The continuous burning of fossil fuels, deforestation, and livestock farming are increasingly influencing the climate and the earth's temperature. These activities add enormous amounts of greenhouse gases to those naturally occurring in the atmosphere, thereby increasing the greenhouse effect and global warming. Still, most of the developing countries are facing several issues in obtaining energy from sources other than fossil fuels. Recently, the European Union (EU) has introduced numerous guidelines to support the use of renewable energy sources (RES). Additionally, the EU is prioritizing the acquisition of value-added materials from bio-waste, which leads the path to waste to wealth, clean energy and circular economy (CE).

The utilization of bio-waste is in line with the waste hierarchy described in the European Waste Framework Directive 2008/98/EC, as well as with the concept of a circular economy (CE). The principal aim of CE is to generate new value-added products from bio-waste via an integrated approach, resulting in zero waste discharge and the development of cost-effective technology. Additionally, tackling bio-waste (food waste) represents a triple opportunity: for the climate, for food security, and for agri-food system sustainability. It is an opportunity we cannot afford to miss. According to Eurostat 2023 report, around *58 million tonnes of food are wasted annually in the EU, with an associated market value estimated at 132 billion euros*. *In Poland approximately 4 million tons of food is wasted annually throughout the nation with an associated market value estimated as 40 billion Polish Zloty*.Therefore, food waste is considered a potential feedstock for the recovery of biofuels and biomaterials.

The main aim of the "**Food Waste Biorefinery for Sustainable Production of Next-Generation Algae-Based Bio-Products (FW-ALGAE)**" project is to develop a novel, cost-effective integrated biorefinery approach for food waste management and the recovery of algal-based bio-products. *The proposed research methodology is designed for the complete conversion of food waste into biohydrogen, hydro char, biodiesel, and biodegradable packing film*. Initially, the food waste will be subjected to combined pretreatment to achieve higher liquefaction. After pretreatment, the liquid and solid portions of the food waste are divided into two streams. For instance, **Stream I (solid stream)**: *The solid residue left over after food waste pretreatment will be subjected to dark fermentation for biohydrogen production, followed by hydrothermal carbonization of the dark fermentative digestate for hydro char production*. In **Stream II (liquid stream)**: *Microalgae cultivation using pretreated food waste supernatant. Then the harvested algae biomass will be subjected to extraction of algal oil using expeller press. Later the algal oil will be utilized to produce biodiesel and biodegradable packing film from defatted cellulose-rich algal biomass*. In addition to this, the study on enhancing the yield of biohydrogen and biodiesel using hydro char will be performed. Finally, all the experimental research actions will be assessed based on energy, economic, and mass balance analyses, which act as indicators for process scaling up with commercial value.

Developing this kind of integrated approach and overcoming the practical feasibility of three major task in the proposed research methodology is an important and innovative outcome of the project. *Such as* ***i) cultivating microalgae using different mixed culture media****, such as pretreated food waste supernatant, dark fermentative fatty acid-rich effluent, and nutrient-rich aqueous phase from hydrothermal carbonization,* ***as an integrated system ii) evaluating the efficiency of hydro char in enhancing biofuel yield*** *(biohydrogen from pretreated food waste residue and biodiesel from algal oil) represents a* ***complex aspect of process optimization****.* ***iii) Extracting cellulose from algae*** *and utilizing it for the production of* ***biodegradable packing film*** *is a novel approach with significant market value.* The comprehensive research planned within the project will allow the extension of the knowledge related to the management of food waste by integrated biorefinery for the production of several highly value added products at low cost and this research results will contribute to the development of new materials obtained from food waste in commercialisation aspect. The proposed work is significant as it offers ideal solution to polish society by implementing renewable energy programs as an alternative to fossil fuel-based programs, while also facilitating knowledge transfer to researchers and fostering a sustainable environment for the future.

The "**FW-ALAGE"** project will be delivered at the Silesian University of Technology, Gliwice, Poland. The project outcomes will be published in scientific journals and presented at national and international conferences to promote the environmental benefits of waste management in line with a circular economy concept. Furthermore, *this project aligns closely with the aim of SDG 7- Affordable and clean energy (Target 7.2 - Renewable energy and Target 7.4 – Promote international cooperation to facilitate access to clean energy research and upgrade technology all in developing countries), and SDG 12 – sustainable consumption and production patterns (Target 12.4 -Management of solid wastes)*.