



turn waste into gains





## BGU Project for processing of 20 tons of chicken manure per day







## BGU Project for processing of 1 ton of chicken manure per day







## Dear Ladies and Gentlemen!

We are proud to present to you the highly professional company **Integro** (Integro-SD LLC) created on the ground of many years' experience of world leaders in the field of biohumus (soil conditioner) production based on biogas technology.

The company **Integro** was founded in 2002; it specializes in biohumus production and, derivatively, on renewable energy sources. The company is a part of MacHOUSE Holding (Ukraine).

MacHOUSE Holding has been the leading local project integrator and engineering company for more than 20 years. In 1993, MacHOUSE became the first official Apple dealer in Ukraine (currently, the dealership is performed by m-HOUSE retail network). MacHOUSE has been the member of American Chamber of Commerce since 2005. The holding also comprises the company Michael Huber München (Germany). The holding's turnover in 2013 amounted to 35 million Euros.

Biohumus production and bioenergetics as entrepreneurial activities are well-developed in many countries of the world; they stimulate expansion of cultivation lands, lower economy's dependence on consumption of natural resources, which leads to considerable increase in economical indexes.

One of the goals of the company **Integro** is to demonstrate, through its operation, the quality of services it renders, and flexible approach to the customers' needs, the advantages of the new lifestyle in which bioenergetics and its derivatives are common. Such approach is especially sought after in the period of winning new areas for living and agriculture as well as the growth of prices of energy resources.

The company **Integro** tries to popularize, develop, and maintain the culture of waste processing and production of renewable energy sources for the benefit of the nation.



The raw material for biohumus production and the derivative of biogas by **Integro's** technology is pure chicken manure output by poultry plants specializing in the production of eggs and replacement chicks.

Chicken manure, by its efficiency, is as good as quick-soluble chemical fertilizers. However, one does not put chicken manure into the soil straight from the poultry plant or farm. Raw chicken manure contains large amount of weed seeds, worm eggs and larvae, and various bacteria, including dangerous pathogens. It has been calculated that one gram of manure may contain around 100,000 bacterial cells of various pathogens. Pathogenic microflora of the manure can preserve its life-sustaining activity for a long time. For example, salmonellas can live in manure for up to 12 months and tubercle bacillus for 18 months. In this connection, poultry plant, according to Convention on Environmental Impact Assessment in a Transboundary Context, belong to environmentally hazardous types of economic activity. For further use of manure, it must be processed by way of composting, which is expensive, takes a long time, and has low efficiency, or by processing in biogas units (BGU).

Processing of pure chicken manure in BGUs is a difficult task. West European manufacturers of BGUs chiefly focus on vegetable mass (energy crops) as the main part of raw material.

Lately, the peculiarities of technological process of European BGU led to high competition in cultivation lands for growing energy crops, whereas there exists the problem of food shortage on the planet, for example, in the Third World countries. The high cost makes agricultural producers grow energy crops on large areas of land for biogas (biofuel) productions. Such monoculture production causes soil exhaustion and requires using large amounts of synthetic fertilizers, which deteriorates natural fertility of soil.

Every year the world loses the area of green land equal to that of Switzerland (41,000 km<sup>2</sup>). This problem is most acute at the frontiers of the Sahara and Gobi Deserts.

In 2011, the company **Integro** mastered the technological process of sustainable anaerobic processing of pure chicken manure with no additives and chemical treatment using reactors of its own manufacture. The company **Integro** is the author of the original BGU design.

In 2012, **Integro** built the first mobile biogas unit (experimental version) for processing 100 per cent pure chicken manure.

In 2015, the company **Integro** built the first industrial biogas unit for processing one ton of 100 per cent chicken manure per day.

Modern technologies and know-hows used by Integro in the manufacture of BGUs allow developing large-scale environmentally friendly biohumus production with low prime cost.

The biohumus produced by **Integro's** technology is high in its qualitative indexes and as good as the well-known vermicompost; it is also capable of restoring exhausted soil and increase crop production considerably. Besides, biohumus may be the base for restoration of fertile soil layer in the areas where it is absent or was lost.

The high quality of biohumus obtained as the result of the operation of BGU by **Integro** was repeatedly confirmed by laboratory tests in 2013 and 2014 by:

- Ukrainian Laboratory of Quality and Safety of Agricultural Products of the National University of Life and Environmental Sciences of Ukraine, accredited according to the DSTU ISO / IEC 17025:2006;
- Organic Fertilizers and Humus Laboratory of the National Scientific Center "Institute for Soil Science and Agrochemistry Research named after O.N. Sokolovsky" (Ukraine), accredited according to the DSTU ISO / IEC 17025:2006;
- JSC "Labtarna" laboratory (Lithuania), accredited according to the ISO / IEC 17025:2005.







# Overview of Ukrainian Poultry Husbandry Market

In the last 14 years Ukrainian poultry husbandry faced considerable changes both in productivity and in investment generation and production modernization.

According to the Ministry of Agrarian Policy and Food of Ukraine, in 2013, 19.6 billion eggs were produced, which is 2.5% more than in 2012. The number of poultry stock increased by 7.3% and amounted to 229.6 million in 2013. Since 2007, poultry husbandry industry showed positive dynamics that was used as the base for a forecast of the number of poultry stock until 2017. According to the trends, by 2017, total number of poultry stock will amount to 244.6 million.

## The forecast of the number of poultry stock up to 2017, million heads



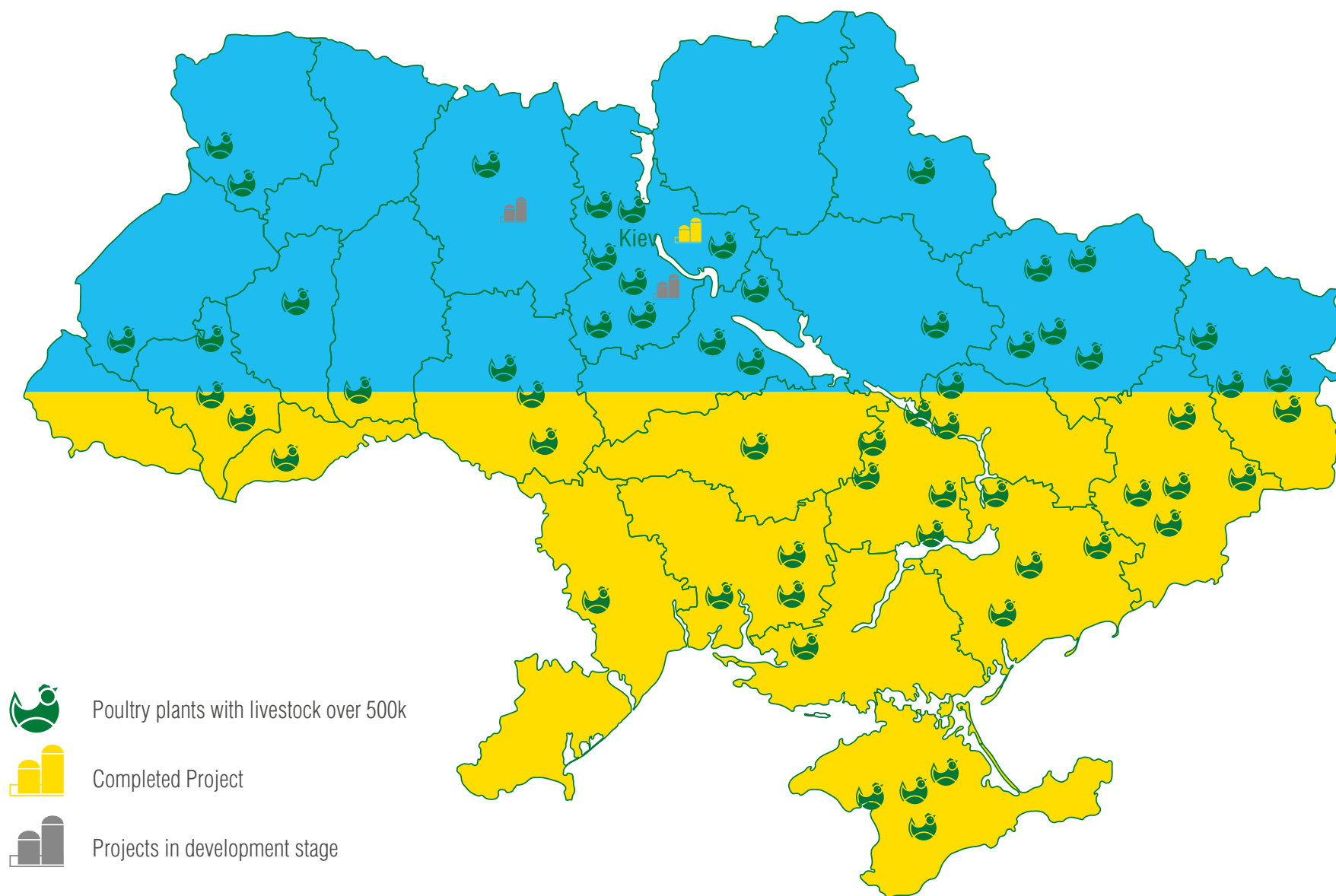
Today there are 90 large enterprises producing chicken meat and eggs in Ukraine. In 2013, Ukraine occupied the 9th place in the world in poultry meat export. According to the forecasts by US Department of Agriculture, in 2014, Ukraine will be the 7th largest exporter of these products in the world.

The potential volume of market of raw materials (chicken manure) for BGUs by Integro's technology amounts to 3.5 million tons a year.





## BGUs by Integro and the largest sources of raw material in Ukraine





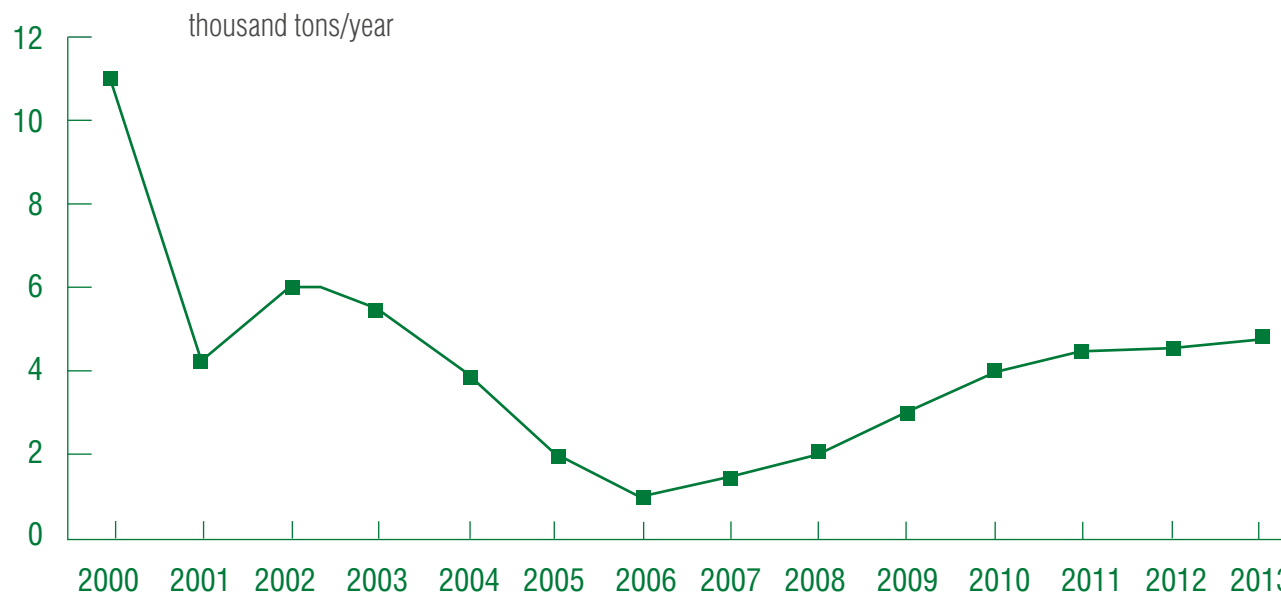


## Short Overview of Fertilizers Market of Ukraine

Total area of cultivation lands of Ukraine is 27 million hectares. Most of them are comprised by chernozems of high quality that do not need large volumes of fertilizers.

As a whole, fertilizers consumption market in Ukraine amounts to 6.3 million tons a year, including both mineral and organic fertilizers. According to official statistics, consumption of organic fertilizers amounts to 5 per cent of total volume of used fertilizers.

### Dynamics of Consumption of Organic Fertilizers in Ukraine



Main organic fertilizers in Ukraine are the waste of cattle and hog farms, poultry manure, various kinds of compost (vermicompost), sapropels, and peat mixtures.

The company Integro sees its mission in altering the above mentioned state of affairs at the fertilizer market shifting it towards organics.

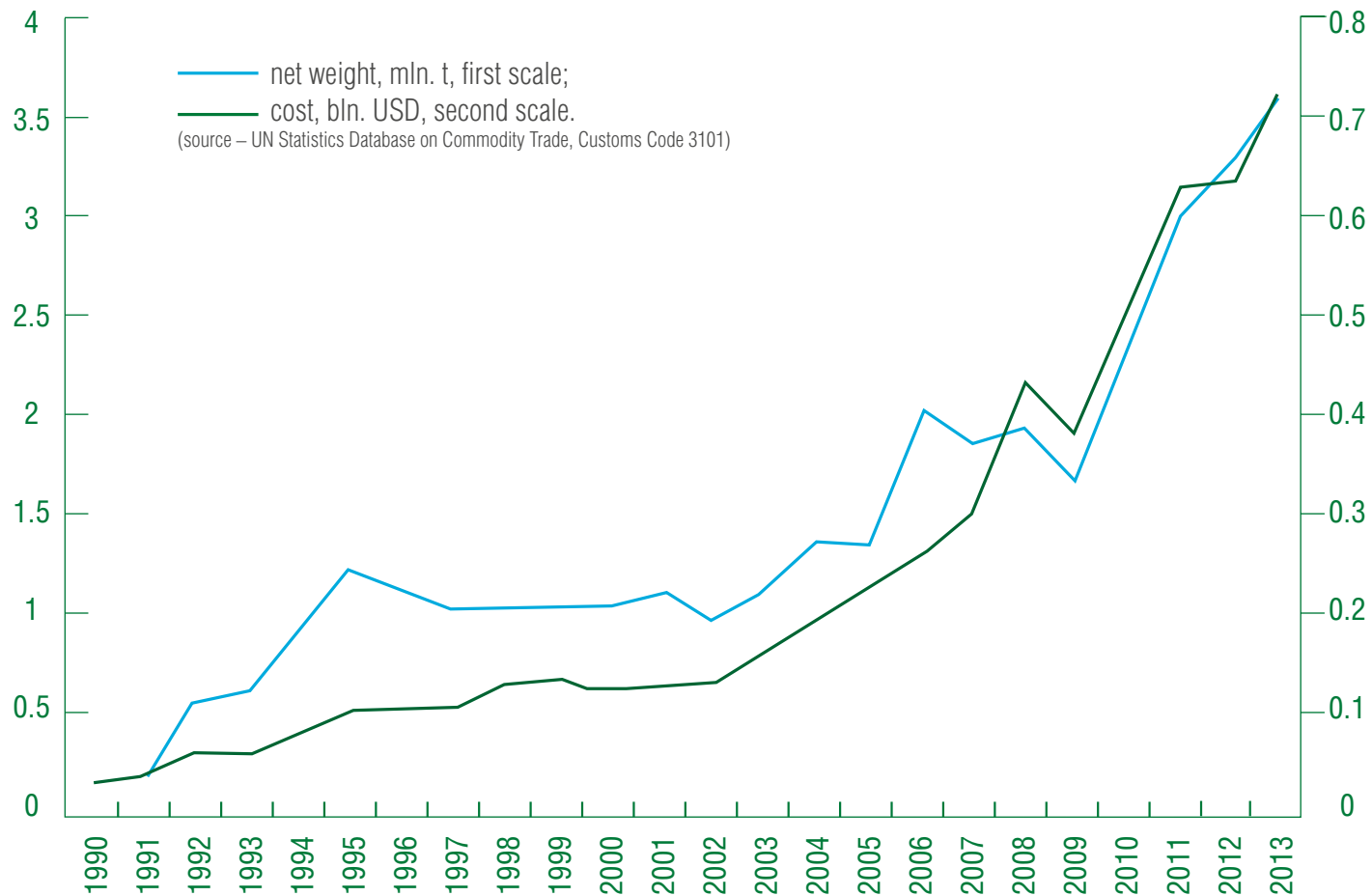


## Short Overview of Global Biofertilizers Market

The volume of global trade in organic fertilizers today amounts to c. 3.5 million tons a year.

The indexes of global trade in organic fertilizers, as compared to early 1990s, have increase fivefold in terms of volume and cost.

### Global Trade in Organic Fertilizers



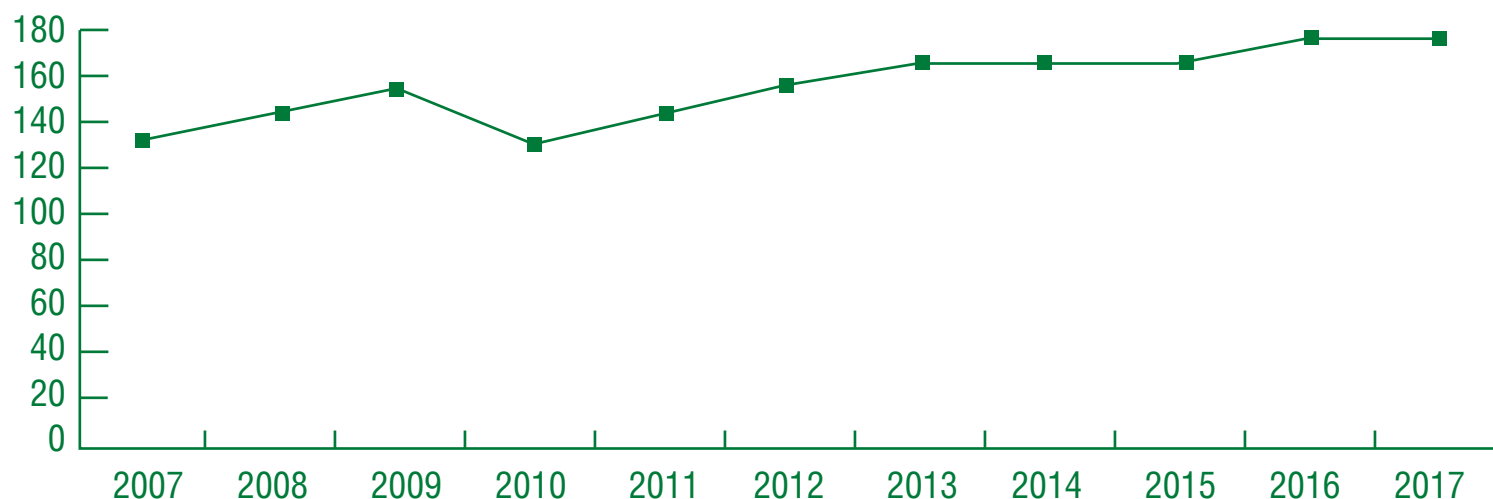




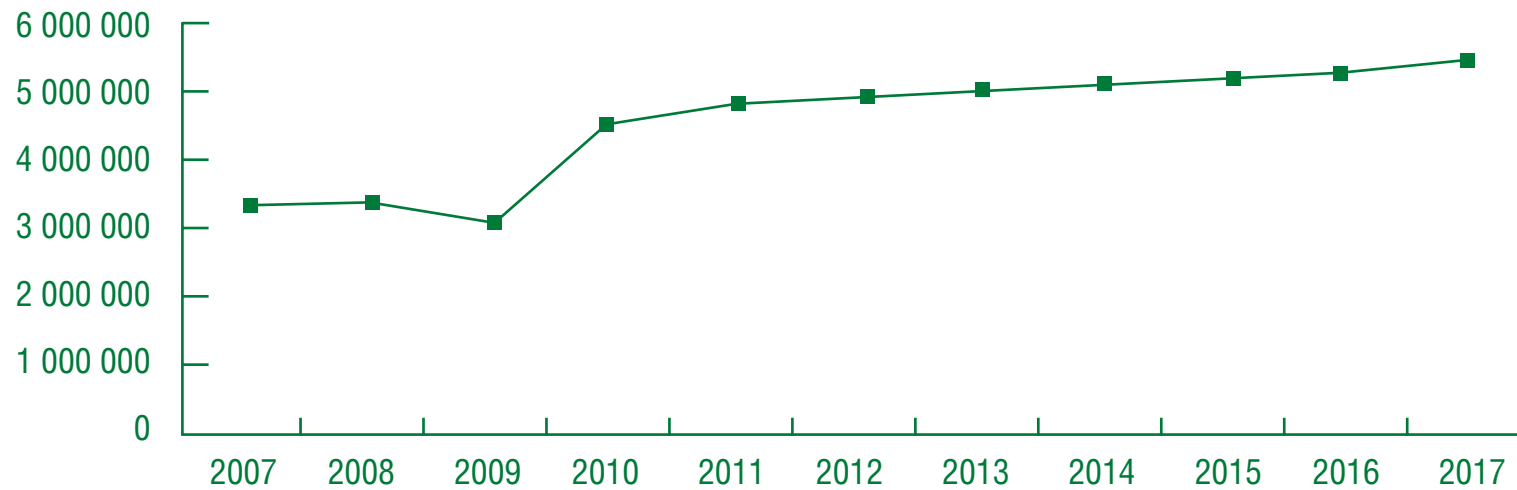
As of today, the leaders of organic fertilizers export are Europe (71.5%), Asia (12.7%) and the Americas (12.6%).  
The leaders of organic fertilizers import are the Americas – cross supplies (34%), Asia (32.95%) and Africa (5.5%).

Considerable influence on the markets is being made by the changes in EU policies, e.g. Nitrates Directive that is currently being implemented in EU member states. This Directive, first and foremost, regulates the use of nitrogen fertilizers and also aims at lessening of leaching of nitrates from inorganic fertilizers into groundwater. It will, probably, stimulate the use and promotion of organic fertilizers. It is thought that other countries that are focused on supplies of commodities to Europe might follow EU's example.

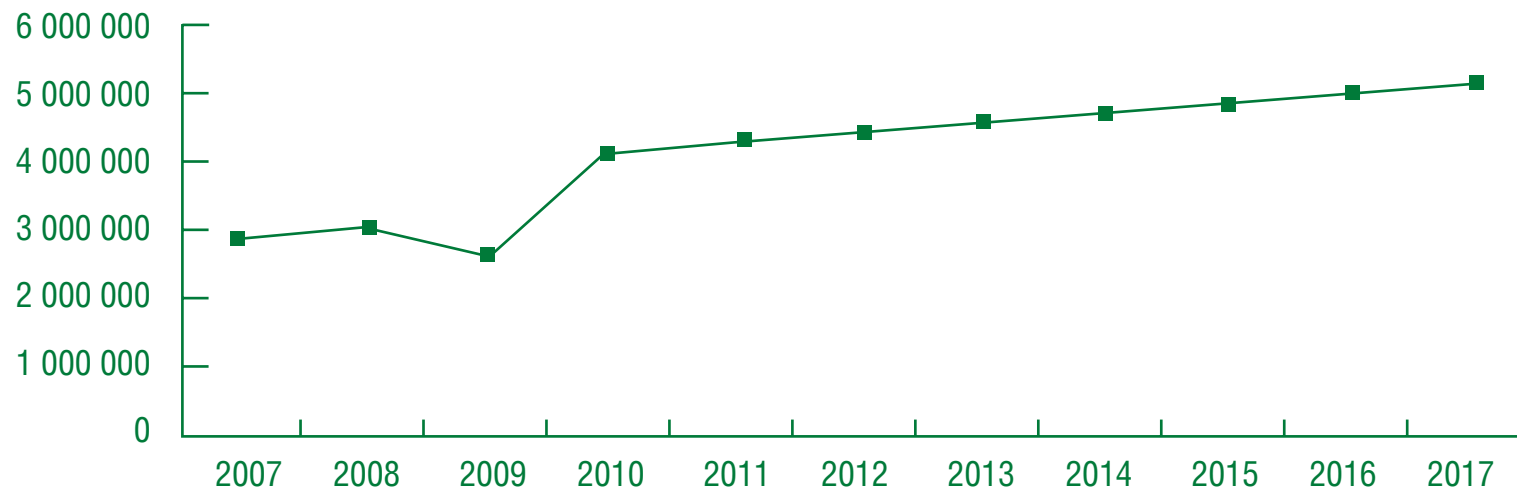
### Trends of price for organic fertilizers (EXW), 2007-2017



**Trends of organic fertilizers production (tons), forecast for 2007-2017**



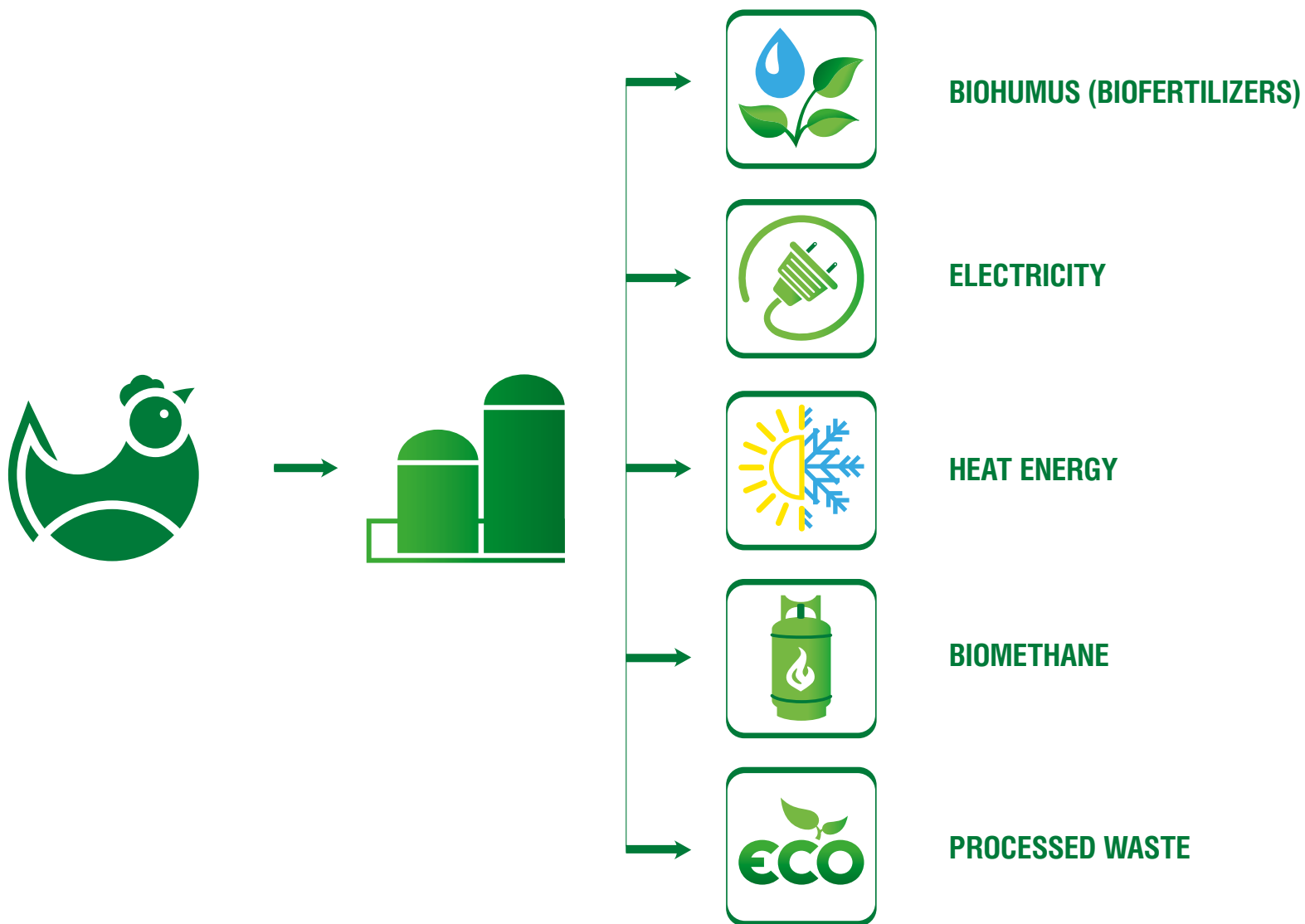
**Trends of organic fertilizers consumption (tons), 2007-2017**







## Process flowsheet





## Brief Description of Technology

To solve the task of biohumus production, the company **Integro** took advantage of global experience and a number of author solutions in the design of BGU's fermenter, also fine-tuning the technological process, which allowed us achieve steady anaerobic fermentation of substrate consisting of high-ammonium chicken manure. No additives are used in the process. We input pure chicken manure and output biohumus, biogas, and liquid humic fertilizer.

The humidity of biohumus is 60% or higher, which ensures the conditions for preserving useful microflora in active state; this implies that our product is "live".

Biogas is used as fuel for piston co-generator that produces electric and heat energy. The produced energy is mainly used for powering the technological process. The surplus might be directed to the surrounding infrastructure. The BGUs designed by **Integro's** technology are based on waste-free production.

One of the innovation in **Integro's** BGU technology is the manufacture of hydrolysis tanks and fermenters from composite materials that are as good as the ones used in aircraft manufacture (the mentioned panels have passed all necessary tests at the aircraft manufacture plants and in the profile R&D institutions.) Comparing them to the materials used by European and American BGU manufacturers, which are chiefly concrete and enameled metal, the composite materials specially designed for **Integro** are characterized by:



low costs of production;



long life (more than 50 years);



quick and easy mounting (no welding joints) at any weather conditions;



resistance to corrosion and stability in aggressive ambient conditions.





## Description of Final Product

**Biohumus**, after separation, looks like moist friable dark brown mass. Linear size of fragments is no larger than 1 mm. When stored in open air biohumus has the smell of raw forest earth. Dark color of biohumus is caused by humic and fulvic acids. By its texture and tangible properties, biohumus can hardly be distinguished from soil.



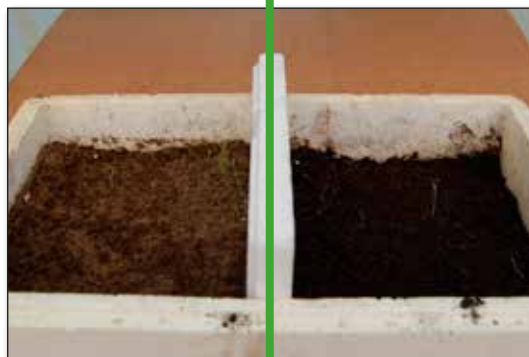


## Field studies

For the purpose of defining the regularities of effect of biohumus, being produced by the Integro's technology, on physicochemical and agrochemical soil characteristics as well as germinating capacity, vegetation and development of control crops, the field studies of abovementioned biohumus have been carried out since August, 2014 under control of the relevant institute for soil science.

The results of these tests show the significant increase of crops growth on the soil with biohumus comparing to control samples being cultivated on the professional well-balanced soil for greenhouses.

The tests are carried out on the mixture of sand with biohumus and on the mixture of sand, peat with biohumus.



Biohumus

Specially  
prepared soil



Biohumus

Specially  
prepared soil





# The Results of Laboratory Tests

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE**  
**UKRAINIAN LABORATORY OF QUALITY AND SAFETY OF AGRICULTURAL PRODUCTS**

Location: Mashynobudivnykiv str., 7, Chabany village, Kiev-svyatoslavsky district, 08162, Ukraine.  
Legal address: Heroyiv Oboroyi str., 15, Kyiv, 03041, Ukraine. Tel./fax: +38 (044) 5278943, 5264502  
E-mail: info@quality.ua + http://www.quality.ua/

ACCREDITED BY NAAU  
(National Accreditation Agency of Ukraine)  
ACCORDING TO REQUIREMENTS  
OF DSTU ISO / IEC 17025:2004  
ACCREDITATION CERTIFICATE  
№ 2N724 OF 4 JULY 2010

APPROVED BY  
DIRECTOR ULQSAP  
S. Melnychuk

TEST PROTOCOL № 0403-N  
1 July 2013

Customer: Integro-SD, LLC  
Customer Address: 48 Degtiarivska str., Kiev  
Tested objects and registration codes:  
14360 – Organic fertilizer (solid), the sample is taken in Vasilkov. The sample is submitted in non-sealed PE package (product name meets the sampling report and sample labels). Amount of sample provided for testing: 1.135 kg.  
Application letter: Dated on 19.06.2013 (which is registered in ULQSAP as № 712-N of 19.06.2013)  
Sampling report: Dated on 19.06.2013 (which is registered in ULQSAP as № 713-N of 19.06.2013)  
Samples are taken and delivered by the customer's representative.  
Period of testing: 19.06.2013 – 27.06.2013  
Date of obtaining samples: 19.06.2013

**TEST RESULTS**

Registration code of the sample: 14360

Parameters and measuring units	Test results	Errors in the test
Total nitrogen, % of dry matter	2.69	± 0.20
Total phosphorus, % of dry matter	4.2	± 0.20
Total potassium, % of dry matter	0.7	± 0.05
Organic matter, % of dry matter	20.3	± 0.80
Ash, %	22.3	± 0.80
pH value, pH units	7.8	± 0.30
Moisture, %	72.2	± 0.90
Ammonium nitrogen, % of dry matter	1.5%	± 0.1%
Carbon to nitrogen relation (C:N)		8.2:1

**TEST METHODS:**  
Determination of total nitrogen: acc. GOCT 26715-85 Удобрения органические. Методы определения общего азота (Organic fertilizers. Methods for determination of total nitrogen);  
Determination of ammonium nitrogen: acc. GOCT 26716-85 Удобрения органические. Методы определения аммонийного азота (Organic fertilizers. Methods for determination of ammonium nitrogen);  
Determination of total phosphorus: acc. GOCT 26717-85 Удобрения органические. Метод определения общего фосфора (Organic fertilizers. Methods for determination of total phosphorus);  
Determination of total potassium: acc. GOCT 26718-85 Удобрения органические. Метод определения общего калия (Organic fertilizers. Methods for determination of total potassium);  
Determination of organic matter and carbon-to-nitrogen relation: acc. GOCT 27980-88 Удобрения органические. Методы определения органического вещества (Organic fertilizers. Methods for determination of organic matter);  
Determination of ash: acc. GOCT 26714-85 Удобрения органические. Метод определения золы (Organic fertilizers. Method for determination of ash);  
Determination of pH: acc. GOCT 27979-88 Удобрения органические. Метод определения pH (Organic fertilizers. pH determination method);  
Determination of water content: acc. GOCT 26713-85 Удобрения органические. Метод определения влаги и сухого остатка (Organic fertilizers. Method for determination of moisture and dry matter).

**Notes:**  
1. Test report concerns only to samples submitted for testing.  
2. Test report is not allowed to be reprinted fully or partially without any permission of Ukrainian laboratory of quality and safety of agricultural products.  
3. With no original seal and signature of Director ULQSAP AIC test results are not valid.

Done by: Domnenko I.V.  
Tel.: (+380 44) 527-89-43

Test protocol № 0403-N  
page 1 of 1

**END OF THE DOCUMENT**

**НАЦІОНАЛЬНА АКАДЕМІЯ АГРАРНИХ НАУК УКРАЇНИ**  
Национальный научный центр  
«Институт грунтознавства та агрохімії імені О.Н.Соколовського»

**NATIONAL ACADEMY OF AGRARIAN SCIENCES OF UKRAINE**  
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05.05.14 № 1-04/429

**ПРОТОКОЛ ІСПЫТАНІЙ**  
Испытатель: лаборатория органических удобрений и гумуса (свидетельство №100-4142/2011 от 04.08.2011 г.)  
Заказчик: Компания «Интегро-СД», г. Киев, Украина  
Название образцов: почвоулучшитель «Biohumus»  
Дата испытаний: 24.04.2014 г.

Показатели	Почвоулучшитель «Biohumus»
Массовая доля влаги, %	77,62
Массовая доля сухого вещества, %	22,38
Массовая доля золы, %	13,25
Массовая доля органического вещества, %	86,75
Массовая доля общего углерода, <i>С<sub>общ.</sub></i> % (из сухой навески)	37,01
Массовая доля общего углерода, <i>С<sub>выт.</sub></i> % (из вытяжки)	1,16
Массовая доля углерода гуминовых кислот, <i>С<sub>гк.</sub></i> % (из вытяжки)	0,31
Массовая доля углерода фульвокислот, <i>С<sub>фк.</sub></i> % (из вытяжки)	0,85
Массовая доля углерода гуминовых кислот, <i>С<sub>гк.</sub></i> в общем углероде <i>С<sub>общ.</sub></i> % (из вытяжки)	27
Массовая доля общего азота, <i>N</i> , %	влаж. 0,67 сух. 3,00
Массовая доля общего фосфора, <i>P<sub>общ.</sub></i> %	влаж. 0,61 сух. 2,73
Массовая доля общего калия, <i>K<sub>2</sub>O</i> , %	влаж. 0,30 сух. 1,34
Массовая доля аммонийного азота, <i>N-NH<sub>4</sub></i> , %	влаж. 0,49 сух. 2,20
Массовая доля нитратного азота, <i>N-NO<sub>3</sub></i> , %	влаж. 0,02 сух. 0,07
pH	8,2

Заведующий лабораторией органических удобрений и гумуса  
доктор с.-х. наук

Е. Скрыльник



## Possible variants of use of biohumus produced by Integro's technology

- Recreation of lost fertile layer of the soil for agricultural needs;
- Creation of fertile layer of the soil for agricultural needs from the scratch;
- Using as biofertilizer for agricultural needs;
- Using for landscaping of motorways, streetcar and railroad tracks;
- Using for landscaping of gardening enterprises and landfills.

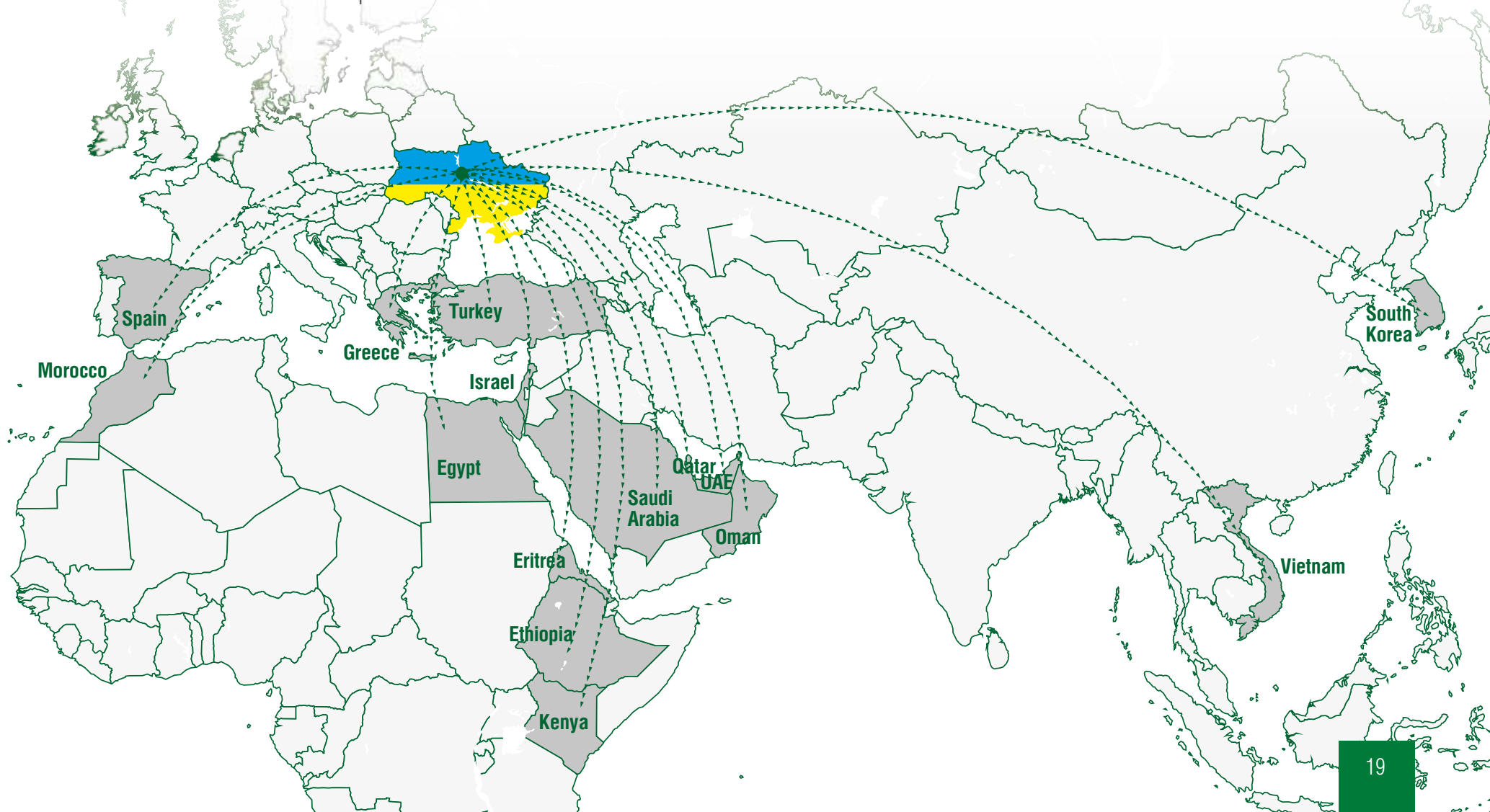






## Brief Information on Target Markets

Definition of target markets for biohumus sales is based on its features and properties as well as on understanding needs of potential customers. Considering possible variants of the use of biohumus, we defined priority markets for sales: North Africa, Middle East and South-East Asia. Considering geographic position of Ukraine and convenient location of priority sales regions from the point of view of logistics (delivery by sea), we defined 15 most attractive countries for sales of our products:





## BGU 20 Characteristics

The project envisages processing of 20 tons of pure chicken manure a day. At the same time, without considerable technological alterations, the complex capacity can be increased up to 30 tons a day.

The technological process envisages separation of output slime and the yield of 14 tons of biohumus with 70% moisture. The ready product is to be packed into 1 ton big bags for convenient transfer to consumers.

In order to provide autonomous functioning of BGU, the biogas obtained in the production process is to be directed into cogeneration unit with output electric power of 80 KW and heat capacity of 120 KW. Also, separated slime is to be forwarded to BGU's input, which means no need for additional water supply. The electric power demand of the complex amounts to 30 per cent of its output power.

The offered complex consists of the following components: BGU itself, separation unit, control room, cogeneration unit and/or biogas boiler, packing unit and finished product store.







## BGU 1 Characteristics

The project is aimed at energy-efficient (clean) processing of 1 ton of pure chicken manure per day.

The technological process envisages separation of output slime and the yield of 700 kg of biohumus (soil conditioner) with 70% moisture per day or 250 tons per year. The ready product can be packed into bags from 1 kg till 1 ton (big-bags) depending on customer preferences.

The complex is completely able to provide itself with heat energy that reduces costs on purchase of energy supplies. To this end the biogas obtained during production process is to be directed to biogas boiler for securing heating of BGU's tanks during complex's operation.

The separated slime is to be forwarded again to BGU's input, which means no need for current water supply.

The offered complex consists of the following components: BGU itself, separation unit, control room, biogas boiler, packing unit and finished product store.





## As of today, Integro has at its disposal

- biogas unit with the capacity of 1t of pure chicken manure per day;
- an experimental mobile BGU used for mastering of all necessary technological processes;
- professional staff;
- office premises (holding-based);
- general designer;
- full range of parts suppliers (European and North American manufacturers);
- reactor manufacturer;
- potential territory for construction of a BGU (Kiev Oblast, Ukraine).



Thank you for the attention you paid to our company.  
We are open to productive and mutually beneficial co-operation.  
We shall be glad to see you among our partners!

With best regards, Company President

Anton Bulygin

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