The challenges for agriculture in reducing greenhouse gas emissions and other environmental targets are greater than for other sectors. Agriculture faces many environmental and social challenges, including climate protection, biodiversity maintenance, landscape conservation, food security, ensuring agricultural income, and the sustainability of rural cultural heritage.

Agriculture is a sector that contributes significantly to climate change, although it is difficult to estimate the exact magnitude of this contribution and make precise projections. Globally, agriculture is believed to be responsible for 9.3 trillion tonnes of carbon dioxide equivalent emissions. In particular, it is a major source of methane and nitrous oxide emissions, - 49% and 66% of global emissions respectively. Methane emissions from livestock production (from enteric fermentation) and crop production (from manure management) and nitrous oxide from agricultural soils account for around 80% of total agricultural GHG emissions. Therefore, emission reductions can be achieved by improving resource efficiency in agriculture, which would come down to reducing energy intensity, fertiliser use, and agricultural production intensity.
Despite the fact that scientists from various disciplines are aware of the large contribution of agriculture to greenhouse gas emissions, the essence of this problem is not always properly understood. Many reports, including the latest by the Intergovernmental Panel on Climate Change, conclude that active and extensive measures are needed to stop global warming at up to 1.5°C above pre-industrial levels. To achieve this goal, several conditions must be met: i) emit no more than 570 gigatonnes of carbon dioxide equivalent, ii) achieve zero net global carbon dioxide emissions by 2050, and iii) significantly reduce methane and nitrous oxide emissions.

The project team says that the target reduction for agriculture can be achieved primarily by improving resource efficiency in agriculture, the way to achieve at least 20% of the required reduction in agricultural emissions! More specifically, removing managerial inefficiencies in agricultural production can contribute to achieving at least 1/3 of the global greenhouse gas reduction targets that have been developed to limit global warming and the project attempts to find the way how to do it with regard to the particular farming systems. Assuming that the objectives of the European Green Deal were taken as a general guideline, it would be possible to achieve a 46% reduction target for nitrogen emissions and a 15% reduction in pesticide emissions globally just by increasing production efficiency in agriculture.

The project will adopt a multidimensional perspective, the Integrated Efficiency approach. From the farmers' point of view, a reduction in inputs can only be accepted if it meets the condition of progress in the Pareto sense, i.e. if the reduction of emissions in a given production does not have a negative impact on other aspects of the farm's activity. Therefore, the orientation of agricultural policy towards efficiency improvements in the production function complemented by environmental and social criteria must be considered a prerequisite for the effectiveness of the policy in implementing sustainable agricultural practices.

The integrated efficiency approach has not yet been tested at the farm level for a nationally representative sample of farms in Europe, mainly due to the difficult availability of data on GHG emissions and biodiversity. Therefore, the main objective of the project is to estimate potential improvements in relation to GHG emissions, food security, and biodiversity in different farming systems and to design/adapt agri-environmental policy instruments that could contribute to inefficiency reduction (based on the analysis of a panel of 24,000 farms from Poland and international focus groups).

The specific objectives of the project include:
1) Embedding ecologically and socially adjusted production function in welfare economic theory; 2) Assessing the interaction between GHG emissions, soil biodiversity and food security at farm level; 3) Integrating the GHG measurement method into the FADN agricultural accounting system; 4) Integrating the biodiversity measurement into the FADN agricultural accounting system; 5) Integrating the food security measurement into the FADN agricultural accounting system; 6) Testing the integrated efficiency approach at farm level - defining the technological frontier for different farming systems and size classes; 7) Identification of potential Pareto improvements in GHG emissions, biodiversity and food security in different farming systems; 8) Designingh agri-environment policy tools to reduce inefficiencies in GHG emissions, biodiversity and food security - implications for the EU CAP and agricultural policies in other countries of the world.