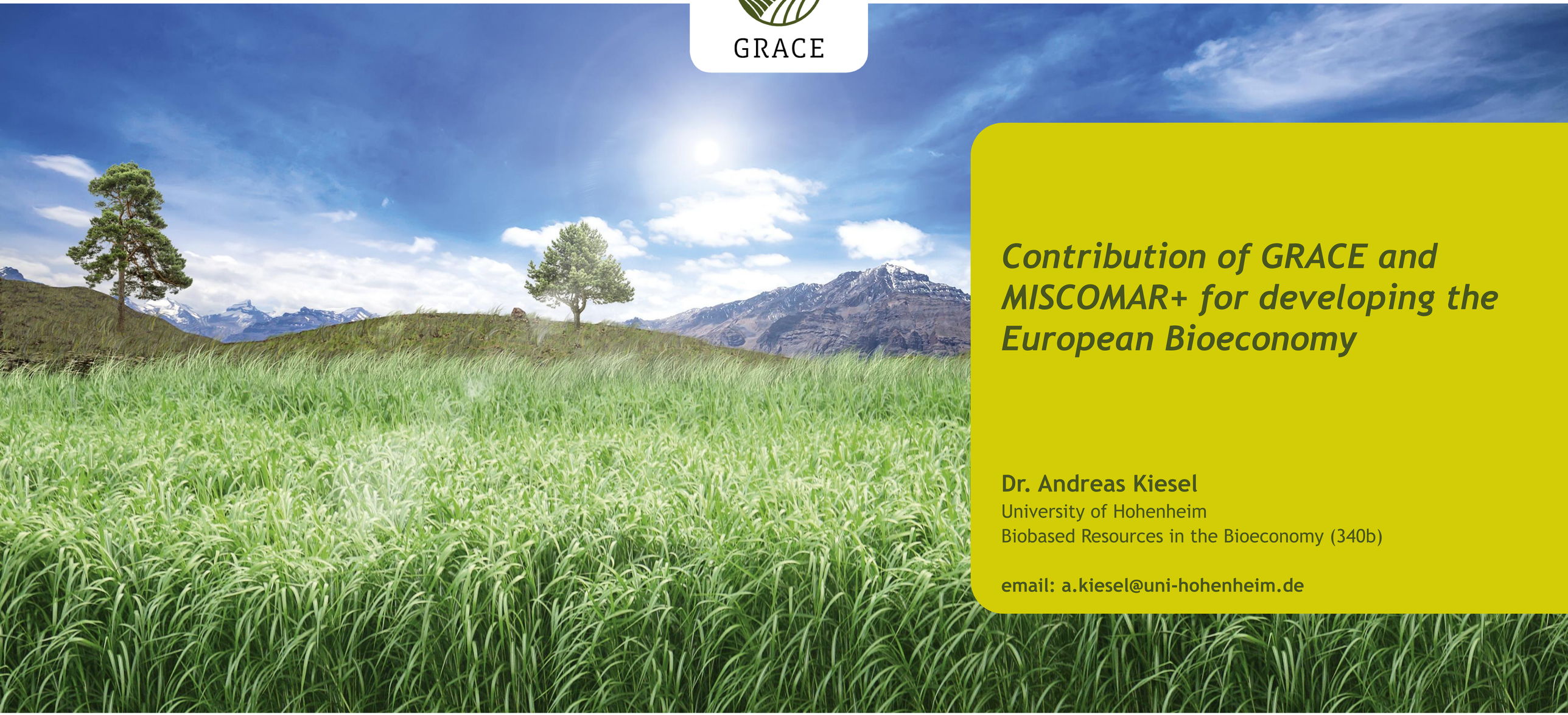
GRACE

UNIVERSITY OF HOHENHEIM



Contribution of GRACE and MISCOMAR+ for developing the European Bioeconomy

Dr. Andreas Kiesel
University of Hohenheim
Biobased Resources in the Bioeconomy (340b)

email: a.kiesel@uni-hohenheim.de

Providing Growledge.

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

The Team involved in this work:

Andreas Kiesel[1], John Clifton-Brown[4], Luisa Trindade[2], Stefano Amaducci[5], Herman Höfte[3], Jan Lask[1], Mario Bonaccorso[21], Andrea Ferrarini[5], Angela Zerga[13], Anita Shepherd[22], Astley Hastings[22], Bert-Jan van Dinter[18], Boris Slijepčević[11], Carmen Retzela[14], Cecile Barron[3], Chiara Gemmati[13], Chris Ashman[4], Danny Awty-Carrol[4], Elena Magenau[1], Emmanuel De Maupeou[19], Enrico Martani[5], Federico Peterlongo[12], Gert-Jan Petrie[16], Gilbert Anderer[9], Giorgio Impollonia[5], Guillaume Ales[10], Henrì Blandinières[5], Isabelle Lamy[3], Jan Weik[1], Jason Kam[17], Johannes Furtlehner[20], Johannes Krümpel[1], Kasper van der Cruijsen[2], Lars Kraak[18], Maciej Olszewski[1], Maria Garcia Torreiro[8], Michael Squance[17], Michele Agriesti[15], Mislav Kontek[6], Mohamad Al Hassan[2], Muhammad Tahir Khan[1], Oene Dolstra[2], Olivier Bancel[10], Philip van der Pluijm[19], Pieter Ravaglia[7], Sara Guerrini[7], Silvia Gava[8], Slavica Rukavina[11], Stefan Krawielitzki[9], Stefano Babbini[8], Uwe Kühn[14], Vanja Jurisic[6], William Cracroft-Eley[17] and Iris Lewandowski[1]

[1]University of Hohenheim, [2]Wageningen University and Research, [3]INRAE, [4]Aberystwyth University, [5]Università Cattolica del Sacro Cuore, [6]University of Zagreb Faculty of Agriculture, [7]Novamont, [8]MOGU SrL, [9]AVA Biochem, [10]Addiplast, [11]INA d.d., [12]INDENA, [13]Consorzio di Bonificia di Piacenza, [14]Technical Service Kühn, [15]Gruppa Fobranova, [16]Miscanthusgroep, [17]Terravesta, [18]Van Dinter Semo, [19]Novabiom, [20]Miscanthus F.A.R.M., [21]SPRING - Italian Circular Bioeconomy Cluster, [22]University of Aberdeen

Bio-based Industries Consortium

BBI

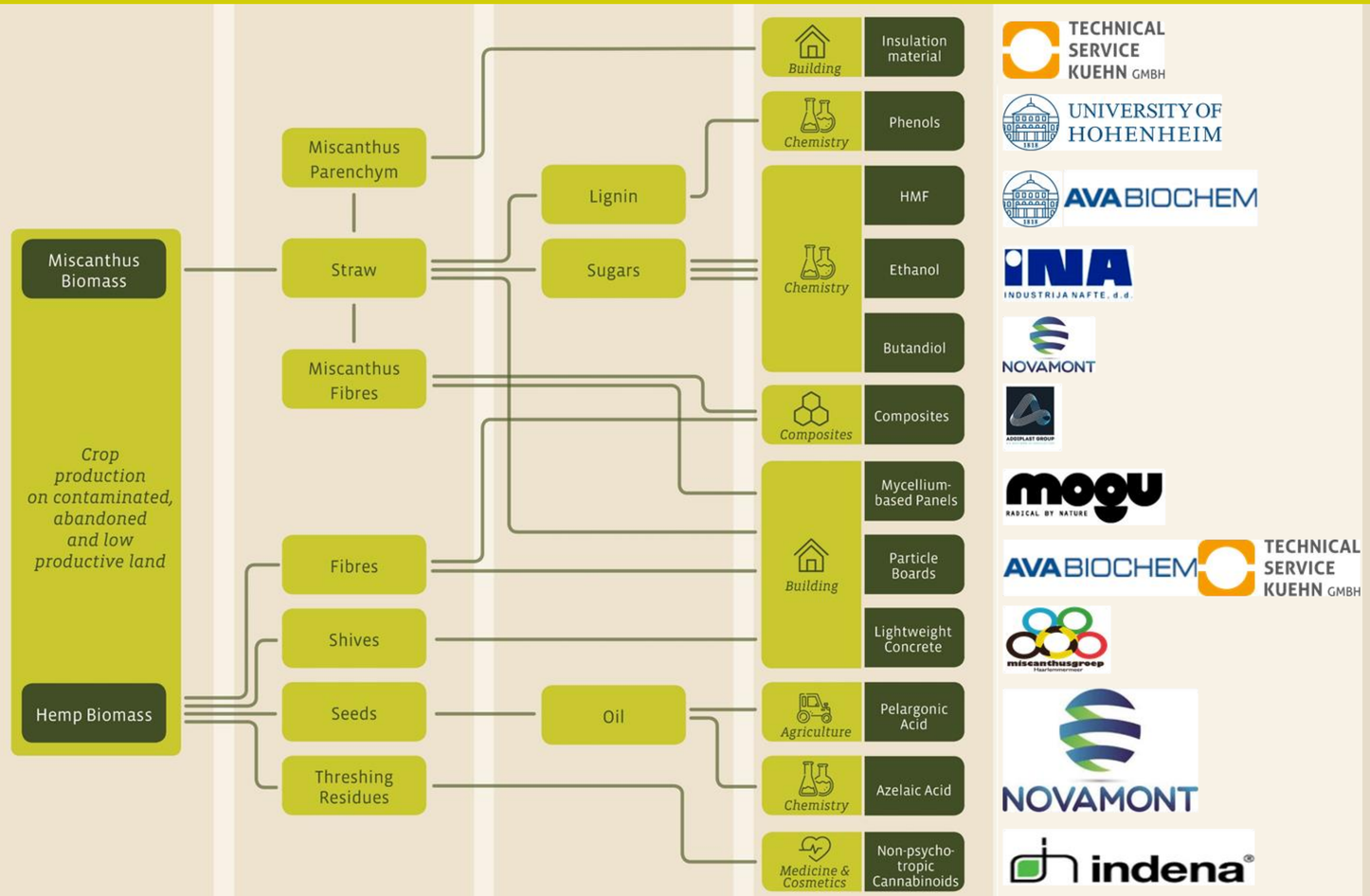
Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Objectives of GRACE



- Demonstration of 10 complete value chains at industry relevant scale
- Miscanthus and hemp production focussing on low-productive, contaminated and abandoned land
- Demonstration of large scale establishment of novel, seed-based miscanthus hybrids
- Assessment of environmental, social and economic impacts
- Participative approach – Industry panel

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Crop Production on marginal land

Main challenge on marginal land:

Similar/higher costs

+ lower yield

= low economic viability

New seed-based miscanthus hybrids can help to overcome this bottleneck:

→ R&D and breeding: ripening, lodging, establishment costs

- *M. sinensis* seem suitable for maritime climates in Northwest/Central Europe
- *M. sac x M. sin* seem suitable for continental climates in Southeast Europe

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Establishment using film

miscomar+

Benefits:

- Speeding up early growth by increasing temperature
- Reducing plant losses by keeping soil moisture
- Reducing risk of frost damages for early plantings

Risks:

- Plant losses due to overheating (late planting dates)

Bio-based Industries Consortium

BBI

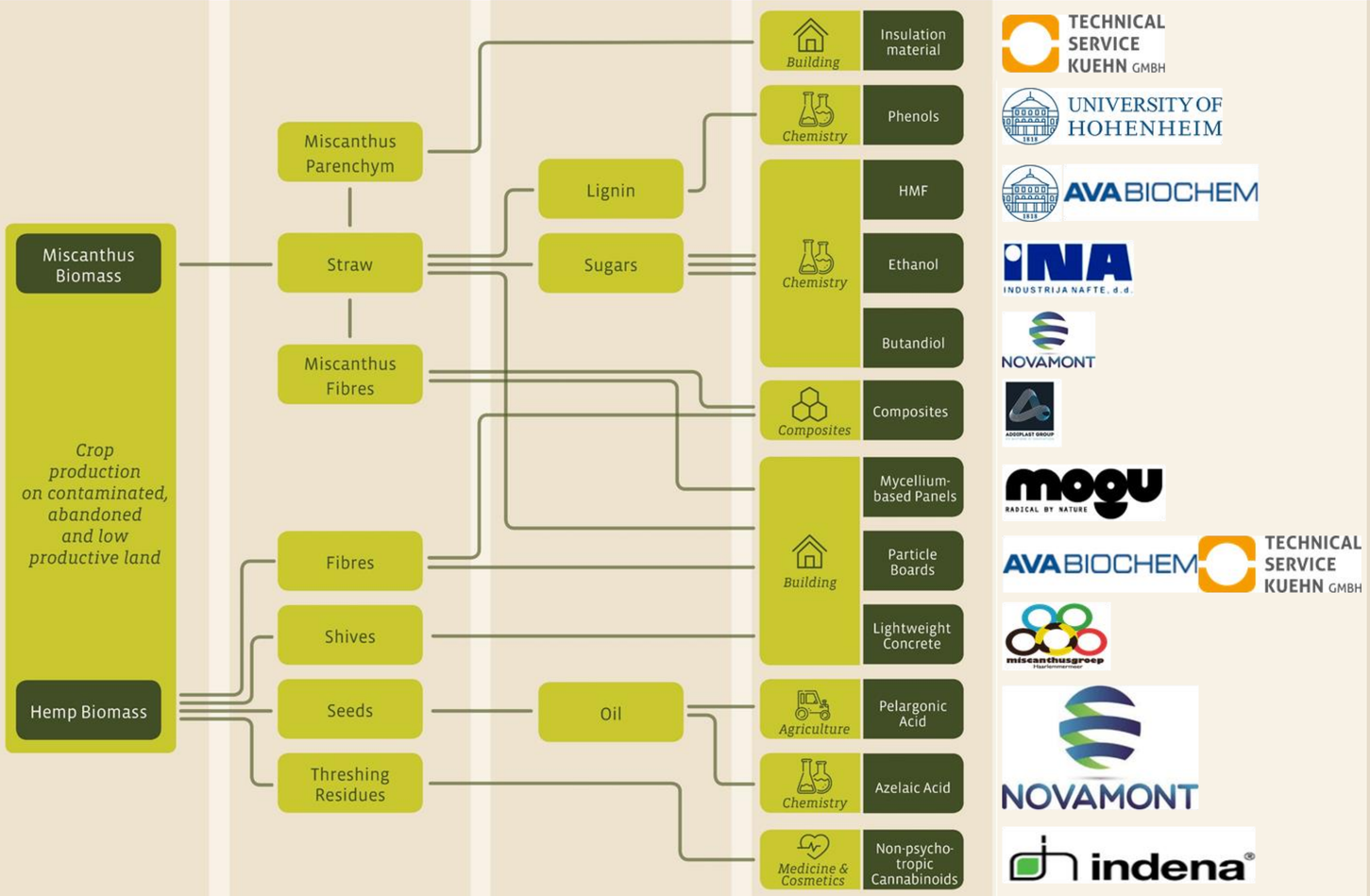
Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Demonstration Cases and Sustainability Assessment



- Demonstration of biobased value chains
- Sustainability Assessment (environmental, economic, social), incl. hotspots identification

→ value chain optimization

- Business plan development and improvement

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Miscanthus - Chemicals

NOVAMONT

Butandiol, Azelaic Acid:

- Target: Production of in soil biodegradable polymers and composites for different applications, e.g. in agriculture
- Tests with 2G sugars showed general feasibility for butandiol fermentation
- Biobased polymer optimized (higher proportion of biobased resources)
- Degradability of polymer and hemp/miscanthus fiber composites proven

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

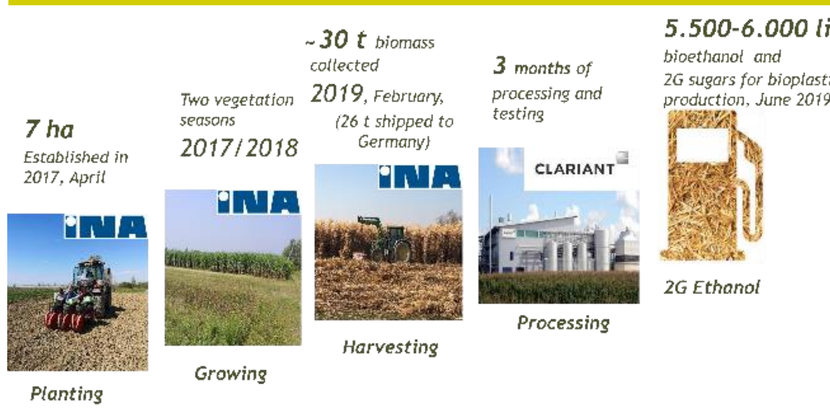
The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

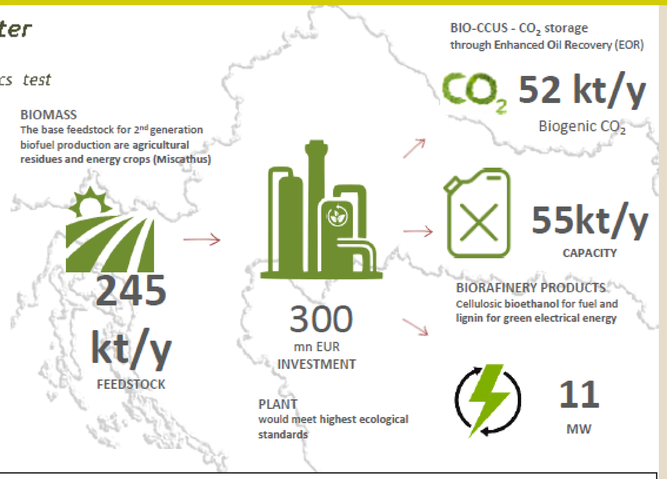
GRACE

UNIVERSITY OF HOHENHEIM

INA INDUSTRIJA NAFTE, d.d.

Miscanthus - Chemicals





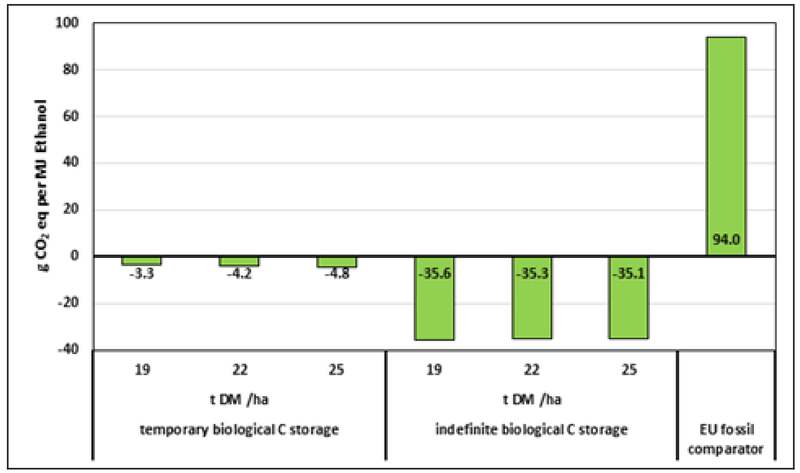


Figure 3 Global Warming Potential (GWP) per MJ (in g CO_2eq) of ethanol produced using two alternative approaches to biological carbon storage accounting: temporary and indefinite. Temporary biological C storage assumes that all carbon stored in the below-ground biomass is released after the cultivation period. Indefinite biological C storage assumes that all carbon remains indefinitely in the soil. Three yield levels are compared: 19, 22 and 25 t DM/ha, corresponding to harvestable biomass yields of 15, 18 and 21 t DM/ha.

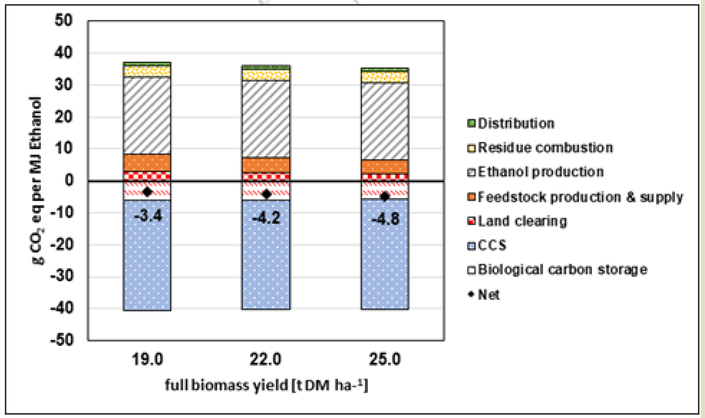


Figure S1 Global Warming Potential (GWP) per MJ (in g CO2eq) of ethanol produced. Comparison of three yield levels: 19, 22 and 25 t DM/ha, corresponding to harvestable biomass yields of 15, 18 and 21 t DM/ha. Temporary biological C storage is assumed, i.e. all carbon stored in the below-ground biomass is released after the cultivation period.

Miscanthus Bioethanol:

- Demonstration successfully performed; planning of full-scale plant is progressing
- Key advantages: Feedstock security, low GHG emissions and CO_2 sequestration potential (BECCS)
- EU policy in place: RED II directive
- Carbon mitigation potential >100%

www.grace-bbi.eu

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

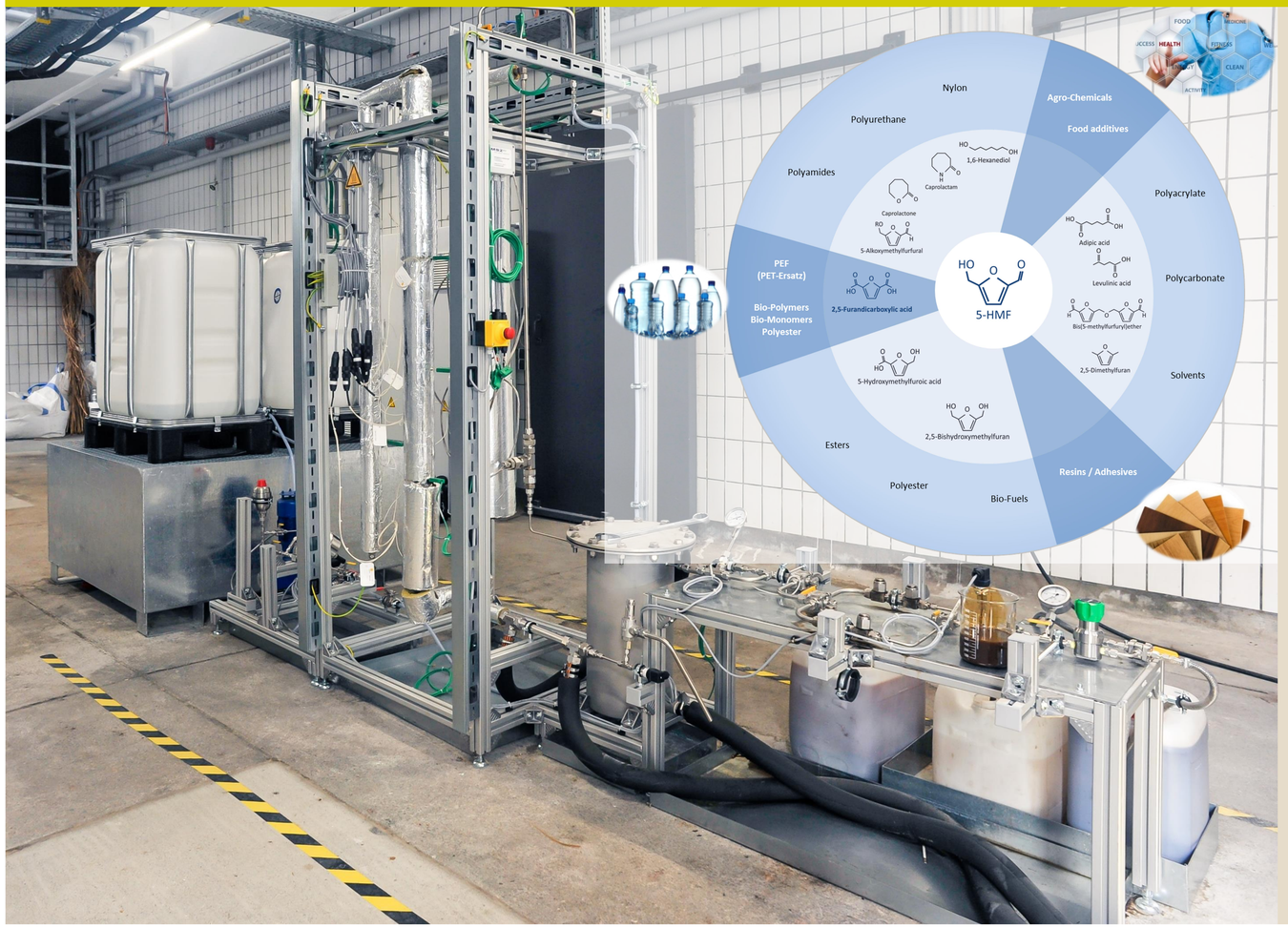
The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Miscanthus - Chemicals

UNIVERSITY OF HOHENHEIM AVABIOCHEM



HMF/Phenols:

- Production of HMF and Phenols from lignocellulosic material
- Pilot plant running
- Potential applications of platform chemical HMF:
  - Biobased polymers, e.g. PEF (replaces PET)
  - Biobased Resins (HMF + Phenols) replacing formaldehyde-based binders

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

Miscanthus - Chemicals

HMF/Phenols:

- Pilot plant running
- HMF solution converted in biobased resins
- Tests with spruce wood and miscanthus fibers
- Optimization potential: Pressing time and temperature

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Miscanthus – Composites

ADDIPLAST GROUP
EN MATIÈRE D'INNOVATION

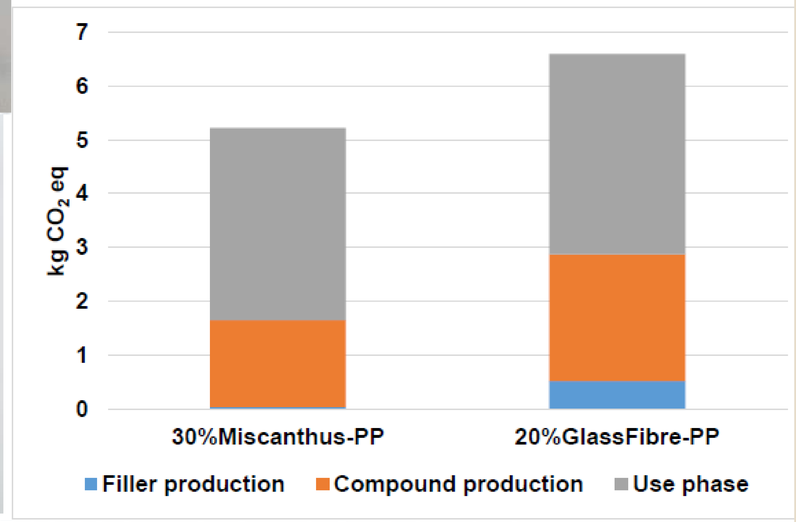


Figure 9 Total global warming impacts Cradle-to-gate plus use phase.

Miscanthus fiber composite for automotive sector:

- Two materials listed in the car automotive panel: Addibio® GJI 53116 (30% miscanthus fiber) and Addibio® GGI 53002 (25% recycled PP + 30% miscanthus fiber)
- 1-2 car models in the next 2-3 year; dashboard element for first model (1Q 2023)
- Key selling point: Carbon mitigation potential 20-25%
- Miscanthus fiber demand: 200 t a^{-1} in 2025

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

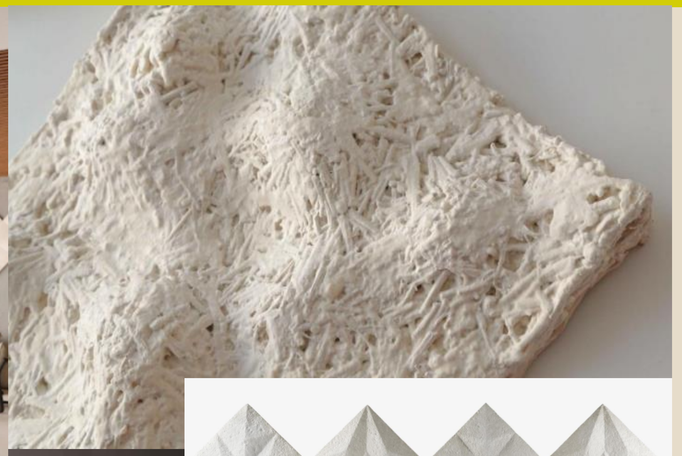
The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Miscanthus – Building materials

mogu RADICAL BY NATURE



Mycellium-based Sound absorption panels:

- Key advantages: high sound-absorption capacity, lightweight, 100% biobased and no chemicals used as binders
- Improved performance (e.g. shrinking) by using specific miscanthus fractions
- Sustainability Assessment:

  → Hotspot identified:
  Energy Use during Production

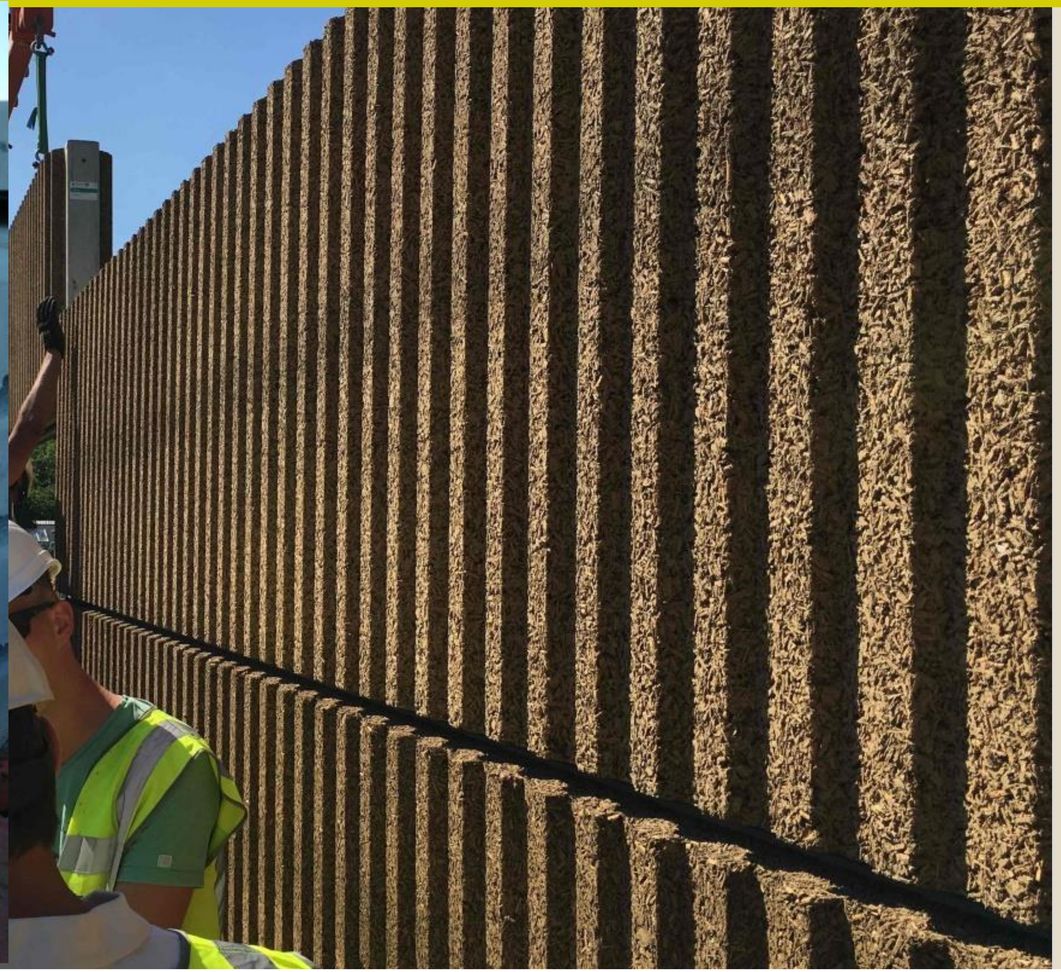
Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

Miscanthus – Building materials



Miscanthus as additive in concrete:

- **Strukton Green Silence Wall meanwhile available on the market in NL**

→Large interest in such materials in NL, since national regulation is in place to reduce impact of building sector

Sustainability: Cement is main driver! Replacing cement leads to significantly lower impacts.

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Fractionation for insulation material

TECHNICAL SERVICE KUEHN GMBH

Fractionation Demo plant successfully in operation!

- Frationation provides valueable fiber fraction for other material applications (improved quality)
- Light fraction (pith) is suitable as insulation material with improved environmental sustainable compared to non-renewable products

→ Challenge: Find a market for each fraction!

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Paper Based Products

miscomar+

- Production of paper containing 30% steam-exploded miscanthus fibers successfully demonstrated!
- *M. sinensis* seems to provide higer paper qualities
- Biomass harvest and processing is very important

  → less intensive to maintain fiber length and strength

Fibers 365

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.

GRACE

UNIVERSITY OF HOHENHEIM

Remarks


Wiley Online Library

Search

GCB-BIOENERGY
BIOPRODUCTS FOR A SUSTAINABLE BIOECONOMY
Open Access

HOME | ABOUT | CONTRIBUTE | BROWSE

Valorization of Marginal Agricultural Land in The Bioeconomy

First published: 6 July 2021 | Last updated: 11 March 2022

Guest Editors:

John Clifton-Brown (Aberystwyth University)
Andreas Kiesel (University of Hohenheim)
Iris Lewandowski (University of Hohenheim)
Moritz von Cossel (University of Hohenheim)

European policy makers have long recognized the socio-economic and environmental opportunities associated with increasing biomass supply and utilization, with R&D in this area starting in the early 1990s. While opportunities for biomass are large, they are complex because they cut across sectors: agriculture, energy, environment, and manufacturing. The European 'Bioeconomy' concept unifies sectors into a progressive strategy to provide solutions to current problems by translating research into commercial opportunities. Responding to the twin challenges of COVID-19 economic recovery and climate change is the announcement of a billion euro 'Green Deal'. This Deal was aimed at accelerating innovations that could transform societies from fossil-fuel based to those based on biomass – bio-economies.

https://onlinelibrary.wiley.com/doi/toc/10.1111/(ISSN)1757-1707.marginal-agricultural-land

Miscanthus establishment

❖ Film technology only suitable for early planting dates

Miscanthus as feedstock for:

1. **Conversion into chemicals:** very basic quality requirements: dry, free of stones/contaminants, format which allows easy handling and transport;
   Lignin content in practice not really relevant!

2. **Direct material use:** Physical parameters highly relevant: particle size and distribution, no dust, no oversizes, fiber length and strength

Bio-based Industries Consortium

BBI

Horizon 2020 European Union Funding for Research & Innovation

The GRACE project has received funding from the Bio-Based Industries Joint Untertaking (BBI JU) under the European Union's Horizon 2020 research and innovation programme under grant agreement No 745012.


Thanks for your attention!