The summary of the doctoral thesis

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entitled: “Systems of environmental evaluation of agricultural technologies and selection of activities supporting their development”

The doctoral thesis addresses the issue of evaluation of innovative biomass processing techniques from the point of view of their impact on the natural environment. In addition, an assessment was made of the conditions for the effective implementation of innovations using the environmental assessment tool - on the example of the implementation of the EU ETV program. Environmental aspects including respect for the environment in agricultural technologies, from a practical point of view, accentuate the optimization of agricultural production by increasing energy efficiency and reducing emissions of pollutants into the air. The development of new environmental agricultural technologies will contribute in the long-term aspect to shaping sustainable agriculture using optimal solutions. The fulfillment of these assumptions will be possible through the development of simple tools enabling reliable assessment of environmental aspects of the technologies used to determine boundary values and criteria dedicated to solutions for the management of agricultural products.

The assessment of the impact on the natural environment of technical solutions related to biomass processing was made taking into account energy expenditure and generated emissions using the available multicriteria tools for environmental assessments. The currently undertaken activities assessing environmental aspects are mainly related to the production phase and concern, among others: emissions of carbon dioxide and ammonia, energy consumption and utilities. Among the many tools available on the market for the assessment of environmental technologies, the most credible and multifaceted ones are the European Union environmental technologies verification program - EU ETV and life cycle analysis - LCA.

The main purpose of the work was to determine the impact of selected technologies of biomass processing of agricultural origin on environmental effects. The objective was implemented by qualitative assessment of the environmental aspect of biomass processing processes using selected tools, including LCA and ETV methods. As a result, a method was proposed that allows simple verification of environmental performance and an indication of the most favorable parameters of the technology for acquiring renewable energy from

agricultural raw materials. Additionally, an attempt was made to identify determinants affecting the overall perception and dissemination of the ETV program as a method supporting the commercialization of environmentally beneficial technologies. The utilitarian purpose of the work was to determine environmental effectiveness on selected examples of agricultural technologies using selected tools: ETV, LCA and own tool for reliable assessment.The implementation of the work objective was carried out through the following four groups of activities that are at the same time the scope of work:

1. The study of environmental aspects of selected biomass processing technologies using the ETV environmental technology verification method.
2. Evaluation of environmental sustainability.
3. Evaluation of the environmental potential of innovative biomass processing techniques - emission matrix.
4. Selection of activities supporting the development of biomass processing technology.

The subject of the work is an innovative method of assessing the impact on the natural environment of the effects of obtaining renewable energy carriers by processing biomass of agricultural and municipal origin.

In the first part of the study a literature analysis was carried out, on the basis of which environmental aspects for agricultural technologies were defined, with an indication of those aspects that are particularly important from the point of view of biomass processing techniques. The tools used to assess environmental aspects of technology and national normative documents, indicating the need to use these tools and the development of eco-innovation, were reviewed. The theoretical part is closed with a chapter describing the possibility of using selected tools to evaluate biomass processing techniques.

The second part presents the assessment of selected biomass processing technologies. The results for each technology are discussed separately for each tool. The conducted research and analysis allowed to conclude that the currently leading methods of ETV and LCA environmental assessments allow for a comprehensive and reliable assessment, but in practice they are too complicated and costly. Therefore, we have proposed our own evaluation method with matrix structure. Emission matrix as an original method of environmental assessment - is a concise tool applicable to any technological solution. Bearing in mind the international potential market expansion of Polish biomass processing products of agricultural origin and the possibility of adapting processing technologies to these national markets, the factors for the development of innovative solutions were

identified. The questionnaire method was used. The last chapter presents the results of surveys identifying innovation development factors - taking the EU ETV program as an example. The end of the work contains a summary of the results of the tests carried out together with conclusions regarding the effectiveness of the tools used in the cases under consideration.