MODEL2BIO

Modelling tool for giving value to agri-food residual streams in bio-based industries

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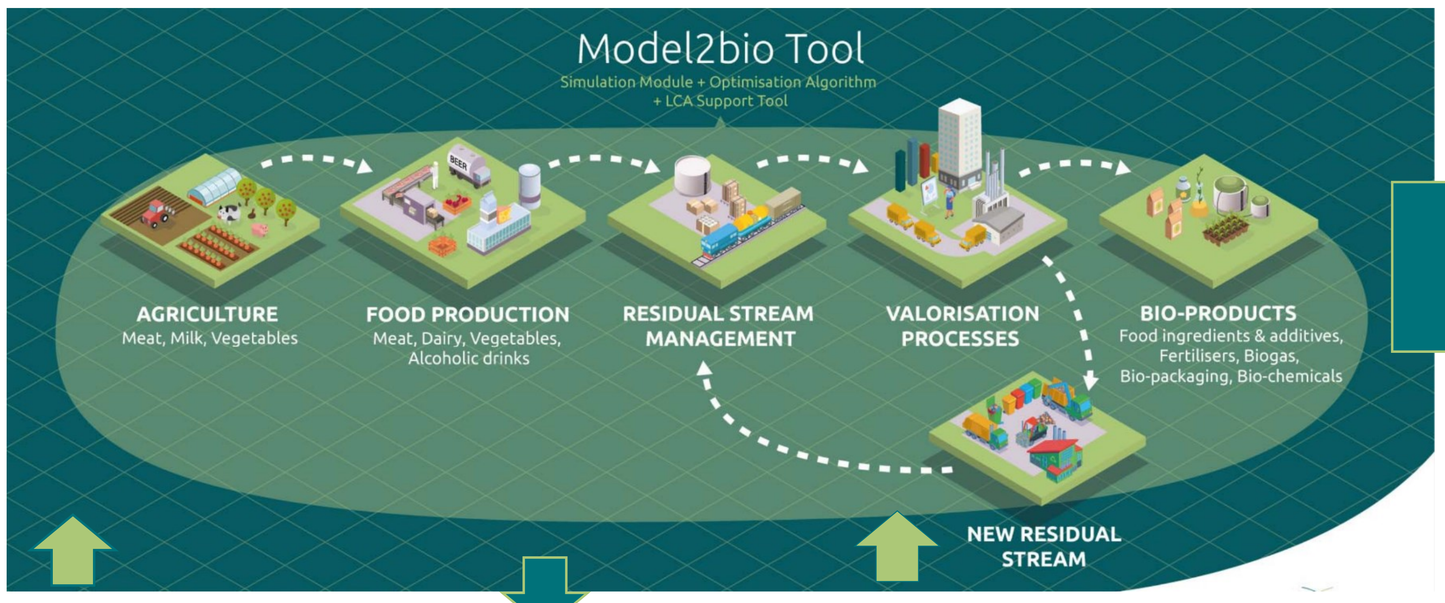
Διαδυμα
ΔΙΑΧΕΙΡΙΣΗ ΑΠΟΡΡΙΜΜΑΤΩΝ ΔΥΤΙΚΗΣ ΜΑΚΕΔΟΝΙΑΣ Α.Ε.

model2bio
waste-to-feedstock

ABSTRACT

Climate change, along with the growing need to reduce greenhouse gases (GHG) emissions and eliminate the use of fossil fuels, as well as the corresponding societal challenges, are the key drivers of several approaches for waste disposal reduction via concepts of Circular Economy and Bio-economy in Europe. In food supply chain, given the high amounts of food waste surpassing the 150 million tonnes of food each year in EU, one of the targets set by the European Green Deal and the Farm to Fork Strategy is to cut EU food waste from farm to fork by 50% by 2030. Through the EU Circular Economy Action Plan, emphasis is given to the reuse of food waste and the extraction of valuable resources via valorisation routes. Considering some key parameters of the agri-food waste including the great heterogeneity and variability in quantity and composition during the year (seasonality), in addition to the lack of information regarding the operation and viability of the Bio-Based Industries (BBIs), render the management of such residual streams rather challenging. To this direction, the European project MODEL2BIO is examining an innovative solution through the development of a decision-support (DSS) tool that predicts the physico-chemical characteristics of the residual streams generated in the agri-food sector, explores all the available alternatives for their valorisation as feedstock in the BBIs and selects the most appropriate options considering their composition, seasonality and location of the generation and processing units.

MODEL2BIO SOLUTION



RAW MATERIAL
- Agri-food industry type
- Nature of raw materials
- Quantity of raw materials
- Location
- Season

AGRI-FOOD BY-PRODUCTS
- Type of by-product
- Quantity of by-product
- Physico-chemical characteristics

VALORISATION INDUSTRY (BBI)
- Industry type
- Process applied
- Type of bio-products
- Location

BIO-PRODUCTS
- Type of bio-product
- Quantity of bio-product (on the basis of raw material)

ENERGY
- Energy produced per kg of raw material

WASTE
- Waste generated with re-use potential in BBIs
- Waste to landfill

RESULTS
- Net operational cost
- Energy and reagents consumed in the BBI production processes
- Prioritised list of valorisation routes
- Net costs (logistics + operational)

❖ Residual streams studied in Model2Bio

Industry	Residual streams
Alcoholic beverages	Skin, seed and stem, spent grains and marcs, yeast
Dairy	Whey, curd, and milk sludge
Meat	Animal by-products, including carcasses, hides, hoofs, heads, feathers, manure, offal, viscera, bones, fat and meat trimmings, blood
Vegetable	Peelings, stems, seeds, shells, bran, trimmings

❖ Development of an innovative Decision-Support (DSS) tool

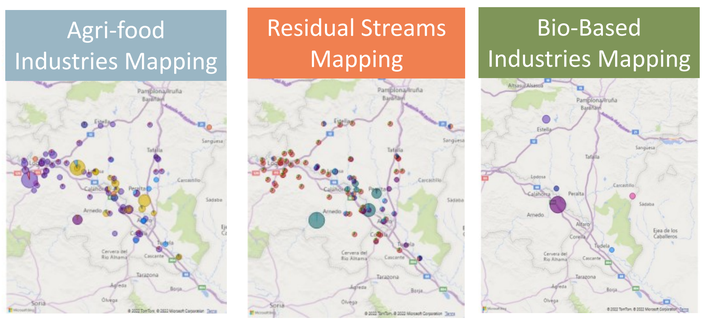
SIMULATION MODULE
- Prediction of bio-based residual stream mass fluxes
- Compatible model libraries: a) agri-food production lines, b) intermediate processes & c) valorisation bioprocesses

OPTIMISATION ALGORITHM
- Automatic selection of the bio-based residual stream alternatives.
- Minimisation of a global cost function previously defined using the mathematical models constructed

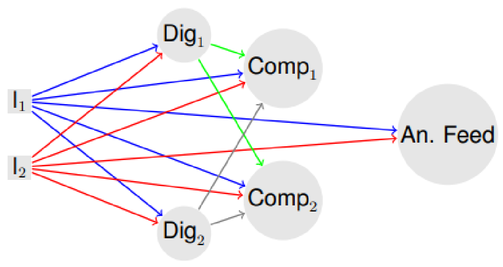
LCA MODULE
- Estimation of the environmental, economic and social impacts associated with any bio-based residual stream alternative using an LCA methodology

RESULTS

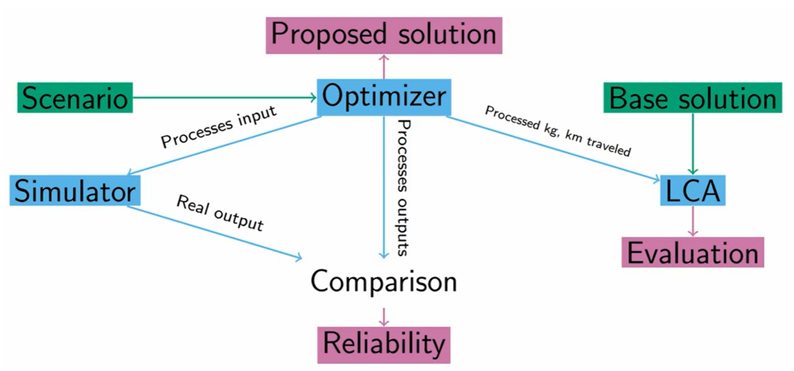
❖ Problem stated: Input data

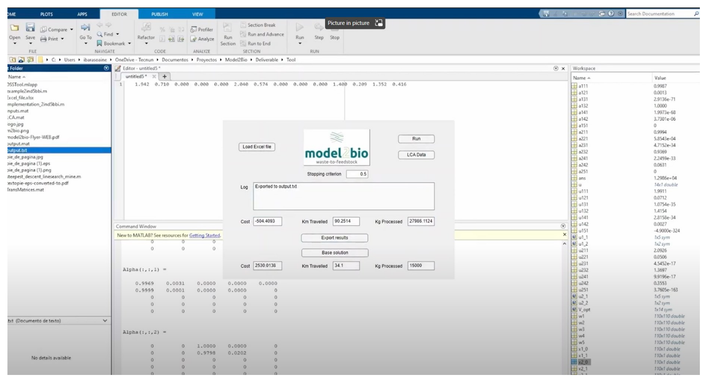


❖ Mathematical model



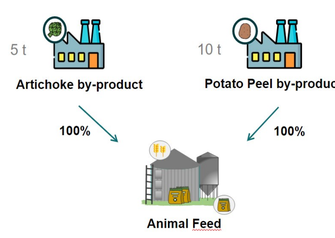
❖ MODEL2BIO optimizer interface

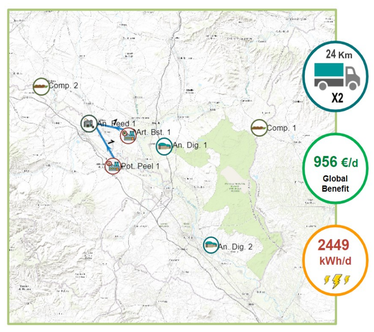




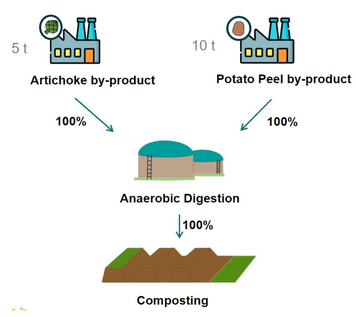
❖ Output

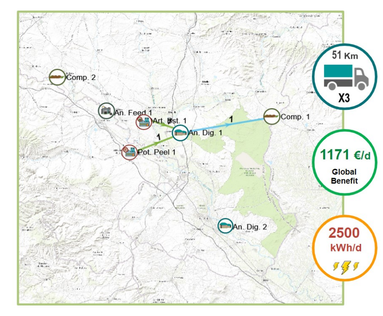
Baseline solution





Optimized solution





CONCLUSIONS

An effective and innovative approach is suggested via Model2Bio to apply circular economy models in agri-food value chains, offering different advantages for various groups, including agri-food companies, waste management companies and bio-industries.

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