The First International Scientific-practical

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of students, postgraduates, scientists

and specialists

"Sustained development of region: problems and perspectives"

SHEI "National Mining University"
Institute of Economics
Faculty of Management
Department of Applied Economics

University of Illinois at Urbana-Champaign
Bioengineering Department

4th and 5th of December, 2013

Dnipropetrovsk

Ministry of Education, Youth and Sports of Ukraine
State Higher Education Institution
"National Mining University"
The Institute of Economics
Faculty of Management
Department of Applied Economy

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Abstracts

Dnipropetrovsk
NMU
2013

The First International Scientific-practical web-conference of students, postgraduates, scientists and specialists "Sustained development of region: problems and perspectives": the collection of abstracts/edited by O.G. Vagonova, L.V. Tymoshenko. – Dnipropetrovsk: SHEI National Mining University, 2013. - p

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MOTIVATION INCREASING AND ECONOMIC STIMULATION OF LABOR CONDITIONS IMPROVEMENT AT AN ENTERPRISE

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Analysis of possible ways of motivation increasing and economic stimulation of enterprises for labor conditions improvement is carried out. The mechanism of motivation increase by means of changing the current legislation base on the issue of labor protection is suggested.

Economic stimulation and improvement of legislation on labor protection are the main mechanisms of the strategy of workers' protection in all industrially developed countries of the world. Stimulation can be considered as an indirect method, while the labor protection legislation and policy in the sphere of labor protection in the world are, as a rule, concentrated on legislation execution. From the beginning of XIX century scientists have been arguing about the question of advantages of direct and indirect regulation [1]. Supporters of economic stimulation believe it to have significant advantages over the legislation. They are described further.

No all the set rules and standards are carried out properly. For an enterprise it is father simple to ignore the rules, which control the labor conditions. This problem is especially urgent in the mining sphere, where rules are especially detailed and refer to exact conditions. For example, mines often face situations of unauthorized intrusion to the work of equipment of automatic gas control, the preliminary damping of coal in the massifs with the aim of dust level decrease [2-4].

With the change of conditions there arise new rules. The quantity of normative legal acts of labor protection is increasing and only the professional in this sphere can understand them. The main advantage of economic stimulation is the more general approach and simplicity and, what is more important: the language of economic stimulation – the business language. Managers can see the influence, provided by the measures of labor protection, on mines operation. They react in the same way as on any other factor of expenses or profit gain.

The potential of economic stimulation consists in the fact that it acts from bottom to the top and at all levels: any existing risk in the sphere of labor protection can have its own type of economic stimulation, regardless of the level that a mine has gained in this sphere previously. This is its main difference from the most part of rules, which define the minimal level of measures, taken to follow them. Having achieved this minimum these rules are considered as fulfilled and the further work for labor conditions improvement is not required.

Economic stimulation can be easily adapted to the new risk classes as they arise. Due to the fact that it is not concentrated on the process, where the risk actually appears, but only on the results, the economic stimulation is easily used for new unknown risk classes as well as for the new ones. As for the regulation system, the new risk class requires new rules and this process is very complicated, slow and politically diverse. The advantage of economic stimulation in comparison with the regulation is becoming more and more important as technological changes are happening.

Economic stimulation is a flexible instrument that allows enterprises to find effective solutions to the labor protection problems. Economic approaches, based on the results but not on methods, favor the process of solving problems and innovations implementation and allow a more effective use of knowledge – both the one collected at work places and special. Regulation, on the contrary, always faces the choice between maximum accuracy of execution for the maximum control and between the simplicity and universality of approach for the improvement of management and rules fulfillment. Rules, which are obligatory for fulfillment, are often considered to interfere work.

The main objective of the labor legislation is the solution of triune task: workers' protection from harmful and dangerous production factors, which threaten their health and physical safety at the work place; provision of compensation in case of accidents at production and of professional diseases; provision of medical and professional rehabilitation of those injured at production.

ECOLOGICAL AND ECONOMIC ASPECTS OF RECYCLING: EUROPEAN AND UKRAINIAN EXPERIENCE

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Production and household activities inevitably involve the formation of waste. Growing human pressure brought the situation from increasing garbage volumes and waste products to the level of the global up-to-date problem. The issue of the most efficient and long-cycle circulation of raw materials in the production process rose. This became possible due to waste recycling and returning to the circulation. Recycling at enterprises is a promising direction of development, as products that have completed their life cycle are often a cheaper source for many substances and materials than their natural counterparts.

Large scales of resources use, energy and raw materials specialization of Ukraine's economy together with outdated technological base have determined the high rates of annual formation and accumulation of waste. Over the past 10 years, the total volume of formation of industrial and household waste in Ukraine

continuously grew, except for the crisis year of 2009. According to government statistics, updated annual waste generation in 2010 made up 419.2 million tons and the amount of savings in "specially designated areas or objects" – 13.27 billion tons. According to the statistics of 2010, Ukraine's share of waste generation in the European region is about 7%. If the European standards were taken as a base, waste only of I to III hazard classes would enter the category of dangerous waste in Ukraine. In 2010, for example, there was 1.66 million tons of waste or about 2% of that in the EU-27.

The most interesting is the specific indicators of waste per person. Ukraine annually produces 9.2 tons of waste per person, that is in 1.76 times higher than the average for the EU-27 (5.2 t / per person according to the Eurostat). If Dnipropetrovs'k region is "excluded" from Ukraine, the rate of waste per person in the rest of the territory will immediately fall to 3.2 tons. If Donetsk region is additionally "separated", the specific rate will reduce to 2.1 t / person.

Nowadays, the specific indicator of domestic waste per person in Ukraine is up to 310-330 kg / year. In EU countries this indicator ranges from 316 kg in the Czech Republic to 833 kg - in Germany, and the average is 513 kg. So in Ukraine waste formation per person is at the lower limit of the European range. But the infrastructure of waste management in Ukraine, unlike the EU, is in its infancy. The dominant share of waste is piled up on environmentally hazardous landfills. As a result, both resources, and clean environment are lost. In European (EU-27) practice only 38% of such wastes placed in landfills, while in Ukraine - 93%.

The problem of waste in Ukraine differs in special scale and significance as a result of the dominance of many intensive-waste technologies in the national economy, and lack of long-term adequate reaction to its challenges. Differences between Europe and Ukraine once again concerns not with the amount of waste, but with the lack of adequate waste management, including separate collection and recycling.

European countries are guided by a number of directives and regulations in the field of solid waste management. The basic law of the EU waste management is "The Waste Framework Directive (WFD)", which covers all waste streams and establishes, so-called, hierarchy of waste, rules of planning, waste management, qualified collecting, recycling, and requires obligatory compliance with licensing procedures for recyclers. Therefore, it is urgent for Ukraine to form the same normative, legal and information development in the field of waste management and to cross to international regulations - classification and accounting of wastes, its transportation, disposal and neutralization in compliance with all the requirements of environmental safety of the EU.

As mentioned above, the difference between the situation of waste in Ukraine compared to the developed countries consist both in more significant volumes of waste and the lack of waste management infrastructure, that is an integral part of the economies of European countries. The only civilized and safe way to manage solid household waste is to minimize the generation of it on the basis of spreading public ecological awareness and recycling, because almost all components of solid waste can be reused.

Mineral wastes in Ukraine (71.5%) are drastically dominated in the volume of utilization. This is mainly because of low technological using of overburden rocks, mining waste and enriching process of mineral resources during the construction of roads and dams.

Further development of secondary resources consuming is hampered by a lack of development and poor infrastructure, low motivation of concerning activity of waste management, passive position of the authorities at various levels, some riskiness of the business in its infancy. The system of waste collecting is imperfect and has fragmentary nature, regulation and economic stimulation of related activities is almost absent.

From the experience of foreign countries, for the financial support of production activity of Ukrainian system of secondary resources it is appropriate to introduce environmental payments (or system of license fees) for using the packaging. In addition, the mechanism of funds should be developed for this purpose – formed by fees for waste disposal. An important tool for economic stimulation that completes payments for the packaging and waste disposal, should become the mechanism of reimbursement for collecting and preliminary processing of certain categories of the most resource-valuable waste, in particular: used oils, used tires and rubber waste, packaging materials and containers, vehicles, electrical and electronic equipment, batteries and accumulators, etc. This process requires a state support, identification of national and regional priorities, on which an appropriate support measures will be extended, and creation of territorial industrial complex that is concerned to recycling in regional centers and coordination of its development at regional formation. One of the main tools should be the adoption of special laws that regulate activity in connection with reusing resources (material recycling) in general, as well as packing materials, in which specific mechanisms should be involved.

RECLAMATION OF LANDS AFTER MINING AS A MEASURE OF ECOLOGICAL RESPONSIBILITY OF MINING ENTERPRISES

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Mining is important for local and global economy, but this operation mostly and inevitably leads to substantial environmental damage and due to these kinds of activities, original potential of landscape is extremely altered. All mining operations, due to their nature, have negative impacts on the cultural landscape. Coal mining, particularly surface mining, requires large areas of land to be temporarily disturbed [1]. Open pit mining activity, and to a far lesser extent underground mining, by nature cause alterations to the natural landscape, visual changes to the land morphology and disturbance to the fauna and flora of the

extraction site [2]. Soil destruction is one of the most crucial environmental impacts of open pit mining activities. After mining finishes, the mine area must undergo rehabilitation.

Generally speaking, developing countries do not have strict environmental regulations and effective enforcement programs, and they usually address the issue within mining and environmental acts, or related national laws.

Coal mining is only a temporary use of land, so it is vital that rehabilitation of land takes place once mining operations have stopped. In best practice a detailed rehabilitation or reclamation plan is designed and approved for each coal mine, covering the period from the start of operations until well after mining has finished.

Mine reclamation is an integral part of the mineral development process. It is designed to restore to an acceptable state the physical, chemical, and biological quality of land and water regimes disturbed by mining. It is recognized that reclamation plans need to remain flexible and adaptable to changes in site characteristics, mine plans, geology and long-term and land use changes [3]. The overall objective of a reclamation plan is to produce a landscape that is safe, stable and compatible with the surrounding landscape and final and use.

Reclamation has been widely accepted by both developed and developing countries as a desirable and necessary remedy in order to: 1) reestablish the environmental conditions in post-mining landscapes at an acceptable level, and 2) increase their economic value to an optimum level.

Reclamation of post-mining landscapes is a very challenging task since there is no unique reclamation planning scheme for such landscapes, and it highly depends on the site-specific characteristics. Therefore, successful and sustainable reclamation requires interdisciplinary approach leading to an integrated and effective proposal to restore ecological, hydrological, aesthetic, recreational and other functions of the post-mining landscape.

In the course of removing the desired mineral material, original soil become lost, or buried by wastes. When mining is going and has gone on, particularly top soil must be conserved because it is an essential source of seed and nutrients, and should be preserved for use in reclamation. When viewed in the landscape planning perspective, landscape evaluation can be considered as a management tool and the first thing to consider is to decide for which purpose the landscape will be used. Then, the implementation of reclamation should be carried out by taking the basic rules of ecology into account. It’s crucial to make a mine disturbed land environmentally stable in order to transfer an unpolluted environment and natural resources to the next generations. Post-mining reclamation works are those aiming to regain landscape’s fertility, its ecologic, economic and esthetic values.

Hence, discovering the unique potential of mined land and choosing appropriate methods and measures, which actually form the core of reclamation, are necessary for the successful transformation of this potential into a sustained capability. In order to obtain satisfactory results in reclamation, special attention must be paid to the post-mining use of the land and its potential functions together with the implementation of environmental conservation and land reclamation

programs to minimize the negative environmental effects. A successful biological reclamation restores the natural capital of flora and fauna and productivity of land, which had been previously converted into fabricated capital through mining [4].

Reclaimed land can be used for agriculture, forestry, wildlife habitation, and recreation [5]. Substantial deformation of the topographic structure of the landscape, loss of fertile top soil, detriment in the flora and fauna; reduction of such negative effects to a minimum level or complete removal of them are achieved by landscape use planning. Re-establishing the balance between ecology and economy in order to decrease the inevitable environmental problems at a minimum level caused by mining, reconstructing the disturbed ecosystem and introducing the possible new uses according to the needs of dwellers are among the main concerns of landscape use planning. Potential future use of the post-mining lands basically depends on the nature of the land, soil conditions, and communal structure of nearby surrounding to be rehabilitated by technical, biological, agricultural means or forestry applications. The followings are the potential land use types that follow successful land reclamation. Restoration of a landscape disturbed by opencast mining operations is mostly viewed in technical or economic perspectives only. Even though the public focused only on the forestry and agricultural aspects of restoration previously, there has been a recent interest in nature conservation and recreation. In order to restore ecological, hydrological, aesthetic, production, recreational and other functions of the post-mining area, a sustainable land use development plan should be prepared through a holistic approach. It is impossible to replenish the minerals once mined out, however; we can reclaim the derelict land by establishing self-sustaining vegetation cover with pre- determined end use.

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MINING ENTERPRISES AS A SOURCE OF THE ENVIRONMENT VIOLATION

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Leading fields in the economy of Ukraine are closely associated with the use of natural raw materials, production processes that are accompanied by tangible antropo-technological impact. Removal of a certain amount of raw materials from the natural subsoil forces funds spending on restoration of damaged nature. Some of the extracted raw materials are used in commercial production, the other - in the form of waste are sent back to nature, polluting air, water environment, soil, and require the cost of cleaning toxic waste. Thus, mining production in varying degrees destroys the ties that have been developed in a sustainable ecosystem that can lead to its destabilization.

Environmental problems require an integrated and systematic approach using the world experience. The study of world markets has shown that their absolute leaders are companies that have adopted and successfully implemented environmentally-oriented business models. Environmental policy of leading companies became part of their corporate strategy. Environment Strategy, in turn, is important not only to achieve stable development, but also to increase competitiveness. Unfortunately, few domestic enterprises using foreign experience on the promotion of environmental activities do not introduce a one-time resolution mechanism of economic and environmental problems.

The territory of Ukraine with the anthropogenic impact on the environment is 4-5 times higher than for developed countries [2]. Exploitative use of natural resources has led to massive destruction of natural landscapes. The use of outdated technologies and equipment, high concentrations of hazardous facilities in some regions, a large depreciation of fixed assets mining cause a significant probability of industrial accidents and disasters with severe consequences for the environment.

One of the important areas of environmental protection provided for implementation by 2020 is environmentally safe technology of mining and compulsory recultivation and environmental rehabilitation of territories affected as a result of industrial activity of mining industry.

Environmental problems are very acute in all mining regions of Ukraine, but receiving is substantial for Krivorozhskiy basin. More than a century-old existence of Krivbass (currently operates 10 quarries and 23 mines of five ore-bearing plants) in the rock massif formed more than 10 million cubic meters of cavities, most of which are located directly under the area of Krivoy Rig. Area of collapse is 7 square kilometers and covers almost the entire area of clearing mines. In the basin there are 44 piles of rocks area of 69 square kilometers and 10 slime storages (2.5 billion tons of sludge) of the 71 square kilometers. Drainage water salinity is more than 20 grams\cubic meter. Drainage water is accumulated in tailings and

discharged into the river Ingulets. Intensive filtration of mineralized and polluted water from tailings is contributed to flooding within industrial agglomeration of Krivoy Rig of more than 500 square km of territory and caused the failures affected rocks.

Increasing of useful components extraction from the depths is equivalent to 1-2% the identification of new large deposits of minerals [6]. Under the natural environment of mining there are changes that can be defined as elements of ecological-economic damages: lost product (loss of valuable raw materials from industrial waste), insufficiently produced product (reducing power production facilities as a result of environmental technology, productivity of the causes of pollution), compensation costs (the cost of reducing the negative impact of pollutants).

Indicators characterizing the current state of environmental protection of Krivoy Rig mining companies are considered. Among these enterprises the higher amount of pollutants than the other, has Pivdennyi Mining (PivdGZK), much smaller - Ingulets Mining and Enrichment Plant (IngGZK), the smallest - Zaporozhye iron-ore plant (ZZRK), where the ore is mined in underground way with filling the produced area with hardening mixture. It should also be noted that areas of natural lands, which are broken to accommodate technological objects at different plants vary greatly among themselves in the Pivnichny Mining (PivnGZK) - 6.9 hectares, Ingulets Mining - 2.3 hectares, while all mining enterprises used almost the same technology of extraction and enrichment of ore raw materials.

Zaporozhye iron-ore plant spends little money on pollution charges. Its current cost of the natural environment reach a significant size - 52.2 million UAH, but by volume of pollutants, received water and used land area this mine makes little impact on the nature.

Technology of underground ore deposits as an alternative of open way should be assessed in terms of modern requirements for cleanliness and fullness of deposits generated laying area extraction that allows to reduce pollution up to 2-3 times, to reduce to losses of ore on 5-10%, and enables underground utilization of industrial waste and increase ecological safety of the environment.

Thus, environmental and economic component of any production process that affects the environment should be based on new technological thinking. For each process mining enterprise should pay more attention to economical use of natural resources and the minimum possible environmental violations at the lowest cost. The largest amount of waste is generated at enterprises of mining and ore mining industries. These wastes can be used on their own plants for better extraction of mineral components and for production of building materials. In engineering and technology decisions based on recycling of waste, neutralization of reasons that lead to violations of the environment should dominate. At the same time the problem of using the principles of environmental rehabilitation of mining technology should be stated.

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ANALYSIS OF ACCIDENTS AND THEIR CONSEQUENCES ON THE WESTERN DONBASS MINES

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The coal industry is considered as the most dangerous one not only in Ukraine but all over the world. Each year on the Ukrainian coal mines thousands of miners die and get injured.

Since Ukrainian has been independent, there were 34 major accidents on the coal mines, 3,400 people have died. The most serious accident occurred at the Zasyadko coal mine in 2007, 106 people died and 138 people were injured.

The main cause of accidents is an explosion or dust-methane-air mixture ignition, due to violations of safety rules. However, the human factor is not the

main cause. The accidents in some cases are the result of a complex circumstances confluence. We need to pay our attention to the accidents occurring as a result of dust-methane-air mixture inflammation, since they are the biggest threat and cause great damage to the mines.

In Ukraine the coal enterprises are being privatized and today more than a half of them are in the hands of private capital.

Therefore, in the article, an analysis of accidents and their causes on the example of the Western Donbass mines (10 mines) are presented. Since 2005 this mines are owned by DTEK. 10 mines are included in a public joint stock company DTEK Pavlohradvuhillia and their coal annual production is about 20% of the total coal production in Ukraine.

DTEK is the largest private vertically-integrated energetic company in Ukraine. Its departments operate efficiently in the areas of mining and coal washing, as well as in the generation markets and electricity supply. At the company about 140,000 people are employed.

The first issue is analysis of the most serious accidents occurred in the period from 2002 to 2012 on the Western Donbass mines.

On the 21st of July 2002 explosion occurred in the 572 air drift on mine "Yubileynaya."

Six miners were killed and dozens of people were burned.

July 3, 2006 exogenous fire occurred in 578 conveyer drift on mine " Yubileynaya " of "Pavlohradvuhillia." The reasons for a possible source of methane ignition are the hot metal particles formed while the cutting arch drift support elements by means of rotary executive body machine. Because of the low technological and industrial discipline on mines 2 rescuers were perished as well.

May 27, 2009 a fire occurred in the 1021 lava seam C_{10}^{B} "Zapadno-Donbasskaya Mine". "The cause of this accident was the methane-air mixture ignition at the excavation site in 1021 of lava east wing seam C_{10}^{B} block number 1 in the 100-105 support section.

July 23, 2011 a fire occurred in 158 lava on the coal seam C_6 on Stepnaya Mine. It was formed in compartment 8 support section.

The fire was ignited because of methane - air mixture in the 158 lava around 8 roof support .

Inflammable methane - air mixture is formed in poorly ventilated space between the body and the executive bodies of MB- 410E shearer.

A source of methane - air mixture ignition in the lava was sparks friction resulting from the interaction of the failed cloves of MB- 410E shearer executive body with pyrite inclusions in the coal seam .

April 19, 2012, an explosion occurred in 1010 conveyer drift C_{10} seam horizon. 390 m "Zapadno-Donbasskaya Mine". One person died, one was easily injured.

It follows that, in spite of all mine explosion and fire protection systems have been installed, accidents related to the methane ignition occur almost every year.

Therefore, the DTEK Company’s priority aim is safety of their employees.

The second issue is the international safety standard OHSAS. Labor system control is the basis for the adoption of measures to ensure the effectiveness and safety. Production processes of coal mining DTEK company passed the audit certification and confirmed its operating security system and OHSAS 18001:2007 management standard. The certification audit was conducted by an international agency Moody 's International, confirmed the successful integration of the standard requirements in the extraction and enrichment of coal production processes. DTEK have invested 22 million dollars in this project. OHSAS 18001:2007 is Management Systems Occupational Health and Safety. It is a set of international standards for the formation of safety management system as part of an overall company management system. All the enterprises of DTEK was introduced advanced corporate safety management system. It is designed with the line managers advanced training of the company.

These measures have yielded positive results.

Fig. 1 shows a diagram that reflects occupational injuries in the mines of PJSC "DTEK Pavlohradvuhillia" for the years 2010-2011. The x-axis reflects the number of casualties occurred in the mines for the year. The figure shows that the injuries in some mines declined by about 30%.

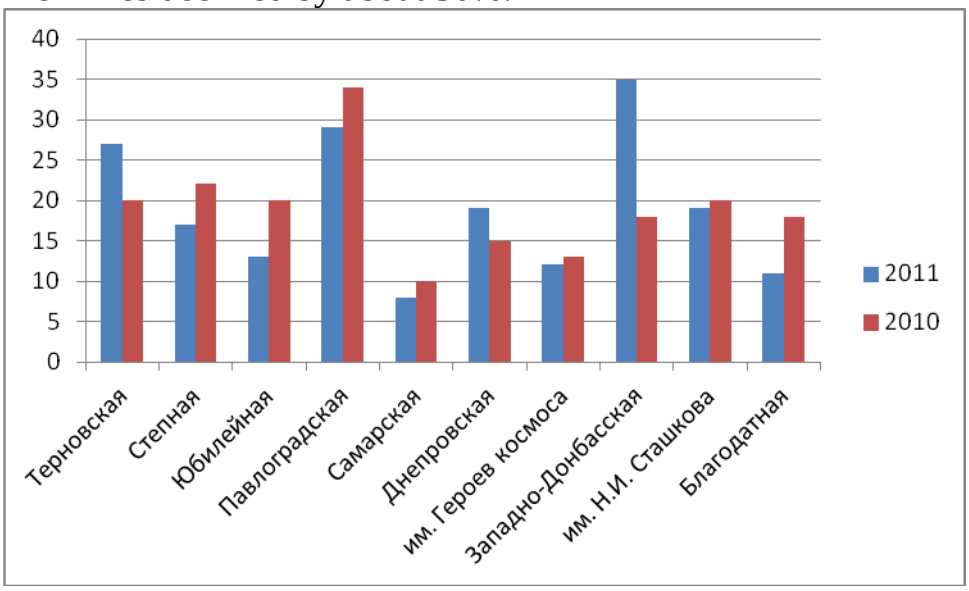

Figure 1 - Analysis of occupational injuries in the mines of PJSC "DTEK Pavlogradugol"

And the third issue is a cooperation of National Mining University with the largest coal companies in the problems solving direction of this nature. At the moment to the company DTEK the researchers have filed an application for an Agreement on scientific subjects named DEVELOPMENT AND IMPLEMENTATION METHODS AND MEANS of Explosion and Dust Proof in the zone of cutting of MINING MACHINEs. This problem, as can be seen from the above is very important not only for the Western Donbass mines, but also for mines all over Ukraine.

Conclusions:

The main causes of accidents occurring on the Western Donbass mines are: violation of labor and production discipline, poor organization of production work, the violation of the process, the lack of or inadequate technical documentation, instructions on labor protection, violation of safety in the operation of machinery, tools and equipment.

After analyzing the level and causes of accidents in the mines of PJSC " DTEK Pavlogradugol" it is obvious that the injury rate is still quite high and should be reduced . To substantially reduce the number of accidents we should strengthen the monitoring of the implementation of safety rules. It is also necessary to deliver and perform the following tasks and to take appropriate measures:

1. Modernization and improvement of new mining technologies.

2 . The new systems acquisition for automatic methane in the mine atmosphere monitoring .

3 . Stiffer penalties for violation of safety rules.

4 . Every worker have to use the personal hygiene equipment.

5. Constant checking of subordinates on the knowledge briefings, safety rules , as well as plans for emergency exits .

6. Permanent control of workers' health and annual recreation.

7. Organizing and conducting regular visits to the forefront mines in Ukraine and abroad to exchange experience in the field of mining technology and safety rules performance.

Section 2. Modern technologies of the alternative energy sources, tools for their implementation

SOME LEGAL ASPECTS OF THE PROCESSING OF AGRICULTURAL WASTE

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Some problems with economic energy resources, search for new energy sources and environment protection are faced by each state, irrespective of the size and natural possibilities.

Besides, in the context of globalization, states are energy-dependent from each other. Only some states can dispense own resources. For example, Ukraine imports oil and gas, and exports coal.

So being an energy-dependent state, Ukraine is also interested in the production of alternative energy sources.

Nowadays agricultural wastes do not always find use, but they are a valuable raw material. Tons of organic fertilizers are accumulated on farms. Runoff livestock farms are a double danger, because they produce both chemical and biological contamination. They pollute the ground, water and air.

Agricultural products, as a rule, have a big number of components, and conversion industry is traditionally oriented to get only main products. The average yield of finished products is 15-30% of weight of agricultural raw materials. The rest is waste and by-products. Production and use of biogas, which is obtained in the processing of animal waste household waste, have great prospects. Its production provides disposal of waste, improves sanitary-hygiene condition of territories, limits fugitive emissions of methane and carbon dioxide in the atmosphere. It is convenient to use biogas for the production of thermal energy and, in fact, it can be transported over distance.

Despite some specific environmental problems of agricultural waste, legal regulations in this area are insufficient. Instead, the general provisions of ecological legislation about waste.

Ukraine has developed and adopted several laws regarding the development in the use of alternative energy sources, nevertheless on agricultural residues and almost did not use. So the law "About Alternative Types of Liquid and Gaseous Fuels", the basic principles of the field of alternative fuels, including "promotion of the development and rational use of unconventional sources types of energy raw materials for production (extraction) of alternative types of fuel with the purpose of economy and energy resources and reduce dependence of Ukraine on imports". However, specific financing mechanisms for this are not considered. It is only indicated that funding for appropriate action is "carried at the expense of enterprises, institutions, organizations regardless of ownership, funds of state and local budget and other sources, not prohibited by law".

According to the same Law "About Alternative Energy Sources", financing of measures in the area, given by the funds laid in wholesale tariffs for electricity and heat, state and local budgets, donations and other means not prohibited by laws of Ukraine. However, this law does not provide any financial incentives and support mechanisms for producers and users of renewable energy.

If the entrepreneur or the company decides to deal with the processing of agricultural products – there are no special restrictions – it must register in the Unified State Register of legal entities and natural persons – entrepreneurs by providing code activity.

It also should be kept in mind that implementation of this type of activity requires a license.

To stimulate employers to an activity, the state sets certain privileges. Tax Code provides two types of incentives for alternative energy: breaks when you

import equipment, materials processing and tax benefits to income tax. The energy produced from alternative sources, if it is the same production, is sold by wholesalers with the use of "green" energy tariff. The difference between the "green" tariff and retail tariff gives biogas producers the chance to receive earnings higher, than other energy producers. Size of "green" tariff is reviewed on a monthly basis based on the official NBU rate in Euros.

Also state methods to stimulate the development of alternative energy sources in our region are regional programs in this area.

The regional integrated waste management program for 2006 – 2015 years includes the realization of development and implementation (including technical, organizational and economic support) of regional infrastructure collection, sorting, transportation, processing and disposal of waste as secondary raw materials.

Program of energy efficiency and reducing energy consumption in Dnipropetrovs'k Region for 2010 – 2015 years provides the use of alternative renewable energy sources. It is stated that one of the main energies in agriculture is the introduction of biogas plants on farms. In addition, it was noted that the production of biogas, while the solution of health problems and environmental pollution, improves power animal systems, reduces costs of energy purchasing.

Ukraine does not use more than 20 million tons of biomass, which is suitable for processing on high-quality and environmentally friendly granular energy, equivalent to 10 billion cubic meters of natural gas.

So Ukraine has raw potential to produce biogas, which under current market conditions may allow to replace 4–7% of annual electricity production in Ukraine. If the government fulfills its obligations to finance "green tariff" that guarantees investors a stable framework conditions and clearly defined administrative function concerned authorities, biogas production in Ukraine will be profitable. However, given the current budget constraints, it is likely that the growth rate of biogas production in Ukraine may be lower than in other European countries with "green tariff".

ANAEROBIC DIGESTION FOR NASA AND RURAL FARMING

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Why AD?

The recent oil crisis, global warming concerns and the consequent price rises have spawned considerable interest in the exploration of renewable energy sources. Biomass will be the most significant renewable energy source in the next few decades until solar or wind power production offers an economically attractive large-scale alternative. Biomass may be converted to a variety of energy forms including thermal, steam, electricity, hydrogen, ethanol, methanol, and methane.

Selection of the energy form is dependent upon a number of factors, including need for direct heat or steam conversionefficiencies, energy transport, conversion process and hardware, economies of scale, and environmental impact of conversion process waste streams. Under most circumstances methane is an ideal fuel. Currently it represents about 20% of the US energy supply in the form of natural gas. Related to this, an extensive pipeline distribution system and a variety of hardware are in place for its domestic, municipal, and industrial use. Compared to other fossil fuels, methane produces few atmospheric pollutants and generates less carbon dioxide per unit energy. Because methane is comparatively a clean fuel, the trend is toward its increased use for appliances, vehicles, industrial applications, and power generation. Although some applications require high purity methane, it can be used in a variety of stages of purity and efficiencies of transport and energy from conversion are good. Other fuels such as methanol and hydrogen are not well developed commercially for production and use and are more difficult to produce from biomass. Ethanol is becoming a popular biomass-derived fuel. Although it has the advantage of easy storage and transport, the fermentation process for its production requires extensive feedstock pretreatment and pure culture maintenance, and energy requirements associated with feed processing and product separation result in overall low process efficiencies. These problems are not characteristic of processes for biological conversion of biomass to methane.

AD for space missions:

Waste treatment and removal for long term space missions will be more challenging due to the longer mission duration regardless of complications from the environment. Waste management for such space missions may employ more efficient versions of technologies than developed for Shuttle or completely different approaches may be more cost effective. Depending on the mission protocols, indefinite stable storage for the end products of any waste processing scheme will be necessary.

Historically wastes generated during human spaceflight are materials with no further utility requiring only storage until missions end. However, Exploration WasteSubsystems may reclaim resources from input wastes allowing greater closure withinthe overall life support system. The waste subsystem collects waste materials from lifesupport subsystems and interfaces. Current NASA spacecraft waste handlingapproaches essentially rely on dumping and/or storage. For future long duration Lunarmission, it is practically impossible to get all the stored wastes back to the earth and thewaste generated over a year cannot be dumped in Lunar surface. The present studieshighlights the importance of a technology called ‘Anaerobic Digestion’ which not onlyreduces the wastes on the Lunar surface, but may provide significant fuel out of it during a year of exploration. Anaerobic Digestion (AD) or biogasification is a biological processin which microorganisms break down organic matter into methane and carbon dioxideunder anaerobic (or no oxygen) conditions. The technology is ideally suited for space mission, as it does not require oxygen.

The goal of the research was to effectively carry out bench-scale studies on theanaerobic digestion (also known biogasification) of NASA long term Lunar missionwaste stream in an effort to identify critical factors and performance measures duringbatch operation. The research findings would ultimately lead to a proposal of a systemdesign and operation concept for full-scale application of biogasification. This goal waschosen as a sub- study on an on-going project (Biogasification Studies for JohnsonSpace Center, NASA: High Solids Technology) carried out over twelve months in theBioprocess Engineering Research Laboratory, Agricultural and Biological EngineeringDepartment, University of Florida, Gainesville. The goals of this research work weredivided into four objectives:

• Objective 1: Determine the biochemical methane potential of NASA Lunar waste stream and the effect of pretreatment.

• Objective 2: Determine the biochemical methane potentials of biodegradable materials as an alternative for Lunar waste packaging.

• Objective 3: Evaluate appropriate process designs for anaerobically digesting Lunar mission wastes

• Objective 4: Propose a full scale design for anaerobic digestion of Lunar mission waste and carry out mass and energy balances for this system.

This research supports the use of high-solids leachbed anaerobic digestion for bioregenerative reduction and stabilization of the organic components of solid wastes during one year exploratory Lunar space missions. Initial biochemical methane potential studies and one stage as well as two stage studies followed by conceptual prototype reactor have shown positive results for decreased retention time and increased reduction of biomass in the modified anaerobic digestion system.

Our Vision. We have a vision for how to create both an individual and community model of anaerobic digestion in a rural setting, especially in Ukraine. We have used the village of Nikolai-Poli, an hour's ride from Dnepropetrovsk, as our model. An analysis of our individual model is attached in our supplementary materials, along with a full description of both. We are still conducting an analysis of the community model.

An AD model in Ukraine would not only help reach a global goal of completely sustainable energy production, but it would also provide the Ukrainian people with free or nearly-free natural gas, without binding them and their government to Russian gas companies. The very fertile soil and rich agricultural experience of Ukraine makes us believe that AD systems like the ones we've been working on could be very environmentally and economically beneficial. To confirm this hypothesis we've spoken to the Agrarian Institute of Dnepropetrovsk, several biodiesel and biogas entrepreneurs in the city, AD users who own multiple large farms in both Ukraine and Canada, and AD researchers at the University of Illinois. Armed with the knowledge they've provided us, we'd like to offer our models for consideration.

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ANAEROBIC DIGESTION FOR NASA AND RURAL FARMING: MODEL DESCRIPTION

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Community Model

We take these models after Nikolai-Poli near Dnepropetrovsk, assuming 200 cows in the village who all produce 150 lbs(68 kg) of manure per day. We'd like to emphasize that these models are not the only way we see AD working in a village; they are simply initial visions to be.

In what we'll call the community model, one anaerobic digester would serve the entire village. It would need to handle over 13,600 kilograms of feedstock per day. If the tank were emptied of digestate and new manure pumped in every three days, this would require a capacity of about 40,800 kg, or more if vegetable matter were also added. It would need to be built very sturdily or purchased directly from a manufacturer, and would more than likely have a dedicated maintenance worker. The worker's wages would be paid by a small fee from all villagers. In order to work, this fee would have to be less than the cost of the natural gas the villagers receive from the AD system.

All residents would be given a container to store manure in; ideally, one that could be placed at the exit of the barn where manure is already pushed out. Depending on the size of the container, it would either be dumped into a tank mounted on a truck, or pumped there. Households would be encouraged to add their vegetable waste to the tank, to enhance the carbon-nitrogen balance of the feedstock.

The same pump used to pump manure from households into the truck tank could also be used to pump directly into the AD system. It should be buried mostly underground, with a flexible membrane cap. The methane produced could be connected directly to the natural gas pipelines already present in the village or used to fill portable containers which could be distributed to each family.

To avoid the lag time between when manure is first put into the system and when it begins to produce methane, a bacterial culture could be created in a lab and acclimated to medium temperatures.

Ideally, this would be a continuous process. Methane would constantly be produced, while the spent manure (the digestate) would be pumped out the bottom and used as fertilizer. Therefore a constant pressure would be maintained. The person designated the responsibility of the digester would need to experiment at first to see at what intervals manure should be added to maintain a constant gas pressure while not overfilling the digester.

In the individual model, each family would have their own digester with a volume suited to the number of animals they have; in Nikolai-Poli this ranges from 1 to 50 head per household. In this case each family would be directly responsible for maintaining their digester. The gas would either be pumped into the gas line

very close to the house, or into a set of gas cylinders for personal use. In this situation, the gas would truly be free because there would be no maintenance workers needed or heavy equipment to purchase- in fact, it's possible to create a small digester with bricks and a plastic membrane, if there are people in the village who know how to do so. Other advantages to this method are that it is easier to collect the gas, there are less parts that could break within a single system, it can be built by non-experts, it is easier to clean the digestate, and there is a greater community investment in the technology when everyone is directly involved. The advantages of the community model include: a more efficient use of resources to build the system, the ability to continue serving gas to the community even if some farms become smaller or larger, the employment of people to maintain the system, a greater likelihood of being well-maintained and the concentration of AD expertise in a few dedicated people; a greater likelihood of being a continuous system; more equitable distribution of gas (small families will also get enough gas to heat their homes), and a single inoculation step.

ANAEROBIC DIGESTION FOR NASA AND RURAL FARMING: INDIVIDUAL MODEL ANALYSIS

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Summary

Following table summarizes the energy consumption for operation of thermophilic and mesophilic digester systems. The net energy gain is 72% and 76% for thermophilic and mesophilic operation respectively. Most of the energy is consumed for maintaining the temperature in the vessels. If temperature losses can be minimized with better insulation then net energy gain would be even higher.

Net Energy Gain for Digesters

S.N	Type of Energy	Thermophilic (55 C) System (KJ)	Mesophilic (38 C) System (KJ)
1	Energy Potential of Wastes	11,992,972	11,992,972
2	Energy Consumption during digestion operation	3,408,212	2,867,457
Net Gain		8,584,760	9,125,515

Abbreviations:

FM = Family Member
D = Day
L = Litres
Kg = kilograms

M = Million
KJ = Kilo joules
kW = killo watts

Detailed Design:

Energy Potential of Anaerobic Digestion Operations During 1 Year

Expected Methane Potential = 200 L/FM-D
For a family of 4= 200 * 4 = 800 L/D/kg
Total methane potential = 800 * 1.101 = 880.8 L/D
For a Batch of 8- Days = 880.8 * 8 = 7046.4 L =7.046 m3
Calorific Value of Methane = 37,000 KJ/m3
Total Energy potential of wastes = 260,716 KJ for a batch of 8 days
For a 1 year, there will be 46 such batch digestions.
Energy potential for 1 year worth of wastes= 11,992,972 KJ which is almost 12 M KJ.
In the units of power=0.3824 kW

Energy Requirements

Energy Required for the Digester Start-Up

The amount of heat needed to heat a subject from one temperature level to another can be expressed as:

Q = cp m dT
where
Q = amount of heat (kJ)
cp = specific heat capacity (kJ/kg.K)
m = mass (kg)
dT = temperature difference between hot and cold side (K)

For Thermophilic (55 C) Operation:
Q=4.19 (KJ/kg.K) * (1410+1410+846) kg * (328-298) K
Q= 460,816 KJ for start up
For Mesophilic (38 C) Operation:
Q=4.19 (KJ/kg.K) * (1410*3+3384) kg * (311-298) K
Q= 414,735 KJ for start up

Heat Losses from Insulation

For Thermophilic (55 C) Operation:
Required heat for maintaining the temperature in the tank= 0.1656 W/m2oC
= 0.1656 * 17.7661* 30
= 88.2366 W
= 2,782,631 KJ per year
For Mesophilic (38 C) Operation:
Required heat for maintaining the temperature in the tank= 0.1656 W/m2oC
= 0.1656 * 34.2838* 13
= 73.8062 W
= 2,327,551 KJ

Heat of Vaporization

For Thermophilic (55 C) Operation:

Biogas moles for a batch=524.28 moles
Water moles=12.5% Biogas Moles
G=0.125 G + 524.28
Heat of Vaporization = 2370.8 * 1.34 = 3176.87 KJ per Batch
For Mesophilic (38 C) Operation:
Biogas moles for a batch=524.28 moles
Water moles=6.54% Biogas Moles
108
G=0.0654 G + 629.14
Heat of Vaporization = 2411.7 * 0.79 = 1911.15 KJ per Batch

Energy Requirement of Pump

To recirculate the leachate within the digester and to transfer liquid between stage

1 and stage 2 a pump must be used. For one digester, the required leachate volume is 1.413 m3. It is assumed that the total leachate recirculation/transferred volume per day is 10 times the leachate volume in digester, i.e., 14.13 m3 and the pumps work 20 minutes per 2 hours. So, the leachate recirculation flow rate is:

Q = 10 * 1.413 (m3/d) / (24/2) * 20 (min/d) = 0.0588m3/min

According to Energy Conservation Law, the energy required can be calculated as

follows:

ET = 0.5 m v2 + $m\ g\ H$ [6-3]

$v = Q/D2$ [6-4]

Hence, Pump energy = 51,038 J per day

So, its 18,629 KJ per year for Thermophilic (55 C). It will be twice this for mesophilic system as liquid needs to be recirculated between two digesters and anaerobic filter.

Energy Consumption for Digesters

S.N	Type of Energy	Thermophilic (55 C) System (KJ)	Mesophilic (38 C) System (KJ)
1	Energy for digester start up	460,816	414,735
2	Energy to compensate heat losses from insulation	2,782,631	2,327,551
3	Energy to compensate heat of vaporization	146,136	87,913
4	Energy consumed for pumping operation	18,629	37,258
Total		3,408,212	2,867,457

ANALYSIS OF PERSPECTIVE OF USING SOLAR COLLECTORS IN UKRAINE

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The possibility of using clean, widely available renewable energy of solar radiation is drawing increasing attention. In accordance with the predictions [1], within the next 15-20 years, renewable energy sources (solar, wind, biomass, etc.) should occupy a prominent place in the global energy mix, providing the replacement of dwindling fossil fuel reserves and environmental improvement of the environment.

Within a year , on average, based on the climatic conditions and latitude, solar radiation flux at the Earth's surface is 100 to 250 W/m2 , reaching peak values at noon under a clear sky , almost in any (regardless of latitude) location, near 1000 W/m2. The total average annual solar radiation in Ukraine, according to the duration of observation ranges from 1000 kW · h / m ² in the northern and central parts of the country is up to 1350 kW · h / m ² on the Crimean peninsula and the southern part of Odessa region. For easy analysis, these calculations were divided into 4 zones (Fig. 1). The actual distribution of the total solar radiation on different months may differ from the average by 50 per cent in different years.

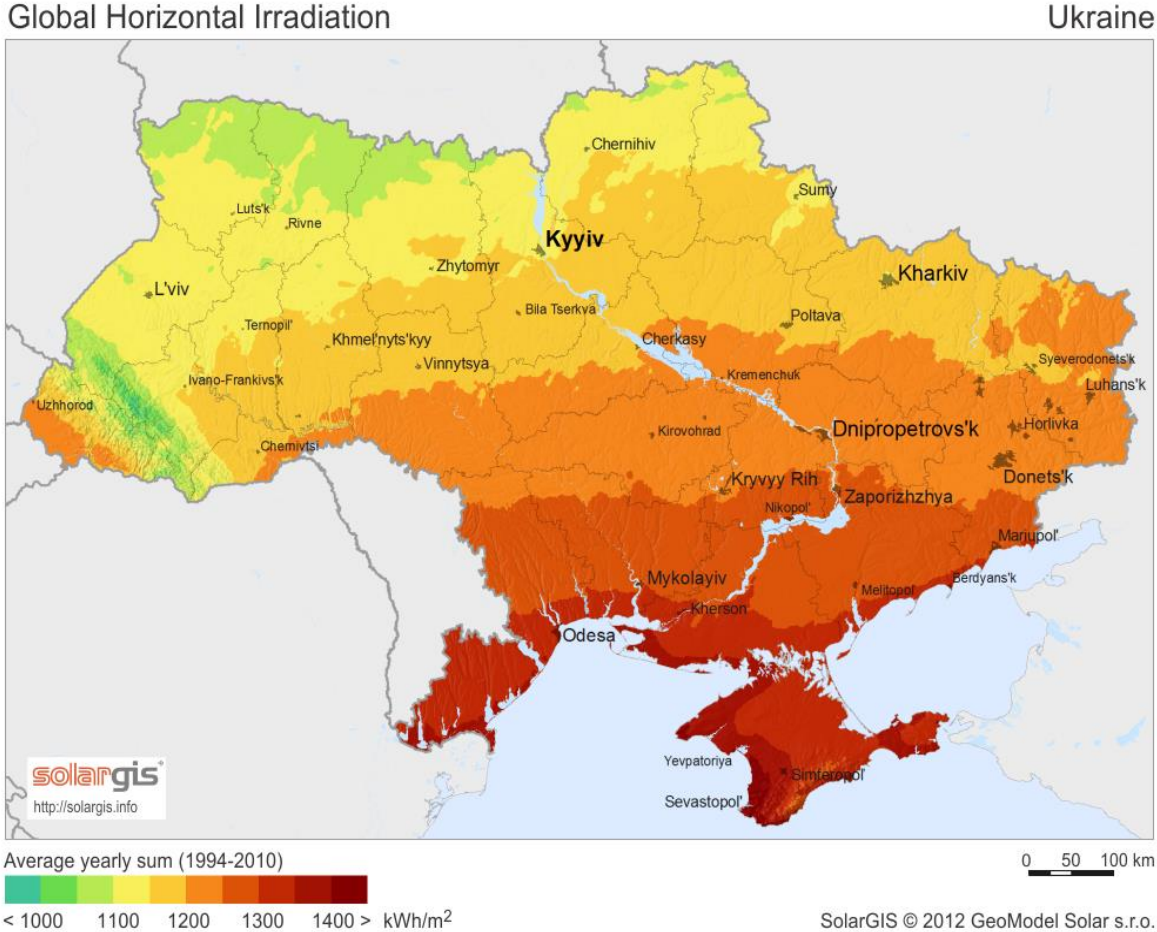

Figure 1 - The intensity of solar radiation in Ukraine

In some countries, solar water heaters have become a common fixture of life. For example, in Israel hot water 80 % of residential houses provided with solar water heaters, which gives savings of more than 5 % of the country's electrical power. Dozens of manufacturers of different types of solar collectors and water heating systems are successfully operating in Europe, America, Australia and other regions of the world. The total area set out in our time of solar collectors in the world is already more than 50 million square meters, equivalent to the replacement of traditional energy sources in the amount of approximately 7.5 million tons of fuel per year. The peak of the "sun" in the world market due erupted energy "crisis" and the sharp rise in energy prices falls in the middle and the end of the 70s. Many countries have adopted special state program of financial, legal and information support and stimulate the development of technologies for the use of renewable energy sources. Speaking of solar water heaters , we can say that at present in many countries of the world , technology efficient heating water for domestic use solar radiation is well worked out and widely available on the market. Most cost-effective scope of solar water heaters are largely already mastered. For example, in the U.S. more than 60 % of private and public swimming pools are heated by solar energy (simple non-glass without thermal insulation, usually plastic solar collectors).

Geographical location of Ukraine opens great potential for the development of the solar energy market, so we can say that the potential of solar energy in Ukraine is high enough for widespread use of solar equipment. The possibility of using solar radiation increases from north- west to south -east with the highest potential in the Crimean peninsula. The time period for the effective use of solar collectors in the southern regions of Ukraine is 7 months (April to October), in the northern regions - 5 months (May to September).

At present, solar collectors for heating water are widely used in the southern part of Ukraine, and their number is growing every day. According to the National Agency for Energy Conservation and Energy Efficiency (formerly NAES) , the potential of solar energy in Ukraine is much higher than in Germany, and it is technically possible that the proportion of solar energy reaches 10% of the energy balance of Ukraine by 2030 .

According to data from the European Bank for Reconstruction and Development (EBRD), Ukraine in the near future is ready to become a leader of environmentally friendly economies in Europe, especially with regard to solar energy market, which is one of the most promising markets for renewable energy. In Ukraine there are all prerequisites for the successful development of solar energy market: high rate of DNI (direct normal radiation) , high grace " green " tariff . In addition, the Energy Strategy of Ukraine means achieving 20% of energy from renewable sources by 2020. [2]

Difficulties in achieving the objectives are not a perfect legal framework and lack of technical advice on the efficient use of solar heating elements. The most common type of collector on the Ukrainian market are flat and vacuum. Vacuum

solar collectors are high-tech and technically interesting view of this product, and have a higher efficiency than the flat. Unfortunately, our market reach devices manufactured mainly in China, it does not always ensured proper quality of materials and assembly conditions. When working in harsh climatic conditions that characterize the latitude of Ukraine (freezing, high precipitation, hail), reduce the efficiency of this type of collectors. The disadvantage is also the inability to carry out repairs at a loss of vacuum in the reservoir tube.

Flat-plate solar hot water collectors are deprived of the most described disadvantages though have higher prices and low efficiency. When using such systems it must be remembered that they can provide the required functional tasks only in combination with conventional equipment (running on electricity, gas, oil or solid fuel).

Implemented in recent years, pilot projects have shown that the annual heat production in conditions of Ukraine is 500 - 600 kWh/m2. Given the generally accepted in the West, the potential use of solar collectors for developed countries of 1 m2 per person, and the performance of solar installations for the conditions of Ukraine, the annual resources of solar hot water and heating may reach 28 billion kWh of thermal energy. Realizing this potential would save 3.4 million tons of oil equivalent (TOE) per year.

Currently, utilities Ukraine consumes annually about 74 million tce. Annually thermal energy demand increases by 1.5-2%. There are estimates that the resumption of economic growth, consumption could increase substantially. On the other hand, the potential of energy efficiency and conservation in the municipal economy of Ukraine is variously estimated at least 50%. In the case of this potential economic growth should not lead to a significant increase in thermal energy consumption.

Ukraine has implemented several dozen pilot projects in different sectors of the economy. Among them, the hot water system of residential and public buildings, medical and health institutions; solar attachment to the fuel and electric boiler serving the industrial, agricultural and utilities ; small stand-alone systems for individual houses and public service enterprises . According to estimates made by Ukrainian specialists payback embedded experimental installations of solar water and heating is from five to ten years.

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ALTERNATIVE SOURCES OF ENERGY SOURCES APPLICATION IN THE WORLD

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Modern world has a lot of reasons forcing us to look for and use renewable sources of energy. The main reasons are as follows: limited fossils fuels, depletion of natural resources, environmental problems worsening nowadays. The only solution of this problem seems in transferring to alternative energy. Being greatly advantageous, development in this field is gaining momentum at the moment. The merits of non-traditional sources of energy are: renewability, environmental friendliness, high reliability, simple technological processing of the used materials. The importance and reliability of this way is justified by multiple researches from all over the world.

To demonstrate maturity of alternative energy Swiss-French team has designed the biggest twin-hulled vessel named PlanetSolar. The main objective of this project was to go round the world by water by means of solar power. On 4th May 2013 the PlanetSolar finished its journey having covered 60,000 km in 584 days. The side boards 31 meters long were covered with solar collectors with total area of 537 sq. m. generating around 93.5 KWh of energy. This capacity is enough to charge lithium-ion accumulators driving electric motors.

Along with solar energy, biofuel is being used wider and wider. Two countries opted for energy of microalgae. The first project was designed by Splitterwerk Architects architect bureau and a German company named Arup. This is a building with SE and SW outer walls covered with panels with microalgae continuously fed by nutrients and CO_2, moreover, the panels are made of glass to allow the photosynthesis processes in algae under the influence of sun light. When biomass grows adequately, it is used for production of biogas for industrial purposes. A similar construction is being built in the French city of Nanter – the energy of algae provides the building with heat and energy. The pipes on the roof with the future fuel circulating inside are of the same power value as coal. This system can provide energy for 80% of the needs of the building having no harmful emissions in the atmosphere.

Another means of transport was designed in Switzerland: a plane named Solar Impulse weighing 1.6 tons flies exclusively by means of the solar energy. 12,000 photoelectric cells are inbuilt in the wings and stabilizer of the plane to charge 400 kg lithium-ion accumulators providing the energy for the plane at night. The plane has flown through Northern America avoiding areas with unfavourable weather conditions. Solar Impulse is a record-setter in its class. Prototype HB-SIA was built in 2012 and set a record in the range of flight making 26 hours. Soon after this, the record was beaten by Zephyr flying machine (Great Britain) capable of flying up to a week. In addition, the officially recognized record for the length of flight of pilotless aircraft makes 30 hours and 24 minutes.

Unlike local use of the green energy, London architect bureau named Baharash Architecture was authorized to design a residential complex in Dubai with the total area of 46 ha for 550 villas, organic farms, educational institutions and a solar farm. According to the plan, the city will satisfy 50% of its own demand in electric energy. Moreover, to reduce carbon emissions it is planned to transfer both private and public transport to the usage of alternative energy. The construction is planned to finish by the end of 2016.

Until recently the operation of solar batteries heavily depended on the weather conditions. In Ukraine, a place having the largest amount of sunny days is the Crimea peninsular. It still remains one of the most favourable areas for "green" energy: in 9 months' period the energy produced by wind and the sun accounted for a third of the whole amount of energy produced at the peninsular – 285.7 KWh. However, a solar electric station has been built in Pidgorodnie town, Dnipropetrovsk region, which provides thousands of houses with energy. The solar batteries operate under any weather conditions; the difference is only in efficiency coefficient which makes 40-50% in cloudy weather. Currently the capacity of this object is 1645 KWh. This station is fully automated and operated by no more than 6 people, as human factor cannot be excluded altogether.

Spanish Andalusia extensively uses geothermal sources of energy producing energy from the heat of the Earth interior. The use of such source of energy will reduce the emission of carbon dioxide by 2.5m tons. The "green energy" sector provides energy to 1400 enterprises, the proportion of clean wind energy making up to 50%. Solar panels account for almost 16%, photoelectric cells reaching almost 15% of the "green" whole. These indexes allow Spain to keep the leading positions in the world as for the use of alternative energy.

Canada is among the leading countries in the production and use of renewable energy, with renewable energy representing 17 percent of Canada's total primary energy supply. In the electricity sector, hydroelectricity is the largest renewable energy source in Canada, accounting for approximately 60 percent of Canada's electricity generation.

However, Germany remains the leader in the making "green" energy its strategic priority. For the initial half of 2013 Germany has generated 19.4 terawatt-hour of energy from the Sun, and 24.2 terawatt-hour of energy from wind.

Conclusions:

1) "Green" energy is highly perspective and can solve a number of vital issues for humanity, namely it can reduce environmental pollution, use human-friendly energy resources, utilize bio-waste and so on.

2) "Green" installations can be of different scale: from small electric cars to providing energy for cities.

3) Not only nature can become a source of energy, but also different types of biological raw materials and their waste.

WIND POWER GENERATION IN THE WORLD

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Wind energy – the energy sector, specializing in converting the kinetic energy of air masses in the atmosphere into the electrical, mechanical, thermal or any other form of energy.

Wind energy is a renewable form of energy, as it is a consequence of solar activity. Wind power is a booming industry, so at the end of 2012 the total installed capacity of all the wind turbines was 282.6 gigawatts. In 2010, the amount of electrical energy produced by wind turbines all over the world was 430 terawatt-hours (2.5% of all generated electricity humanity). Some countries are particularly intensively developing wind energy, in particular, for the year 2011 in Denmark the use of wind turbines produced 28% of all electricity, in Portugal – 19%, in Ireland – 14%, in Spain – 16% and in Germany – 8%.

The first half of 2013 there were worldwide established offshore wind turbines with 1080 MW capacity, i.e. in 6 months of their worldwide capacity increased by 20%.

Marine wind turbines provide electricity in a more stable way than ground ones, but the need for foundations limits their shallow waters and lifts energy prices. As a result, in July 2013, the total capacity of offshore wind turbines has risen to 6500 MW until the end of 2015 will jump to at least 7100 MW.

These 40 % for 1 year about twice as fast as the overall growth rate of wind power , which dominated until the dry way and equal growth rate of solar energy.

Of course, against 300 GW of wind power the ground data ground is modest. However, their dynamics suggests that soon everything can change. More than a half (3400 MW) of these facilities belongs to Britain, and another 1 200 MW – to Denmark.

Much more spectacular prospects open before sea windmills in Asia: China plans to increase its current 390 MW to 5000 MW already by 2015, and the implementation of this plan, in contrast to Europe, without inflated prices for the purchase of such energy, is already at full speed .Japanese situation: there's just a little shallow water and onshore and the wind is slow, therefore an urgent need for the placement of wind turbines in the sea gave birth to a fundamentally different approach to the construction of offshore ES.

I also want to mention the development of wind turbines with a concentrator. American company SheerWind, which specializes in designing and manufacturing of wind turbines, has unveiled its new product called INVELOX. Its novelty lies in a wind turbine tunnel. In addition to increased energy output (nominal efficiency of 73%) and the necessary wind speed of 1 m / h, installation of Invelox worth less than $ 750/KVt. The company also claims that, in comparison with traditional wind turbines, installation maintenance costs considerably less. Thanks to its

reduced dimensions the system is less dangerous for birds and other animals. Finally, the new technology also makes it possible to install a network of towers and create a wind power.

Also there is an interesting solution for the urban energy. Quietrevolution – a wind turbine with vertical axis and three S- shaped blades made in the UK. Thanks to its engineering features windmills are almost noiseless and adapted to urban conditions where the wind direction can change very often. Installation height is 5 meters, diameter is 3 meters. One unit of 6 kW can provide electricity for five houses, producing 10,000 kilowatt-hours per year at an average wind speed of 5.8 m / sec. Installing is efficient at wind speed within 4,5 – 16 m / s.

Domestic wind turbine industry is actively developing and for quite reasonable money now it is possible to buy a wind turbine and for many years to provide energy independence for a suburban home. Typically, to provide electricity for small house the enough wattage is 1 kW with the wind speed of 8 m / s. If the area is not windy, wind turbine can supplement photovoltaic cells and wind turbines with vertical axes can be complemented by smaller wind turbines (e.g. turbine Darrieus rotor can be supplemented by Savonius; this one does not interfere – sources will complement each other).

The most promising areas for the development of small wind energy regions are considered with the cost of electricity for more than $ 0.1 kW-h. The cost of electricity produced by small wind turbines in 2006 in the USA was $ 0.10 - $ 0.11 per kW-h. According to the AWEA, in 2006 in the USA there were sold 6,807 small wind turbines. Their total capacity is 17,543 kW. Their total cost is $ 56,082,850 (approximately $ 3,200 per kW capacity). The rest of the world in 2006 sold 9,502 small turbines (excluding the U.S.), their total capacity is 19,483 kW.

CURRENT ISSUES OF DEVELOPMENT OF SMALL HYDROPOWER ENGINEERING IN UKRAINE TODAY

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Introduction. Hydro power plants (HPP) on small rivers in Ukraine have played a crucial role in the electrification of the rural economy and life of the population. These formed the basis of complex production processes electrification in rural areas, creating electrical equipment for processing agricultural products, electrification supply of large livestock complexes and industrial plants, irrigation systems.

In recent years, the development of small hydropower engineering has received support at the state level. However, the construction of new stations is delayed due to the presence of subjective and objective reasons, the essence of

which is connected with the consideration of small hydropower plants only as those of the energy use.

Complex properties of small hydropower engineering. Small hydropower engineering has an economic impact on the economic status of different areas. Creation of HPP will address issues of water supply of cities and enterprises, improve power supply reliability and socially significant consumer protection implementation, controlled by neighborhoods and facilities from flooding, recreation, fish farming and irrigation. Ukraine possesses the unique experience of creating hydroelectric plants on small and large rivers. For example, a cascade of small hydropower plants on the river. Southern Bug practically solves the problem of flooding in the river valley provided the operation of all stations. A similar cascade of small hydropower plants was built on lowland rivers as Ros and Psyol. Hydroelectric power plants on the Dnieper River are currently the main tool of protecting neighborhoods from the spring floods. Creation of cascades of small hydropower plants is especially urgent for western regions of the country. Carpathians position relative to the centers of action of atmospheric fronts and circulation conditions of moisture in the atmosphere determines the intense precipitation events, which entails short-term flooding. Heavy rains of up to 3-4 days are a common phenomenon. In the winter there is the greatest expense of water formed during the thaw under the influence of a mixed flow, which is formed from melting snow and rain. The effect of tributaries, including the small ones in mountainous terrain, is quite significant. But even in such periods reservoir of small hydropower plants can afford to cut peak water consumption. Simultaneously, they can significantly improve the reliability of power supply remote mountain settlements to protect important industries and locations.

Neighboring territory in the Carpathian region is also prone to flooding. Today they are interested in the construction of hydroelectric power station on inter-state rivers, but it is necessary to develop a system of co-financing the construction and operation of such hydropower objects.

Environmental aspects in the construction of small hydropower plants. Direct and indirect effects on adjacent areas of creation of hydropower reservoirs are the cause of intense political and social debate. They appear also in the process of operation of the stations, despite the waste rules and regulations of their operation. With the privatization of some enterprises hydro reservoirs, which they owned, were excluded from the statutory fund. Some reservoirs have no owners, some are unfinished. Local authorities agree to use these reservoirs, but cannot bring them to the state of the design requirements.

Be aware that the mountain rivers are sources of water supply to rural communities that live in the river valleys, as well as to the flora and fauna. When making decisions about the construction of hydroelectric power of any great importance is compliance with the mandatory requirements of the state building codes – the thorough analysis of the impact on environment. According to many water specialists, being a source of cheap electricity and a way to improve the reliability of electricity supply local consumers , small hydropower engineering can play a significant role in the preservation and revitalization of rivers ,

especially for regions with large destructive flood water discharge and very low cost of water and very small expenditure of low-water periods. Hydropower, including small, is based on the method of production of electricity from renewable energy resource without waste emissions into the environment.

Coordination of the design and operation of small hydropower plants. Further development of small hydropower engineering is impossible without a coordinated state basic layout of small hydropower plants, the development of procedures of permission for special use, cooperation with non-governmental organizations and environmental conservation areas, update of regulatory framework of operation.

In Ukraine, to a certain extent, lost experience in designing new small hydropower plants. Over the past 50 years, new stations have not been built. Necessary arrangements were done for the Joint Institutes "Ukrvodproekt" and "Ukrgidrproekt", which can perform hydropower projects. Ukrainian enterprises in principle have the necessary capacity for multi- batch and multiproduct production equipment for small hydropower engineering. Moreover, mass production equipment will lead to a reduction in cost. Fundamentally the problem can be solved only through the introduction of regulatory and technical requirements for equipment. Today in Ukraine 84 small hydropower plants are in operation – with the total installed capacity of about 107 MW.

I*nvestment conditions for development of small hydropower engineering*. Ukraine has the final role in the creation of conditions for the interest of various domestic and foreign investors is critical. Unfortunately, the problem cannot be solved at the national level purposefully. Often offers of investors are not systematic. But there is scope for joint activities of local authorities and investors. Reservoirs in the upper reaches of rivers, particularly in mountainous areas, can mitigate the effects of flood peaks and cut costs. Financing problems are rather complicated. Potential investors may support the processes of internal quotas, but they need to get normative- legal status. Financing with loans of European countries and structures is possible.

Conclusions. Deliberate government support is required for the development of ideology and legal framework of small hydropower engineering, justification layout of new hydropower stations. The level of interest of public authorities will necessarily find concrete expression in enhancing the investment attractiveness of small hydropower engineering.

CONSIDERING HYDROTHERMAL CATALYTIC GASIFICATION FOR WASTE TO ENERGY

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Hydrothermal Catalytic Gasification (HCG) is a unique and versatile waste to energy technology that may provide a feasible alternative to Anaerobic

Digestion (AD) for producing energy rich methane gas (CH_4). HCG reactions occur in a pressurized-water environment (20MPa) at a standard operating temperature of 350° C (662°F) and near-complete conversion of the organic structure of biomass to gases has been achieved in the presence of ruthenium metal catalyst.[1]A main advantage of HCG is the unique operating condition forfeits the drying wet biomass which is required for other thermochemical processes. HCG yields methane rich gasses from feedstocksdirectly introduced into the reactor that are 15%-20% solids by mass, the rest being moisture content. Furthermore, HCG works similarly on almost anything organic that can be made into a water slurry.[2]

CEE 398: Waste to Energy Team's endeavour is a projected comparison between HCG and AD technologies to produce methane gas from swine manure as the feedstock. Utility of methane gas in our projections are expected to enable electrical generation through combustion in a combined heating and power (CHP) unit, or for paybackopportunities by adding the renewable natural gas (RNG)product back to the natural gas infrastructure grid.

Catalyst life cycles are a focus in research of HCG technology since longevity of catalyst reactiveness affects the cost of operating the system. From the research referenced in our study, using Nickel and Ruthenium catalysts formulations yielded near complete conversion of organic structure of biomass to RNG. Product gas yields of HCG reactions range between 55%-62% CH_4 and 38%-45% CO_2. Furthermore, Nickel catalyst formulations have been proven to be beneficial inHCGprocesseswith various feedstocks. Asuccessful 2013 master's thesis defence by Matthew Ong at the University of Illinois concluded that Raney-Nickel for processing of paper waste slurries yielded energetically competitive or favourable results when comparing net energy yields to AD and bioaugmented AD (i.e. addition of externally cultured microorganisms to increase acid-phase reaction rates).[3]

A challenge to consider considering HCG technology is the issue of catalyst poisoning. Specifically with regard to HCG processing of swine manure, nitrate and cyanide are destroyed producing nitrogen gas and ammonia; however, sulphides and sulfates are catalyst poisons and must be avoided or removed[1]. Catalysts rendered inert by poisoning drastically affect the efficiency and operating cost of an HCG system and is a prominent challenge expressed in the space of HCG research.

Currently, the University of Illinois researches technologies such as Hydrothermal Liquifaction (HTL), and nutrient uptake and purification of swine manure lagoon effluent using algaewheel and algal photo-bioreactor technologies. Such technologies may provide a viable solution to catalysts poisoning issues in HCG reactions. According to the industry source Genifuel, HCG is a feasible technology to put in series downstream from HTL processing of wet feedstock such as swine manure and algal biomass. The HTL process yields valuable biocrude oil from either swine manure effluent, algal biomass or both. From the HTL reaction a nutrient rich, low-solid content effluent remains which could be directed into an HCG reactor to convert the remaining organic residue in the water to produce RNG. Furthermore, CO_2 from the HCG process and post-combustion in

a CHP unit could also be sequestered back into the algaewheel or algal photo-bioreactor to enhance treating of catalyst-contaminating elements in swine manure and to provide nutrient availability for biomass proliferation for additional feedstock to the HCG reactor. It is expected that sulfur content contained in an algal biomass used to treat effluent from a swine manure lagoon would be significantly lower than if the manure effluent were to be put in the HCG system directly. However, to meet certainty these are assumptions that should be satisfied through research in the near future.

The CEE: 398 Waste to Energy Team's study will provide a foundation of projections for further analysis of how feasible HCG is compared to AD for waste to energy applications. Industry sources promulgate benefits of HCG as a waste to energy technology over AD. Some points to consider: CHG has a higher and cleaner gas yield (99% conversion to gas using HCG v. 40%-50% in AD), AD leaves 50% influent as sludge to be removed that requires treatment whereas HCG leaves nitrogen, potassium, and phosphorus which are cycled back into the process or may provide valuable crop nutrients, the spatial footprint required for CHG technology is drastically smaller than AD, CHG technology is more versatile in modular form factors, CHG is a thermochemical process which is more uniform, precisely controllable and repeatable in its performance regardless of feedstock.[2]

Given the findings of previous HCG research through the Pacific Northwest National Laboratory, University of Illinois and the South farms Anaerobic Digester Feasibility Study, our intent is to provide an efficiency calculator to compare theoretical projected annual yields of CHG v. AD to understand the benefits expressed by industry sources. Another aspect of our analysis is to calculate the engineering economics entailed in investing in each system. University of Illinois has undertaken significant research measures to better understand waste to energy and waste treatment systems. It is the intent of the CEE:398 Waste to Energy Team to contribute to this research endeavour by taking initial steps in understanding how HCG technology may improve the efficiencies of utilizing waste streams.

[1]Ro, K. S., Cantrell, K., Elliott, D., & Hunt, P. G. (2007). *Catalytic Wet Gasification of Municipal and Animal Wastes*. Florence: USDA Coastal Plains Soil, Water & Plant Research Center.

[2]Genifuel (2009). *Comparison of Catalytic Hydrothermal Gasification and Anaerobic Digestion*.

http://www.genifuel.com/text/20110526%20Comparison%20of%20CHG%20and%20AD.pdf

[3] Ong, Matthew (2013). *Evaluation of Anaerobic Membrane Bioreactors and Hydrothermal Catalyitic Gasification for Enhanced Conversion of Organic Wastes to Renewable Fuels.*