JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
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SECTION A. General description of the project

A.1. Title of the project:

Conduction of the complex technical and technological modernization of an enterprise which is aimed at the reduction of energy consumption and the implementation of the utilization system of organic waste from sugar production on PJSC «Rise-Maksymko»

№3: Energy demand
№13: Waste handling and disposal

Version 05

Data: 20/03/2012

A.2. Description of the project:

The main goal of the Joint Implementation project «Conduction of the complex technical and technological modernization of an enterprise which is aimed at the reduction of energy consumption and the implementation of the utilization system of organic waste from sugar production on PJSC «Rise-Maksymko»» is the implementation of the programme of complex technical and technological modernization of four sugar plants exploited by PJSC «Rise-Maksymko», the implementation of the utilization system of secondary products of sugar production, which includes both technical and organizational measures.

The proposed project is aimed at the emission reduction of:

(1) Carbon dioxide from natural gas combustion
(2) Carbon dioxide from coal combustion
(3) Carbon dioxide due to electric power consumption from Ukrainian power system
(4) Limestone decomposition while calcination
(5) Methane due to pulp decomposition in landfills of PJSC «Rise-Maksymko» in baseline scenario.

In general, project is aimed at the reduction of antropogenic emission due to reduction of energy demand for plants' operation, implementation of measures that lead to reduction of limestone decomposition necessity by improvement of juice purity and implementation of measures that lead to elimination of necessity of pulp transportation to landfills due to adaptation of pulp pressing, drying and granulating systems.

The situation at the moment of the project initiation

There are four sugar plants exploited by PJSC «Rise-Maksymko»:

1. Chervonozavodska branch of PJSC "Rise-Maksymko" (**hereinafter - Lokhvytskiy sugar plant**);
2. Kremenetska branch of PJSC "Rise-Maksymko" (**hereinafter - Kremenetskiy sugar plant**);
3. Agricaltural enterprise "Niva" Ltd. (**hereinafter - Dubenskiy sugar plant**);
4. "Zolochivtsukor" Ltd. (**hereinafter - Zolochivskiy sugar plant**).

Each plant uses heat and electric power that are generated at the object on Combined Heat and Power (CHP) and purchased electric power. CHP provides the plants with heat and electric power necessary for sugar production process. Before project initiation plants were operating using the technologies existing in Ukraine now. These technologies allow sugar production with average performance indicators and correspond with common practice in Ukraine.

Pulp is the secondary product of sugar production. Existing systems of pulp processing allow only the production of damp pulp humidity of which is higher than 80%. It does not allow the transportation of pulp for long distances that makes difficult it’s saling to distanced agricultural enterprises. That is why beneficial use of only a small part of pulp produced for own demand by plants of PJSC “Rise-Maksymko” is possible. The main part of pulp produced at all plants passes the storage period in beet silos and than is transferred to the landfills belonging to PJSC “Rise-Maksymko”. There the landfill gas evolves due to putrefaction. The landfill gas contains methane that is greenhouse gas.

Baseline scenario foresees the continuation of existing equipment exploitation in the same conditions as it was before the project implementation and the practice of pulp processing as it was before the project will also continue. The equipment used before the project implementation can operate for the whole crediting period in case of regular maintenance activities. Pulp processing does not directly affect on sugar production. Considering the mentioned above, the plants can be operational in the absence of the proposed scheme of investment during the crediting period. More extensive information on the baseline setting is provided in the section B.

Project scenario

As it was mentioned above, project scenario is aimed at saving/reduction of natural gas, coal, electricity and limestone demand, elimination of necessity of pulp transportation to landfills and reduction of consumption of refining agent on the basis of limestone which is necessary for sugar production. Saving of electricity and heat directly corresponds with decrease of fuel consumption demand of CHP facilities and reduction of purchased electricity amount. Maximization of efficiency of energy resources using through the optimization of heat systems on the plants will allow to reduce fuel consumption on CHP. Emission reduction of greenhouse gases (GHG) appear also as the result of elimination of necessity of pulp transportation to landfiils due to implementation of deeper pressing, drying and granulating systems.

Implementation of biogas facilities that use pulp as fuel is planned on the plants. This measure is aimed at pulp utilization as well as plants’ energy efficiency increasing. Biogas production using pulp will allow to abandon pulp transportation to landfills regardless of demand on it. Further using of biogas for electricity and heat production will allow to reduce plants’ demand in electricity and fuel. In its turn, it will lead to greenhouse gases emission reduction.

Besides, increased purity of diffusion juice will lead to decreasing of demand in purification through lime milk using (lime milk stands for products of calcination process (limestone) and water that create milky-like liquid). Reduction of lime milk consumption for sugar production will allow to reduce coal and limestone consumption for production of refining agent on the plants.

In addition, implementation of several less significant measures is planned. Among them are heat insulation improvement, implementation of frequency transformers, adoption of preliminary heating of diffusion juice through consumption of less energy-intensive resources, reconstruction and automation of CHP stations. More detailed information on measures under the project scenario is provided in section A.4.2.

Project history

From 2000 plants that are included into the Project and PJSC “Rise-Maksymko” have been developing its energy efficiency programmes. This voluntary programs are aimed at the increasing of sugar plants efficiency through implementation of technologies that are in line with the best existing methods of raw materials and pulp processing. Possibility of investment receiving through emission reduction units (ERUs) selling was always one of the key factors for sugar plants of PJSC “Rise-Maksymko” and the management of company considered it from the beginning of the project.

For Project initiation in accordance with Order №76 dated 01/09/2000 workgroup for reducing power consumption and utilization of organic waste, which appeared as a result of sugar production, was established at Dubenskiy sugar plant. Within the duties of this group are the consideration of possibility and provision of receiving of additional investments from Kyoto Protocol mechanism. This workgroup has participated as the coordinator of implementation of this project on Dubenskiy, Kremenetskiy and Zolochivskiy sugar plants This date is considered to be the date of project recognition as JI project.

Later, the similar groups were established on the other sugar plants included in project

From 2010 management of PJSC "Rise-Maksymko" decided to include all four plants into one project. For management and coordination of actions for project implementation by issuance of Order #315/1 dated 14/12/2010 the workgroup containing of the production personnel of PJSC "Rise-Maksymko" was created.

A.3. Project participants:

Party involved	Legal entity	Please indicate if the Party involved wishesto be considered as project participant (Yes/No)
Ukraine (Host Party)	PJSC "Rise-Maxymko"	No
The Netherlands	Ohana LLP	No

PJSC «Rise-Maksymko» is vertically integrated agricultural company, the main area of activities of which is sugar production, production of cereal seeds, marketable grains of corn, millet, white beets and cattle breeding products. There are four sugar plants included in the project exploited by the company: Zolochivskiy sugar plant, Kremenetskiy sugar plant, Dubenskiy sugar plant, Lokhvytskiy sugar plant. Besides, company exploits agricultural farms-filiations that till approximately 176 thousand ha of the ground in Vinnytsia, Zaporizhzhia, Zhytomyr, Kirovograd, Rivne, Poltava, Sumy, Khmelnytskiy, Ternopil, Cherkassy and Mykolaiv regions.

Zolochivskiy sugar plant

Zolochivskiy sugar plant was built in 1961. As for the history of the project, the target of sugar plant building in Lviv region was developed on the basis of resolution of Cabinet of Ministers of the USSR dated 09/02/1956 and order of the Minister of Industry of Food Products of the USSR dated 21/02/1956 #114.

It was foreseen the building of the plant with productivity of 25 thousand quintals of beets per day, containing separation workshop and pulp drying facility.

Industrial area of the plant is located on the lands of the village Yasenivtsi of Zolochiv district, Lviv region on the area of 15 ha at a distance of 1.2 km west of the station Zolochiv-Lviv.

Dubenskiy sugar plant

The company is located in Dubno, Rivenskiy region. It was built in 1960, in the years 1974-1979 workshops were fully reconstructed, making it possible to increase the daily processing of raw materials from 2.5 to 4.5 thousand tonnes. During this period, it was replaced outdated equipment with newer, progressive ones, it was built a new limestone branch with two furnaces, grocery shop, sugar drying, beet processing plant was reconstructed, juice cleaning department, TPP.

Raw zones of the plant are located in Dubno, Radyvyliv, Mlyniv, Demydivs'kyy, Zdolbunivska, Rivne District of the Rivne region, Brody district of the Lviv region, where the stationary beet collection points are located.

Main product range of the Dubenskiy sugar plant: sugar, molasses (molasses), fresh pulp, dry pulp, granulated pulp, lime. The plant's production meets the requirements of the international standard ISO - 9001 - quality management system.

In 1982 the plant has mastered the scheme of the raw sugar processing. With particular intensity the works on reconstruction, technical modernization of the plant were carried out from 1987 to 1998. During this time the capacity increasing was about in 500 tonnes and reached 5 thousand tonnes of beets per day. In this period a significant progress took place not only in manufacturing but also in the social development of the microdistrict. It was constructed a new juice cleaning plant and installed a new tract of raw material supply, introduced other advances in science and technology.

Kremenetskiy sugar plant

The company is located in the Kremenets town, Ternopil region. Construction of the Kremenetskiy sugar plant was started in autumn 1962.

November 3, 1965 the plant launching was held. In the first season 100 thousand tonnes of beets were processed and 8,1 thousand tonnes of sugar were produced.

In the season 1970-71 it were processed 547 thousand tonnes of beets and produced 67,273 tonnes of sugar.

In 1985 the group celebrated the 20th anniversary of the plant launching. During this period, it were processed almost 10 million tonnes of raw materials and produced 1 million 146 thousand tonnes of sugar.

It was built on a complete-import equipment of the English firm "Vikkers-Bukers." In 1982 twice received the red flag of the USSR Ministry of Food Industry and sectoral trade unions for the championship in the All-Union competition, had been cleared in September and November.

Lokhvytskiy sugar plant

Lokhvytskiy sugar plant was built in 1929 with a design production capacity of 2 tonnes of beets processing per day. The main technological and energy equipment for the plant was completely delivered by the Czech-German company "Erste-Bryuner."

In pre-war years by the technical reconstruction the plant power was brought up to 3.6 thousand tonnes of processed beets per day. During the war part of the most valuable equipment was dismantled and taken out of the occupied zone. The main building of the factory, railway station, steam boiler, water duck, some residential buildings were destroyed by the German army.

Its first postwar production season plant began in November 1945. Further by the reconstruction and technical upgrading production capacity was brought gradually to 9350 tonnes of beet processing per day.

At the plant is used a typical technological scheme of sugar production with continuous beet chips sugar removal, pulp pressing and return of all pulp pressing water to the diffusion installation.

“MT-Invest” is the first specialized operator on the Ukrainian M&A (mergers and acquisitions) market. The company provides the following services: purchase and sale of business, investors or strategic partners search, investment consulting and financial consulting, maintenance of investment projects and agreements. Making the M&A market more transparent, civilized and comprehensible to investors, the company effectively meets its main goals – increasing market capitalization of the clients of “MT-Invest”.

A.4. Technical description of the project:

A.4.1. Location of the project:

Project is implemented on equipment and objects of Zolochivskiy sugar plant, Kremenetskiy sugar plant, Dubenskiy sugar plant and Lokhvytskiy sugar plant that are exploited by PJSC «Rise-Maksymko».

A.4.1.1. Host Party(ies):

Ukraine.

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

Zolochivskiy sugar plant - Lviv region
Dubenskiy sugar plant - Rivne region
Kremenetskiy sugar plant - Ternopil region
Lokhvytskiy sugar plant - Poltava region

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

Zolochivskiy sugar plant – Yasenivtsi village
Dubenskiy sugar plant – Dubno town
Kremenetskiy sugar plant – Kremenets town
Lokhvytskiy sugar plant – Chervonozavodske town

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

● - Yasenivtsi ● - Dubno ● - Kremenets ● - Chervonozavodske

Fig. A.1 The location of plants included in the Project on the map of Ukraine

Yasenivtsi village was found in 1473 and the population of it numbers 1 611. The area of the village is 2,95 km². Geographical coordinates of the plant are as follows: northern latitude: 49°48′9.07″, eastern longitude: 24°50′46.72. The village is situated in Zolochiv district in Lviv region. Zolochiv district is famous for its history, crafts, especially for pottery.

Dubno is the town of regional subordinance in Ukraine, the center of Dubno district in Rivne region. Population of it numbers 39 146 (as for enumeration in 2001). The area of the town is 27 km². Geographical coordinates of plant are as follows: northern latitude: 50°23′35.38″, eastern longitude: 25°44′6.58″. The city is known from 1100. The routes E40 and E85 of European significance crosses the town.

Kremenets is the town of district subordinance, the center of the district, economical and cultural center of the northern (Volhynian) part of Ternopil region. The town is situated near the Kremenets mountains. The distance from the center of the region is 70 km. Population of it numbers 23,3 thousand of persons (as for 2004). The area of the town is 31 km². Geographical coordinates of the plant are as follows: northern latitude: 50°6′4.29″, eastern longitude: 25°44′12.99″.

The town of Chervonozavodske was founded in 1928 because of the building of sugar works. Population of it numbers 9 024 (as for 2001). The area of the town is 12,34 km². Geographical coordinates of the plant are as follows: northern latitude: 50°24′7.74″, eastern longitude: 33°22′35.49″. The town is situated on the north of Poltava region, on the interfluves of Sula and Artopolot rivers, in forest-steppe zone of Ukraine, in the distance of 160 km from the city of Poltava and 12 km from the town of Lokhvitsa. Food industry is well developed in this town

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

PJSC «Rise-Maksymko» exploits four sugar plants: Zolochivskiy Sugar Plant, Dubenskiy Sugar Plant, Kremenetskiy Sugar Plant, Lokhvytskiy Sugar Plant.

Taking into account the fact that sugar plants are located in localities among residential areas, the company has always paid close attention to the reduction of factors that negatively affect the environment. In order to reduce the amount of pollutants which come into the atmosphere from the plant, the management of PJSC «Rise-Maksymko» begins the gradual introduction of a new economic and energy saving equipment, new technologies in sugar production.

Late 90th - early 2000 found out to be the most difficult period for sugar producers in Ukraine. The collapse of collective and state farms, privatization of the alcohol producers market, reduction of livestock – all these problems severely influenced the pulp sale by the enterprises of the sugar industry. Signing the agreements with the new owners of farms, the introduction of new methods of utilization and processing of pulp, implementation of biogas producing facilities became the priority. Investments in the system of pulp processing, the introduction of new management solutions in dealing with farmers and other buyers as well as implementation of biogas and bioethanol producing facilities will solve the problem of pulp in enterprises fully and will become a significant contribution of this project to the reduction of greenhouse gases emission on the planet.

However, implementation of program of measures similar to the scope of the program presented in the given project was impossible due to its financial unattractiveness (payback period was more than 20 years, and some measures were not paid back at all), risks associated with its implementation (the overall effect of implementation of measures for the effectiveness of the whole process could be wiped out in the case of partial implementation of the program, or by errors during its implementation), an unstable economic and political situation in Ukraine.

Taking into account all mentioned above, the company’s management concluded the expediency of the implementation of the program aimed at reducing energy consumption and the specific formation of pulp as a result of sugar production and the implementation of utilization of all amount of pulp only in 2004, when, after ratifying the Kyoto Protocol by the international community, the prospect of a partial compensation of project costs according to the Kyoto Protocol appeared.

Productive capacities of sugar plants are maintained by three types of energy resources, that are/were purchased from external suppliers:

- Electric power
- Natural gas
- Coal

Limestone is also used in sugar production. The calcination of limestone leads to emissions of carbon dioxide.

The objectives of sugar plants reconstruction in the framework of the Project:

Sugar plant	**Objectives of reconstruction**	
	Reduction of energy resources consumption	**Pulp utilization**
Zolochivskiy sugar plant	☐ **Yes** ☒ **No**	☒ **Yes** ☐ **No**
Dubenskiy sugar plant	☒ **Yes** ☐ **No**	☒ **Yes** ☐ **No**
Kremenetskiy sugar plant	☒ **Yes** ☐ **No**	☒ **Yes** ☐ **No**
Lokhvytskiy sugar plant	☐ **Yes** ☒ **No**	☒ **Yes** ☐ **No**

In general, technological processes of sugar production is shown on Figure A.2 below:

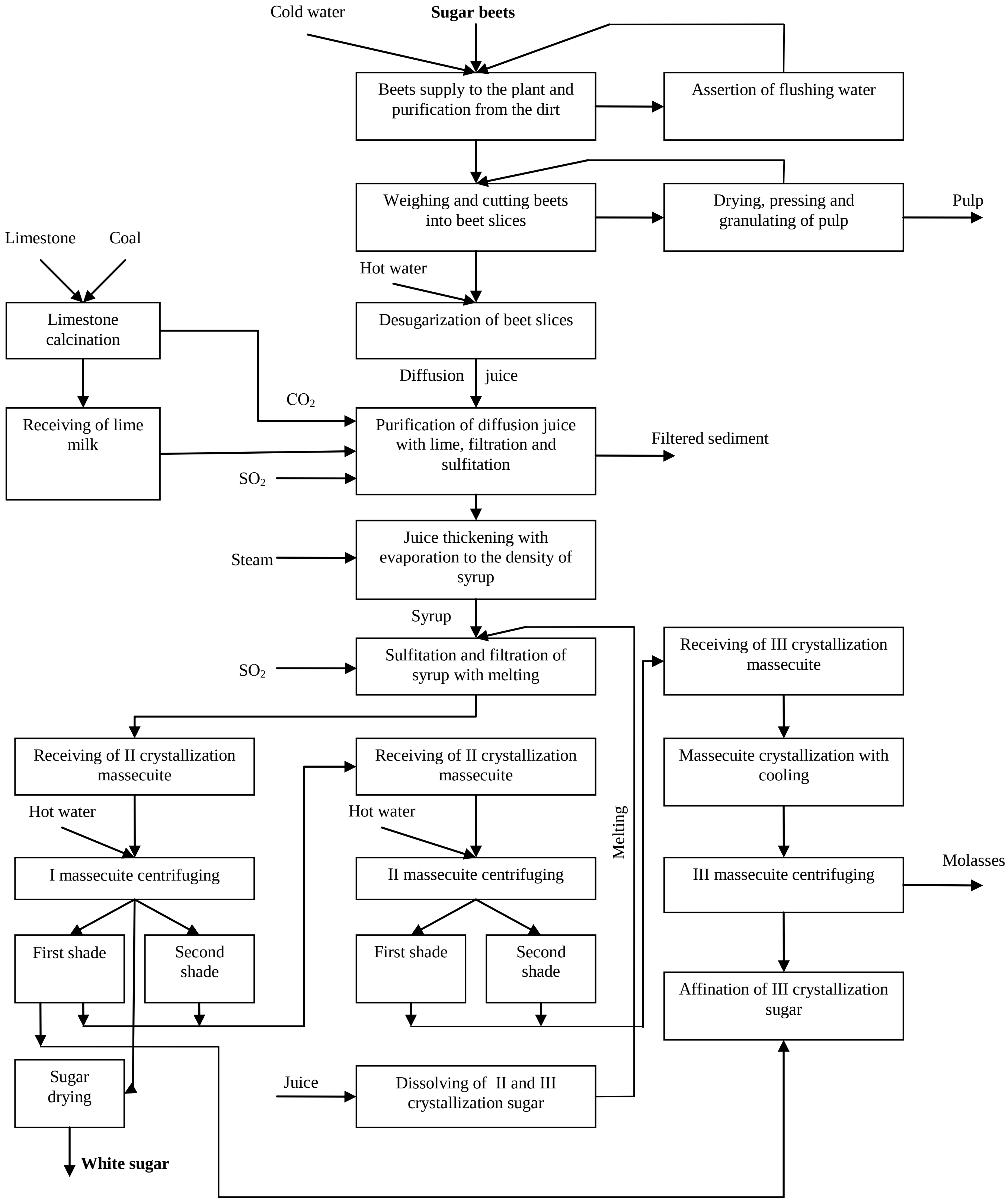

Fig. A.2. Technological scheme of sugar production

Description of technological processes on sugar plants included in the project as per 2011 is provided below:

Zolochivskiy sugar plant

Technological scheme of sugar production with continuous sugar removal from beet chips, pressing of pulp and three-producing scheme of massecuite boiling is used on the plant.

The main amount of beets that entries to the plant are unloaded on beet pile field by beet pilers KF-2 (2 units) and facilities BUM (Complex-65).

There are two floatable platforms and railway beet platform for vagon's unloading on the beet pile field.

Beets are transported to the plant from beet pile field, from beet or floatable platform through terrestrial hydrotransporter.

Purification of raw materials from light or heavy pollutants and washing is performed by straw and tops screens, stone screens, water screens beet washer, beet rinser, belt-type conveyor, beet rootlet screen and wastes removal.

Beets washed and purified from wastes are transferred through belt transporter into bunker near beet cutters. Corrugated slices are received through beet-slicers STs2B-12 (4 units). Sugar removal from beet slices is made in the inclined diffusion apparatus DC-12.

Purification of diffusion juice is performed through the scheme with "Brugel-Muler" predefecator, on the output of which lime milk is delivered for juices purification. After cold defecator juice is delivered to hot defecator and I saturation boiler. 30-50% of juice goes back to predefecator. After filtration juice is processed in II saturation boiler. Saturation process goes in airlift-type boilers.

In filtration chamber decanting tanks "Dorra", disc and vacuum filters BOU-40 are used.

For juice overcrowding five-bottom vapor facility with concentrator is used. General heating surface of evaporation station is 9430 m2.

Crystallization of sugar is carried out in vacuum apparatus with a capacity of 40 and 60 tonnes of the massecuite

For crystallization of massecuite of last crystallization vertical crystallizer is used.

Massecuite separation of the I crystallization on the crystalline mass and outflows is carried out on periodically operating centrifuges FPN-1251L (7 units). II and III crystallization massecuite and afination massecuite are fuged on centrifuges of continuous action FkNo (5 units).

Drying and cooling of the produced sugar is held in drying-cooling facility (Poland).

Part of the pulp, squeezed to content of 15 - 17% solids, is dried in dry pulp drums (productivity is equal to 60 tonnes per hour and 100 tonnes per hour of dry pulp) and is granulated on granulating machines produced by company "Grantex". The remaining pulp with the help of pulp removal gallery conveyor goes into the open pulp repositories.

The process of limestone combustion is conducted in two lime-heating furnaces.

Useful capacity of the furnaces respectively contains: furnace № 1 - 90 m^3; furnace № - 120 m^3;

The plant is provided with pair and electric power by its own CHP, where three boilers are installed: two boilers with capacity of 50 tonnes of steam per hour, one boiler with capacity of 35 tonnes of steam per hour, steam pressure of 4 MPa.

One turbogenerator with capacity of 6 MW is used for electric power generation on CHP.

The main type of fuel, used on CHPs, is gas.

Fuel oil is not used.

Dubenskiy Sugar Plant

Beets are transported from beet pile field, beet platform through hydrotransporter to the beet hydraulic pumping station, from which beets are transported by beet pumps US-3 to the upper hydrotrnsporter. Tops and straw are removed on tops screens stones are removed on stone screens. Beets are transferred to washing chamber where beets are washed, rinsed, chlorated with water solution and are transferred by beet elevators into bunker near beet cutters. Beet slicers are used for cuts washing.

After beet cutters slices are held to the diffusion plants where process of extraction of slices takes place. The relevant technological mode is maintained. After diffusion juice is delivered into the pulp screen, pulp goes back to diffusion, pulp goes to presses.

Diffusion juice than goes to collector and is transferred by pumps through cavitating device and heater with II saturation suspension to the horizontal apparatus of preliminary defecation of Brigel-Muler system where lime milk is added and relevant technological mode is maintained. From predefecator juice goes to cold defecator through overflowing box, to where the lime milk is delivered. From cold defecator juice is delivered to boiler of hot defecation through the heaters. From hot defecator defecated juice goes to the I saturation boiler, to where CO2 is supplied.

Unfiltered juice of I saturation is delivered through the heaters to filters MVZh-70.

Suspension after filters MVZh of I saturation is delivered on vacuum filters. Defecat is removed and transported from the plant to the filtration fields, while purified juice goes back to the collector of unfiltered juice of I saturation.

Filtered juice through heaters is supplied to defecator before II saturation and goes to II saturation boiler.

Unfiltered juice of II saturation is delivered to juice decanter and then is filtered on filters MVZh-70. Filtered juice is delivered on evaporation station and is boiling until the content of dry substances is 58-60%.

Sulfurated syrup is filtered on filters «BARIMEX» and delivered to product department for massecuite boiling.

I product massecuite is boiled from syrup and I product white molasses and is spined with hot on periodic centrifuges. As a result, white sugar, white and green molasses are achieved. White sugar is delivered into drying drum. Then sugar is delivered by belt-type transporter through the shaker of dry sugar to sugar bunkers, where it is weighed on automatic weights, sewed up into the polyethylene bags with insets and is delivered by belt-type transporter to sugar warehouse for storage.

II product sugar is boiled in vaccum devices from II product green molasses and I product green molasses. II product massecuite is sludged on centrifuge of continuous action. Achieved II product sugar melt is supplied on sulfitization. II product green molasses goes for boiling of III product massecuite.

III product massecuite is boiled from II product green molasses. III product massecuite is delivered to mixers-crystallizers. Massecuite cooled to 45 ^{o}C is sludged on centrifuges continuous action. Achieved III product sugar melt is supplied on sulfitization. III product molasses is weighed and pumped into molasses containers.

The steam and electric power are consumed by the plant from its own CHP.

Kremenetskiy Sugar Plant

Betts that are transported to beet point are anloaded by gross-placing machines into floatable platform. Then beets are transferred by hydrotransporter to beet pump USZ (2 units) of beet lifting station. Beet and water mixture is lifted by the pump on 18 meters overhead hydrotransporter, passes through the heavy pollutants screen RZ-PUB-6, three straw screens SBG-1060.

Flow is devided on two branches by turning gate. Each branch has the screen for heavy pollutants, grate for water removal, water catcher VDF-6, beet washer (England).

After beet washers beets are delivered into rinser where light pollutants are removed. Then beets are delivered through water catchers VDF-3 by belt conveyers to beet weights.

Weighed beet is supplied to bunker over beet slicers. Under the bunker there are 7 beet slicers SUB-12M, three for each defusion and one with switch for one of two lines. Beet slice is delivered to prescelder of each of two rotation facilities RDA by two parallel inclined transporters KL-1000.

After prescelder beet slices are delivered to scalder and then to headstock of diffusion facility gradually moving to the tailpiece through double-threaded auger with screens. Water heated to 72°C is delivered to the tailpiece of diffusion facility toward the beet slices. While moving to tailpiece of diffusion facility sugar is removed from the slices. Then through auger conveyors slices are delivered to pulp landle elevators TsG-700, which supply pulp to rate transporter TG-1200.

After rate transporter pulp is allocated on 10 pulp presses GH-2. Part of pulp is delivered to pulp drying chamber by belt conveyor PZh-100, the rest of pulp is transported by pulp gallery to the pulp silos. Diffusion juice from the headstock of the facility is supplied into the juice collector PSS. Part of circulatory juice is supplied into the scalder for scalding of slices. The other part is delivered through prescalder to four pulp screens PR25/30. Purified juice is delivered to raw juice collector and is supplied to cavitation device by pumps 8NDV and 10 NDV 630/90. The juice is supplied to Brigel-Muler predefecator and then goes to hot defecator. From there juice is transferred to heaters of raw juice PSS by pump 8NDV.

After the heaters juice is transferred to the I saturation facility. Saturated juice is delivered to filters FILS-100 (8 units). Filtered juice is delivered to II saturation facility. From decanting tanks juice is transferred to disc filters DF-80 of control filtration by pump 8NDV. After disc filters of control filtration filtered juice is delivered to heaters PSS by pump 10NDV, and then to juice collector before evaporation station.

Juice is delivered from collector to the first chamber of evaporation station by pump ASKM or 10 NDV. Evaporation station has four bottoms. After the third bottom of evaporation station juice is delivered to sugar melt from II and III product centrifuges. Then juice is filtered on disc filters DF-150 and then goes back to the IV bottom of evaporation station, where it is boiled until the content of dry substances will be 65-67% and delivered into the syrop boxes before vaccum facilities of I product by pump. In vacuum facilities of I product 92-94% of dry substances are achieved and then delivered to hangover mixes of I product massecuite. From mixers massecuite goes to the distributor before centrifuges ARO-1250 (for the present moment there are 4 centrifuges in operation).

Spined white sugar is delivered to sugar shaker and then through landle elevator to sugar drying drum (England), cooling drum (England). Cooled sugar is delivered through landle elevator (England) to reticulate grate and then through belt conveyor with which magnetic separators to automatic 250 kg weights (2 units – England). After weighing sugar is delivered for packing into the bags and is sent to sugar warehouse or is delivered by belt conveyor into lendle elevator up to the gallery over silos of sugar with volume of 20 thousand tonnes. White molasses of I product massecuite spinning used for final drinking while boiling of syrup in vacuum facilities of I product and depending on quality can be used for drinking while boiling in vacuum facilities of II product.

Green molasses is delivered by pump SOT-60 to boxes of II product and is boiled in vacuum facilities of II product. II product massecuite is spinned on centrifuges of II product II product yellow sugar is delivered to heat-exchange boiler for dissolution with juice of III bottom of evaporation station. Outflow of green molasses after II product spinning is made by pump SOT-60 to III product boxes. Then molasses is boiled in III product vacuum facilities. III product massecuite is delivered to crystallization mixes (England – 10 units), crystallizes and is delivered to III product centrifuges (Zengerhauzen – 3 units). Beet molasses after III product spinning is weighed and delivered to molasses vessels by pump P-6PPV.

After III product centrifuges yellow sugar is dissolved with II product green molasses and water and is supplied to affination centrifuges (Zengerhauzen – 3 units). Molasses outflow after affination is delivered for boiling in vacuum facilities of II product, while yellow sugar is delivered to heat-exchange boiler for dissolving with the juice of III bottom of evaporation station.

The steam and electric power are consumed by the plant from its own CHP.

Lokhvytskiy sugar plant

Technological scheme of sugar production with continuous beet chips sugar removal, pulp pressing and return of all pulp pressing water to the diffusion installation is used at the plant.

Sugar factory is equipped with the rotational diffusion plant RT-5 ETI of FCB (France) firm and deep streak pulp presses of the firm "Stord". This equipment allows a wide range of performance work with minimal cost of sugar in the pulp.

The plant uses a scheme of "hot" lime-carbon dioxide diffusion juice purification, three crystallization and III crystallization sugar afination.

Technological equipment at the plant is located in three buildings, connected by the transitional galleries. CHP is located in a separate production facility.

The bulk of the beets, which comes to the plant in railway wagons, is unloaded with the help of hydraulic monitor setting "Elfa". Part of the railway cars are unloaded through the bucket cranes with a beet capacity of 1920 tonnes.

At the enterprise an automobile beet equipment with the capacity of 2.56 tonnes of beets, loading of which is carried out by the piles putting or directly by the dump trucks, is used. Heavy vehicles are discharged at a floatable platforms.

Sugar beets dirtiness is defined while their acceptance on all base beet points on lines RYUPRO, sugar content is defined on lines LLC-1.

Beets are supplied to the plant by the upground hydraulic conveyor. Raw materials cleaning - from the light and heavy impurities and their washing is carried out on the two parallel lines, on which stone traps, beet traps, water separators, beet washing, beet rinses, conveyor belts, tail traps and other equipment for transporting clean beets, classification and waste disposal are established.

Beets washed and cleaned from the impurities get into the hopper before the beet cuttings. Shavings are obtained with the help of drum beet cuttings of the firm "Magen" (France).

Beet chips sugar removal is carried out in rotary diffusers machine RT-5ETI.

Diffusion juice cleaning is made by the scheme with hot progressive pre defecation and main hot defecation. I saturation process is carried out in two stages in the bubbling type saturators. To improve the quality of juice purification before II saturation I saturation filtered juice treatment with milk lime is carried out. Juice suspension of saturation II is returned to the previous defecation.

In the filtration branch tanks-dekantators, automatic filter -presses, cartridge filters for control filtering are used.

Five evaporator corps (two lines with the common fifth corps) serve for the juice concentration. The total surface of evaporating station heating is about 28 858 m2.

Crystallization of sugar is carried out in vacuum apparatus with a capacity of 50, 60 and 80 tonnes of the massecuite. For the massecuite boiling of the last crystallization vacuum apparatus with mechanical circulators are used.

Massecuite separation of the I crystallization on the crystalline mass and outflows is carried out on periodically operating centrifuges. II and III crystallization massecuite and afination massecuite are fuged on continuous centrifuges.

Drying and cooling of the produced sugar is held in many tubular drying-cooling facility of the company Thebes-Calle (France).

Part of the pulp, squeezed to content of 20 - 23% solids, is dried in dry pulp drums. The remaining pulp with the help of pulp removal gallery conveyor goes into the open pulp repository. In order to prevent wrung pulp damage in the pulp repository, in the end of pulp putting into the pit an extra water moisture is carried out.

The process of limestone combustion is conducted in four lime-heating furnaces. Useful capacity of the furnaces respectively contains: furnace № 1 and № 2 - 89 m; furnace №3 - 110 m^3; furnace №4 - 275 m^3.

The plant is provided with pair and electric power by its own CHP, where the five boilers are installed with capacity of 75 tonnes / hour, steam pressure of 4 MPa and two turbogenerators with capacity of 6 and 12 thousand kV. The main type of fuel, used on CHPs, is gas. Fuel oil is not used.

Brief description of actions implemented or planned within the project frameworks:

Zolochivskiy sugar plant

2003. Reconstruction of pulp drying section.

Before the reconstruction of pulp drying section and installation of granulators GT-500 (3 units) two grass granulators and brick pulp presses were operating. Productivity of productionline and pulp processing have increased and electricty consumption have decreased after the reconstruction.

2006. Pulp drying drum replacement.

Replacement of pulp drying drum, which productivity was 60 tonnes per hour for pulp drying drum with the productivity of 100 tonnes per hour. This measure allowed to increase the amount of dry pulp and to decrease the amount of damp pulp that is delivered to pulp silos.

2008.Implementation of pulp granulators “Grantex”.

Raw pulp with dry substances content of 18% is supplied to the pulp drying drum, where it is dryed until the dry substance content is 84% and then is granulated by press GT-500. Rolls depress pulp into the matrix and granules with diameter of 10 mm and length 10-20 mm are received.

Table A.1. Measures included into the framework of JI project implemented on Zolochivskiy sugar plant.

Year	*Modernization content*	***The achieved benefits***
2003	Pulp pellet GT-500 of the firm "Hranteks" establishing. 1 unit.	Electric power saving
2006	Drum for pulp drying replacement, drum for pulp drying productivity of 100tn/year.	Incresing of pulp drying section productivity.
2008	Establishing of 2 pulp granulators GT-500 of the firm "Hranteks" – 2units.	Increasing of pulp processing section productivity , electric power saving.
2012	Installation of biogas facility	Productionof biogas, electric power from pulp and organic wastes.

Dubenskiy sugar plant.

2003. I product massecuite boilers installation

The implementation of automation system (TsAI 6.4) for vacuum facilities is aimed at economy and efficiency of control of sugar crystallization in vacuum facilities. This system is produced by “Tsukorautomat-INH”, Kyiv, and include microprocessor controllers Mikro PC and computer for displaying of production information.

The system provides automatic control of massecuite crystallization process.

System makes it possible to control the following parameters:
1. Massecuite electric resistivity
2. Level in apparatus
3. Dilution in apparatus

4. Massecuite temperature

2003. Reconstruction of washing and pulp drying sections' transformer substation.
Two transformers TM-1000 kWA were installed as a part of this measure. For equal distribution of the load on plant's substations reconstruction of washing and pulp drying sections was carried out. This allowed toreduce the load on substations "Socotsekh" and substation #1.

This measure resulted in improvement of reliability and quality of plant's energy systems operation and electric power saving due to optimization of technological modes.

2003 . Implementation of condensing facility.
The significant amounts of reactive energy were consumed before condensing facility installation. It was decided to install condensing facilty KS-12. It allowed to save expenses due to reduction of reactive energy consumption and to improve quality of plant's energy systems operation.

2003. Production and implementation of heat exchanger into the technological process.

Heat exchanger TSK-200 was installed for heating of juice with condensateJuice from cold defecator passes through heater warming to the temperature from 28^0C to 38^0C and going to the further technological link – purification.

It's implementation results in the reduction of steam consumption that lead to natural gas saving.

2004. Implementation of ammonia condensates deammoniation system..

Deammoniator contains of column and rings, located inside of it, and evaporator. Ammonia condensate is delivered to column. There deammoniation (ammonia removal from condensate) process takes place. The results of this measure are prolongation of equipment operational time, secondary steam using for juice heating, natural gas saving,

2004. Heat system improvement

The main point of this measure is transfer of secondary steam intake from IV to V frame of evaporation station for heating of raw juice and barometric water through steam-contact heater. It allowed to reduce fuel consumption for sugar production

2004-2005. Implementation of III product centrifuges ACWW-1000

In 2004-2005 discontinuous action centrifuges were replaced with continuous action centrifuges ACWW-1000 – 5 units, productivity of which is 5 tonnes per hour.

This reconstruction resulted in increasing of III product massecuite spinning productivity and increasing of received III product sugar quality, which is controlled and delivered for I product massecuite boiling. While centrifugation of III product massecuite beet molasses is achieved.

2005. Implementation of recirculation of flue gases

The main point of this measure is installation of recirculator D-12,5 which is installed after cyclone on the outlay of pulp pressing drum. Implementation of recirculation gives the possibility to use hot flue gases. It leads to significant natural gas saving.

2005. Installation of frequency transformer on damp juice pump from cold defecator..

Frequency transformer «Tverd» was installed on pump 8NVD from cold defecator to further defecosaturation scheme.

Installation of frequency transformer allowed to make production line stable and to save about 300 thousand kW/hour per season.

2006 Automation of limestone removal using computer technologies

At the moment of measure implementation scheme of gas ovens loading with charge was relay. Such scheme was out date both morally and physically. Mechanic weights did not allow to dose coal and charge with the necessary accuracy.

That is why the decision to automize the sector was made.

Mechanic weights were replaced with electrical ("LIBRA" controllers and "HBM" tensometric gages).

Automatic mode working began to be controlled by microprocessor controller «Micro-PC». All the working process was displayed at the computer. Operator received the ability to state the proportion of stones and coal. The data on amount of coal and charge was saved in computer.
All mechanisms practicing (lining start, cover opening-closing, hydropusher, level) was controlled by controller. Information was displayed ontime if any problem has appeared
Unloading of burnt stone was carried out by analogue block, command from which went to pneumatic cylinder PSP, by which made the oven unloading table to move

Loading automation made it possible to control materials' losses (coal, stone), to keep ovens in relevant mode (burning process)

Automation of gas ovens was carried out by "Viol-2" Ltd, Kyiv.

2006. Automation of defecosaturation

Automation included diffusion juice processing with saturation gas and lime milk in cavitator, predefecator, cold defecator, hot defecator, presaturator before I saturation, then II saturation.
Controller «Micro-PC» was installed, which displayed information to computer's display. Slotted flow meter were replaced for inductive ones, electric pressure and level gages "Apliseus" were installed.

The following parameters are regulated automatically:

1. Diffusion juice spending for predefecator
2. Suspension spending of II separation for cavitator
3. I saturation juice spending for rev.
4. Juice spending from cold defecator
5. Milk spending for predefecator
6. Lime milk spending for general defecation
7. Lime milk spending for II saturation
8. Pressure spending in gas collector
9. pH juice spending for I saturation
10. pH juice spending for II saturation
11. pH sulfurated water spending
12. Juice spending for II saturation
13. Juice temperature for hot defecator,
14. juice spending for filters MVZh of I saturation
15. juice temperature for II saturation
16. Lime milk losses in decanter and mixer

Producer: Viol-2 Ltd.

2006. Limestone section reconstruction

Reconstruction of limestone sector was made in accordance with method of engineer Naumenko. This method lies in modernization of kiln IPSh-100 to IPSh-150.
Limestone kiln IPSh-150 makes it possible to increase the amount of processed beet per day due to increasing of limestone kiln productivity. It allowed to improve circulation of air, reduce energy resources consumption and CO2 emission.

2007. Installation of frequency transformers 200 kW (5 units) on production line

Installation of frequency transformers «Tverd» on production line (unfiltered juice of I saturation, filtered juice of II saturation, juice delivery on evaporation station) was carried out.
Besides, 2 frequency transformers were installed on beet slicers.

The implementation of this measure resulted in electric power saving.

2007. Implementation of scheme of massecuite steam utilization. Company "Energotekhnologiia".

Horizontal shell-tube heater used in the link of burnt massecuite steam of vacuum facilities and included to scheme of damp juice heating from 38^0C to 50^0C make it possible to reduce gas consumption for production

2008. Automation of diffusion facilities

This measure included the implementation of the following processes::

- measuring of level in beet bunkers (2 units);
- automated control of 6 slicers in accordance with the stated productivity;
- measuring of slices amount for each of two diffusion facilities (belt weights "Mika") DS-12 (№1) and DS-10 (№2);
- Measuring and regulating of pulp-pressed water and supply water;
- temperature maintenance in chambers of both diffusion facilities in accordance with the stated objectives;
- measuring and regulating of diffusion juice amount;
- measuring of levels in chambers of diffusion facilities;
- automatic level maintenance in condensate collectors;
- regulation of supply water diffusion auger revs on steam-contact heater
- sulfitation of condenser water,
- regulation of levels in water collectors (condensed, sulfurated, heated, supply),
- indication of rotating mechanisms movement (augers and diffusions, wheels, pulp augers, pulp belts),
- measuring of levels on pulp elevators.;

Diffusion facilities are regulated by microprocessor «Micro-PC», information from which is displayed on computer's display.

Producer: Viol-2 Ltd, Kyiv

The implementation of this measure allowed to make the diffusion flow stable and to increase the efficiency of the processes.

2008. Reconstruction of beet slicer STsB-12

After washing sector beets are delivered to bunker over slicers.

Before reconstruction 4 units of beet slicers STsB-12 were operating.

In 2008 beet slicers STsB-12 were reconstructed into 16-framed (3 units), 20-framed (1 unit) using frames as it is foreseen in the method of engineer Adamenko. Quality of slices was improved and productivity of beet processing was increased up to 5 tonnes per day due to reduction of distance between frames.

After reconstruction 2 units of beet slicers are operating (2 other are in reserve). It resulted in electric power saving .

2008. Presses «Stord - 2500»

After cooling in diffusion facility, pulp is supplied by pulp elevators and transporters to presses “Stord”. Installation of pulp deep pressing presses gives an opportunity to improve the quality of pulp and dry substances content in it. It allowed to save natural gas while pulp drying. It also allowed to return pulp water and save reduce river water consumption

2008.Implementation of granulator produced by firm KAHL

Granulators produced by the company KAHL are installed after pulp drying drums. Implementation of complex KAHL for dry pulp granulation results in electric power saving due to granulator productivity. Besides, implementation of this measure allowed to improve the pulp’s quality.

2008. Automation of evaporation station

Automation of evaporation station included the following measures:

- measuring and regulation of pure juice,
- heating of juice on heaters before evaporation station,
- measurement and regulation of levels on frames,
- measurement and regulation of steam in steam collector,
- measurement of steam amount in I-a and I-b frames through the gates Du-200,
- temperature measurement in steam and juice chambers of the station,
- regulation of levels in frames by interframe gates,
- pressure measurement in steam and juice chambers of the station,
- measurement and regulation of condensate levels in collectors.
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For emergency cases the circuit of automatic supply of prepared water to juice collector located before evaporation station is installed.

While water evaporation juice thickening takes place, juice temperature decreases due to tilution on tailpiece of the station. Secondary steam on frames of used station are used as heaters for the following frames and are connected to steam consumers on the plant (vacuum facilities, heaters).
Syrup from collector after passing of exaporation station is sulfurized and purified on filters “Borinex” and then goes to syrup collector on vacuum facility.

Evaporation station working is regulated by microcontroller “Shpaider”, which displays information in computer.

While automation inductive flow meters and mass measurement devices SV were used. After the station capacitive levels, pressure gages ”Arlisens”, frequency transformer of juice supply, stop and control valves were used.

Producer of automation system: Viol-2 Ltd.
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2009. Installation of frequency transformers with capacity of 200 kW (2 units).

Two frequency transformers «Tverd» were installed on drives of beet slicers. It allowed to optimize electric power consumption by beet slicers depending on loading of process and achieve the electric power saving.

2009 Installation of ASCME (automated system of commercial measurement of electricity)..

Due to different tariffs ASCME meter was installed. It transferrs the information which allow to reduce payment for electric power.

2009. Boarding of building frame of sugar plant with metal flank

Heat isolation of building frame was improved through its boarding with metal flank with area of 8200 m^2

It allowed to save heat energy and energy resources necessary for its generation.

2003-2010. Modernization of technological process.

Diffusion juice from diffusion facility, to which pulp-pressed water is supplied through heaters to cavitator as well, is delivered with suspension of II saturation to horizontal facility of predefecation of Brigel-Muller system, where lime milk is added. The aim of predification is the receiving of thick and compact residue, which is stable to high alkalinity influence during main defecation, and to provide high filtration indicators of I saturation juice.

From predefecator juice goes to cold defecator through overflowing box, to where lime milk is supplied. From cold defecator juice is supplied by pump through heaters to the boiler of hot defecation. Main defecation is performed for decomposition of unstable non-sugars in alkali medium and receiving of thermal-stable juice while evaporation.

From hot defecator defecated juice goes to the boiler of I saturation, to where saturation gas is supplied. The aim of I saturation is neutralization of limestone and receiving of juice with high filtration indicators.

In 2003 the scheme of defecosaturation was reconstructed. It resulted in increasing of utilized CO_2 from 45% to 70%.

In 2007 due to reconstruction of defecosaturation the amount of utilized CO_2 have increased from 70% to 90%, and the productivity have increased as well.

Unfiltered juice of I saturation through heaters is supplied to MVZh filters. Filtered juice is delivered through heaters to defecator of II saturation and then goes to II saturation boiler where adsorbtion of soluted potassium salts. Syrup receiving from evaporation facility is carried out with all necessary technological indicators.

After I saturation MVZh filters suspension is delivered to vacuum filters. Thick dirt is removed from the plant into the disposal fields. Filtrate goes back to collector of unfiltered juice.

Unfiltered juice of II saturation is delivered to defecator tank and then is filtered on MVZh filters juice decanter and then is filtered on filters MVZh-70. Filtered juice is delivered on evaporation station and is boiling until the content of dry substances is 58-60%.

In 2009-2010 filters “BARIMEX” (6 units for each year) were installed for filtration of sulfurated syrup. It ensured the reduction of amount of filtrated tissue and filtration speed increasing. Filtrated juice is delivered to product department for I product massecuite boiling.

After evaporation station syrup is delivered through filtration to I product vacuum facilities VATs-600, where having dilution 0,82 kg/sm^2 and steam pressure 0,7-1,0 kg/sm^2 and temperature 72^{0}C it is boiled until content of solids is 92%. Then massecuite is supplied to massecuite mixer, from where it is delivered to centrifuge.

In 2007-2008 centrifuges BMA-B-1750 were installed. I product massecuite is boiled from syrup and I product white molasses and is spined with hot on periodic centrifuges BMA-B-1750, which were installed in 2007 – 2 units and 2008 – 1 unit.. This reconstruction allowed to increase the productivity of I product massecuite spinning up to 17,5 quintals per one cycle of one centrifuge and receive sugar-sand of high quality without molasses losses with lower humidity (up to 1%). Energy resources consumption becames lower as a result.
While centrifugation of I product massecuite white molasses (which then goes for I product massecuite boiling) and green molasses (which then goes for II product massecuite boiling) and white sugar are achieved. White sugar is delivered into drying drum. Then sugar is delivered by belt-type transporter through the shaker of dry sugar to sugar bunkers, where it is weighed on automatic weights, sewed up into the polyethylene bags with insets and is delivered by belt-type transporter to sugar warehouse for storage.Green molasses (II runoff) of I product is delivered to II product vacuum facilities VATs-600. There been diluted to 0,85-0,9 kg/sm^2 it is boiled until the solids content is 93%. Then it goes to massecuite xer of II product distributor, from where it is delivered to centrifuge.

In 2005 complex modernization of sugar drying sector was carried out (installation of dryind complex produced in Poland). It resulted in reduction of steam consumption, decreasing of sugar humidity, reduction of sugar crystals shattering due to dilution.

In 2008 centrifuge VMA K-2300 with productivity of 10 tonnes per hour and simultaneous liquoring was installed. Melt achieved after centrifuge goes for I product massecuite boiling. I runoff of molasses achieved after centrifuge goes for III product massecuite boiling.

This reconstruction resulted in reduction of energy resources consumption and increasing of II product massecuite spinning productivity.

Achieved II product sugar melt is supplied on sulfitization. II product green molasses goes for boiling of III product massecuite.

In 2007 III product centrifuge K-2300 was installed. III product massecuite is boiled from II product green molasses. III product massecuite is delivered to mixers-crystallizers. Massecuite cooled to 45 ^{o}C is sludged on centrifuges continuous action. In 2007 III product centrifuge K-2300 was installed. It resulted in reduction of fuel consumption and reduction of sucrose content in molasses.
Achieved III product sugar melt is supplied on sulfitization. III product molasses is weighed and pumped into molasses containers.
In 2004 scheme of water clarification of II category, which uses flocculating agent (magnofloc-25) was installed. It resulted in reduction of fresh river water for 10%.
In 2009 scheme of pulp-pressed water circulation was implemented. It resulted in reduction of condenser water used for vapor in evaporation facility.The amount of steam reduces as well as the amount of natural gas consumed.

2010. Reconstruction of boiler BKZ-50. Changing the fuel type from coal to natural gas.

Changing of boiler’s BKZ-50 fuel type from coal to gas with installation of backstone in the underbody of furnace, made it possible to extend operation time of tube system, increase coefficient of efficiency and productivity of boiler.
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2011. Installation of saturation gas separators.

Separator PGS-6 purifies the gas that is used for production of sand-dust. It also improves gas ovens’ efficiency, extends the operation lifetime of gas pumps, reduces expenses for repair.

2011. Replacement of heating surface area of boiler BKZ-50

Heating surface area of boiler BKZ-50 containes waterwall tubes in boiler's furnace, through which vapor-air mixture passes. This measure allowed to increase the boiler's reliability and quality of it's operation..

2011. Replacement of steam communications using isolation materials

Steam communications located inside the boiler and communications for used steam supply were replaced. It resulted in workshop's operational reliability increasing and heat energy saving up to 10%.

2011. Installation of softstarters – 4 units.

Installation of softstarters (2 units) on beet slicers allowed to reduce start current of electric motors, achieve the stable current on substation transformer and protect electromotors from overload.

Besides, installation of softstarter (1 unit) «Danfos» on chlorate water supply pump, on condenser and pumps for water spilling from waste disposal facilities was carried out.

It allowed to reduce starting current for electric motors and provide its protection from overloading.

2012. Implementation of biogas facility.

Biogas station is designed for producing of biogas and biofertilizers by oxygen fermentation of wastes and energy crops.

It contains of closed reactors performed from steel concrete or steel with the cover.
It is modular construction with diameter of 24 meters and height of 6 meters.
Liquid biowastes are delivered to biogas facility through pipeline by pump. Biowastes are then supplied to front tank were mixing of mass, diluting tonecessary humidity and heating to technological parameters take place. Solid wastes are also loaded to the preparatory tank. From homogenization tank prepared biomass is supplied to reactor. Microorganisms that promote fermentation of wastes are delivered to reactor only once while it's first start.

There are two resulting products of this process - biogas and biofertilizers. Biogas is stored in the gas-holder. Gas facility stops drying of gas and it's purification from sulphurretted hydrogen. All the system is automated.

Table A.2. Biogas outlet for different types of organic wastes.

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Substrate	m^3/t
Natural gleet (85% mass)	62
Bird-lime (60% mass)	90
Corn silage	180
Beet pulp (78% mass)	119
Grain vinasse (93% mass)	40
molasses vinasse (90% mass)	50
Corn fiber (80% mass)	85
Industrial glycerin	500

Biogas production for generation of electric and heat power will reduce the amount of natural gas and purchased electric power consumption. It will lead to reduction of GHG emission.

Table A.3. Measures included into the framework of JI project implemented on Dubenskiy sugar plant.

Year	*Modernization content*	***The achieved benefits***
2003	Reconstruction of lime section (charge preparing, weighing devices replacement, partial automation)	Coal and limestone consumption reduction.
	Reconstruction of defecosaturation with the equipment replacement.	Increasing of defecosaturation facilities efficiency.
	Reconstruction of transformer substation of washing and pulp drying sections with installation of two transformers TM-1000	Reduction of energy resources consumption
	Production and implementation of heat exchanger TSK-200 in technological process.	Using of heat from condensates.
	Implementation of condensing facility	Reduction of reactive energy consumption
	Establishing of I product massecuite cookers CAI-6,4 and transition to the massecuite boiling with less potential	Reduction of heat recources consumption for 10%
2004	The introduction of the deamonization system of the ammonia condensates for feed water using on diffusion facilities and deamonization vapor using for raw juice heating	Construction of the company “Energotekhnologiia”. Reduction of water and energy resources consumption .
	Improvement of the thermal scheme (using vapor of the IV frame of evaporationstation for raw juice heaters, steam contact heater connection to V frame of evaporation station.)	Construction of the company “Energotechnologiia”. Reduction of heat and energy resources consumption
	Implementation of the purification scheme of firm “Aladis-Koloids” of the second category water with flocculent using (mahnoflok LT-25)	Rational using of water resources, reduction of electric power
	Replacing of the periodic action III product centrifuges for the continuous centrifuge. 3 units ACWW-100	Reduction of electric power consumption
2005	Establishing of the frequency converter “TVERD” with capacity of 350 kV on pump for the raw juice from a cold defector	Reduction of electric power consumption
	Modernization of the drying section of sugar production (polish production drying facilities implementation)	Steam saving
	Replacing of the III product periodic action centrifuges for the continuous centrifuge. 2 units. ACWW-1000	Electric power saving
	The introduction of the flue gas recycling system D-12.5 for pulp drying	CO_2 emission reduction. Reduction of natural gas consumption.
2006	Reconstruction of limestone section in accordance with the method of engineer V.Naumenko: 1) broadening of lime kiln from 100 m2 (IPSh-100) to 150 m2 (IPSh-150) of loading capacity 2) reconstruction of unloading facilities for lime kilns (2 units) 3) automation of lime section using the computer technologies bycompany “Viol-2” .	Reduction of limestone and coal consumption
	Defecosaturation automation.	Energy resources saving due to flow stabilization
	Pair pipelines isolation 450 m.l.	Heat power saving

2007	Establishing of the frequency converters on the process. 5 units with productivity 200 kV	Electric power saving
	Defecosaturation reconstruction	CO_2 utiization
	Implementation of utilization system for heat power of massecuite steam produced by company “Energotekhnologiia” for raw juice heating	Energy resources saving
	Implementation of the I product centrifuges BMA –B – 1750- 2 units.	Electric power saving
	Implementation of the III product centrifuges K-2300 – 1 units.	Electric power saving
2008	Establishing of the deep streak presses of the firm Stord-2500- 2 units.	Natural gas saving
	Implementation of dry pulp granulation complex of the firm KALL	Electric power saving
	Reconstruction of the beets cutting SCB12 – 4 units.	Electric power saving
	Automation of diffusion apparatus DS – 10; DS – 12. Producer of the system company “Viol-2”	Energy resources saving
	Automation of the evaporation station	Energy resources saving
	Implementation of the I product centrifuges BMA 1750 W – 1 unit.	Electric power saving
	Implementation of the II product centrifuges K 2300 – 1 unit.	Electric power saving
2009	Establishing of the frequency converters 200 kV – 2 units.	Electric power saving
	Implementation of the I product centrifuges BMA B-1750 – 1 unit.	Electric power saving
	Implementation of the II, III product centrifuges K2300 – 2 units.	Electric power saving
	Establishing of the ASCAE counter (electric power metering in hourly mode)	ASCME Reduction of expenses due to improvement of energy consumption control
	Implementation of the pulp press water return scheme	Fuel and water saving
	Establishing of the syrup filters, type «Borimex» - 6 units.	Energy resources saving
	Sugar plant building corps sheathing with metal profiles 8200 m²	Heat saving
2010	Implementation of the thick syrup filter «Borimex» - 6 units	Energy resources saving
	Boiler BKZ-50 transforation from coal to gas	CO2 emission reduction due to using of more environmentally safe fuel (natural gas) and energy resources saving due to improvement of efficiency coefficient
2011	Establishing of the soft starters – 4 units.	Electric power saving
	Establishing of the carbonation gas separators	GHG emission reduction
	Replacement of the heating surface on the boiler BKZ -50-№2.	Energy resources saving
	Replacement of the steam communication with	Energy resources saving

	the installation of isolation materials	
2012	Installation of biogas facility	Gas and electric power generation from pulp and organic wastes

Kremenetskiy sugar plant

<u>2003. Automation of kilns loading and charge preparation. .</u>

Gages record the working parameters and of skip and makes the command for loading. Coal is uniformly delivered from one bunker and limestone is delivered from another one..Charge is delivered to skip with separate components in the calculation proportion in accordance with skip’s volme. Skip automatically rises to the upper level of lime kiln where it’s loading takes place.. Information is displayed on display in accordance with prescribed program.

Reconstruction resulted in energy resources saving and juice quality improvement.

<u>2003. Installation of III product centrifuges FPI. Replacement of affination mass centrifuge for new FKNO-1400.</u>

Continuous action centrifuge FKNO-1400 was installed. Massecuite is delivered to drum (rotation speed - 1600 turns/min.), where liquid components(molasses) are removed and III product sugar crystals are delivered for melting into syrup and further boiling in I product vacuum facilities..

Implementation of this measures resulted in energy resources consumption reduction due to change of syrup thickness.

<u>2004. Implementation of coal separation scheme</u>

The main point of this measure is devision of coal used for limestone burning off into screenings and fractions of 10 – 20 millimeters and 40 – 80 illimeters for mixing and burning processes improvement.

Separation process scheme: bunker – transporting belt – separator-drum (perforated in accordance with fractions size) – transporting belt for supply to production.

Implementation of this measure allowed kilns operation in optimal mode that leads to energy resources saving and CO2 emission reduction.

<u>2005, 2008. Implementation of pulp granulators “Grantex”</u>

Raw pulp with content of dry substances equal to 18% is delivered to pulp drying drum. There it is dryed up to 84% of dry substances and granulated under the press GP-500. Rollers are pressed into the matrix that results in receiving of granules with diameter of 10 millimeters and length of 10 – 20 millimeters.

It resulted in more complete pulp processing and excluded the necessarity of its transferring to landfills that resulted in GHG emission reduction.

<u>2006. Implementation of second stage of lime milk purification.</u>

Hydrocyclons for lime milk were implemented.

Lime milk is delivered to frame construction and then to upper jet. The sand is delivered to lower narrowing jet.

The measure results in reduction of energy resources consumption due to decrease of lime milk concentration

2006. Complete replacement of lime milk fettling.

Reconstruction is made in accordance with the method of engineer Naumenko.

Lime kiln IPSh-100 was modernized to IPSh-150 with the extension of diameter of the construction and its lining with isolation stone.

It allowed to improve the air circulation, reduce consumption of coal and lime and reduce GHG emission..

2007-2008. Installation of frequency transformers to electric motors of pumps

Frequency transformers were included into electric scheme of pumps and are operating in automatic mode in accordance with the flow rate. Impementation of them allowed to reduce electric power consumption and related GHG emissions.

2008. Implementation of filters “Barimex” for syrup filtration.

Implementation of this measure allowed to reduce the syrup thickness that leads to energy resources saving.

2008. Reconstruction of pulp drying section with recurring heat using from flue gases for pulp drying.

Implementation of system of reccuring heat using from flue gases allowed to use flue gases that go out from drying drum having temperature of 90 ^{0}C. It leads to significant natural gas saving.

2008. Implementation of I product centrifuges VMA-1750 2 units.

Centrifuges VMA-1750 were implemented into the scheme of I product massecuite jointing.

It allowed to improve the quality of sugar and save electricity.

2008 – 2009. Reconstruction and automation of juice purifying section (defecosaturation).

Implementation of defecosaturation in accordance with Barakaev system includes installation of::

- progressive predefecator,
- cold defecator,
- hot defecator, cavitator,
- presaturator,
- I, II saturator.

In this system process of juice purification from nonsugars for further delivering of juice toevaporation station takes place. There juice is processed with lime milk and carbon dioxide.

Reconstruction allowed to utilize CO2 and reduce energy resources consumption.

2008. Installation of frequency transformers to electric motors of pumps

Installation of frequency transformers (MFC310 -160 kW – 3 units , MFC710 - 200 kW 1 unit., MFC710 - 250 kW) on electric motors of pumps allowed to optimize electric power consumption of electric motors in dependence on pump loading. It resulted in electric power saving.

Table A.4. Measures included into the framework of JI project implemented on Kremenetskiy sugar plant.

Year	Modernization content	The achieved benefits
2003	Defecosaturation automation	Energy resources saving. Increasing of juice purity, CO2 emission reduction.
	Automation of kilns loading and charge preparation.	Reduction of fuel usng. Reduction of CO2 emission
	Installation of III product centrifuges FPI. Replacement of affination mass centrifuge for new FKNO-1400.	Reduction of energy resources consumption due to change of syrup thickness.
2004	Implementation of coal separation scheme	Energy resources saving, CO2 emission reduction
2005	Implementation of pulp granulators “Grantex”	Utilization of organic waste.
2006	Implementation of second stage of lime milk purification	Reduction of energy resources consumption due to increasing of lime milk thickness
	Complete replacement of lime milk fettling	Fuel saving
2007	Installation of frequency transformers to electric motors of pumps	Electric power saving
2008	Implementation of filters “Barimex” for syrup filtration	Reduction of energy resources consumption due to increasing of syrup thickness
	Implementation of I product centrifuges VMA - 1750- 2 units	Electric power and energy resources saving
	Implementation of pulp granulators “Grantex”	Pulp utilization
	Reconstruction of pulp drying section with recurring heat using from flue gases for pulp drying.	Energy resources saving, CO2 emission reduction
	First stage of reconstruction and automation of juice purifying section (defecosaturation). System of engineer Barakaev is implemented.	Utilization of CO_2, energy resources saving
2009	Second stage of reconstruction and automation of juice purifying section (defecosaturation). System of engineer Barkaev is implemented.	CO_2 utilization, reduction of energy resources consumption.
	Installation of frequency transformers to electric motors of pumps – 5 units.	Energy resources saving

Lokhvitskiy sugar plant

2001. Granulation line construction in old pulp drying section.

Granulation line construction in old pulp drying section was carried out due to commercial proposal of granulated pulp transferring to Baltic countries. Until that time granulation of pulp was not performed at the plant. This necessity appeared due to long distance of transportation. Specific weight of granulated pulp is 3 times more than the one of dry pulp.

The scheme includes the following equipment:

1. Belt conveyor B=500 мм, L=19 м
2. Spiral conveyor (screw) Ø 400 мм
3. Granulator B6-DGV with granules cooler, productivity of which is 6 t/hour of granular pulp
4. Granulator «Kahl» with cooling column, productivity of which is 6 t/hour of granular pulp
5. Granules bolter produced on theplant – 1 unit.
6. Ventilator VVD-1,2 containing cycle – 1 unit.
7. Two belt conveyors B=500 mm, L_1=9,5 m, L_2=39 m, and paternoster NTsG 10-1 unit.

In this time scheme with one granulator «Kahl» is in operation. Granulator B6-DGV (Rostovskiy machine-building plant) is out date both morally and physically and can not be repaired.

Implementation of this measure allowed to make the pulp processing more complete and to exclude the necessity of pulp transferring to landfills. This will lead to related GHG emission reduction.

2008. River water and II category water piping replacement (Ø 377mm, Ø 530 mm).

After river water and II category water piping replacement for the time of all production campains appeared no emergency situations due to pipeline breaking, so there was no related reduction of productivity. Pipelines are operating with increased water pressure, so the time of beet transporting through hydrotransporters have decreased, sugar losses in transporting and washing water decreased for 0,2% of beets mass.

The amount of additionally received sugar is 548 tonnes for the seasons of 2008-2011.

It resulted in additional increase of production output that lead to energy resources saving.

2008. Installation of pulp press «Stord-2500».

Installation of pulp press «Stord» allowed to increase the level of pulp pressing after presses due to reduction of number of turns of screw pulp presses(in 2008 while operation of 5 presses the content of dry substances was 24,07%), it leads to reduction of removed water in pulp drying drum, so natural gas consumption for pulp drying is lower. The amount of reccured pulp pressing water increases, that leads to water and energy resources saving.

2008. Construction of pulp drying and granuling complex with the productivity of 340 tonnes of dry pulp per day and warehouse of dry and granular pulp with the capacity of 20 thousand tonnes.

Construction of pulp drying and granuling complex and warehouse of dry and granular pulp solved the problem of reduction of dry pulp part, it resulted in pulp utilization and increasing of demand on dry and granular pulp.

2010. Modernization of feed water supply scheme to diffusion facility with pulp pressing water distribution.

The main goal of the modernization was reduction of diffusion juice spooling from diffusion facility. It allowed to reduce energy consumption for water evaporation from the juice.

2010. Installation of two pulp eliminators with withdrawal of pulp to pulp presses «Stord».

Installation of two pulp eliminators with withdrawal of pulp to pulp presses «Stord» allowed to improve the diffusion process due to pulp withdrawal from facility and pressing of it on pulp presses.
Facility includes two apple steamers SYa-10 produced by the plant «Prodmash», Simferopil, having the productivity of 10 t/hour.

Table A.5. Measures included into the framework of JI project implemented on Kremenetskiy sugar plant.

Year	*Modernization content*	***The achieved benefits***
2001	Granulation line construction in old pulp drying section	More complete processing and utilization of pulp

2003	Automation of defecosaturation station on the basis of microprocessor technical equipment	Improvement of technological process accuracy, energy resources saving.
2008	Installation of pulp press «Stord-2500».	Energy resources saving.
	Construction of pulp drying and granuling complex with the productivity of 340 tonnes of dry pulp per day and warehouse of dry and granular pulp with the capacity of 20 thousand tonnes.	Reduction of energy losses for pulp processing, increasing of demand on dry and granular pulp.
2010	Modernization of feed water supply scheme to diffusion facility with pulp pressing water distribution.	Reduction of diffusion juice withdrawal from diffusion facility, energy resources saving.
	Installation of two pulp eliminators with withdrawal of pulp to pulp presses «Stord».	Improvement of diffusion process due to withdrawal of pulp and its pressing on pulp presses.

Project implementation allowed to achieve significant GHG emission reduction due to reduction of energy resources consumption and biological wastes decomposition..

Feasibility study development or development of detailed business plan for the whole project is not necessary. Taking in account the project's complexity and the number of measures undertaken in the project framework, feasibility study for the whole project is almost impossible. Instead of it, feasibility study for separate measures will be developed as the measures are implemented.

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 circumstance:

Implementation of technologies foreseen by the project will improve the energy efficiency of PJSC "Rise-Maksymko" to European standards.Although this technologies are well known in the Western Europe, they are not in line with Ukrainian common practice and are not required by law.

For now there is no law or other national requirements in Ukraine that require the reduction of energy resources consumption through the measures directed on energy efficiency improvemet in the sector related to sugar production. Development and implementation of measures aimed at the modernization of PJSC "Rise-Maksymko" sugar plants is the initiative of the company's management and are based on financial conditions of the company. In the same time, this measures correspond with Energy strategy of Ukraine until 2001 approved by Ukrainian government in March 2006.

New technologies that lead to improvement of sucrose, beets and pulp processing are implemented in the project framework. These technologies are developed by well-known European and Ukrainian producers.

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[1] http://zakon.rada.gov.ua/signal/kr06145a.doc

Replacement of the installed equipment with more efficient is not expected during the crediting period. All the new equipment will stay in operation for the whole crediting period. De to implementation of new technologies electricity,natural gas and coal consumption will be reduced.

New facilities for pulp pressing, drying and granuling will lead to improvement of pulp processing and will allow to exclude it's transporting to landfills. Further exploiting of biogas facilities will allow to exclude pulp transporting to landfills independently from demand on it and to increase the energy efficiency of sugar production.

The existing equipment on four sugar plants can satisfy the market demand at least until the end of the crediting period in case of regular maintenance and repair. At the moment of project initiation most of Ukrainian rivals of PJSC "Rise-Maksymko" used the similar technologies to those which were used on PJSC "Rise-Maksymko" plants. Taking in account all the mentioned above, through implementation of this project PJSC "Rise-Maksymko significantly reduce the risk of technical failures and production breakdowns. This risk is low because the purchased equipment is highly efficient.

Economical efficiency of the project is calculated on the basis of cumulative economy ofnatural gas, coal and electric power per one tonne of processed beets and reduction of GHG emission caused by pulp transportation to landfills. The reduction of natural gas, coal and electric power consumption is the result of implementation of modernization measures and is assessed taking in account the following aspects::

- Installation of more efficient controlling systems.
- Replacement of existing equipment with more efficient modern equipment (the actual results of new equipment exploitation are compared with the technical characteristics of replaced equipment_;
- Changes in heat and technological schemes aimed at the utilization of secondary heat resources;
- Installation of automized control systems;
- Implementation of new pulp processing systems (pressing granuling, drying);
- Implementation of biogas facilities.

Additional requirements for training of personnel:

Implementation of modernization measures on Zolochivskiy, Dubenskiy, Kremenetskiy and Lokhvitskiy sugar plants including the implementation of modern equipment and organization measures requires training of plants management, technical specialists and personnel.

At all the plants of PJSC "Rise-Maksymko" managing and working stuff passes the trainings on qualification improvement each year. The results of these trainings are confirmed by related exams passing certificates.

To ensure the appropriate implementation and operation of purchased equipment external experts were invited. Their main objective was helping in overcoming of technological barriers.

Confirmation of best engineering practices using

Program of modernization was developed by specialists of plants and engineers of managing company PJSC "Rise-Maksymko" and consultants and technical specialists from Ukrainian and European engineering companies. Planning of modernization aimed at development of general scheme of technical design and energy efficiency program.

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

Emission reduction calculations are provided in the Excel file «TotalER_v.1».

Table A.5. Emission reduction for the period 2004-2007.

	Years
Length of the crediting period	4
Year	Estimation of annual emission reduction in tonnes of CO2 equivalent
2004	112378
2005	427949
2006	793960
2007	1029946
Total estimated emission reduction for the crediting period 2004-2007 (tonnes of CO_2 equivalent)	2364233
Annual average estimated emission reduction over the crediting period 2004-2007 (tonnes of CO_2 equivalent)	591058

Table A.6. Emission reductions for the crediting period 2008-2012

	Years
Length of the crediting period	4
Year	Estimation of annual emission reduction in tonnes of CO2 equivalent
2008	942588
2009	823560
2010	807941
2011	1084070
2012	1082389
Total estimated emission reduction for the crediting period 2004-2007 (tonnes of CO_2 equivalent)	4740548
Annual average estimated emission reduction over the crediting period 2004-2007 (tonnes of CO_2 equivalent)	948109

Table A.7. Emission reduction for post-Kyoto period 2013-2025.

	Years
Length of the crediting period	13
Year	Estimation of annual emission reduction in tonnes of CO2 equivalent
2013	1082389
2014	1082389
2015	1082389
2016	1082389
2017	1082389
2018	1082389
2019	1082389
2020	1082389
2021	1082389
2022	1082389
2023	1082389
2024	1082389
2025	1082389
Total estimated emission reduction for the crediting period 2004-2007 (tonnes of CO_2 equivalent)	14071057
Annual average estimated emission reduction over the crediting period 2004-2007 (tonnes of CO_2 equivalent)	1082389

A.5. Project approval by the Parties involved:

Approval by the investor country and approval by the Ukrainian authorities (State Environmental Investment Agency of Ukraine) will be received after the project's successful determination.

Substantiating materials and petition for issuance of the letter of endorsement were presented to National focal point (NFP) – State agency of ecological investment of Ukraine (SAEI) on 13/09/2011. Letter of endorsement was issued by SAEI on 13/12/2011 (LoE №3601/23/7).

SECTION B. Baseline

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

JI Specific Approach developed on the basis of a Methodological Tool 'Combined tool to identify the baseline scenario and demonstrate additionality' (Version 03.0.1[2]) and the guidance 'JISC Guidance on Criteria for Baseline Setting and Monitoring' (Version 03[3]) were used for determining the baseline scenario and additionality demonstration.

In accordance with the Methodological Tool 'Combined tool to identify the baseline scenario and demonstrate additionality' for baseline setting and additionality demonstration barrier annalysis and common practice analysis were used. This analyses show that continuation of situation existing at the moment of project initiation (2001) is the most plausible scenario. That means that proposed project activity is not the baseline scenario and corresponds with the principles of additionality.

The process of the most plausible scenario selection is described in section B.2 below.

Project boundary

All the sources of GHG emissions that are under the control of project participands and relate to the proposed project activity should be included into the project boundary.

Project boundary include Zolochivskiy, Kremenetskiy, Dubenskiy and Lokhvitskiy sugar plants and all related equipment. More substantiate description of project boundary is provided in section B.4 of this document.

Baseline scenario

Baseline scenatio foresees the continuation of existing equipment using with carrying out of scheduled repair and rehabilitation activities without significant investment. Justification of baseline scenario is provided in this section below.

Only CO2 emission generated as a result of fossil fuel combustion, CO2 emissions associated with electric power consumtion from Ukrainian energy system and methane emissions due to pulp transferring to landfills are taken in account in baseline scenario.

Historical data of fossil fuel and energy resources consumption were used for estimation of specific consumption for product unit. Calculation of specific fuel and energy resources consumption for each plant is based on the historical data of 3 years, which are one year of implementation of the first measures and two previous years. 1 tonne of sugar is considered as one product unit. Baseline scenario foresees that equal amount of sugar is produced in baseline and project scenario. Final amount of produced sugar depends not only on technology of beet processing, but also on sugar content in the used beet. That is why the approach chosen foresees the exclusion of influence mentioned above by using coefficient for adducing of sugar output to the project level. For estimation of emissions in baseline scenario actual (ex post) data of sugar production and sugar content in beets are used.

The amount of methane emissions in baseline scenario associated with pulp transferring to landfills is calculated on the basis of quantity of achieved damp pulp and quantity of pulp that was utilized in baseline period.

Remaining life expectancy of equipment.

If the proposed program of energy efficiency measures will not be realized the existing equipment will be able to operate in normal mode at list until the end of crediting period in case if the regular planned repair and rehabilitation activities will be carried out.

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[2] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v3.0.1.pdf

[3] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

While calculation of baseline GHG emissions for Dubenskiy and Kremenetskiy sugar plants 2003 was taken as baseline year as the year prior to the start of crediting period . Whule calculation of baseline GHG emissions for Zolochivskiy and Lokhvitskiy sugar plants only emissions related to pulp utilization are taken in account (see section D.1.1.4).

While JI specific approach developing the elements and approaches of the following instruments and regulations has been used:

- Tool to calculate baseline, project and/or leakage emissions from electric power consumption[4], Version 01;
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion[5], Version 02;
- 1996 IPCC Guidelines for National Greenhouse Gas Inventories[6][7];
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories[8][9][10];
- Tool to determine the baseline efficiency of thermal or electric energy generation systems[11], Version 1.
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 3 Industrial Processes and Product Use[12]

General amount of baseline emissions is calculated using the following formulae:

$$BE_y = \sum BE_{y,i} \, , \qquad (1)$$

where

BE_y = greenhouse gases emissions according to the baseline scenario in year y, tCO2eq;

$BE_{y,i}$ = greenhouse gases emissions according to the baseline scenario of the sugar plant i in year y, tCO2eq

i = indication of plant for which calculations are carried out;

y = year for which calculations are carried out.

In general, GHG emissions of sugar plants include the parameters provided in the following formulae, such as greenhouse gases emissions according to the baseline scenario related to the consumption of electricity, natural gas, coal, associated with limestone decomposition and transportation of pulp to landfills:

$$BE_{y,i} = BE_{ELEC,y,i} + BE_{NG,y,i} + BE_{Coal,y,i} + BE_{CH4,y,i} + BE_{Calc,y,i} \, , \qquad (2)$$

where

$BE_{y,i}$ = greenhouse gases emissions according to the baseline scenario of the sugar plant i in year y, tCO2eq;

$BE_{ELEC,y,i}$ = greenhouse gases emissions according to the baseline scenario related to the consumption of electric power by sugar plant i in year y, tCO2eq;

$BE_{NG,y,i}$ = greenhouse gases emissions according to the baseline scenario related to the consumption of natural gas by sugar plant i in year y, tCO2eq;

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[4] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

[5] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

[6] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[7] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

[8] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

[9] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[10] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

[11] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v1.pdf

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

$BE_{Coal,y,}$ = greenhouse gases emissions according to the baseline scenario related to the consumption of coal by sugar plant *i* in year *y*, tCO2eq;

$BE_{CH4,y,i}$ = greenhouse gases emissions according to the baseline scenario associated with the utilization of pulp by its removal to the landfill in the year *y*, tCO2eq;

$BE_{Calc,y,i}$ = Baseline GHG emissions related to calcination of limestone on sugar plant *i* in year *y*, tCO2eq;

i = indication of plant for which calculations are carried out;

y = year for which calculations are carried out.

Taking into account the fact that on Dubenskiy and Kremenetskiy plants were implemented measures aimed both at processing of pulp and reduction of energy resources consumption, while on Lokhvitskiy and Zolochivskiy sugar plants only measures aimed at pulp processing were implemented, it was decided to use different approaches for GHG emission reduction calculation on the plants.

Detailed description of formulaes used for calculation of emission reduction in baseline scenario is provided in section D.1.1.4 of this document.

For calculation of baseline emissions of Dubenskiy and Kremenetskiy sugar plants 2003 was used as the year prior to crediting period. For the other two plants only emission reduction due to pulp processing are taken into account. That is why the base period data for Lokhvitskiy and Zolochivskiy sugar plants are not used.

Key parameters for baseline setting.

Data/Parameter	$EC_{BL,i}$
Data unit	MWh
Description	Average amount of electric power consumed from Joint Energy system of Ukraine by sugar plant *i* in base period 2001-2003.
Time of determination/monitoring	Once
Source of data to be used	Calculated on the basis of the statistic data of enterprise using simple arithmetic functions (see Annex 3, paragraph 3.3).
Value of data applied (for ex ante calculations/determinations)	**Dubenskiy sugar plant (average value for 2001-2003)** 806 MWh **Kremenetskiy sugar plant (average value for 2001-2003)** 1165 MWh (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Objectively reflects the average amount of electric power purchased by sugar plants of PJSC «Rise-Maksymko» in base period (2001-2003). Value is based on statistic data of enterprise received by working and calibrated measuring equipment.
QA/QC procedures (to be) applied	This value is calculated using simple arithmetic functions on the basis of statistic data achieved using working and calibrated electric power meters.
Any comment	

Data/Parameter	$EOUT_{BLy,i}$
Data unit	MWh
Description	Amount of electric power supplied by sugar plant *i* to external

<table>
<tr><td></td><td>consumers in year <i>y</i> of base period 2001-2003.</td></tr>
<tr><td>Time of determination/monitoring</td><td>Once</td></tr>
<tr><td>Source of data to be used</td><td>Hangover statements on electric power in accordance with contracts</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>
<table>
<tr><th>Year</th><th>Dubenskiy sugar plant</th><th>Kremenetskiy sugar plant</th></tr>
<tr><td>2001</td><td>409</td><td>0</td></tr>
<tr><td>2002</td><td>1044</td><td>0</td></tr>
<tr><td>2003</td><td>9588</td><td>0</td></tr>
</table>
(While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>Objectively reflects the Amount of electric power supplied to external consumers by sugar plants in base period. Value is based on statistic data of enterprise received by working and calibrated measuring equipment.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>This value is included in general energy balance of enterprises, is based on measuring with working and calibrated equipment and is the subject of cross-checking conducted by electric power suppliers and state authorities.</td></tr>
<tr><td>Any comment</td><td></td></tr>
</table>

Data/Parameter	$FC_{BL,NG,i}$
Data unit	ths m^3
Description	Average consumption of natural gas by sugar plant *i* in base period 2001-2003
Time of determination/monitoring	Once
Source of data to be used	Calculated on the basis of the statistic data of enterprise using simple arithmetic functions (see Annex 3, paragraph 3.3).
Value of data applied (for ex ante calculations/determinations)	**Dubenskiy sugar plant (average value for 2001-2003)** 9639 ths m^3 **Kremenetskiy sugar plant (average value for 2001-2003)** 12036 ths m^3 (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Objectively reflects average amount of natural gas consumption by sugar plants of PJSC «Rise-Maksymko» in base period. Value is based on statistic data of enterprise received by working and calibrated measuring equipment.
QA/QC procedures (to be) applied	This value is calculated using simple arithmetic functions on the basis of statistic data achieved using working and calibrated natural gas meters.
Any comment	

Data/Parameter	$FC_{BL,Coal,i}$
Data unit	t
Description	Average amount of coal consumed by sugar plant *i* in base period 2001-2003.
Time of determination/monitoring	Once
Source of data to be used	Calculated on the basis of the statistic data of enterprise using simple arithmetic functions (see Annex 3, paragraph 3.3).
Value of data applied (for ex ante calculations/determinations)	**Dubenskiy sugar plant (average value for 2001-2003)** 1170 t **Kremenetskiy sugar plant (average value for 2001-2003)** 1636 t (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Objectively reflects average amount of coal consumption by sugar plants of PJSC «Rise-Maksymko» in base period. Value is based on statistic data of enterprise received by working and calibrated measuring equipment.
QA/QC procedures (to be) applied	This value is calculated using simple arithmetic functions on the basis of statistic data achieved using working and calibrated scales.
Any comment	

Data/Parameter	$P_{BL,i}$
Data unit	t
Description	Average amount of sugar produced by sugar plant *i* in base period 2001-2003
Time of determination/monitoring	Once
Source of data to be used	Calculated on the basis of the statistic data of enterprise using simple arithmetic functions (see Annex 3, paragraph 3.3).
Value of data applied (for ex ante calculations/determinations)	**Dubenskiy sugar plant (average value for 2001-2003)** 16129 t **Kremenetskiy sugar plant (average value for 2001-2003)** 13773 t (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Objectively reflects average amount of sugar production in base period 2001-2003. Value is based on statistic data of enterprise received by working and calibrated measuring equipment.
QA/QC procedures (to be) applied	This value is calculated using simple arithmetic functions on the basis of statistic data of the plant.
Any comment	

Data/Parameter	$P_{y,i}$
Data unit	t

Description	The overall sugar production by sugar plant *i* in year *y*
Time of determination/monitoring	monthly
Source of data to be used	Production reports made by the department of planning
Value of data applied (for ex ante calculations/determinations)	see below
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Objectively reflects the amount of sugar production in relevant year. Value based on the measures conducted by working and calibrated measuring equipment.
QA/QC procedures (to be) applied	This value is crosschecked by state authorities.
Any comment	

Year	Dubenskiy sugar plant	Kremenetskiy sugar plant
2004	26721	14415
2005	29018	18276
2006	40845	27914
2007	46343	28363
2008	46288	23624
2009	47207	-
2010	56604	-

Dubenskiy sugar plant

For calculation of GHG emission for the period that goes after 2010 the data of the year 2010 was taken.

Kremenetskiy sugar plant

For calculation of GHG emission for the period that goes after 2010 the data of the year 2008 was taken.

Data/Parameter	$NCV_{NG,BL,i}$
Data unit	GJ/ ths m^3
Description	Weighed average net calorific value of natural gas on sugar plant *i* in base period 2001-2003.
Time of determination/monitoring	Once
Source of data to be used	Weighed average net calorific value of natural gas was determined on the basis of sectoral statistic data of Ukraine used in common reporting format for 2001-2003 Table 1.A(b)[13]. Weighed average value is calculated on the basis of the statistic data of enterprise using simple arithmetic functions (see Annex 3, paragraph 3.3).
Value of data applied (for ex ante calculations/determinations)	$NCV_{NG,BL,i}$ = 33.7 GJ/ ths m^3 (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see

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[13] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-crf-14oct.zip

	section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The main information on enterprise's operation, such as amount of produced sugar and consumed energy resources is copied for many times in production and accounting reports. Data on net calorific value of fuel are supplementary data, which are provided by its suppliers. Any supplementary technical and accounting documentation in Ukraine should be kept for three years[14]. Reliable data on net calorific value of natural gas for the relevant period were lost. That is why statistic data on average yearly net calorific value of natural gas consumed in Ukraine in this period were used for calculation of weighed average net calorific value in base period. This data are provided in common reporting format for 2001-2003. Table 1.A(b).
QA/QC procedures (to be) applied	The estimation of this value is based on statistical data and common practice in Ukraine.
Any comment	m^3 is used in the meaning of standard m^3.

Data/Parameter	$NCV_{NG,y,i}$
Data unit	GJ/ ths m^3
Description	Net calorific value of natural gas combusted in year y on sugar plant *i*
Time of determination/monitoring	Annually
Source of data to be used	Net calorific value of natural gas was determined on the basis of statistic data of Ukraine provided in common reporting format for 2001-2003 years Table 1.A(b)[15]. From 2010 for emission reduction calculation actual average annual calorific value of natural gas determined on the basis of data provided by gas supplier will be used.
Value of data applied (for ex ante calculations/determinations)	<table><tr><th>Year</th><th>Net calorific value of natural gas, GJ/ ths m³</th></tr><tr><td>2004</td><td>33.82</td></tr><tr><td>2005</td><td>33.82</td></tr><tr><td>2006</td><td>33.85</td></tr><tr><td>2007</td><td>33.85</td></tr><tr><td>2008</td><td>33.94</td></tr><tr><td>2009</td><td>34.03</td></tr></table> For preliminary emission reduction calculation for the period from 2010 the data on net calorific value of natural gas achieved in 2009 was used. Calculation for Monitoring report for this period will be based on actual data. (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of	The main information on enterprise's operation, such as amount

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[14] Order #41 dated 20.07.1998 http://zakon.nau.ua/doc/?uid=1036.413.7&nobreak=1

[15] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-crf-14oct.zip

data or description of measurement methods and procedures (to be) applied	of produced sugar and consumed energy resources is copied for many times in production and accounting reports. Data on net calorific value of fuel are supplementary data, which are provided by its suppliers. Any supplementary technical and accounting documentation in Ukraine should be kept for three years[16]. Reliable data on net calorific value of natural gas for the relevant year were lost. That is why statistic data on average yearly net calorific value of natural gas consumed in Ukraine in this year were used. This is the data provided in in common reporting format for relevant years Table 1.A(b). For emission reduction calculation since 2008 actual data will be used. This data is based on the average annual net calorific values of natural gas that was used on the enterprises of PJSC “Rise-Maksymko”. The value is estimated on the basis of the data provided by natural gas suppliers.
QA/QC procedures (to be) applied	The estimation of this value is based on statistical data of enterprise and statistic data in Ukraine.
Any comment	m^3 is used in the meaning of standard m^3.

Data/Parameter	$NCV_{Coal,BL,i}$
Data unit	GJ/t
Description	Weighed average net calorific value of coal in base period 2001-2003 on sugar plant *i*
Time of determination/monitoring	Once
Source of data to be used	Weighed average net calorific value of coal was determined on the basis of sectoral statistic data of Ukraine used in common reporting format for 2001-2003 Table 1.A(b)[17]. Weighed average value is calculated on the basis of the statistic data of enterprise using simple arithmetic functions (see Annex 3, paragraph 3.3).
Value of data applied (for ex ante calculations/determinations)	$NCV_{Coal,BL}$ = 22,94 GJ/t (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The main information on enterprise’s operation, such as amount of produced sugar and consumed energy resources is copied for many times in production and accounting reports. Data on net calorific value of fuel are supplementary data, which are provided by its suppliers. Any supplementary technical and accounting documentation in Ukraine should be kept for three years[18]. Reliable data on net calorific value of natural gas for the relevant year were lost. That is why statistic data on average yearly net calorific value of coal consumed in Ukraine in this period were used. The value is provided in common reporting

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[16] Order #41 dated 20.07.1998 http://zakon.nau.ua/doc/?uid=1036.413.7&nobreak=1

[17] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-crf-14oct.zip

[18] Order #41 dated 20.07.1998 http://zakon.nau.ua/doc/?uid=1036.413.7&nobreak=1

	format for 2001-2003. Table 1.A(b).
QA/QC procedures (to be) applied	The estimation of this value is based on statistical data in Ukraine that are presented in common reporting format for 2003. Table 1.A(b)[19]..
Any comment	

Data/Parameter	$NCV_{Coal,y,i}$
Data unit	GJ/t
Description	Net calorific value of coal combusted in year *y* on sugar plant *i*
Time of determination/monitoring	Annually
Source of data to be used	Net calorific value of coal was determined on the basis of statistic data of Ukraine provided in common reporting format for relevant years Table 1.A(b)[20].. From 2010 for emission reduction calculation actual average annual calorific value of coal determined on the basis of data provided by gas supplier will be used.
Value of data applied (for ex ante calculations/determinations)	<table><tr><th>Year</th><th>Net calorific value of natural gas, GJ/t</th></tr><tr><td>2004</td><td>23.65</td></tr><tr><td>2005</td><td>23.46</td></tr><tr><td>2006</td><td>23.23</td></tr><tr><td>2007</td><td>23.43</td></tr><tr><td>2008</td><td>23.12</td></tr><tr><td>2009</td><td>23.14</td></tr></table> For preliminary emission reduction calculation for the period from 2010 the data on net calorific value of coal achieved in 2009 was used. Calculation for Monitoring report for this period will be based on actual data.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The main information on enterprise’s operation, such as amount of produced sugar and consumed energy resources is copied for many times in production and accounting reports. Data on net calorific value of fuel are supplementary data, which are provided by its suppliers. Any supplementary technical and accounting documentation in Ukraine should be kept for three years[21]. Reliable data on net calorific value of natural gas for the relevant year were lost. That is why statistic data on average yearly net calorific value of natural gas consumed in Ukraine in this period were used. This is the data provided in common reporting format for relevant years Table 1.A(b). For emission reduction calculation since 2008 actual data will be used. This data is based on the average annual net calorific values of coal that was combusted on the enterprises of PJSC “Rise-Maksymko”. The value is estimated on the basis of the data provided by natural gas suppliers.

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[19] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-crf-14oct.zip

[20] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-crf-14oct.zip

[21] Order #41 dated 20.07.1998 http://zakon.nau.ua/doc/?uid=1036.413.7&nobreak=1

	(While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below).
QA/QC procedures (to be) applied	The estimation of this value is based on statistical data of enterprise and statistic data in Ukraine that are presented in common reporting format for 2003. Table 1.A(b)[22].
Any comment	

<table>
<tr><td>Data/Parameter</td><td>$MSW_{T,PJ,y,i}$</td></tr>
<tr><td>Data unit</td><td>t</td></tr>
<tr><td>Description</td><td>Amount of pulp selled off by plant <i>i</i> in year <i>y</i></td></tr>
<tr><td>Time of determination/monitoring</td><td>Monthly</td></tr>
<tr><td>Source of data to be used</td><td>Reporting on pulp transferring to consumers</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>
<table>
<tr><th>Year</th><th>Dubenskiy sugar plant</th><th>Kremenetskiy sugar plant</th><th>Zolochivskiy sugar plant</th><th>Lokhvitskiy sugar plant</th></tr>
<tr><td>2004</td><td></td><td></td><td>100910</td><td></td></tr>
<tr><td>2005</td><td>206608</td><td>77552</td><td>110733</td><td></td></tr>
<tr><td>2006</td><td>290816</td><td>127618</td><td>143843</td><td>169789</td></tr>
<tr><td>2007</td><td>329962</td><td>176015</td><td>128244</td><td>315252</td></tr>
<tr><td>2008</td><td>289607</td><td>129655</td><td>118302</td><td>329482</td></tr>
<tr><td>2009</td><td>270976</td><td>-</td><td>-</td><td>509088</td></tr>
<tr><td>2010</td><td>396085</td><td>-</td><td>-</td><td>358664</td></tr>
</table>

Different period of data displaying is associated with different year of new pulp processing equipment implementation on the enterprises. The first year of data displaying for each plant is the year of pulp processing equipment implementation on the plant. This year is considered as the starting year of monitoing of GHG emissions related to pulp utilization.
For preliminary calculations of GHG emission reduction for the period after 2010 for Dubenskiy and Lokhvitskiy sugar plants value of 2010 was used, for Kremenetskiy and Zolochivskiy sugar plants value of 2008 was used.</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>Objectively reflects the amount of pulp selling in year <i>y</i>. Value based on the measures conducted by working and calibrated measuring equipment.</td></tr>
<tr><td>QA/QC procedures (to be)</td><td>This value is crosschecked by state authorities.</td></tr>
</table>

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[22] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-crf-14oct.zip

applied	
Any comment	

Data/Parameter	$MSW_{F,BL,i}$
Data unit	
Description	The rate of pulp that was transported to landfill in baseline scenario from plant *i*
Time of determination/monitoring	Once
Source of data to be used	This value was estimated on the basis of situation which existed at sugar plants included in the project at the moment of project implementation start[23][24].
Value of data applied (for ex ante calculations/determinations)	1 (100%)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	In accordance with situation on sugar plants of PJSC "Rise-Maksymko" in 2001 100% of pulp were buried on landfills and bunker silos.
QA/QC procedures (to be) applied	The estimation of this value is based practice and objective analysis of situation that existed on sugar plants of PJSC "Rise-Maksymko" [25][26] before the project start. There would be no other alternative for pulp utilization except transporting of all amount of produced pulp topulp silos
Any comment	

Data/Parameter	$SPB_{BL,i}$
Data unit	%
Description	Average sugar content of beets processed on plant *i* in base period 2001-2003
Time of determination/monitoring	Once
Source of data to be used	Average value was calculated on the basis of statistic data of the enterprise and using sumple arithmetic functions (see Annex 3, paragraph 3.3).
Value of data applied (for ex ante calculations/determinations)	**Dubenskiy sugar plant (average value for 2001-2003)** 14.84 % **Kremenetskiy sugar plant (average value for 2001-2003)** 15.02 % (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and	For the assessment of sugar content in beets half-automatic line was used. Sugar content estimation was made by the method of cold digestion, that is widely used in sugar production. This data

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[23] Letter №38 dated 10.01.2012

[24] Letter №150 dated 14.03.2012

[25] Letter №38 dated 10.01.2012

[26] Letter №150 dated 14.03.2012

procedures (to be) applied	is very important for organization of technological process, that is why they are collected and processed very carefully. Average value is calculated on the basis of statistic data of the enterprise using simple arithmetic functions (see Annex 3, paragraph 3.3).
QA/QC procedures (to be) applied	Average value was calculated on the basis of statistic data of the enterprise and using sumple arithmetic functions (see Annex 3, paragraph 3.3). Importance of this data for technological process excludes the high level of its uncertainty.
Any comment	

Data/Parameter	*$SPB_{y,i}$*
Data unit	%
Description	Sugar content of beets processed in year *y* on plant *y*
Time of determination/monitoring	Monthly
Source of data to be used	Production reports
Value of data applied (for ex ante calculations/determinations)	see below
Justification of the choice of data or description of measurement methods and procedures (to be) applied	For the assessment of sugar content in beets half-automatic line was used. Sugar content estimation was made by the method of cold digestion, that is widely used in sugar production. This data is very important for organization of technological process, that is why they are collected and processed very carefully.
QA/QC procedures (to be) applied	Importance of this data for technological process excludes the high level of its uncertainty.
Any comment	

Value of data applied (for ex ante calculations/determinations):

Year	Dubenskiy sugar plant	Kremenetskiy sugar plant
2004	15.30	14.95
2005	16.24	14.88
2006	15.90	15.82
2007	15.32	14.92
2008	16.25	15.45
2009	17.00	-
2010	14.40	-

For preliminary calculation of GHG emission reduction for the period after 2010 the data of the following years was used: Dubenskiy sugar plant – 2010, Kremenetskiy sugar plant – 2008.

(While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)

Data/Parameter	*$CEF_{CO2,ELEC,BL,i}$*
Data unit	%
Description	Weighed average carbon emission factor for GHG emission due to electric power generation by sugar plant *i* in base period 2001-2003.
Time of determination/monitoring	Once

Source of data to be used	This value is calculated as the part of JI project using methodology provided in Annex 3, paragraph 3.1 formulae (36) on the basis of enterprise's statistic data and approved emission factors for the relevant types of fuel.
Value of data applied (for ex ante calculations/determinations)	For preliminary calculations of GHG emission reduction weighed average emission factor for specific GHG indirect emissions due to electric power generation in Ukraine in 2001-2003 was used[27]. **Dubenskiy sugar plant** 0.773 tCO_2eq/MWh **Kremenetskiy sugar plant** 0 tCO_2eq/MWh (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This value reflects specific GHG indirect emissions due to electric power generation on sugar plant.
QA/QC procedures (to be) applied	Calculations are conducted on the basis of statistic data of the enterprise and approved GHG emission factors for corresponding types of fuel using simple arithmetical functions (see Annex 3 formula (34)) that eliminates the high level
Any comment	

Data/Parameter	$SFC_{BL,y,i}$
Data unit	TFE
Description	Specific fuel consumption for electric power generation by plant *i* in year of base period 2001-2003
Time of determination/monitoring	Once
Source of data to be used	Form 11-MTP
Value of data applied (for ex ante calculations/determinations)	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The value is used widely in power industry of Ukraine and reflects specific fuel consumption for electric power generation.
QA/QC procedures (to be) applied	The value is calculated by skilled personnel of plant on the basis of actual statistic data of the plants that were obtained by working and calibrated measurement devices.
Any comment	

Data/Parameter	$FP_{BL\ NG,y,i}$
Data unit	%
Description	Portion of natural gas in total amount of fuel used for electric power generation on plant *i* in year *y* of base period 2001-2003

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[27] ERUPT 4, Senter, Нідерланди

Time of determination/monitoring	Once
Source of data to be used	Determined by chief power engineer of the plant on the basis of energy resources consumption statistic data
Value of data applied (for ex ante calculations/determinations)	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The value is used widely in power industry of Ukraine and reflects portion of natural gas in energy balance of electric power generation by sugar plant.
QA/QC procedures (to be) applied	The value is calculated by skilled personnel of plant on the basis of actual statistic data of the plants that were obtained by working and calibrated measurement devices.
Any comment	

Data/Parameter	$FP_{BL,\ coal\ y,i}$
Data unit	%
Description	Portion of coal in total amount of fuel used for electric power generation on plant *i* in year *y* of base period 2001-2003
Time of determination/monitoring	Once
Source of data to be used	Determined by chief power engineer of the plant on the basis of energy resources consumption statistic data
Value of data applied (for ex ante calculations/determinations)	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The value is used widely in power industry of Ukraine and reflects portion of coal in energy balance of electric power generation by sugar plant.
QA/QC procedures (to be) applied	The value is calculated by skilled personnel of plant on the basis of actual statistic data of the plants that were obtained by working and calibrated measurement devices.
Any comment	

Data/Parameter	EF_{CaCO3}
Data unit	t CO_2e/t $CaCO_3$
Description	Carbon dioxide emission factor for $CaCO_3$
Time of determination/monitoring	Once
Source of data to be used	IPCC 2006 Guidelines for National Greenhouse Gas Inventories[28]
Value of data applied (for ex ante calculations/determinations)	Stoichiometric emission factor: 0.43971 tCO_2eq/t $CaCO_3$
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Necessary for emission calculation
QA/QC procedures (to be) applied	Emission factors are checked annually.
Any comment	

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

Data/Parameter	EF_{MgCO3}
Data unit	$tCO2eq/tCaCO_3$
Description	Carbon dioxide emission factor for $MgCO_3$
Time of determination/monitoring	Once
Source of data to be used	IPCC 2006 Guidelines for National Greenhouse Gas Inventories[29]
Value of data applied (for ex ante calculations/determinations)	Stoichiometric emission factor: 0.52197 $tCO2eq/tCaCO_3$
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Necessary for emission calculation
QA/QC procedures (to be) applied	Emission factors are checked annually. Low level of data uncertainity.
Any comment	

Data/Parameter	$CaCO_{3\ BL,i}$
Data unit	
Description	Weighed average $CaCO_3$ content in limestone calcinated in base period 2001-2003 on plant *i*
Time of determination/monitoring	Once
Source of data to be used	Calculated on the basis of data provided by limestone supplier (see Annex 3, paragraph 3.3).
Value of data applied (for ex ante calculations/determinations)	**Dubenskiy sugar plant (average value for 2001-2003)** 0.884 **Kremenetskiy sugar plant (average value for 2001-2003)** 0.873 (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This value is calculated using simple arithmetic functions on the basis of data achieved from limestone supplier with each limestone shipment.
QA/QC procedures (to be) applied	The value of the parameter is documented by limestone supplier and is provided with each limestone shipping. Low level of data uncertainity.
Any comment	

Data/Parameter	$MgCO_{3\ BL,i}$
Data unit	
Description	Weighed average $MgCO_3$ content in limestone calcinated in base period 2001-2003 on plant *i*
Time of determination/monitoring	Once

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

Source of data to be used	Calculated on the basis of data provided by limestone supplier (see Annex 3, paragraph 3.3).
Value of data applied (for ex ante calculations/determinations)	**Dubenskiy sugar plant (average value for 2001-2003)** 0.0239 **Kremenetskiy sugar plant (average value for 2001-2003)** 0.0248 (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This value is calculated using simple arithmetic functions on the basis of data achieved from limestone supplier with each limestone shipment.
QA/QC procedures (to be) applied	Importance of this data for technological process excludes the high level of its uncertainty.
Any comment	

Data/Parameter	$LC_{BL,i}$
Data unit	t
Description	Limestone consumption in base period 2001-2003 on plant *i*
Time of determination/monitoring	Once
Source of data to be used	Relevant data was collected as the part of JI project. Production reports. Reporting on limestone purchasing.
Value of data applied (for ex ante calculations/determinations)	**Dubenskiy sugar plant (average value for 2001-2003)** 11703 t **Kremenetskiy sugar plant (average value for 2001-2003)** 16640 t (While calculation of GHG emission reduction for Lokhvitskiy and Zolochivskiy sugar plants this value was not used, see section D.1.1.4 below)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This value is calculated using simple arithmetic functions on the basis of data achieved from working and calibrated scales.
QA/QC procedures (to be) applied	Importance of this data for technological process excludes the high level of its uncertainty.
Any comment	

Parameters that are the subjects of monitoring are listed in Table D.1.1.1. and Table D.1.1.3 in section D.

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:

To determine the baseline, demonstrate additionality and feasibility of implementing the proposed JI project "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 03.0.1) was used. Application of this tool is common practice in the development of JI projects.

The baseline scenario is determined in accordance with the following four Steps:
STEP 1: Determination of alternative scenarios;
STEP 2. Barrier analysis;
STEP 3. Investment analysis (if acceptable);
STEP 4. Common practice analysis.

Step 1: Determination of alternative scenarios
Sub-Step 1a: Determination of scenarios alternative to the project activity suggested by the JI
Only two alternatives are the most credible to the suggested project activity.
Alternative A: Continuation of the existing situation.
Alternative B: Implementation of the proposed project activity without registering it as a JI project.

Partial implementation of the complex technical and technological modernization of an enterprise which is aimed at the reduction of energy consumption and the implementation of the utilization system of organic waste from sugar production on PJSC «Rise-Maksymko» would significantly reduce the effect from its implementation. Therefore this scenario is not considered as an alternative to the suggested project activity.

Resolution from Sub-Step 1a: Two most plausible alternatives were determined. See the list of alternatives above.

Sub-Step 1b: Meeting the requirements of the corresponding laws and norms
The main legislative act in Ukraine is the Low of Ukraine about Energy Saving[30], which is directed for stimulation of producers and suppliers to participate in the field of energy saving. However, this document foresees financial charges only in case if amount of energy resources consumption of enterprise is higher than those stated in standards. The Law does not regulate the volume of works related to reconstruction and modernization and the amount of capital investments that should be made by enterprise for energy efficiency improvement.

***Resolution from Sub-Step 1b*:** All the suggested alternatives meet the existing legal rules and regulations.

Step 2: Barrier analysis.
Sub-Step 2a: Determining barriers that will prevent the implementation of alternative scenarios
Alternative A: Continuation of the existing situation.
There are no barriers to this alternative scenario.

Alternative B: Implementation of the suggested project activity without registering it as a JI project.

Inverstment barriers:
Project activity under the proposed projectis is leng-termed complex action foreseen for the period 2002 - 2025. Project foresees the significant amount of investments from 2002 to 2009 (92 millions euro) for the period 2012-2025 additional investments are planned (30,9 millions euro). General amount of project investments should be equal to 122,9 millions euro.

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[30] http://zakon2.rada.gov.ua/laws/show/74/94-%D0%B2%D1%80

This amount is too high for PJSC "Rise-Maksymko" whose profits even in a very successful 2010 did not exceed 10 million. This level of income does not allow the company to finance a program of activities at their own expense.

Attracting funding in required amount from external sources has been and remains improbable.

It should be noted. that when making investment decisions (2001) the economic situation in Ukraine was extremely difficult. The continuous downward trend in GDP throughout the previous decade[31] did the prospect of the project activity improbable.

The chances of attracting funds from abroad have been and are relatively low. As in 2001, Ukraine was considered to be a high risk for business and investment. Overall entrepreneurial sector in Ukraine was very weak. Inappropriate accounting standards prevented the assessment of creditworthiness. Corporate governance has been recognized outside of transparency and open to abuse.

This can be illustrated by the fact that in 2000 Ukraine has managed to attract only 792.2 million dollars of direct foreign investment. In the same year residents seized assets worth 189.6 million dollars. As of 01.01.2001, the total foreign investment in the country was 3 865.5 million, corresponding indicator only $ 78 dollars per capita[32]. This figure clearly shows that the Ukrainian market was unattractive to investors at the beginning of the project.

How unattractive investment climate was in Ukraine can be seen especially in comparison with neighboring countries. For example, geographically much smaller Czech Republic at the end of 2000 attracted 21.6 billion U.S. dollars, Poland managed to attract 34.2 billion U.S. dollars of foreign direct investment[33].

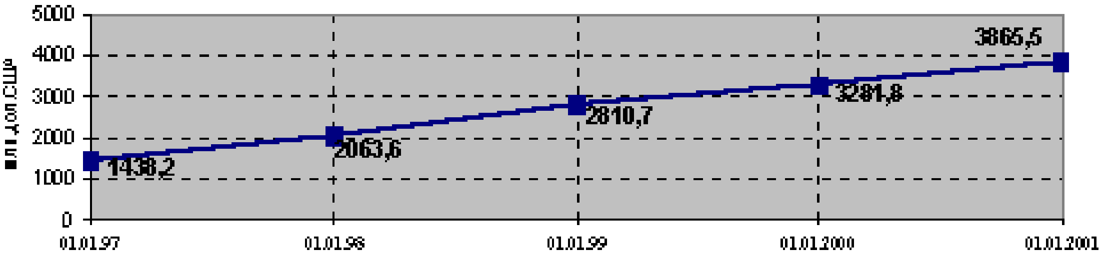

Fig. B.1. Direct investments of non-residents to Ukrainian economy

Another factor which has further undermined the Ukrainian financial market during this period was a sovereign default on Eurobonds denominated German mark in February 2000 and defaulted on bonds denominated in U.S. dollars in January 2000. Ukrainian government had to offer to exchange bonds with a longer term and lower purchasing power. Appeal was taken by a majority of bondholders, but massive withdrawal of Western investors in the country began[34].

There were actually no funds, whether in the form of equity investments or loans that are available on domestic markets to implement medium- and long-term projects. Any capital that was available had very high cost. Ukraine had the very high price of credit, which was (and is often still is) much higher than elsewhere in the region. At the end of 2000, at the time the design decision was made, bank interest rates

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[31] http://ukrstat.gov.ua/operativ/operativ2005/vvp/vvp_ric/vvp_e.htm

[32] Ukrstat.gov.ua

[33] http://unctadstat.unctad.org/TableViewer/tableView.aspx

[34] http://www.moodys.com/sites/products/DefaultResearch/2007100000482445.pdf page7

on loans have been about 37.17%[35] in UAH, denominated loans, expressed through credit risk, inflation and partly due to significant transaction costs of banks, while in Europe, interest rates were much lower. For example 12M euro Libor were about 4.8% in 2000[36].

The legal framework which existed at that time and continue to exist at present, widely regarded as inappropriate, and largely prevent the development of a transparent market economy in Ukraine. Frequent and unpredictable changes to the laws of conflicting and inconsistent codes do not allow the distribution of transparent and stable legal environment of business. This is perceived as a great source of uncertainty for international companies that make prediction of future achievement of business goals and strategies with a high degree of risk.

Registration of JI project will allow to receive partial refund with funds from the sale of emission reduction units, and give the project the status of environmentally oriented and will make getting loans easier. The factors listed above are key factors when deciding on the project realization.

General structure of capital expenses for the project include:

- expenses on new equipment purchasing and construction and software;
- expenses on modernization and reconstruction and capital repair of objects and buildings;
- expenses on scientific, design and construction activities;
- expenses on development and approval of project design documents;
- expenses on salary for employees involved in project realization;
- operational expenses on project realization;
- expenses on loans servicing for project realization;
- other expenses directly related to the project.

Approximate amounts of annual capital investments necessary for project realization are provided in Table below.

Table B.1. Approximate amount of investments for project realization:

Year	Cost, *million euro*
2002	11
2003	12
2004	7
2005	2
2006	19
2007	23
2008	18
2009	
2010	
2011	
2012	1.5
2013	1.4
2014	2
2015	3
2016	2.5
2017	1.7
2018	2
2019	5

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[35] http://bank.gov.ua/Fin_ryn/Pot_tend/2001.zip

[36] http://www.global-rates.com/interest-rates/libor/european-euro/2000.aspx

2020	1.2
2021	1.5
2022	2.4
2023	1.7
2024	2.5
2025	2.5
Total for project	122.9

As a simple payback period of investment project in the absence of the Project that may be acquired under a mechanism established by Article 6 of the Kyoto Protocol to the UN Framework Convention on Climate Change is over 10 years, only getting investments will make the project economically attractive enough to implement it and will allow to obtain loans necessary to implement the project.

Other barriers: The complexity of the production process and the suggested measures, some of which had not had analogues in Ukraine at the moment of the beginning of the project, constant fluctuations of the cost of energy resources in Ukraine do not allow to predict energy and economic results of the implementation of measures within the framework of this project. The uncertainity of results leads to additional risks for the project owner.

The registration of this project as a JI project will make it possible to improve the financial attractiveness of the project as well as its status. This factors has become primary for the project owners in the favor of the project implementation.

Conclusion from Sub-Step 2a: List of barriers is provided above.

Sub-Step 2b: Removal of alternative scenarios that are excluded by the determined barriers.

Only *Alternative A* does not contradict any of the barriers.

Conclusion from Sub-Step 2b: Only *Alternative A* does not contradict any of the barriers.

Step 3:Investment analysis.
For providing for the baseline setting and demonstrating additionality barrier analysis was used.

Conclusion from Step 3: Not applicable.

Step 4: Analysis on generally accepted practice.
Most similar projects have been implemented with the aid of grants and other non-profit financing means, for example through Joint Implementation projects. At the time of the project initiation the general practice in Ukraine was to carry out exploitation works in the amount necessary for preserving output; there have been no reconstructions similar to the suggested ones and of similar scope at other sugar plants.

Conclusion: Taking the above mentioned into the account, Alternative A is the most plausible baseline scenario, which does not have any barriers and fits the general practices of the host country.

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

Project boundary

On Lokhvitskiy and Zolochivskiy sugar plants only measures related to pulp processing are foreseen in the project framework, while on Dubenskiy and Kremenetskiy sugar plants complex of measures related to production modernization is also planned. Taking into account the difference in approaches for assessment of emission reduction, it was decided to consider project boundary separately for each sugar plant.

Dubenskiy sugar plant

While the assessment of emission on Dubenskiy sugar plant the approach takes into account CO_2 emissions, which are formed as a result of generation of electric energy by electric power stations of Joint energy system of Ukraine needed for sugar production and pulp processing and CH_4 emissions caused by disposal of secondary products of sugar production. The figures B.2 and B.3 respectively shows the boundaries of the project scenario and baseline scenario. The sources of emission that are under control of project participants are outlined with red solid line. Emission sources which are not under the control of project participants but objectively affect on amounts of project emissions are outlined with dash line.

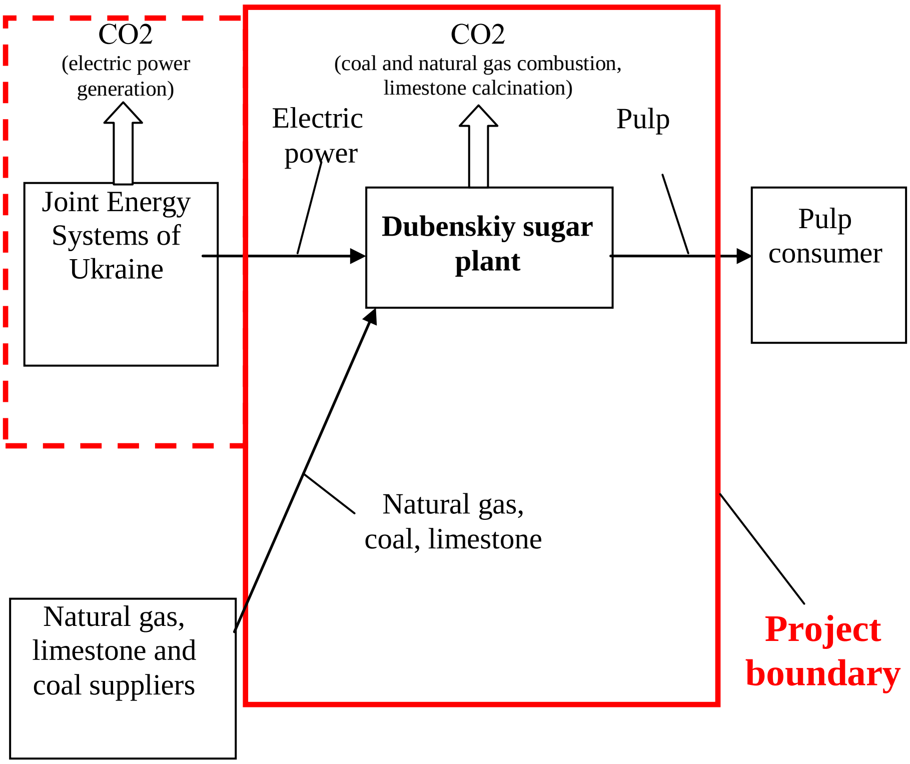

Fig. B.2. Project scenario boundary (Dubenskiy sugar plant)

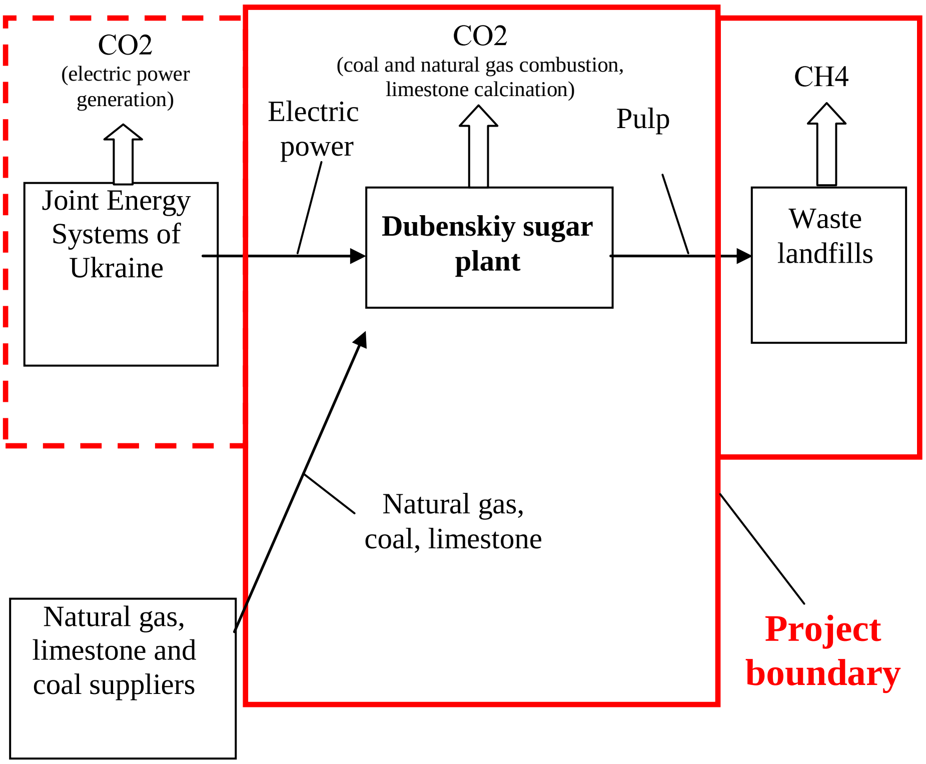

Fig. B.3. Baseline scenario boundary (Dubenskiy sugar plant)

The list of sources of emissions and GHG that are included into or excluded from the project boundary is presented in table B.2.

Table B.2. The list of sources of emissions and GHG that are included into or excluded from the project boundary (Dubenskiy sugar plant).

	Source	Gas	Included?	Reasoning / Explanation
Baseline scenario	Electric power plants of the Joint Electric Systems of Ukraine that consume fossil fuels	CO_2	Yes	Emissions caused by the combustion of fossil fuels by the electric power plants of the Joints Electric Systems (JES) of Ukraine to generate electric power used in the production of sugar and pulp processing
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification
	Technologic and generating equipment at Dubenskiy sugar plant	CO_2	Yes	Emissions caused by the combustion of natural gas and coal on technologic and generating equipment of the plant for sugar and pulp production

		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification
	Emissions related to pulp decomposition on landfills	CO_2	No	Excluded for the purpose of simplification
		CH_4	Yes	For the moment of project start due to lack of pulp demand caused by depression of farm enterprises and lack of facilities for pulp pressing and granulation the most plausible way of bulp utilization was it's transportation the landfills, where CH_4 emitted because of waste decomposition.
		N_2O	No	Excluded for the purpose of simplification
	Emissions related to limestone calcination	CO_2	Yes	Limestone calcination process is connected with generation of CO_2 emissions into the athmosphere.
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification
Project scenario	Electric power plants of JES of Ukraine that consume fossil fuels	CO_2	Yes	Emissions caused by the combustion of fossil fuels by the electric power plants of the Joints Electric Systems (JES) of Ukraine to generate electric power used in the production of sugar and pulp
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification
	Technological and generating equipment of Dubenskiy sugar plant	CO_2	Yes	Emissions caused by the combustion of natural gas and coal on technologic and generating equipment of the plant for sugar and pulp production
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification
	Emissions related to pulp decomposition on landfills	CO_2	No	Excluded for the purpose of simplification

		CH_4	Yes	Only pulp that was selled off in project scenario is included into the project. That is why project emissions related with pulp calcination are equal zero.
		N_2O	No	Excluded for the purpose of simplification
	Emission due to limestone calcination	CO_2	Yes	Limestone calcination process is connected with generation of CO_2 emissions into the athmosphere.
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification

Kremenetskiy sugar plant

While the assessment of emission on Kremenetskiy sugar plant the approach takes into account CO_2 emissions, which are formed as a result of generation of electric energy by electric power stations of Joint energy system of Ukraine needed for sugar production and pulp processing and CH_4 emissions caused by disposal of secondary products of sugar production. The figures B.4 and B.5 respectively shows the boundaries of the project scenario and baseline scenario. The sources of emission that are under control of project participants are outlined with red solid line. Emission sources which are not under the control of project participants but objectively affect on amounts of project emissions are outlined with dash line.

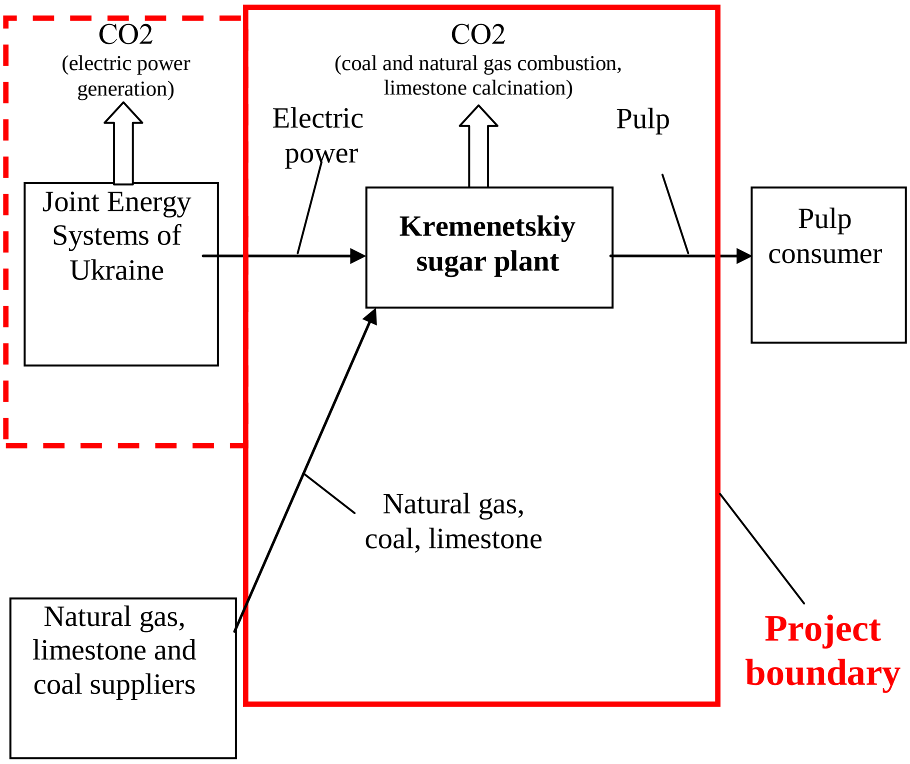

Fig. B.4. Project scenario boundary (Kremenetskiy sugar plant)

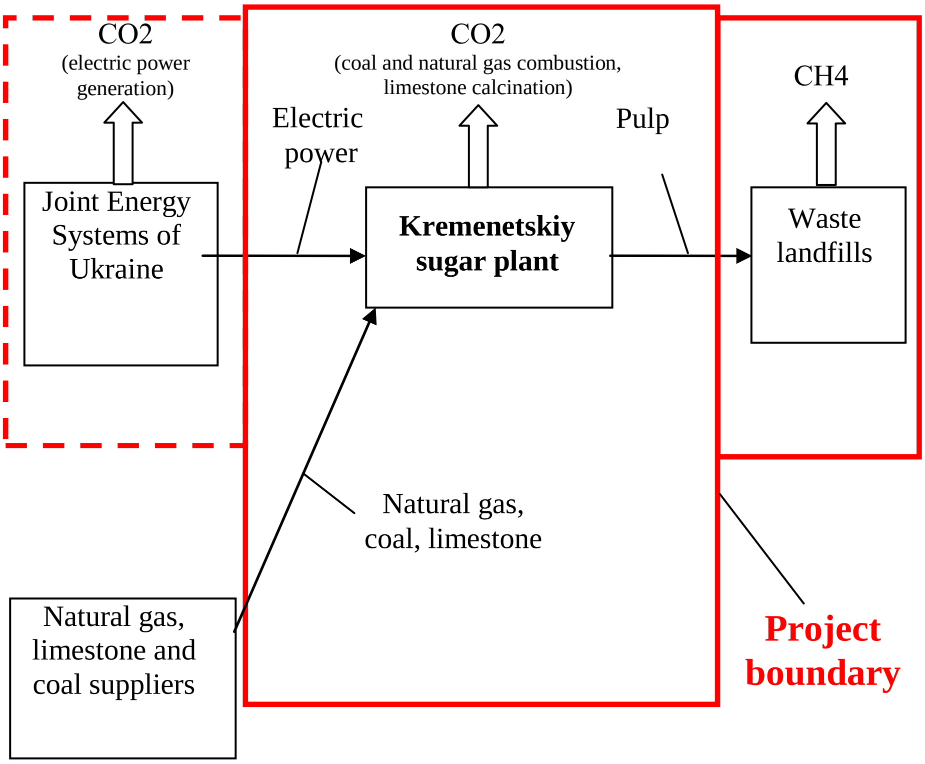

Fig. B.5. Baseline scenario boundary (Kremenetskiy sugar plant)

The list of sources of emissions and GHG that are included into or excluded from the project boundary is presented in table B.3.

Table B.3. The list of sources of emissions and GHG that are included into or excluded from the project boundary (Kremenetskiy sugar plant).

	Source	Gas	Included?	Reasoning / Explanation
Baseline scenario	Electric power plants of the Joint Electric Systems of Ukraine that consume fossil fuels	CO_2	Yes	Emissions caused by the combustion of fossil fuels by the electric power plants of the Joints Electric Systems (JES) of Ukraine to generate electric power used in the production of sugar and pulp processing
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification
	Technologic and generating equipment at Kremenetskiy sugar plant	CO_2	Yes	Emissions caused by the combustion of natural gas and coal on technologic and generating equipment of the plant for sugar and pulp production
		CH_4	No	Excluded for the purpose of simplification

		N_2O	No	Excluded for the purpose of simplification
	Emissions related to pulp decomposition on landfills	CO_2	No	Excluded for the purpose of simplification
		CH_4	Yes	For the moment of project start due to lack of pulp demand caused by depression of farm enterprises and lack of facilities for pulp pressing and granulation the most plausible way of bulp utilization was it's transportation the landfills, where CH_4 emitted because of waste decomposition.
		N_2O	No	Excluded for the purpose of simplification
	Emissions related to limestone calcination	CO_2	Yes	Limestone calcination process is connected with generation of CO_2 emissions into the athmosphere.
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification
Project scenario	Electric power plants of JES of Ukraine that consume fossil fuels	CO_2	Yes	Emissions caused by the combustion of fossil fuels by the electric power plants of the Joints Electric Systems (JES) of Ukraine to generate electric power used in the production of sugar and pulp
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification
	Technological and generating equipment of Kremenetskiy sugar plant	CO_2	Yes	Emissions caused by the combustion of natural gas and coal on technologic and generating equipment of the plant for sugar and pulp production
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification
	Emissions related to pulp decomposition on landfills	CO_2	No	Excluded for the purpose of simplification
		CH_4	Yes	Only pulp that was selled off in project scenario is included into the project. That is why project emissions related with pulp calcination are equal zero.

		N_2O	No	Excluded for the purpose of simplification
	Emission due to limestone calcination	CO_2	Yes	Limestone calcination process is connected with generation of CO_2 emissions into the athmosphere.
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification

Lokhvitskiy sugar plant

While the assessment of emission on Lokhvitskiy sugar plant the approach takes into account CO_2 emissions, which are formed as a result of generation of electric energy by Lokhvitskiy sugar plant for pulp processing and CH_4 emissions caused by disposal of secondary products of sugar production. The figures B.6 and B.7 respectively shows the boundaries of the project scenario and baseline scenario. The sources of emission that are under control of project participants are outlined with red solid line. Emission sources which are not under the control of project participants but objectively affect on amounts of project emissions are outlined with dash line.

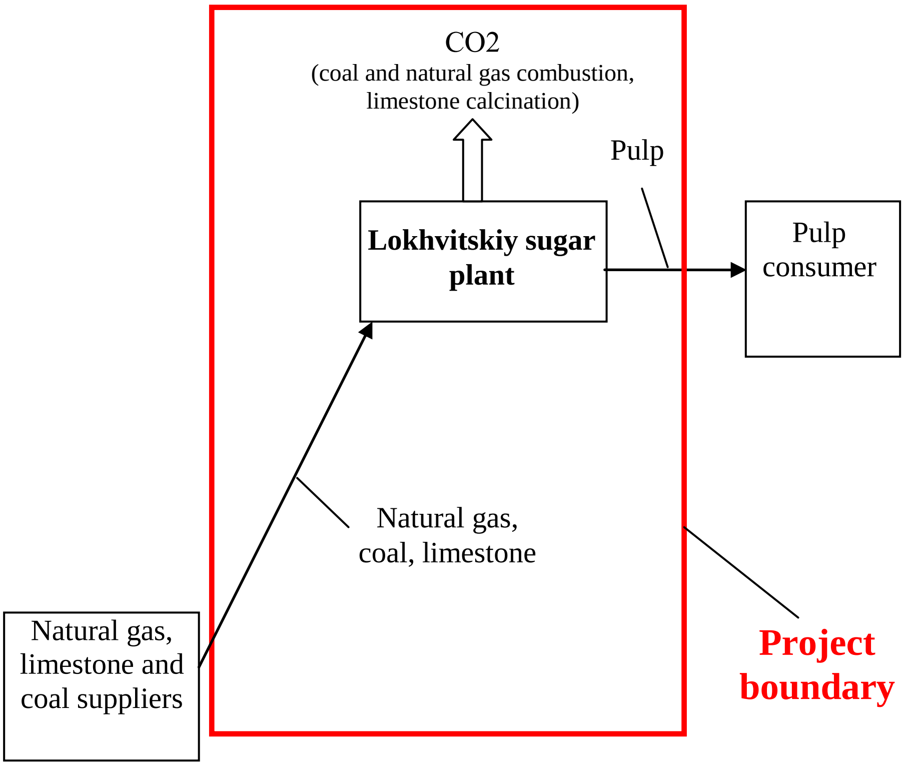

Fig. B.6. Project scenario boundary (Lokhvitskiy sugar plant)

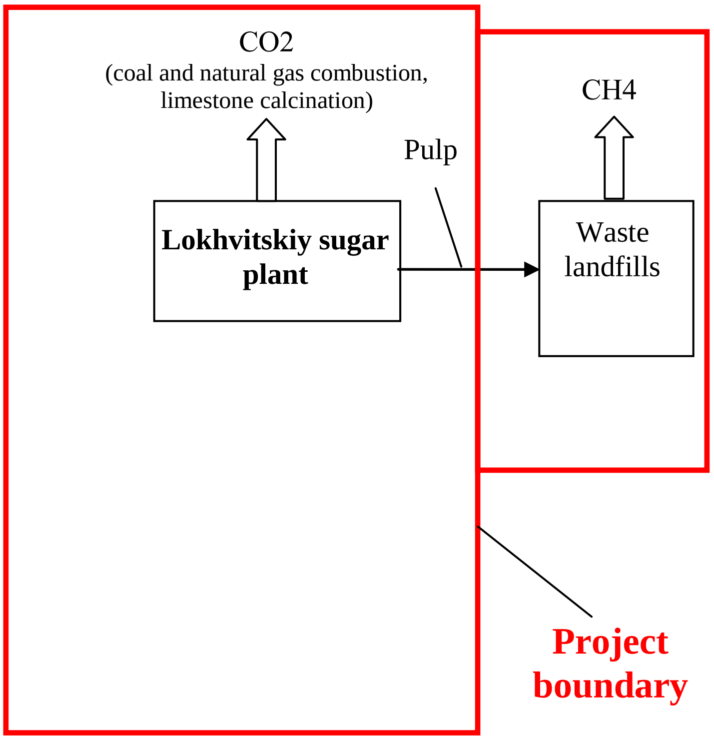

Fig. B.7. Baseline scenario boundary (Lokhvitskiy sugar plant)

The list of sources of emissions and GHG that are included into or excluded from the project boundary is presented in table B.4.

Table B.4. The list of sources of emissions and GHG that are included into or excluded from the project boundary (Lokhvitskiy sugar plant).

	Source	Gas	Included?	Reasoning / Explanation
Baseline scenario	GHG emissions related with pulp decomposition at landfills	CO_2	No	Excluded for the purpose of simplification
		CH_4	Yes	For the moment of project start due to lack of pulp demand caused by depression of farm enterprises and lack of facilities for pulp pressing and granulation the most plausible way of bulp utilization was it's transportation the landfills, where CH_4 emitted because of waste decomposition.
		N_2O	No	Excluded for the purpose of simplification
Project scenario	Facilities for pulp processing and electric power generation	CO_2	Yes	Emissions associated with natural gas and coal combustion in electric power generating and pulp processing facilities
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification

	GHG emissions related with pulp decomposition at landfills	CO_2	No	Excluded for the purpose of simplification
		CH_4	No	Only pulp that was selled off in project scenario is included into the project. That is why project emissions related with pulp calcination are equal zero.
		N_2O	No	Excluded for the purpose of simplification

Zolochivskiy sugar plant

While the assessment of emission on Zolochivskiy sugar plant the approach takes into account CO_2 emissions, which are formed as a result of generation of electric energy by Zolochivskiy sugar plant for pulp processing and CH_4 emissions caused by disposal of secondary products of sugar production. The figures B.8 and B.9 respectively shows the boundaries of the project scenario and baseline scenario. The sources of emission that are under control of project participants are outlined with red solid line. Emission sources which are not under the control of project participants but objectively affect on amounts of project emissions are outlined with dash line.

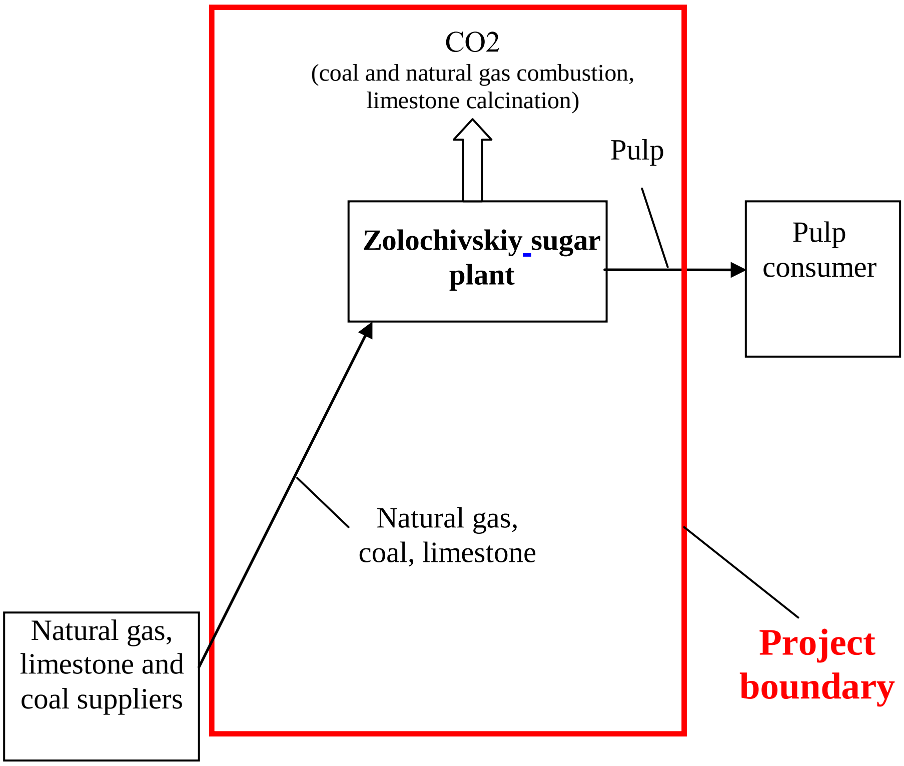

Fig. B.8. Project scenario boundary (Zolochivskiy sugar plant)

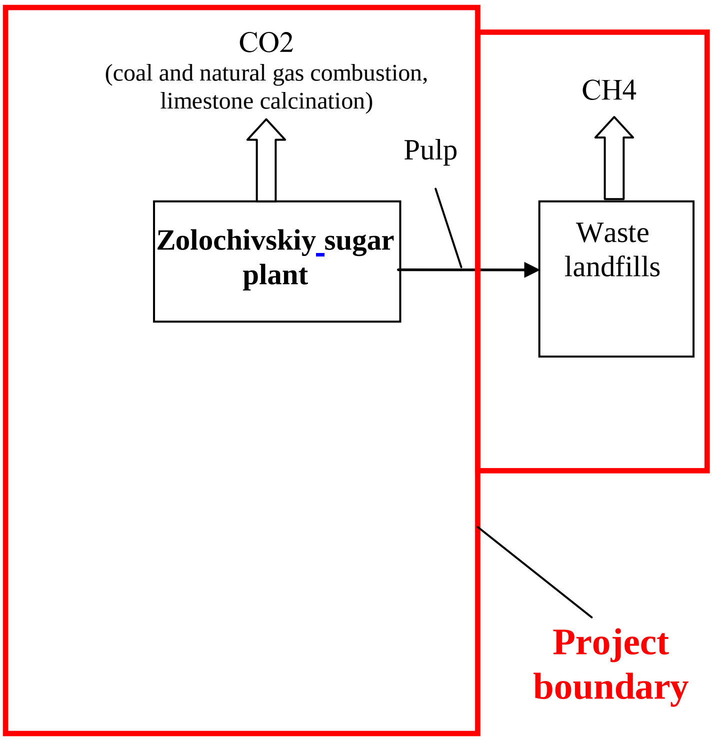

Fig. B.9. Baseline scenario boundary (Zolochivskiy sugar plant)

The list of sources of emissions and GHG that are included into or excluded from the project boundary is presented in table B.4.

Table B.5. The list of sources of emissions and GHG that are included into or excluded from the project boundary (Zolochivskiy sugar plant).

	Source	Gas	Included?	Reasoning / Explanation
Baseline scenario	GHG emissions related with pulp decomposition at landfills	CO_2	No	Excluded for the purpose of simplification
		CH_4	Yes	For the moment of project start due to lack of pulp demand caused by depression of farm enterprises and lack of facilities for pulp pressing and granulation the most plausible way of bulp utilization was it's transportation the landfills, where CH_4 emitted because of waste decomposition.
		N_2O	No	Excluded for the purpose of simplification
Project scenario	Facilities for pulp processing and electric power generation	CO_2	Yes	Emissions associated with natural gas and coal combustion in electric power generating and pulp processing facilities
		CH_4	No	Excluded for the purpose of simplification
		N_2O	No	Excluded for the purpose of simplification
	GHG emissions related with pulp	CO_2	No	Excluded for the purpose of simplification

	decomposition at landfills	CH_4	No	Only pulp that was selled off in project scenario is included into the project. That is why project emissions related with pulp calcination are equal zero.
		N_2O	No	Excluded for the purpose of simplification

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

Date of baseline setting - 01/09/2011.

Development of the baseline was carried out by "Company "MT-Invest" LTD that is not a project participant.

Project design documentation developer – personal information

Organization	"Company "MT-Invest" LTD
Street/PO Box	Kikvidze st.
House:	11
City	Kyiv
Oblast:	Kyiv
Zip code:	01103
Country:	Ukraine
Telephone:	+38 (044) 227-66-86, 253-50-69
Fax:	
E-mail:	zhuravlev@mtinvest.com.ua
Position:	Director for environmental projects
Family name:	Zhuravlev
Patronymic:	Volodymyrovych
Name:	Eugene
Telephone (direct)	
Fax (direct)	
Mobile telephone:	(050)0186821

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

01/09/2000 - in accordance with the Order #76 workgroup for reducing power consumption and processing of organic waste, which appeared as a result of sugar production, was established at Dubenskiy sugar plant. Within the duties of this group are the consideration of possibility and provision of receiving of additional investments from Kyoto Protocol mechanism. This date is considered to be the date of project recognition as JI project.

C.2. Expected operational lifetime of the project:

25 years (300 months) or more – the program includes continuous implementation of measures aimed at reducing the consumption of power resources and utilization pulp, which envisages continuous modernization of equipment and its repair or replacement in case of discovering defects or breakdowns.

C.3. Length of the crediting period:

The overall crediting period is 22 years (264 months):

2004-2007 – Early crediting period (the project will qualify for an early registering of quotas in accordance with Article 17 of the Kyoto Protocol);

2008-2012 – crediting period (the period of commitment);

2013-2025 – post-commitment period (crediting period extension beyond 2012 requires the approval of the project Host country).

ERU generation period will begin only on 01.01.2008 and will not exceed the lifetime of the project.

Starting date of the crediting period is January 1, 2004. Ending date is December 31, 2025

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The monitoring plan was developed by using JI specific approach, based on the criteria of guidance "JISC Guidance on criteria for baseline setting and monitoring. Version 03".

While JI specific approach developing the elements and approaches of the following instruments and regulations has been used:

- Tool to calculate baseline, project and/or leakage emissions from electric power consumption[37], Version 01;
- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion[38], Version 02;
- 1996 IPCC[39][40] Guidelines for National Greenhouse Gas Inventories;
- 2006 IPCC[41][42][43] Guidelines for National Greenhouse Gas Inventories;
- Tool to determine the baseline efficiency of thermal or electric energy generation systems[44], Version 1~~.~~;
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 3 Industrial Processes and Product Use[45]~~;~~.

All formulas that have been identified for monitoring process were made in accordance with the approaches used in the documents mentioned above and taking into account current monitoring system used by the enterprise and the special features of the project. The formulas are listed in the section below.

Taking into account the fact that on Dubenskiy and Kremenetskiy plants were implemented measures aimed both at processing of pulp and reduction of energy resources consumption, while on Lokhvitskiy and Zolochivskiy sugar plants only measures aimed at pulp utilization were implemented, it was decided to use different approaches for GHG emission reduction calculation on the plants.

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[37] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

[38] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

[39] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[40] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

[41] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

[42] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[43] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

[44] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v1.pdf

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

Data collected for monitoring should be kept in electronic and/or paper form. All the key data that should be monitored and are necessary for the determination of the project will be kept for two years after the last transfer of ERUs the project.

The main parameters that should be monitored during the crediting period and parameters to be defined once for the entire crediting period and are not subject to monitoring are presented below. Other parameters not included in the monitoring are derivatives and should be calculated using the initial parameters.

The following parameters of emissions are subject to monitoring under the project scenario:

$EC_{PJ,y\ i}$ = amount of electric power consumed from Joint energy system of Ukraine in the project scenario by sugar plant *i* in a year y, MWh;
$FC_{PJ,NG,y\ i}$ = amount of natural gas consumed in the project scenario by sugar plant *i* in a year y, ths m^3;
$NCV_{NG,y\ i}$ = net calorific value of natural gas consumed in the project scenario by sugar plant *i* in year y, GJ/ ths m^3;
$FC_{PJ,Coal,y\ i}$ = amount of coal consumed in the project scenario by sugar plant *i* in a year y, t;
$NCV_{Coal,y\ i}$ = net calorific value of coal consumed by sugar plant *i* in a year y, GJ/t;
$MSW_{T,PJ,y,i}$ = overall amount of pulp selled off by sugar plant *i* while sugar production in year *y*, t;
$EOUT_{y,i}$ = Amount of electric power supplied to external consumers, MWh;
$CEF_{CO2,ELEC,y,i}$ = Carbon emission factor of GHG emissions related to electric power generation by sugar plant *i*, t CO2/MWh;
$SFC_{PJ,y,i}$ = specific fuel consumption for electric power generation in project scenarioin year *y* by plant *i*, TFE.;
$FP_{NG,y,i}$ = rate of natural gas in total amount of fuel used for electric power generation on plant *i* in year *y*, %;
$FP_{coal,y,i}$ = rate of coal in total amount of fuel used for electric power generation on plant *i* in year *y*, %;
$CaCO_{3\ y,i}$ = $CaCO_3$ content in raw lime in project year *y* on plant *i*;
$LC_{y,i}$ = volume of raw limestone calcinated in year *y* on plant *i* , t;
$MgCO_{3\ y,i}$ = $MgCO_3$ content in raw lime in project year *y* on plant *i*;
$BPEC_{PJ,y,i}$ = the amount of electric power consumed in project scenario in year *y* by plant *i* for pulp processing, MWh;
$BPFC_{PJ,NG,y,i}$ = the amount of natural gas combusted in project scenario in year *y* by plant *i* for pulp generation, ths m^3;
$BPFC_{PJ,Coal,y,i}$ = the amount of coal consumed in project scenario in year *y* by plant *i* for pulp processing, t.

All of the above parameters objectively and clearly reflect the parameters of sugar production at the sugar plants of PJSC «Rise-Maksymko», such as: the amount of energy resources consumption, the amount and the movement of pulp. All parameters are determined using working and calibrated measuring equipment, using the current methods and technological norms, based on passport data provided by the suppliers of equipment and energy resources.

$EF_{CO2,ELEC,y}$ = GHG emission factor during the consumption of electric power by consumers of electric power in Ukraine in year *y*, tCO2eq/MWh;

This coefficient reflects the amount of specific emissions of greenhouse gases related to the consumption of electric power in Ukraine. Using of these factors is common practice in the calculation of joint implementation projects related to electric power consumption. In the calculations only determined and / or approved coefficients are used.

The following parameters are determined only once for the entire crediting period for the project scenario emissions:

$EF_{CO2,NG}$ = GHG emission factor for natural gas, tCO2eq/GJ;

$EF_{CO2,Coal}$ = GHG emission factor for coal, tCO2eq/GJ;

EF_{CaCO3} = carbon dioxide emission factor for $CaCO_3$, $tCO_2eq/tCaCO_3$;
EF_{MgCO3} = carbon dioxide emission factor for $MgCO_3$, $tCO_2eq/tMgCO_3$;
$MSW_{F,PJ,y,i}$ = the rate of pulp transported to landfill in project scenario in the year y.
MCF = coefficient of correction of the methane flow;
DOC = portion of pulp that is expected to decompose;
DOC_F = portion of pulp that decompose in practice;
F = portion of CH4 in gasses generated at landfills (typical value is 0.5);
$\frac{16}{12}$ = coefficient of conversion of carbon into methane;
R_y = utilized CH4 in year y, tCH4;

OX = oxidation factor, (0 as stated in 1996 IPCC);

GWP_{CH4} = global warming potential of methane, tCO2eq/tCH4.

These factors are formally approved and widely used in relevant calculations in JI projects.

The following parameters are subject of monitoring under the baseline scenario:

$SPB_{y,i}$ = sugar content of processed beets in year y on the plant i, %;
P_y = amount of sugar production in year y on the plant i, t.

This parameters display the amount of sugar produced by the plants of PJSC «Rise-Maksymko» and sugar content of raw products. It is determined using procedures and is the subject of commercial accounting. Using of these factors is common practice in the calculation of joint implementation projects related to electric power consumption. In the calculations only determined and / or approved coefficients are used.

$EF_{CO2,ELEC,y}$ = indirect GHG emissions while electric power consumption by consumers of Ukraine in year y, tCO2eq/MWh;

This parameter displays the amount of specific GHG emissions related to electric power consumption in Ukraine. It is determined using procedures and is the subject of commercial accounting. Using of these factors is common practice in the calculation of joint implementation projects related to electric power consumption. In the calculations only determined and / or approved coefficients are used.

The following parameters are determined only once for the entire crediting period for the baseline emissions:

$EF_{CO2,NG}$ = emission factor for natural gas, tCO2eq/GJ;

MCF = coefficient of correction of the methane flow;
DOC = portion of pulp that is expected to decompose;
DOC_F = portion of pulp that decompose in practice;
F = portion of CH4 in gasses generated at landfills (typical value is 0.5);
$\frac{16}{12}$ = coefficient of conversion of carbon into methane;
R_{BL} = CH4 utilized in base period 2001-2003, tCH4;

OX = oxidation factor, (0 as stated in 1996 IPCC);

GWP_{CH4} = global warming potential of methane, tCO2e/tCH4.

These factors are formally approved and widely used in relevant calculations in JI projects.

$NCV_{NG,BL\ i}$ = weighed average net calorific value of natural gas combusted for sugar production by plant *i* in base period 2001-2003, GJ/ ths m^3;
$NCV_{Coal,BL\ i}$ = weighed average net calorific value of coal combusted for sugar production by plant *i* in base period 2001-2002, GJ/t;
$P_{BL\ i}$ = amounts of production by plant *i* in base period 2001-2003, t;
$EC_{BL\ i}$ = average amount of electric power consumed by plant *i* in base period 2001-2003 from Joint energy system of Ukraine, MWh;
$FC_{BL,NG\ i}$ = average amount of natural gas combusted by plant *i* in base period 2001-2003, ths m^3;
$FC_{BL,Coal\ i}$ = amount of coal combusted by plant *i* in base period, t;
$SPB_{BL,i}$ = average sugar content of beets procesed in base period on the plant *i*, %;
$SPB_{y,i}$ = average sugar content of beets in year y on the plant *i*, %;
$MSW_{T,BL,y,i}$ = total amount of pulp selled off by sugar plant *i*, t.
$MSW_{F,BL,i}$ = rate of pulp transferred to landfills in baseline scenario on plant *i*;
R_{BL} = CH4 utilized in baseline scenario, tCH4;
$MgCO_{3\ BL,i}$ = weighed average $MgCO_3$ content in limestone calcinated in base period 2001-2003 on the plant *i*;
$CaCO_{3\ BL,i}$ = weighed average $CaCO_3$ content in limestone calcinated in base period 2001-2003 on the plant *i*;

$LC_{BL,i}$ = average amount of limestone calcinated in base period 2001-2003 on the plant *i*, t;
$SFC_{BL,y,i}$ = specific fuel consumption for electric power generation by plant *i* in year *y* of the base period 2001-2003, TFE;
$FP_{BL,NG,y,i}$ = portion of natural gas in total amount of fuel used for electric power generation on plant *i* in year *y* of base period 2001-2003, %;
$FP_{BL,coal,y,i}$ = portion of coal in total amount of fuel used for electric power generation on plant *i* in year *y* of base period 2001-2003, %;
$EOUT_{BL\ y,i}$ = amount of electric power supplied by sugar plant *i* to external consumers in year *y* of base period 2001-2003, MWh.

The above options represent an objective and transparent parameters of sugar production at sugar plants of PJSC «Rise-Maksymko» in base period. They are determined with a properly calibrated measuring equipment and the valid methodologies and technological standards and based on passport data provided by suppliers of equipment and energy resources.

The calculation formulas used during project monitoring, data description and sources are presented in the following sections of this document.

Scheme of data collection and data management is presented in section D.3.
Verification of emissions reduction units is conducted based on annual data. “Company “MT-Invest” LTD is responsible for the preparation of documentation and submissioin of documents to the Accredited Independent Entities (AIEs).

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. $PE_{y.i}$	GHG emissions in project scenario from plant *i* in year *y*	Calculated in accordance with the provided Monitoring plan	tCO2eq	c	annually	100 %	Electronic/ Paper	
2. $PE_{ELEC,y,i}$	GHG emissions in	Calculated in accordance with	tCO2eq	c	annually	100 %	Electronic/ Paper	

	project scenario related to the consumption of electric power by plant i in year y	the provided Monitoring plan						
3. $PE_{Coal,y,i}$	GHG emissions in project scenario related to the consumption of coal by plant i in year y	Calculated in accordance with the provided Monitoring plan	tCO2eq	c	annually	100 %	Electronic/ Paper	
4. $PE_{NG,y,i}$	GHG emissions in project scenario related to the consumption of natural gas by plant i in year y	Calculated in accordance with the provided Monitoring plan	tCO2eq	c	annually	100 %	Electronic/ Paper	
5. $PE_{CH4,y,i}$	GHG emissions in project scenario related to disposal of pulp at landfills from plant i in year y	Calculated in accordance with the provided Monitoring plan	tCO2eq	c	annually	100 %	Electronic/ Paper	
6. $PE_{Calc,y,i}$	GHG emissions in project scenario	Measured with measuring devices. Annual reports.	tCO2eq	m	annually	100 %	Electronic/ Paper	

	related to limestone calcination on plant *i* in year *y* related to limestone							
7. $EC_{PJ,y,i}$	Consumption of electric power from Joint energy system of Ukraine according to project scenario in by plant *i* in year *y*	Measured with metering equipment. Annual reports	MWh	m	monthly	100 %	Electronic/ Paper	
8. $EF_{CO2,ELEC,y}$	CO_2 emission factor for indirect emissions while electric power consumption from JES of Ukraine for projects aimed at reducing electric power	Default value	tCO2eq/MWh	e	anually	100 %	Electronic/ Paper	For 2004 – 0.916[46] tCO2eq/MWh For 2005 – 0.896[47] tCO2eq/MWh For 2006-2007 – 0.896[48] tCO2eq/MWh For 2008 – 1,219[49] tCO2eq/MWh For 2009 – 1.237[50] tCO2eq/MWh For 2010 – 1.225[51] tCO2eq/MWh

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[46] ERUPT 4, Senter, Netherlands

[47] ERUPT 4, Senter, Netherlands

[48] Emission dvookysuyu carbon (for energy consumption according to the methodology "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD 17.08.2007)

[49] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

[50] http://www.neia.gov.ua/nature/doccatalog/document?id=127172

[51] http://www.neia.gov.ua/nature/doccatalog/document?id=126006

	consumption in year *y*							For 2011-2025 – 1.227[52] tCO2eq/MWh
9. $EF_{CO2,NG}$	GHG emission factor for natural gas	Default value. IPCC 1996[53]	tCO2eq/GJ	e	once	100 %	Electronic/ Paper	0.0561 tCO2eq/GJ
10. $FC_{PJ,NG,y,i}$	Consumption of natural gas for sugar production according to project scenario by plant *i* in year *y*	Measured with measuring equipment. Commercial accounting of gas at the plant (the entire production). Acts with coal suppliers.	ths m^3	m	monthly	100 %	Electronic/ Paper	Amounts of natural gas consumption by Dubenskiy and Kremenetskiy sugar plants are provided in Annex 3, paragraph 3.4.
11. $EF_{CO2,Coal}$	GHG emission factor for coal	Defualt value. IPCC 1996[54]	tCO2eq/GJ	e	once	100 %	Electronic/ Paper	0.096 tCO2eq/GJ
12. $FC_{PJ,Coal,y,i}$	Consumption of coal for sugar production according to project scenario by plant *i* in year *y*	Measured with measuring equipment. Commercial accounting of coal at the plant (the entire production). Acts with coal suppliers.	t	m	monthly	100 %	Electronic/ Paper	Amounts of coal consumption by Dubenskiy and Kremenetskiy sugar plants are provided in Annex 3, paragraph 3.4.
13. $NCV_{NG,y,i}$	Net calorific value of natural gas combusted in year *y* on plant	The value is estimated based on statistic data of enterprises and Ukrainian	ths m^3	e	annually	100%	Electronic/ Paper	

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[52] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

[53] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

[54] http://www.ipcc-nggip.iges.or.jp/public/gl/invs6a.htm

	i	sectoral data						
14. $NCV_{Coal,y,i}$	Net calorific value of coal combusted in year *y* on plant *i*	The value is estimated based on statistic data of enterprises and Ukrainian sectoral data	GJ/t	e	Annually	100%	Electronic/ Paper	
15. $MSW_{T,PJ,y,i}$	Amount of pulp produced by plant *i* according to project scenario in year *y*	Annual reports	t	m, c	monthly	100%	Electronic/ Paper	Only pulp that was selled off in the reporting year has been used in calculations
16. $MSW_{F,PJ,y,i}$	Fraction of pulp removed by plant *i* to landfills according to project scenario in year *y*	Company statistical data.		m	annually	100%	Electronic/ Paper	Consudered to be equal 0 as only those pulp that was selled off in the reporting year has been used in calculations.
17. *MCF*	Methane correction factor (fraction)	Default value. 2006 IPCC[55]		e	once	100%	Electronic/ Paper	Methane correction factor takes into account the conditions of organic wastes storage on landfills. Landfills on which plants despose their wastes are under the control. Inflammation control, graded wate placement and mechanic wate

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[55] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

								pressing are conducted at landfills[56], that is why methane correction factor is considered to be equal 1 in accordance with IPCC 2006.
18. DOC	Portion of pulp that is expected to decompose	Default value. 2006 IPCC [57]		e	once	100%	Electronic/ Paper	Portion of wet wastes of food industry that are expected to decompose is considered to be equal 0.15 in accordance with IPCC 2006
19. DOC_F	Portion of pulp that decompose in practice	Default value. 2006 IPCC [58]		e	once	100%	Electronic/ Paper	Recommended default value is 0.5 in accordance with IPCC 2006
20. R_y	Recovered CH4 in year y	Default value.	tCH4	e	once	100%	Electronic/ Paper	Utilization of GHG is beyond the responsibility of project owners and beyond the boundaries of the project. Therefore, this value for conservative measures, was set at

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[56] Letter №150 dated 14.03.2012

[57] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[58] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

								0.
21. *F*	Fraction of CH4 in produced residue	Default value. 1996 IPCC [59]		e	once	100%	Electronic/ Paper	Recommended default value is 0.5 in accordance with IPCC 2006
22. *OX*	Oxidation factor	Default value. 1996 IPCC [60]		e	once	100%	Electronic/ Paper	Recommended default value is 0 in accordance with IPCC 2006
23. GWP_{CH4}	Potential of global warming of methane	According to the decision of the UNFCCC and the Kyoto protocol	tCO2eq/tCH4	e	once	100 %	Electronic/ Paper	21 tCO2eq/tCH4
24. $EOUT_{y,i}$	Amount of electric power supplied to external consumers in year *y* by plant *i*	Measured by measuring equipment. Annual reports.	MWh	m	monthly	100 %	Electronic/ Paper	
25. $CEF_{CO2,ELEC,y,i}$	Carbon emission factor for GHG emission due to electric power generation by sugar plant *i*	Calculated on the basis of statistic data provided by sugar plants related to the project and approved emission factors	tCO2eq/MWh	c	annually	100 %	Electronic/ Paper	For preliminary calculations GHG emission factor related to electric power generation by electric power stations of JES of Ukraine. For 2004 – 0.755[61] tCO2eq/MWh

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[59] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[60] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[61] ERUPT 4, Senter, The Netherlands

	in year *y*							For 2005 – 0.740[62] tCO2eq/MWh For 2006-2007. – 0.807[63] tCO2eq/MWh For 2008 – 1.055[64] tCO2eq/MWh For 2009 – 1.068[65] tCO2eq/MWh For 2010 – 1.067[66] tCO2eq/MWh For 2011-2025 – 1.063[67] tCO2eq/MWh For calculation of actual GHG emission reduction the actual values of this parameters will be used. The method of its calculation s provided in Annex 3 , paragraph 3.1 formulae (34) below.
26. $SFC_{PJ,NG,y,i}$	Specific fuel consumption for electric power generation in	Form 11-MTP	TFE	c	annually	100%	Electronic/ Paper	

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[62] ERUPT 4, Senter, The Netherlands

[63] CO2 emission factor (for electricity consumption in accordance with methodology "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD on 17.08.2007)

[64] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

[65] http://www.neia.gov.ua/nature/doccatalog/document?id=127172

[66] http://www.neia.gov.ua/nature/doccatalog/document?id=126006

[67] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

	project scenario in year *y* by sugar plant *i*							
27. $FP_{NG,y,i}$	Rate of natural gas in total amount of fuel that was used for electric power generation on plant *i* in year *y*	Determined by chief power engineer of the plant on the basis of statistic data on energy resources consumption	%	c	annually	100 %	Electronic/ Paper	
28. $FP_{coal,y,i}$	Rate of coal in total amount of fuel that was used for electric power generation on plant *i* in year *y*	Determined by chief power engineer of the plant on the basis of statistic data on energy resources consumption	%	c	annually	100 %	Electronic/ Paper	
29. $BPEC_{PJ,y,i}$	Amount of electric power consumed in project scenario in year *y* on plant *i*	Calculated on the basis of production reports	MWh	c	monthly	100 %	Electronic/ Paper	Used for project emission calculation of Lokhvitskiy and Zolochivskiy sugar plants
30. $BPFC_{PJ,NG,y,i}$	Amount of natural gas consumed for pulp processing in year *y* on plant *i*	Calculated on the basis of production reports	ths m^3	c	monthly	100 %	Electronic/ Paper	Used for project emission calculation of Lokhvitskiy and Zolochivskiy sugar plants
31. $BPFC_{PJ,Coal,y,i}$	Amount of coal consumed for pulp	Calculated on the basis of production	t	c	monthly	100 %	Electronic/ Paper	Used for project emission calculation of Lokhvitskiy and

	processing in year *y* on plant *i*	reports						Zolochivskiy sugar plants
32. $LC_{y,i}$	Amount of limestone calcinated in year *y* on plant *i*	Determined on the basis of annual reports and reports on limestone purchase	t	m	monthly	100 %	Electronic/ Paper	
33. EF_{CaCO3}	Carbon dioxide emission factor for $CaCO_3$	IPCC[68]	tCO_2e/t $CaCO_3$	e	annually	100%	Electronic	Sroichiometric emission factor; 0.43971
34. EF_{MgCO3}	Carbon dioxide emission factor for $MgCO_3$	IPCC[69]	$t\ CO_2e/t$ $MgCO_3$	e	annually	100%	Electronic	Sroichiometric emission factor; 0.52197
35. $CaCO_{3\ y,i}$	$CaCO_3$ content in calcinated limestone in year *y* on plant *i*	lime supplier data	-	m	monthly	100 %	Electronic/ Paper	
36. $MgCO_{3\ y,i}$	$MgCO_3$ content in calcinated limestone in year *y* on plant *i*	lime supplier data	-	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):

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

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

Project emissions:

$$PE_y = \sum PE_{y,i} \ , \qquad (3)$$

where

PE_y = greenhouse gases emissions according to the project scenario in year *y*, tCO2eq;
$PE_{y,\ i}$ = greenhouse gases emissions according to the project scenario of the sugar plant *i* in year *y*, tCO2eq;
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

$$PE_{y,i} = PE_{ELEC,y,i} + PE_{NG,y,i} + PE_{Coal,y,i} + PE_{CH4,y,i} + PE_{Calc,y,i} \ , \qquad (4)$$

where

$PE_{y,i}$ = greenhouse gases emissions according to the project scenario of the sugar plant n in year *y*, tCO2eq;
$PE_{ELEC,y\ i}$ = greenhouse gases emissions according to the project scenario related to the consumption of electric power in year *y*, tCO2eq;
$PE_{NG,y\ i}$ = greenhouse gases emissions according to the project scenario related to the consumption of natural gas in year *y*, tCO2eq;
$PE_{Coal,y\ i}$ = greenhouse gases emissions according to the project scenario related to the consumption of coal in year *y*, tCO2eq;
$PE_{CH4,y\ i}$ = greenhouse gases emissions according to the project scenario associated with the utilization of pulp by its removal to the landfill in the year *y*, tCO2eq;
$PE_{Calc,y,i}$ = Project GHG emissions related with calcination of limestone in year *y*, tCO2eq;
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

Taking into account the fact that on Dubenskiy and Kremenetskiy plants were implemented measures aimed both at processing of pulp and reduction of energy resources consumption, while on Lokhvitskiy and Zolochivskiy sugar plants only measures aimed at pulp processing were implemented, it was decided to use different approaches for GHG emission reduction calculation on the plants.

Dubenskiy and Kremenetskiy sugar plants.

Greenhouse gases emissions according to the project scenario and related to the consumption of electric power are calculated according to the approach described in the Tool to calculate baseline, project and/or leakage emissions from electric power consumption[70], Version 01.

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[70] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

$$PE_{ELEC,y,i} = EC_{PJ,y,i} \cdot EF_{CO2,ELEC,y}, \qquad (5)$$

where

$PE_{ELEC,y\ i}$ = greenhouse gases emissions according to the project scenario related to the consumption of electric power by plant *i* in year *y*, tCO2eq;
$EC_{PJ,y\ i}$ = quantity of electric power consumed from power system of Ukraine according to the project scenario by plant *i* in year *y*, MWh;
$EF_{CO2,ELEC,y}$ = indirect greenhouse gases emissions caused by the electric power consumption of electric energy consumers in the Joint Energy Systems of Ukraine in year *y*, tCO2eq/ MWh;
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

Greenhouse gas emissions according to the project scenario related to the consumption of natural gas are calculated according to the approach described in the Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion[71], Version 02.

$$PE_{NG,y,i} = FC_{PJ,NG,y,i} \cdot NCV_{NG,y,i} \cdot EF_{CO2,NG} - EOUT_{y,i} \cdot CEF_{CO2,ELEC,y,i}, \qquad (6)$$

where

$PE_{NG,y\ i}$ = greenhouse gases emissions according to the project scenario related to the consumption of natural gas by plant *i* in year *y*, tCO2eq;
$FC_{PJ,NG,y\ i}$ = amount of natural gas consumed by plant *i* according to the project scenario in year *y*, ths m^3;
$NCV_{NG,y\ i}$ = net calorific value of natural gas consumed by plant *i* in the year *y*, GJ / ths m^3;
$EF_{CO2,NG}$ = emission factor for natural gas, tCO2eq/GJ;
$EOUT_{y,i}$ = Amount of electric power supplied to external consumers in year *y* by plant *i*, MWh;
$CEF_{CO2,ELEC,y,i}$ = Carbon emission factor of GHG emissions related to electric power generation by sugar plant *i* in year *y*, tCO2/MWh;
For preliminary calculations the emission factor of indirect GHG emissions related to electric power generation in power systems of Ukraine was applied.For actual calculations this parameter will be calculated on the basis of production parameters of the enterprise (see Annex 3, paragraph 3.1 of this document).
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

Greenhouse gas emissions according to the project scenario related to the consumption of coal are calculated according to the approach described in the Tool to calculate project or leakage CO2 emissions from fossil fuel combustion[72], Version 02.

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[71] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

[72] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

$$PE_{Coal,y,i} = FC_{PJ,Coal,y,i} \cdot NCV_{Coal,y,i} \cdot EF_{CO2,Coal}, \qquad (7)$$

where

$PE_{Coal,y\ i}$ = greenhouse gases emissions according to the project scenario related to the consumption of coal by plant *i* in year *y*, tCO2eq;

$FC_{PJ,Coal,y\ i}$ = amount of coal consumed according to the project scenario by plant *i* in year *y*, t;

$NCV_{Coal,y\ i}$ = net calorific value of coal consumed by plant *i* in the year *y*, Gcal / t;

$EF_{CO2,Coal}$ = emission factor for coal, tCO2eq/GJ;

i = indication of plant for which calculations are carried out;

y = year for which calculations are carried out.

To calculate emissions for project scenario related to the utilization of secondary products from the production of sugar (pulp) by their removal at the landfills typical approach described in 1996 IPCC (1996[73] IPCC Guidelines for National Greenhouse Gas Inventories) was used.

$$PE_{CH4,y,i} = \sum(MSW_{T,PJ,y,i} \cdot MSW_{F,PJ,y,i} \cdot MCF \cdot DOC \cdot DOC_F \cdot F \cdot \frac{16}{12} - R_y) \cdot (1 - OX) \cdot GWP_{CH4}, \qquad (8)$$

where

$PE_{CH4,y\ i}$ = greenhouse gases emissions according to the project scenario associated with the utilization of pulp by it's removal to the landfill in the year, tCO2eq;

$MSW_{T,PJ,y\ i}$ = amount of pulp selled off by plant *i* according to the project scenario in year *y*, t;

$MSW_{F,PJ,y\ i}$ = part of pulp generated by plant *i* transported to the landfill according to the project scenario in year *y*;

MCF = methane flow correction factor; (IPCC 2006[74])

DOC = Portion of pulp that is expected to decompose; (IPCC 2006[75])

DOC_F = Portion of pulp that decompose in practice; (IPCC 2006[76])

F = Fraction of CH4 in landfill gas (typically 0.5); (1996 IPCC [77])

$\frac{16}{12}$ = factor of carbon conversion in methane;

R_y = CH4 utilized in year *y*, t CH4;

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[73] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[74] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

[75] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[76] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[77] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

OX = oxidation factor (usually 0); (1996 [78] IPCC)
GWP_{CH4} = global warming potential of methane tCO2eq/tCH4; (According to the UNFCCC and the Kyoto Protocol)
i = indication of the plant for which calculations are carried out;
y = year for which calculations are carried out.

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*[79]. 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 PJSC «Rise-Maksymko» 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 combustion 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 combust the 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 PJSC «Rise-Maksymko» project.

$$PE_{Calc,y,i} = LC_{y,i} \cdot CaCO_{3\,y,i} \cdot EF_{CaCO3} + LC_{y,i} \cdot MgCO_{3\,y,i} \cdot EF_{MgCO3}, \qquad (9)$$

where
$PE_{Calc,y,i}$ = project GHG emissions from calcination of limestone in year y at plant i, tCO_2e;
EF_{CaCO3} = GHG emission factor for $CaCO_3$ ($tCO_2/tCaCO_3$)
$CaCO_{3\,y,i}$ = content of $CaCO_3$ in the raw material limestone in project year y at plant i
$LC_{y,i}$ = amount of limestone calcinated year y at plant i (t)
EF_{MgCO3} = carbon dioxide emission factor for $MgCO_3$ ($tCO_2/tMgCO_3$)
$MgCO_{3\,y,i}$ = content of $MgCO_3$ limestone calcinated in year *y* at plant *i*
i = indication of the plant for which calculations are carried out;

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[78] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[79] 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)

y = year for which calculations are carried out.

Lokhvitskiy and Zolochivskiy plants.

Greenhouse gases emissions according to the project scenario and related to the consumption of electric power are calculated according to the approach described in the Tool to calculate baseline, project and/or leakage emissions from electric power consumption[80], Version 01.

$$PE_{ELEC,y,i} = BPEC_{PJ,y,i} \cdot CEF_{CO2,ELEC,y,i}, \qquad (10)$$

where

$PE_{ELEC,y,i}$ = project GHG emissions in project scenario due to electric power consumption in year y by plant i, tCO2eq;
$BPEC_{PJ,y,i}$ = Amount of electric power consumed in project scenario in year y by plant i for pulp processing, MWh;
$CEF_{CO2,ELEC,y,i}$ = Carbon emission factor of GHG emissions related to electric power generation by sugar plants, tCO2/MWh;
For preliminary calculations the emission factor of indirect GHG emissions related to electric power generation in power systems of Ukraine was applied.For actual calculations this parameter will be calculated on the basis of production parameters of the enterprise (see Annex 3, paragraph 3.1 of this document).
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

Greenhouse gas emissions according to the project scenario related to the consumption of natural gas are calculated according to the approach described in the Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion[81], Version 02.

$$PE_{NG,y,i} = BPFC_{PJ,NG,y,i} \cdot NCV_{NG,y,i} \cdot EF_{CO2,NG}, \qquad (11)$$

where

$PE_{NG,y,i}$ = GHG emissions in project scenario related to natural gas consumption in year y by plant i, tCO2eq;
$BPFC_{PJ,NG,y,i}$ = Amount of electric power consumed in project scenario in year y by plant i for pulp production, ths m^3;
$NCV_{NG,y,i}$ = net calorfic value of natural gas consumed in year y by plant i, GJ/ ths m^3;
$EF_{CO2,NG}$ = GHG emission factor for natural gas, tCO2eq/GJ;
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

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[80] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

[81] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

Greenhouse gas emissions according to the project scenario related to the consumption of coal are calculated according to the approach described in the Tool to calculate project or leakage CO2 emissions from fossil fuel combustion[82], Version 02.

$$PE_{Coal,y,i} = BPFC_{PJ,Coal,y,i} \cdot NCV_{Coal,y,i} \cdot EF_{CO2,Coal}, \qquad (12)$$

where

$PE_{Coal,y,i}$ = GHG emissions in project scenario related to coal consumption in year y by plant i, tCO2eq;

$BPFC_{PJ,Coal,y,i}$ = amount of coal consumed in project scenario in year y by plant i for pulp processing, t;

$NCV_{Coal,y,i}$ = net calorfic value of coal consumed in year y by plant i, GJ/t;

$EF_{CO2,Coal}$ = GHG emission factor for coal, tCO2eq/GJ;

i = indication of plant for which calculations are carried out;

y = year for which calculations are carried out.

To calculate emissions for project scenario related to the decomposition of pulp at the landfills typical approach described in 1996 IPCC (1996[83] IPCC Guidelines for National Greenhouse Gas Inventories) was used.

$$PE_{CH4,y,i} = \sum (MSW_{T,PJ,y,i} \cdot MSW_{F,PJ,y,i} \cdot MCF \cdot DOC \cdot DOC_F \cdot F \cdot \frac{16}{12} - R_y) \cdot (1 - OX) \cdot GWP_{CH4}, \qquad (13)$$

where

$PE_{CH4,y\ i}$ = greenhouse gases emissions according to the project scenario associated with the utilization of pulp by it’s removal to the landfill in the year, tCO2eq;

$MSW_{T,PJ,y\ i}$ = amount of pulp selled off by plant i according to the project scenario in year y, t;

$MSW_{F,PJ,y\ i}$ = part of pulp generated by plant i transported to the landfill according to the project scenario in year y;

MCF = methane flow correction factor; (IPCC 2006[84])

DOC = Portion of pulp that is expected to decompose; (IPCC 2006[85])

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[82] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

[83] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[84] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

[85] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

DOC_F = Portion of pulp that decompose in practice; (IPCC 2006[86])
F = Fraction of CH4 in landfill gas (typically 0.5); (1996 IPCC [87])
$\frac{16}{12}$ = factor of carbon conversion in methane;
R_y = CH4 utilized in year y, t CH4;
OX = oxidation factor (usually 0); (1996 [88] IPCC)
GWP_{CH4} = global warming potential of methane tCO2eq/tCH4; (According to the UNFCCC and the Kyoto Protocol)
i = indication of the plant for which calculations are carried out;
y = year for which calculations are carried out.

Emissions related to limestone calcination for these plants are considered to be equal zero because calcination and processing of limestone are divorced from each other.

$$PE_{Calc,y,i} = 0 , \qquad (14)$$

where
$PE_{Calc,y,i}$ = project GHG emissions due to calcination of limestone in year y on plant i, tCO_2e;
i = indication of the plant for which calculations are carried out;
y = year for which calculations are carried out..

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[86] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[87] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[88] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

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	Electronic/ Paper	Comment
37. $BE_{y,i}$	Baseline GHG emissions on plant *i* in year *y*	Calculated in accordance with provided Monitoring plan	tCO2eq	c	annually	100 %	Electronic/ Paper	
38. $BE_{ELEC,y,i}$	Baseline GHG emissions related to electric power consumption by plant *i* in year *y*	Calculated in accordance with provided Monitoring plan	tCO2eq	c	annually	100 %	Electronic/ Paper	
39. $BE_{Coal,y,i}$	Baseline GHG emissions related to coal consumption by plant *i* in year *y*	Calculated in accordance with provided Monitoring plan	tCO2eq	c	annually	100 %	Electronic/ Paper	
40. $BE_{NG,y,i}$	Baseline GHG emissions related to natural gas consumption by plant *i* in year *y*	Calculated in accordance with provided Monitoring plan	tCO2eq	c	annually	100 %	Electronic/ Paper	
41. $BE_{CH4,y,i}$	Baseline GHG emissions related to pulp utilization by its transferring to landfills by plant *i* in year *y*	Calculated in accordance with provided Monitoring plan	tCO2eq	c	annually	100 %	Electronic/ Paper	

42. $BE_{Calc,y,i}$	Baseline GHG emissions related to limestone calcination on plant *i* in year *y*	Calculated in accordance with provided Monitoring plan	tCO2eq	c	annually	100 %	Electronic/ Paper	
43. $EC_{BL,y,i}$	Amount of electric power consumed inbaseline scenario in year *y* by plant *i* in year *y*	Calculated in accordance with provided Monitoring plan	MWh	c	annually	100 %	Electronic/ Paper	
44. $EC_{BL,i}$	Average amount of electric power consumed from JES of Ukraine in base period 2001-2003 in by plant *i*	Calculated on the basis of data received from measuring with measuring equipmentand reflected in annual reports.	MWh	m	once	100 %	Electronic/ Paper	See Annex 3, paragraph 3.3
45. $P_{y,i}$	Amount of sugar production in year *y* by plant *i*	Production reports made by the department of planning	t	m	monthly	100 %	Electronic/ Paper	
46. $P_{BL,i}$	Average amount of sugar production in base period 2001-2003 by sugar plant *i*	Calculated on the basis of data received from measuring with measuring equipmentand reflected in annual reports.	t	c	once	100 %	Electronic/ Paper	
47. $FC_{BL,NG,y,i}$	Amount of natural gas combusted in baseline scenario in year *y* by plant *i* in year *y*	Calculated in accordance with provided Monitoring plan	ths m^3	c	monthly	100 %	Electronic/ Paper	
48. $FC_{BL,NG,i}$	Average amount of natural gas combusted by sugar plant *i* in base period 2001-2003	Calculated on the basis of data received from measuring with natural gas meters and reflected in acts with Natural gas suppliers.	ths m^3	c	once	100 %	Electronic/ Paper	See Annex 3, paragraph 3.3

49. $FC_{BL,Coal,,y,i}$	Amount of coal combusted in baseline scenario in year *y* by plant *i*	Calculated by project developers based on the statistical data of the company and parameters of year *y* of base period	t	c	monthly	100 %	Electronic/ Paper	
50. $FC_{BL,Coal,i}$	Average amount of coal combusted by sugar plant *i* in base period 2001-2003	Calculated on the basis of data received from measuring with measuring equipment and reflected in acts with coal suppliers.	t	c	once	100 %	Electronic/ Paper	See Annex 3, paragraph 3.3
51. $NCV_{NG,BL,i}$	Weighed average net calorific value of natural gas combusted in base period 2001-2003 on sugar plant *i*	The value is calculated on the basis of statistic data of Ukraine provided in common reporting forms for 2001-2003	GJ/ ths m^3	c	annually	100%	Electronic/ Paper	See Annex 3, paragraph 3.3
52. $NCV_{Coal,BL,i}$	Weighed average net calorific value of coal in base period 2001-2003 on sugar plant *i*	The value is calculated on the basis of statistic data of Ukraine provided in common reporting forms for 2001-2003	GJ/t	c	Annually	100%	Electronic/ Paper	See Annex 3, paragraph 3.3
53. $MSW_{T,BL,y,i}$	Amount of pulp removed to landfills in baseline scenario in year *y* by plant *i*	Calculated in accordance with provided Monitoring plan	t	c	monthly	100%	Electronic/ Paper	See formulas (24) and (31) below

54. $MSW_{F,BL,i}$	Fraction of pulp disposed to landfills according to base scenario by plant *i*	According to general practice at sugar plants included into project at the time of Project start[89][90]		e	once	100%	Electronic/ Paper	In case of project absence there would be no other alternative except pulp transferring to landfills, that is why this value is considered to be equal 1 (100%).
55. R_{BL}	Recovered CH4 in baseline scenario	Default value.	tCH4	e	Once	100%	Electronic/ Paper	At project inception there were no projects aimed at utilizing landfill gasses planned or implemented on landfills included in the project boundary. Therefore this value was set equal to 0.
56. $SPB_{y,i}$	Sugar content of beets processed in year *y* on plant *i*	Production reports	%	m	monthly	100%	Electronic/ Paper	

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[89] Letter №38 dated 10.01.2012

[90] Letter №150 dated 14.03.2012

57. $SPB_{BL,i}$	Average sugar content of beets processed in in base period 2001-2003 on plant *i*	Calculated on the basis of statistic data of the enterprise using simple arithmetic functions	%	c	once	100%	Electronic/ Paper	See Annex 3, paragraph 3.3
58. $EOUT_{BL,i}$	Average amount of electric power supplied to external consumers by sugar plant *i* in base period 2001-2003	Calculated on the basis of statistic data of the enterprise using simple arithmetic functions	MWh	c	once	100 %	Electronic/ Paper	See Annex 3, paragraph 3.3
59. $CEF_{CO2,ELEC,BL,i}$	Weighed average emission factor for GHG emission related to electric power generation by sugar plant *i* in base period 2001-2003	Calculated on the basis of statistic data provided by the enterprise and approved emission factors for the relevant types of fuel.	tCO2eq/MWh	c	once	100 %	Electronic/ Paper	See Annex 3, paragraph 3.1, formulae (36)
60. $SFC_{BL,y,i}$	Specific fuel consumption for electric power generation by plant *i* in year *y* of base period 2001-2003	Form 11-MTP	TFE	c	annually	100%	Electronic/ Paper	
61. $FP_{BL,NG,y,i}$	Portion of natural gas in total amount of fuel used for electric power generation on plant *i* in year *y* of base period 2001-2003	Determined by chief power engineer of the plant on the basis of energy resources consumption statistic data	%	c	annually	100 %	Electronic/ Paper	

62. $FP_{BL,coal,y,i}$	Portion of coal in total amount of fuel used for electric power generation on plant *i* in year *y* of base period 2001-2003	Determined by chief power engineer of the plant on the basis of energy resources consumption statistic data	%	c	annually	100 %	Electronic/ Paper	
63. $LC_{BL,i}$	Average amount of limestone calcinated in base period 2001-2003	Production reports. Reports on limestone purchasing	t	m	once	100 %	Electronic/ Paper	
64. $CaCO_{3\ BL,i}$	Weighed average CaCO3 content in limestone calcinated in base period 2001-2003 on plant *i*	Calculated on the basis of data provided by limestone suppliers	-	c	once	100 %	Electronic/ Paper	See Annex 3, paragraph 3.3
65. $MgCO_{3\ BL,i}$	Weighed average MgCO3 content in limestone calcinated in base period 2001-2003 on plant *i*	Calculated on the basis of data provided by limestone suppliers	-	c	once	100 %	Electronic/ Paper	See Annex 3, paragraph 3.3
66. $SLC_{BL,i}$	Specific CO2 emission due to limestone calcination in base period 2001-2003 on plant *i*.	Calculated in accordance with provided Monitoring plan	tCO_2e/t sugar	c	once	100 %	Electronic/ Paper	
67. $EOUT_{BL,y,i}$	Amount of electric power supplied by sugar plant *i* in base year *y* of the base period 2001-2003to external consumers	Measured with measuring equipment. Annual reports	MWh	m	once	100 %	Electronic/ Paper	See Annex 3, paragraph 3.3

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

Baseline emission:

$$BE_y = \sum BE_{y,i} \text{ ,} \qquad (15)$$

where
BE_y = greenhouse gases emissions according to the baseline scenario in year *y*, tCO2eq;
$BE_{y,i}$ = greenhouse gases emissions according to the baseline scenario of the sugar plant *i* in year *y*, tCO2eq
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

$$BE_{y,i} = BE_{ELEC,y,i} + BE_{NG,y,i} + BE_{Coal,y,i} + BE_{CH4,y,i} + BE_{Calc,y,i} \text{,} \qquad (16)$$

where
$BE_{y,i}$ = greenhouse gases emissions according to the baseline scenario of the sugar plant n in year *y*, tCO2eq;
$BE_{ELEC,y,i}$ = greenhouse gases emissions according to the baseline scenario related to the consumption of electric power in year *y*, tCO2eq;
$BE_{NG,y,i}$ = greenhouse gases emissions according to the baseline scenario related to the consumption of natural gas in year *y*, tCO2eq;
$BE_{Coal,y,}$ = greenhouse gases emissions according to the baseline scenario related to the consumption of coal in year *y*, tCO2eq;
$BE_{CH4,y,i}$ = greenhouse gases emissions according to the baseline scenario associated with the utilization of pulp by its removal to the landfill in the year *y*, tCO2eq;
$BE_{Calc,y,i}$ = Baseline emissions related with calcination of limestone in year *y*, tCO2eq;

i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

Taking into account the fact that on Dubenskiy and Kremenetskiy plants were implemented measures aimed both at processing of pulp and reduction of energy resources consumption, while on Lokhvitskiy and Zolochivskiy sugar plants only measures aimed at pulp processing were implemented, it was decided to use different approaches for GHG emission reduction calculation on the plants.

Dubenskiy and Kremenetskiy sugar plants.

Greenhouse gases emissions according to the baseline scenario and related to the consumption of electric power are calculated according to the approach described in the Tool to calculate baseline, project and/or leakage emissions from electric power consumption[91], Version 01.

$$BE_{ELEC,y,i} = EC_{BL,y,i} \cdot EF_{CO2,ELEC,y,i}, \qquad (17)$$

where

$BE_{ELEC,y,i}$ = greenhouse gases emissions according to the baseline scenario related to the consumption of electric power by plant *i* in year *y*, tCO2eq;

$EC_{BL,y,i}$ = quantity of electric power consumed according to the baseline scenario by plant *i* in year *y*, MWh;

$EF_{CO2,ELEC,y}$ = emission factor for indirect greenhouse gases emissions caused by the electric power consumption of electric energy consumers in the Joint Energy Systems of Ukraine in year *y*, tCO2eq/ MWh; (See formulae 3 above)

i = indication of plant for which calculations are carried out;

y = year for which calculations are carried out.

$$EC_{BL,y,i} = P_{y,i} \cdot \frac{SPB_{BL,i}}{SPB_{y,i}} \cdot \frac{EC_{BL,i}}{P_{BL,i}}, \qquad (18)$$

where

$EC_{BL,y,i}$ = amount of electric power consumed in baseline scenario by plant *i* in year *y*, MWh;

$P_{y,i}$ = amount of sugar production in year y by plant i, t;

$P_{BL,i}$ = average amount of sugar production in base period 2001-2003 by plant i, t;

$EC_{BL,i}$ = average amount of electric power consumed from energy system of Ukraine in base period 2001-2003 by the plant i, MWh;

$SPB_{BL,i}$ =average sugar content in beets in baseline period on the plant *i*, %;

$SPB_{y,i}$ = sugar content in beets in year *y* on plant *i*, %;

i = indication of plant for which calculations are carried out;

y = year for which calculations are carried out.

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[91] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf

Greenhouse gases emissions according to the baseline scenario and related to the consumption of natural gas are calculated according to the approach described in Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion[92], Version 02.

$$BE_{NG,y,i} = FC_{BL,NG,y,i} \cdot \frac{NCV_{NG,BL,i}}{NCV_{NG,y,i}} \cdot NCV_{NG,y,i} \cdot EF_{CO2,NG}\ , \qquad (19)$$

where

$BE_{NG,y,i}$ = greenhouse gases emissions according to the baseline scenario related to the consumption of natural gas by plant *i* in year *y*, tCO2eq;
$FC_{BL,NG,y,i}$ = amount of natural gas consumed by plant *i* according to the baseline scenario in year *y*, ths m^3;
$NCV_{NG,BL,i}$ = weighed average net calorific value of natural gas consumed in base period 2001-2003 by plant *i*, GJ/ths m^3;
$NCV_{NG,y,i}$ = net calorific value of natural gas consumed by plant *i* in the year *y*, GJ / ths m^3;
$EF_{CO2,NG}$ = GHG emission factor for natural gas, tCO2eq/GJ;
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

$$FC_{BL,NG,y,i} = \frac{P_{y,i}}{P_{BL,i}} \cdot \frac{SPB_{BL,i}}{SPB_{y,i}} \cdot (FC_{BL,NG,i} - \frac{EOUT_{BL,i} \cdot CEF_{CO2,ELEC,BL,i}}{NCV_{NG,BL,i} \cdot EF_{CO2,NG}})\ , \qquad (20)$$

where

$FC_{BL,NG,y,i}$ = amount of natural gas consumed by plant *i* according to the baseline scenario in year *y*, ths m^3;
$P_{y,i}$ = amount of sugar production by sugar plant *i*in year *y*, t;
$P_{BL,i}$ = average amount of sugar production by sugar plant *i* in base period 2001-2003, t;
$FC_{BL,NG,i}$ = average amount of natural gas consumed in base period 2001-2003 by plant *i*, ths m^3;
$SPB_{BL,i}$ = average sugar content of beets in base period 2001-2003 on plant *i*, %;
$SPB_{y,i}$ = sugar content of beets processed in year *y* on plant *i* , %;
$NCV_{NG,BL,i}$ = weighed average net calorific value of natural gas in base period 2001-2003 on the plant *i*, GJ/ths m^3;
$EF_{CO2,NG}$ = GHG emission factor for natural gas, tCO2eq/GJ;
$EOUT_{BL,i}$ = average Amount of electric power supplied to external consumers in base period by plant *i*, MWh;
$CEF_{CO2,ELEC,BL,i}$ = Weighed average GHG emission factor of emissions related to electric power generation by sugar plant*i* in base period 2001-2003, tCO2eq/MWh ;

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[92] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

For preliminary calculations the emission factor of indirect GHG emissions related to electric power generation in power systems of Ukraine was applied.For actual calculations this parameter will be calculated on the basis of production parameters of the enterprise (see Annex 3, paragraph 3.1 of this document).

i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

Greenhouse gases emissions according to the baseline scenario and related to the consumption of coal are calculated according to the approach described in Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion[93], Version 02.

$$BE_{Coal,y,i} = FC_{BL,Coal,y,i} \cdot \frac{NCV_{Coal,BL,i}}{NCV_{Coal,y,i}} \cdot NCV_{Coal,y,i} \cdot EF_{CO2,Coal}, \qquad (21)$$

where
$BE_{Coal,y,i}$ = greenhouse gases emissions according to the baseline scenario related to the consumption of coal by plant i in year y, tCO2eq;
$FC_{BL,Coal,y,i}$ = amount of coal consumed by plant i according to the baseline scenario in year y, t;
$NCV_{Coal,BL\ i}$ = weighed average net calorific value of coal consumed in base period 2001-2003 by plant i, GJ/t;
$NCV_{Coal,y,i}$ = net calorific value of coal consumed by plant i in the year y, GJ / t;
$EF_{CO2,Coal}$ = GHG emission factor for natural gas, tCO2eq/GJ;
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

$$FC_{BL,Coal,y,i} = P_{y,i} \cdot \frac{SPB_{BL,i}}{SPB_{y,i}} \cdot \frac{FC_{BL,Coal,i}}{P_{BL,i}}, \qquad (22)$$

where
$FC_{BL,Coal,y,i}$ = amount of coal consumed by plant i according to the baseline scenario in year y, t;
$P_{y,i}$ = amount of sugar production by sugar plant $i$in year y, t;
$P_{BL,i}$ = average amount of sugar production by sugar plant i in base period 2001-2003, t;
$FC_{BL,Coal,i}$ = average amount of coal consumed in base period 2001-2003 by plant i, t;
$SPB_{BL,i}$ =average sugar content in beets in baseline period 2001-2003 on the plant i, %;

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[93] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

$SPB_{y,i}$ = sugar content in beets processed in year y on plant i, %;
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

To calculate emissions for project scenario related to the utilization of secondary products from the production of sugar (pulp) by their removal at the landfills typical approach described in 1996 IPCC (1996[94] IPCC Guidelines for National Greenhouse Gas Inventories) was used.

$$BE_{CH4,BL,y,i} = (MSW_{T,BL,y,i} \cdot MSW_{F,BL,i} \cdot MCF \cdot DOC \cdot DOC_F \cdot F \cdot \frac{16}{12} - R_{BL}) \cdot (1 - OX) \cdot GWP_{CH4}, \qquad (23)$$

where
$BE_{CH4,BL,y}$ = greenhouse gases emissions according to the baseline scenario associated with the utilization of pulp by it's removal to the landfill in the year, tCO2eq;
$MSW_{T,BL,y,i}$ = total amount of pulp transferred to landfills by plant i according to the baseline scenario in year y, t;

$MSW_{F,BL,i}$ = part of pulp generated by plant i transported to the landfill according to the baseline scenario;
MCF = methane utilized in baseline scenario; (2006 IPCC) [95]
DOC = Portion of pulp that is expected to decompose; (2006 IPCC) [96]
DOC_F = Portion of pulp that decompose in practice; (2006 IPCC) [97]
F = Fraction of CH4 in landfill gas; (1996[98] IPCC)
$\frac{16}{12}$ = factor of carbon conversion in methane;
R = CH4 utilized in year y, t CH4;
OX = oxidation factor, (1996[99] IPCC)
GWP_{CH4} = global warming potential of methane tCO2eq/tCH4; (in accordance with decision of UNFCCC and Kyoto protocol)
i = indication of the plant for which calculations are carried out;
y = year for which calculations are carried out.

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[94] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[95] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

[96] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[97] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[98] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[99] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

In case of project absence there would be no other alternative except pulp transferring to landfills, that is why amount of pulp transferred to landfills in baseline scenario is calculated using the following formulae:

$$MSW_{T,BL,y,i} = MSW_{T,PJ,y,i}, \tag{24}$$

where

$MSW_{T,BL,y,i}$ = amount of pulp transferred to landfills by plant *i* according to the baseline scenario in year *y*, t ;
$MSW_{T,PJ,y,i}$ = amount of pulp selled off by plant *i* according to the project scenario in year *y*, t;
i = indication of the plant for which calculations are carried out;
y = year for which calculations are carried out.

$$BE_{Calc,y,i} = P_{y,i} \cdot SLC_{BL,i} \cdot \frac{SPB_{BL,i}}{SPB_{y,i}}, \tag{25}$$

where

$BE_{Calc,y,i}$ = baseline carbon emissions from calcination of limestone per tonne of beet processed in project year y at plant i (tCO2eqq)
$P_{y,i}$ = amount of sugar production by sugar plant *i*in year *y*, t;
$SLC_{BL,i}$ = specific CO2 emission due to limestone calcination in base period 2001-2003 on plant *i*, t CO_2e/t beets;
$SPB_{BL,i}$ =average sugar content in beets processed in baseline period 2001-2003 on the plant *i*, %;
$SPB_{y,i}$ = sugar content in beets processed in year *y* on plant *i*, %;
i = indication of plant for which calculations are carried out;
y = year for which calculations are carried out.

$$SLC_{BL,i} = \frac{LC_{BL,i} \cdot CaCO_{3\,BL,i} \cdot EF_{CaCO3} + LC_{BL,i} \cdot MgCO_{3\,BL,i} \cdot EF_{MgCO3}}{P_{BL,i}}, \tag{26}$$

where

$SLC_{BL,i}$ = specific CO2 emission due to lime calcination in base period 2001-2003 on plant *i*, t CO_2e/t beets;
EF_{CaCO3} = carbon dioxide emission factor for $CaCO_3$, t CO_2e/t $CaCO_3$;
$CaCO_{3\,BL,i}$ = weighed average $CaCO_3$ content in limestone calcinated in base period 2001-2003 on plant *i*;
$LC_{BL,i}$ = average amount of calcinated limestone in base period 2001-2003 on plant *i*, t;
EF_{MgCO3} = carbon dioxide emission factor for $MgCO_3$, t CO_2e/t $MgCO_3$;
$MgCO_{3\,BL,i}$ = weighed average $MgCO_3$ content in limestone calcinated in base period 2001-2003 on plant *i*;

i = indication of the plant for which calculations are carried out.

Lokhvitskiy and Zolochivskiy sugar plants.

GHG emission in baseline scenario due to electric power consumption on this plants are considered to be equal zero, because in case of project absence pulp processing would only contain pulp pressing necessary for pulp transportation to landfills. This the common procedure. This is conservative assumptionand does not lead to overestimation of GHG emission reduction due to project realization.

$$BE_{ELEC,y,i} = 0, \tag{27}$$

where

$BE_{ELEC,y,i}$ = GHG emission in baseline scenario due to electric power consumption in year y, tCO2eq;

i = indication of the plant;

y = year for which calculations are carried out.

GHG emission in baseline scenario due to natural gas consumption on this plants are considered to be equal zero, because in case of project absence pulp processing would only contain pulp pressing necessary for pulp transportation to landfills. This the common procedure. This is conservative assumptionand does not lead to overestimation of GHG emission reduction due to project realization.

$$BE_{NG,y,i} = 0, \tag{28}$$

where

$BE_{NG,y,i}$ = GHG emission in baseline scenario due to natural gas consumption in year y by plant i, tCO2eq;

i = indication of the plant;

y = year for which calculations are carried out.

GHG emission reduction in baseline scenario due to coal consumption are considered to be equal zero because coal was never used for pulp processing.

$$BE_{Coal,y,i} = 0, \tag{29}$$

where

$BE_{Coal,y,i}$ = GHG emission in baseline scenario due to coal consumption in year y by plant i, tCO2eq;

i = indication of the plant;

y = year for which calculations are carried out.

To calculate GHG emissions for baseline scenario related to the utilization of secondary products from the production of sugar (pulp) by their removal to the landfills typical approach described in 1996 IPCC Guidelines for National Greenhouse Gas Inventories was used[100].

$$BE_{CH4,BL,y,i} = (MSW_{T,BL,y,i} \cdot MSW_{F,BL,i} \cdot MCF \cdot DOC \cdot DOC_{F} \cdot F \cdot \frac{16}{12} - R_{BL}) \cdot (1 - OX) \cdot GWP_{CH4}, \qquad (30)$$

where

$BE_{CH4,BL,y}$ = greenhouse gases emissions according to the baseline scenario associated with the utilization of pulp by it's removal to the landfill in the year, tCO2eq;

$MSW_{T,BL,y,i}$ = total amount of pulp transferred to landfills by plant i according to the baseline scenario in year y, t;

$MSW_{F,BL,i}$ = part of pulp generated by plant i transported to the landfill according to the baseline scenario;

MCF = methane utilized in baseline scenario; (2006 IPCC) [101]

DOC = Portion of pulp that is expected to decompose; (2006 IPCC) [102]

DOC_F = Portion of pulp that decompose in practice; (2006 IPCC) [103]

F = Fraction of CH4 in landfill gas; (1996[104] IPCC)

$\frac{16}{12}$ = factor of carbon conversion in methane;

R = CH4 utilized in year y, t CH4;

OX = oxidation factor, (1996[105] IPCC)

GWP_{CH4} = global warming potential of methane tCO2eq/tCH4; (in accordance with decision of UNFCCC and Kyoto protocol)

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[100] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[101] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_3_Ch3_SWDS.pdf

[102] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[103] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf

[104] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

[105] http://www.ipcc-nggip.iges.or.jp/public/gl/wastrusn.html

i = indication of the plant for which calculations are carried out;
y = year for which calculations are carried out.

In case of project absence there would be no other alternative except pulp transferring to landfills, that is why amount of pulp transferred to landfills in baseline scenario is calculated using the following formulae:

$$MSW_{T,BL,y,i} = MSW_{T,PJ,y,i}, \qquad (31)$$

where
$MSW_{T,BL,y,i}$ = amount of pulp transferred to landfills by plant i according to the baseline scenario in year y, t ;
$MSW_{T,PJ,y,i}$ = amount of pulp selled off by plant i according to the project scenario in year y, t;
i = indication of the plant for which calculations are carried out;
y = year for which calculations are carried out.

Emissions related to calcination of limestone are considered to be equal 0, because calcination process is not related to pulp processing.

$$BE_{Calc,y,i} = 0, \qquad (32)$$

where
$BE_{Calc,y,i}$ = GHG emissions in baseline scenario due to lime calcination in project year y on plant i, t CO_2e;
i = indication of the plant for which calculations are carried out;
y = year for which calculations are carried out.

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

Not applicable

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

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

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO2 equivalent):

Not applicable.

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

An increase in GHG emissions outside the project boundaries as a result of the project implementation is not expected.

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):

Leakages are not expected.

The project does not envisage any activities that may lead to leakages.

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):

Emission reduction is calculated using the formulae:

$$ER_y = BE_y - PE_y , \qquad (33)$$

where

ER_y = GHG emission reduction in year y, tCO2eq;

BE_y = GHG emissions according to baseline scenario in year y, tCO2eq;

PE_y = GHG emissions according to project scenario in year y, tCO2eq;

y = year for which calculations are carried out.

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:

Collection, handling, transfer and utilization of waste at the company is carried out in accordance with the Law of Ukraine “On waste”.

Applicable laws and regulations on environmental safety are the legal basis for waste management.

Detailed description of waste management can be found in the section of Annex 3 of this document below.

The project implementation does not require gathering of information on the influence on the environment in excess of information collected at the pant prior to the project start.

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.
Table D.1.1.1. *7.* $EC_{PJ,y}$ *Table D.1.1.3.* *44.* EC_{BL}	low	Quantity of electric power consumed by sugar plants of PJSC «Rise-Maksymko» is measured using working, calibrated and tested in accordance with the current demand in Ukraine equipment. Moreover, the amount of electric power consumed is cross-checked with the supplier of electric power and state authorities.
Table D.1.1.1. *29.* $BPEC_{PJ,y,i}$	low	This value is determined by sugar plants' specialists that have the necessary qualification and based on official statistic data of the enterprises and using the relevant methodologies. This information is submitted to the statistic reporting forms 11-MTP.
Table D.1.1.1. *24.* $EOUT_{y,i}$ *Table D.1.1.3.* *58.* $EOUT_{BL,i}$	low	Quantity of electric power supplied by sugar plants of PJSC «Rise-Maksymko» to external consumers is determined using working, calibrated and tested in accordance with the current demand in Ukraine equipment. Moreover, the amount of electric power supplied to external consumers is cross-checked with the supplier of electric power and state authorities.
Table D.1.1.1. *26.* $SFC_{PJ,NG,y,i}$ *Table D.1.1.3.* *60.* $SFC_{BL,y,i}$	low	Determined by chief power engineers of sugar plants on the basis of statistic data of sugar plants received from measurement with working and calibrated measuring devices and using the corresponding methodologies. Specific consumption of energy resources for electric power generation are included into statistic reporting form 11-MTP.
Table D.1.1.1. *27.* $FP_{NG,y,i}$ *Table D.1.1.3.* *61.* $FP_{NG,y,i}$	low	Portion of natural gasin total amount of consumed energy resources for electric power generation by sugar plants is determined by chief power engineers of sugar plants on the basis of statistic data of sugar plants received from measurement with working and calibrated measuring devices and applying simple arithmetic functions
Table D.1.1.1. *28.* $FP_{coal,y,i}$ *Table D.1.1.3.* *62.* $FP_{coal,y,i}$	low	Portion of coal in total amount of consumed energy resources for electric power generation by sugar plants is determined by chief power engineers of sugar plants on the basis of statistic data of sugar plants received from measurement with working and calibrated measuring devices and applying simple arithmetic functions

Table D.1.1.1. 12. $FC_{PJ,Coal,y,i}$ *Table D.1.1.3. 50.* $FC_{BL,Coal,i}$	low	Amount of coal consumed by sugar plants of PJSC "Rise-Maksymko" is measured using using working, calibrated and tested in accordance with the current demand in Ukraine equipment. The value is cross-checked by conducting the balance of purchased and combusted coal.
Table D.1.1.1. 31. $BPFC_{PJ,Coal,y,i}$	low	Amount of coal consumed by sugar plants for pulp processing is determined by enterprises' specialists that have the necessary qualification and based on official statistic data of the enterprises and using the relevant methodologies. This information is submitted to the statistic reporting forms 11-MTP.
Table D.1.1.1. 10. $FC_{PJ,NG,y,i}$ *Table D.1.1.3. 48.* $FC_{BL,NG,i}$	low	Amount of natural gas consumed by sugar plants of PJSC "Rise-Maksymko" is measured using using working, calibrated and tested in accordance with the current demand in Ukraine equipment. The value is cross-checked by natural gas supplier and state authorities.
Table D.1.1.1. 30. $BPFC_{PJ,NG,y,i}$	low	Amount of natural gas consumed by sugar plants for pulp processing is determined by enterprises' specialists that have the necessary qualification and based on official statistic data of the enterprises and using the relevant methodologies. This information is submitted to the statistic reporting forms 11-MTP.
Table D.1.1.1. 13. $NCV_{NG,y,i}$ *Table D.1.1.3. 51.* $NCV_{NG,BL,i}$	low	Net calorific value of natural gas was determined on the basis of sectoral standards of Ukraine provided in common reporting format for relevant years Table 1.A(b)[106]. For calculation of emission reduction starting from 2010 actual average annual net calorific value of natural gas determined on the basis of data provided by the supplier will be used.
Table D.1.1.1. 14. $NCV_{Coal,y,i}$ *Table D.1.1.3. 42.* $NCV_{Coal,BL,i}$	low	Net calorific value of coal was determined on the basis of sectoral standards of Ukraine provided in common reporting format for relevant years Table 1.A(b)[107]. For calculation of emission reduction starting from 2010 actual average annual net calorific value of coal determined on the basis of data provided by the supplier will be used.
Table D.1.1.1. 15. $MSW_{T,PJ,y,i}$	low	Generation of organic wastes and secondary products and its movement is controlled by state authorities in the field of ecology and environmental protection, that is why the accuracy of this information is assured.

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[106] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-crf-14oct.zip

[107] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-crf-14oct.zip

Table D.1.1.1. *8. $EF_{CO2,ELEC,y}$*	low	While emission reduction monitoring in the framework of this project only officially approved emission factor for Ukrainian power system was used. The actuality of this value is the object of monitoring by project developer. In case if the value is changed, project developer updates the value while development and issuance of the following periodic monitoring report..
Table D.1.1.3 *45. $P_{y,i}$* *46. $P_{BL,i}$*	low	The amount of product produced is the object of commercial reporting that is cross-checked by state authorities (tax inspection etc). This information is provided in many separate documents on different stages, that is why the possibility of mistake or incorrectness of this information is excluded.
Table D.1.1.3 *56. $SPB_{y,i}$* *57. $SPB_{BL,i}$*	low	For determination of sugar content in beets half-automatic line is used. Sugar content determination is performed by method of cold digestion.
Table D.1.1.1. *32. $LC_{y,i}$* *Table D.1.1.3.* *63. $LC_{BL,i}$*	low	Weighing of lime is performed on mechanic weights with capacity of 100 t. The calibration of weights is performed one time per 6 month. Review and checking is performed with application of trial weights of 4th level with total weight 80 t. The results of state calibration, reviews and checkings are submitted into the technical passport for the weights.
Table D.1.1.1. *35. $CaCO_{3\ y,i}$* *Table D.1.1.3.* *64. $CaCO_{3\ BL,i}$*	low	Documented by lime supplier while each lime unloading
Table D.1.1.1. *36. $MgCO_{3\ y,i}$* *Table D.1.1.3.* *65. $MgCO_{3\ BL,i}$*	low	Documented by lime supplier while each lime unloading

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

The monitoring plan does not foresee any other additional measures, resulting in installation of new measuring equipment or collection of additional parameters except those that are already implemented. A scheme of data collection is provided on Figures D.1 and D.2.

The main coordinators of the collection of all necessary data for monitoring of the project are the specially established working groups, containing members of main departments and services of the plants.

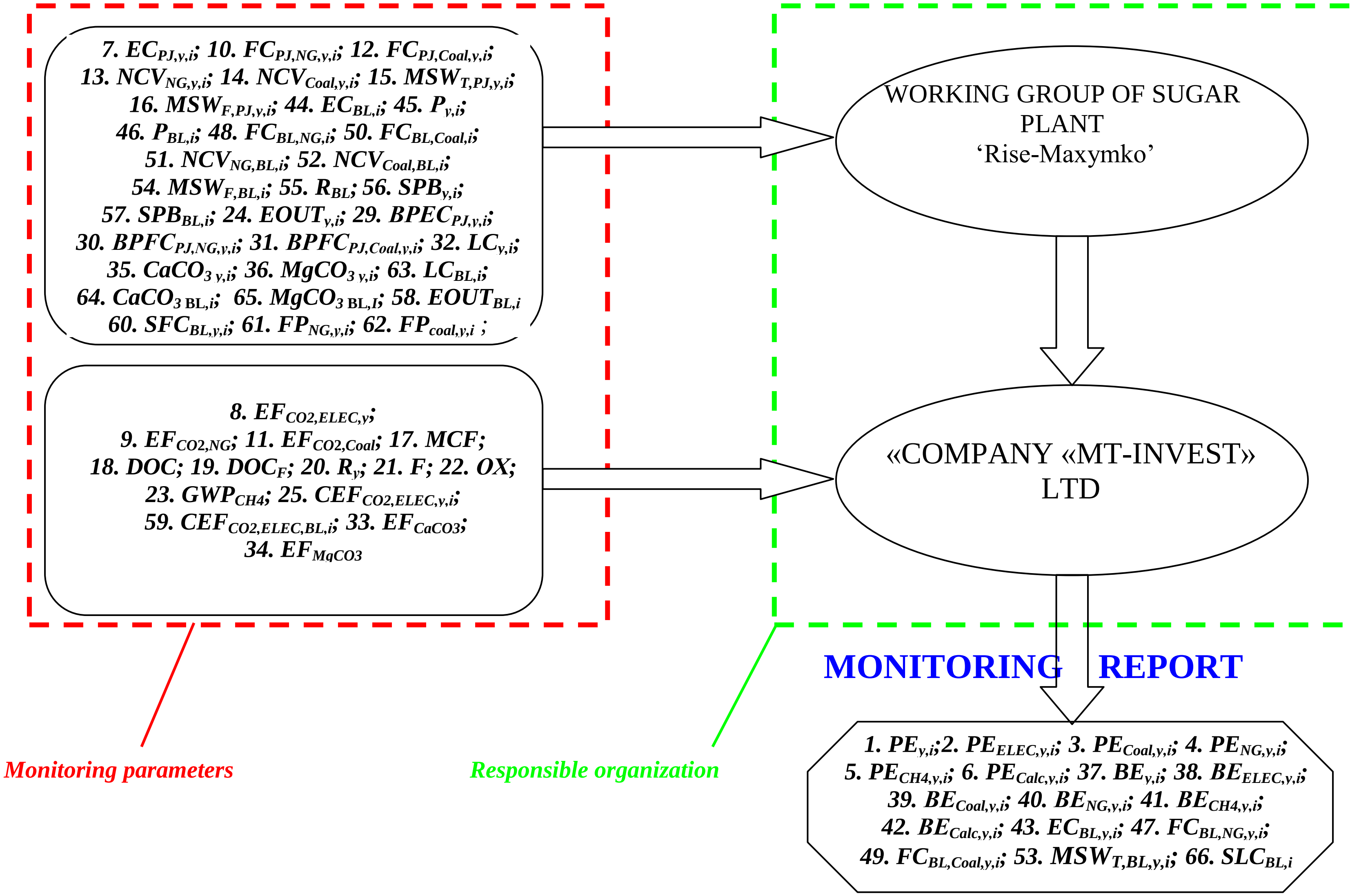

Fig. D.1 Scheme of data collection for project parameters’ monitoring

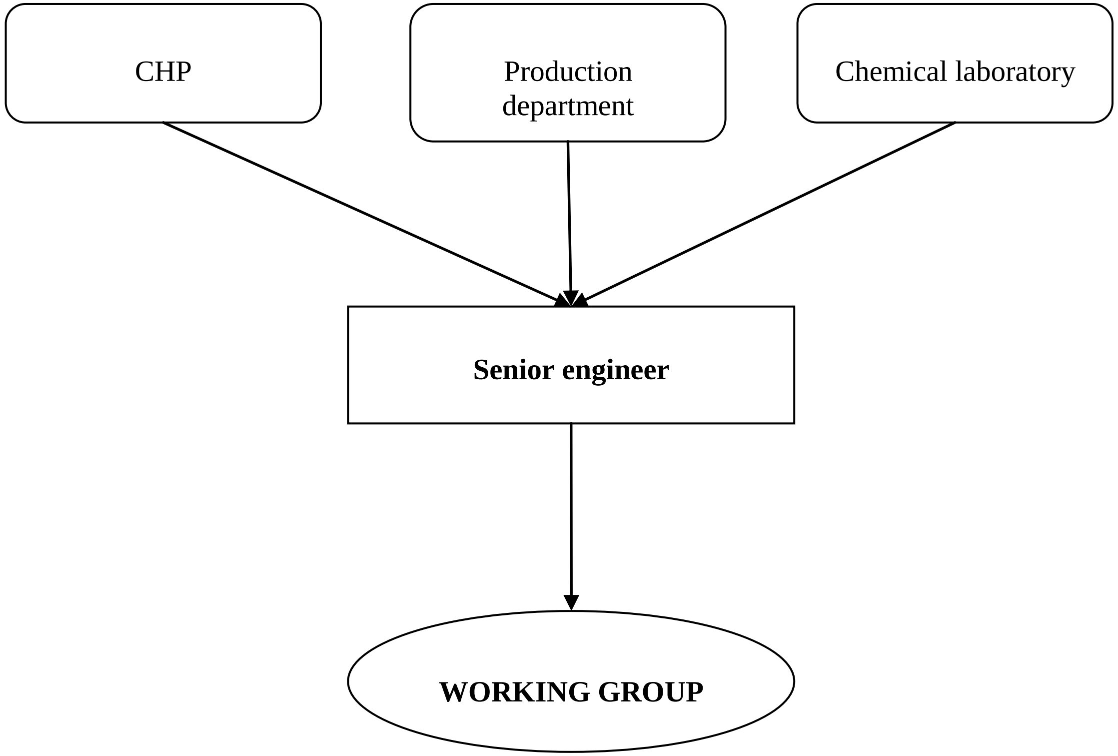

Fig. D.2. Data direction for monitoring on sugar plant

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

PJSC «Rise-Maksymko», which is the project participant.

«Company «MT-Invest» LTD, which is not the project participant.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

The calculation of project emissions is carried out in accordance with formulas listed in section D.1.1.2.

Results of calculations are presented in the table below. Calculations themselves can be found in files «Zolochiv_v.1.xls», «Dubno_v.1.xls», «Kremenets_v.1.xls», «Lohvytsi_v.1.xls» and «TotalER_v.1.xls», which are attached to the PDD.

Table E.1. Project scenario emissions. Dubenskiy sugar plant (see «Dubno_v.1.xls»).

	$PE_{ELEC,y,i}$	$PE_{NG,y,i}$	$PE_{Coal,y,i}$	$PE_{CH4,y,i}$	$PE_{Calc,y,i}$	$PE_{y,i}$
Year	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
2004	1224	23612	3387	0	5977	34200
2005	1300	26376	3475	0	6204	37355
2006	1830	36983	4463	0	7937	51213
2007	2076	32239	5003	0	8929	48247
Total for 2004-2007:	6430	119210	16328	0	29047	171015
Average amount of emissions in 2004-2007:	1608	29803	4082	0	7262	42754
2008	2821	23729	5465	0	9822	41837
2009	2919	10053	21928	0	10477	45377
2010	3467	43058	5305	0	9487	61317
2011	3472	43065	5305	0	9487	61329
2012	3472	43065	5305	0	9487	61329
Total for 2008-2012:	16151	162970	43308	0	48760	271189
Average amount of emissions in 2008-2012:	3230	32594	8662	0	9752	54238
2013	3472	43065	5305	0	9487	61329
2014	3472	43065	5305	0	9487	61329
2015	3472	43065	5305	0	9487	61329
2016	3472	43065	5305	0	9487	61329
2017	3472	43065	5305	0	9487	61329
2018	3472	43065	5305	0	9487	61329
2019	3472	43065	5305	0	9487	61329
2020	3472	43065	5305	0	9487	61329
2021	3472	43065	5305	0	9487	61329
2022	3472	43065	5305	0	9487	61329
2023	3472	43065	5305	0	9487	61329
2024	3472	43065	5305	0	9487	61329
2025	3472	43065	5305	0	9487	61329
Total for 2013-2025:	45136	559845	68965	0	123331	797277
Average amount of emissions in 2013-2025:	3472	43065	5305	0	9487	61329
Total for 2004-2025:	67717	842025	128601	0	201138	1239481
Average amount of emissions in 2004-	3078	38274	5846	0	9143	56340

2025:							

Table E.2. Project scenario emissions. Kremenetskiy sugar plant (see «Kremenets_v.1.xls»).

	$PE_{ELEC,y,i}$	$PE_{NG,y,i}$	$PE_{Coal,y,i}$	$PE_{CH4,y,i}$	$PE_{Calc,y,i}$	$PE_{y,i}$
Year	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
2004	1560	18865	2293	0	7053	29771
2005	1346	20246	2583	0	6299	30474
2006	1323	30418	2821	0	7455	42017
2007	1508	28739	3880	0	10599	44726
Total for 2004-2007:	5737	98268	11577	0	31406	146988
Average amount of emissions in 2004-2007:	1434	24567	2894	0	7852	36747
2008	2308	23391	4392	0	11186	41277
2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	2323	23453	4396	0	11186	41358
2012	2323	23453	4396	0	11186	41358
Total for 2008-2012:	6954	70297	13184	0	33558	123993
Average amount of emissions in 2008-2012:	1391	14059	2637	0	6712	24799
2013	2323	23453	4396	0	11186	41358
2014	2323	23453	4396	0	11186	41358
2015	2323	23453	4396	0	11186	41358
2016	2323	23453	4396	0	11186	41358
2017	2323	23453	4396	0	11186	41358
2018	2323	23453	4396	0	11186	41358
2019	2323	23453	4396	0	11186	41358
2020	2323	23453	4396	0	11186	41358
2021	2323	23453	4396	0	11186	41358
2022	2323	23453	4396	0	11186	41358
2023	2323	23453	4396	0	11186	41358
2024	2323	23453	4396	0	11186	41358
2025	2323	23453	4396	0	11186	41358
Total for 2013-2025:	30199	304889	57148	0	145418	537654
Average amount of emissions in 2013-2025:	2323	23453	4396	0	11186	41358
Total for 2004-2025:	42890	473454	81909	0	210382	808635
Average amount of emissions in 2004-2025:	1950	21521	3723	0	9563	36756

Table E.3. Project scenario emissions. Lokhvitskiy sugar plant (see «Lohvytsi_v.1.xls»).

Year	$PE_{ELEC,y,i}$	$PE_{NG,y,i}$	$PE_{Coal,y,i}$	$PE_{CH4,y,i}$	$PE_{Calc,y,i}$	$PE_{y,i}$
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	105	1282	0	0	0	1387
2007	166	6329	0	0	0	6495
Total for 2004-2007:	271	7611	0	0	0	7882
Average amount of emissions in 2004-2007:	68	1903	0	0	0	1971
2008	531	3233	0	0	0	3764
2009	1630	8929	0	0	0	10559
2010	1332	7400	0	0	0	8732
2011	1327	7400	0	0	0	8727
2012	3008	7400	0	0	0	10408
Total for 2008-2012:	7828	34362	0	0	0	42190
Average amount of emissions in 2008-2012:	1566	6872	0	0	0	8438
2013	3008	7400	0	0	0	10408
2014	3008	7400	0	0	0	10408
2015	3008	7400	0	0	0	10408
2016	3008	7400	0	0	0	10408
2017	3008	7400	0	0	0	10408
2018	3008	7400	0	0	0	10408
2019	3008	7400	0	0	0	10408
2020	3008	7400	0	0	0	10408
2021	3008	7400	0	0	0	10408
2022	3008	7400	0	0	0	10408
2023	3008	7400	0	0	0	10408
2024	3008	7400	0	0	0	10408
2025	3008	7400	0	0	0	10408
Total for 2013-2025:	39104	96200	0	0	0	135304
Average amount of emissions in 2013-2025:	3008	7400	0	0	0	10408
Total for 2004-2025:	47203	138173	0	0	0	185376
Average amount of emissions in 2004-2025:	2146	6281	0	0	0	8426

Table E.4. Project scenario emissions. Zolochivskiy sugar plant (see «Zolochiv_v.1.xls»).

Year	$PE_{ELEC,y,i}$	$PE_{NG,y,i}$	$PE_{Coal,y,i}$	$PE_{CH4,y,i}$	$PE_{Calc,y,i}$	$PE_{y,i}$
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
2004	210	2372	0	0	0	2582
2005	175	2019	0	0	0	2194
2006	222	2347	0	0	0	2569
2007	192	2028	0	0	0	2220
Total for 2004-2007:	799	8766	0	0	0	9565

Average amount of emissions in 2004-2007:	200	2192	0	0	0	2391
2008	92	744	0	0	0	836
2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	92	746	0	0	0	838
2012	92	746	0	0	0	838
Total for 2008-2012:	276	2236	0	0	0	2512
Average amount of emissions in 2008-2012:	55	447	0	0	0	502
2013	92	746	0	0	0	838
2014	92	746	0	0	0	838
2015	92	746	0	0	0	838
2016	92	746	0	0	0	838
2017	92	746	0	0	0	838
2018	92	746	0	0	0	838
2019	92	746	0	0	0	838
2020	92	746	0	0	0	838
2021	92	746	0	0	0	838
2022	92	746	0	0	0	838
2023	92	746	0	0	0	838
2024	92	746	0	0	0	838
2025	92	746	0	0	0	838
Total for 2013-2025:	1196	9698	0	0	0	10894
Average amount of emissions in 2013-2025:	92	746	0	0	0	838
Total for 2004-2025:	2271	20700	0	0	0	22971
Average amount of emissions in 2004-2025:	103	941	0	0	0	1044

Table E.5. Total amount of project emission (see «TotalER_v.1.xls»)

Year	$PE_{ELEC,y}$	$PE_{NG,y}$	$PE_{Coal,y}$	$PE_{CH4,y}$	$PE_{Calc,y}$	PE_{y}
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
2004	2994	44849	5680	0	13030	66553
2005	2821	48641	6058	0	12503	70023
2006	3480	71030	7284	0	15392	97186
2007	3942	69335	8883	0	19528	101688
Total for 2004-2007:	13237	233855	27905	0	60453	335450
Average amount of emissions in 2004-2007:	3309	58464	6976	0	15113	83863
2008	5752	51097	9857	0	21008	87714
2009	4549	18982	21928	0	10477	55936

2010	4799	50458	5305	0	9487	70049
2011	7214	74664	9701	0	20673	112252
2012	8895	74664	9701	0	20673	113933
Total for 2008-2012:	31209	269865	56492	0	82318	439884
Average amount of emissions in 2008-2012:	6242	53973	11298	0	16464	87977
2013	8895	74664	9701	0	20673	113933
2014	8895	74664	9701	0	20673	113933
2015	8895	74664	9701	0	20673	113933
2016	8895	74664	9701	0	20673	113933
2017	8895	74664	9701	0	20673	113933
2018	8895	74664	9701	0	20673	113933
2019	8895	74664	9701	0	20673	113933
2020	8895	74664	9701	0	20673	113933
2021	8895	74664	9701	0	20673	113933
2022	8895	74664	9701	0	20673	113933
2023	8895	74664	9701	0	20673	113933
2024	8895	74664	9701	0	20673	113933
2025	8895	74664	9701	0	20673	113933
Total for 2013-2025:	115635	970632	126113	0	268749	1481129
Average amount of emissions in 2013-2025:	8895	74664	9701	0	20673	113933
Total for 2004-2025:	160081	1474352	210510	0	411520	2256463
Average amount of emissions in 2004-2025:	7276	67016	9569	0	18705	102567

E.2. Estimated leakage:

No leakages are expected.

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

Since the leakage emissions LEy = 0, the sum of leakage emissions and project scenario emissions is in fact equal to the identified project scenario emissions. The volumes are presented below in the Table below.

Table E.6. Sum of emissions from leakages and project activity (see «TotalER_v.1.xls»).

Year	PE_y	LE	PE_y+LE
	tCO2eq	tCO2eq	tCO2eq
2004	66553	0	66553
2005	70023	0	70023
2006	97186	0	97186
2007	101688	0	101688
Total for 2004-2007:	335450	0	335450
Average amount of	83863	0	83863

emissions in 2004-2007:			
2008	87714	0	87714
2009	55936	0	55936
2010	70049	0	70049
2011	112252	0	112252
2012	113933	0	113933
Total for 2008-2012:	439884	0	439884
Average amount of emissions in 2008-2012:	87977	0	87977
2013	113933	0	113933
2014	113933	0	113933
2015	113933	0	113933
2016	113933	0	113933
2017	113933	0	113933
2018	113933	0	113933
2019	113933	0	113933
2020	113933	0	113933
2021	113933	0	113933
2022	113933	0	113933
2023	113933	0	113933
2024	113933	0	113933
2025	113933	0	113933
Total for 2013-2025:	1481129	0	1481129
Average amount of emissions in 2013-2025:	113933	0	113933
Total for 2004-2025:	2256463	0	2256463
Average amount of emissions in 2004-2025:	102567	0	102567

E.4. Estimated baseline emissions:

Calculation of emissions of the baseline is carried out with formulas presented in section D.1.1.4.

Results of calculations are presented in the table below. Calculations themselves can be found in files «Zolochiv_v.1.xls», «Dubno_v.1.xls», «Kremenets_v.1.xls», «Lohvytsi_v.1.xls» and «TotalER_v.1.xls», which is attached to the PDD.

GHG emissions for baseline scenario are presented in tables of this section

Table E.7. Baseline scenario emissions. Dubenskiy sugar plant (see «Dubno_v.1.xls»).

Year	$BE_{ELEC,y,i}$	$BE_{NG,y,i}$	$BE_{Coal,y,i}$	$BE_{CH4,y,i}$	$BE_{Calc,y,i}$	$BE_{y,i}$
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
2004	1187	24717	4143	0	7542	37589
2005	1188	25288	4239	216938	7716	255369
2006	1708	36357	6094	305357	11094	360610
2007	2011	42812	7176	346460	13064	411523
Total for 2004-	6094	129174	21652	868755	39416	1065091

2007:						
Average amount of emissions in 2004-2007:	1523,5	32294	5413	217189	9854	266273
2008	2577	40314	6757	304087	12301	366036
2009	2549	39301	6587	284525	11992	344954
2010	3573	55632	9324	415889	16975	501393
2011	3579	55632	9324	415889	16975	501399
2012	3579	55632	9324	415889	16975	501399
Total for 2008-2012:	15857	246511	41316	1836279	75218	2215181
Average amount of emissions in 2008-2012:	3171	49302	8263	367255,8	15043,6	443036
2013	3579	55632	9324	415889	16975	501399
2014	3579	55632	9324	415889	16975	501399
2015	3579	55632	9324	415889	16975	501399
2016	3579	55632	9324	415889	16975	501399
2017	3579	55632	9324	415889	16975	501399
2018	3579	55632	9324	415889	16975	501399
2019	3579	55632	9324	415889	16975	501399
2020	3579	55632	9324	415889	16975	501399
2021	3579	55632	9324	415889	16975	501399
2022	3579	55632	9324	415889	16975	501399
2023	3579	55632	9324	415889	16975	501399
2024	3579	55632	9324	415889	16975	501399
2025	3579	55632	9324	415889	16975	501399
Total for 2013-2025:	46527	723216	121212	5406557	220675	6518187
Average amount of emissions in 2013-2025:	3579	55632	9324	415889	16975	501399
Total for 2004-2025:	68478	1098901	184180	8111591	335309	9798459
Average amount of emissions in 2004-2025:	3113	49950	8372	368709	15241	445385

Table E.8. Baseline scenario emissions. Kremenetskiy sugar plant (see «Kremenets_v.1.xls»).

	$BE_{ELEC,y,i}$	$BE_{NG,y,i}$	$BE_{Coal,y,i}$	$BE_{CH4,y,i}$	$BE_{Calc,y,i}$	$BE_{y,i}$
Year	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
2004	1122	23593	3732	0	6939	35386
2005	1398	29913	4753	81430	8839	126333
2006	2009	45687	6829	133999	12699	201223
2007	2164	46422	7357	184816	13681	254440
Total for 2004-2007:	6693	145615	22671	400245	42158	617382
Average amount of emissions in 2004-2007:	1673	36404	5668	100061	10540	154346
2008	2368	38666	5917	136138	11004	194093

2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	2384	38666	5917	136138	11004	194109
2012	2384	38666	5917	136138	11004	194109
Total for 2008-2012:	7136	115998	17751	408414	33012	582311
Average amount of emissions in 2008-2012:	1427	23200	3550	81683	6602	116462
2013	2384	38666	5917	136138	11004	194109
2014	2384	38666	5917	136138	11004	194109
2015	2384	38666	5917	136138	11004	194109
2016	2384	38666	5917	136138	11004	194109
2017	2384	38666	5917	136138	11004	194109
2018	2384	38666	5917	136138	11004	194109
2019	2384	38666	5917	136138	11004	194109
2020	2384	38666	5917	136138	11004	194109
2021	2384	38666	5917	136138	11004	194109
2022	2384	38666	5917	136138	11004	194109
2023	2384	38666	5917	136138	11004	194109
2024	2384	38666	5917	136138	11004	194109
2025	2384	38666	5917	136138	11004	194109
Total for 2013-2025:	30992	502658	76921	1769794	143052	2523417
Average amount of emissions in 2013-2025:	2384	38666	5917	136138	11004	194109
Total for 2004-2025:	44821	764271	117343	2578453	218222	3723110
Average amount of emissions in 2004-2025:	2037	34740	5334	117202	9919	169232

Table E.9. Baseline scenario emissions. Lokhvitskiy sugar plant (see «Lohvytsi_v.1.xls»).

Year	$BE_{ELEC,y,i}$	$BE_{NG,y,i}$	$BE_{Coal,y,i}$	$BE_{CH4,y,i}$	$BE_{Calc,y,i}$	$BE_{y,i}$
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
2004	0	0	0	0	0	0
2005	0	0	0	0	0	0
2006	0	0	0	178278	0	178278
2007	0	0	0	331015	0	331015
Total for 2004-2007:	0	0	0	509293	0	509293
Average amount of emissions in 2004-2007:	0	0	0	127323	0	127323
2008	0	0	0	345956	0	345956
2009	0	0	0	534542	0	534542
2010	0	0	0	376597	0	376597
2011	0	0	0	376597	0	376597
2012	0	0	0	376597	0	376597
Total for 2008-	0	0	0	2010289	0	2010289

2012:						
Average amount of emissions in 2008-2012:	0	0	0	402058	0	402058
2013	0	0	0	376597	0	376597
2014	0	0	0	376597	0	376597
2015	0	0	0	376597	0	376597
2016	0	0	0	376597	0	376597
2017	0	0	0	376597	0	376597
2018	0	0	0	376597	0	376597
2019	0	0	0	376597	0	376597
2020	0	0	0	376597	0	376597
2021	0	0	0	376597	0	376597
2022	0	0	0	376597	0	376597
2023	0	0	0	376597	0	376597
2024	0	0	0	376597	0	376597
2025	0	0	0	376597	0	376597
Total for 2013-2025:	0	0	0	4895761	0	4895761
Average amount of emissions in 2013-2025:	0	0	0	376597	0	376597
Total for 2004-2025:	0	0	0	7415343	0	7415343
Average amount of emissions in 2004-2025:	0	0	0	337061	0	337061

Table E.10. Baseline scenario emissions. Zolochivskiy sugar plant (see «Zolochiv_v.1.xls»).

Year	$BE_{ELEC,y,i}$	$BE_{NG,y,i}$	$BE_{Coal,y,i}$	$BE_{CH4,y,i}$	$BE_{Calc,y,i}$	$BE_{y,i}$
	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
2004	0	0	0	105956	0	105956
2005	0	0	0	116270	0	116270
2006	0	0	0	151035	0	151035
2007	0	0	0	134656	0	134656
Total for 2004-2007:	0	0	0	507917	0	507917
Average amount of emissions in 2004-2007:	0	0	0	126979	0	126979
2008	0	0	0	124217	0	124217
2009	0	0	0	0	0	0
2010	0	0	0	0	0	0
2011	0	0	0	124217	0	124217
2012	0	0	0	124217	0	124217
Total for 2008-2012:	0	0	0	372651	0	372651
Average amount of emissions in 2008-2012:	0	0	0	74530,2	0	74530
2013	0	0	0	124217	0	124217

2014	0	0	0	124217	0	124217
2015	0	0	0	124217	0	124217
2016	0	0	0	124217	0	124217
2017	0	0	0	124217	0	124217
2018	0	0	0	124217	0	124217
2019	0	0	0	124217	0	124217
2020	0	0	0	124217	0	124217
2021	0	0	0	124217	0	124217
2022	0	0	0	124217	0	124217
2023	0	0	0	124217	0	124217
2024	0	0	0	124217	0	124217
2025	0	0	0	124217	0	124217
Total for 2013-2025:	0	0	0	1614821	0	1614821
Average amount of emissions in 2013-2025:	0	0	0	124217	0	124217
Total for 2004-2025:	0	0	0	2495389	0	2495389
Average amount of emissions in 2004-2025:	0	0	0	113427	0	113427

Table E.11. Total amount of baseline emissions (see «TotalER_v.1.xls»).

	$BE_{ELEC,y}$	$BE_{NG,y}$	$BE_{Coal,y}$	$BE_{CH4,y}$	$BE_{Calc,y}$	BE_{y}
Year	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq	tCO2eq
2004	2309	48310	7875	105956	14481	178931
2005	2586	55201	8992	414638	16555	497972
2006	3717	82044	12923	768669	23793	891146
2007	4175	89234	14533	996947	26745	1131634
Total for 2004-2007:	12787	274789	44323	2286210	81574	2699683
Average amount of emissions in 2004-2007:	3197	68697	11081	571553	20394	674921
2008	4945	78980	12674	910398	23305	1030302
2009	2549	39301	6587	819067	11992	879496
2010	3573	55632	9324	792486	16975	877990
2011	5963	94298	15241	1052841	27979	1196322
2012	5963	94298	15241	1052841	27979	1196322
Total for 2008-2012:	22993	362509	59067	4627633	108230	5180432
Average amount of emissions in 2008-2012:	4599	72502	11813	925527	21646	1036086
2013	5963	94298	15241	1052841	27979	1196322
2014	5963	94298	15241	1052841	27979	1196322
2015	5963	94298	15241	1052841	27979	1196322
2016	5963	94298	15241	1052841	27979	1196322
2017	5963	94298	15241	1052841	27979	1196322
2018	5963	94298	15241	1052841	27979	1196322

2019	5963	94298	15241	1052841	27979	1196322
2020	5963	94298	15241	1052841	27979	1196322
2021	5963	94298	15241	1052841	27979	1196322
2022	5963	94298	15241	1052841	27979	1196322
2023	5963	94298	15241	1052841	27979	1196322
2024	5963	94298	15241	1052841	27979	1196322
2025	5963	94298	15241	1052841	27979	1196322
Total for 2013-2025:	77519	1225874	198133	13686933	363727	15552186
Average amount of emissions in 2013-2025:	5963	94298	15241	1052841	27979	1196322
Total for 2004-2025:	113299	1863172	301523	20600776	553531	23432301
Average amount of emissions in 2004-2025:	5150	84690	13706	936399	25161	1065105

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

Emission reduction was calculated in accordance with formulae (31) above. Results are provided in tables of this section.

Table E.12. Emission reduction. Dubenskiy sugar plant (see «Dubno_v.1.xls»).

Year	$BE_{y,i}$	$PE_{y,i}$	$ER_{y,i}$
	tCO2eq	tCO2eq	tCO2eq
2004	37589	34200	3389
2005	255369	37355	218014
2006	360610	51213	309397
2007	411523	48247	363276
Total for 2004-2007:	1065091	171015	894076
Average amount of emission reduction in 2004-2007:	266273	42754	223519
2008	366036	41837	324199
2009	344954	45377	299577
2010	501393	61317	440076
2011	501399	61329	440070
2012	501399	61329	440070
Total for 2008-2012:	2215181	271189	1943992
Average amount of emission reduction in 2008-2012:	443036	54238	388798
2013	501399	61329	440070
2014	501399	61329	440070
2015	501399	61329	440070
2016	501399	61329	440070
2017	501399	61329	440070
2018	501399	61329	440070

2019	501399	61329	440070
2020	501399	61329	440070
2021	501399	61329	440070
2022	501399	61329	440070
2023	501399	61329	440070
2024	501399	61329	440070
2025	501399	61329	440070
Total for 2013-2025:	6518187	797277	5720910
Average amount of emission reduction in 2013-2025:	501399	61329	440070
Total for 2004-2025:	9798459	1239481	8558978
Average amount of emission reduction in 2004-2025:	445385	56340	389044

Table E.13. Emission reduction. Kremenetskiy sugar plant (see «Kremenets_v.1.xls»).

Year	$BE_{y,i}$	$PE_{y,i}$	$ER_{y,i}$
	tCO2eq	tCO2eq	tCO2eq
2004	35386	29771	5615
2005	126333	30474	95859
2006	201223	42017	159206
2007	254440	44726	209714
Total for 2004-2007:	617382	146988	470394
Average amount of emission reduction in 2004-2007:	154346	36747	117599
2008	194093	41277	152816
2009	0	0	0
2010	0	0	0
2011	194109	41358	152751
2012	194109	41358	152751
Total for 2008-2012:	582311	123993	458318
Average amount of emission reduction in 2008-2012:	116462	24799	91664
2013	194109	41358	152751
2014	194109	41358	152751
2015	194109	41358	152751
2016	194109	41358	152751
2017	194109	41358	152751
2018	194109	41358	152751
2019	194109	41358	152751
2020	194109	41358	152751
2021	194109	41358	152751
2022	194109	41358	152751
2023	194109	41358	152751
2024	194109	41358	152751
2025	194109	41358	152751
Total for 2013-2025:	2523417	537654	1985763
Average amount of	194109	41358	152751

emission reduction in 2013-2025:			
Total for 2004-2025:	3723110	808635	2914475
Average amount of emission reduction in 2004-2025:	169232	36756	132476

Table E.14. Emission reduction. Lokhvitskiy sugar plant (see «Lohvytsi_v.1.xls»).

Year	$BE_{y,i}$	$PE_{y,i}$	$ER_{y,i}$
	tCO2eq	tCO2eq	tCO2eq
2004	0	0	0
2005	0	0	0
2006	178278	1387	176891
2007	331015	6495	324520
Total for 2004-2007:	509293	7882	501411
Average amount of emission reduction in 2004-2007:	127323	1971	125353
2008	345956	3764	342192
2009	534542	10559	523983
2010	376597	8732	367865
2011	376597	8727	367870
2012	376597	10408	366189
Total for 2008-2012:	2010289	42190	1968099
Average amount of emission reduction in 2008-2012:	402058	8438	393620
2013	376597	10408	366189
2014	376597	10408	366189
2015	376597	10408	366189
2016	376597	10408	366189
2017	376597	10408	366189
2018	376597	10408	366189
2019	376597	10408	366189
2020	376597	10408	366189
2021	376597	10408	366189
2022	376597	10408	366189
2023	376597	10408	366189
2024	376597	10408	366189
2025	376597	10408	366189
Total for 2013-2025:	4895761	135304	4760457
Average amount of emission reduction in 2013-2025:	376597	10408	366189
Total for 2004-2025:	7415343	185376	7229967
Average amount of emission reduction in 2004-2025:	337061	8426	328635

Table E.15. Emission reduction. Zolochivskiy sugar plant (see «Zolochiv_v.1.xls»).

Year	$BE_{y,i}$ tCO2eq	$PE_{y,i}$ tCO2eq	$ER_{y,i}$ tCO2eq
2004	105956	2582	103374
2005	116270	2194	114076
2006	151035	2569	148466
2007	134656	2220	132436
Total for 2004-2007:	507917	9565	498352
Average amount of emission reduction in 2004-2007:	126979	2391	124588
2008	124217	836	123381
2009	0	0	0
2010	0	0	0
2011	124217	838	123379
2012	124217	838	123379
Total for 2008-2012:	372651	2512	370139
Average amount of emission reduction in 2008-2012:	74530	502	74028
2013	124217	838	123379
2014	124217	838	123379
2015	124217	838	123379
2016	124217	838	123379
2017	124217	838	123379
2018	124217	838	123379
2019	124217	838	123379
2020	124217	838	123379
2021	124217	838	123379
2022	124217	838	123379
2023	124217	838	123379
2024	124217	838	123379
2025	124217	838	123379
Total for 2013-2025:	1614821	10894	1603927
Average amount of emission reduction in 2013-2025:	124217	838	123379
Total for 2004-2025:	2495389	22971	2472418
Average amount of emission reduction in 2004-2025:	113427	1044	112383

Table E.16. Total amount of emission reduction (see «TotalER_v.1.xls»).

Year	BE_y tCO2eq	PE_y tCO2eq	ER_y tCO2eq
2004	178931	66553	112378
2005	497972	70023	427949
2006	891146	97186	793960
2007	1131634	101688	1029946

Total for 2004-2007:	2699683	335450	2364233
Average amount of emission reduction in 2004-2007:	674921	83863	591058
2008	1030302	87714	942588
2009	879496	55936	823560
2010	877990	70049	807941
2011	1196322	112252	1084070
2012	1196322	113933	1082389
Total for 2008-2012:	5180432	439884	4740548
Average amount of emission reduction in 2008-2012:	1036086	87977	948109
2013	1196322	113933	1082389
2014	1196322	113933	1082389
2015	1196322	113933	1082389
2016	1196322	113933	1082389
2017	1196322	113933	1082389
2018	1196322	113933	1082389
2019	1196322	113933	1082389
2020	1196322	113933	1082389
2021	1196322	113933	1082389
2022	1196322	113933	1082389
2023	1196322	113933	1082389
2024	1196322	113933	1082389
2025	1196322	113933	1082389
Total for 2013-2025:	15552186	1481129	14071057
Average amount of emission reduction in 2013-2025:	1196322	113933	1082389
Total for 2004-2025:	23432301	2256463	21175838
Average amount of emission reduction in 2004-2025:	1065105	102567	962538

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

Year	*BEy*	*PEy*	*ERy*
	tCO2eq	tCO2eq	tCO2eq
2004	178931	66553	112378
2005	497972	70023	427949
2006	891146	97186	793960
2007	1131634	101688	1029946
Total for 2004-2007:	2699683	335450	2364233
Average amount of emission reduction in 2004-2007:	674921	83863	591058
2008	1030302	87714	942588

2009	879496	55936	823560
2010	877990	70049	807941
2011	1196322	112252	1084070
2012	1196322	113933	1082389
Total for 2008-2012:	5180432	439884	4740548
Average amount of emission reduction in 2008-2012:	1036086	87977	948109
2013	1196322	113933	1082389
2014	1196322	113933	1082389
2015	1196322	113933	1082389
2016	1196322	113933	1082389
2017	1196322	113933	1082389
2018	1196322	113933	1082389
2019	1196322	113933	1082389
2020	1196322	113933	1082389
2021	1196322	113933	1082389
2022	1196322	113933	1082389
2023	1196322	113933	1082389
2024	1196322	113933	1082389
2025	1196322	113933	1082389
Total for 2013-2025:	15552186	1481129	14071057
Average amount of emission reduction in 2013-2025:	1196322	113933	1082389
Total for 2004-2025:	23432301	2256463	21175838
Average amount of emission reduction in 2004-2025:	1065105	102567	962538

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:

Collection, handling and transfer of waste and secondary products of sugar production for utilization are carried out in accordance with the law of Ukraine "On waste".

The legal foundation for handling waste are the current legal and normative acts on environmental safety.

Production waste, depending on its physical, chemical and biological characteristics is divided into four classes of danger:

- I class - extremely high-risk waste;
- II class - high-risk waste;
- III class - medium-risk waste;
- IV class - low-risk waste.

Procedures for handling waste are described in Annex 3 of this document.

"Rise-Maxymko" PJSC has the necessary Environmental Impact Assessment of its activities in accordance with Ukrainian law.

In general the «Conduction of the complex technical and technological modernization of an enterprise which is aimed at the reduction of energy consumption and the implementation of the utilization system of secondary products of sugar production on PJSC «Rise-Maksymko» project will have positive effect on the environment. The following points will give detailed information on the positive effect on the environment:

1. The project implementation will reduce CO_2 emissions in the sites of sugar plants location due to more effective energy consumption. This will be achieved by implementing modern equipment and preproduction processes.

2. Due to lower fuel consumption, electric power and ecological technologies for the processing of pulp, the implementation of the project will reduce emissions of $SO_{x,}$ NOx, CO and CH_4 solid particles (co-products of combustion).

No transboundary environmental impacts are expected from the implementation of this project.

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:

Impact on the aquatic environment

Impact on the aquatic environment will be the same as in the baseline scenario. The existing technologies used in the production of sugar foresee the disposal of waste water through the drainage system with mandatory chemical control. All these actions are stipulated by the Water Code of Ukraine, State Standard GOST 28.74-82 "Rules of hygiene and quality control", Construction rules and regulations SNiP 4630-92 that determine the maximum concentration for internal water objects. Disposal into open water objects will not be done.

Project implementation will have positive effect. It will allow the reducing of water consumption and, as a result, lead to the reduction of waste water discharge.

Impact on ambient air

Project implementation will have positive effect on air:

1) Reduction of the emissions of NOx, SOx, CO and solid particles due to the use of more environmentally clean technologies;
2) Reduced consumption of electric power will lead to lower emissions of the same pollutants into the air;
3) Will reduce the emission of CH4 through the implementation of ecological technologies for the processing of pulp.

Effects on land use

There will be no effect on land/soil.

The corresponding law on land use is stated in the Land Code of Ukraine. The National technological practice/standard: State Standard GOST 17.4.1.02-83 “Protection of nature, soil. Classificatioin of chemicals for pollution controlling”.

Impact on biodiversity

There will be no impact on biodiversity.

Generation of waste, waste discharge and handling

Generation of waste, waste discharge and handling are present. In the process of project implementation waste will be generated after the dismantling of outdated equipment, pipes etc. There will be construction waste as a result of dismantling of boilers and construction of boiler shops and others.

Collection, handling and transfer of waste for utilization of the enterprise’s waste will be carried out in accordance with the law of Ukraine “On waste”.

Handling procedures are described in Annex 3 of this document.

Conclusions concerning the most significant environmental impacts from implementation of activities under this project are presented in the Environmental Impact Assessment (EIA), obtained according to state building norms of Ukraine A.2.2-1-2003:

- Permission #5610300000-3 for pollutants waste into the athmospheric air by stationary sources;
- Conclusion of the Sanitation and Epidemiological expertise № 02.01.-26/234 dated 12.05.2011;
- Addition to the permission #22 dated 13.09.2010. “List and amount of waste acceptable for disposal”;
- Limits for generation and disposal of waste for 2011;
- Permission # 564030/22 dated 13.09.2010 for waste disposal in 2011;
- Agreement for exhausted wires delivery #A0505 dated 05.05.2011.

SECTION G. Stakeholders’ comments

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

Project activity does not include the negative impact on the environment and the negative social impact. Therefore, consultation with stakeholders is required and not conducted.

According to Ukrainian law, business owners, which implemented the project of new construction, renovation and modernization of industrial and civil objects that require EIA to inform the public through local authorities (State Building Standards Ukraine A.2.2-1-2003 p. 1.6). Therefore, in the process of receiving the EIA in the detection of possible cases of significant environmental impacts from implementation of activities under the project was conducted to inform the public about these events through media.

Moreover, PJSC "Rise-Maxymko" is one of the leading companies of Ukraine in its industry; therefore all of its activities including environmental projects and projects aimed at improving the efficiency of enterprise will receive wide coverage in the media regardless of the materiality of the impact of these projects on the environment.

There have been no negative Stakeholders' comments.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Project owner:

Organisation:	PJSC «Rise-Maksymko»
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Annex 2

BASELINE INFORMATION

Please refer to the Section B.

Main information and data for determining baseline scenario

№	Description	Variable
44.	Average amount of electric power consumed from JES of Ukraine by sugar plant *i* in base period 2001-2003	$EC_{BL,i}$
45.	Amount of sugar production in year *y* by plant *i*	$P_{y,i}$
46.	Average amount of sugar production in base period 2001-2003 by sugar plant *i*	$P_{BL,i}$
48.	Average amount of natural gas combusted in base period 2001-2003 by sugar plant *i*	$FC_{BL,NG,i}$
50.	Average amount of coal combusted in base period 2001-2003 by sugar plant *i*	$FC_{BL,Coal,i}$
51.	Weighed average net calorific value of natural gas in base period 2001-2003 on sugar plant *i*	$NCV_{NG,BL,i}$
52.	Weighed average net calorific value of coal in base period 2001-2003 on sugar plant *i*	$NCV_{Coal,BL}$
15.	Amount of pulp selled off in year *y* by plant *i*	$MSW_{T,PJ,y,i}$
54.	Part of pulp transferred in baseline scenario by plant *i*	$MSW_{F,BL,i}$
56.	Sugar content in beets processed in year *y* on plant *i*	$SPB_{y,i}$
57.	Average sugar content in beets processed in base period 2001-2003 on plant *i*	$SPB_{BL,i}$
67.	Amount of electric power supplied to external consumers by plant *i* in year y of the base period 2001-2003	$EOUT_{BL,y, i}$

60.	Specific fuel consumption for electric power generation in project scenario in year *y* of base period 2001-2003 by plant *i*	$SFC_{BL,y,i}$
61.	Portion of natural gas in total amount of fuel used for electric power generation on plant *i* in year *y* of base period 2001-2003	$FP_{BL,NG,y,i}$
62.	Portion of natural gas in total amount of fuel used for electric power generation on plant *i* in year *y* of base period 2001-2003	$FP_{BL,coal,y,i}$
63.	Average amount of limestone calcinated in base period 2001-2003 on plant *i*	$LC_{BL,i}$
64.	Weighed average $CaCO_3$ content in limestone calcinated in base period 2001-2003 on plant *i*	$CaCO_{3\ BL,i}$
65.	Weighed average $MgCO_3$ content in limestone calcinated in base period 2001-2003 on plant *i*	$MgCO_{3\ BL,i}$

Annex 3

MONITORING PLAN

The main information on the monitoring plan can be found in Section D.

Information on calculation of carbon emission factor of GHG emissions related to electric power generation by sugar plants and the order of wastes handling are provided below.

3.1 Calculation of carbon emission factor of GHG emissions related to electric power generation by sugar plants.

Project scenario.

Calculation of carbon emission factor of GHG emissions related to electric power generation by sugar plants is made applying the following formulae:

$$CEF_{CO2,ELEC,y,i} = SFC_{PJ,y,i} \cdot NCV_{tef} \cdot EF_{CO2,tef,y,i} , \qquad (34)$$

where

$CEF_{CO2,ELEC,y,i}$ = carbon emission factor of GHG emissions related to electric power generation by sugar plant i in year y, tCO_2/MWh;

$SFC_{PJ,NG,y,i}$ = specific fuel consumption for electric power generation in project scenario in year y by plant i,TFE;

This value is determined by working groups of sugar plants of PJSC “Rise-Maksymko” on the basis of statistical data on energy resources consumption and electric power generation provided in statistic reporting forms 11-MTP.

NCV_{tef} = net calorific value of fuel equivalent, 29.3 GJ/TFE.;

This value is standard and used widely for heat and power calculations.

$EF_{CO2,tef,y,i}$ = GHG emission factor for fuel equivalent for plant i in year y, tCO_2eq/GJ;

i = indication of plant;

y = year for which calculations are carried out.

GHG emission factor for fuel equivalent is determined as the average value of emission factors of all the types of fuel used for electric power generation.

$$EF_{CO2,tef,y,i} = FP_{NG,y,i} \cdot EF_{CO2,NG} + FP_{coal,y,i} \cdot EF_{CO2,coal} , \qquad (35)$$

where

$EF_{CO2, tef,y,i}$ = GHG emission factor for fuel equivalent for plant i in year y, tCO_2eq/GJ;

$FP_{NG,y,i}$ = part of natural gas in total amount of fuel used for electric power generation on plant i in year y, %;

$EF_{CO2,NG}$ = GHG emission factor for natural gas, tCO_2eq/GJ;

$FP_{coal,y,i}$ = part of coal in total amount of fuel used for electric power generation on plant i in year y, %;

$EF_{CO2,coal}$ = GHG emission factor for coal, tCO_2eq/GJ.

Baseline scenario.

The same approach used for calculation of GHG emission factor for fuel equivalent in baseline scenario.

$$CEF_{CO2,ELEC,BL,i} = \frac{\sum CEF_{CO2,ELEC,BL,y,i} \cdot EOUT_{BL,y,i}}{\sum EOUT_{BL,y,i}}, \qquad (36)$$

where

$CEF_{CO2,ELEC,BL,i}$ = Weighed average carbon emission factor for GHG emission due to electric power generation by sugar plant *i* in base period 2001-2003, tCO2/MWh;

$CEF_{CO2,ELEC,BL,y,i}$ = Carbon emission factor of GHG emissions related to electric power generation by sugar plant *i*, tCO2/MWh;;

$EOUT_{BL,y,i}$ = Amount of electric power supplied by sugar plant *i* to external consumers in year *y* of base period 2001-2003.

i = indication of plant for which calculations are carried out;

y = year for which calculations are carried out.

$$CEF_{CO2,ELEC,BL,y,i} = SFC_{BL,y,i} \cdot NCV_{tef} \cdot EF_{CO2,tef,BL,y,i}, \qquad (37)$$

where

$CEF_{CO2,ELEC,BL,y\ i}$ = carbon emission factor of GHG emissions related to electric power generation by sugar plant i in year y of the base period 2001-2003, tCO_2/MWh;

$SFC_{BL\ y,i}$ = specific fuel consumption for electric power generation in year y of the base period 2001-2003 by plant *i*,TFE;

This value is determined by working groups of sugar plants of PJSC “Rise-Maksymko” on the basis of statistical data on energy resources consumption and electric power generation provided in statistic reporting forms 11-MTP.

NCV_{tef} = net calorific value of fuel equivalent, 29.3 GJ/TFE.;

This value is standard and used widely for heat and power calculations.

$EF_{CO2,tef,BL,y,i}$ = GHG emission factor for fuel equivalent for plant *i* in base year y of the base period 2001-2003, tCO_2eq/GJ;

i = indication of plant;

y = year for which calculations are carried out.

GHG emission factor for fuel equivalent is determined as the average value of emission factors of all the types of fuel used for electric power generation.

$$EF_{CO2,tef,BL,y,i} = FP_{BL,NG,y,i} \cdot EF_{CO2,NG} + FP_{BL,coal,y,i} \cdot EF_{CO2,coal}, \qquad (38)$$

where

$EF_{CO2,\ tef,BL,i}$ = GHG emission factor for fuel equivalent for plant *i* in base year y of the base period 2001-2003, tCO_2eq/GJ;

$FP_{NG,BL,i}$ = part of natural gas in total amount of fuel used for electric power generation on plant *i* in base year y of the base period 2001-2003, %;

$EF_{CO2,NG}$ = GHG emission factor for natural gas, tCO_2eq/GJ;

$FP_{coal,BL,i}$ = part of coal in total amount of fuel used for electric power generation on plant *i* in year *y*, %;

$EF_{CO2,coal}$ = GHG emission factor for coal, tCO_2eq/GJ;

i = indication of plant for which calculations are carried out;

y = year for which calculations are carried out.

All values are provided on the basis of statistic data of the enterprise and widely used emission factors.

3.2 WASTE HANDLING (scheme of waste handling on Dubenskiy sugar plant used as an example of general approach applied at all four sugar plants).

Collection, handling and transfer of waste for utilization was carried out in accordance with the law of Ukraine “On waste”.

The legal foundation for handling waste are the current legal and normative acts on environmental safety.

Production waste, depending on its physical, chemical and biological characteristics is divided into four danger classes:

- I class - extremely high-risk waste;
- II class - high-risk waste;
- III class - medium-risk waste;
- IV class - low-risk waste.

For waste handling organization and performing, persons responsible for waste management are listed in Order #36 dated 25.04.2011.

Register cards for every source of waste are drawn up .

Dangerousness for human health, existence of dangerous properties, aggregative state and chemical structure are defined in Register cards. Parameters of waste generation and handling are adjusted with Rivne region SES and State administration of environmental protection management in Rivne region..

For all the kinds of waste that are included into the Register card of source of waste and its maintenance it was received the annual permission #564030/22 dated 13.09.2010 and limits for generation and disposal of waste .

The following organizations that have the necessary licenses are involved into the operation.

LLC «Vtorma-s» agreement #A0505 dated 05.05.2011.

LLC «ECO-HELP» agreement #140 dated 14.04.2011.

SC «Rivne vtorkolirmet» agreement #87 dated 18.04.2011.

“The scheme of places of temporary waste keeping” was approved for the determination of places of temporary waste keeping. Control on waste handling is under the responsibility of lead engineer of environment.

General order procedures for waste management

The main objective of waste management is to prevent the formation of excessive volumes of waste in their proper collection, storage, transmission processing, utilization and disposal, as well as prevent the negative impact of waste on the environment and human health.

Waste generated by sugar plants depending on their type are subject of:

- collection;
- accounting;
- timely removal from production lines;
- temporary storage in specially-designated places.

At production lines waste is collected into special containers and tanks.

Mixing of different types of wastes is not acceptable.

Those responsible for waste collection and storage perform carry out the accounting of generated waste.

In accordance with signed agreements the responsible persons transfer waste to special organizations with the appropriate supporting handling documents.

Waste processing at the boundary of enterprise is not acceptable.

Persons responsible for storage carry out the waste transfer for utilization.

Automotive workshop carries out the defecation mud transfer for soil deacidification.

Personnel of mechanization workshop carries out the accounting of storage of outgoing wires and outgoing AKB and lubricants.

Personnel of electric workshop carries out the accounting of mercury-containing waste (luminescent lamps).

Data on the amount of transferred waste is sent to the State administration of ecological safety once for each quarter for the 1st date of the following month by engineer of environmental protection.

Preparation of report data

Engineer of Environmental Protection keeps track of the number allocated to waste disposal in the form of 1-TU. Quarterly, leading engineer of the Environment, conducts calculation pay charges for waste disposal. According to the calculation provided by collecting accounting of company shall pay the tax calculation of the fee for waste disposal.

Lead engineer of the Environment prepares a statistical report on the creation, processing and disposal of waste of 1-4 hazard classes in F-1.

Senior Engineer on Environmental Protection analyzes the waste generation for the reporting year and for the first quarter of current year.

Lead engineer of the Environment carries out calculations and draws up the normative calculation of waste amount grounding for the following year and sends it to State administration of ecological safety in Rivne region.

Managing waste, that may be generated in case of emergency.

With the purpose of reducing the influence on the environment a “List of possible emergency situations.

In case of emergency that results in spilling of hazardous chemicals.

Works aimed at neutralizing the spilled chemicals with alkali or sand are carried out with further cleaning of the spill place with sufficient amount of water. Neutralized solution is collected into specially-marked containers for further removal for utilization.

Responsibility

Responsibility for upholding the standards of this manual and for sorting and timely removal of waste from production facilities and shops is assigned to the heads of structural departments.

F.20.01.OTOS #z/p

#	Waste name	Hazard class	Previous year 2004		Current year 2005		Next year
			Approved waste generation limit ,t	Actual waste, t	Approved waste generation limit, t	Actual waste,t on 1.04.05	Project waste generation, t
1	2	3	4	5	6	7	8

Approved:

Technical director ________________________ “____”______________20

(Last name and initials)

F.20.11.__________.________
Subdivision code #

Journal of production waste removal

Date of registration counter foils for waste removal	Vehicle number	Driver’s name	Number of counterfoils m^3			Driver’s signature
			Issued	Used	Returned	
1	2	3	4	5	6	7

F.18.16.OBK.________
Subdivision code #

Journal of construction waste

#	Date of registration counterfoils for waste removal	Vehicle number	Driver's name	Number of counterfoils m^3	Object	Driver's signature
1		2	3	4	5	6

3.3 CALCULATION OF AVERAGE AND WEIGHED AVERAGE VALUES OF PARAMETERS RELATED TO BASE PERIOD 2001-2001

Average amounts of sugar production by sugar plant *i* in base period 2001-2003

$$P_{BL,i} = \frac{P_{BL,2001,i} + P_{BL,2002,i} + P_{BL,2003,i}}{3}, \qquad (39)$$

where

$P_{BL,i}$ = average amounts of sugar production by sugar plant *i* in base period 2001-2003 , t;

$P_{BL,2001,i}$ = amount of sugar production by sugar plant *i* in 2001, t;

$P_{BL,2002,i}$ = amount of sugar production by sugar plant *i* in 2003, t;

$P_{BL,2003,i}$ = amount of sugar production by sugar plant *i* in 2003, t.

Data used for calculation and calculation results are provided in Table An.1.

Table An.1. Data used for calculation of average amounts of sugar production by sugar plant i in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$P_{BL,2001,i}$	t	18805	21905
2002	$P_{BL,2002,i}$	t	15025	9002
2003	$P_{BL,2003,i}$	t	14556	10411
Average value	$P_{BL,i}$	**t**	**16129**	**13773**

Average sugar content of beets processed by sugar plant *i* in base period 2001-2003

$$SPB_{BL,i} = \frac{SPB_{BL,2001,i} + SPB_{BL,2002,i} + SPB_{BL,2003,i}}{3}, \qquad (40)$$

where

$SPB_{BL,i}$ = average sugar content of beets processed by sugar plant *i* in base period 2001-2003, %;

$SPB_{BL,2001,i}$ = sugar content of beets processed by sugar plant *i* in 2001, %;

$SPB_{BL,2002,i}$ = sugar content of beets processed by sugar plant *i* in 2002, %;

$SPB_{BL,2003,i}$ = sugar content of beets processed by sugar plant *i* in 2003, %.

Data used for calculation and calculation results are provided in Table An.2.

Table An.2. Data used for calculation of average sugar content of beets processed by sugar plant *i* in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$SPB_{BL,2001,i}$	%	14.4	15.22
2002	$SPB_{BL,2002,i}$	%	14.82	14.95
2003	$SPB_{BL,2003,i}$	%	15.31	14.88
Average value	$\boldsymbol{SPB_{BL,i}}$	**%**	**14.84**	**15.02**

Average amount of electric power consumed from JES of Ukraine by sugar plant *i* in base period 2001-2003

$$EC_{BL,i} = \frac{EC_{BL,2001,i} + EC_{BL,2002,i} + EC_{BL,2003,i}}{3}, \tag{41}$$

where

$EC_{BL,i}$ = average amount of electric power consumed from JES of Ukraine by sugar plant *i* in base period 2001-2003, MWh;

$EC_{BL,2001,i}$ = amount of electric power consumed from JES of Ukraine by sugar plant *i* in 2001, MWh;

$EC_{BL,2002,i}$ = amount of electric power consumed from JES of Ukraine by sugar plant *i* in 2002, MWh;

$EC_{BL,2003,i}$ = amount of electric power consumed from JES of Ukraine by sugar plant *i* in 2003, MWh.

Data used for calculation and calculation results are provided in Table An.3.

Table An.3. Data used for calculation of average amount of electric power consumed from JES of Ukraine by sugar plant *i* in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$EC_{BL,2001,i}$	MWh	940	904
2002	$EC_{BL,2002,i}$	MWh	751	1228
2003	$EC_{BL,2003,i}$	MWh	728	1364
Average value	$\boldsymbol{EC_{BL,i}}$	**MWh**	**806**	**1165**

Average amount of natural gas combusted by sugar plant *i* in base period 2001-2003

$$FC_{BL,NG,i} = \frac{FC_{BL,NG,2001,i} + FC_{BL,NG,2002,i} + FC_{BL,NG,2003,i}}{3}, \tag{42}$$

where

$FC_{BL,NG,i}$ = average amount of natural gas combusted by sugar plant *i* in base period 2001-2003, ths m^3;

$FC_{BL,NG,2001,i}$ =amount of natural gas combusted by sugar plant *i* in 2001, ths m^3;

$FC_{BL,NG,2002,i}$ = amount of natural gas combusted by sugar plant *i* in 2002, ths m^3;

$FC_{BL,NG,2003,i}$ = amount of natural gas combusted by sugar plant *i* in 2003, ths m^3.

Data used for calculation and calculation results are provided in Table An.4.

Table An.4. Data used for calculation of average amount of natural gas combusted by sugar plant *i* in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$FC_{BL,NG,2001,i}$	ths m^3	9271	17712
2002	$FC_{BL,NG,2002,i}$	ths m^3	7407	8255
2003	$FC_{BL,NG,2003,i}$	ths m^3	12238	10141
Average value	$\boldsymbol{FC_{BL,NG,i}}$	**ths m^3**	**9639**	**12036**

Average amount of electric power supplied to external consumers by sugar plant *i* in base period 2001-2003

$$EOUT_{BL,i} = \frac{EOUT_{BL,2001,i} + EOUT_{BL,2002,i} + EOUT_{BL,2003,i}}{3}, \qquad (43)$$

where

$EOUT_{BL,i}$ = average amount of electric power supplied to external consumers by sugar plant *i* in base period 2001-2003, MWh;

$EOUT_{BL,2001,i}$ = amount of electric power supplied to external consumers by sugar plant *i* in 2001, MWh;

$EOUT_{BL,2002,i}$ = amount of electric power supplied to external consumers by sugar plant *i* in 2002, MWh;

$EOUT_{BL,2003,i}$ = amount of electric power supplied to external consumers by sugar plant *i* in 2003, MWh.

Data used for calculation and calculation results are provided in Table An.5.

Table An.5. Data used for calculation of average amount of electric power supplied to external consumers by sugar plant *i* in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$EOUT_{BL,2001,i}$	MWh	409	0
2002	$EOUT_{BL,2002,i}$	MWh	1044	0
2003	$EOUT_{BL,2003,i}$	MWh	9588	0
Average value	$\boldsymbol{EOUT_{BL,i}}$	**MWh**	**3680**	**0**

Average amount of coal combusted by sugar plant *i* in base period 2001-2003

$$FC_{BL,Coal,i} = \frac{FC_{BL,Coal,2001,i} + FC_{BL,Coal,2002,i} + FC_{BL,Coal,2003,i}}{3}, \qquad (44)$$

where

$FC_{BL,Coal,i}$ = average amount of coal combusted by sugar plant *i* in base period 2001-2003, t;
$FC_{BL,Coal,2001,i}$ = amount of coal combusted by sugar plant *i* in 2001, t;
$FC_{BL,Coal,2002,i}$ = amount of coal combusted by sugar plant *i* in 2002, t;
$FC_{BL,Coal,2003,i}$ = amount of coal combusted by sugar plant *i* in 2003, t.

Data used for calculation and calculation results are provided in Table An.6.

Table An.6. Data used for calculation of average amount of coal combusted by sugar plant *i* in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$FC_{BL,Coal,2001,i}$	t	996	1341
2002	$FC_{BL,Coal,2002,i}$	t	796	2661
2003	$FC_{BL,Coal,2003,i}$	t	1719	906
Average value	$FC_{BL,Coal,i}$	**t**	**1170**	**1636**

Weighed average net calorific value of natural gas combusted by sugar plant *i* in base period 2001-2003

$$NCV_{NG,BL,i} = \frac{NCV_{NG,BL,2001} \cdot FC_{BL,NG,2001,i} + NCV_{NG,BL,2002} \cdot FC_{BL,NG,2002,i} + NCV_{NG,BL,2003} \cdot FC_{BL,NG,2003,i}}{FC_{BL,NG,2001,i} + FC_{BL,NG,2002,i} + FC_{BL,NG,2003,i}}$$

, (45)

where

$NCV_{NG,BL,i}$ = weighed average net calorific value of natural gas combusted by sugar plant *i* in base period 2001-2003, GJ/ths m^3;
$NCV_{NG,BL,2001}$ = net calorific value of natural gas combusted by sugar plant *i* in 2001, GJ/ths m^3;
$NCV_{NG,BL,2002}$ = net calorific value of natural gas combusted by sugar plant *i* in 2002, GJ/ths m^3;
$NCV_{NG,BL,2003}$ = net calorific value of natural gas combusted by sugar plant *i* in 2003, GJ/ths m^3;
$FC_{BL,NG,2001,i}$ = amount of natural gas combusted by sugar plant *i* in 2001, ths m^3;
$FC_{BL,NG,2002,i}$ = amount of natural gas combusted by sugar plant *i* in 2002, ths m^3;
$FC_{BL,NG,2003,i}$ = amount of natural gas combusted by sugar plant *i* in 2003, ths m^3.

Data used for calculation and calculation results are provided in Table An.7.

Table An.7. Data used for calculation of weighed average net calorific value of natural gas combusted by sugar plant *i* in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$FC_{BL,NG,2001,i}$	ths m^3	9271	17712
2002	$FC_{BL,NG,2002,i}$	ths m^3	7407	8255
2003	$FC_{BL,NG,2003,i}$	ths m^3	12238	10141
2001	$NCV_{NG,BL,2001,i}$	GJ/ths m^3	33.76	33.76
2002	$NCV_{NG,BL,2002,i}$	GJ/ths m^3	33.73	33.73
2003	$NCV_{NG,BL,2003,i}$	GJ/ths m^3	33.7	33.7
Weighed average value	$\boldsymbol{FC_{BL,NG,i}}$	**GJ/ths m^3**	**33.7**	**33.69**

Weighed average net calorific value of coal combusted by sugar plant *i* in base period 2001-2003

$$NCV_{Coal,BL,i} = \frac{NCV_{Coal,BL,2001} \cdot FC_{BL,Coal,2001,i} + NCV_{Coal,BL,2002} \cdot FC_{BL,Coal,2002,i} + NCV_{Coal,BL,2003} \cdot FC_{BL,Coal,2003,i}}{FC_{BL,Coal,2001,i} + FC_{BL,Coal,2002,i} + FC_{BL,Coal,2003,i}}$$

, (46)

where

$NCV_{Coal,BL,i}$ = weighed average net calorific value of coal combusted by sugar plant *i* in base period 2001-2003, GJ/t;

$NCV_{Coal,BL,2001}$ = net calorific value of coal combusted by sugar plant *i* in 2001, GJ/t;

$NCV_{Coal,BL,2002}$ = net calorific value of coal combusted by sugar plant *i* in 2002, GJ/t;

$NCV_{Coal,BL,2003}$ = net calorific value of coal combusted by sugar plant *i* in 2003, GJ/t;

$FC_{BL,Coal,2001,i}$ = amount of coal combusted by sugar plant *i* in 2001, t;

$FC_{BL,Coal,2002,i}$ = amount of coal combusted by sugar plant *i* in 2002, t;;

$FC_{BL,Coal,2003,i}$ = amount of coal combusted by sugar plant *i* in 2003, t;.

Data used for calculation and calculation results are provided in Table An.8.

Table An.8. Data used for calculation of weighed average net calorific value of coal combusted by sugar plant *i* in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$FC_{BL,Coal,2001,i}$	t	996	1341
2002	$FC_{BL,Coal,2002,i}$	t	796	2661
2003	$FC_{BL,Coal,2003,i}$	t	1719	906
2001	$NCV_{Coal,BL,2001,i}$	GJ/t	21.99	21.99
2002	$NCV_{Coal,BL,2002,i}$	GJ/t	22.54	22.54
2003	$NCV_{Coal,BL,2003,i}$	GJ/t	23.68	23.68
Weighed average value	$\boldsymbol{NCV_{Coal,BL,i}}$	**GJ/t**	**22.94**	**22.6**

Average amount of limestone calcinated on sugar plant *i* in base period 2001-2003

$$LC_{BL,i} = \frac{LC_{BL,2001,i} + LC_{BL,2002,i} + LC_{BL,2003,i}}{3},$$ (47)

where

$LC_{BL,i}$ = average amount of limestone calcinated on sugar plant i in base period 2001-2003, t;

$LC_{BL,2001,i}$ = amount of limestone calcinated on sugar plant i in 2001, t;

$LC_{BL,2002,i}$ = amount of limestone calcinated on sugar plant i in 2002, t;

$LC_{BL,2003,i}$ = amount of limestone calcinated on sugar plant i in 2003, t.

Data used for calculation and calculation results are provided in Table An.9.

Table An.9. Data used for calculation of average amount of limestone calcinated on sugar plant i in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$LC_{BL,2001,i}$	t	9960	15170
2002	$LC_{BL,2002,i}$	t	7960	16110
2003	$LC_{BL,2003,i}$	t	17190	18640
Average value	$\boldsymbol{LC_{BL,i}}$	**t**	**11703**	**16640**

Weighed average $CaCO_3$ content in limestone calcinated on sugar plant *i* in base period 2001-2003

$$CaCO_{3BL,i} = \frac{CaCO_{3BL,2001,i} \cdot LC_{BL,NG,2001,i} + CaCO_{3BL,2002,i} \cdot LC_{BL,NG,2002,i} + CaCO_{3BL,2003,i} \cdot LC_{BL,NG,2003,i}}{LC_{BL,NG,2001,i} + LC_{BL,NG,2002,i} + LC_{BL,NG,2003,i}} \quad (48)$$

,

where

$CaCO_{3\ BL,i}$ = weighed average $CaCO_3$ content in limestone calcinated on sugar plant i in base period 2001-2003;

$CaCO_{3\ BL,2001,i}$ = weighed average $CaCO_3$ content in limestone calcinated on sugar plant i in 2001;

$CaCO_{3\ BL,2002,i}$ = weighed average $CaCO_3$ content in limestone calcinated on sugar plant i in 2002;

$CaCO_{3\ BL,2003,i}$ = weighed average $CaCO_3$ content in limestone calcinated on sugar plant i in 2003;

$LC_{BL,2001,i}$ = amount of limestone calcinated on sugar plant i in 2001, t;

$LC_{BL,2002,i}$ = amount of limestone calcinated on sugar plant i in 2002, t;

$LC_{BL,2003,i}$ = amount of limestone calcinated on sugar plant i in 2003, t.

Data used for calculation and calculation results are provided in Table An.10.

Table An.10. Data used for calculation of weighed average $CaCO_3$ content in limestone calcinated on sugar plant i in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$LC_{BL,2001,i}$	t	9960	15170
2002	$LC_{BL,2002,i}$	t	7960	16110
2003	$LC_{BL,2003,i}$	t	17190	18640
2001	$CaCO_{3\ BL,2001,i}$		0.88	0.87
2002	$CaCO_{3\ BL,2002,i}$		0.874	0.89
2003	$CaCO_{3\ BL,2003,i}$		0.89	0.86
Weighed average value	$\boldsymbol{CaCO_{3\ BL,i}}$		**0.884**	**0.873**

Weighed average $MgCO_3$ content in limestone calcinated on sugar plant *i* in base period 2001-2003

$$MgCO_{3BL,i} = \frac{MgCO_{3BL,2001,i} \cdot LC_{BL,NG,2001,i} + MgCO_{3BL,2002,i} \cdot LC_{BL,NG,2002,i} + MgCO_{3BL,2003,i} \cdot LC_{BL,NG,2003,i}}{LC_{BL,NG,2001,i} + LC_{BL,NG,2002,i} + LC_{BL,NG,2003,i}}$$

, (49)

where

$MgCO_{3\ BL,i}$ = weighed average $MgCO_3$ content in limestone calcinated on sugar plant i in base period 2001-2003;

$MgCO_{3\ BL,2001,i}$ = weighed average $MgCO_3$ content in limestone calcinated on sugar plant *i* in 2001;

$MgCO_{3\ BL,2002,i}$ = weighed average $MgCO_3$ content in limestone calcinated on sugar plant *i* in 2002;

$MgCO_{3\ BL,2003,i}$ = weighed average $MgCO_3$ content in limestone calcinated on sugar plant *i* in 2003;

$LC_{BL,2001,i}$ = amount of limestone calcinated on sugar plant *i* in 2001, t;

$LC_{BL,2002,i}$ = amount of limestone calcinated on sugar plant *i* in 2002, t;

$LC_{BL,2003,i}$ = amount of limestone calcinated on sugar plant *i* in 2003, t.

Data used for calculation and calculation results are provided in Table An.11.

Table An.11. Data used for calculation of weighed average $MgCO_3$ content in limestone calcinated on sugar plant i in base period 2001-2003 and calculation results

Year	Indication of parameter	Units	Dubenskiy sugar plant	Kremenetskiy sugar plant
2001	$LC_{BL,2001,i}$	t	9960	15170
2002	$LC_{BL,2002,i}$	t	7960	16110
2003	$LC_{BL,2003,i}$	t	17190	18640
2001	$MgCO_{3\ BL,2001,i}$		0.024	0.0248
2002	$MgCO_{3\ BL,2002,i}$		0.022	0.025
2003	$MgCO_{3\ BL,2003,i}$		0.025	0.0246
Weighed average value	$\boldsymbol{MgCO_{3\ BL,i}}$		**0.0239**	**0.0248**

3.4 Amounts of energy resources consumption, sugar production, amount of limestone calcinated and it's content on Dubenskiy and Kremenetskiy sugar plants in 2001-2010

Table An.12. Amount of energy resources consumption, sugar production, amount of limestone calcinated and it's content on Dubenskiy sugar plant in 2001-2010

Year	Sugar production, t	Amount of electric power consumed from JES of Ukraine, MWh	Amount of electric power supplied to external consumers, MWh	Amount of combusted natural gas, ths m^3	Amount of combusted coal, t	Sugar content of beets, %	Amount of calcinated limestone, t	Content of $CaCO_3$ in calcinated limestone	Content of $MgCO_3$ in calcinated limestone
2001	18805	940	409	9271	996	14.4	9960	0.88	0.024
2002	15025	751	1044	7407	796	14.82	7960	0.874	0.022
2003	14556	728	9588	12238	1719	15.31	17190	0.89	0.025
2004	26721	1336	1091	12879	1492	15.30	14920	0.879	0.0270
2005	29018	1451	1044	14309	1543	16.24	15430	0.877	0.0315
2006	40845	2042	1567	20141	2001	15.90	20010	0.870	0.0270
2007	46343	2317	1562	17641	2224	15.32	22240	0.884	0.0245
2008	46288	2314	830	12922	2462	16.25	24620	0.870	0.0314
2009	47207	2360	590	5596	9871	17.00	26000	0.885	0.0265
2010	56604	2830	1891	23611	2388	14.40	23880	0.875	0.0240

Table An.13. Amount of energy resources consumption, sugar production, amount of limestone calcinated and it's content on Kremenetskiy sugar plant in 2001-2010

Year	Sugar production, t	Amount of electric power consumed from JES of Ukraine, MWh	Amount of electric power supplied to external consumers, MWh	Amount of combusted natural gas, ths m^3	Amount of combusted coal, t	Sugar content of beets, %	Amount of calcinated limestone, t	Content of $CaCO_3$ in calcinated limestone	Content of $MgCO_3$ in calcinated limestone
2001	21905	904	0	17712	1341	15.22	15170	0.87	0.0248
2002	9002	1228	0	8255	2661	14.95	16110	0.89	0.025
2003	10411	1364	0	10141	906	14.88	18640	0.86	0.0246
2004	14415	1703	0	9943	1010	14.95	17440	0.89	0.0250
2005	18276	1502	0	10671	1147	14.88	16110	0.86	0.0246
2006	27914	1477	0	16018	1265	15.82	18640	0.88	0.0249
2007	28363	1683	0	15134	1725	14.92	26785	0.87	0.0252
2008	23624	1893	0	12285	1979	15.45	28583	0.86	0.0253
2009	-	-	-	-	-		-	-	-
2010	-	-	-	-	-		-	-	-