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NUTRIENT MANAGEMENT AT BIOGAS PLANTS IN LATVIA

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RESPONSIBLE ORGANISATION: LATVIAN STATE ENVIRONMENTAL SERVICES

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SUSTAINABLE BIOGAS

Interreg Central Baltic

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1. INTRODUCTION

1.1. Report objective

This report is the result of the D.T1.1 project activities under the Sustainable Biogas project. The objective of the Sustainable Biogas project co-funded by the EU Interreg Central Baltic program is to promote sustainable biogas, considering water protection. The project is implemented by John Nurminen Foundation, ELY Centre in Southwestern Finland, Finnish Biocycle and Biogas Association, Latvian State Environmental Service and Latvian Biogas Association.

The objective of this report is to review the existing biogas production practices and regulation in Latvia, from the nutrient management point of view. The main sources of nutrient discharges to the environment are biogas plants where storage of raw materials and primary processing take place, and locations where digestate dehydration, storage and application to soil is provided. Deficiencies in the technologies used to process nutrient-rich biomass in biogas plants can pose a risk of nutrient management and cause pollution of watercourses.

The report comprises an overall description of biogas plants in Latvia and their characteristics as compared to other countries of the Baltic Sea region as well as a more detailed review of the Zemgale region. Thereafter, the legislative framework covering permitting and supervision over the use of the output is described, paying special attention to matters that may directly or indirectly affect nutrient leakages in the biogas sector. Finally, conclusions are made about overall situation relating to the biogas production in Latvia and main nutrient management problems and shortcomings as well as examples of best practices relating to nutrient management are identified.

1.2. Biogas production in Latvia

In 2020, 52 biogas plants were operated in Latvia with the overall installed electric power equal to 57.823 MWe, that produced 305.6 GWh of electricity. Among them, there are 5 biogas cogeneration plants in waste landfills with their total installed electric power equal to 8.875 MWe that generated 29.84 GWh or 10% of the total electric energy generated by all biogas cogeneration plants in 2020. The biogas plants operating in municipal waste landfills are not considered within the framework of this project as those do not produce digestate and are subject to other legislative acts.

In 2020, other 47 biogas plants produced digestate from various raw materials, including 44 plants that used agricultural and food production waste, 2 plants used industrial wastewater sludge and 1 plant used municipal wastewater sludge as feedstock. These biogas plants processed 1.66 million tons of biomass, including 779 thousand tons (47%) of manure, 563 thousand tons (34%) of crop cultivation waste, 232 thousand tons (14%) of food industry waste 82.5 thousand tons (5%) of municipal and industrial wastewater sludge. Various green biomasses amounted to 8% and corn silage amounted to 21% of the total volume of raw materials in Latvia.

In 2020, one biogas plant used biogas from a food (beer) production wastes for heat production only, while 46 others had cogeneration units with total installed electric power 48.948 MWe (Table 1).

Table 1. Number of operating biogas plants, installed electric power and electric energy generated in Latvia.

Year	Number of biogas plants	Installed electric power, MWe	Generated electricity, GWh annually
2017	50	51.961	349.4
2018	50	52.561	314.5
2019	49	51.881	286.0
2020	46	48.948	285.9
2021	43	46.935	n/a

Amount of digestate produced in these 47 biogas plants totalled 1.53 million tons or 33% of all organic fertilizers used for fertilisation in Latvia in 2020. The digestate contained 2.94 thousand tons of phosphorus pentoxide (P_2O_5), or 1.28 thousand tons of pure phosphorus thus lowering the need of mineral phosphorus fertilizers by 8.6% in Latvia in 2020.

The use of digestate for fertilizing of soil was made easier by decentralised location of biogas plants in Latvia, that decreased the cost of raw materials and digestate transportation and facilitated return of nutrients to the circulation, see Fig. 1.

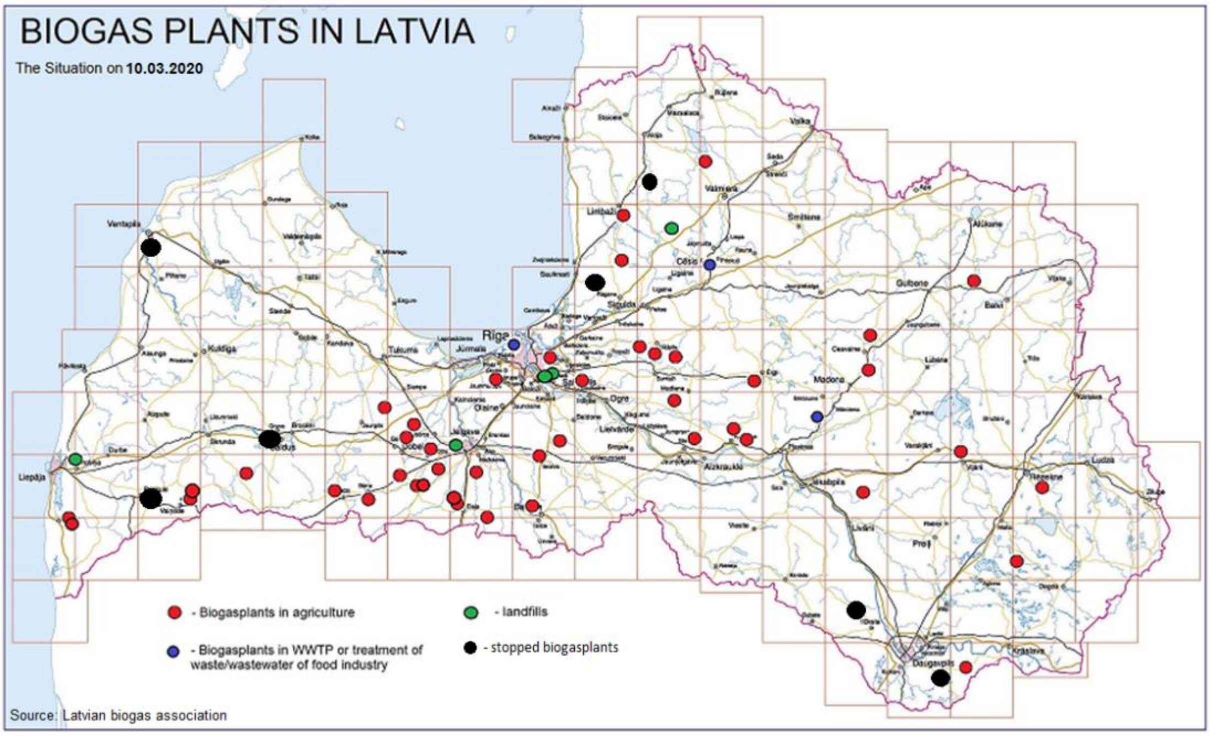

Fig. 1. The number and location of operating and non-operating biogas plants in Latvia. (Source: Latvian Biogas Association, 2019).

In the picture, red points are used to show agricultural biogas plants; landfill biogas installation are depicted in green and biogas cogeneration installations at wastewater treatment facilities are shown in blue. Black points show closed biogas plants.

The number of biogas plants and total installed electric power has decreased over the last few years, (Table 1). It can be explained by gradual reduction in state support for biogas plants running more than 10 years as well as by frequent amendments of legislative acts that govern the biogas sector which considerably complicates business activities relating to biogas production.

This tendency continued in 2020 when two biogas plants stopped operation in the Zemgale region (those 2 plants not depicted in black in Fig. 1).

As compared to other European biogas producers, for example, compared to Finland, the biogas plants in Latvia can be characterised by comparatively high proportion of utilized energy crops or agricultural wastes and comparatively low proportion of biogas installations at wastewater treatment plants or landfills, see Fig. 2.

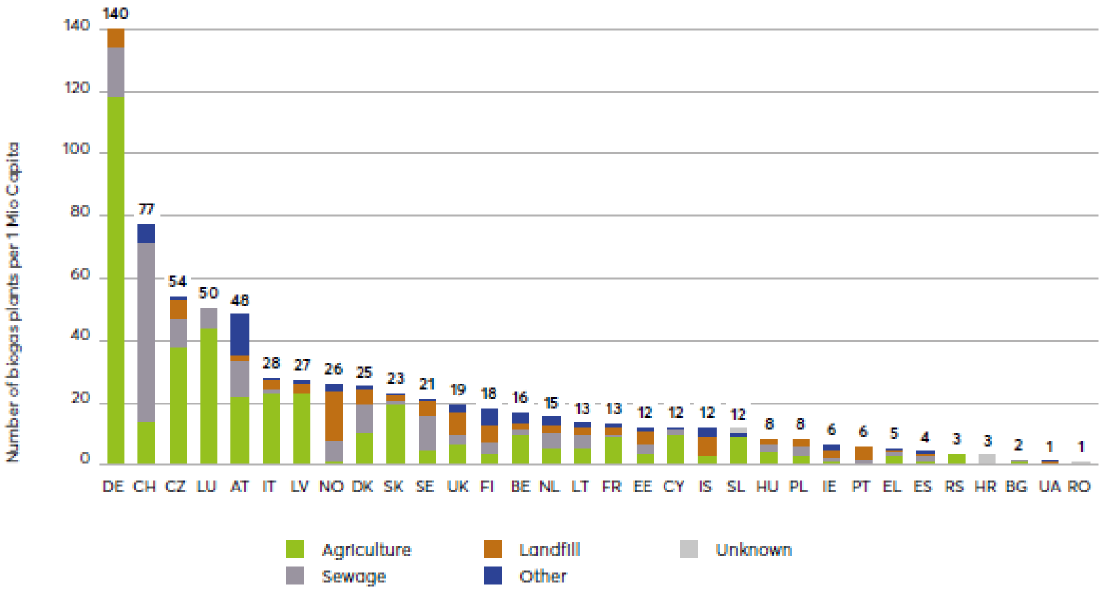

Fig. 2. The number of biogas plants per 1 Mio Capita in European countries in 2019. (Source: EBA statistical report 2020, provided by Latvia Biogas association)

All produced biogas was used in cogeneration units for electricity and heat production, and there are no biogas plants producing biomethane for transport in Latvia in 2021.

2. NUTRIENT MANAGEMENT IN ZEMGALE REGION

Pollution resulting from agricultural activities accounts for majority of phosphorus and nitrogen compounds that reach the Baltic Sea and the Gulf of Riga after being discharged into rivers. The risk of point source pollution is mainly associated with farms and biogas plants that use various types of biomasses, including manure, silage, food industry waste and sludge from wastewater treatment plants (WTP).

Agricultural fertilizers, including slurry and scattered leftover manure contain valuable nitrogen and phosphorous compounds that are easily available for plants; however, their excessive application may cause pollution of surface and groundwaters with nitrates and soluble phosphorous compounds that promote water eutrophication. Also, leakages from raw material storages of biogas production, e.g. urine or silage effluent may cause dangerous surface and groundwater point source pollution in the surroundings of biogas plants. If those highly polluting substances are placed into a digester, then as a result of anaerobic digestion digestate is generated, being an eco-friendlier fertilizer as compared to manure and silage effluent due to its greater stability against decomposition during its storage and application.

Although during biogas production the majority of organic substances is transformed into less active compounds, it should be noted that, in Latvian climate, leaching is common to soils, i.e. waters ooze through soil and take away many chemical compounds, including nitrogen and phosphorus, which is not desirable in respect of environmental pollution and agricultural performance [1].

Zemgale region is included in the list of environmentally sensitive areas, so use of digestate for fertilisation shall not exceed the established limitation for nitrogen application 170 kg/ha annually [2].

Latvian laws do not set limitations for the use of phosphorus for application of digestate obtained from manure or similar organic biomasses. Moreover, if digestate is produced from wastewater sludge, the limit for the use of phosphorus established by the law for the use of processed sludge for fertilizing, i.e. 30 kg/ha annually, is to be complied with [3].

The amount of phosphorus in Latvian soils is comparably low except for some individual fields, therefore, limits for the use are generally secondary as compared to the limits set for the use of nitrogen.

According to the data obtained during inspections at plants, in 2020, biogas plants in the Zemgale region generated 515,844 tons of digestate. The content of phosphorus pentoxide (P_2O_5) in the digestate totalled to 1.413 tons, while the volume of nitrogen totalled to 2.581 tons, which correspondingly reduced the need for application of phosphorus and nitrogen mineral fertilisers in the Zemgale region in 2020.

2.1. Investments, further plans for biogas plant operation

The number of biogas plants built in the Zemgale totals to 16. Among them, 15 biogas plants use agricultural biomasses, and one biogas plant is made for burning of landfill gases released from municipal waste. Considering the goal of the project, municipal waste landfill biogas plants are not covered by the project activities.

Most biogas plants were constructed by using state support (up to 40% of investments) and are running thanks to mandatory electricity purchase for a price higher by 0.077 - 0.160 EUR/kWh (in dependence on electric power) compared to the market price of electricity.

Currently this support mechanism is reduced and legislation on conditions for biogas plant operation is modified, creating problems for biogas plants operation in the future.

2.2. Agricultural biogas plants

Among 15 biogas plants based on agricultural raw materials in the Zemgale region, two biogas plants use only agricultural cultivars or their residues, one uses only cattle manure and other biogas plants use agricultural biomass co-fermentation with food industry by-products, food waste, industrial wastewaters and WTP sludge, Table 2.

Raw biomass used as a feedstock in biogas plants in the Zemgale region was 515.8 thousand tons or 33.7% of biomasses used in biogas plants in Latvia in 2020. Livestock manure treated in anaerobic process was 296.3 thousand tons corresponding to 57.4% of used feedstocks at biogas plants in the Zemgale region.

Table 2. Number of biogas plants in the Zemgale region and amounts of raw materials used in 2020 (thousand tons a year). AW - crop production waste; LW - livestock waste; FW - food and food industry waste; IWW - industrial wastewaters; MWW - municipal wastewater treatment plant sludge.

Used raw materials	Number of plants	Raw materials, th t/a					
		AW	LW	FW	IWW	MWW	Sum
AW	2	18.5	0.0	0.0	0.0	0.0	18.5
LW	1	0.0	39.6	0.0	0.0	0.0	39.6
AW+LW	3	25.2	55.9	0.0	0.0	0.0	81.1
AW+LW+FW	3	12.1	18.7	7.4	0.0	0.0	38.2
AW+LW+FW+IWW	2	29.1	14.7	9.4	1.5	0.0	54.8
AW+LW+FW+IWW+MWW	4	83.1	167.4	15.7	2.6	14.9	283.7
Total	15	168.0	296.3	32.6	4.1	14.9	515.8
Percent of total volume		32.6	57.4	6.3	0.8	2.9	100.0

Table 3. Amount of digestate and nutrients produced in biogas plants in the Zemgale region in 2020. AW - crop production waste; LW - livestock waste; FW - food industry waste; IWW - food industry wastewaters; MWW - municipal wastewater treatment plant sludge; P_2O_5 - diphosphorus pentoxide; P (N) - phosphorus (nitrogen).

Used raw materials	Number of plants	Digestate, th t/a	P_2O_5, %	P_2O_5, th, t	P, th, t	N, %	N, th, t
AW	2	13.5	0.12	0.016	0.007	0.48	0.065
LW	1	94.5	0.26	0.250	0.109	0.64	0.582
AW+LW	3	79.5	0.22	0.176	0.077	0.51	0.402
AW+LW+FW	3	30.9	0.13	0.041	0.018	0.22	0.066
AW+LW+FW+IWW	2	130.2	0.11	0.141	0.061	0.35	0.458
AW+LW+FW+IWW+MWW	4	250.6	0.31	0.789	0.344	0.40	1.009
Total (average)	15	599.2	(0.24)	1.413	0.616	(0.43)	2,581

Digestate produced in biogas plants at the Zemgale region was 515.8 thousand tons that contained 616 t recycled phosphorus (P) and 2581 t recycled nitrogen (N) utilised to replace commercial fertilisers in the Zemgale region in 2020.

2.2.1. Raw material storage

In the Zemgale region, the total volume of silage used by 14 biogas plants totalled to 152,728 tons in 2020. It should be noted that, when green biomass with dry content less than 35% is stored, silage effluent may release from a heap. For example, the volume of leakages from silage may reach 35 litres per one ton of green mass if the moisture of green biomass placed in the storage is 25% [1]. This means that, on average, given that green biomass moisture totals to 25%, silage effluent from 11,700 tons (average silage amount in the Zemgale region) may produce as much as 400 tons of liquid at one biogas plant. Silage effluent is one of the most concentrated environmental pollutants, and its biological oxygen consumption may reach 12,000 - 32,000 mg/l [1]. Improper preparation and storage of silage may cause serious environmental pollution. Although usually efforts are made to storage green mass silage with dry mass content exceeding 30%, sometimes this is impossible due to precipitation during harvest period, particularly, when corn or other energetic plants are harvested in the autumn. Also, effluent from silage trench increase due to increased heigh of pile and pressure inside the heap. Additional factors for leakage from piles and loss of organic mass are routine opening the silage pile during unloading of silage, and improper resealing of the pile, which can lead to an 8-15% reduction in organic matter during storage.

To prevent nutrient runoffs from silage into environment, the following provisions for storage of silage in trenches and heaps are provided for in the Cabinet Regulation No. 829 (23.12.2014) “Special requirements for performance of polluting activities at animal housing” [4]:

- The bottom of a silage trench is to be made of hermetic material that is durable against silage impact and possible mechanical damage during loading or unloading.
- The base of a trench is to be inclined towards the direction of silage unloading, and a crosswise channel to direct silage effluent to an accumulation reservoir is to be arranged at its lower end.
- When storing silage in a heap in a field, a film or layer of absorbing material is to be laid under a heap. The laid film is to be connected to a film covering the heap or a heap is to be covered with a layer of an absorbing material.
- Silage heap is to be arranged at places where the slope of a field does not contribute to formation of a surface leakage and silage effluent runoff. The silage heap is to be placed so that it meets the requirements set to protection zones of surface water facilities, but not closer than 30 meters from a river, brook, ditch, melioration system wells or well, from which water is obtained for a household.
- If a silage heap is arranged at the same place each year, the base of the heap is to be made of concrete. The base of the site is to be inclined towards the silage effluent runoff collection reservoir. Around the site for a silage heap, a trench for silage effluent runoff or an edge with a height of 0.2-0.3 m is to be arranged.
- Silage effluent may be stored at a urine or liquid manure storage if the volume of silage effluent does not exceed five percent of the volume of liquid manure.
- Release of silage effluent into environment is not permissible.
- Silage effluent must not be spread during the period from December 1 to March 1 as well as on frozen, wetlands or lands covered by snow.

The results of inspections have shown that in Zemgale region storage and use of silage at biogas plants comply only partly with regulation and signs of silage runoff to the environment are frequently noticed (Table 4).

In 2020, manure was used as a raw material for biogas plants at 14 biogas plants in the Zemgale region, i.e. total 272.7 th tons or 57.4% of all raw materials (Table 2). Mainly cattle manure was used for biogas production (77%) as well as smaller proportions of poultry manure (16%) and pig manure (7%).

Usually in the Zemgale region, slurry is pumped from nearby farms to a biogas installation at biogas plants by using a pipeline or channel system. Such a system results in the lowest nutrient loss and less odour. To eliminate odours, receiving reservoirs at many biogas installations have connectors for connecting to output pipes of mobile cisterns. Solid manure and solid biomasses are transported and unloaded into mixing reservoirs. Heavy equipment are used for transportation of manure from distant farms.

2.2.2. Raw material processing at digestion installations

Agricultural biomasses, livestock waste and other types of biomasses, including organic waste from food industry, energy crops and wastewater sludge, are processed at biogas plants, by using an anaerobic digestion process.

Biogas plants in Latvia use wet digestion technology (dry matter content does not exceed 10%), by processing large volumes of substrate (2,000-5,000 m^3) in digesters for 21-60 days in a mesophilic mode at 37-40 °C temperature. To accelerate the digestion process, substrate is mixed, by using mechanical rotary mixers (13 installations) or mixing with biogas (one installation). Usually, two digesters connected in series are used, where digestion takes place in the first reactor, and post-fermentation takes place in the second reactor. From digesters, digestion residues are pumped to a digestate storage and/or facility for solid-liquid separation.

2.2.3. *Digestate storage*

No special regulations for storing digestate have been developed so far, therefore, digestion residues are governed according to Cabinet Regulation No. 829 for storage of slurry “Special requirements for performance of polluting activities at animal housing” [4] that mention the following main requirements to the storage of organic fertilizers:

- The capacity of a reservoir is sufficient for accumulation of digestion residues for at least eight months.
- Liquid and semi-liquid manure are to be stored in closed storages or with a permanent natural or artificial floating covering layer.
- The loading system is designed so that it does not destroy a floating covering layer.

Additional requirements to a lagoon type of storage:

- Storage base layer is to be at least 50 cm above the maximum groundwater level.
- Base and walls of a storage are to be sealed by using waterproof material, the edges of which are to be attached at the top of the storage.
- Storage shall be fenced.

As a result of inspection at existing biogas plants in Zemgale region, it was established that “liquid digestate is kept in storages that correspond to building regulations”. The separate problems identified and relating to digestate storage are mentioned in Table 4.

2.2.4. *Digestion waste application*

The Nitrate Directive and Cabinet Regulation No. 834 “Requirements to water, soil and air protection from contamination resulting from agricultural activities” [5] stipulate that the volume of nitrogen applied by using manure and digestates per one hectare of agricultural land may not exceed 170 kg, which is to be calculated based on the volume of nitrogen in manure and digestates.

If the volume of nitrogen in manure and digestates produced by a farm exceeds 170 kg per one hectare of available agricultural land annually, operator needs to provide written evidence confirming transfer of manure and digestates to other farms or their use for another purpose.

To determine the amount of digestate application to soil precisely, an annual plan for fertilizing the crops at each field is to be developed based on agrochemical analysis of soils. This is to be done not later than by the time of sowing or planting cultivars, and by beginning of vegetation for perennial sowings and plantings. Data on the results of an agrochemical survey and analysis of soils may not be older that five years. One soil sample is taken per area (field) smaller than six hectares, stipulating the relevant field number or name in the results of analysis.

When determining the need of nitrogen for a cultivated plant, planned harvest and its quality, nitrogen (nutrient) removal for relevant cultivated plants, content of organic matter in soil, rate of use of manure in previous year, applied crop residues and green manures, after-effects of the previous crop and data on the content of mineral nitrogen in soil should be considered.

Samples to detect the amounts of nutrients in manure and digestates should be taken before emptying manure or digestate leakage storage.

For the development of the fertilization plan, in order to determine the amounts of relevant nutrients (N, P_20_5 and K_2O) depending on the type of soil and planned harvest in Latvian circumstances, it is recommended to use methodological materials, e.g. Standards for fertilizing agricultural plants [6].

To decrease the discharge of volatile nitric compounds, e.g. ammonia, and prevent contamination of soil with phosphorus and nitrogen compounds, great attention is to be paid to a proper application technique.

Biogas plants in the Zemgale region use both broadband spreaders and band-like application of digestate.

Many biogas plants do not have their own agricultural lands, and digestate is transferred to other operators, which complicates the control over digestate application to soil.

In the circumstances of market economy, eco-friendly digestate application results in decreased use of mineral fertilisers, therefore, entrepreneurs gradually purchase or lease modern digestate application machines to ensure minimum nutrient loss in the process of application.

3. LEGISLATION AND PRACTICE

All biogas plants shall obtain permits for performance of polluting activities of a relevant category (C, B or A) before starting production.

3.1. Procedures for issuance of permits for installations with various types of waste

In order to receive a permit, an operator shall file a submission to Regional Environmental Board of the State Environmental Service (hereinafter - Board) at least 150, 60 or 30 days prior to the intended commencement of polluting activities of category A, B or C respectively. According to Cabinet Regulation No. 1082 "Procedure by which polluting activities of category A, B and C shall be declared and permits for the performance of category A and B polluting activities shall be issued" [7].

If an operator is unable to determine whether a polluting activity corresponds to category A, B or C then operator should submit to Board a clarifying information regarding the production capacity or other indicators specified in the Law On Pollution [8] or in Annex 1 or 2 [7]. The Board shall provide an opinion to operator regarding the category of the polluting activity.

After reviewing the application, the Board determines whether an environmental impact assessment (EIA) is required. If the EIA procedure is unnecessary the Board issues Technical regulations for intended activities in accordance with the requirements of the "Law On Environmental Impact Assessment" [20]. Technical regulations shall be prepared also for polluting activities listed in Annex of Cabinet Regulation No. 30 of 27 January 2015 "Procedures by which the State Environmental Service shall issue technical regulations for the intended activity" [22].

Preparation of Technical Regulations is also mandatory for polluting activities listed in Annex of Cabinet Regulation No. 30 of 27 January 2015 "Procedures by which the State Environmental Service shall issue technical regulations for the intended activity" [22] and those activities include also the construction or installation of biogas equipment.

The technical regulations set out the following environmental protection requirements, which are relevant for the operation of biogas plants:

- Environmental quality limit values and emission limit values for ensuring the quality of surface and groundwater, air, soil and other environmental territories.
- Site requirements, paying particular attention to watercourses and bodies of water and paying attention to particularly sensitive areas. Requirements for the performance site of the activity, paying special attention to:
    - highly sensitive areas;
    - requirements for the protection of groundwaters;

- requirements for the waste management created by the activity.

The State Environmental Service issues technical regulations also if the activity is subject to an initial assessment but the intended activity includes construction, therefore technical regulations are issued for the construction of any biogas plant.

Technical regulations shall be prepared based on the information submitted by the applicant, public comments and proposals, initial assessment performed in accordance with the Law “On Environmental Impact Assessment”, as well as the information provided by the relevant State and local government institutions and expert opinions.

Technical regulations shall be valid for five years, however, they may be amended by the Service during the entire validity term of the technical regulations, if:

- a negative impact of the pollution on human health or environment has been established which was not known until the day when the technical regulations were issued;
- amendments were made to the laws and regulations governing the area of environmental protection [22].

Such amendments in technical regulations should be provided for biogas plants in the Zemgale region, where the surface water and groundwater pollution was observed, mostly due to improper silage storage construction. Also, there are many biogas plants having operated with the same technical regulations more than 5 years in Latvia.

3.1.1. Environmental Impact Assessment (EIA)

If the activity complies with Annex 1 of the Law “On Environmental Impact Assessment” [20] or if the State Environmental Service has decided to conduct an environmental impact assessment of the proposed activity.

Impact assessment shall be performed on the basis of the information provided by the initiator and the information which has been obtained from the concerned State authorities and local governments, as well as during the participation process from the proposals submitted by the public [20}.

The stages of the process for assessment of the impact of provided activities are as follows: initial public discussion of provided activities, development of a program, preparation of a notification on assessment and public discussion, conclusion made by a competent institution on the above-mentioned notification and decision on acceptance of the provided activities including the conclusion made by a competent institution.

If biogas plants are planned to be located in an area of working farms that already have a permit for polluting activities, usually the environmental impact assessment does not have to be conducted for existing manure management as biogas plants are constructed in accordance with the existing building regulations, and manure is processed into an environmentally safer product, i.e. digestate.

3.1.2. Permits for performance of polluting activities

To obtain a permit for commencement of polluting activities, the operator submits an application to the relevant state institution, together with the documents specified in other regulatory enactments.

For issuance of the permit for polluting activities of category A, the relevant conclusions on the best available techniques are to be prepared and included in guidelines for the best available techniques.

Among 15 biogas plants in the Zemgale region, two biogas plants have permits of category C (biogas combustion installations), 12 biogas plants have permits of category B (waste management) and one has a permit of category A (waste management if the number of sows exceeds 750).

3.1.3. Permits for industrial or municipal wastewaters

Operator shall obtain a permit for performance of polluting activities of category C if operator has wastewater treatment installations with an output totalling to 5 to 20 cubic meters a day, a permit for performance of polluting activities of category B is needed if operator has wastewater treatment installations with output totalling to more than 20 cubic meters a day. If the wastewater is discharged to environment, Annex 1 and 2 of the Cabinet Regulation No. 1082 [7] is applicable.

Information on discharge of polluting substances to water is to be stipulated in an application for a permit for performance of polluting activities of category B as well as its impact on environment, initial and final concentration of polluting substances, an applicable treatment method and its performance indicators.

In the Zemgale region, there are no biogas plants with industrial or municipal wastewater treatment installations.

3.1.4. Permits for processing waste and raw materials of animal origin

Permit for performance of polluting activities of category C is needed if operator processes products of animal origin (except for dairy) and produces 0.1 to 1 ton of finished products a day, annex 2 to the Cabinet Regulation No. 1082 “Procedure for application for polluting activities of A, B and C categories and issuance of permits for performance of polluting activities of categories A, B and C” [7].

In case a permit is obtained for performance of polluting activities of category B, biogas plants are usually required to have a permit for installations providing storage of animal and plant waste (including animal fertilizers and slaughter-house waste), regeneration or processing (including composting and biogas installations) with their input totalling to 30 or more tons a day provided for by Annex 1 to the Cabinet Regulation No. 1082 “Procedure for application for polluting activities of categories A, B and C and issuance of permits for performance of polluting activities of categories A, B and C” [7].

A permit for performance of polluting activities of category A is mandatory for a biogas plants if the operator manages a large-scale farm, e.g., in the Zemgale region, a permit for pig farm waste processing is required because the number of sows exceeds 750.

3.2. Supervision

Activities of a biogas plant are supervised by different Latvian state institutions, particularly, environmental pollution is supervised by inspectors of the State Environmental Service. Biogas plants are subject to regular, but not less frequent than once in seven years, integrated inspections of their condition, including comprehensive assessment of activities and installations of a biogas plant, considering environmental protection. After inspections, plant operators receive a notification on revealed shortcomings and instructions for the period of their monitoring.

3.2.*1 Integrated inspections at biogas plants in Zemgale*

Within the framework of the project in 2020-2021, integrated inspections were carried out at all biogas plants in Zemgale, particularly, for assessing their condition and operation, considering the risk of surface and groundwater contamination.

As a result of the inspection, problems were documented in relevant sections of inspection forms referring to raw material and digestate storages, fermentation installations, groundwater monitoring installations and correspondence of a biogas plant technological process to legislative acts (Table 4).

Problems relating to protection of biogas plants surrounding area from contamination released into environment are partly indirectly caused by vague wordings of provisions of existing regulations. E.g., in general, release of silage effluent runoff into environment is prohibited by the legislation [4], however, simultaneously, silage may be stored in field storages that are associated with an increased nutrient runoff risk.

Table 4. Problems and environmental pollution risks associated with biogas plants operation in the Zemgale region.

Stage of biogas production process	Problem	Level of risk of environmental pollution:	Reference to the relevant regulation
Overall management of activities	The list of operator's duties is not provided for operations procedure	average	Article 6 of the law "On contamination" [8]
Overall management of activities	Technical regulations for polluting activities have not been updated in more than 5 years	average	Article 24 of Cabinet Regulation No. 30 [22]
Raw material storage	Leakages to the environment from stationary silage storages/trenches	very high	Cabinet Regulation No. 829 [4]
Water supply and wastewater management	Missing confirmations of transfer of household wastewater to a local wastewater treatment plant for management	average	Para. 43 of Cabinet Regulation No. 34 [9]
Raw material storage	Leakages to the environment from silage storages/trenches	very high	Paragraph 6 of the Cabinet Regulation No. 829 [4]
Fermentation process	The volume of silage effluent runoff provided into a fermenter is not accounted for	average	Para. 21.3 of the Cabinet Regulation No. 560 [10]
Fermentation process	The volume of biomass input stipulated in the permit has been exceeded	low	Para. two of article 31(1) of the law "On contamination" [8]; para. five part one article 21 of the law "On environmental protection" [11]
Air pollution	The annual number of hours stipulated in the permit has been exceeded	low	Data stipulated in permits
Storage of chemicals and mixtures	The chemicals log book does not stipulate classification and marking of substances	low	Para. 2 of the Cabinet Regulation Regulations No. 795 [12]
Leakage monitoring	Silage effluent storages are not equipped with installations for groundwater monitoring	high	n/a
Leakage monitoring	Damaged groundwater monitoring installations, e.g. no well cover control, surface waters may get in wells	average	Cabinet Regulation No. 92 dated February 17, 2004
Fermentation waste storage	Capacity of digestate storages at individual plants is not enough for an 8-months' accumulation period; filling level of storages exceeds maximum allowable	high	Para. 5.1 Cabinet Regulation No. 829 dated December 23, 2014
Fermentation waste storage	No natural or artificial floating cover has been formed for digestate kept in lagoons	average	Para. 7.1 Cabinet Regulation No. 829 of 23 December 2014

	Separated fraction of digestate is stored in an area without an impenetrable anti-seepage cover protecting against water and pollutants	high	Cabinet Regulation No. 829 of 23 December 2014
Fermentation waste application	The laws do not establish maximum dose of phosphorus (P_2O_5) for fertilising soil by using digestate that does not contain wastewater sludge	average	Is not provided by the standard
Fermentation waste application	Test for biological contamination of digestate containing wastewater sludge is not provided before digestate application to soil	high	Is not provided by the standard
Waste management	Type of stored waste that is not stipulated in the permit	low	Data contained in the permit

Problems with the release of silage effluent into the environment at biogas plants may be due to contradictory or unclear wording of existing rules. For example, discharges of silage effluent into the environment are generally prohibited by law [4], but at the same time storage of silage is still allowed in the “field storages” facilities whose design conditions are not sufficient to prevent the risk of silage effluent leakage.

In the Zemgale region, on average, about 11 thousand t of silage is prepared and stored in one biogas plant. The storage of such industrial biomass requires well-constructed storages equipped with a watertight silage effluent collection and storage system. Current legislative acts provide that agricultural silage field storages are to be equipped with an edge or ditch around the perimeter for collecting leakages from silage storage, however, detailed measures providing impermeability of such an edge or a ditch is not mentioned in the regulations mentioned above.

There are no silage storages in the Zemgale region equipped with a groundwater monitoring well, which is an additional factor for uncontrolled runoff of silage effluent into the groundwater.

These problems are complex, and can be resolved, by documenting the problem, assessing the risks and by reconsideration of relevant legislative acts.

3.2.2. Surface water monitoring

Matters relating to the compliance with requirements of the Nitrogen Directive has been resolved in Latvia since 1994, when, in cooperation with the Scandinavian states (Sweden and Norway), creation of a sustainable agricultural leakage monitoring system was commenced. Currently, arrangement of surface water monitoring in Latvia is governed by the Cabinet Regulation No. 92 [13].

Surface water monitoring is not provided for biogas plants in Zemgale region. During integrated inspections, surface water condition has been visually assessed at biogas plants and adjacent territories. During inspections, leakages of wastewaters that cannot be classified as household wastewaters or stormwater have been visually observed in close proximity to the silage storages.

Silage effluent runoff may contaminate both surface and groundwaters, negatively affecting water quality, particularly, contaminating it with ammonia and nitrites, which is not allowable in accordance with para. 2.3.3 of the Cabinet Regulation No. 34 [9].

Leakage of silage effluent to surface waters has been observed in many biogas plants, especially where silage storage facilities are not equipped with a functioning silage effluent collection and storage system, including a concrete base for the silage pile, a transverse channel at its lower end, a silage collection tank, and system for transferring of effluent from the storage tank to the fermenter or digestate storage.

3.2.3. Groundwater monitoring

When designing a new fermentation tank or lagoon type storage, shallow groundwater quality monitoring system is to be arranged [16]. At least one well with a filter placed one to three meters deeper than a storage base is arranged along the possible groundwater flow, but not farther than 10 meters from a storage. The well may be substituted with a drainage system to be arranged under the base of a storage so that it is possible to take water samples as well as to ensure drain collector output to any watercourse, ditch or reservoir in accordance with regulations on standards for building hydrotechnical and melioration buildings.

To monitor groundwaters, biogas plants are to arrange monitoring wells at the lower part of fermentation reservoirs and digestate storages. Water samples are to be taken and analysed by a certified laboratory at least once a year. Most of the biogas plants comply with these regulations on groundwater monitoring.

Operators that manage a lagoon type of storage, in which wells are arranged, or a drainage system with a monitoring well, ensure supervision/monitoring, maintenance of a monitoring system as well as taking groundwater samples once a year before emptying a storage, and results of analysis are to be submitted to the Service within one month after receipt.

A certified laboratory defines such parameters for groundwaters as total nitrogen (N_{tot}) and individual nitrogen compounds (nitrates, nitrites and ammonia) as well total phosphorus (P_{tot}) as main plant nutrient leakage indicators.

Legislation in Latvia does not contain a mandatory requirement for arrangement of water monitoring wells at silage storages. After having assessed the situation, in which the greatest contamination risks, according to observations were caused by silage storages of industrial volume, relevant amendments should be provided in regulations to ensure arrangement of an groundwater monitoring posts (control wells) for all silage storages at biogas plants.

3.2.4. Air pollution and odour monitoring

Gas (sulphur dioxide, SO2, nitric oxide, NOx and carbon oxide CO) emissions from combustion installations at cogeneration biogas stations (compression combustion engines) as well as gas (ammonia NH3, hydrogen sulphide H2S) emissions from raw materials and digestate storages and emissions during digestate application are main sources of air pollution.

The limits of air pollution from combustion installations at cogeneration stations (gas engines) is defined in accordance with the Cabinet Regulation No. 17 “Regulations for limitation of air pollution cause by combustion installations” [15]. The following allowable concentrations are defined for flue gases from biogas combustion in gas engines: SO2 – 40 mg/Nm3, NOx – 190 mg/Nm3un CO – 200 mg/Nm3. Combustion installations of average capacity (1-20 MW) measure air polluting emissions at least each three years. According to the results of inspection at biogas cogeneration stations in Zemgale region, emissions from combustion installations at biogas plants correspond to the volume of polluting gas emissions stipulated in permits. Insignificant exceeding of allowed operation time duration of cogeneration installations were observed in some biogas plants, but that would be allowable for compliance with a energy production goal have been established for every individual biogas plant.

Odour monitoring at biogas plants.

Individual plants may be required to develop an odour emission control project with odour monitoring posts and maximum odour limits in order to obtain a permit for polluting activities. If three complaints relating to odours are received, operator is to ensure odour concentration and emission flow measurements defined in the Cabinet Regulation No. 724 “Regulations for methods of defining odours caused by polluting activities” [17].

Raw material (manure, silage) storage areas, digestate storage reservoirs, lagoons as well as a process of digestate transportation and application are sources of odour at biogas plants.

Each permit for polluting activities stipulates the maximum odour levels and durations as well as defines an obligation to develop a plan for measures for decreasing odours during biogas production processes. For example, biogas production plant of category A in the Zemgale region has a plan for decreasing odour emissions, including also the following measures:

- Manure is to be collected regularly (pumping liquid fertilisers to the biogas plant), pigs stalls are to be washed, wetted and aerated.
- Digestate can be mixed at storages only before transportation of the fertiliser to the field.
- Ensuring impermeability of liquid fertiliser and digestate storages to decrease and activate ammonia evaporation and spread of odours.

Digestate lagoon surface in this biogas plant was covered by plastic cover that efficiently limits emissions of evaporable substances (NH3, N2O and H2S), odours and decrease the loss of nitrogen.

Additionally, odours, particularly, ammonia (NH3) and loss of nitrogen during digestate application can be decreased by using digestate acidification at a storage or before its application to a field, adding 2-3 kg of sulphuric acid per one ton of digestate [18].

The effect of acidification may be achieved also, by adding silage effluent to digestate, however, in this case, the maximum amount of silage juice (5%) allowed in regulation [4] for inflow in digestate storages should to be reconsidered and, if reasonably, to be increased.

3.3. Use of output

The Directive of the European Union (91/676/EEC) defines limitations (i.e. nitrogen limit in 170 kg/ha per year) to protect water sources from nitrate contamination resulting from agricultural activities. This directive and relevant Latvian regulation [5] should be observed for application of digestate into soil.

The restriction on the use of phosphorus, which is incorporated together with digestates that do not contain sewage sludge per hectare in agricultural areas, is not specified in the current Latvian legislation. As the recommended application rate for phosphorus can be considered 25 kg / ha per year [6].

However, if the digestate contains sewage sludge, the restrictions set up the annual application of ammonia nitrogen and the total phosphorus in the soil in 30 kg/ / ha N and 40 kg / ha P per year in accordance with Cabinet Regulation no. 362 Annex 11. "Regulations on the use, monitoring and control of sewage sludge and compost" [3].

3.3.1. Agriculture

The requirements and restrictions in the Nitrate Directive for the application of fertilizers in Latvia are currently applied in accordance with the Cabinet Regulation No. 834 [5].

These regulations lay down the same requirements for the use of digestate as for the use of manure:

- The amount of nitrogen from manure and digestate produced in a farm cannot exceed 170 kg per one hectare of agricultural land in a year.
- Fertilizers, including digestates, must not be spread on frozen, wetlands or lands covered in snow in places where it is forbidden in accordance with regulations on protective zones and specially protected areas.

- Fertilizers must not be spread in places where it is forbidden in accordance with regulations on specially protected areas.
- Fertilizers must not be spread within 10 m from reservoirs, water courses and artificial water bodies.
- Litter manure and digestates are to be mixed into soil within 24 hours after spreading.
- Liquid manure and urine are to be mixed into soil within 12 hours after spreading.

In the highly vulnerable zones, e.g. the Zemgale region, it is additionally prohibited to spread any manure and digestates within the period from October 20 to March 15, and green fertilizers from November 5 to March 15.

When using fertilizers, maximum allowable nitrogen doses per one hectare for various cultivars are to be complied with (Annex 3 to the Cabinet Regulation No. 834). A volume of nitrogen applied by a household may not exceed 170 kg per one hectare of agricultural lands annually. As a matter of exception, the nitrogen dose may be increased up to 220 kg/ha for highly productive crops, e.g. winter wheat with expected harvest exceeding 7 t/ha.

When estimating an area of agricultural land needed for application of manure (and digestate), the total number of agricultural animals at a household in livestock units is to be taken into account (1.7 livestock units are allowable per 1 ha) or fermentation residues depending on the volume of nitrogen and phosphorus [5]. Samples of manure and digestates are taken before emptying manure or digestate leakage storage.

In the Zemgale region, 4 biogas plants used wastewater sludge totalling to 14.9 thousand tons in 2020. Maximal share of wastewater sludge was up to 12.2% of the amount of raw materials used in one biogas plant in the Zemgale region. After finishing of anaerobic digestion process of substrate and wastewater sludge at temperatures at 38-40°C during more than 21-day period in digester, the produced digestate containing sewage sludge obtains the status of “treated sludge” as the minimal requirements for treatment process (temperature above 35°C and treatment time more than 21 day) are exceeded and, therefore, digestate can be used for soil fertilisation according to Cabinet regulation No. 362 [3].

Digestate analyses from 2 biogas plant using sewage sludge as feedstock shows low concentration of heavy metals compared to limit values set out in Annex 9 of the Cabinet Regulation No. 362 (Table 5).

Table 5. Limits of heavy metal concentration for fertilizing soils and their concentration in digestates from agricultural biomass and municipal wastewater sludge mixture in the Zemgale region. CD - cadmium; Cr - chrome; Cu, - copper; Hg - mercury; Ni - nickel; Pb - lead; Zn - zinc; Pb - lead; class 1 sludge - sludge containing smaller amounts of heavy metals and is usable for soil fertilisation.

Source	Concentration of heavy metals in the dry fraction, mg/kg					
	Cr	Cu	Hg	Ni	Pb	Zn	Cd
Heavy metal limits (Cabinet Regulation No. 362)	600	800	10	200	500	2.500	10
Requirements to class 1 sludge	<100	<400	<3.0	<50	<150	<800	<2.0
Digestate (Plant No. 1)	5.24	63	0.01	9.09	0.105	151	0.046
Digestate (Plant No. 2)	6.92	263	0.01	8.88	4.6	281	0.36
% of a limit (Plant No. 1)	0.87	7.88	0.10	4.55	0.02	6.04	0.46
% of a limit (Plant No. 2)	1.15	32.88	0.10	4.44	0.92	11.24	3.60

The table shows that the content of heavy metals in digestates of biogas plants in the Zemgale region produced with a mixture of agricultural biomass and wastewater sludge reached only 0.02% (Pb) to 32% (Cu) of the heavy metal limit values set for soil fertilisation. Therefore, in terms of heavy metal content, digestates are comparable to 1st class wastewater sludge, which provides that the sludge can be applied to agricultural lands.

Amount of digestate used for fertilisation should be calculated in accordance with plans for crop fertilizing by an operator managing 20 ha or more. For fruits and vegetables, the threshold is 3 ha according to Cabinet Regulation No. 834 [5].

Commercial fertiliser product is produced in one biogas plant in the Zemgale region where poultry manure based digestate is mixed with different minerals and then dried and pelletised. Produced mineral-organic fertiliser is packed in sacks and sold in Latvia and in other countries.

The produced organic fertiliser is an innovative product, and was provided with necessary documentation, including material safety data sheet, necessary for sale in Latvia or in EU market according to Cabinet Regulations No. 506 “Regulations regarding the identification, quality conformity assessment and sale of fertilisers and substrates” [14].

3.3.2. Landscaping

Digestate that contain wastewater sludge can be used for landscaping, e.g. for recultivation of granite quarries, etc., complying with standards defined by the Cabinet Regulation no. 362 of 2 May 2006 “Regulations regarding utilisation, monitoring and control of sewage sludge and the compost thereof” [3].

If wastewater sludge, including wastewater sludge based digestate, is used for landscaping, e.g. recultivation of degraded areas, the limit for a dry fraction of compost can be changed from 60 to 350 t/ha depending on the class of the wastewater sludge and type of the recultivated soil [3].

If the wastewater sludge based digestate is planned to be used as a fertilizer, the heavy metal content of the sludge is to be taken into account. For example, wastewater sludge from the city of Jelgava can occasionally contain concentration of chrome (Cr) that corresponds to the third quality class, that allows its use only for recultivation [17]. In order for such sludge to be used for crop fertilization, the required reduction in heavy metal concentrations can easily be achieved by adding 5-15% sludge to biogas plant substrates. In the Zemgale region, 4 biogas plants use wastewater sludge in the quantity totalling to 2.9 - 12% of raw materials, and the obtained digestate is used for fertilizing.

Currently, there is no data on use of digestate for landscaping in the Zemgale region.

3.3.3. Storage and disposal at landfills

An operator ensures useful application of wastewaters and wastewater sludge (including use of wastewaters and wastewater sludge for fertilizing soils and landscaping in accordance with the procedure provided for in regulations). The producer of sewage sludge and compost shall issue a copy of the quality certificate to the user of the sewage sludge and compost, paragraph 11, Cabinet Regulation No. 34 of 2 September 2002 [9].

All digestates in Zemgale region were used for soil fertilisation, and there were no digestate disposed at landfills.

4. CONCLUSIONS

The current situation related to biogas production in the Zemgale region, assessed in the project activities, can be briefly described as follows:

- Observed signs of leakages from silage storages at biogas plants are mainly caused by the operation of field silage storages of simplified structure.
- In some biogas plants silage effluent drainage and collection system is not in working condition due to lack of maintenance.
- There are no groundwater quality monitoring wells at silage storages, and the existing regulation sets no requirements for such monitoring wells.
- In the Zemgale region, the capacity of the digestate storages is not sufficient for a period of 8 months of digestate accumulation required for sensitive areas.
- At one biogas plant, the surface of digestate storage lagoons are not covered with an artificial or natural floating protective layer.
- To prevent environmental pollution, legislative acts and technical regulations related to biogas plants need to be amended, considering the risks associated with the industrial volume of silage.
- Mandatory analysis of bacteriological contamination for fertilisers containing wastewater sludge is not provided in legislation in Latvia.
- To minimise the risks associated with health and environmental safety, conditions for use of digestate containing processed wastewater sludge for fertilizing should be elaborated in legislation.

4.1. Challenges in the biogas sector

Today, new permits for biogas plants construction are not applied as the state support of electric power generation by obligatory procurement is decreased after 10 years of operation, and, according to the data provided by the LBA survey, biogas plant owners mainly plan to stop their activities within the following two to three years.

Biogas plants are also exposed to risks associated with standards contained in legislative acts that determine, for example, that the total volume of useful heat energy does not include heat energy used for own consumption. In such a standard, when estimating energy efficiency of electricity generation cycle, biogas plants are erroneously equalised to ordinary cogeneration stations that, for example, only work on natural gas and producing only one product, i.e. energy, while the biogas plants produce two products - energy and digestate.

There is the risk of bankruptcy of biogas plants, as 7 biogas plants have stopped their operations in Latvia, including 2 biogas plants in the Zemgale region during the past 5 years.

Biogas production can be developed and bankruptcies of biogas producers avoided by implementing relevant support measures in legislative acts to ensure continuous waste processing and biogas production, while complying with the requirements to decrease the greenhouse gas emissions in Latvia by 2030. Wide use of biogas contributes to sustainable development of the cattle-farming sector and can decrease the volume of degradable biomass stored in landfills.

The future of biogas plants is associated to the implementation of the National Energy and Climate Plan in Latvia to ensure that by 2030 the share of modern biofuels, including biogas, in the transport sector will increase to 3.5% [23]. This goal can be achieved by technical upgrading of biogas plants from cogeneration technologies to biomethane technologies for production of gaseous (Bio-CNG) or liquid (Bio-LCG) biofuels for transport or for injection into the natural gas network.

A survey of biogas plant managers (2021) confirms the readiness of entrepreneurs to invest in their biogas plants by introducing biogas purification and biomethane production for vehicle refuelling [19].

Currently, state support for biomethane production is discussed at the level of the Cabinet of Ministers to decrease greenhouse gas emission in transport sector using modern biofuels, including biomethane. Majority of these discussions are related to normalisation of statutory requirements in this area as, currently, some requirements for support in proposed regulations are excessively tough, for example, requirements to biomethane quality are considerably stricter than those set by EU regulatory documents.

4.2. Examples of best practices

To compare various biogas plants' operations, best practices criteria are to be developed, e.g.:

- Improved biomass management in the process of digestion (e.g. transportation of raw materials and/or digestate in pipelines, improved pre-processing and anaerobic digestion methods, chemical recovery of nutrients, etc.);
- Improved biomass storage conditions, e.g. covered storages, a cover on a digestate storage, etc.
- Minimal nutrient loss (data from the input/output biomass analysis)

In Zemgale region, some examples of good practices at different stages of biogas production were observed:

- Raw materials were delivered to a digester, by using a pipeline system and sealed connections that eliminate ammonia and other harmful gas emissions.
- Raw materials were stored on a concrete base with operating drains and reservoirs for accumulation and pumping the silage effluent to a digestion reservoir or digestate storage.
- In the process of anaerobic digestion of raw materials, the N:C ratio of raw material corresponded to recommendations.
- Improved biomass storage conditions, e.g. storages covered by artificial plastic, provided stable floating layer on the surface of a digestate lagoon, etc.
- Machines were used for the application of digestate, and the methods for application ensured minimum ammonia emission to the environment, e.g., after application of a basic fertilizer, digestate is immediately applied to soil, and after digestate is applied to supplementary fertiliser, a band-type application between rows of plants takes place.
- At one silage storage, base of the storage was constructed with inclination towards a cavity in concrete base at the opposite side to the unloading part of the storage, providing safe accumulation and transfer of silage effluent into reservoir.

REFERENCES

1. Code of Good Agricultural Practice for Latvia, Jelgava, LLU, 1999, p. 95. [https://www.varam.gov.lv/sites/varam/files/content/files/elauks_prakse2.pdf]
2. Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources (Nitrates Directive).
3. Cabinet Regulation No. 362 of 2 May 2006 "Regulations for use, monitoring and control of wastewater sludge and its compost".
4. Cabinet Regulation No. 829 of 23 December 2014 "Special requirements for performance of polluting activities at animal housing."
5. Cabinet Regulation No. 834 of 23 December 2014 "Requirements Regarding the Protection of Water, Soil and Air from Pollution Caused by Agricultural Activity".
6. Kārkliņš A. and A. Ruža A. Lauku kultūraugu mēslošanas normatīvi (Standards for fertilizing cultural plants), Jelgava: LLU, 2013, p. 55. (in Latvian) [https://www.zm.gov.lv/public/ck/files/ZM/lauksaimnieciba/Lauku%20kulturaugu%20mesl%20normativi.pdf].
7. Cabinet Regulation No. 1082 of 30 November 2010 "Procedure by which polluting activities of category A, B and C shall be declared and permits for the performance of category a and b polluting activities shall be issued."
8. The law "On Pollution" (2001), second subparagraph of article 31(2).
9. Cabinet Regulation No. 34 of 22 January 2002 "Regulations for release of pollutants into water."
10. Cabinet Regulation No. 560 of 2 September 2020 "Regulations on electricity generation, by using renewable resources, as well as procedure for and control over pricing", Para. 21.3.
11. The law "On environmental protection" (2006), paragraph five of article 21(1).
12. Cabinet Regulation No. 795 of 22 December 2015 "Procedure and database for accounting chemicals and mixtures."
13. Cabinet Regulation No. 92 of 17 February 2004 "Requirements to the development of surface water, groundwater and protected territory monitoring and monitoring programs", 7 paragraph 36.
14. Cabinet Regulation No. 506 of 01 September 2015 "Regulations regarding the identification, quality conformity assessment and sale of fertilisers and substrates".
15. Cabinet Regulation No. 17 of 7 January 2021 "Regulations for limitation of air pollution cause by combustion installations".
16. Instruction of the Cabinet Regulation No. 45 of January 2021 "On state waste management plan for 2021 - 2028."
17. Cabinet Regulation No. 724 of 25 November 2014 "Regulations regarding the methods for determination of the odours caused by polluting activity, as well as the procedures for restricting the spread of such odours"
18. Kirsanova L. Skābinātu kūtsmēslu izmantošana laukaugu mēslošanā (Use of soured manure for agricultural fertilizing). Materials relating to the "Implementation of sustainable agricultural production pilot projects", 2019, pp. 19-28 (in Latvian).
19. Order of the Cabinet of Ministers No. 46 of 4 February 2020 "Par Latvijas Nacionālo enerģētikas un klimata plānu 2021.-2030. gadam" (On the Latvian National Energy and Climate Plan 2021-2030) (in Latvian).
20. On Environmental Impact Assessment. Latvijas Vēstnesis, 322/325, 30.10.1998
21. Cabinet Regulation No. 18 of 13 January 2015 "Procedures for assessing the environmental impact of the proposed activity and accepting the proposed activity"
22. Cabinet Regulation No. 30 of 27 January 2015 "Procedures by which the State Environmental service shall issue technical regulations for the intended activity".

23. Kleperis J., Dimanta I., Sloka B., Zemite L. Hydrogen supported bioconversion of biogas CO_2 to upgrade biomethane in fuel for vehicles: recent findings in farmers survey" in proceedings of conference Engineering for rural development, Jelgava, 2021, pp. 1774-1780.

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The Sustainable Biogas project worked together with the biogas sector and various stakeholders to reduce nutrient discharges from the whole production chain of the biogas production: from the handling of raw materials to the production and to the safe utilisation of nutrient-rich digestates.

According to the results of the project, sustainable nutrient management in biogas production requires careful consideration when planning, permitting and operating the biogas facilities so that the regional nutrient balance is considered, storages for the feedstocks and digestates are adequate and appropriate, and digestate application is based on the plant needs.

Improving the quality of recycled nutrients and promotion of their use are needed. In addition, the reconciliation of the partly contradictory objectives for sewage sludge management - pollution prevention, nutrient recycling and climate change mitigation - should be continued.

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