Decarbonization of an economy: creating economic prerequisites through the development of the waste recycling accounting at landfills

Alena Malei, and *Renata* Trubovich*

Euphrosyne Polotskaya State University of Polotsk, Novopolotsk, the Republic of Belarus

Abstract. Reforming the methodology of waste accounting to decarbonize the environment is an ecological innovation in information support. Reformation allows organizations to understand their environmental responsibility, economic benefits from involving waste in re-production. The purpose of this study is a theoretical justification and development of accounting methodology for municipal waste operating in unequipped landfills. To get the purpose, the article presents the economic essence of "organic municipal waste". The natural transformation of organic municipal waste into a biogas in the landfill body requires the allocation of two new accounting objects: "biomass of municipal waste" and "biogas reserves". The article suggests an interconnected methodology for accounting for "biomass of municipal waste" as a secondary resource, and "biogas reserves" as renewable natural capital reflecting the economic potential of the landfill. The presented methodology will provide users with information about: the contribution of organic waste to reproduction; the energy value of the landfill and its economic potential; consumption of renewable natural capital; reduction of greenhouse gas emissions. The developed recommendations regarding the accounting of municipal waste in organizations operating unequipped landfills increase the information content, which is important for making management decisions, attracting investments, aimed at the disposal of carbon gases.

Keywords: Unequipped landfill· Greenhouse effect· Biomass of municipal waste ·Biogas reserves Renewable energy resource ·Natural capital

1 Introduction

Since the second half of the XX century, the aggravation and globalization of environmental problems has been increasing . First of all, these are problems related to climate change and the destruction of environmental elements due to global emissions into the atmosphere of so-called greenhouse (carbon) gases: carbon dioxide and methane.

The main reason for the excess of carbon gases in the development of civilization is the use of hydrocarbons. The largest share of all global emissions falls on the energy sector — 73.2%. 18.4% of greenhouse emissions fall on agriculture. The industrial sector is the source of 5.2% of emissions, waste corresponds to 3.2% of emissions [1]. Waste, unlike energy, makes a modest contribution to the greenhouse effect, but it is responsible for the emissions of dangerous

* Corresponding author: r.trubovich@psu.by

methane. The "Waste" sector in the above statistics includes methane emissions from the disposal of municipal and industrial waste at landfills [2]

In the fight against the greenhouse effect, the United Nations Framework Convention on Climate Change (UNFCCC) developed the Kyoto Protocol in 1997. Since 2020, it has been replaced by the Paris Agreement under the United Nations Framework Convention on Climate Change, which was the result of the realization that there is a need for radical solutions to the problem of global climate change. Recognizing the importance of the innovations of the Kyoto Protocol and the Paris Agreement, the countries of the world space have prepared international and local regulatory measures aimed at reducing greenhouse emissions and climate regulation.

In international practice, decarbonization of the environment at municipal waste disposal facilities is focused on the disposal of landfill gas. The creation of new equipped facilities (landfills) that allow environmentally safe storage, storage of municipal waste and disposal of landfill gas is becoming increasingly relevant in the management of the greenhouse effect. However, today, unequipped landfills significantly predominate, which continue to accumulate waste and act as an object of greenhouse gas emissions. The solution to this environmental problem is new technologies that allow pumping landfill gas from the depths of the landfill and using it in energy production. Thanks to this, the extraction and disposal of landfill gas is now allocated to an independent branch of the global industry. Municipal waste management and orientation to a renewable energy source (greenhouse gases) of an unequipped landfill are becoming concomitant reasons for the development of the biogas industry.

The development of biogas activity increases the interest in accounting information from various users and economic entities. For example, organizations that extract landfill gas (with subsequent energy production) are primarily interested in information about the energy value of the landfill and its economic potential

However, at present, many data are not recorded in the accounting and financial statements of organizations engaged in the disposal of municipal waste. For example, data on the receipt of organic municipal waste to the landfill (as an incoming resource in the production process) are not taken into account, the formed reserves of organic matter and landfill gas in the landfill body are not recorded. Extracting organizations, pumping landfill gas, take into account only the actual costs of its extraction and energy production, ignoring the use of energy resources, which distorts the cost of energy produced, the organization's income and financial result. The absence of this information does not allow economists at the macro level to get clear answers to the questions: what is the share of secondary (renewable) energy resources in the country's energy balance and what is the economic feasibility of increasing it; how the development of renewable energy sources will affect the economy and the environment.

Extractive organizations do not keep records of the consumption and depletion of landfill gas as an element of a renewable natural resource. This fact does not allow us to assess the contribution of natural capital to the economy of the state, excludes the possibility of calculating national wealth and "green" GDP. The need to include information in the accounting system on the use of natural capital was first recorded in the declaration signed during the UN Conference on Sustainable Development "RIO+20" in 2012 [3]. Accounting for the use of natural capital remains relevant to this day in international practice

Thus, insufficient information on the part of organizations engaged in municipal waste disposal and landfill gas extraction definitely leads to a decrease in their investment attractiveness, as well as to the possibility of calculating and evaluating macroeconomic indicators of sustainable socio-economic development.

It is important to note that many scientific papers have been devoted to the search for solutions to waste management issues and the environmental problems caused by them. For example, the issues of creating an industrial waste management system in the context of a circular (waste-free) economy, including them in the accounting system, financial statements have become the subject of research by many foreign and domestic authors, such as S.G.

Vegera, E.B. Maley, I.I. Sapego, O.A. Sushko [4], M. Bartolomeo [5], N.V. Pakhomova, K.K. Richter, M.A. Vetrova [6] R. H. Gray [7], D'onza, G., Greco, G., Allegrini, M. [8], Parajuli, K [9] and others.

Issues in the field of environmentally negative human impact on nature, the environment, as well as accounting for the costs associated with waste management, environmental protection costs and environmental protection activities are reflected in the scientific works of scientists: L.V. Masko, R.V. Gavrilov [10], Lisina Yu.B., Ivanovskaya A.V. [11], I.V. Zamula, A.V. Zotov, E.K. Murueva. Various aspects of the inclusion of information on the use of natural capital in accounting and reporting are considered in the works of foreign and domestic authors: Richard Jacques, V.G. Shirobokov, Yu.V. Altukhova [12], O.S. Romanova, S.G. Vegera [13], Bazylev, N. I. [14]. The scientific works and studies of S.N. Bobylev, V.M. Zakharova, [15], J.Farley, R. Costanza, were devoted to the study of issues in the field of assessing an assimilation resource (of an ecosystem) that is able to absorb carbon gases.

Despite the significant contribution of scientists to the development of methodological recommendations for the management of industrial waste and their accounting, as well as the development of accounting for environmental protection costs, the costs of preventing greenhouse gas emissions, accounting for environmental assets and liabilities, natural capital, there is currently no comprehensive scientifically based approach to accounting for municipal waste, including municipal waste from unequipped landfills, which are, on the one hand, an environmental threat, and on the other – the energy potential of the country with the technological capabilities of landfill gas production.

To solve the problem of including information about municipal waste and its energy potential in the accounting and analytical support of organizations engaged in landfill gas disposal and extraction, the purpose of this study is to substantiate and develop recommendations for the development of accounting for municipal waste biomass and landfill gas reserves at unequipped landfills.

The purpose of the work determined the formulation and solution of the following tasks:

-to investigate the economic essence of organic municipal waste from the point of view of their resource value, as well as to consider their natural transformation into a gaseous state in the body of an unequipped landfill and the possibility of using this resource in energy production

- to give a scientific justification and recognize the biomass of municipal waste as an object of accounting;

- to substantiate the definition of valuation and develop a methodology for accounting for biomass of municipal waste.

Previously, we conducted a study in the field of the economic essence of biogas reserves in the body of an un-equipped landfill and we proposed a gas accounting methodology for organizations engaged in landfill gas extraction. To date, this methodology requires clarification in terms of the valuation of a long-term asset and it should be included in a comprehensive methodology for accounting for municipal waste at unequipped landfills.

The scientific novelty of the results obtained lies in the substantiation of the economic essence of municipal waste biomass as an object of accounting, as well as in the development of an interconnected accounting methodology for municipal waste biomass and biogas reserves.

The object of the study is organic municipal waste. The choice of the object of research is due to the relevance of issues in the field of reflection in the accounting and reporting of information on organic municipal waste and practical significance in modern conditions.

2 Materials and Methods

The identified problem - the lack of information about municipal waste and its energy potential in the accounting and analytical support of organizations engaged in landfill gas disposal and

extraction - was established based on the results of a comparative analysis of domestic and foreign literature reflecting the relevance of environmental problems in waste management and prospects for the development of renewable energy sources; an oral survey in organizations engaged in the disposal of municipal waste and the study of regulations in the field of accounting of the Republic of Belarus and IFRS and other countries.

In the study of the economic essence of municipal waste biomass, the analysis of the concepts of "organic waste", "municipal waste", "biomass" by foreign and domestic authors from special literature, waste management standards and renewable energy was used. As a result of the analysis, the grouping of organic municipal waste was given and by deduction we proposed our own definition of "biomass of municipal waste" as an object of accounting. The possibility of recognizing biomass of municipal waste as a short-term asset of the organization, the determination of its valuation were scientifically substantiated by critical analysis and application by analogy of certain articles of the Law "On Accounting and Reporting", regulations in the field of accounting of the Republic of Belarus, the Russian Federation and other countries applying the continental accounting model, as well as IFRS.

Earlier, we analyzed the economic essence of "Biogas reserves" in the landfill body, which were recognized as a long-term asset; we determined that biogas reserves in unequipped landfills can be estimated and reflected in accounting; we proposed a model for accounting for an energy resource in the context of the concept of natural capital. All the results obtained from an earlier study have been clarified in this study and they are a significant addition to the development of integrated accounting of municipal waste at unequipped landfills.

Summarizing the results of the study, we have developed a logically interrelated methodology for accounting for municipal waste biomass, biogas reserves and their assessment, which is set in accordance with the preferences of interested parties in obtaining the necessary information

Thus, among the methods used in the study, we distinguish analysis, comparison, conclusion by analogy, grouping, critical evaluation, systematization and logical generalization, and others. The theoretical basis of the study was: standards in the field of environmental management, the regulatory framework for the management of municipal waste and renewable energy sources in the Republic of Belarus, as well as in the CIS countries and the European Space; special foreign and domestic economic literature on environmental protection, environmental damage (caused by the greenhouse effect), environmental management (including accounting for the use of natural capital); accounting regulations in the Republic of Belarus, IFRS; Internet sources.

3 Results

In the special literature, regulatory and legislative acts of the Republic of Belarus and neighboring countries, in addition to the category of "organic municipal waste", there is the concept of "biomass of municipal waste", which are often identified. Thus, the Law of the Republic of Belarus "On Waste Management" defines waste as "objects or substances formed in the course of economic activity, human activity and not having a specific purpose at the place of their formation or having lost completely or partially consumer properties"[16]. In our opinion, the lack of consumer properties of substances or the absence of their purpose at the place of formation indicate that "organic municipal waste" cannot be considered as an economic category.

The presence of consumer properties of the substance (with possible reuse) indicates potential economic benefits, which allows this category to be defined not as a "waste", but as a "resource". "Biomass of municipal waste", being a substance with consumer properties and participating in the process of generating electricity at an unequipped landfill, is nothing more than a resource. In this regard, at the first stage of the study, we will determine the economic essence of the "biomass of municipal waste" as an object of accounting.

Let's consider the existing definitions of this category. The National Strategy for the Management of Solid Municipal Waste and Secondary Material Resources of the Republic of Belarus does not define the concept of "biomass". The Law of the Republic of Belarus "On Renewable Energy Sources" focuses on wood biomass due to the fact that forest waste in the republic is the most consumed raw material in heat production. At the same time, the Law also establishes the possibility of using other types of biomass in energy production. In the Manual on Energy Statistics of the International Energy Agency of the Republic of Belarus, the following types of biomass are defined: plant or animal raw materials obtained as a result of agricultural, forestry and related industries, as well as waste products of organisms or organic industrial and household waste [17]. Federal Law No. 35-FZ of 26.03.2003 "On Electric Power Industry" established that biomass includes plants specially grown for energy production, including trees, as well as production and consumption waste.

In the special literature, "biomass" is considered from the perspective of organic substances of plant and animal origin. Oleshkevich M.M., Rudenya A.S. point to the following main sources of biomass formation: 1) wood processing waste; 2) crop production waste; energy crop production products (corn, rapeseed); 3) animal husbandry waste (manure); 4) urban runoff and garbage (solid municipal waste) [18].

Such authors as Govorushko S.M., Plachkova S.G., Plachkov I.V., Sou fera S., Zaborski O. distinguish the so-called primary and secondary "biomass" [19]. The primary includes plants (twigs, grass and others), animals, microorganisms, etc. Secondary includes waste from the processing of primary biomass and waste from human and animal life (from consumption) [20].

Thus, "biomass" is an organic substance, which includes: waste from agricultural production, woodworking and food industry; municipal waste (waste of consumption and production). The main types of "primary biomass" are: waste from forestry, crop production and animal husbandry; cultivated energy crops. Accordingly, the "primary biomass" of municipal waste can include waste (garbage) parks, squares and courtyards (branches, foliage, grass). Organic municipal waste, which includes waste from consumption and production (similar to human waste), refers to "secondary biomass", which mainly includes food and other waste of organic origin.

Biomass of municipal waste, as a secondary resource in a waste-free cycle, can have both material and energy value, which is determined from the intentions of further use of the resource. Clean/sorted organic waste is used in international practice in the production of biogas, compost or fertilizers. Compost and fertilizers obtained from organic waste biomass indicate the material value of the secondary resource. The possibility of obtaining biogas indicates the presence of energy potential in the biomass of municipal waste. Depending on the processing method used in the circular economy, the "biomass of municipal waste" is a secondary material or energy resource. In the Republic of Belarus, the biomass of municipal waste entering an unequipped landfill as part of mixed solid municipal waste has energy potential, as it transforms into biogas over.

"Biomass of municipal waste" can be an asset of an organization if it meets the criteria for recognition of the asset.

According to the Conceptual Framework of Financial Reporting, an asset is understood as "resources controlled by an organization as a result of past events from which future economic benefits are expected to flow to the organization". A similar definition of the concept of "assets" is given in the Law "On Accounting and Reporting" of the Republic of Belarus, in the "Concept of accounting in the market economy of Russia" (1997) and in other regulatory legal acts of the CIS countries in the field of accounting. However, a distinctive feature of the recognition of an accounting object as an asset of an organization in domestic practice, the Russian Federation is the "ownership" of the resource, while IFRS establishes the criterion for recognition of an asset - "resources controlled by the organization", which implies not only ownership, but also the right to use, own and other rights to the resource.

Thus, according to the regulatory framework of the Republic of Belarus, the Russian Federation in the field of accounting and the Conceptual Foundations of financial reporting, we will highlight the criteria for recognizing biomass of municipal waste as an asset:

1. control over the resource (IFRS); ownership of the resource (Republic of Belarus and Russian Federation)
2. occurrence as a result of past events;
3. the expectation of economic benefits.

It is important to note that the simultaneous fulfillment of these criteria is mandatory for the recognition of municipal waste biomass as an asset

Consider the application of the first criterion: the presence of control (ownership) over the biomass of municipal waste. In accordance with the Law of the Republic of Belarus "On Waste Management", the right of ownership of waste belongs to its producer [16]. In this regard, the "biomass of municipal waste" cannot be included in the composition of assets in the domestic accounting system, since organizations engaged in the disposal and processing of municipal waste do not have ownership rights to them. The reflection of property to which there is a right of ownership as assets of the balance sheet is a fundamental condition of static accounting, which is used in countries applying the continental accounting model (including in domestic practice). The purpose of static accounting is to assess the possibility of covering debts with its assets. Therefore, it is considered impossible to reflect the balance of values in an asset without ownership of them [21]. In turn, IFRS allow the use of dynamic accounting theory, which is based on the principle of reflecting all assets used in the balance sheet, regardless of ownership of them [21]. The Law of the Republic of Belarus "On Accounting and Reporting" establishes the principle in the preparation of accounting statements - "the priority of content over form"[22]. This principle means that information should reflect the truthful reality of events, based not only on the legal, but also on the economic component. Since information about the secondary resource is significant for various users of accounting statements in domestic and international practice, we consider it permissible to use dynamic accounting theory to recognize "biomass of municipal waste" as an asset.

Consider the second criterion necessary for the recognition of municipal waste biomass as an asset: the occurrence as a result of past events. "The assets of an organization arise as a result of past transactions or other past events. Organizations usually acquire assets by acquiring or producing them, but other transactions or events can also create assets" [23]. An example of such operations may be the gratuitous receipt of municipal waste biomass to an unequipped landfill; or the gratuitous transfer of biomass of municipal waste from an unequipped landfill to an organization that produces biogas from its bowels. Therefore, the presence of the second criterion in relation to the biomass of municipal waste is confirmed.

The third criterion: the expectation of economic benefits. Consider its compliance with the biomass of municipal waste. The potential economic benefits from the use of municipal waste biomass directly depend on the tasks of the business entity in the municipal waste management system. For example, in domestic practice, organizations that dispose of municipal waste at old unequipped landfills have the opportunity to obtain economic benefits when transferring the contents of the landfill to the processor on the terms of a paid lease agreement for the operation of the landfill. Organizations extracting landfill gas from the depths of the landfill expect a natural transformation of the biomass of municipal waste into reserves of biogas, the use of which in the further production of electricity involves obtaining economic benefits. Thus, the biomass of municipal waste controlled by organizations makes it possible to obtain economic benefits in the future. Consequently, the third criterion for recognizing municipal waste biomass as an asset in accordance with the requirements of national legislation and IFRS is fulfilled.

In accordance with the requirements of national legislation and IFRS (IAS) 1 "Presentation of Financial statements", biomass of municipal waste should be defined as a short-term or long-term asset. Organizations that exclusively dispose of municipal waste, as such, do not have

a production process at an unequipped landfill. Biomass decomposes under the influence of microorganisms, as a result of which it turns into a gaseous state. This process proceeds rather slowly, exceeding the limits of the generally accepted operating cycle (more than 12 months). This fact casts doubt on the possibility of classifying the asset under study as a short-term asset. Nevertheless, we consider it legitimate to recognize the biomass of municipal waste at unequipped landfills as a short-term asset, since organic waste received at the landfill as part of mixed solid municipal waste eventually acts as a raw material in the production of electricity.

So, for organizations operating unequipped landfills, the "biomass of municipal waste", as an object of accounting, *is organic substances in the composition of municipal waste that have energy potential, changing a materially inhomogeneous form to a gaseous one under the influence of natural processes in nature; subsequently, this gaseous form can be used in the process of energy production. The biomass of municipal waste should include "primary" biomass - waste from parks, squares and courtyards of plant origin, and "secondary" biomass - waste of consumption and production (similar to human waste), the bulk of which is food waste. According to the dynamic balance theory, "biomass of municipal waste" should be reflected in accounting and financial reporting forms as part of short-term assets.*

Thus, the "primary" and "secondary" biomass of municipal waste can be recognized as a short-term asset of organizations that dispose of municipal waste at unequipped landfills. The need to disclose information about the biomass of municipal waste in accounting is justified by the desire to attract investments in order to purchase equipment for processing existing organic stocks or in order to attract third-party processing organizations.

Recognition of the "primary" and "secondary" biomass of municipal waste as an asset of the organization is possible at the disposal facilities after weighing them. They can be recognized as an asset only if the morphological composition of the incoming mixed municipal solid waste to the landfill and the specific weight of organic matter in their total mass are established in the organization. In the Republic of Belarus there are methodological recommendations for determining the morphological composition of municipal solid waste and the specific weight of organic matter in their total mass [24].

Next, we will consider approaches to the valuation of the asset under study. It is important to note that in accordance with the national standard of the Republic of Belarus "Reserves", reserves are taken into account at actual costs, which include the cost of purchased raw materials (goods), costs associated with procurement, transportation and other costs included in the actual cost of the stock [25], however, we believe that organizations engaged exclusively in waste disposal activities should take into account the costs associated with the delivery and loading of waste to the landfill separately as expenses of the period, not including them in the initial cost of the asset (biomass of municipal waste). Such an approach will allow to observe the comparability of income and expenses, obtaining a reliable financial result of organizations whose operational activities are related only to the provision of services (waste disposal) and are not related in any way to the production of products from raw materials. It should be noted that the resource in question is supplied to unequipped landfills free of charge. As such, the market value of municipal waste biomass does not exist today due to the lack of a market and transactions for this resource. Nevertheless, the biomass of municipal waste, as a resource in a circular (waste-free) economy, has a certain "residual" value in the chain of transformation of substances "commodity- municipal waste-biomass of municipal waste". The international standard IFRS 13 "Fair Value Measurement" stipulates that when determining the fair value of an asset, information about the market that is the main one for this asset is used, and in case of its absence, information about the most profitable market is used [26]. The market approach uses prices and other relevant information based on the results of market transactions involving identical or comparable assets. Since the market for the organic part of municipal solid waste is not developed in international practice, it seems appropriate to consider the value of municipal

waste biomass referring to its qualitative characteristics (energy potential) and the fair value of an identical (comparable) resource in another market.

In the domestic and international biogas industry, in addition to organic municipal waste, livestock farm waste is processed quite efficiently in specialized bioreactor plants. Organic waste is processed into biogas for the purpose of producing thermal or electrical energy. Municipal solid waste in terms of organic matter content and energy potential is comparable and similar to litter manure [19], combining elements such as proteins, lipids, carbohydrates, nucleic acids and others. In this regard, we propose to consider litter manure as a comparable asset ("reference" raw material) to the biomass of municipal waste. The value of biomass is determined by its energy potential in the production of combustible matter, which is characterized by the volume of biogas formation and the content of methane in it. Organic municipal waste and reference raw materials have their own distinctive characteristics. For example, the largest methane yield is provided by pig manure (about 70%), Cattle manure provides biogas output - 0.34 m3 s and contains 65% methane. The output of biogas from municipal waste exceeds the output of biogas from cattle manure by 0.06 m3 per 1 kg of raw materials with the same methane content [27]. So, the economic value of biomass of municipal waste can be determined by the level of energy potential of organic municipal waste in the energy potential of the reference raw material (manure) and its current market value.

"Primary biomass" entering an unequipped landfill also has its own energy value and is subject to economic assessment. Despite the fact that it enters the landfill in its pure form, during burial, organic waste is mixed with the rest of municipal waste, creating a single integral substrate. The actual biogas yield of the mixed organic substrate exceeds the calculated one for individual elements of organic substances. This happens as a result of a synergistic effect, when the components of organic substances enhance each other's actions. Therefore, we consider it appropriate to consider leaves, grass, twigs, and other organic debris falling on an unequipped landfill as a single substrate entering the landfill and to assess the value, as well as "secondary" biomass - by the level of energy potential of municipal waste biomass in the energy potential of the reference raw materials (livestock biomass -manure) and the current market value of the reference raw materials.

Earlier, we conducted a study of the economic essence of biogas reserves, which showed that in accounting, landfill gas reserves at an unequipped landfill are a renewable gaseous resource that is part of mineral resources and has energy potential; they are established based on the results of laboratory testing, expert evaluation and are consumed over a long-term period [28]. The study also justified: firstly, the possibility of applying the dynamic theory of the balance sheet to recognize a renewable gaseous resource as an asset of an organization; secondly, the definition of a controlled resource to a group of long-term assets due to a long period - both the formation of landfill gas reserves themselves and their pumping from the depths of the landfill.

Considering the issue of assessing the long–term natural asset under study, we proposed the use of static balance sheet theory to disclose information about the energy potential at fair value, determined based on the market price of the energy "standard" - natural gas, and the energy potential of biogas in the energy "standard". This approach will allow interested parties to assess the potential property status and uninterrupted operation of the mining organization, provided that they receive landfill gas reserves free of charge.

To build a methodology for accounting for biomass of municipal waste and landfill gas reserves, we will consider the economic content of the emerging relationships of business entities, which are conditioned by existing legal practice and basic technological processes. These technological processes correspond to the types of unequipped landfill.

According to the life cycle of an unequipped landfill, it is customary to distinguish two types of landfills: an operational landfill and a closed landfill.

The first type includes a disposal facility, where municipal waste is continuously received during the period established by the technical documentation. Organizations engaged in the disposal of municipal waste necessarily carry out their activities at the operated landfills. Extractive organizations can pump gas and produce energy (if there is economic feasibility) under the terms of a landfill lease agreement, the owner of which, as a rule, is an organization that carries out the disposal of municipal waste. At the same time, the contents of the landfill are transferred for free use. The technological stages correspond to the operated unequipped landfill: 1) disposal of municipal waste, 2) extraction of landfill gas from the depths of the landfill, 3) energy production from landfill gas. The first of the selected stages is implemented by organizations engaged in waste disposal, the second and third are mining organizations with subsequent electricity production. With financial opportunities to purchase degasification equipment, the legislator does not prohibit one business entity from carrying out two types of activities simultaneously –both waste disposal and landfill gas extraction with its subsequent use, however, this practice is not widespread in the Republic of Belarus.

The next type of landfills are closed landfills, that is, decommissioned, which exclude the possibility of waste disposal and become the property of local self–government bodies. Accordingly, only mining organizations can carry out their activities at a closed landfill on the terms of a lease agreement with its owner.

Next, we will present the proposed system of synthetic and related analytical accounts, which are the basis of the developed accounting methodology for organizations engaged in municipal waste disposal, biogas extraction at operated and closed unequipped landfills (Table 1).

Table 1. A system of new synthetic and related analytical accounts, which are the basis of accounting for organizations engaged in the disposal of municipal waste, biogas extraction at operated and closed unequipped landfills

Designation/number and name of the account	Type of account in relation to the balance	Designation/number and name of the sub-account	The essence of innovation
LONG-TERM ASSETS			
XX "Mineral resources"	Active	X "Renewable gaseous resource"	New account, new sub-account
XX "Depletion (consumption) of mineral resources"	Passive	X "Renewable gaseous resource"	New account, new sub-account
SHORT-TERM ASSETS			
XX "Materials"	Active	X "Biomass of municipal waste": *X.1"Biomass of municipal waste in solid state";* *X.2 "Gaseous resource produced from biomass of municipal waste"*	New sub-accounts and second-order analytical accounts
PRODUCTION COSTS			
XX "Main production"	Active	X "Production of electricity (thermal energy)"	new sub-account
XX "Auxiliary production"	Active	X "Biogas production"	new sub-account
CAPITAL			
XX "Attracted natural capital"	Passive		New account

Note- own development

Next, we will consider the accounting methodology developed by us for "biomass of municipal waste", "biogas reserves" for organizations that dispose of municipal waste and extract biogas at operated and closed unequipped landfills.

Case 1. The implementation of activities by business entities at the operated unequipped landfill.

In order to reflect the movement of biomass of municipal waste in accounting, we suggest that organizations engaged in the disposal of municipal waste open a sub-account "Biomass of municipal waste" to the synthetic account XX "Materials" and display the receipt of the resource at fair value by debit of the specified account. We also recommend opening an analytical account of the second order X.1 "Biomass of municipal waste in a solid state" to reflect the material form of the resource, that is, its solid state.

When the biomass of municipal waste arrives at the landfill, it is necessary to apply the account XX "Income of future periods" in the credit accounting system. Since there is no supplier of organic waste (sources of asset formation) to the landfill, then, referring to the regulatory acts of the Republic of Belarus, IFRS in the field of accounting for gratuitous receipt of inventories, it is necessary to use the account of accounting for future income, since it is assumed that the organization will receive economic benefits from the resource for a long period, and not simultaneously [29].

When the biomass of municipal waste enters the landfill, it is necessary to apply the account XX "Income of future periods" in the credit turnover accounting system. Referring to the regulatory acts of the Republic of Belarus, IFRS in the field of accounting for the gratuitous receipt of inventories should be used to account for future income, since it is assumed that the organization will receive economic benefits from the resource over a long period, and not simultaneously. Please note that organizations engaged in the disposal of municipal waste do not have a supplier of organic waste (sources of asset formation), and the waste is sent to the landfill for free

According to the results of the expert assessment of the formed reserves of biogas in the landfill body, the transformation of municipal waste biomass from solid to gaseous (at the fair value of decomposed biomass) should be reflected in the accounting. To do this, we recommend opening an analytical account of the second order X.2 "Gaseous resource produced from biomass of municipal waste" to the sub-account X "Biomass of municipal waste" of account XX "Materials".

At the same time, in parallel, it is necessary to record the acceptance of the long-term asset "biogas reserves" at fair value (determined by the value of the "reference" resource-natural gas), reflecting the debit turnover for the amount of formed biogas reserves. To do this, we recommend opening a subaccount X "Renewable Gaseous Resource", to a synthetic account XX "Mineral Resources", and using account XX "Attracted natural capital" as a source of long-term asset formation (to reflect credit turnover). In addition to the biomass reserves of municipal waste and landfill gas reserves recognized as assets in organizations that dispose of municipal waste, it is necessary to reflect the source of such assets. The works of such scientists as A.P. Shevlyukov, Yu.V. Altukhova, V.G. Shirobokov were devoted to the methods of accounting for natural assets and their sources of origin. Richard J., Vegera S.G., Metla O.S., as a result of the analysis of which, we agreed with the opinion of most of them that in order to reflect as a source of formation of biogas reserves, it is necessary to consider natural capital displayed on the passive account XX "Attracted natural capital" [30].

When concluding a lease agreement with a mining organization for the right to use the landfill, the organization that carries out the disposal of municipal waste transfers the formed biogas reserves to it free of charge. This fact of economic activity is subject to mandatory reflection in the accounting system of both business entities. Namely, it is necessary to simultaneously record the transfer/receipt of both a long-term asset and a short-term asset at fair value, respectively, for each accounting object.

The accounting of biogas reserves should be reflected by correspondence to the extractive organization: Debit XX "Mineral resources"/ X "Renewable gaseous resource" - Credit XX "Attracted natural capital". The gratuitous receipt of a short-term asset must be recorded as: Debit XX "Materials" / X "Biomass of municipal waste" / X.2 "Gaseous resource" - Credit XX "Income of future periods".

A mining organization carries out its activities consisting of two technological stages: 1) landfill gas extraction, 2) electricity production from landfill gas, - each of which will incur the corresponding operating costs. At the same time, the stage of "electricity production" is the main one, and the stage of "landfill gas extraction", respectively, is auxiliary in the entire technological process, since it is aimed at ensuring uninterrupted electricity production. Thus, we recommend displaying on the account XX "Auxiliary production" the costs associated with the extraction of landfill gas, and at the end of the month distribute them (if there are several mini-power plants) and write off the costs of the main production in proportion to the amount of electricity generated. In the composition of the costs of the main production, we recommend including the cost of the gaseous raw materials extracted and released into production, which is obtained from the biomass of municipal waste. Thus, a gaseous resource for the amount of decomposed waste biomass will be included in the cost of energy. In addition, at the time of the release of raw materials into production, it is necessary to reflect the current income from the use of the gratuitously obtained gaseous resource produced from the biomass of municipal waste.

When pumping out landfill gas, it is necessary to record the depletion of the subsoil of the landfill. Accordingly, the accounting system of mineral resources (long-term assets) should reflect not only information about biogas reserves at fair value, but also include information about its consumption. Pumping out biogas leads to a decrease in its reserves in the thickness of the landfill, so we propose to register this indicator on a separate passive subaccount X "Renewable gaseous resource", opened to the account XX "Depletion (consumption) of mineral resources".

In Table 2, we present the accounting of biomass of municipal waste and biogas reserves.

Table 2. Accounting of municipal waste biomass and biogas reserves in organizations engaged in municipal waste disposal and landfill gas extraction with its subsequent use

Economic operation	Debit	Credit	Amount, money units.	Evaluation
1.Accounting of biomass of municipal waste and biogas reserves in organizations that dispose of municipal waste				
Receipt of municipal waste biomass to an unequipped landfill	XX "Materials"/ X "Biomass of municipal waste": *X.1"Biomass of municipal waste in solid state";*	XX "Income of future periods"	100	At fair value, determined by the level of energy potential of municipal waste biomass in the "reference" resource (livestock biomass) and its cost
The transition of municipal waste biomass from solid to gaseous state. *(It is reflected in the accounting after the experts have established the formed reserves*	XX "Materials"/ X "Biomass of municipal waste": *X.2 "Gaseous resource produced from biomass of municipal waste"*	XX "Materials"/ X "Biomass of municipal waste": *X.1"Biomass of municipal waste in solid state";*	20	The amount of biomass losses of municipal waste at fair value

of biogas in the body of the landfill)				
The formed reserves of biogas are reflected.	XX Mineral resources /X Reneable gaseus resources	XX Attracted natural capital	50	At fair value, determined by the level of energy potential of biogas in the "reference" resource (natural gas) and its cost
The formed reserves of biogas are donated to the mining organization	XX "Other expenses for current activities"	XX "Materials"/ X "Biomass of municipal waste": *X.2 "Gaseous resource produced from biomass of municipal waste"*	20	At fair value for the amount of resulting biomass losses
	XX "Income of future periods"	XX "Other income from current activities"	20	
The reserves of biogas extracted from the depths of the landfill have been written off.	XX Attracted natural capital	XX Mineral resources /X Reneable gaseus resources	50	At fair value, determined by the level of energy potential of biogas in the "reference" resource (natural gas) and its cost.
2. Accounting of biomass of municipal waste and biogas reserves in organizations engaged in landfill gas extraction and energy production				
Landfill gas reserves have been taken into account free of charge	XX "Materials"/ X "Biomass of municipal waste": *X.2 "Gaseous resource produced from biomass of municipal waste"*	XX "Income of future periods"	20	At fair value for the amount of resulting biomass losses
formed biogas reserves	XX Mineral resources /X Reneable gaseus resources	XX Attracted natural capital	50	At fair value, determined by the level of energy potential of biogas in the "reference" resource (natural gas) and its cost
The costs associated with gas production	XX "Auxiliary production"/ X "Biogas production"	Resources consumed (cost accounts)	20	Amount of actual costs
costs associated with the production of electricity from biogas	XX "Main production"/ X "Production of electricity (thermal energy)"	Resources consumed (cost accounts); "Auxiliary production"/ X "Biogas production"	40 (20+20)	Amount of actual costs
The consumed biogas is written off for electricity production	XX "Main production"/ X "Production of electricity (thermal energy)"	XX "Materials"/ X "Biomass of municipal waste": *X.2 "Gaseous resource produced from biomass of municipal waste"*	20	At fair value for the amount of resulting biomass losses
Income from the use of a gratuitously	XX "Income of future periods"	XX "Other income from current activities"	20	At fair value for the amount of resulting biomass losses

obtained gaseous resource is reflected				
the costs of biogas extraction and electricity production (taking into account the gaseous resource)	XX Expenses/X "Actual cost of products, works, services"	XX "Main production"/ X "Production of electricity (thermal energy)"	60	Amount of actual costs
Revenue from electricity sales	XX "Buyers and customers"	XX "Income from current activities"	80	Sale price
financial result from the production of electricity and its sale	XX "Profit (loss) from current activities"	XX "Profit and loss"	40	-
disposal of a renewable energy resource as an element of natural capital	XX Attracted natural capital	XX "Depletion (consumption) of mineral resources"/ X "Renewable gaseous resource"	30	At fair value, determined by the level of energy potential of biogas in the "reference" resource (natural gas) and its cost
depletion of mineral resources by the amount of gas consumed from the landfill body	XX "Depletion (consumption) of mineral resources"/ X "Renewable gaseous resource"	XX Mineral resources /X Reneable gaseus resources	30	At fair value, determined by the level of energy potential of biogas in the "reference" resource (natural gas) and its cost

Note- own development

Case 2. Carrying out activities by a mining organization on a closed unequipped landfill.
The mining organization enters into legal relations with local governments by concluding a landfill lease agreement. According to the results of the expert assessment, the formed reserves of biogas are established. The remaining biomass of municipal waste is also installed (if any) in the thickness of the polygon. We recommend entering the biomass of municipal waste in accounting using account 10 "Materials", to which a sub-account X "Biomass of municipal waste" and analytical accounts of the second order are opened - X.1 "Biomass of municipal waste in solid state", X.2 "Gaseous resource produced from biomass of municipal waste". As noted earlier, "Gaseous resource" and "biomass" in second-order analytical accounts should be accounted for at fair value, determined by the level of energy potential of municipal waste biomass in the "reference" resource (manure) and its cost. Mandatory in accounting is the fixation of a gratuitously received resource using account XX "Income of future periods". At the same time, we propose to take into account biogas reserves as part of long-term assets using the account XX "Mineral Resources" / X "Renewable gaseous resource". The source of the formation of mineral resources is natural capital, displayed on the account XX "Attracted natural capital". A renewable gaseous resource should be accounted for at fair value, determined by the level of the energy potential of biogas in the "reference" resource (natural gas) and its cost.

The mining organization goes through the same technological stages as in the first case. Therefore, accounting for the costs of landfill gas extraction and electricity production is recommended to be organized in a similar way using the accounts: XX "Auxiliary production"

to account for the costs of gas production; XX "Main production" to account for the costs of electricity production, adding to the costs the volume of the consumed gaseous resource, which was formed from the biomass of municipal waste. At the time of the release of landfill gas into production , it is also necessary to reflect the current income from the use of the resource received free of charge in accordance with the accounting rules . At the same time, it is necessary to record the depletion of reserves in the subsoil of the landfill at a fair value determined by the level of the energy potential of biogas in the "reference" resource (natural gas) and its cost.

In international accounting practice, long-term assets can be revalued in accordance with the legislation. In this connection, we consider it expedient to take into account the revaluation of the long-term asset we are investigating (a renewable gaseous resource as an element of natural capital) based on the results of an expert assessment of changes in mineral resource reserves in the depths of the landfill or with a change in the cost of "reference" raw materials (natural gas). We recommend reflecting the additional assessment of landfill gas reserves by correspondence: Debit XX "Mineral resources"/ X "renewable gaseous resource" - Credit XX "Attracted natural capital".

In Table 3, we present the procedure for accounting for biomass of municipal waste and landfill gas reserves in the presence of a lease agreement for the operation of a landfill between a mining organization and local self-government bodies (case 2).

Table 3 Accounting of biogas reserves in organizations engaged in the extraction of landfill gas with its subsequent use

Economic operation	Debit	Credit	Amount, money units.	Evaluation
Landfill gas reserves have been taken into account free of charge	XX "Materials"/ X "Biomass of municipal waste": *X.2 "Gaseous resource produced from biomass of municipal waste"*	XX "Income of future periods"	100	For the amount of losses of biomass of municipal waste at fair value, determined by the level of energy potential of biomass in the "reference" resource (livestock biomass)and its cost
formed biogas reserves	XX Mineral resources /X Reneable gaseus resources	XX Attracted natural capital	200	At fair value, determined by the level of energy potential of biogas in the "reference" resource (natural gas) and its cost
The costs associated with gas production	XX "Auxiliary production"/ X "Biogas production"	Resources consumed (cost accounts)	20	Amount of actual costs
costs associated with the production of electricity from biogas	XX "Main production"/ X "Production of electricity (thermal energy)"	Resources consumed (cost accounts); "Auxiliary production"/ X "Biogas production"	40 (20+20)	Amount of actual costs
The consumed biogas is written off for electricity production	XX "Main production"/ X "Production of electricity (thermal energy)"	XX "Materials"/ X "Biomass of municipal waste":	20	At fair value for the amount of resulting biomass losses

		X.2 "Gaseous resource produced from biomass of municipal waste"		
Income from the use of a gratuitously obtained gaseous resource is reflected	XX "Income of future periods"	XX "Other income from current activities"	20	At fair value for the amount of resulting biomass losses
the costs of biogas extraction and electricity production (taking into account the gaseous resource)	XX Expenses/X "Actual cost of products, works, services"	XX "Main production"/ X "Production of electricity (thermal energy)"	60	Amount of actual costs
Revenue from electricity sales	XX "Buyers and customers"	XX "Income from current activities"	80	Sale price
financial result from the production of electricity and its sale	XX "Profit (loss) from current activities"	XX "Profit and loss"	40	-
disposal of a renewable energy resource as an element of natural capital	XX Attracted natural capital	XX "Depletion (consumption) of mineral resources"/ X "Renewable gaseous resource"	30	Fair value, determined by the level of energy potential of biogas in the "reference" resource (natural gas) and its cost
depletion of mineral resources by the amount of gas consumed from the landfill body	XX "Depletion (consumption) of mineral resources"/ X "Renewable gaseous resource"	XX Mineral resources /X Reneable gaseus resources	30	Fair value, determined by the level of energy potential of biogas in the "reference" resource (natural gas) and its cost

Note- own development

4 Discussion

We consider the presented research to be a completed work containing new scientific and practical results in the field of accounting for municipal waste at unequipped landfills. These results were obtained in order to form an information base for making managerial decisions in the field of municipal waste management, greenhouse gases and the development of socio-economic sustainability of the state.

Considering the biogas industry at unequipped landfills from the point of view of the possibility of achieving climate neutrality, it should be noted about the implemented mechanism - carbon emissions quota trading. This mechanism was developed by international climate change programs. In the context of the introduction of trading quotas for greenhouse gas emissions in domestic practice, there is currently no regulatory regulation in terms of organizational issues related to the issuance of permits for trading quotas, as well as their accounting. There are no corresponding proposals in IFRS either. In this regard, in order to form an information base on greenhouse gas emissions quotas, it is advisable to develop methodological provisions on accounting, including for organizations engaged in municipal waste disposal and landfill gas extraction, taking into account the specifics of the activities of the organizations under study. Consideration of reserves of emission quotas as an object of accounting requires deep scientific understanding, taking into account the requirements of modern market mechanisms for regulating the state of the climate. In this regard, we believe that the elaboration of the rules for

accounting for carbon emissions trading can be an independent scientific study, the results of which will safely fit into the integrated greenhouse emissions management system and will complement the results we have already obtained in the field of biogas industry at unequipped landfills

5 Conclusion

Based on the conducted research , the following final provisions can be distinguished:
- The recognition of the new accounting object "biomass of municipal waste" is scientifically justified. So, for organizations operating unequipped landfills, the "biomass of municipal waste", as an object of accounting, *is organic substances in the composition of municipal waste that have energy potential, changing a materially inhomogeneous form to a gaseous one under the influence of natural processes in nature; subsequently, this gaseous form can be used in the process of energy production. The biomass of municipal waste should include "primary" biomass - waste from parks, squares and courtyards of plant origin, and "secondary" biomass - waste of consumption and production (similar to human waste), the bulk of which is food waste. According to the dynamic balance theory, "biomass of municipal waste" should be reflected in accounting and financial reporting forms as part of short-term assets.*
For organizations that dispose of municipal waste and extract biogas (with subsequent use in energy production) at operated and closed unequipped landfills, we have proposed:
- to take into account the biomass of municipal waste on account XX "Materials" with additional second and third order subaccounts to be opened: X "Biomass of municipal waste" / X.1 "Biomass of municipal waste in solid state", X.2 "Gaseous resource produced from biomass of municipal waste" at fair value determined based on the level of energy potential biomass of municipal waste in the energy potential of the reference raw materials (livestock biomass) and the market value of the reference raw materials. The transition of a resource from a solid state to a gaseous state should be displayed by debit of the account XX "Materials"/ X "Biomass of municipal waste" / X.2 "Gaseous resource produced from biomass of municipal waste" and Credit XX "Materials"/ X "Biomass of municipal waste" / X. 1 "Biomass of municipal waste in solid state";
- include biomass of municipal waste (in a gaseous state) in the cost of electricity production at a fair value determined by the level of energy potential of biomass of municipal waste in the "reference" resource (biomass of livestock) and its market value;
- maintain parallel accounting of a long-term asset - biogas reserves, representing a renewable gaseous resource, as an element of renewable natural capital at fair value, determined by the level of the energy potential of biogas in the "reference" resource (natural gas) and its cost. The fair value of the formed renewable energy resource should be fixed - debit of the account XX "Mineral resources" /X "Renewable gaseous resource" and the credit of the account XX "Attracted natural capital". Pumping of a renewable energy resource should be reflected as depletion of biogas reserves using the passive account XX "Depletion (consumption) of mineral resources";
In the context of decarbonization of the economy, municipal waste management and the development of renewable energy, the presented methodology allows: to take into account the "residual" value of organic waste (in the chain of transformation of substances "commodity –waste-secondary resource") in the total value of energy; to analyze the use of a secondary resource in the total value of energy resources of a region, region or country. The proposed method of accounting for biogas reserves, on the one hand, informs users of financial statements about the economic potential of an unequipped landfill, which increases the investment attractiveness of organizations, on the other hand, creates economic prerequisites for the use of greenhouse gases as renewable energy sources in order to reduce carbon dioxide emissions per unit of GDP.

References

1. Ritchie, H. Where do global greenhouse gas emissions come from? Accessed on 2020. [Online]. Available: https://ourworldindata.org/ghg-emissions-by-sector
2. Galcheva, A. Waste and climate: how to reduce emissions by upgrading landfills. Accessed on 2022. [Online]. Available: https://trends.rbc.ru/trends/green/6285e6159a7947bbcc15503a
3. The World Bank. Mass demonstration of support for measures to account for natural capital at the Rio summit. Accessed on 2012. [Online]. Available: https://www.vsemirnyjbank.org/ru/news/press-release/2012/06/20/massive-show-support-action-natural-capital-accounting-rio-summit
4. Vegera, S., Malei, A., Sapeha I., Sushko V. Information support of the circular economy: the objects of accounting at recycling technological cycle stages of industrial waste. Entrepreneurship and Sustainability Issues, V, 6 (1), pp.190-210, 2018. https://doi.org/10.9770/jesi.2018.6.1(13)
5. Bartolomeo, M. Environmental management accounting in Europe: current practice and future potential, European Accounting Review, Vol. 9: pp. 31-52 (2000)
6. Pahomova, N.V. & Rihter, K.K. & Vetrova M.A. Transition to the circular economy and the closed chain of supply as a factor for sustainable development, Bulletin of St. Petersburg State University. Economy. 33(2): 244-268 (2017)
7. Gray, R.H. Environmental accounting, managerialism and sustainability: is the planet safe in the hands of business and accounting, Advances in Environmental Accounting and Management, Vol.1: pp. 1-44 (2000)
8. D'Onza, G., Greco, G., Allegrini, M. Full Cost Accounting in the Analysis of Separated Waste Collection Efficiency: A Methodological Proposal. Accessed on 2016. [Online]. Available: https://books.google.by/books?id=lsAstAEACAAJ&dq=waste+cost+accounting&hl=ru&sa=X&ved=0ahUKEwj2t7q8utzaAhVKaFAKHfn OBFo4ChDoAQg5MAM
9. Parajuly, K. Circular Economy in E-waste Management: Resource Recovery and Design for End-of-Life. Accessed on 2017. [Online]. Available: https://books.google.by/books?id=Ys2XtAEACAAJ&dq=circular+economy&hl=ru&sa=X&ved=0ahUKEwi_6MLhsNzaAhXGL1AKHaS UDQc4HhDoAQhhMAk
10. Masko, L.V., Gavrilov R.V. Green economy in the context of sustainable development: economic essence. Studia Universitatis Moldaviae, nr. 7(137) Seria“Stiinte exacte si economice” - p. 187-196 (2020)
11. Lisina Yu.B., Ivanovskaya A.V. Actual problems of formation of environmental accounting. Accessed on 2019. [Online]. Available: https://www.researchgate.net/publication/338353709_Aktualnye_problemy_formirovania_ekologiceskogo_uceta
12. Richard J., Shirobokov, V.G., Altukhova, Yu.V. Information support for the analysis of sustainable development. Accounting, analysis and audit. Issue 1. Strategic economic analysis and its information support. Functional and cost analysis. p.16-19 (2010).
13. Vegera, S., Malei, A., Romanova, O., & Sushko, V. Environmental innovation as a part of mineral resources accounting and financial reporting development for natural capital involvement in management decision-making process. Marketing and Management of Innovations, 4, 244-262 (2018). https://doi.org/10.21272/mmi.2018.4-22
14. Bazylev, N. I. Natural (planetary) capital and its role in the economy Bulletin of the Belarusian State University of Economics. Vol. 4. - p. 5-10, (2014).

15. Bobylev, S.N., Zakharov, V.M. Ecosystem services and economics. — M.: OOO "Tipografiya LEVKO", Institute of Sustainable Development/Center for Environmental Policy of Russia, Vol. 69, № 11. – P. 2069-2074 (2010).
16. The Law of the Republic of Belarus on July 20, № 271-3, 2007 “On waste management”. [Online]. Available: https://enp.by/zakon-ob-obrashchenii-s-othodami/
17. National Statistical Committee of the Republic of Belarus. Accessed on 2022. [Online]. Available: https://www.belstat.gov.by/ofitsialnaya-statistika/makroekonomika-i-okruzhayushchaya-sreda/okruzhayuschaya-sreda/sovmestnaya-sistema-ekologicheskoi-informatsii2/g-energetika/g-4/?special_version=Y
18. Oleshkevich M.M., Rudenia A.S. Renewable energy sources in electric power in industry of Belarus. Proceedings of CIS higher education institutions and power engineering associations. Vol.(3):49–61 (2014).
19. Soufera S., Zaborski O. Biomass as an energy source [Biomass Conversion Processes for Energy and Fuels]. Moscow: Mir, p.368 (1985).
20. Plachkova S.G., Plachkov I.V. Electric power industry and environmental protection. Functioning of energy in the modern world. Vol.5. (2013). [Online]. Available: http://energetika.in.ua/ru/books/book-5/part-3/section-5
21. Richard, J. Accounting: Theory and Practice. France: Finance and Statistics.p.158 (2000).
22. The Law of the Republic of Belarus No. 57-Z. from July 12, 2013 «On Accounting and Reporting». [Online]. Available: https://pravo.by/document/?guid=3871&p0=h11300057
23. Conceptual foundations of financial reporting. International Financial Reporting Standards. [Online]. Available: https://www.minfin.gov.by/upload/accounting/mfso/conceptual_framework.pdf
24. Methodological recommendations for determining the morphological composition of municipal solid waste in cities with varying degrees of improvement."Belzhtlproekt Institute", (2000) [Online]. Available: https://vtoroperator.by/sites/default/files/doc/metodicheskie_rekomendacii_po_opredeleniyu_morfologicheskogo_sostava_tko.pdf
25. National Accounting and Reporting Standard "Reserves" Resolution of the Ministry of Finance of the Republic of Belarus 22.12.2022 №64 [Online]. Available: https://www.minfin.gov.by/upload/accounting/acts/postmf_281222_64.pdf
26. IFRS 13 "Fair Value Measurement". [Online]. Available: https://www.accaglobal.com/cis/ru/qualifications/dipifr-rus/exam_structure/technical-articles/IFRS13_fair_value_measurement.html
27. Biogas enrichment. Eco-friendly technologies for a secure future. 2020. [Online]. Available: URL https://www.airproducts.ua/Biogas-brochure.pdf
28. Maley, E. B., Trubovich., R.O. Energeticheskiy potentsial otkhodov kommunal'nogo khozyaystva v sisteme bukhgalterskogo ucheta (Nachalo) [Energy potential of municipal waste in the accounting system] (Beginning) (Minsk: Bukhgalterskiy uchet i analiz , 2017)
29. Resolution of the Ministry of Finance of the Republic of Belarus. No. 112 dated 31.10.2011 "On approval of the instructions on accounting of gratuitous assistance"
30. Vegera, S.G. Metla, O.S. Otsenka i bukhgalterskiy uchet mineral'nykh resursov kak chasti prirodnogo kapitala: problemy i puti resheniya [Assessment and accounting of mineral resources as part of natural capital: problems and solutions].(Minsk: Bukhgalterskiy uchet i analiz, 2015)