



HAL
open science

Accounting development of natural resources in organizations carrying out the disposal of municipal waste and biogas extraction in the context of the 'green' economy

Svetlana Vejera, Alena Malei, Renata Trubovich

► To cite this version:

Svetlana Vejera, Alena Malei, Renata Trubovich. Accounting development of natural resources in organizations carrying out the disposal of municipal waste and biogas extraction in the context of the 'green' economy. *Entrepreneurship and Sustainability Issues*, 2018, 6 (1), pp.211-225. 10.9770/jesi.2018.6.1(14) . hal-02121141

HAL Id: hal-02121141

<https://hal.science/hal-02121141>

Submitted on 23 Jun 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Publisher

<http://jssidoi.org/esc/home>



Business Support on Your Doorstep



ACCOUNTING DEVELOPMENT OF NATURAL RESOURCES IN ORGANIZATIONS CARRYING OUT THE DISPOSAL OF MUNICIPAL WASTE AND BIOGAS EXTRACTION IN THE CONTEXT OF THE "GREEN" ECONOMY

Svetlana Vegeera¹, Elena Malei², Renata Trubovich³

^{1,2,3} Polotsk State University, 29 Blokhin street, Novopolotsk, The Republic of Belarus

E-mails: ¹svegeera@mail.ru; ²maleialena@yandex.by; ³renatalv@tut.by

Received: 19 March 2018; accepted 7 May 2018 published 30 September 2018

Abstract. Since the end of the 20th century, in the context of developing rational consumption of natural resources, energy efficiency and solving environmental problems related to the management and burial of municipal waste, there is a need to take into account the consumption of natural capital, its degradation, as well as to determine the growth of gaseous energy resources in assessing economic growth in both the whole country, and in a separate organization that buries municipal waste and extract biogas. Therefore, the authors set forward the objective of the research: to develop the account of gaseous resources stocks (biogas) and assimilation resource as elements of natural capital. For the purpose of the achievement of aim, the authors apply generally accepted economic research methods. The article considers the economic essence of assimilation and gaseous energy resources of municipal waste as new objects of accounting. Both accounting objects are considered as long-term assets. The authors propose an accounting model for natural resources, which provides with information on the consumption of ecosystem capital and its degradation. It is proposed to estimate the assimilation potential of the environment at fair value (according to the current market) in the presented accounting model. As a result of the study on the possibilities of applying parallel accounting for long-term natural resources, we propose to account the gaseous resources in two assessments: on the one hand, based on actual costs associated with investing in the formation and attraction of alternative technogenic energy resources in economic activity, on the other hand - at the fair value (current market value) of the methane stocks.

Keywords: municipal waste, biogas, technogenic energy resource, mineral resource, natural capital, assimilation resource, assimilative potential, assimilative capacity

Reference to this paper should be made as follows: Vegeera, S.; Malei, A.; Trubovich, R. 2018. Accounting development of natural resources in organizations carrying out the disposal of municipal waste and biogas extraction in the context of the "green" economy, *Entrepreneurship and Sustainability Issues* 6(1): 211-225. [http://doi.org/10.9770/jesi.2018.6.1\(14\)](http://doi.org/10.9770/jesi.2018.6.1(14))

JEL Classifications: Q29, Q42, Q53, Q57

Additional disciplines: ecology and environment

1. Introduction

Changes in approaches to assessing sustainable development, the economic potential of the country in the 21st century, have made it necessary to take into account natural capital and its reflection in the reporting of business entities. Wealth accounting, including natural capital accounting (NCA), is needed to sustain growth. Long-term development is a process of accumulation and sound management of a portfolio of assets—manufactured capital, natural capital, and human and social capital (Natural Capital Accounting, 2016). Natural capital accounting can help deliver the SDGs by making explicit the links between the economy and the environment, enabling sustainable policy decisions and actions, and monitoring progress (Natural Capital Accounting and the Sustainable Development Goals, 2016). In 2012, at the Rio + 20 Conference on Sustainable Development, seventy-five countries and the European Commission supported the Communique on the call of Governments, the United Nations system, international financial institutions and other international organizations to take more active measures to include the natural capital in the macroeconomic indicators calculation throughout the world. (A mass demonstration of support measures to integrate natural capital at a summit in Rio, 2012).

Researching problems in accounting of organizations that carry out the municipal waste disposal and the biogas extraction, we propose to consider new objects of accounting - an assimilation resource and an energy resource of municipal waste (biogas) as elements of the natural capital. At present time the energy potential of landfill gas (biogas) as an alternative source of energy and, simultaneously, as an element of natural capital is not reflected in the accounting system of organizations in the Republic of Belarus and in international practice. The organizations reflect only the actual costs of forming and attracting the alternative gaseous resource into economic activity, which are capitalized as part of fixed assets and intangible assets. There is no correlation in the accounting system between the indicators of municipal waste flows, the biogas stocks formation, its consumption flows and the flows of greenhouse gases into the atmosphere (Malysheva, 2013). The environmental assimilation potential (the ecosystem's stability to anthropogenic impact), as a component of natural capital, is not reflected in the accounting system.

Various aspects of including information on the usage of natural capital in accounting and calculating are viewed in works of foreign and native authors such as: Altuhova Y.V., Rishar J., Zamula I.V., Shiribokov V.G., Shevlukov A.P., Metla O.S., Vegera S.G., etc. The authors consider various approaches of natural resources accounting and the possibility of including them in financial statements. Scientists are investigating in general the existing problems in approaches to evaluate natural resources, types of natural rent, the possibility of including natural resources in the composition of assets at fair (market) cost, and not only at historical cost. Metla O.S., Vegera S.G. emphasize the problem of the absence of a system that takes into account the links between the indicators of the use of natural capital and the economic results of the business entity. The authors have developed a system of accounting for mineral resources as an element of natural capital (Vegera, Metla, 2015). There are enough researches devoted to accounting and evaluation of biological assets in literature. At the same time, today scientists haven't paid attention to accounting to such specific natural resources as landfill gas and assimilation resources. Neverov A.V., Voropaeva O., A., Robert Constanza and many other scientists consider only approaches to measuring ecosystem services in value terms (Neverov, Voropaeva, 2012; Constanza, 1997).

Among the defined unresolved issues in accounting system the purpose of this research is the theoretical justification and the accounting development of anthropogenic gaseous resources (biogas) and assimilation resources as the elements of natural capital for organizations engaged in waste disposal and biogas extraction.

The objects of the research are natural resources: technogenic gaseous resources that are derived from municipal waste under the influence of the natural environment and assimilation resource of the ecosystem within the municipal waste disposal site. The choice of the research objects is due to the topicality of issues of natural

resources valuation, reflection them in accounting and financial statements. These issues remain not sufficiently solved, while the indicators of natural resources stocks and their consumption are of practical importance in the context of the transition to sustainable economic development.

In order to achieve the target, the following tasks shall be carried out:

- to explore the essence for the identified natural resources from the point of the economic potential (stocks) of organizations carrying out the municipal waste disposal and the biogas extraction; scientifically substantiate and recognize biogas and environmental assimilation stocks as accounting objects;
- to conduct a comparative analysis of existing methods for valuation of long-lived assets including natural resources and to propose the methods of biogas and assimilation stocks evaluation in accounting based on stakeholders preferences;
- to suggest the system of the accounting and reflecting in financial statements the biogas and assimilation stocks, allowing to provide information on the used natural capital and its degradation.

The scientific novelty of the results - is the recognition of technogenic gaseous resources of communal waste (biogas stocks) and assimilation resources as an accounting objects, as well as the development of accounting methodology for natural resources.

The presented system of natural resources accounting can find its practical application by its implementation in the normative documents of the Republic of Belarus, the CIS countries, the EU. In the research there are applied the methods of general scientific research in economics: of economic analysis and synthesis, logically – constructive, qualitative methods including the methods of the analysis of normative acts. Theoretical and methodological basis of a research are: the standard and legislative documents regulating waste management, energy saving, environmental management, environmental protection in Republic of Belarus and neighboring countries, in the EU; the normative documents regulating accounting in the Republic of Belarus, IFRS; special literature of domestic and foreign scientists; Internet sources.

2. The economic essence and recognition of a technogenic energy resource of municipal waste as an asset in accounting

In the context of a wasteless economy, all municipal wastes have a resource value. However, the resource component of municipal waste in itself as economic category exists within technological capabilities of the state and the commercial profitability of garbage use. Investigating the activities of organizations that deal with the waste burial, we came to the conclusion that municipal waste, which are directed to burial do not represent economic value at the period of collection unsorted garbage. Such waste is treated primarily as an object, which it is necessary to get rid of in environmentally safe conditions in controlled landfills.

The bulk of organic wastes mixed with inorganic ones enter the burial sites, where all wastes lose their resource value. However, biological processes in the body of the landfill with household wastes are inevitable. Fermentation microorganisms break down complex organic compounds (waste) into simpler ones. These less complex organic substances are a source of nutrition for another group of bacteria - methane-forming bacteria, which convert organic acids into methane-biogas (garbage gas). Methane has an energy potential, so gas generation in the body of a landfill can to fill up national raw material base in production, subject to the availability of technological capability and economic profitability of biogas extraction to the surface of the landfill. So, a new economic category is emerging, which affects the level of national security and is one of the conditions for sustainable development.

Below is a schematic representation of the chain of biogas formation in the landfill body. The figure is based on the study of the life cycle of municipal waste and biogas utilization (Camobreco, Ham, Barlaz, 1999; Isa, Johari, Hashim, 2014)

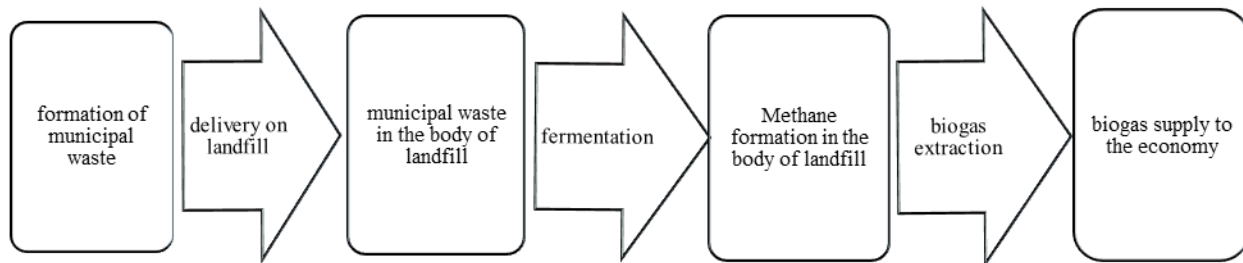


Fig. 1. The chain of biogas formation in the landfill body

Source: author's construction based on the studied special literature

Thus, municipal wastes in the presented chain have material utility in the body of the landfill, as they are a product of consumption for a microbiome. Municipal wastes do not cease to be one of the biogas formation sources. Since municipal wastes by themselves are a direct threat to the environment (including potential emission of greenhouse gases into the atmosphere), at the stage of collection and accumulation in the body of the landfill, they are subject to mandatory assessment in physical units of measurement.

The methane presence in the biogas shows the natural origin of the resource. The essential difference between this deposit and natural ones is the absence of gas-tight insulation, as a consequence of which, without the rapid extraction of gas at the same time as its generation, the resulting biogas will simply be emitted into the atmosphere, contaminating it. Confirmation of the fact that biogas is a part of mineral substances is indicated by an almost identical chemical composition with natural gas (Biogas of the landfill site as a source of energy, 2017). Thus, biogas reserves as a component of mineral resources form the energy potential of a separate organization and the state as a whole. In turn, mineral resources are the basic component of the national security of any country and an element of the national wealth of each country.

Growing environmental problems of a global scale in the field of municipal waste disposal are the main reason for the emergence of a new industrial sector-the extraction of garbage gas (biogas) at burial sites. At the same time, the environmental problem is not the only impetus for the development of the biogas industry. The tasks of avoiding the total dependence of the countries rich in hydrocarbons, the reorientation to alternative energy sources remain relevant at the international level to this day. So, technogenic gaseous resources in our study represent the energy and economic potential (methane stocks) generated by decomposition of waste utilities in the body of the landfill under the influence of microorganisms; the extraction of technogenic gas resources on the earth's surface and its further use implies environmental and economic feasibility. It should be noted that the quantitative evaluation of biogas in the body of the landfill is being expressed by its stocks, the value of which is being established by specialists on the basis of data on the volume and composition of wastes, temperature in the body of the landfill, climatic conditions and other parameters.

The technogenic gaseous resource can act as an asset of the organization if it meets the criteria of the asset. According to the concept of international financial reporting standards, the asset is a resource controlled by the organization as a result of past events, from which future economic benefits are expected to flow into the organization. So, in the Republic of Belarus under the law "About accounting and report" assets are considered to be "property, appeared in organization as a result of performed economic operations and that causes receiving

economic profit”. Thus, in the Republic of Belarus there are the following assets peculiarities: right of property for the object, so called right of use, disposition (right of ownership); the presence of economic profit. According to the current legislation of the Republic of Belarus, a technogenic gaseous resource cannot be included in the composition of assets, since the exclusive right to own the components of the natural environment belongs to the state. Consequently, the ownership of the technogenic energy resource (biogas), as a component of mineral resources, belongs to the state.

Reflecting values as balance assets for which there is a right of ownership, is the fundamental objective of static accounting. It's necessary to emphasize that the order of priority of content against form is included into “The main principles of preparation and presentation of financial reports”: if the information should truly represent operations and other events, so it's necessary for this information to be taken into account in accordance with their content and economic essence and not only with legislative form”. The principle of priority of content against form is fixed in Law “About accounting and report” of the republic of Belarus and other countries. Absence in the balance of this indicator distorts information about the resource and economic potential of the organization. While the economic potential of a business entity reflects the ability to ensure its long-term functioning and the solution of its strategic tasks.

It is necessary to note that biogas as a part of minerals is national wealth of each country, however at this time in the Republic of Belarus, it is not considered the object of economy and it is not joined in calculating of national wealth of the country. National accounts do not record the consumption of biogas as an element of natural capital in the process of economic activity, and, accordingly, the natural capital contribution to the economic component of the state. Therefore, the system of accounting does not provide necessary informational base for estimation of macroeconomic indicators of stable country development (net inner product, index of adapted net savings, “Green” GDP etc.)

In order to disclose information about the economic facts, that meets the interests of some consumers of financial statements, it is considered permissible to apply the dynamic theory of accounting to accept the technogenic gaseous resource of municipal waste as an asset. Thus, IFRS(IAS) accept the dynamic theory of accounting based on the principle of reflecting all used assets on the balance sheet irrespective of their ownership. The significance of reflecting all natural resources (both owned and not owned by an organization according to the property rights) on the balance sheet is noted in the works of such native and foreign scientists as Vegeera S.G., Metla O.S. Shevlyukov A.P., Altuhova Y.V., Shirobokov V.G. (Vegeera, Metla, 2015; Shevlyukov, 2009).

We believe that the recognition of technogenic gaseous (energy) resources as long-term assets in accounting will be correct. The explanation for this is the unstable and prolonged emission of biogas in the body of the landfill for several years. So, in accounting, the stocks of technogenic gaseous resources of municipal wastes are long-term assets that are a part of the mineral resources (established by the results of laboratory tests and expert evaluations).

3. The economic essence and recognition of assimilation resource as an asset in accounting

Today, the ecosystem (natural) capital in the international practice involves all the elements of the natural resource potential that contributes to the increase in national wealth. The ecosystem (natural) assets include natural resources, resources regulating and supporting the functioning of the ecosystem and other resources. In economic literature, publications, international reports «Ecosystem Resources» are frequently identified with the category of «environmental services». This identification of the concepts is due to the fact that the very ecological services of the ecosystem are just a special form of consuming the ecosystem resource, the use of which brings certain benefits (Tabekina, Fedotova, 2013).

According to the main international standards focusing on the classification of ecosystem services (resources), ecosystems from a functional point of view are provided by regulatory and supporting (preserving) services (resources), one of which involves a waste assimilation. R. Constanza, H. Daley, F. Torez, S.N. Bobylev, V.M. Zakharov, N.I. Bazylev notice the ability of ecosystems to rework (decompose) waste, to control pollution, to maintain the level of detoxification. Consequently, the category of «ecosystem services (resources)» includes the service (resource) of waste assimilation by ecosystems, providing benefits to society by ensuring the uninterrupted functioning of an ecosystem (Constanza, 1997; Daley, Farley, 2003; Bobylev, Zakharov, 2009).

While studying the accounting of organizations engaged in waste disposal, it seems advisable to consider the «assimilation resource» of an ecosystem as an accounting object. The lack of interpretation in the normative documentation of the Republic of Belarus and neighboring countries, in special literature has made it necessary to identify the characteristic features of an ecosystem «assimilation resource» as an ecological-economic category based on the analysis of such concepts as « assimilation capacity» and «assimilation potential» in special literature.

So, Vishnyakova S.M., Vishnyakov G.A., Aleushkin V.I., Bocharova N.G., Nikitenko U.V. understand the assimilation potential as: «the environmental ability to absorb, assimilate waste resulting from specific production activity within specific natural complexes and ecosystems. Shimova O. S. provides the following definition: «The assimilative potential is the ability of the natural environment to neutralize, absorb and process a certain amount of harmful substances without changing its basic properties». Crepscha N. in her writings describes the assimilation potential as follows: «If the amount of pollutants released into the environment, does not exceed the allowable limit of emissions, the territory itself, without any additional environmental costs, copes with incoming harmful substances and eliminates them without significant consequences»(Crepscha , 2011). In our opinion Gofman K. G., Mamontov Y. I. and Usmanov V. V. supplement the definition of the assimilation potential interpreting it as –«.....natural resource...» or «.....specific natural resource...»

The assimilative capacity of the environment in the works of S. V. Dorozhko, S. A. Horeva is «its ability to assimilate anthropogenic impact without damaging itself. Assimilative capacity is treated as a special kind of natural resources» (Dorozhko, Horeva, 2008 p.165). In publications called «Assimilative capacity» Sharon Beder notes that the environment has an assimilative capacity, which is able to absorb waste without long-term damage. Tom Barker, Martin Mortimer and others mention that the ability of an ecosystem to withstand load without losing its functional properties is determined by its capacity or resistance (Biodiversity, ecosystems and ecosystem services, chapter 2, 2010).

The analysis of the above interpretations of «assimilation potential» and «assimilative capacity» shows that the authors single out the same key characteristics of an ecosystem resource – the ability of the natural environment to absorb, neutralize, recycle waste without significant consequences. Thus, on the basis of the carried out analysis, we consider it permissible to give the following characteristics to the studied category of «assimilation resource»:

1. Ability: to neutralize, absorb and process wastes within a certain anthropogenic load; to move waste outside the ecosystem; to resist contamination;
2. Natural/ecosystem resource.

Thus, from an economic point of view the waste assimilation of an ecosystem is an assimilation resource that is able to withstand the ecosystem pollution through: absorption, neutralization, waste treatment within a specific anthropogenic load, and to move them outside the ecosystem.

Considering the value of the assimilation resource, the following features should be noticed:

- the size of an ecosystem capable to assimilate waste. According to the Technical Code of the Republic of Belarus an ecosystem is «...a part of the natural environment that has spatial boundaries...»;
- the abiotic component of an ecosystem (climatic conditions: light, temperature and humidity; soil factors, the factors of water environment, topography factors):
- the biotic component (plants, zoogenic and microbiogenic factors),
- the intensity of substance and energy exchange within the ecosystem.

In their turn, the qualitative characteristics of an ecosystem do not possess equivalent (identical) possibilities of waste assimilation.

Moreover, the time lag of waste absorption and assimilation depends on the origin of waste (wood, mineral and so on), the source of waste formation, its aggregation state, toxic properties, the method of waste burial, storage and disposal. Therefore, the impact of waste on the natural environment and its capacity to recover could be: negligible, weak, moderate and strong.

Thus, the intensity of waste assimilation and consequently the use of the assimilation resource by society depend directly on the territorial and qualitative characteristics of ecosystem, as well as on the source of waste formation, its aggregate state, toxic properties and methods of burial (storage, disposal). Since the value of the assimilation resource depends on the factors established above, it is considered appropriate for the accounting system to examine this resource from the point of view of the expected flows at which an ecosystem absorbs (assimilates) these or those wastes over a certain period of time. Accordingly, the expected assimilation flows should be measured by the acceptable waste load of a ditch in physical terms (tones) within the territorial space of the investigated ecosystem (m², m³).

It should be noted that the process of consuming this ecosystem resource involves changes in the quality of the resource flow, but not in its quantity. Unlike other natural resources it is impossible to create reserves of ecosystem flows of waste and emission assimilation. They cannot be used more or less at the request of the consumer. The assimilation resource can be an asset of an organization if it meets the criteria of an asset. Similarly, like the technogenic energy resource, the assimilation resource is a component of the natural environment, the ownership of which belongs to the state. Consequently, according to the Legislation of the Republic of Belarus an assimilation resource cannot be reflected on the balance sheet as an asset in organizations involved in the disposal of waste. The absence of this indicator on the balance sheet distorts the information about the resource potential of organizations dealing with waste disposal, because the activities of these organizations do not reflect the consumption of ecosystem capital, and it eliminates the possibility to calculate the following indexes: ecological capacity, stability of ecosystems, consumption of natural capital, national well-being and, among other things, the size of national wealth.

In order to reveal the information content about the facts of economic life that meets the interests of some consumers it is considered permissible to apply the dynamic theory of accounting to accept the assimilative resource as an asset. As we have noted, IFRS (IAS) accept the dynamic theory of accounting based on the principle of reflecting all used assets on the balance sheet irrespective of their ownership.

This study of environmental and economic essence of the category of ecosystem services (resources) testifies to the fact that consumers benefit from indirect or direct use of an ecosystem resource. The very possibility to reduce environmental costs by using the assimilation resource brings economic benefits. Along with economic benefits, the assimilation resource provides environmental benefits. The assimilation resource is a specific object, consequently its value largely depends on the qualitative and spatial characteristics of an ecosystem location.

As organizations involved in waste landfilling regularly emit waste into the environment, the consumption of the assimilation resource flow is a constant process. That is, the use of this resource is continuous and long-term. In this connection, it is considered appropriate to recognize this asset as long-term.

In addition to the general recognition criteria of an asset the waste assimilation resource has specific features that make this facility different from other ecosystem assets (subsoil, forests, water): the absence of material form; the possibility of consumption only in the process of using the environment. Based on the conducted research general and specific characteristics of the asset are presented in table 1

Table 1. General and specific features of the asset «assimilation resource»

General features	Specific features
Resource for long-term use	Ecosystem (natural) resource
Able to bring economic benefits	Has no material form
	Has qualitative characteristics rather than quantitative
	Consumption is measured by flows over a certain period of time (ton/m ³ , tons/m ²)
	Resource consumption is possible in the process of using the environment
	Able to provide stable (steady) functioning of ecosystems within a certain anthropogenic load
	A resource that brings ecological benefits

Source: author's construction based on the studied special literature

Given the characteristics of this asset, we propose the following definition for the assimilation resource as an object of accounting: The assimilation resource is a long-term asset that represents a continuous flow of an ecosystem resource produced by the functionally interrelated components of the environment, which is able to absorb, neutralize, recycle a certain amount of waste or emissions within allowable anthropogenic load, to move them outside this ecosystem, thereby providing its stable (steady) functioning; on the one hand, the flow changes of this resource depend on the qualitative characteristics of an ecosystem (natural components), on the other hand, they are influenced by anthropogenic impacts caused by an economic entity (man). In its turn, the assimilation resource may be subsequently consumed or subjected to degradation.

With increasing anthropogenic pressures above allowable limits, the processes of absorption, waste disposal and restoration of the natural environment get broken. The ecosystem loses its functional potential, stability, capacity to assimilate waste. From the environmental point of view, such an ecosystem is considered degrading. The quality of animal and human habitat deteriorates, the risk of body intoxication and chronic diseases increases and so on. Such an ecosystem ceases to function with the same effect or the quality of its functions (services) changes. In the publication «The System of Environmental Economic Accounting 2012— Central Framework» (developed by the UN Statistical Commission in 2012) the inability of ecosystems to generate the same range, quantity or quality of ecosystem services on the regular basis is called degradation. Degradation considers changes in the quality of environmental assets in terms of their ability to bring a wide range of benefits known as ecosystem services as well as the extent to which this capacity may be reduced through the action of economic units, including households (Central Framework -System of Environmental Economic Accounting, 2012).

The System of Environmental-Economic Accounting 2012: Experimental Ecosystem Accounting defines degradation as: « The decline in the quality of an ecosystem asset over an accounting period due to economic and other human activity. It is generally reflected in declines in an ecosystem condition and/or declines in the expected flow of an ecosystem service. The extent of the ecosystem degradation will be influenced by the scale of

analysis, the characteristics of the ecosystem asset, and the expectations regarding the use of the ecosystem asset in the future. Ecosystem degradation may be measured in physical and monetary terms» (The System of Environmental-Economic Accounting 2012: Experimental Ecosystem Accounting, 2014 p.155). The degree of the ecosystem degradation is evaluated according to the criteria that define adverse changes in the structure and functioning of ecosystems and take into account their spatial differentiation according to the degree of disturbance and the dynamics of degradation processes.

In native and international managerial practice there are certain regulations, standards or limits on emissions, dumping and storage of waste and concentration of pollutants in the natural environment, the compliance of which does not cause the degradation of natural components and respectively leads to their proper functioning and the expected flow of ecosystem resources. Thus, degradation in the environment is deterioration in qualitative characteristics of an ecosystem, caused by the negative impact of human activities, reflecting the irreversibility in recovering sustainable functioning of the interrelated components of the natural environment within a given ecosystem.

In accounting, organizations involved in waste disposal, should consider degradation as the excess consumption of the ecosystem resource flow (assimilation resource) over established norms in the process of economic activities, which leads to the dysfunction of a component of the natural environment; or as the termination (decrease) of the expected flow of an ecosystem resource caused by the dysfunction of a component of the natural environment due to third-party entities,

4. Evaluation of natural resources

Proceeding from the fact that the stocks of methane formation in the body of the landfill (which will be the added value of the organization) are of commercial interest, and the municipal wastes stocks are of ecological interest, the economic evaluation can be assigned only to the energy potential in the body of the landfill. In turn, municipal waste flows, their accumulation are subject to mandatory assessment in physical units for rational management and forecasting of the emission of gaseous resources in the body of the landfill.

As it was already noted, there are no data on the economic value of gas reserves in the accounting of organizations that extract biogas from the landfill body. The lack of such data leads to a decrease in the information content of the reporting and does not allow to assess the resource and economic potential. Accordingly, the investment attractiveness of the organization is missed, the possibility of receiving government subsidies is declining. The organizations reflect only the actual costs of forming and attracting a technogenic gaseous resource into economic activity, which are capitalized as part of fixed assets and intangible assets. This is the cost of acquiring a license for economic activity, the right to use the land and the cost of disposal facility, of equipment that monitor temperature and humidity in the body of the landfill, wells and pumps and other devices. At the same time, according to the legislation of the Republic of Belarus in the accounting of fixed assets and intangible assets and in IAS 16 these costs can subsequently be subject to revaluation at current market prices. As a result, the revaluation distorts the information on the costs of the formation of technogenic gaseous resource and its involvement in economic activity for the analysis of the effectiveness of the invested funds.

To address the issue in determining the type of assessment of a long-term asset as a technogenic gaseous resource, we analyzed the scientific works of J. Richar, Y.V. Sokolov, M.I. Kuter, M.L. Pyatov, N.M. Karzaeva, S.G. Vegera, O.S. Metla. Scientists are considering approaches to assessing long-term natural resources and are of the opinion that the choice of the type of assessment should be consistent with the goals set for the organization. And the idea of simultaneous application of static and dynamic balance concepts for accounting of long-term natural assets is currently extremely urgent (Vegera, Metla, 2015).

The idea of a static balance theory is based in the calculation and reflection of data in financial statements about the organization's ability to pay off its debts. Thus, the valuation of assets at current market prices (fair value) is the principle of the static balance theory. The valuation at fair value provides for the analysis of the property position. Accordingly, the main users of reporting static theory are lenders. The idea of a dynamic theory is based on the reflection in the reporting of the effectiveness of the organization's activities, the calculation of financial results. Valuation of assets at historical cost is the principle of dynamic accounting theory. The owners of the company are interested in such accounting information. The combination of the two accounting theories within a single balance sheet is justified by the desired results- the reflection in accounting and financial reporting of data both on property status and on the effectiveness of the business entity. Such an idea helps to fix actual costs by attracting natural resources to economic activity (according to the dynamic theory of balance), which provide a basis for analyzing the effectiveness of investments in the formation and attraction of resources. While accounting of natural resources at current market value (according to the static balance theory) will allow assessing the resource potential and investment attractiveness of the organization.

As a result of the study on the possibilities of applying parallel accounting for long-term natural resources, we propose to account the technogenic gaseous resources as a long-term asset in two assessments: on the one hand, based on actual costs associated with investing in the formation and attraction of alternative technogenic energy resources in economic activity (costs of economic activity right and so on, the costs of acquiring devices to maintain temperature level in the body of the landfill, bioreactors, wells and pumps, etc.), on the other hand - at the fair value (current market value) of the methane stocks.

Reassessment of market value and depreciation of technogenic energy resources (methane reserves) should be carried out according to changes in current market prices, as well as according to changes in the volume of stocks in the body of the landfill, based on laboratory analysis and expert evaluation.

The meaning of the economic evaluation of ecosystem services is to determine the value, and hence the importance for a person of all kinds of benefits derived from ecosystem services. The first large-scale assessment of world ecosystem services was carried out in 1997 by the American scientists. By their calculations, the nature provides to mankind ecosystem services on average for \$33 trillion annually that exceeds world GDP almost twice (\$18 trillion a year, in the prices of 1997) (Vahrusheva, 2016). For reliable analysis of the activities of organizations involved in municipal waste disposal, an important issue is also assessment of the assimilation resource.

Approaches to the economic value of ecosystem resources consumption in recent years has acquired a special relevance over the world in connection with the methodological problems caused by the complexity of the valuation of ecosystem services and natural interactions. Over the past few years, international organizations such as the United Nations, the World Bank, the World Wildlife Fund have actively promoted scientific research on the economic valuation of ecosystem services (resources). Within the framework of waste management, international experience indicates a mechanism for compensating for the use of ecosystem services (resources). The mechanism is based on the need to compensate for damage caused by harmful effects on the environment. Purchase and sale of additional environmental impact units in the state have promising market relations. The unit of environmental impact saved by the organization can be formed by improving technology or restructuring production.

Therefore, we believe it makes sense to reflect in accounting the assimilation resources at fair value, i.e. at current market prices. The reassessment of the assimilation resource should be carried out with a change in market prices or by monitoring the ecosystem sustainability.

As we propose to assess the assimilation resource at market value, it is necessary to mention about the accounting system of the property rights acquisition (licenses, permits) for nature objects. According to the Decree of the Ministry of Finance of the Republic of Belarus on accounting of intangible assets and IAS 38, property rights refer to intangible assets.

Thus, acquired limited proprietary rights to the object of nature management (ecosystem, land) together with the assimilation resource, in accounting should be assessed at actual costs. These are the costs associated with the attraction (involvement) of assimilation resource and resolution of its consumption. As a result of the study, we propose to account the assimilation resource as a long-term asset in two assessments: on actual costs, associated with attraction of ecosystem resource in economic activity, at the fair value (current market value)-assimilation potential.

5. An accounting system and the natural resources reflection in the financial statements in organizations carrying out the burial of municipal waste and the extraction of biogas

Recognizing technogenic gaseous resources as assets in the system of accounting and financial reporting, information about methane stocks is proposed to be reflected on the subaccount XX.X “technogenic gaseous (energy) resources”, opened to synthetic account XX “Mineral Resources”. It should be noted, that the system of mineral resources accounting should reflect not only information about biogas stocks, but also include information on its consumption. Consumption should be considered as extraction of biogas from the landfill body, which leads to a reduction in biogas stocks. Therefore, it is proposed to register information about consumption on a separate passive subaccount XX.X “Consumption of technogenic gaseous resources” of account XX “Depletion (consumption) of mineral resources”.

To reflect the potential of the assimilation resource at fair value in accounting and reporting, we suggest using a separate synthetic account: XX "Assimilation Resources". The credit turnover will reflect resource consumption (reduction in value), degradation, and debit turnover - attraction of additional flows of assimilation resource (increase in value). Consumption of assimilation resource and ecosystem degradation makes sense to be reflected in a separate passive synthetic account XX "Consumption and degradation of ecosystem resources", with the opening of additional sub-accounts:

XX.1 – "Consumption of assimilation resource within the limits of norms"

XX.2 – "Consumption of assimilation resource in excess of the established limits (degradation)"

Such subaccounts system will allow to take into account differences in the approach to the consumption process: on the one hand, the consumption of the flow of the assimilation resource within the norms established by specialists, and, on the other hand, the reflection of ecosystem's degradation.

Speaking of biogas (garbage gas) and assimilation resource as elements of natural capital, we recall the existing need for accounting of natural capital in the 21st century. The natural capital contribution to economic development was investigated by: R. Konstanza, H. Daley, Brendar Fisher, Kerry Tyurner, Bazylev N.I., Bobylev S. N. and many other scientists. As well as the study of the contribution of natural capital are paying attention representatives of the collective co-authorship of public and international organizations of the «Big eight» countries, preparing reports on the economics of ecosystems and biodiversity (The Economics of Ecosystems and Biodiversity-TEEB).

As for the accounting of natural assets, we have analyzed the scientific works of Shevlyukov A.P., Altukhova Y.V., Shirobokov V.G., J. Richar, Vegeva S.G., Metla O.S. The recognition of a natural resource by an organization's assets presupposes the existence of a balancing item in the passive side of the balance sheet. Shevlyukov A.P., Altukhova Y.V., Shirobokov V.G. consider “natural capital” as a source of formation of land

plots and natural resources of state property. Considering the accounting problem of the sources of land plots on which the organization has no rights of ownership, Vegea S.G. suggests in the passive side of the balance sheet as the source of such asset to consider “the attracted natural capital” and reflect it on the separate account (Vegea, 2011). Paying attention to the fact that the objects of burial are exploited in the process of landfill functioning and of biogas extraction on lease / temporary use of ecosystem objects, we share the scientific justification of Vegea S.G. in the part of reflecting in the balance sheet as a source of formation of natural resources not of natural capital as such, but of attracted natural capital.

Both negative and positive effects of the use of natural capital should be reflected in the accounting. According to Vegea S.G, the ecological and economic result of land use should express additional ecological (anti-ecological) capital, which the author suggests to reflect on the active-passive account -XX "Additional ecological (anti-ecological) natural capital" or "Attraction of an additional anti-ecological (ecological) natural capital ". Consequently, in the case of consumption of ecosystem resources above the permissible norms (limits), which leads to degradation (as a result of predatory use), it is advisable to fix the negative effect of nature use on the active-passive account XX "Attraction of an additional anti-ecological natural capital". The debit of this account reflects the increase in the additional anti-ecological capital, the credit- its reduction.

Positive impact on the natural object (ecosystem object) will be reflected in the accounting as: the credit should take into account the growth of additional ecological natural capital, the debit - its decline. Thus, reflecting on the debit of the account "assimilation resource" and the credit of the account "Attracted additional ecological natural capital", the value of assimilation potential increases due to the improvement of the ecological state and additional ecological natural capital. So, the information on this account will reflect the ecological and economic effect of anti-ecological or ecological management. The proposed methodology will provide information on the direct dependence of: the organization's own capital and the contribution to the country's natural capital reproduction as part of national wealth.

With regard to actual costs. The cost of forming methane stocks in the activities of economic entities is suggested to be capitalized on the accounts “Investments in long-term assets”, “Fixed assets” or “Intangible assets”. So, the costs for the formation of technogenic gaseous (energy) resources will include the cost of those facilities that are directly involved in the process of methane generation, namely: the right to use land plots (burial objects), devices for maintaining the optimum temperature level in the body of the landfill, drainage systems and other devices. In the balance sheet, the source of assets at the actual cost of forming and attracting mineral resources will be either own capital or liabilities. In turn, it is necessary to reflect the costs of permission (license) for the assimilation resource consumption as an intangible asset in accounting. In the balance sheet, the source of intangible assets at the actual cost will be either own capital or liabilities.

Conclusions

With the purpose of determining economic growth and solving environmental problems and ensuring sustainable development of nature management, there is a need to develop accounting for natural resources in organizations that carry out municipal waste disposal and biogas extraction. In this connection, we have presented in this article: the economic essence of biogas reserves and assimilation potential as accounting objects; a natural resources accounting system and reflection them (resources) in financial statement.

Based on the highlighted goal and tasks of the research, the following final clauses can be singled out:

1. In the study we have scientifically justified the recognition of new accounting objects in organizations carrying out municipal waste disposal and biogas extraction:
 - the «technogenic gaseous (energy) recourse of municipal wastes», which is a long-term asset in the form of stocks of mineral substances in the landfill body, and which has economic potential.

- assimilative ecosystem stability as "assimilation resource (potential)", which is a long-term asset.
- 2. To keep accounting of the studied objects is offered in two aspects:
 - 2.1 «technogenic gaseous (energy) recourse of municipal wastes»
 - accounting at actual costs (historical cost) for the generation of technogenic gaseous (energy) resource of municipal wastes and its attraction to economic activity. We propose to capitalize the costs of forming and attracting technogenic gaseous (energy) resources, which will be included in fixed assets or intangible assets. Through the process of calculating depreciation, these costs will fall into the composition of the costs of the main activity of the organization (extraction of biogas). According to the dynamic theory of balance, the reflection of biogas stocks at actual costs for their formation and involvement in economic activity will provide a basis for analysis of efficiency of investments in technogenic natural resources:
 - accounting at fair value (current market value) of biogas stocks. According to the static balance theory, biogas stocks accounting at the current market value will allow estimating the resource potential and investment attractiveness of the organization. The process of consumption of technogenic gaseous resources in accounting will reduce the value of technogenic natural resource.
 - 2.2 «assimilation resource (potential)»:
 - at actual costs, take into account the acquisition of licenses, permits for consumption of the assimilation resource and include them in the value of intangible assets;
 - at fair value, take the assimilation stock (potential) of the ecosystem. The process of consumption in accounting will reduce the value of assimilation resource.
- 3. In the balance sheet as a source of formation of the investigated long-term assets in the valuation at historical cost is the company's own capital or liabilities. The source of the natural resources (economic potential) in the market value assessment is the attracted natural capital.
- 4. The biogas extraction on the surface of the landfill should be considered in accounting as consumption (depletion) of mineral resources; the consumption of the assimilation resource makes sense to be divided into consumption within the limits of norms and in excess of norms, leading to degradation of assimilation stability.
- 5. The negative effect of nature management as a result of the anti-ecological consumption of the assimilation resource, leading to ecosystem degradation, should be reflected in the accounting with the use of the supplementary account " attraction of an additional anti-ecological natural capital".

The proposed accounting system will provide an opportunity for further assessing the contribution of natural capital to the development of the business entity and the state as a whole. It will provide the necessary information base for calculating macroeconomic indicators of the country's sustainable development, characterizing human progress taking into account the natural factor.

References

Natural Capital Accounting, March 31, 2016. Available on the Internet: <http://www.worldbank.org/en/topic/environment/brief/environmental-economics-natural-capital-accounting> Camille Bann, International Institute for Environment and Development. Policy Briefing: Natural Capital Accounting and the Sustainable Development Goals. Retrieved from: https://unstats.un.org/unsd/envaccounting/londongroup/meeting22/BK_5.pdf

A mass demonstration of support measures to integrate natural capital at a summit in Rio, 2012. Retrieved from: <http://www.worldbank.org/ru/news/2012/06/20/massive-show-support-action-natural-capital-accountingrio-summit>.

Altuhova Y.V., Rishar J., Shiribokov V.G., 2009 Uchetno-informacionnoye obespechenie ustoychivogo razvitiya I racionalnogo prirodopolzovaniya [Accounting and information support of sustainable development and environmental management] Retrieved from: <https://cyberleninka.ru/article/v/uchetno-informatsionnoe-obespechenie-ustoychivogo-razvitiya-i-ratsionalnogo-prirodopolzovaniya>

Vegera, S.G., Metla, O.S., 2015. "Assessment and accounting of mineral resources as part of natural capital: problems and solutions" *Buhgalterskij uchet i analiz* [Accounting and analysis], no. 9, pp. 8-15.

Robert Constanza, 1997 Value of world's ecosystem services and natural capital/ Robert Constanza [et.al.] // *Nature*. – London, 1997. – Vol. 387/15. – p. 253–260

Malysheva, M. S. 2013. Organization, the Main Directions and Objectives of Economic Analysis Environmental Performance, *Contemporary Economic Issues* 4. <https://doi.org/10.24194/41301>

Neverov A.V., Voropaeva O., A., 2012. Stoimostnaya ocenka ekosistemnyh uslug I biologicheskogo bioraznoobraziya [Valuation of ecosystem services and biological diversity] Retrieved from: <https://elib.belstu.by/bitstream/123456789/3484/1/26-neverov.pdf>

V. Camobreco, R. Ham, M. Barlaz, 1999. Life-cycle inventory of a modern municipal solid waste landfill. Retrieved from: <http://journals.sagepub.com/doi/pdf/10.1177/0734242X9901700602>

Isa A. S, Johari A., Hashim H., Mat R., Lim J. S., Ngadi N., & Ali A. (2014) Optimal landfill gas utilization for renewable energy production, *Environmental Progress & Sustainable Energy*. Retrieved from: <http://www.ccacoalition.org/en/resources/optimal-landfill-gas-utilization-renewable-energy-production>

Sirius Group, 2017. Biogas of the landfill site as a source of energy. Retrieved from: <http://srsgroup.su/biogaz-poligona-tbo-kak-istochnik-energii.php>

Shevlyukov A.P., 2009. Paradigmy russkoy modeli schetovodstva kapitalnogo imuschestva [paradigms of the Russian model of capital assets accounting]. Gomel, The Republic of Belarus, pp. 128-129

Daly, Herman E. *Ecological economics: principles and applications* / by Herman E. Daly and Joshua Farley/ pp.107. Retrieved from: http://indomarine.webs.com/documents/Ecological_Economics_Principles_And_Applications.pdf

S.N. Bobylev, V.M. Zakharov, 2009 Ecosystemniye uslugi I ekonomika [Ecosystem services and economics] pp. 7-11/ Retrieved from: http://sustainabledevelopment.ru/upload/File/Books/Inst_book_7.pdf

Krepsha, N.V., 2011. Ekonomika prirodopolzovaniya i prirodoohrannoy deyatel'nosti [The economics of nature management and environmental protection]. Retrieved from: <http://bookbk.net/book/116-yekonomika-prirodopolzovaniya-i-prirodooxrannoj-deyatelnosti-krepsha-nv/32-53-assimilyacionnyj-potencial-prirodnoj-sredy-i-ego-yekonomicheskaya-ocenka.html>

Dorozhko, S. V., Horeva S. A., 2008 Osnovi ekonomiki prirodopolzovaniya [the economy basis of nature management], Minsk, BNTU [Belarusian national technical university], 2008.-165c.

Barker Tom, Mortimer Martin, 2010. Biodiversity, ecosystems and ecosystem services. Chapter2 Retrieved from: <http://www.teebweb.org/wp-content/uploads/2013/04/D0-Chapter-2-Biodiversity-ecosystems-and-ecosystem-services.pdf>

System of Environmental Economic Accounting 2012— Central Framework. Retrieved from: https://unstats.un.org/unsd/envaccounting/seearev/seea_cf_final_en.pdf

System of Environmental-Economic Accounting 2012: Experimental Ecosystem Accounting, 2012. Retrieved from: <http://ec.europa.eu/eurostat/documents/3859598/6925551/KS-05-14-103-EN-N.pdf>

Tabekina, O. A.; Fedotova, O. V. 2013. Features of the Process of Ecologization of Russian Enterprises, *Contemporary Economic Issues* 2 <https://doi.org/10.24194/21307>.

Vahrusheva, K. Ekonomicheskaya ocenka ekosistemnyh uslug [Economic evaluation of ecosystem services], «Ekologiya i pravo» [«Ecology and right»]. Retrieved from: <http://bellona.ru/2016/07/14/ecology-economy/>

Vegeera, S.G., 2011. Razvitiye metodologii bukhgalterskogo ucheta zemli v kontekste sovremennoy teorii renty [Land accounting methodology within the context of the state-of-the-art rent theory], Vegeera, S.G., Novopolotsk, The Republic of Belarus. Retrieved from: <http://docplayer.ru/53829259-S-g-vegeera-razvitie-metodologii-buhgalterskogo-ucheta-zemli-v-kontekste-sovremennoy-teorii-renty.html>

Svetlana VEGERA is Doctor of Economic Sciences, Associate professor, First pro-rector of Polotsk State University. Research interests: problems of accounting development, economic analysis and control in the context of sustainable development concept; methodology of natural capital account; corporate social accountability.

ORCID ID: orcid.org/0000-0002-5717-6109

Alena Malei is Associate professor, head of department of Business Accounting and Audit, Logistics and Management in Polotsk State University. Research interest: the development of accounting in the context of «green» economy.

ORCID ID: orcid.org/0000-0002-5331-0032

Renata Trubovich is Master of Economic Sciences, assistant of department of Business Accounting and Audit, Logistics and Management in Polotsk State University. Research interest: the development of accounting in the context of «green» economy.

ORCID ID: orcid.org/0000-0003-2455-705X

Register for an ORCID ID:

<https://orcid.org/register>

Copyright © 2018 by author(s) and VSI Entrepreneurship and Sustainability Center

This work is licensed under the Creative Commons Attribution International License (CC BY).

<http://creativecommons.org/licenses/by/4.0/>

