



BIOGAS PRODUCTION FROM ANIMAL WASTE FOR ENERGY USE

TECHNOLOGY DESCRIPTION

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Biogas is produced as a result of biochemical decomposition of macromolecular compounds of animal manure into methane (CH₄), carbon dioxide (CO₂), and ammonia (NH₄). The process is performed under anaerobic conditions. Animal waste could be used in combination with agricultural crops.

The produced biogas will be used for heat energy and / or electricity generation, upgrading to biomethane and injection into natural gas grid or as a fuel for transport, including agricultural machinery. The key technological equipment used for biogas production include reactors for anaerobic fermentation with substrate mixing units and gas holders, biogas treatment units and co-generation units. The by-products of biogas production (i.e. processed substrate) are used as bio-fertilizers. The use of produced biogas will be defined for each specific project based on the availability of infrastructure near the animal farm (e.g. electricity transmission network, district heating systems, natural gas grid, etc.), energy demand of the farm, market conditions, regulations, and other factors.

CLIMATE RATIONALE OF THE TECHNOLOGY

Agriculture sector is an important driver of national economic growth, expansion of export volumes, as well as food security. At the same time, agriculture sector has significant contribution to total greenhouse gases emissions in Ukraine with the total volume of emissions estimated at the level of 99 Mt CO₂-eq. for 2019. The main sources of emissions include soil organic carbon loss at cropland (51%), agricultural soils (33%), enteric fermentation (8%), fuel use by agricultural machinery (6%), and manure management (2%). Ukraine's updated NDC has a target to reduce GHGs emissions by 65% compared to 1990 levels in 2030 and support of climate technologies in agriculture would support achieving the target and sustainable development of agricultural sector.

The implementation of the technology leads to the reduction of GHG's emission due to the substitution of fossil fuel-based energy (e.g. in energy generation and transport sector) with renewable energy and reduction of methane emissions from animal manure management. Assuming the potential for substituting 0.34 billion cubic meters of natural gas, the reduction of GHGs emission would constitute to 0.7 Mt CO₂. The actual reduction of emission would be higher as a part of the biogas would substitute electricity generated at coal fired power plants. The additional reduction in GHG emission is achieved because of the avoidance of animal manure decay in the lagoons or other storages. The potential for the reduction of GHG emissions from this source is estimated at the level of 1 Mt CO₂-eq. Total potential of GHG's emission reduction for the technology is approximately 2 Mt CO₂-eq.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

According to the estimate of Bioenergy Association of Ukraine, the total potential of biogas production from animal manure (cattle, swine, chicken) is almost 1 billion cubic meter per year. The Bioenergy Association of Ukraine estimates that 97% of the theoretical biogas potential for cattle manure, 30% for swine manure, and 68% for chicken manure are available for energy purposes, which is the equivalent of substituting 0.34 billion cubic meters of natural gas.



Biogas production technology could be implemented in all regions of Ukraine near animal farms to ensure the stable centralized source of animal manure, as its transportation is not economically feasible. Limitation could include infrastructure constraints to organize supply of electricity or heat energy to the to the grid or consumers, as well as environmental restrictions.

EXPECTED IMPACTS OF THE TECHNOLOGY

The technology supports national environmental priorities because of the reduction of environmental pollution associated with animal manure management. The utilization of animal waste by anaerobic treatment reduces the surface and groundwater pollution with nitrates, organic substances and biological contamination. Bio-fertilizers, which are the by-products of biogas production process, contribute to soil improvement. The implementation of technology could be combined with natural-based solutions for wastewater treatment such as constructed wetlands further extending environmental benefits.

The implementation of technology has also social benefits, as it leads to job creation in the agricultural industry and reduces health risks related to environmental pollution by animal waste for the people living near farms. The diffusion of technology will also contribute to the economic development and energy security of Ukraine.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

One of the goals prescribed by the Law of Ukraine On the Main Grounds of the State Environmental Policy of Ukraine for the Period till 2030 (2019) is ensuring the integration of environmental policy in the decision-making process with respect to the social and economic development of Ukraine, including the task of climate change mitigation and adaptation, as well as the sustainable low carbon development of all areas of the Ukrainian economy.

The agriculture sector is reflected in the existing strategic documents related to national climate policy but there is insufficient coverage of climate change mitigation activities in sector-specific policy documents and the lack of policy tools which promote climate technologies in the agriculture sector. New policies are expected to be developed to support the transformation of agricultural sector and achievement of updated NDC target under the Paris agreement.

The Law of Ukraine On Alternative Energy Types defines provisions on renewable energy generation support through green tariff. The green tariff for biogas and biomass electricity is EUR 123.86 per MWh. The alternative option introduced in 2019 is participation in renewable energy capacity auctions, where the tariff could not be higher than the green tariff level for biomass power plants, but the validity period could be extended beyond 2030.

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

The common policy measures that could streamline the diffusion of climate technologies in agriculture in Ukraine include introduction of environmental and climate related conditions for the provision of state subsidies, strengthening and improving regulatory requirements, capacity building policies, information policies and supporting the development of project-based carbon crediting mechanisms. Specific actions and activities to support the development of biogas production are presented in the table below.



Actions	Activities
1. The improvement of incentives for energy generation and consumption using biogas (power, heat energy, transportation)	1.1 The adoption of the Order of the Cabinet of Ministers of Ukraine On the Allocation of Annual Support Quota and the Schedule of Auctions for the Next Year and Indicative Forecasted Support Quotas for the Next Four Years with the inclusion of separate annual quotas for biomass and biogas-based power plants.
	1.2 The development and introduction of tariff incentive for heat energy generation from renewable energy, incl. biomass and biogas (fixed tariffs or premiums) by amending the Law of Ukraine On Heat Supply
	1.3 The amendment of the Law of Ukraine On Alternative Fuel Types with the introduction of the definition of biomethane (article 1), defining procedures for the access to natural gas grids and issuing certificates of origin
	1.4. The development and approval of the Decree of the Cabinet of Ministers of Ukraine On Promoting Biomethane Use with the definition of a) quality requirements and quality control procedures for biomethane injection into natural gas grids; b) certification scheme for biomethane; c) financial incentives for certified biomethane.
2. Reforming carbon taxation mechanisms	2.1. The adoption of the amendments for the Tax Code of Ukraine (section 8 Environmental Taxes, article 242) with the exclusion of biomass, biogas and biomethane from the tax base of the carbon tax.
	2.2. The adoption of the amendments for the Tax Code of Ukraine (section 8 Environmental Taxes, article 243) foreseeing gradual increase of carbon dioxide tax rates for fossil fuels.
3. Regulatory framework on nutrients management and animal manure management	3.1 The adoption of regulations on compulsory action plans for agricultural producers working in vulnerable zones defined using the Methodology for the Identification of Vulnerable Zones, in particular limitations related to the input of mineral and organic fertilizers
	3.2 The approval of the Code of Good Agricultural Practices (with incorporation of animal manure management requirements and organic fertilizers use requirements)
	3.3 Setting up and implementation of a programme on promoting the application of the code of good agricultural practice, including the provision of training and information for farmers
	3.4 The amendment of the Law of Ukraine On Animal By-products not Intended for Human Consumption and adoption of related secondary regulations (e.g. Orders of the Ministry of Agricultural Policy of Ukraine) taking into account the provisions of EU Fertilizing Products Regulation EU2019/1009, EU Regulation (EC) No 1069/2009 and Regulation (EU) No 142/2011 with the aim of a) introduction of the definition of digestate and categorization of digestate as animal by-product, b) requirements for animal manure and digestate storage and application (time before land application, storage systems, management practices, quality restrictions and quality control requirements); c) requirements for organic fertilizers (heavy metals and pathogens maximum limits, minimum requirements for primary nutrients and organic carbon content); and d) requirements for collection, transportation, processing, packing, labelling and use of animal by-products and relevant processing facilities, including biogas plants.
	3.5 Changes to the Land Code of Ukraine (article 22) allowing construction of biogas production plants using animal waste on land plots designated for agricultural purposes.
4. Capacity building	4.1 Introducing biogas related educational programs in the curriculum of educational institutions
	4.2 Support the creation of demonstration programs and learning centers for biogas technology and animal manure management
	4.3 The dissemination of information on the benefits and the best practices of biogas production from animal manure



COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

The implementation of actions and activities included in the TAP will require capacity building support in the form of educational programs and establishment of learning centers for biogas technology and animal manure management, as well as the dissemination of information on benefits and the best practices of biogas production from animal manure.

Capital expenditures for the implementation of technology is in the range of EUR 2 – 5 million per MW with higher values applicable for biogas units with additional equipment for biogas and digestate treatment.

USEFUL INFORMATION

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LINKS TO TNA REPORTS

Reports prepared within the TNA Project:

- Technology Needs Assessment
- Barriers Analysis and Enabling Frameworks
- Technology Action Plan

Full texts of the TNA reports are available at: <https://tech-action.unepdtu.org/country/ukraine/>

TNA Project page at the web-site of the Ministry of Environment and Natural Resources of Ukraine:
<https://menr.gov.ua/news/33450.html>