



THE PRODUCTION AND USE OF SOLID BIOFUELS FROM AGRICULTURAL RESIDUES

TECHNOLOGY DESCRIPTION

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Ukraine is one of the major producers of cereals in the region with cereals and legumes growing area of 15 million ha and production volumes at the level of 60-70 Mt per year. The production of sunflower increased six-fold during the last 20 years and reached 14.5 Mt per year (growing area of 6.2 million ha).

The technology foresees the direct combustion of biomass residues or combustion of biofuels produced from biomass residues (e.g. pellets, briquettes, biogas) to produce heat and/or electricity. Biomass residues could be used in combination with other sources of biomass (e.g. animal manure or corn silo) or fossil fuels (e.g. in case of co-firing). Besides, the technology could also include biochar production from agricultural residues using pyrolysis process (thermochemical conversion under low oxygen level), which result in generation of both soil additives (called charcoal or biochar) and energy source (pyrolysis gas or syngas). Pellets production allows extending the area of solid biofuel use due to high density and energy content, as well as the standardization of quality parameters.

Main agricultural residues, which could be used for energy generation, include straw, sunflower seed's husk, as well as corn and sunflower stalks and other residues. The availability of biomass residues depends on the yield's volumes in a particular year, but the overall trend in Ukraine is the increasing yields and increasing biomass volumes that could be used for energy purposes.

Biomass residues should partly remain in fields in order to ensure soil protection from erosion, compensating the loss of organic content and reducing evaporation. The percentage of crop residues that could be removed from each particular farm should be defined on a case-by-case basis, taking into account the full range of local conditions (crop yield, the level of development of local animal husbandry, soil condition, application of mineral and organic fertilizers).

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 use of agricultural biomass residues for energy generation leads to the reduction of GHG's emission because of the substitution of fossil fuels. The Bioenergy Development Roadmap proposes the targets of 3.61 Mtoe of solid agricultural residues (straw, stalks, sunflower seed husk) used as energy source for 2030. Only about 1 Mtoe is being already in use (mostly sunflower seed husk and partly straw). Greenhouse gases emission reduction potential due to additional use of 2.6 Mtoe of agricultural residues is conservatively estimated at the level of 3.8 Mt CO₂-eq. for 2030. In case of biochar production, the additional GHG's emission reduction could be achieved due to carbon sequestration in agricultural soils.



AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

According to the Energy Strategy of Ukraine for the period till 2035 “Security, Energy Efficiency, Competitiveness”, the share of biomass will be increasing in heat and power generation. Biomass and solid municipal waste would cover 11 Mtoe out of 96 Mtoe of the total primary energy supply already in 2035. In order to achieve this goal, additional 7.6 Mtoe of biomass should be brought in Ukraine’s energy balance. The share of biomass and solid municipal waste in the total primary energy supply will be increased to 11.5% in 2035 and will ensure approximately half of all renewable energy sources used in the country. Specifically, for the heating sector, the Concept of State Policy Implementation in the Area of Heat Supply aims to achieve the 40% share of renewable sources in heat generation by 2035. Therefore, biomass is a crucial component of national energy strategy and the use of biomass is expected to increase more than threefold during next 15 years. Solid biofuels from agricultural residues will play an important role in reaching renewable energy targets in Ukraine and will contribute to decarbonization of electricity and heating sectors.

Key limitations for the technology are associated with infrastructural requirements (e.g. power substations for electricity’s export, district heating infrastructure or nearby heat energy consumer for heat energy’s supply, road infrastructure for organizing biomass residues logistics, etc.). Besides, environmental impact and mitigation measures, as well as competing the use of agricultural crops residues (as substitutes of organic fertilizers, feed for livestock, etc.) should be considered on case-by-case basis.

EXPECTED IMPACTS OF THE TECHNOLOGY

The promotion of the technology could support rural development due to diversification of revenue streams for agricultural enterprises and, creation of local job opportunities in biomass logistics and heat energy generation sectors, and supporting economic development in rural areas. The technology would contribute to the economic development of Ukraine by fostering the development of renewable energy sector.

Environmental impact and mitigation measures in order to reduce air emissions from biomass combustion (e.g. particulate matter, nitrogen dioxide) should be analysed on a case-by-case basis (based on baseline air quality studies, dispersion modelling of air pollution from particular installation and definition of appropriate combustion technology and air quality control systems, such as multi-cyclones, electrostatic filters and selective catalytic reduction of NOx). Competing the use of agricultural crops residues (as organic fertilizers substitutes, feed for livestock, etc.) should be considered in estimating technology’s application potential.

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 solid biofuels use from agricultural residues are presented in the table below.

Actions	Activities
1. Establishing biomass trading platform	1.1 Approving the Law of Ukraine On the Development of Solid Biofuel Market with the introduction of electronic biomass trading platform
	1.2 Approving the rules of conducting electronic trading of biofuels (incl. selection of operator, eligibility conditions, reporting requirements, etc.)
	1.3 Approving requirements for the quality of biofuel traded at the platform and quality control procedures
2. The adoption of air emission requirements for small and medium size energy installation using biomass	2.1 Approve regulation with established maximum allowed air emission limits for the installation with different capacity.
3. The development of renewable heat energy incentive mechanism for district heating systems	3.1 Adopt changes to the Law of Ukraine On Heat Supply with the introduction of renewable heat energy incentive mechanism for district heating systems defining the level and duration of support.
	3.2 Define eligibility requirements for the subsidy scheme, including types of technologies, efficiency, air quality control and reporting.
4. Reforming carbon taxation mechanisms	4.1 The adoption of 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.
	4.2. The adoption of amendments for the Tax Code of Ukraine (section 8 Environmental Taxes, article 243) foreseeing gradual increase of carbon dioxide tax rates for fossil fuels.
5. Soil quality monitoring system	5.1 The approval of soil quality monitoring standards with synchronization of approaches and methods for soil sampling and soil analysis.
	5.2 The development and approval of the Law of Ukraine On Soil Protection and Preservation of Fertility in line with the in the National Action Plan to Combat Land Degradation and Drought.
	5.3 The development of national soil quality database, including national soil organic content map, on the basis of soil quality studies and approved data sharing arrangements.
	5.4 The incorporation of soil quality studies in the concept of state scientific and technical program in the area of climate change and projects supported by the National Research Foundation of Ukraine



Actions	Activities
6. Information policies to promote crop residues use for energy purposes	6.1 The development and dissemination of guidance document describing the supply chain of crop residues (equipment, practices, cost, etc.) and management options (combustion, biochar production and use, pelleting, etc.).
	6.2 The development and dissemination of guidance document describing environmental mitigation measures for biomass to energy projects (fuel quality control, optimization of combustion process, air quality control systems, monitoring, etc.), emission monitoring and reporting
	6.3 Support scientific studies for the identification of sustainable removal rates for different regions, crops management systems and soil quality; impact of biochar application on soil and yields.

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 developing and dissemination among interested stakeholders of guidance documents on crops residues supply chain and management options, as well as environmental mitigation measures for biomass to energy projects, emission monitoring and reporting. The preparation of guidance documents could be supported by capacity building activities in the form of training, seminars and workshops.

Capital expenditures for the implementation of technology is in the range of EUR 0.15-0.25 million per MW for biomass boiler houses and EUR 2.5 – 3.5 million per MW for biomass CHP.

USEFUL INFORMATION

CONTACT DETAILS

Mr. Anatoliy Shmurak

National coordinator of the Technology Needs Assessment Project
Ministry of Environment and Natural Resources of Ukraine
shmurak@i.ua

Mr. Mykola Shlapak

Climate mitigation expert for agricultural sector of the Technology Needs Assessment Project
m.shlapak.ua@gmail.com

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>