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INTELLIGENT BIOMASS ANALYSER (IBA)

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Intelligent biomass analyser (IBA) can quickly determine the key characteristics of biomass. This will allow the sorting of biomasses, for example, into quality groups or types, and the determination of moisture content. By using the electrical impedance spectroscopy (EIS) technique, it is possible to obtain information from a relevant volume of biomass, and not only from its surface (as near infrared/infrared (NIR/IR) techniques do). The IBA product is still a prototype, but it has many promising applications relating to renewable resources.

By combining EIS technique with a robot and artificial intelligence (AI), the process will be both quicker and more accurate. An automated sampling solution replaces time-consuming and expensive manual laboratory work. Digitalised quality data serves the supply chain in real-time.

In forestry, EIS probes are usually installed in the moving stream of wood chips. The IBA process helps to control logistics and storage. If the wood chips are of high quality, they are used in pulp and by the paper industry. If there is a lot of bark, the chips still produce heat and power.

Fast testing and analysing helps to overcome the information market failures that hinder the sustainable transition into a circular bio-economy.

Continuous development of the IBA system is an example of a good working university-industry link. Puumit Ltd, a spin-off from the University of Eastern Finland (UEF), is the main developer of the IBA. It has created a consortium to take the IBA product to the next level by integrating robotics in the system.

EU DG-Regio supports IBA, as the development project is part of a High Impact Action programme (EU In My Region). East and North Finland (ENF) encourages RDI actors and firms to cooperate trans-regionally. The integrated ENF area increases knowledge cooperation between partner regions but ENF can also distort knowledge trade due to its borders.

Application scenario

Non-destructive classification of biomass into different quality groups

Digital technologies

Artificial intelligence (AI), EIS sensing, robotics

Socio-economic impact

- Economic: Intelligent biomass analyser (IBA) can lead to better valorisation of circular bio-economy side-streams. In forestry, this includes wood chips, tree bark, and sawdust
- Environmental: Using more renewable resources from forests (like wood chips and forest residuals) for heat and power production leads to substitution of imports
- Social: Small-scale forestry firms remain in remote rural areas if they can automate analysing forestry side streams

More info: https://elmoenf.eu/wp-content/uploads/tiitta_elmo-1112-2019.pdf

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Purpose of the tool

Many biomasses are wasted because there is uncertainty about their attributes. In rural areas there are usually no laboratories nearby, so a fully automated analysing system would help remote heat and power producers to optimise their input mix of different forest residuals.

The intelligent biomass analyser (IBA) reveals the key characteristics of biomass: quality, type and moisture content. It aims to help sort biomasses like wood chips into different quality groups (without breaking the study objects). In addition, the tool will provide quality data to the whole supply chain in real-time. The outcome will be better valorisation of the circular bio-economy side-streams.

The IBA product is still a prototype but it has many promising applications in renewable resources and could be used to control logistics and storage. IBA systems need in-site testing and investigations of the main industrial challenges with different types of end-users.

Description of the tool

The tool obtains information from a relevant volume of biomass using the electrical impedance spectroscopy (EIS) technique. The IBA process combines the EIS technique with robotics and artificial intelligence (AI). It includes investigations of combining IBA sensors with commercial industrial robots.

The variety of solid bio-based raw materials makes testing important due to the economic significance. Wood chips are utilised as a raw material for many bio-refining industrial processes. High quality wood chips are used for pulp production. If the properties are known beforehand, the processes may be improved, for example by adjusting the amount of chemicals. Large amount of resins or bark may cause problems in bio-refining processes.

The sample's division according to its properties, at an early stage of processing in forest industries, increases the efficiency of wood processing and use.

Areas of socio-economic impacts

Social	Strengthened cooperation on many levels. Universities will work with SMEs and energy firms. Regions will cooperate more as the RDI actors and firms can be from different regions in the ENF collaboration area.
Economic	Quality control in factories. IBA is a substitute for laboratory work but employment in rural areas will likely rise. Automated systems can help remote areas to create more income from their renewable resources.
Environmental	Taking renewable resources and side streams from forestry and agriculture into use usually lessens the amount of nutrients in rural areas. Optimising the moisture content and other characteristics of wood chip batches early in the process will save energy and materials.