

Policy Brief

Regional nutrient balances



Photo: Vladvitek, Dreamstime.com

Summary

Biogas production is increasing today as it contributes to the substitution of fossil fuels. However, there are risks associated with the nutrient-rich biomass used in production, which must be considered. Poor nutrient management poses environmental risks, such as eutrophication of the Baltic Sea and other water bodies. Good nutrient management can reduce runoff into water bodies and balance the nutrient load between nutrient surplus and deficit areas thus ensuring the efficient use of nutrients.

Regional nutrient management plans are crucial in overcoming these challenges. Before the nutrient load can be balanced between regions, it is necessary to know where nutrients are formed, where they accumulate and where crops have the greatest need for nutrients. Appropriate management of digestate and other biomasses in biogas plants, transport and farms is also needed. Achieving these goals requires cooperation between authorities and operators in the sector.



Introduction

Biogas production offers important opportunities in solving challenges related to climate change, the circular economy and nutrient and energy self-sufficiency. However, there are also some challenges in biogas production chains, especially concerning water protection. The proper management is needed, when the bigger volumes of agricultural biomass and manure are treated in the biogas plants in the future.

Biogas production affects the flows of nutrient-rich biomasses by concentrating them at fewer collection and treatment points. This allows cost-effective further processing of biomasses into organic fertilizers or nutrient products, but can cause problems in nutrient rich areas if the nutrient-rich digestates or reject waters from the process are not properly handled or if there is no proper use for these end-products. The whole biogas production chain can be associated with water and groundwater pollution, air emissions or nutrient loss if the processing of nutrient-rich digestates and reject waters is not well designed.

At present, both national and EU-level legislation and regulations on organic fertilizers are lagging behind the rapid development of the biogas sector, which poses risks to the environment. Regional nutrient management plans are currently made at the national level but should be consistent at the EU level to improve the management of nutrient flows.



Photo: Vladvitek, Dreamstime.com

Nutrient maps and regional nutrient management plans

To ensure the sustainability of biogas production from the point of view of water protection, it is important that besides being a green form of energy production, biogas production is also seen in the context of regional nutrient management.

Today, nutrient-rich biomasses processed by biogas plants still receive too little attention in land use planning and permitting. The eutrophication risks arising from biogas production stem from the regional concentration of nutrient-rich biomass. Thus, more detailed information on the biomasses in the area and the nutrient flows they contain is needed for biogas plant location planning. Various tools have been made, including nutrient maps to illustrate regional nutrient flows.

It is possible to present the data on maps with different levels of accuracy, for example at the municipal level or by utilizing geographical information also in a more detailed way. Nutrient maps¹ should contain as comprehensive information as possible on the biomasses, such as manure, organic waste and sewage sludge generated and their nutrient content. In addition, when information on the nutrient utilization potential as a fertilizer is available, a nutrient balance can be calculated for the area in question. Nutrient balance indicates whether the area or place has nutrient surplus or deficit. The nutrient maps should be based on accurate and updated data, so regular updates are needed.

Knowing the nutrient sources and nutrient balance in the area enables making a good nutrient management plan. The aim of a nutrient management plan is to strive for better nutrient management to ensure that the nutrients will be utilized sustainably. Moreover, management plans can also be applied in a situation where a biogas plant ceases to operate in an area, but nutrient rich biomasses still need to be properly managed.

¹ Varsinais-Suomen ELY-keskus, newsletter September 2021
(See more about nutrient maps made in the Sustainable Biogas project: Lounais-Suomen ravinnekartat (FIN), Nutrient maps for Åland Islands (ENGL))

Steps towards better nutrient management

General recommendations

- The nutrients must be balanced between regions to avoid a situation where valuable nutrients are detrimental to their producers or end users and not beneficial.
- At the end of the production chain, the nutrients from the digestates or from biomasses must be recycled, either to fields as nutrients or to industry, for example, as raw materials for organic fertilizers.
- Awareness of nutrient management in biogas production needs to be raised.
- To avoid the risk of nutrient leaching, the use of nutrient products in agriculture must be based on the need of plants and the timing of crop needs. To avoid overall losses of nutrients, digestate should not be applied when there is no or very limited crop uptake.
- The processing of digestate further should be promoted, especially in biogas plants where there is no sustainable use of nutrients as fertilizer nearby. Processing the digestate into a more concentrated form reduces transportation costs.
- Creating markets for digestate would enhance nutrient management, as a lack of demand and finding end users for digestate are often costly and time consuming, especially in areas with nutrient surpluses.

Planning authorities

- Responsibility for nutrient management lies with the authorities, as well as the operators working with digestates and other biomass in biogas plants, farms and transportation.
- When planning the location of biogas plants and granting permits, regional nutrient balances should be considered.
- Regional data on the relevant actors producing and using nutrients and the nutrient content on biomasses should be collected, and nutrient balances in regions should be calculated (surplus and deficit areas for critical nutrients).
- There is a need for consistent data collection methods, more detailed research and more transparent information exchange.
- Sufficiently accurate and consistent calculations of regional nutrient balances are needed to compare areas and plan large areas individually and together.
- Stakeholders should be genuinely involved in the planning.
- Transportation of nutrients from nutrient-surplus to deficit areas should be supported, for example, by developing more detailed action plans with actors and supporting the projects that create practical conditions for nutrient transfer.
- Mixing feedstock materials especially with sewage-sludge should be avoided, as it might affect the acceptability of recycled nutrients.
- All major nutrient producers and users in the region should be considered when planning and permitting a biogas plant.

Operators in the biogas production chain

The collection, storage, transport and recycling of nutrients must be properly managed.

- Structures and equipment must prevent leakage during emptying, transfer and transport.
- Biogas plants must have sufficient digestate storage capacity.
- The digestate should be stored in a closed storage container until it is used.
- Precision agriculture methods should be used for the application of digestate in soil, where applicable.
- The digestate should be tilled to the soil as soon as possible after its application.
- The use of the digestates should be carefully considered either by ensuring that the demand in the vicinity of the plant is sufficient or it is economically viable to transport it further.
- Biogas operators should consider separating digestate more often so that it can be transported to regions with lower nutrient content in its soil.

Conclusions

Especially large, centralized biogas plants can collect biomasses from large areas, which threatens to distort the regional nutrient balance if the digestate from biogas production is spread only in the vicinity of the plant. This kind of concentration of biomasses can lead to nutrient run-off into water bodies.

To prevent these risks, the authorities must take regional nutrient management into account when planning and granting permits to biogas plants. One useful tool to increase the knowledge and understanding of nutrient balance at a local level are nutrient maps^{1,2}. The maps show where the areas of nutrient surpluses and deficits are located and thus provide useful information to those using and planning the use of biomasses. In the long run, regular updating and development of nutrient maps are needed.

However, legislation needs to be developed to give authorities better tools to develop nutrient management. For example, nutrient recycling targets could be included in the building permit procedure. Otherwise, authorities can give recommendations to biogas producers to sell digestate in a nutrient deficit area.

Overall, awareness of the potential effects of biogas production on nutrient flows and regional nutrient management should be increased. The importance of nutrient management should be widely understood both in the biogas production chain and by planning authorities and decision makers.

Regional nutrient imbalances can be prevented by good biogas plant location planning. In addition, it is important that digestion-based fertilizers and products are utilized more efficiently and in a wider range of areas than currently. Further processing of digestates to enable longer transportation distances is one way to achieve this goal.

² The root cause of eutrophication in the Baltic Sea is addressed through nutrient maps and strategies - Sustainablebiogas (15.9.2021)

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.

The project, funded by the EU Interreg Central Baltic Programme, was implemented by the John Nurminen Foundation, the ELY Centre for Southwest Finland, the Finnish Biocycle and Biogas Association, Latvian State Environmental Services, and the Latvian Biogas Association.

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