

BIOproducts from lignocellulosic biomass derived from MArginal land to fill the Gap In Current national bioeconomy

BIOmagic



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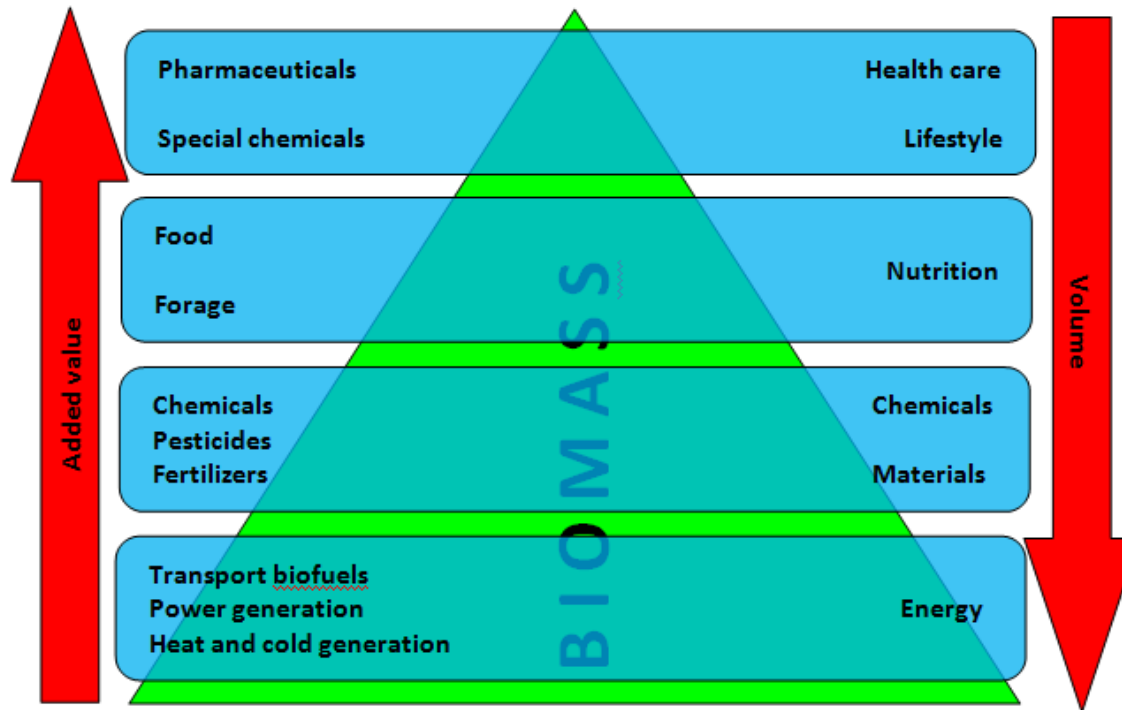
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PRESENTATION PLAN

- ◎ **Introduction**
- ◎ **Project Consortium**
- ◎ **General concept of the project**
- ◎ **Work Packages with short description**
- ◎ **Conclusions**

- The biobased economy needs sustainable supply of biomass for bioproduct generation and multiple uses.
- In this concept, no biomass should be used for energy generation unless other options have been considered of using it to produce higher value added products.



Hierarchy of the use and applications of biomass

source: the authors, based on <http://www.sustainable-biomass.eu/>

Introduction

- **Perennial Industrial Crops (PIC)** grown on marginal lands can become an important source of biomass in Poland.
- It is estimated that **marginal land in Poland covers over 2 million ha** of agricultural land. In addition, it may be possible to grow PIC on post-industrial lands, fallow lands with natural plant cover.
- **PIC include non-food and non-feed crops** and generate agricultural products that can be categorized as commodity and/or the raw material for industrial goods rather than feed and food products for direct human consumption.
- The concept of cultivating PIC for non-food (and/or non-feed) uses is not new but, despite considerable investment in research and development, **little progress has been made** with regard to the introduction of such products **into the commercial marketplace**.

- When developing **production of bioproducts in agriculture**, it is important to avoid land-use competition with production of food and feed.
- In order to ensure food security and quality of food, **most productive agricultural lands must be saved** for food crop production.
- Therefore, for initiating sustainable production of bioproducts it is well justified to **promote efficient crops that can grow on marginal lands**.
- Thus, **BIOmagic Project** inscribes itself into the European and global trend of **sustainable and cascade-like use of PIC biomass harvested from marginal land**.

Project Consortium

1. University of Warmia and Mazury in Olsztyn (UWM) – Univ
2. ChemProf s.c. (CP) – SME
3. Quercus Sp. z o.o. (Qs) – SME
4. New Chemical Syntheses Institute
– Łukasiewicz Research Network (INS) – RI
5. Institute of Soil Science and Plant Cultivation
– State Research Institute (IUNG) – RI
6. Institute of Technology and Life Sciences (ITP) – RI
7. Medical University in Lublin (UMLUB) – Univ



Project Consortium



Project duration:
01.12.2017 – 31.11.2021

General concept of the project

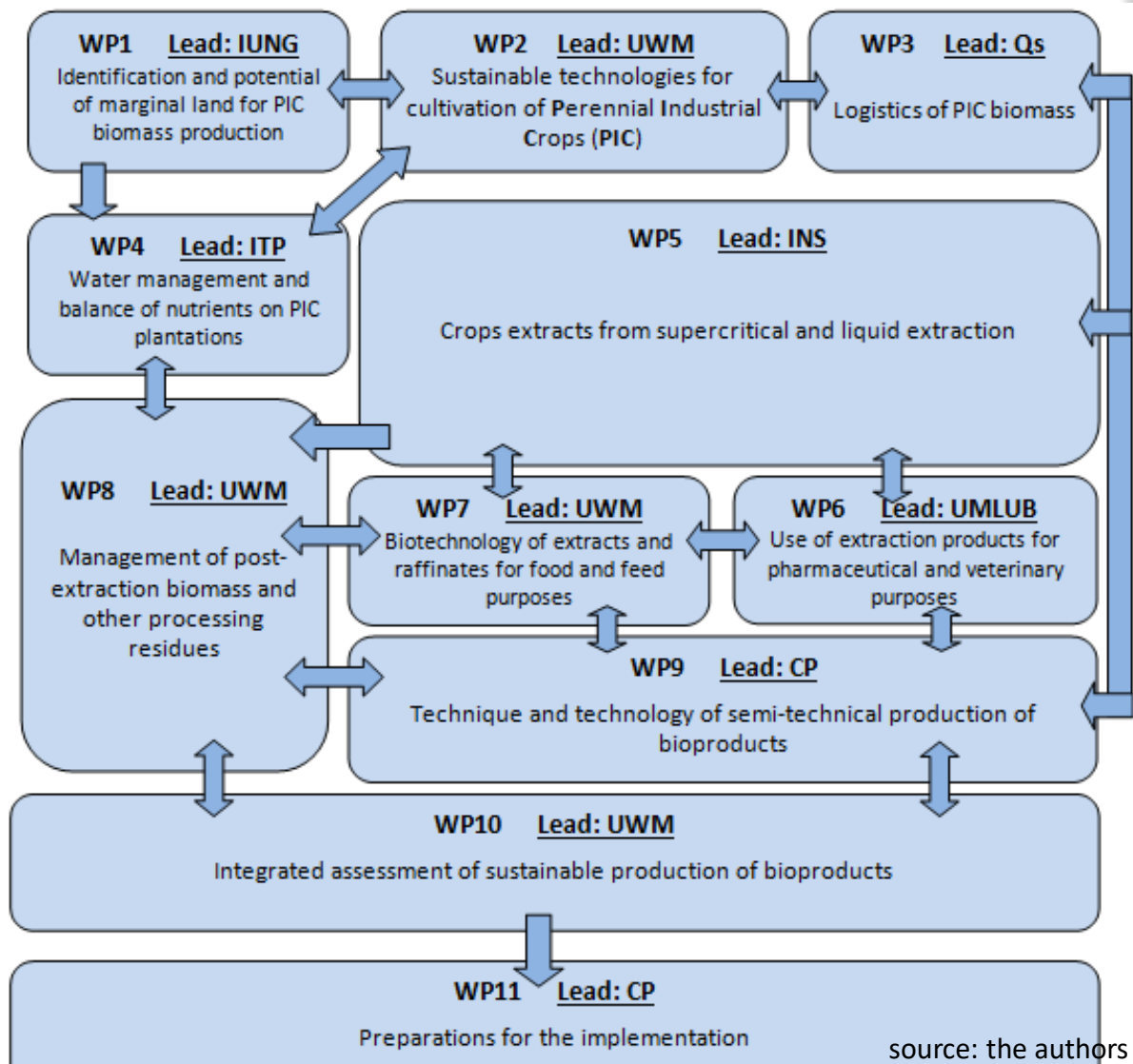
- BIOmagic aims to design a penetration path of PIC into Polish agriculture producing feedstocks on marginal land for bioproducts to feed national bioeconomy.



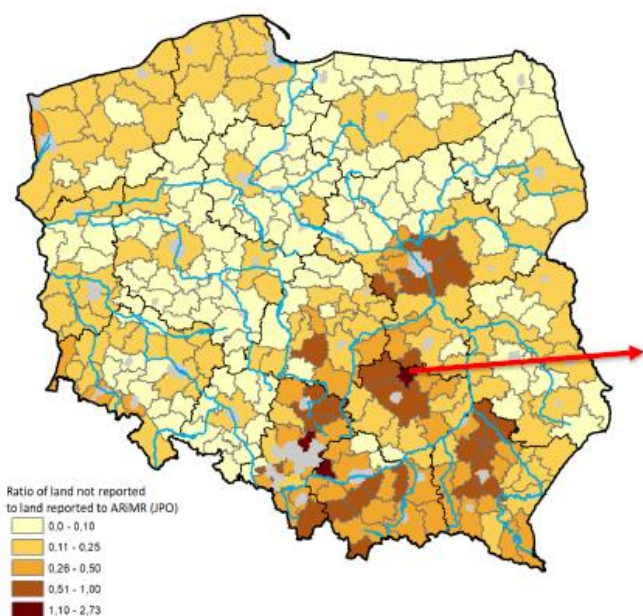
Sustainable production of PIC lignocellulose biomass on marginal land and generation of bioproducts as an element of the development of the national bioeconomy

source: the authors

- The main aim of the **BIOmagic** project is to **generate a bioproduct / bioproducts** containing **bioactive substances** from **lignocellulosic biomass** produced by **PIC** grown **on marginal land**.



- **WP1 (IUNG, ITP)**
- The major goal of this task is to identify the spatial distribution of the potential for PIC biomass production on marginal land in Poland.
- Another aim is to evaluate the influence of climate change on the possibility of using marginal land in the time horizon until 2090.



source: Pudełko et al. 2019



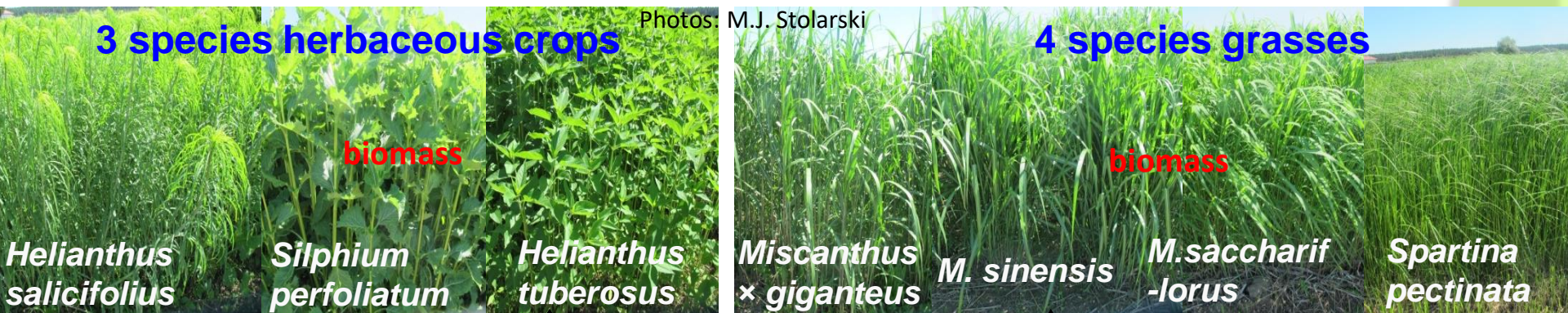
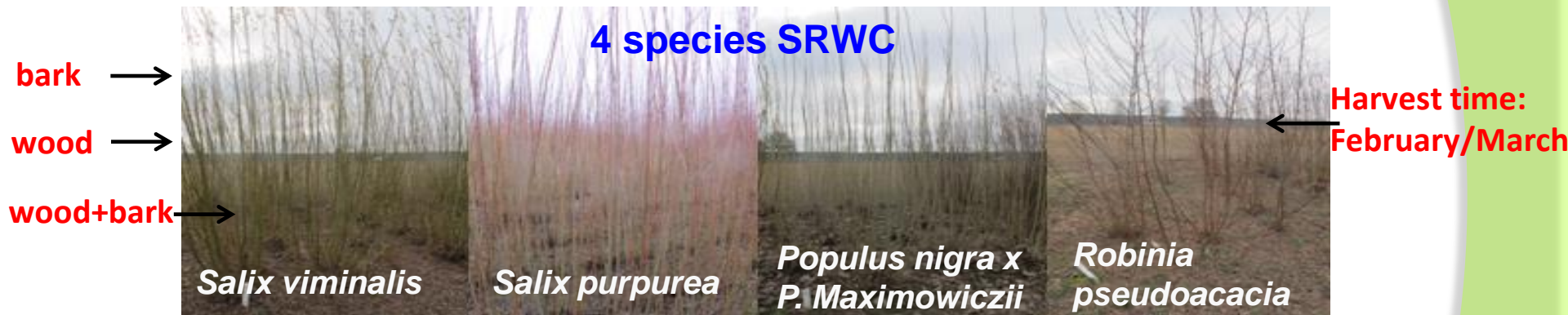
Parcels > 1 ha marked by red line



source: Stolarski et al. 2019

WP2 - Sustainable technologies for cultivation of Perennial Industrial Crops

- WP2 (UWM, Qs, IUNG)
- The objective of this task is to evaluate factors which affect the productivity and thermophysical and chemical properties of biomass of **11 PIC species**, generating biomass in the form of **wood, semiwood and straw**, in the context of sustainable biomass production. Elaboration of **optimal PIC cultivation technologies** on marginal land, and delivery of biomass, satisfying the quality requirements, to the project's partners.



Harvest time: (i) February/March, (ii) June, (iii) October

- **WP3 (Qs, UWM)**
- The major goal is to evaluate technical possibilities of obtaining PIC biomass and elaborating its logistics depending on the quality requirements of producers of extracts and bioproducts.
- To develop a technology for separation of bark from wood so as to ensure the suitable quality of substrates for further processing.



SRWC



Photos: M.J. Stolarski



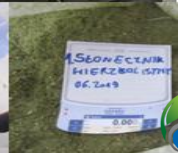
Photo: M.J. Stolarski

Grasses and Herbaceous crops



Photos: M.J. Stolarski

Example of biomass logistic



Photos: M.J. Stolarski

WP4 - Water management and balance of nutrients on PIC plantations

- **WP4 (ITP, IUNG)**
- The aim of this task is to identify the demand of PIC for water and nutrients. The elaboration of a water and nutrients balance in PIC cultivation.
- The elaboration of recommendations (guidelines) for water and nutrients management in PIC cultivation on marginal land.



source: Paszkiewicz-Jasińska et al. 2019

source: Strzelczyk et al. 2018

- **WP5 (INS)**
- The goal of this task is to:
- determine the usability of biomass originating from perennial industrial plants in terms of its content and activity of bioactive substances;
- perform extractions of selected raw materials using supercritical extraction methods;
- prepare adequate quantities of extracts for further studies by the consortium partners.

Lignocellulosic biomass



source: UWM

Supercritical extraction



source: INS

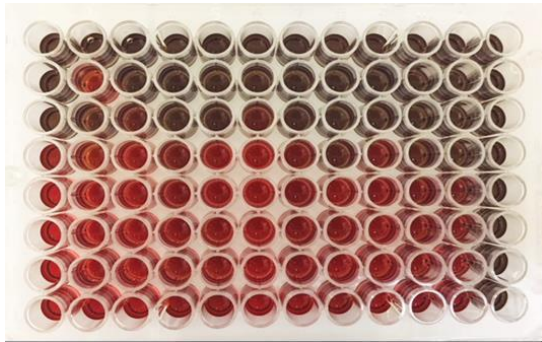
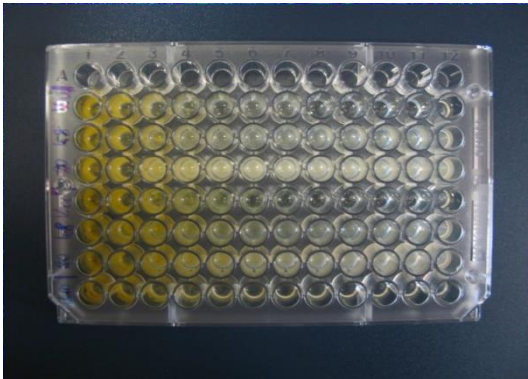
Extracts



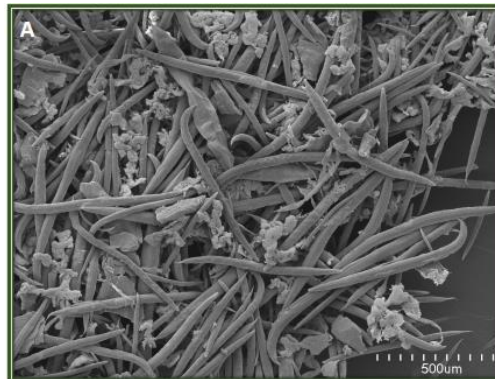
source: INS

WP6 - Use of extraction products for pharmaceutical and veterinary purposes

- **WP6 (UMLUB)**
- The major goal of this task is determination of possibilities of using standardized plant extracts for pharmaceutical and veterinary medicine purposes.



source: Grzegorzczak et al. 2019



source: Grzegorzczak et al. 2019



Cream, cream gel

source: Sobczyński et al. 2019

WP9 - Technique and technology of semi-technical production of bioproducts

- ◎ **WP9 (CP)**

- ◎ The aim of WP9 is to implement a production technology on a semi-technical scale of at least one bioproduct which will serve as an ingredient of:
 - food and/or feeds,
 - and/or pharmaceuticals,
 - and/or veterinary medical products,
 - and/or supplements.

- ◎ This WP has just started so there are no results yet.

- **WP10 (UWM, INS, CP, Qs, IUNG, ITP)**
- The objective of this task is to deliver a multi-criterial assessment of the sustainable production of selected chains generating bioproducts, including life cycle assessment in the context of the natural environment, economics and energy as well as social factors and the development of rural areas.

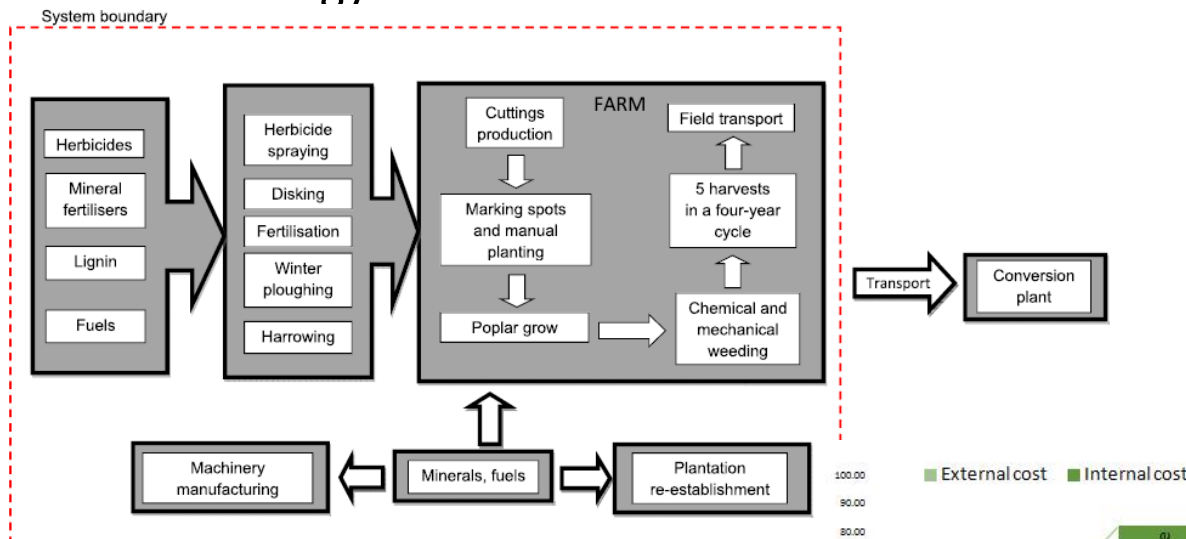
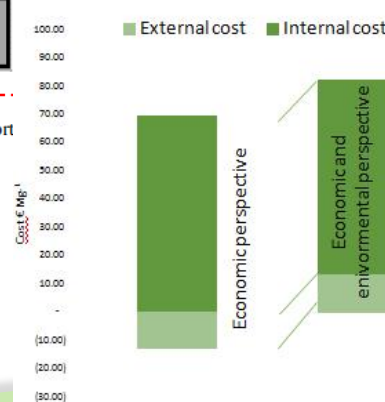


Fig. 1. System boundary of poplar cultivation, harvest and transport

source: Krzyżaniak et al. 2018



source: Olba-Zięty et al. 2020

- ◎ **WP11 (CP, Qs)**
- ◎ The aim of this task is to prepare the technical documentation necessary to implement the production process of at least one bioproduct.
- ◎ Another objective is to evaluate the market demand for new bioproducts and for the service of producing high quality bark as substrate for companies which extract this raw material and produce bioactive substances.
- ◎ *This WP will start in 2021.*

Current situation:

- PIC cultivation is seen as competition (occupying good quality land) for food and feed crops;
- The use of PIC biomass is one-way, mainly as a raw material for energy production;
- Information about the PIC production potential and the possibilities of using biomass are dispersed and ambiguous, and their cultivation is not attractive.

◎ **BIOmagic** it is:

- ◎ **The bridge between PIC production on marginal land and the industrial use of lignocellulosic biomass.**
- ◎ **Many types of non-food biomass (11 plant species) and integration of the entire production and logistics chain.**
- ◎ **Supercritical extraction and many extracts, bioactive substances and bioproducts that can be used in industry, e.g. pharmaceutical, cosmetics, chemical, food, feed, energy.**
- ◎ **A new and strategic approach to the acquisition and cascade use of PIC lignocellulosic biomass, first as raw material for the production of extracts and bioproducts, and second production residues for energy purposes.**
- ◎ **Modern development of research institutions, companies and a step forward towards meeting the R&D goals pursued in the EU and globally in the field of bioeconomy.**

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**THANK YOU FOR
YOUR ATTENTION**

Project coordinator

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BIOPRODUCTS from lignocellulosic biomass

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