table 11.

Table 11: Sensitivity analysis

Project IRR without Emission Reduction Sales	Yareskivskiy Plant	Globynsky Plant	Veselopodilskiy Plant
Natural Gas Price +10%	2.52%	12.00%	Negative
Natural Gas Price -10%	-1.07%	-2.34%	Negative
Capital Expense +10%	-1.25%	5.50%	Negative
Capital Expense -10%	3.06%	12.90%	Negative
Sugar production -10%	-1.07%	5.79%	Negative
Sugar production +10%	2.52%	12.00%	Negative
Benchmark (Adjusted WACC)	13.06%		

As presented in the spreadsheet of financial model[42], it is impossible that the project IRR of the project activity being higher than the benchmark in case the three variables change in the range between -10% - 10%. Actually, the realised investment expense of the project activity is overspent compared with the estimation in 2006 when the investment decision was made (see Table 12). Without the help from JI, the project activity would not be invested and continued.

Table 12: The estimated and realised investment expense (thousand EURO[43])

	Yareskivskiy Plant		Globynsky Plant		Veselopodilskiy Plant	
	Estimation in 2006	Reality	Estimation in 2006	Reality	Estimation in 2006	Reality
2007	2,286.22	3,276.65	1,049.54	2,391.80	509.05	1,250.61
2008	2,383.66	4,530.72	1,148.39	1,586.88	400.67	1,328.91

[41] Veselopodilskiy plant has stop servicing after 2008. The investment return in Veselopodilskiy is very negative.

[42] Supporting documentation 4, ERU Calculations (incl. financial analysis)

[43]The realised investment expense is provided by the financial department of the project developer. The exchange rate is set as EUR: UAH=6.34, available in 2006.

2009	107.57	1,880.18	128.39	875.81		
2010	480.32	4,327.79	1956.94	6,250.78		
2011	750.15	5,026.26	2,050.58	7,038.20		
2012	995.21	2,497.16	2,150.67	1,806.97		

As the conclusion of Step 2, the project activity is additional.

Step 3: Barrier analysis

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed JI project activity:

Technological Barrier

Modernization measures implemented at the Tsukrovyk'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 Tsukrovyk's plants are faced by some significant technological issues. The modernized technological processes need to be united 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 water after pulp pressing 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 Tsukrovyk's plants were manufactured by the firm "Babbini" in the eighties (the oldest press purchased by Veselopdilsky plant was manufactured in 1978). 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, Tsukrovyk 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 (3 units), beets slicers Maguin (2 units) and centrifuges BMA-1250 (4 units) at Globinsky plant required a retrofit of the beets workshop and construction of the deep pressing station[44]. Beets slicers Maguin were installed in August of 2007 and, to set them in operation, 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. Deep presses Babbini were installed in July of 2007; however, they were set in operation only in October since additional equipment and installation work were required. Centrifuges BMA-1250 were installed in August of 2008 and their setting in operation required a new automation system and fans for electric motors.

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.

[44] Letter by Director of Globinsky plant, September 25, 2009

Financing Barrier

Energy efficiency projects are typically associated with high transaction costs for the planning, implementation and monitoring phases. In Tsukrovyk's case this is even more pronounced due to the large number of measures in three different locations. Without the sale of carbon credits, this is a serious barrier 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 Tsukrovyk[45], 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 Tsukrovyk. Although Tsukrovyk 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"[46] and to "support investments in the modernization of energy-intensive industries"[46]. 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 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 Hryvnias and foreign 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 Tsukrovyk'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

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

[46] EBRD document "Energy Operations Policy" approved by the Board of Directors on July 11 2006. http://www.ebrd.com/downloads/policies/sector/energy_policy.pdf

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 value[47]. The proposed crediting conditions clearly demonstrate a high level of risks associated with these projects and create a serious financial barrier to their implementation.

Social Barrier: Training of Personnel

Implementation of modernization measures at Globinsky, Yareskivskiy and Veselopodilskiy plants, including instalment of more advanced equipment and organizational measures 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 three plants: at Globinsky plant - by Kremenchug educational organization, 60 people were trained; at Yareskivskiy – by Poltava educational centre, 125 people were trained; and at Vesepodilsky plant –also by Poltava educational centre, 65 people were trained. In 2009 training of plants' personnel in this area continues.

The advanced trainings for workers are undertaken at the Yareskivskiy and Globinskiy sugar plants each year.
In 2011 55 workers and 29 engineering and technical specialists of Yareskivskiy plant received advanced trainings on:

- Apparatus- technological scheme of diffusion plant of Yareskivskiy sugar plant;
- Requirement for beets slicers. Requirement for feeding water;
- Feeding water schemes preparation;
- Technological regulations of diffusion plant;
- Possible breaches of diffusion plant operation and measures on its removal.

Since 12.03.2012 till 24.03.2012 32 workers from Globinskiy sugar plant received advanced trainings on:

- Prospects of sugar industry of Ukraine;
- Sugar beets quality. Changes in chemical content of sugar beets at the saving;
- The work of equipment of post-treatment tract for maximum effect of beets cleaning of pollution;
- Washing department. Regime of equipment operation. Modern scheme;
- Measures on diffusion purification effect increasing, experience of CIS and Khmelnitskiy region. Microbiological regime of diffusion;
- Peculiarities of separate schemes of juices purification. Schemes for receiving of maximum effect of juice purification, etc.

As described within the technological barriers analysis, outside experts were brought to Tsukrovyk 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.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives:

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

The identified barrier in Sub-step 3a would not prevent the implementation of the alternative c, which is the baseline scenario of the project activity.
As the conclusion of Step 3, based on the substantial technical, financial and social barriers analysis, the project is additional.

Step 4: Common practice analysis

The proposed project activity applies the technology listed in Paragraph 6 of the "Tool for the Demonstration and Assessment of Additionality (Version 06.0.0)", i.e. switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies). Thus, below steps will be applied to demonstration that the proposed JI project activity is not the common practice.

Step 4.1: *Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.*

As forecasted in Table 1, the total capacity of the proposed project activity will be 797,000 tons of sugar beet consumption annually. The applicable output with the range as +/- 50% of the project capacity will be 398,500 – 1,195,500 tons of sugar beet consumption annually.

Step 4.2: *In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number N_{all}. Registered JI project activities and projects activities undergoing validation shall not be included in this step;*

The applicable geographic area is selected to be Ukraine. Below criteria is set to identify the plants:.

The criteria to count N_{all} [48] **are list as below:**

i. 797,000 tons of sugar beet consumption annually. The applicable output with the range as +/- 50% of the project capacity will be 398,500 – 1,195,500 tons of sugar beet consumption annually.
ii. The starting date of the proposed project is 2 Nov 2006. Therefore, only the project activities have started commercial operation before 2 Nov 2006 should be included;
iii. Registered JI project activities and projects activities undergoing validation should be excluded.

Therefore, N_{all} is 0.

Further justification is given as follows. Most beet refineries in the Ukraine currently use power-consuming technology developed in the 1980's and depreciated equipment[49]. 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 processing technologies within Ukraine; in each case, energy efficiency measures at Tsukrovyk have gone beyond the prevailing case.

[48] N_{all}=_N_i (i mean number of projects of different energy sources)

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

1. Only 10% of sugar producing plants (including Tsukrovyk and Astarta-Kyiv) 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 Tsukrovyk's plants achieve 26-30% 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 Tsukrovyk and Astarta-Kyiv, have installed filter presses to improve efficiency.
4. For the crystallization processes, most beet refineries use vacuum devices of periodic operation without mechanical circulators. Vacuum devices of periodic operation with mechanical circulators are only installed at 5-7 Ukrainian sugar refineries and there are no sugar refineries in the Ukraine with vacuum devices 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[50].

In comparison to current technologies used in the sugar beets processing business in Ukraine, it is clear that Tsukrovyk technologies installed in the project go above and beyond that of common practice[28].

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[51]. For the Tsukrovyk plants, the average energy efficiency improvement from 2004 to 2008 was 3% per year. With the implementation of the modernization program the Tsukrovyk plants are anticipating an 8% per year energy efficiency improvement during the crediting period (to 2012)[52]. This demonstrates that the Tsukrovyk projects are overcoming the prevailing practice barrier to be able to implement this project.

The distinctive feature of the modernization program being implemented by Tsukrovyk is that the program includes a series of comprehensive measures aimed at improving energy efficiency including: new technology and equipment, introducing of new 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.

Thus, there does not exist any plant that delivers the same output or capacity, within the applicable output range calculated in Step 1, as the proposed project activity, and has started commercial operation before the start date of the project activity, and has not been developed as a JI project.

Step 4.3: *Within plants identified in Step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number* $N_{diff.}$
According to the definition of N_{diff}, if N_{all} is 0, $N_{\boldsymbol{diff}}$ is 0 too.

Step 4.4: *Calculate factor* $F=1-N_{diff}/N_{all}$ *representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as*

[50] Information provided by Tsukrovyk. Refer to supporting documentation 9

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

[52] Supporting Document 4, ERU Calculations

the proposed project activity.

The proposed project activity is a common practice within a sector in the applicable geographical area if both the following conditions are fulfilled:

(a) the factor F is greater than 0.2, and
(b) N_{all}-N_{diff} is greater than 3

Since N_{all}-N_{diff} is 0, which is less than 3, the proposed project activity is not a common practice within a sector in the applicable geographical area.

In conclusion, all the steps above are satisfied. The proposed JI project activity is not the baseline scenario and is additional. Consequently, the alternative c is defined to be the baseline scenario.

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

Project boundaries

The project boundary is the physical, geographical site of the project facilities, production process, and the equipment that are affected by the project activity. Project boundaries include all emissions sources controlled by project owner. Following these definition, the project boundary has been applied to the geographic locations of the Yareskivskiy, Globinskiy and Veselopodilskiy Plants. The project boundaries include each of the plants completely with all equipment (Fig. 16). 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 combustion of natural gas and coal in the existing steam boilers, the pulp drying facilities and the lime kiln. CO_2 will be emitted during the process of the fossil fuel consumption. In addition to the emissions from the fossil fuel combustion, CO_2 emissions from the decomposition of lime during the sugar production process are taken into account. Thus, CO_2 is the main greenhouse gas related to the project activity. Emissions of other greenhouse gases, such as methane and N_2O from fuel combustion, were considered to be insignificant and were not taken into account. This is a conservative approach.

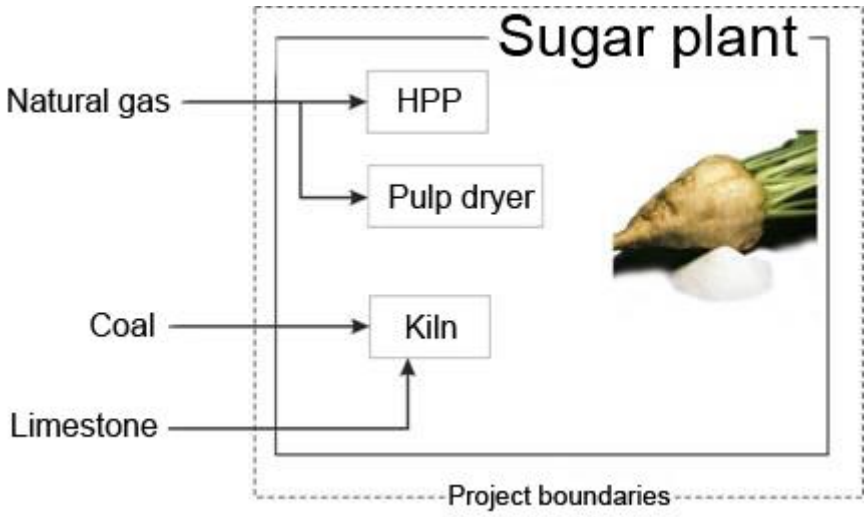


Figure 16. Project boundaries

No leakage was identified outside of the project boundary. As the energy efficiency project, the main potential of leakage emission is the continuously used of the replaced equipment in another user outside the project boundary. In the project activity the replaced equipments will not be transferred to another user and continue the service. The reason is that these pieces of equipments keep functional only when they serve as a part of the whole system. They are useless after they are replaced.

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

Table 13. 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. It is released by the consumption of natural gas.
		CH_4	No	Insignificant source. Minor amount of CH_4 is emitted from the inefficient combustion of natural gas in the boilers. The project activity will improve the efficiency of the boilers, including the combustion efficiency, which will cause less CH_4 emission from the better combustion efficiency. As a conservative approach, this emission source is excluded from the project activity and the CH_4 emission reduction from the improvement of combustion efficiency is not accounted.
		N_2O	No	Not relevant.
	Emissions as a result of natural gas combustion in pulp drier	CO_2	Yes	CO_2 is the main source of emissions. It is released by the consumption of natural gas.
		CH_4	No	Insignificant source. Minor amount of CH_4 is emitted from the inefficient combustion of natural gas in the pulp drier. The project activity will improve the efficiency of the pulp drier, including the combustion efficiency, which will cause less CH_4 emission from the better combustion efficiency. As a conservative approach, this emission source is excluded from the project activity and the CH_4 emission reduction from the improvement of combustion efficiency is not accounted.

		N_2O	No	Not relevant.
	Emissions as a result of coal combustion in the lime kilns	CO_2	Yes	CO_2 is the main source of emissions. It is released by the consumption of coal.
		CH_4	No	Not relevant.
		N_2O	No	Not relevant.
	Emissions as a result of limestone consumption in the lime kilns	CO_2	Yes	CO_2 is the main source of emissions. It is released by the consumption of limestone
		CH_4	No	Not relevant.
		N_2O	No	Not relevant.
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. It is released by the consumption of natural gas, but with a smaller volume compared with the baseline scenario.
		CH_4	No	Insignificant source. As a conservative approach, this emission source is excluded from the project activity and the CH_4 emission reduction from the improvement of combustion efficiency is not accounted.
		N_2O	No	Not relevant.
	Emissions as a result of natural gas combustion in pulp drier	CO_2	Yes	CO_2 is the main source of emissions. It is released by the consumption of natural gas, but with a smaller volume compared with the baseline scenario.
		CH_4	No	Insignificant source. As a conservative approach, this emission source is excluded from the project activity and the CH_4 emission reduction from the improvement of combustion efficiency is not accounted.
		N_2O	No	Not relevant.
	Emissions as a result of coal combustion in the lime kilns	CO_2	Yes	CO_2 is the main source of emissions. It is released by the consumption of coal, but with a smaller volume compared with the baseline scenario.
		CH_4	No	Not relevant.
		N_2O	No	Not relevant.
	Emissions as a result of limestone consumption in the lime kilns	CO_2	Yes	CO_2 is the main source of emissions. It is released by the consumption of limestone, but with a smaller volume compared with the baseline scenario.
		CH_4	No	Not relevant.
		N_2O	No	Not relevant.

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, 15/06/2012, 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:

The starting date of the project is 02/11/2006.

The JI project activities consist of various measurements to improve the energy efficiency. The earliest measurement was conducted on 02 Nov 2006, which includes the purchase of 7 pulp presses (manufactured by "Babbini", type P-18). It is defined as the starting date of the project.
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 (60 months) within the Kyoto crediting period and 2013-2017 (60 months) 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 01, 2008 – December 31, 2012 (01/01/2008-31/12/2012) (5 Years or 60 months) and January 01, 2013 - December 31, 2017 (01/01/2013-31/12/2017) (5 years or 60 months).

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The JI-specific approach from "Guidance on criteria for baseline setting and monitoring (version 03)" was selected to establish the monitoring plan. The paragraph 11 of the Guidance further explains that project that select a JI-specific approach may use selected elements or combinations of approved CDM baseline and monitoring methodologies or approved CDM methodological tool.

As addressed by the «Guidelines for the implementation of Article 6 of the Kyoto Protocol» (Appendix B) the project participants shall include, as part of the project design document, a monitoring plan that provides for:

(a) The collection and archiving of all relevant data necessary for estimating or measuring anthropogenic emissions by sources and/or anthropogenic removals by sinks of greenhouse gases occurring within the project boundary during the crediting period;

(b) The collection and archiving of all relevant data necessary for determining the baseline of anthropogenic emissions by sources and/or anthropogenic removals by sinks of greenhouse gases within the project boundary during the crediting period;

(c) The identification of all potential sources of, and the collection and archiving of data on increased anthropogenic emissions by sources and/or reduced anthropogenic removals by sinks of greenhouse gases outside the project boundary that are significant and reasonably attributable to the project during the crediting period. The project boundary shall encompass all anthropogenic emissions by sources and/or removals by sinks of greenhouse gases under the control of the project participants that are significant and reasonably attributable to the Article 6 project activity;

(d) The collection and archiving of information on environmental impacts, in accordance with procedures as required by the host Party, where applicable;

(e) Quality assurance and control procedures for the monitoring process;

(f) Procedures for the periodic calculation of the reductions of anthropogenic emissions by sources and/or enhancements of anthropogenic removals by sinks by the proposed Article 6 project, and for leakage effects, if any. Leakage is defined as the net change of anthropogenic emissions by sources and/or removals by sinks of greenhouse gases which occurs outside the project boundary, and that is measurable and attributable to the Article 6 project;

(g) Documentation of all steps involved in the calculations referred to in subparagraphs (b) and (f) above.

Each of the plants will collect and archive all relevant data on parameters necessary for estimating or measuring of the emissions. The documentation on following parameters should be collected and archived at the plants:

- Natural gas consumption;
- Coal consumption;
- Limestone consumption;
- Net calorific value of natural gas;
- Net calorific value of coal;

- Percent of $CaCO_3$ in raw;
- Percent of $MgCO_3$ in raw;
- Sugar production;
- Sugar content in sugar beets.

Each of the plants will collect and archive all relevant data necessary for determining the baseline. More information could be found in Section B.1.

The project is aimed at the reduction of the emissions of carbon dioxide from the three main sources:
1) The combustion of fossil fuel;
2) Decomposition of limestone within the calcination process;
3) Coal combustion from the calcination process.

Each plant develops water, wastes and air reports for authorized governmental bodies. The plants also receive environmental permits in accordance with Ukrainian legislature. More information is given in the Section F.

Quality assurance and quality control are given in details at the Section D.2.

The leakages beyond the project boundaries are not determined.

Table 14. Data and parameters that are not monitored throughout the crediting period, but are determined only once, and that are available already at the stage of determination regarding the PDD.

Baseline Emissions

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	Determined only once and available already at the stage of determination regarding the PDD

<table>
<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>Yareskivskiy sugar plant
<table><tr><td>2004</td><td>283,785</td></tr><tr><td>2005</td><td>256,890</td></tr><tr><td>2006</td><td>342,992</td></tr></table>
Globinskiy sugar plant
<table><tr><td>2004</td><td>-</td></tr><tr><td>2005</td><td>-</td></tr><tr><td>2006</td><td>144,201</td></tr></table>
Veselopilskiy sugar plant
<table><tr><td>2004</td><td>123,910</td></tr><tr><td>2005</td><td>158,236</td></tr><tr><td>2006</td><td>200, 471</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</td></tr>
<tr><td>QA/QC procedures
(to be) applied</td><td>Yareskivskiy Plant:
The sugar beets are weighed using tenso-metric automated scales (4 units) with carrier power of 60 t. State calibration of automated scales is done once per year.
Level of Uncertainty: Low

Globinskiy Plant:
The sugar beets are weighed using automated scales: AC-30t number 7654, AC-60 t number 2878, AC-60t number 6968, AC-30t number 7659, AC-60t number 7907, AC-60t number 4847, and AC-60 t number 4249.
Level of Uncertainty: Low</td></tr>
</table>

	Veselopodilskiy Plant: The sugar beets from the field are weighed with the use of automated weight measuring device (AVK) which includes tenso-metric truck scales (4 units) with carrying capacity of 60 t. Level of Uncertainty: 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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Appropriate data collected as part of JI project
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant: 2004: 34,537 2005: 35,993 2006: 47,610 Globinskiy sugar plant 2004: - 2005: - 2006: 17,885

	Veselopodilskiy sugar plant 2004 14,082 2005 20,825 2006 24,827
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project
QA/QC procedures (to be) applied	Yareskivskiy sugar plant: Produced sugar is scaled by bags accounting system SUM-232. The calibration is undertaken by plant specialists once a year. Sugar is put into the bags with help of weigh hopper DVS-301. Calibration is undertaken by plant specialists once a year. State check is undertaken by State Enterprise "Poltavastandartmetrologiya". Uncertainty level: Low Globinskiy sugar plant: Produced sugar is scaled by bags accounting system SUM-232. Calibration is undertaken by plant specialists once a year. Check is undertaken by Kremenchuk branch of SE "Poltava Regional Center of Standardization, Metrology and Certification" once a year. Sugar is put into the bags with help of weigh hopper – SVEDA LTD. Calibration is undertaken by plant specialists once a year. Check is undertaken by Kremenchuk branch of SE "Poltava Regional Center of Standardization, Metrology and Certification" once a year. Uncertainty level: Low Veselopodilskiy sugar plant: Sugar is put into the bags with help of weigh hopper DVS-301. Calibration is undertaken by plant specialists once a year. State check is undertaken by Kremenchuk branch of SE «Poltava Regional Scientific-Technical Center of Standardization,

	Metrology and Certification». 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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Appropriate data collected as part of JI project
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004 15.34 2005 17.35 2006 16.39 Globinskiy sugar plant 2004 - 2005 - 2006 15.71 Veselopodilskiy sugar plant: 2004 14.81 2005 16.89 2006 15.69

Justification of the choice of data or description of measurement	Required for baseline emissions of JI project calculation
QA/QC procedures (to be) applied	Yareskivskiy sugar plant: Sugar content in sugar beets is measured by semi-automatic line ULS-1. The calibration is undertaken by SE "Poltavastandartmetrologiya" once a year. The calibration is undertaken by SATER once a year. Sugar content is measured by cold digestion method. Uncertainty level: Low Globinskiy sugar plant: Sugar content in sugar beets is measured by semi-automatic line ULS-1. The calibrations and checks are undertaken by SE "Poltavastandartmetrologiya" once a year. Sugar content is measured by cold digestion method. Uncertainty level: Low Veselopodilskiy sugar plant: Sugar content in sugar beets is measured by semi-automatic line ULS-1. The calibrations and checks are undertaken once a year by SE «Poltava Regional State –Technical Center of Standardization, Metrology and Certification». Uncertainty level: Low
Any comment	

Data/Parameter	$FC_{coal,hist,y,i}$
Data unit	t
Description	Coal consumption at the historical period (2004-2006) at plant i

<table>
<tr><td>Time of determination/monitoring</td><td>Determined only once and available already at the stage of determination regarding the PDD</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>Yareskivskiy sugar plant:<table><tr><td>2004</td><td>1,671</td></tr><tr><td>2005</td><td>1,759</td></tr><tr><td>2006</td><td>1,976</td></tr></table>Globinskiy sugar plant:<table><tr><td>2004</td><td>-</td></tr><tr><td>2005</td><td>-</td></tr><tr><td>2006</td><td>877.4</td></tr></table>Veselopodiskiy sugar plant:<table><tr><td>2004</td><td>858</td></tr><tr><td>2005</td><td>1,133</td></tr><tr><td>2006</td><td>1,237</td></tr></table></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>Yareskivskiy Plant:
The mechanical scale used to weigh coal is: RS-150C13V inventory number 7331. The scale has a carrying capacity of 150 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: Low</td></tr>
</table>

	Globinsky Plant: Coal is weighed using mechanical carriage scales: 5044ES150 DS24V, plant number 866/1118. The scale has a carrying capacity of 150 t. State calibration is performed once every 6 months. Test calibration is performed once every two months. The results of state calibrations, reviews and checks are put into the technical passport of the scale. The recent calibrations were conducted on 01.06.2010, 01.12.2009, 19.09.2010. The recent test calibrations were implemented on 01.06.2010, 03.08.2010 and 29.09.2010. The calibrations are done by Scales Calibration Road Inspection RPZF. Level of Uncertainty: Medium Veselopodilskiy Plant: Railroad cars and trucks with coal are weighed at this plant Weighting of railroad cars with coal is done with the use of mechanical track scales (model VO-2002) inventory number 05302000743 with carrying capacity of 150 tonnes. These scales belong to the railway station. Veselopodilskiy of Southern railway. State calibration is conducted once every six months; test calibration is conducted once every two months. Tests are conducted with the use of exemplary weights of the fourth grade with a total mass of 80 tonnes. Results of state and test calibrations are recorded in the scale's technical passport. Calibrations are conducted by Kremenchuk branch of State Enterprise "Poltavastandartmetrologiya". The most recent calibration was conducted in August of 2008. Level of Uncertainty: Low
Any comment	

<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>Determined only once and available already at the stage of determination regarding the PDD</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>Yareskivskiy sugar plant
<table><tr><td>2004</td><td>14,125</td></tr><tr><td>2005</td><td>13,862</td></tr><tr><td>2006</td><td>16,831</td></tr></table>
Globinskiy sugar plant
<table><tr><td>2004</td><td>-</td></tr><tr><td>2005</td><td>-</td></tr><tr><td>2006</td><td>8,099.5</td></tr></table>
Veselopodilskiy sugar plant
<table><tr><td>2004</td><td>3,550</td></tr><tr><td>2005</td><td>8,688</td></tr><tr><td>2006</td><td>10,635</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>Yareskivskiy Plant:
Natural gas consumption of the plant and the beet dryer are recorded.
The accounting of natural gas consumed for production process is done by an automated measuring-management meter named "LIDER" (inventory number 1-873). The meter can</td></tr>
</table>

	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). Globinsky Plant: The accounting of natural gas consumed for the production process is done by an automated system at base of MK named "LIDER VG-1", serial number 1-187. The main functions of the metering device are: measuring data on a momentary, hourly, daily and monthly gas consumption, off-nominal and emergency cases, printout of reports (by request of user). Monthly records and billing for gas consumption are taken from this metering device, and is certified by the gas supplier. State calibration of the meter is performed not less than once in 2 years (certificates number 16-04/2418 11.06.08, number 16-04/2395 24.06.08, number 16-04/2396 from 24.06.08, number 16-04/2397 from 24.06.08). The most recent calibration was conducted on 03.08.2010. Calibration is conducted periodically before the beginning, and during the gas consumption season (September-March). The calibrations are done by the representatives of gas supplier (JSC "Poltavagas"). Veselopodilskiy Plant: Accounting of natural gas used for the production process is done by the measuring-management meter "FLOLUTEC-TM-VR-1" inventory number 05302000679. Main functions of the device are: measuring of data on a momentary, hourly, daily and monthly gas consumption basis, contingency and

	emergency situations, printout of reports (upon request of user), exchange of information with PC by radio channel using a mobile connection. State calibration is conducted not less than once every two years. Test calibration is conducted periodically before and during gas consumption season (September -March). Calibrations are conducted by representatives of gas supplier (JSC "Kremenchukgas"). The most recent calibration was conducted in August of 2008.
Any comment	

Data/Parameter	$LC_{hist,y,i}$
Data unit	t
Description	Limestone consumption at the historical period (2004 -2006) at plant i
Time of determination/monitoring	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Appropriate data collected as part of JI project
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant: 2004: 20,859 2005: 18,708 2006: 23,017 Globinskiy sugar plant: 2004: - 2005: - 2006: 11,009 Veselopodilskiy sugar plant: 2004: 9,024

	2005 12,947 2006 15,043
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project calculation
QA/QC procedures (to be) applied	Yareskivskiy Plant: The mechanical scale used to weigh limestone is: RS-150C13V inventory number 7331. The scale has a carrying capacity of 150 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: Low Globinsky Plant: The mechanical scale used to weigh limestone is: 5044ES150 DS24V, plant number 866/1118. 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. The recent calibrations were conducted on 01.12.2009, 01.06.2010, 19.09.2010. The recent test calibrations were implemented on 01.06.2010, 03.08.2010 and 29.09.2010. The calibrations are done by Scales Calibration Road Inspection RPZF. Level of Uncertainty: Low Veselopodilskiy Plant: Limestone is weighed using mechanical track scales (model VO-2002) with a carrying capacity of 150 tonnes. Inventory number of the scales is 05302000743. The scales belong to the railway station Veselopodilskiy of Southern Railway.

	State calibration is performed once every six months; test calibration is conducted once every two months. Tests are conducted with the use of exemplary weights of the fourth grade with a total mass of 80 tonnes. Results of state and test calibrations are recorded in the scale's technical passport. Calibrations are conducted by Kremenchuk branch of State Enterprise "Poltavastandartmetrologiya". The most recent calibration was conducted in August of 2008.
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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Natural gas supplier
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004: 8,321 2005: 8,280 2006: 8,513 Globinskiy sugar plant 2004: 7,204 2005: 7,100 2006: 6,910 Veselopodilskiy sugar plant 2004: 8,334 2005: 8,373 2006: 8,312

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. 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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Coal supplier
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004: 7,204 2005: 7,100 2006: 6,910 Globinskiy sugar plant 2004: - 2005: - 2006: 7,230 Veselopodilskiy sugar plant 2004: 7,010 2005: 7,010

	2006 | 9,610
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. 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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Limestone Supplier
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004 | 0.9730 2005 | 0.9721 2006 | 0.9690 Globinskiy sugar plant 2004 | - 2005 | - 2006 | 0.972 Veselopodilskiy sugar plant

	2004 0.9730 2005 0.9721 2006 0.9725
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	$MgCO_{3\ hist,y,i}$
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	Determined only once and available already at the stage of determination regarding the PDD
Source of data (to be) used	Limestone Supplier
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004 0.0125 2005 0.0121 2006 0.0111 Globinskiy sugar plant 2004 - 2005 - 2006 0.0125 Veselopodilskiy sugar plant 2004 0.0125

	2005 0.0121 2006 0.0110
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	

Project emissions

Not applicable.

Data and parameters that are not monitored throughout the crediting period, but are determined only once, but that are not already available at the stage of determination regarding the PDD

Baseline emissions

Not applicable.

Project emissions

Not applicable.

Table 15. Data and parameters that are monitored throughout the crediting period.

Baseline emissions

Data/Parameter	EF_{NG}
Data unit	t CO_2 /TJ
Description	Carbon emissions factor for natural gas
Time of determination/monitoring	Monitored annually throughout the crediting period
Source of data (to be) used	Section P2.5.1.3 (p. 437), National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2010[53]
Value of data applied (for ex ante calculations/determinations)	2004: 55.66 2005: 55.70 2006: 55.81 2008: 55.62 2009: 55.73 2010: 55.62
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 The data are to be kept for 2 years after the last transfer of ERUs from the project activity.
Any comment	In accordance with National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2010, the carbon content in natural gas is

[53] The document can be downloaded from: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

	15.18 t C/TJ which equals to 55.66 tCO_2/TJ (15.18* 44/12) – for 2004; 15.19 t C/TJ which equals to 55.70 tCO_2/TJ (15.19* 44/12) – for 2005; 15.22 t C/TJ which equals to 55.81 tCO_2/TJ (15.22* 44/12) – for 2006; 15.17 t C/TJ which equals to 55.62 tCO_2/TJ (15.17* 44/12) – for 2008 and 2010; 15.20 t C/TJ which equals to 55.73 tCO_2/TJ (15.2* 44/12) – for 2009.

Data/Parameter	EF_{coal}
Data unit	t CO_2/TJ
Description	The carbon emission factor for coal
Time of determination/monitoring	Monitored annually throughout the crediting period
Source of data (to be) used	Section P2.5.3, Table P2.15 (p.444), National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2010[54]
Value of data applied (for ex ante calculations/determinations)	2004: 101.2 2005: 100.1 2006: 99.73 2008-2010: 92.77
Justification of the choice of data or description of measurement	Required for emission calculations.

[54] The document available at: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

QA/QC procedures (to be) applied	Data variables reviewed to be in line with national or international fuel standards Level of Uncertainty: Low The data are to be kept for 2 years after the last transfer of ERUs from the project activity.
Any comment	In accordance with National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2010, the carbon content in coal: 27.6 t C/TJ which equals to 101.2 t CO_2/TJ (27.6* 44/12) in 2004; 27.3 t C/TJ which equals to 100.1 t CO_2/TJ (27.3* 44/12) in 2005; 27.2 t C/TJ which equals to 99.73 t CO_2/TJ (27.2* 44/12) in 2006; 25.3 t C/TJ which equals to 92.77 t CO_2/TJ (25.3* 44/12) in 2008-2010;

Data/Parameter	EF_{CaCO3}
Data unit	t CO_2/t $CaCO_3$
Description	The carbon emission factor for $CaCO_3$
Time of determination/monitoring	Monitored annually throughout the crediting period
Source of data (to be) used	Section 4.8.2 (P.116), National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2009[55]
Value of data applied (for ex ante	Stoichiometric emission factor; 0.44 t CO2/CaCO3

[55] The document available at: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php

calculations/determinations)	
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 The data are to be kept for 2 years after the last transfer of ERUs from the project activity.
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	Monitored annually throughout the crediting period
Source of data (to be) used	Section 4.8.2 (P.116), National Inventory Report of Anthropogenic Emissions by Sources and Removals by Sinks of Greenhouse Gases in Ukraine for 1990-2009[56]
Value of data applied (for ex ante calculations/determinations)	Stoichiometric emissions factor: 0.522 t CO_2/t$MgCO_3$
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 The data are to be kept for 2 years after the last transfer of ERUs from the project activity.

[56] The document available at: http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/5888.php

Any comment	

Data/Parameter	$SP_{y,i}$
Data unit	Ton
Description	Sugar production in year y at plant *i*
Time of determination/monitoring	Monitored monthly throughout the crediting period
Source of data (to be) used	The bags accounting system SUM-232
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant: 2004: 34,537 2005: 35,993 2006: 47,610 Globinskiy sugar plant 2004: - 2005: - 2006: 17,885 Veselopodilskiy sugar plant 2004: 14,082 2005: 20,825 2006: 24,827
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project
QA/QC procedures (to be) applied	Produced sugar is scaled by bags accounting system SUM-232. The calibration is undertaken by plant specialists once a year. Sugar is put into the bags with help of weigh hopper DVS-301.

	Uncertainty level +/-0.25%. Calibration is undertaken by plant specialists once a year. State check is undertaken by State Enterprise "Poltavastandartmetrologiya". The data are to be kept for 2 years after the last transfer of ERUs from the project activity.
Any comment	

Data/Parameter	$SPB_{y,i}$
Data unit	%
Description	Average sugar content in sugar beets in year y at plant *i*
Time of determination/monitoring	Monitored monthly throughout the crediting period
Source of data (to be) used	The semi-automatic line ULS-1
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004 15.34 2005 17.35 2006 16.39 Globinskiy sugar plant 2004 - 2005 - 2006 15.71 Veselopodilskiy sugar plant: 2004 14.81 2005 16.89 2006 15.69
Justification of the choice of data or description of measurement	Required for baseline emissions of JI project

QA/QC procedures (to be) applied	Sugar content in sugar beets is measured by semi-automatic line ULS-1. The calibration is undertaken by SE "Poltavastandartmetrologiya" once a year. The calibration is undertaken by SATER once a year. Uncertainty level - +/- 0.2%. Sugar content is measured by cold digestion method. The data are to be kept for 2 years after the last transfer of ERUs from the project activity.
Any comment	

Project emissions

Data/Parameter	$FC_{NG,y,i}$
Data unit	m^3
Description	Natural gas consumption for sugar plants needs
Time of determination/monitoring	Monitored monthly throughout the crediting period
Source of data (to be) used	Tsukrovyk
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004: 14,125 2005: 13,862 2006: 16,831 Globinskiy sugar plant 2004: - 2005: - 2006: 8,100 Veselopodilskiy sugar plant

	2004: 6,550 2005: 8,688 2006: 10,635
Justification of the choice of data or description of measurement	The accounting of natural gas consumed for production process is done by an automated measuring-management meter. 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.
QA/QC procedures (to be) applied	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 data are to be kept for 2 years after the last transfer of ERUs from the project activity.
Any comment	

Data/Parameter	$NCV_{NG,y,i}$
Data unit	kcal/m^3
Description	Net calorific value of natural gas
Time of determination/monitoring	Monitored monthly throughout the crediting period
Source of data (to be) used	Supplier's certificate
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004: 8,321 2005: 8,280 2006: 8,513

	Globinskiy sugar plant 2004 - 2005 - 2006 8,704 Veselopodilskiy sugar plant 2004 8,333 2005 8,370 2006 8,319
Justification of the choice of data or description of measurement	Required for emission calculations.
QA/QC procedures (to be) applied	The data are to be kept for 2 years after the last transfer of ERUs from the project activity.
Any comment	

Data/Parameter	$FC_{Coal,y,i}$
Data unit	Tons
Description	Coal consumption for sugar plants needs
Time of determination/monitoring	Monitored daily throughout the crediting period
Source of data (to be) used	Tsukrovyk
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004 1,671 2005 1,759 2006 1,976

	Globinskiy sugar plant 2004 - 2005 - 2006 877 Veselopodilskiy sugar plant 2004 858 2005 1,133 2006 1,237
Justification of the choice of data or description of measurement	The mechanical scale is used to weigh coal. The scale has a carrying capacity of 150 tonnes.
QA/QC procedures (to be) applied	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. The data are to be kept for 2 years after the last transfer of ERUs from the project activity.
Any comment	

Data/Parameter	$NCV_{Coal,y,i}$
Data unit	kcal/kg
Description	Net calorific value of coal
Time of determination/monitoring	Monitored monthly throughout the crediting period
Source of data (to be) used	Supplier's certificate

Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004: 7,204 2005: 7,100 2006: 6,910 Globinskiy sugar plant 2004: - 2005: - 2006: 7,230 Veselopodilskiy sugar plant 2004: 7,010 2005: 7,100 2006: 6,910
Justification of the choice of data or description of measurement	Required for emission calculations.
QA/QC procedures (to be) applied	The data are to be kept for 2 years after the last transfer of ERUs from the project activity.
Any comment	

Data/Parameter	$LC_{y,i}$
Data unit	Tons
Description	The mass of raw material limestone burned in the kiln in project year *y* at plant *i*
Time of determination/monitoring	Monitored monthly throughout the crediting period
Source of data (to be) used	Tsukrovyk

Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004: 20,859 2005: 18,708 2006: 23,017 Globinskiy sugar plant 2004: - 2005: - 2006: 11,009 Veselopodilskiy sugar plant 2004: 9,024 2005: 12,947 2006: 15,043
Justification of the choice of data or description of measurement	The mechanical scale is used to weigh limestone. The scale has a carrying capacity of 150 tonnes.
QA/QC procedures (to be) applied	State calibration is performed once every 6 months. Test calibration is conducted once every two months. The data are to be kept for 2 years after the last transfer of ERUs from the project activity.
Any comment	

Data/Parameter	$CaCO_{3\,y,i}$
Data unit	-
Description	The percent of $CaCO_3$ in the raw material limestone in project year *y* at plant *i*
Time of determination/monitoring	Monitored monthly throughout the crediting period

Source of data (to be) used	Limestone supplier
Value of data applied (for ex ante calculations/determinations)	Yareskivskiy sugar plant 2004 0.9730 2005 0.9721 2006 0.9690 Globinskiy sugar plant 2004 - 2005 - 2006 0.972 Veselopodilskiy sugar plant 2004 0.9730 2005 0.9721 2006 0.9725
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 The data are to be kept for 2 years after the last transfer of ERUs from the project activity.
Any comment	

Data/Parameter	$MgCO_{3\,y,i}$
Data unit	-
Description	The percent of $MgCO_3$ in the raw material limestone in project year *y* at plant *i*
Time of determination/monitoring	Monitored monthly throughout the crediting period

<table>
<tr><td>Source of data (to be) used</td><td>Limestone supplier</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td>Yareskivskiy sugar plant
<table><tr><td>2004</td><td>0.0125</td></tr><tr><td>2005</td><td>0.0121</td></tr><tr><td>2006</td><td>0.0111</td></tr></table>
Globinskiy sugar plant
<table><tr><td>2004</td><td>-</td></tr><tr><td>2005</td><td>-</td></tr><tr><td>2006</td><td>0.0125</td></tr></table>
Veselopodilskiy sugar plant
<table><tr><td>2004</td><td>0.0125</td></tr><tr><td>2005</td><td>0.0121</td></tr><tr><td>2006</td><td>0.0110</td></tr></table></td></tr>
<tr><td>Justification of the choice of data or description of measurement</td><td>Required for emission calculations.</td></tr>
<tr><td>QA/QC procedures
(to be) applied</td><td>This data is provided by the limestone supplier with every shipment.

Level of Uncertainty: Low
The data are to be kept for 2 years after the last transfer of ERUs from the project activity.</td></tr>
<tr><td>Any comment</td><td></td></tr>
</table>

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	Tsukrovyk	m^3	M	Monthly	100%	Electronic and Paper	
2. $EF_{NG,y}$	Carbon emissions factor for natural gas	National Inventory Report in Ukraine for 1990-2010	t CO_2/TJ	C	Annually	100%	Electronic	For 2008, 2010: 55.62 tCO_2/TJ For 2009: 55.73 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	Tsukrovyk	t	M	Daily	100%	Electronic / Paper	
5. $EF_{Coal,y}$	Carbon emissions factor for coal	National Inventory Report in Ukraine for 1990-2010	T CO_2/TJ	C	Annually	100%	Electronic	92.77 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 consumption	Tsukrovyk	t	M	Monthly	100%	Electronic / Paper	

8. EF_{CaCO3}	Carbon emissions factor for $CaCO_3$	National Inventory Report in Ukraine for 1990-2009	t CO_2/t $CaCO_3$	C	Annually	100%	Electronic	Stoichiometric emissions factor 0.44
9. EF_{MgCO3}	Carbon emissions factor for $MgCO_3$	National Inventory Report in Ukraine for 1990-2009	t CO_2/t $MgCO_3$	C	Annually	100%	Electronic	Stoichiometric emissions factor 0.522
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

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

$PE_{y,i}$ the project carbon emissions in project year y at plant i (t CO_2);
$PE_{NG\,y,i}$ the project carbon emissions from natural gas consumption in project year y at plant i (t CO_2);
$PE_{Coal,y,i}$ 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

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

$FC_{NG,y,i}$ 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*[57]. 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 Tsukrovyk 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 Tsukrovyk 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:

$PE_{Calc,y,i}$ 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 $CaCO_3$).
$CaCO_{3\,y,i}$ the percent of $CaCO_3$ in the raw material limestone in project year y at plant i;
$LC_{y,i}$ the mass of raw material limestone burned in the kiln in project year y at plant i (t);
EF_{MgCO3} the carbon emission factor for $MgCO_3$ ($tCO_2/tMgCO_3$);

[57] 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)

$MgCO_{3\,y,i}$ 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	Tsukrovyk	t	M	Monthly	100%	Electronic/ Paper	
13. $SPB_{y,i}$	Average sugar content in sugar beets in year y	Tsukrovyk	%	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

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

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

Emissions from natural gas consumption

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

$SNG_{Hist,i}$ 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:

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

$FC_{NG,Hist,i}$ 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

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

$SP_{y,i}$ 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

This section has been intentionally left blank.

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:

The Section D.1.3. is left blank on purpose as there is no leakages beyond the project boundaries.

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:

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

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:

Please refer to Section F "Environmental Impacts".
The tables below give information about measuring equipment, time of their calibrations and checks and uncertainty level. The uncertainty level is given at the technical passports of the equipment and certificate of checks of the equipment.

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 records of the monitoring parameters are to be kept for 2 years after the last transfer of ERUs from the project activity. 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. During the verification the measurement of QA/QC and data management will be proved by the written order.

Yareskivskiy QA/QC Procedures

Table 16: QA/QC Procedures for Yareskivskiy Plant

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 "LIDER" (inventory number 1-873). 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).

3. $NCV_{NG,y,i}$	Low	Records are provided by the gas supplier on a monthly basis
7. $LC_{y,i}$	<75 kg (Low)	The mechanical scale used to weigh limestone is: RS-150C13V inventory number 7331. The scale has a carrying capacity of 150 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.
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-150C13V inventory number 7331. The scale has a carrying capacity of 150 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 plant specialists once a year. Sugar is put into the bags with help of weigh hopper DVS-301. Uncertainty level +/-0.25%. Calibration is undertaken by plant specialists once a year. State check is undertaken by State Enterprise "Poltavastandartmetrologiya".
13. $SPB_{y,i}$	Low	Sugar content in sugar beets is measured by semi-automatic line ULS-1. The calibration is undertaken by SE "Poltavastandartmetrologiya" once a year. The calibration is undertaken by SATER once a year. Uncertainty level - +/-0.2%. Sugar content is measured by cold digestion method.

Globinsky Plant QA/QC Procedures

Table 17: QA/QC Procedures for Globinskiy Plant

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 the production process is done by an automated system at base of MK named "LIDER VG-1", serial number 1-187. The main functions of the metering device are: measuring data on a momentary, hourly, daily and monthly gas consumption, off-nominal and emergency cases, printout of reports (by request of user). Monthly records and billing for gas consumption are taken from this metering device, and is certified by the gas supplier. State calibration of the meter is performed not less than once in 2 years (certificates number 16-04/2418 11.06.08, number 16-04/2395 24.06.08, number 16-04/2396 from 24.06.08, number 16-04/2397 from 24.06.08). The most recent calibration was conducted on 03.08.2010. Calibration is conducted periodically before the beginning, and during the gas consumption season (September-March). The calibrations are done by the representatives of gas supplier (JSC "Poltavagas").
3. $NCV_{NG,y,i}$	Low	Records are provided by the gas supplier on a monthly basis
7. $LC_{y,i}$	< 75 kg (Low)	The mechanical scale used to weigh limestone is: 5044ES150 DS24V, plant number 866/1118. 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. The recent calibrations were conducted on 01.12.2009, 01.06.2010, 19.09.2010. The recent test calibrations were implemented on 01.06.2010, 03.08.2010 and 29.09.2010. The calibrations are done by Scales Calibration Road Inspection RPZF.
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. $FC_{Coal,y,i}$		Coal is weighed using mechanical carriage scales: 5044ES150 DS24V, plant number 866/1118. The scale has a carrying capacity of 150 t. State calibration is performed once every 6 months. Test calibration is performed once every two months. The results of state calibrations, reviews and checks are put into the technical passport of the scale. The recent calibrations were conducted on 01.06.2010, 01.12.2009, 19.09.2010. The recent test calibrations were implemented on 01.06.2010, 03.08.2010 and 29.09.2010. The calibrations are done by Scales Calibration Road Inspection RPZF.
6. $NCV_{Coal,y,i}$		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. Calibration is undertaken by plant specialists once a year. Check is undertaken by Kremenchuk branch of SE "Poltava Regional Center of Standardization, Metrology and Certification" once a year. Sugar is put into the bags with help of weigh hopper – SVEDA LTD. Calibration is undertaken by plant specialists once a year. Check is undertaken by Kremenchuk branch of SE "Poltava Regional Center of Standardization, Metrology and Certification" once a year.
13. $SPB_{y,i}$	Low	Sugar content in sugar beets is measured by semi-automatic line ULS-1. The calibrations and checks are undertaken by SE "Poltavastandartmetrologiya" once a year. Uncertainty level - +/-0.2%. Sugar content is measured by cold digestion method.

Veselopodilskiy QA/QC Procedures

Table 18: QA/QC Procedures for Veselopodilskiy Plant

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)	Accounting of natural gas used for the production process is done by the measuring-management meter "FLOLUTEC-TM-VR-1" inventory number 05302000679. Main functions of the device are: measuring of data on a momentary, hourly, daily and monthly gas consumption basis, contingency and emergency situations, printout of reports (upon request of user), exchange of information with PC by radio channel using a mobile connection. State calibration is conducted not less than once every two years. Test calibration is conducted periodically before and during gas consumption season (September -March). Calibrations are conducted by representatives of gas supplier (JSC "Kremenchukgas"). The most recent calibration was conducted in August of 2008.
3. $NCV_{NG,y,i}$	Low	Records are provided by the gas supplier on a monthly basis
7. $LC_{y,i}$	2% (Low)	Limestone is weighed using mechanical track scales (model VO-2002) with a carrying capacity of 150 tonnes. Inventory number of the scales is 05302000743. The scales belong to the railway station Veselopodilskiy of Southern Railway. State calibration is performed once every six months; test calibration is conducted once every two months. Tests are conducted with the use of exemplary weights of the fourth grade with a total mass of 80 tonnes. Results of state and test calibrations are recorded in the scale's technical passport. Calibrations are conducted by Kremenchuk branch of State Enterprise "Poltavastandartmetrologiya". The most recent calibration was conducted in August of 2008.
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. $FC_{Coal,y,i}$	2% (Low)	Weighting of railroad cars with coal is done with the use of mechanical track scales (model VO-2002) inventory number 05302000743 with carrying capacity of 150 tonnes. These scales belong to the railway station. Veselopodilskiy of Southern railway. State calibration is conducted once every six months; test calibration is conducted once every two months. Tests are conducted with the use of exemplary weights of the fourth grade with a total mass of 80 tonnes. Results of state and test calibrations are recorded in the scale's technical passport. Calibrations are conducted by Kremenchuk branch of State Enterprise "Poltavastandartmetrologiya". The most recent calibration was conducted in August of 2008.
6. $NCV_{Coal,y,i}$		This data is provided by the coal supplier with every shipment.

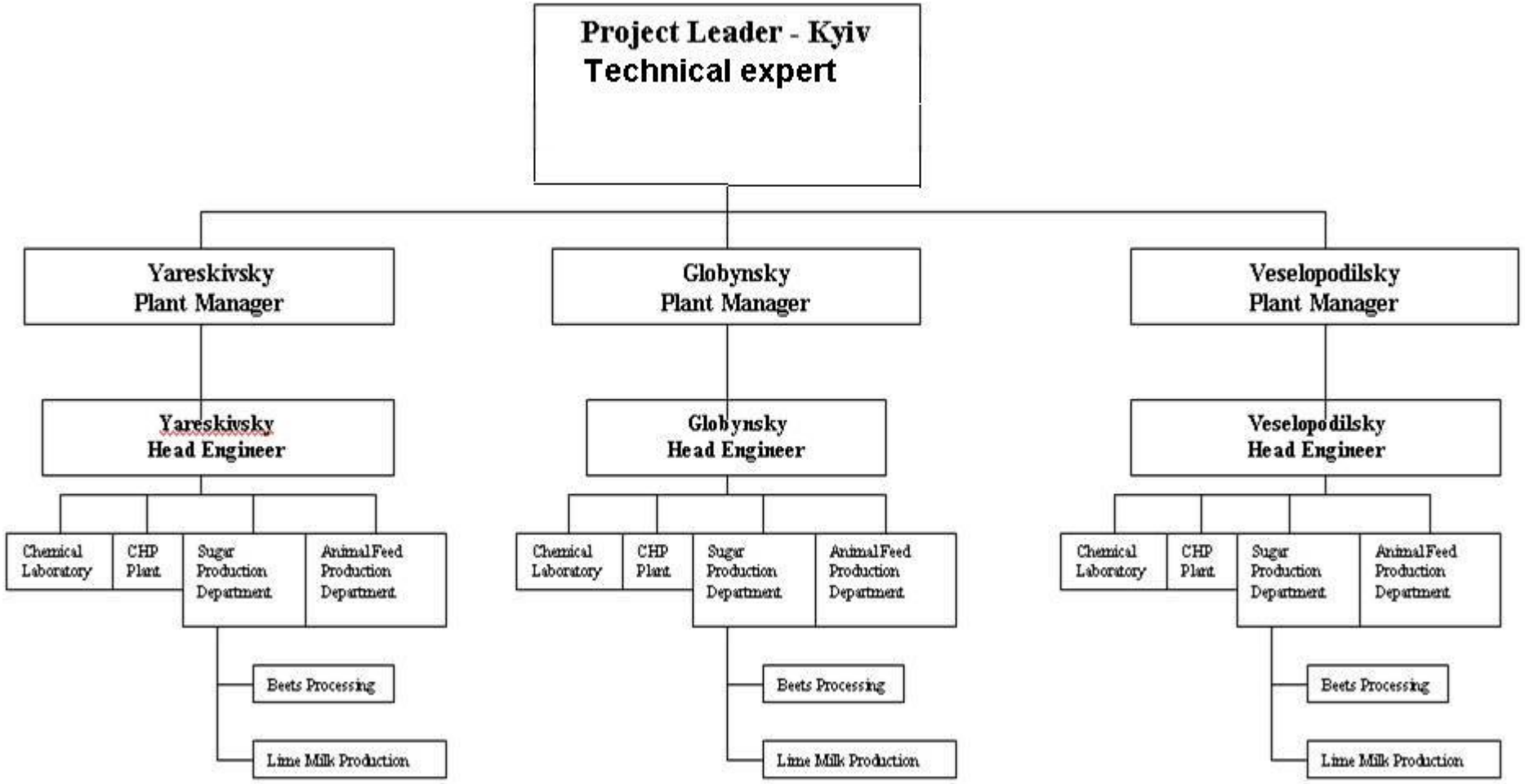
12. $SP_{y,i}$	Low	Sugar is put into the bags with help of weigh hopper DVS-301. Uncertainty level - 0.25%. Calibration is undertaken by plant specialists once a year. State check is undertaken by Kremenchuk branch of SE «Poltava Regional Scientific-Technical Center of Standardization, Metrology and Certification».
13. $SPB_{y,i}$	Low	Sugar content in sugar beets is measured by semi-automatic line ULS-1. The calibrations and checks are undertaken by SE «Poltava regional state –technical center of standardization, metrology and certification» once a year. Uncertainty level - 0.25%.

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.

Tsukrovyk has confirmed that the management of the JI project will be led through the head office in Kyiv. The head office will coordinate with Yareskivskiy, Globinsky and Veselopodilskiy to ensure that proper monitoring and documentation retention is completed for the JI project. 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.

Figure 17. Organizational chart of the management structure in the company for the JI project



The information on such key parameters as natural gas, coal, limestone consumption, net calorific value of natural gas, produced sugar and sugar content is gathered once a day during one hour by the relevant specialists (Head of CHP Plant, Chief Technologist, Chief Engineer, Head of Packing Room, Head of Raw Laboratory). The values of net calorific value of coal are gathered once a decade as well as the values of percentage of $MgCO_3$ and $CaCO_3$ in raw are recorded after each batch. The data is recorded into the Beets Processing Decade Report. On the base of this data the monthly and annual reports are developed. These reports are archived at the Accountant Office or by Chief Technologist or Chief Engineer. The monitoring data is transferred to the Sugar Department of "Astarta-Kyiv". Sugar Department of "Astarta-Kyiv" provides the data to JI project developer "GreenStream".

Moreover, Yareskivskiy and Globinskiy sugar plants implemented and certified Quality Management System by DSTU ISO 9001 in accordance with Ukrainian procedure UkrSEPRO. The Quality Management System assists to optimize the management of the plants.

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

This monitoring plan is set by the PDD developer, GreenStream Network, 15/06/2012, 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, Tsukrovyk'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, Tsukrovyk intends to increase the volumes of the processed sugar beets. The expected volume of beet produced at Tsukrovyk agriculture is provided in Table 1.

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.

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.

E.1. Estimated project emissions:

Table 19: Project Emissions[50]

Year	Estimate of Annual Project Emissions (tonne CO_2e)
2008	104,473
2009	83,109
2010	88,023
2011	87,150
2012	86,238
2013	86,238
2014	86,238
2015	86,238
2016	86,238
2017	86,238

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 20: The Sum of Project Emissions and Leakage [50]

Year	Estimate of Annual Project Emissions (tonne CO2e)
2008	104,473
2009	83,109
2010	88,023
2011	87,150
2012	86,238
2013	86,238
2014	86,238
2015	86,238
2016	86,238
2017	86,238

E.4. Estimated baseline emissions:

Table 21: Baseline Emissions[50]

Year	Estimate of Annual Baseline Emissions (tonne CO_2e)
2008	140,794
2009	120,541
2010	134,005
2011	137,484
2012	138,415
2013	138,415
2014	138,415
2015	138,415
2016	138,415
2017	138,415

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 48,313 t CO_2e/a.

Table 22: Emission Reductions from the Project[50]

Length of the crediting period:	10 years
Year	Estimate of annual of emission reductions, tonnes of CO_2-equivalent
2008	36,321
2009	37,432
2010	45,982

2011	50,334
2012	52,177
2013	52,177
2014	52,177
2015	52,177
2016	52,177
2017	52,177
Total estimated amount of emission reductions over the crediting period (tonnes of CO_2-equivalent)	483,313
Annual average emission reductions over the crediting period (tonnes of CO_2-equivalent)	48,313

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

Table 23: Summary of values - Kyoto Crediting Period[50]

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	104,473	0	140,794	36,321
2009	83,109	0	120,541	37,432
2010	88,023	0	134,005	45,982
2011	87,150	0	137,484	50,334
2012	86,238	0	138,415	52,177
Total (tonnes of CO_2 equivalent)	448,993	0	671,239	222,246

Table 24: Summary of values - Post Kyoto Crediting Period[50]

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	86,238	0	138,415	52,177
2014	86,238	0	138,415	52,177
2015	86,238	0	138,415	52,177
2016	86,238	0	138,415	52,177
2017	86,238	0	138,415	52,177

Total (tonnes of CO_2 equivalent)	431,190	0	692,075	260,885

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[58].
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 Tsukrovyk's Sugar Plants

Air pollution is a major environmental concern of the Ukraine's sugar industry including Tsukrovyk. The national legislation has established maximum permissible emission standards for the following air pollutants being emitted by sugar plants: nitrogen dioxide, carbonic oxide, sulfurous anhydride, ammonia, sugar dust, 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.

Yareskivskiy sugar plants obtained Air Emissions Permits № 5325786001-4 valid since 27.08.2009 till 27.08.2014 from the Poltava Regional Environmental Protection Department. Globinskiy sugar plant obtained Air Emissions Permits № 5320610100-20 valid since 28.08.2009 till 27.08.2014 from the Poltava Regional Environmental Protection Department.

In compliance with the national legislation and regulation, sugar plants collect and record data on air pollution emissions on a regular basis. In addition, national certified organizations with specialized

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

laboratories take test measurements of air pollution usually once a year during beets processing season when plants operate at their full capacity.

Test measurements at the Veselopodilskiy plant are taken by the certified organization "TeploEcoNaladka", city of Poltava, at the Globinsky and the Yareskivskiy plants – by the certified organization "PromEcoService", city of Poltava. Results of test measurements are recorded in the reports on emission standards compliance issued by the organizations mentioned above. The most recent reports available at the Globinsky (2006-2008), Yareskivskiy (2000-2008) and Veselopodilskiy plants (2004-2007) confirm that actual air pollution emissions at the plants are within the standards.

The shortest distances between the Tsukrovyk's plants and the state border between Ukraine and Russia are: 180 kilometers (Yareskivskiy plant) and 270 kilometers (Globinsky and Veselopodilskiy plants). The plants do not have negative transboundary pollution impacts on the territory of Russia and other of neighbouring foreign countries.

Water Management at the Tsukrovyk'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 the Poltava 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. All Tsukrovyk's plants have valid Water Usage Permits. 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 region subordinated to the Ukraine's Ministry of Environmental Protection as well as the Poltava Regional Department of Water Resources under the Ukraine's Water Management Committee.
Yareskivskiy sugar plant obtained Water Use Permits № 4001 valid since 25.09.2009 till 02.03.2012.
Globinskiy sugar plant obtained Water Use Permit № 4002 valid since 28.09.2009 till 01.01.2012.

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 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 Regional Environmental Protection Department which take into account inspections 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 Tsukrovyk'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 Poltava Regional Environmental Protection Department for review and approval. In case of approval, the Department issues Permit for Waste Generation and Disposal. All Yareskivskiy plant and Globinskiy plants have valid Permits (Permit № 21030 valid since 01.01.2012 till 31.12.2012, Globinskiy plant- Permit № 03013 valid since 01.01.2012 till 31.12.2012) as well as agreements with companies involved in waste utilization. Particular attention is paid to hazardous wastes and their recycling. The 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 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 certificate is mandatory for plant's continuing operation. Annual Report on wastes generation and disposal is submitted to the Poltava Regional Environmental Protection Department and State Statistics Committee in Poltava 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:

In compliance with the Ukraine's Law on Ecological Expert Assessment #46/95 of 09.02.1995, all investment projects which include a new construction and rehabilitation of existing enterprises are subject to the state ecological expert assessment. Thus the environmental impact assessment documents were prepared for the projects being implemented at the Yareskivskiy and the Globinsky plants. The document entitled "Environmental impact assessment of rehabilitation of beet processing department in the main building and the station for deep pulp presses at the Yareskivskiy sugar plant" was commissioned by the plant and prepared by the licensed design company "Proektbudmontazh", Kharkiv in 2007. The document contains analysis of the project impacts on water bodies and soil as well as the project's noise characteristic. It provides evidence that the project is in compliance with the national environmental legislation and regulations including the laws "On Protection of the Environment", "On Ecological Expert Assessment", the Ukraine's Water Code and the Ukraine's Land Code as well as the established sanitary norms for local settlements. The EIA of the project "Rehabilitation of the existing facilities to install three pulp presses and equipment for cargo handling and lifting machinery P-10 at the Globinsky plant's site" was commissioned by the plant and completed by the licensed design company "Proektbudmontazh", Kharkiv as a part of the design project documents prepared by the Ukrainian design and research institute "Ukrtsukroproekt" under the Ministry of Agrarian Policy of Ukraine in 2009. The expert examination of the EIA documents was implemented by the state organization Poltavukrinvestexpertiza with participation of the Poltava sanitary-epidemiological agency. The expert conclusion on the EIA documents was approved by the Poltava Regional Department of Environmental Protection. The projects do not have negative transboundary pollution impacts on the territory of neighboring foreign countries.

SECTION G. Stakeholders' comments

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

Due to the nature of the modernization measures being implemented at the plants, public consultations are not required by Ukraine's national legislation and, therefore, have not been conducted. Information about Modernization program planned at the plants and the intentions to obtain permits relating to air pollution emissions from the State regional departments of the Ministry of ecology and natural resources were published in local newspapers.

Modernization measures implemented at Globinsky and Veselopodilskiy plants in 2007-2008 didn't undergo approval process by local authorities. Modernization measures implemented at Yareskivskiy plant were reviewed and approved by Yareskivskiy Village Council and Regional Administration.

Annex 1

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Annex 2

BASELINE INFORMATION

Please refer to Section B.

Annex 3

MONITORING PLAN

Please refer to Section D.