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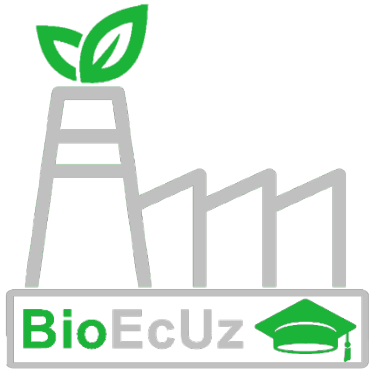

The project "New Master's Degree Curricula for Sustainable Bioeconomy in Uzbekistan" (BioEcUz)

No 619294-EPP-1-2020-1-LV-EPPKA2-CBHE-JP

Presentation of MRS Kirsi Knuuttila from JAMK University of APPLIED Sciences

INNOVATIVE BIOECONOMY SOLUTIONS PROMOTING CIRCULARITY AND SUSTAINABILITY

BIOECONOMY FORUM 2022 IN SAMARKAND

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Innovative bioeconomy solutions promoting circularity and sustainability

What is circular bioeconomy?

Innovative biobased solutions

Future bioeconomy

Wise use of resources

jamk | Jyväskylän ammattikorkeakoulu
University of Applied Sciences
Kirsi Knuuttila

Circular bioeconomy

Building solutions for the sustainable future

Kirsi Knuuttila

Team leader of Forest (bioeconomy) in Institute of Bioeconomy in JAMK University of Applied Sciences (UAS)

Education

- Master of Environmental Sciences (1997)
- EU Expert (2000)
- Certified project manager (IPMA) (2020)

Professional experience

- Regional, national and international bioenergy (2000-2009), bioeconomy (2009-) and circular economy (2013-) research, development and innovation related tasks
- Representative of JAMK in Resource wisdom cooperation group of Jyväskylä City, Central Finland sustainability education network (KYKY) & CIRCWASTE regional steering group and Sustainable and responsible RDI working group of Arene (Finnish UAS association)
- Projectmanager in Jamk for BioEcUz project and secretary of Jamk sustainable development working group

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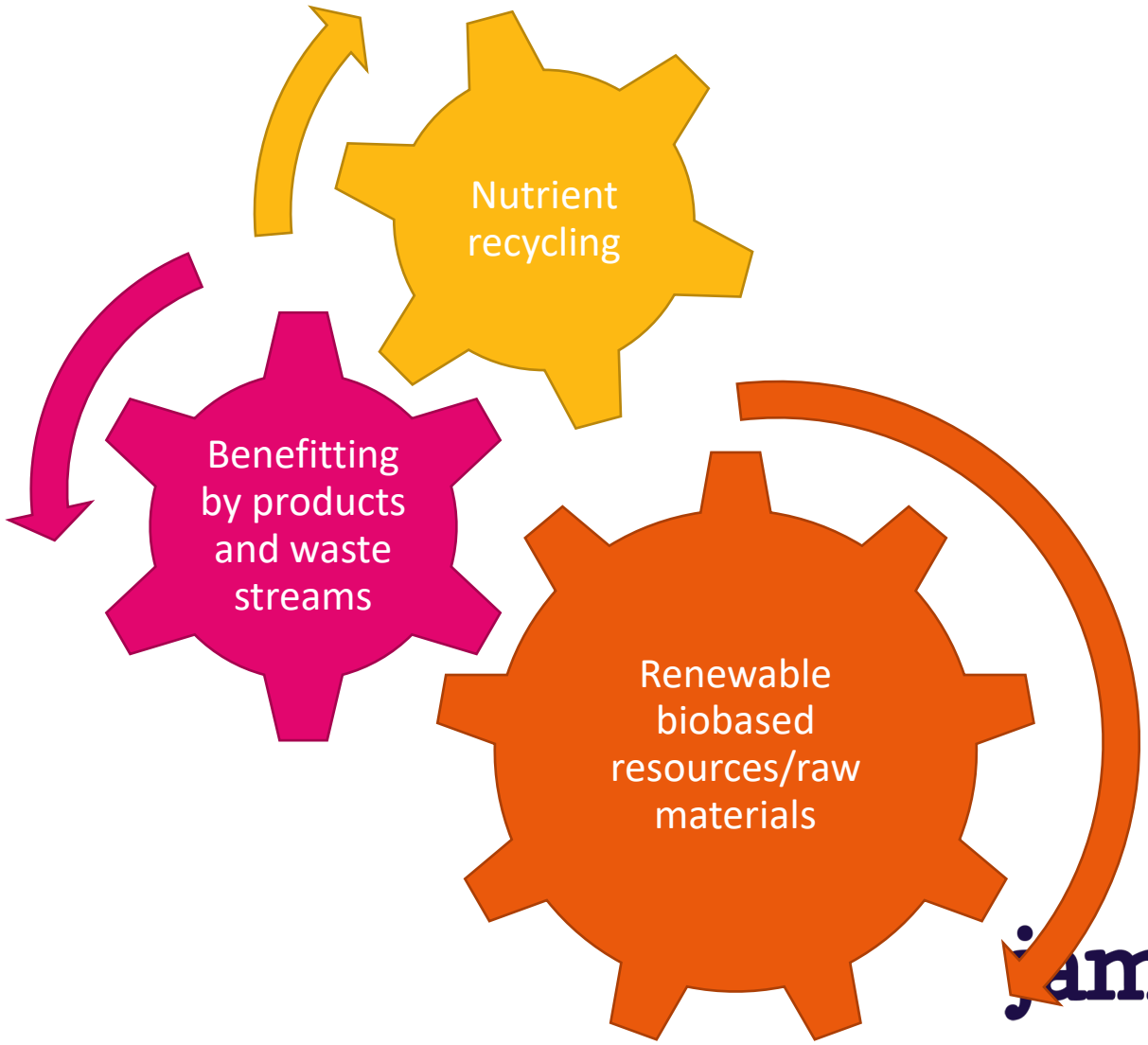
Bioeconomy provides input for circular economy

Bioeconomy solutions…

- **Promote circular economy**
  especially when
  - **Reducing the use of fossile resources** (coal, gas, oil) OR
  - **Reducing the use of other natural resource causing unwanted environmental (sustainability) impacts** during extraction, processing, utilisation or circulation (supply chain)
  - Offering sustainable produced **virgin renewable raw materials** for circular economy.



Dec 2019:
EU New circular economy action plan ”Green deal”

Resource extraction and processing:

- **half of total greenhouse gas emissions**
- **more than 90% of biodiversity loss and water**

Strategy for a **climate-neutra**l, **resource-efficient** and **competitive** economy.

Climate neutrality by 2050
Decoupling economic growth from resource use
Economy growth
Social values

Source:Green deal. 2019. https://ec.europa.eu/environment/pdf/circular-economy/new_circular_economy_action_plan.pdf

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Innovative biobased products

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Renewable package materials

Sulapac® meets circular principles

- Woodchips combined with binding natural extract
- Material has plastic like properties
- 100 % biodegradable
- Doesn’t not for micro-plastic particles when degrading
- Applicable for
  - packages of food and cosmetics industry
  - Traditionally plastic products with high hygiene requirements, e.g. disposal cutlery
- Material
  - Endures (not absorbs) water, grease,
  - Not absorbing water or grease
  - Impervious on water
- Material can be circulated in industrial size composters (EN 13432).

Picture: Sulapac

Renewable materials replacing non-renewable

Woodio-biocomposite

- Wood based composites for bath room furnitures (sinks, toilets…)
- Consists wood chips and transparent resin based binder
- Comparison to the tradiotional material of bathroom furniture produced for ceramics :
  - The carbon footprint of a Woodio basin is 80% smaller when to a similar sized compared to ceramic basins.
  - The lightness of our material reduces emissions in logistics.
  - Material is durable, not fragile like porsline
  - End of use can be combusted → converted to energy
  - Achieved Design from Finland –label and awarded with Annual design prize of Finland 2019.

Source: https://www.woodio.fi/

Photo: Woodio

Photo: Kirsi Knuuttila

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Animal free materials

Bacterial leather

- Bacteria (Kompbucha) can produce material that can has properties of leather
- The material is cellulose formed by biosynthesis out of glugose (suger).
- The preliminar material is gel like, spongy thick mass – almost water proof
- Material is elastic and easily formed
- Can be used as artificial skin in health care.
- Commercial used as artificial skin (in health care) and in clothing

Upper photo: Mushroom colonia in Aalto University (down). Kompucha Lower photo: Leather jacket designed by British designer Suzanne Lee.

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Renewable materials replacing fossile materials

Car wheels with the portion lignin

- Wood processing industry provides as by product lignin (black liquir) that is typically converted to energy
- Lignin can be used as filling for car wheels.
  - Replaces fossile materials
- Lignin is expected to become typical material replacing fossile based materials in many applications
- Lignin is fully bio-based and renewable.
- Lignin has low density compared to the traditional fossile based materials (about 25–35 procent lower)
- Car industry is eager to compensate the high weight of electric cars with low weight wheels.
- Reduces the toxity of car wheels and reduces the carbon foot print.

Source: Metsä.fi, Nämä 7 asiaa on tehty puusta – vähentävät arjen hiilijalanjälkeä - Forest.fi (8.4.2022)

Photo: Electrical sharing car in Jyväskylä City Hall parking lot. (Kirsi Knuuttila)

Innovation from 2009: Dandelion consist gum that is already used to produce wheel for the bicycles

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Well-being from soil/ground

Uute Scientific - Microbe extract and biodiversity powder

People are getting more and more easily sick. Their immunity system has not met forest and soil (nature) origin bacteria that would support the immunity system development.

- These extracts and powers use the mixture of soils as raw materials.
- The products consists substance that prevents from urban deceases, such as diabetes, asthma and allergies
- Strengthens the immunity system of urban people
- 11 out of 20 largests global cosmetic producers are interested in this special product.

(Source: Tekniikka ja talous, 9/21, https://www.tekniikkatalous.fi/uutiset/suomalaisyritys-kehitti-mullasta-aineen-joka-ehkaisee-diabetesta-astmaa-ja-allergioita-johtajat-sekoittavat-mikrobijauheen-itse-tehtaalla-lohjalla/b10ce09e-2569-4cad-82c2-91699204bcda)

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Industrial wastes to new products

Betolar sustainable concrete

The company has developed technology to upgrade industrial waste streams to construction materials, e.g. geopolymers

- Benefitting waste streams of forest industries, mining industries, steel industries and energy production
- Materials has similar strength properties like traditional concretes
  - Carbon footprint is even 90 % lower
- Offers benefits to companies producing unwanted by streams, customers, other end-users
- Waste producers saves costs related to the waste management and the customer get low cost and sustainable product.
- The production technology has a license.

Source: Kiertotalouden kiinnostavimmat. Sitra. 2019. https://www.sitra.fi/caset/teollisuuden-jatteista-betonia-korvaavia-tuotteita/

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Cascade use of waste - Infinited fibre

- Textile waste recycling is becoming mandatory in the EU in 2025
- Company has technology to produce new textile fibre from cellulose rich by-streams and waste streams, such as
  - Textile waste
  - Recycled cardboard
  - Crop residues (e.g. rice or wheat straw)
- Process is suitable for existing cellulose and viscose processing factories
- Fibre can be re-circulated with no remarkable quality loss
- Process can separate with elastan
- Comparison to cotton production water consumption
  - 1 kg cotton fible comsumes 20 000 l water
  - 1 kg Infinited fiber requires 50 l water
    - Almost closed loop
- Carbon positive material

Kuva: Infinited fiber

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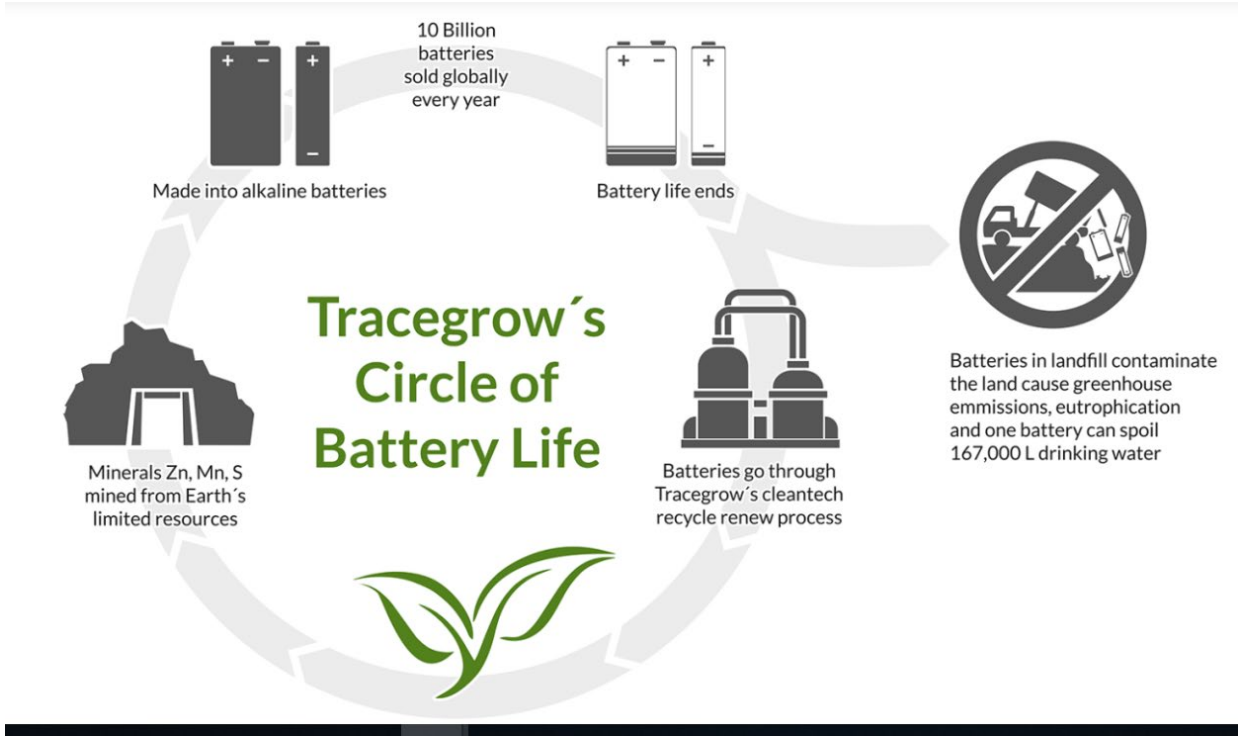
Organic fertilizer out of used batteries

Tracegrow – reproducing circular fertilizer

- Technology to produce sustainable fertilizers out of micronutrients: (Zn (Zink) & Mn (Magnan)
- Product is extracted and purified from used alkaline batteries
- Solves two major global challenges
  - Cascade and sustainable use pf alcale batteries
  - Fertilizing crop production.
- Process saves non-renewable natural resources and promotes resource wisdom
- Process benefits about 90 % of waste like material



Source: Tracegrow website, https://www.tracegrow.com/ (19.4.2022)

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Future bioeconomy

Lignin-based glue for plywood

27.10.2017 / FOREST BIOECONOMY FUTURE CATALOGUE
CIRCULAR BIOECONOMY, INNOVATIONS

Cutting WISA spruce plywood at Pellosniemi plywood mill. Photo: UPM

Super wood is as strong as steel and aluminium

13.4.2018 / FOREST BIOECONOMY FUTURE CATALOGUE
CIRCULAR BIOECONOMY, INNOVATIONS

TULEVAISUUS-KUVASTO
forest.fi
FUTURE CATALOGUE

A research group led by the University of Maryland in the United States has developed a process, by which several tree species can be strengthened to being bulletproof. A research report published in Nature magazine says that wooden boards made in the process match steel and some

Forest industry process fibre-rich sidestream into a soil conditioner

25.11.2020 / FOREST BIOECONOMY FUTURE CATALOGUE
CIRCULAR BIOECONOMY, INNOVATIONS

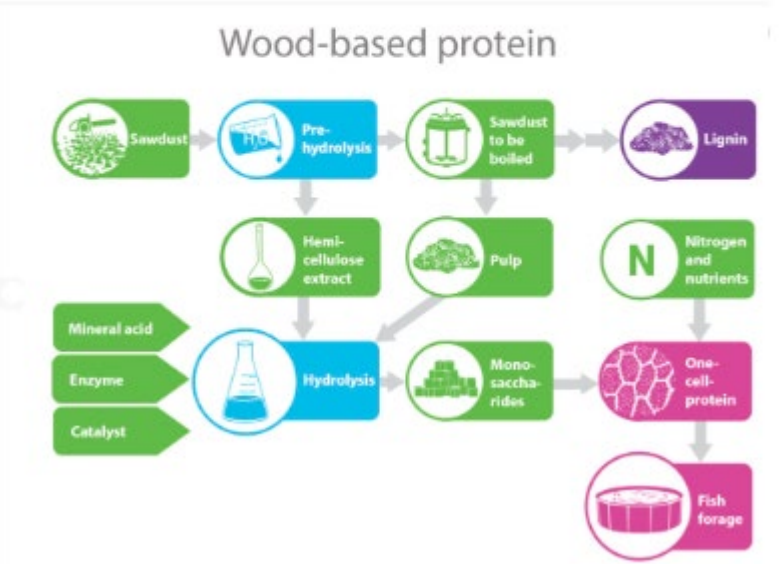
Soilfood soil conditioner is being spread on a field. Photo: Soilfood

Marsh microbes producing biogas from carbon dioxide

24.10.2017 / FOREST BIOECONOMY FUTURE CATALOGUE
CIRCULAR BIOECONOMY, CLIMATE CHANGE, INNOVATIONS

Protein in wood could be the answer for global need of nutrients

24.9.2018 / FOREST BIOECONOMY FUTURE CATALOGUE
INNOVATIONS



UPM developed a bio-based material for 3D printing

17.9.2018 / FOREST BIOECONOMY FUTURE CATALOGUE
CIRCULAR BIOECONOMY, INNOVATIONS

UPM Formi 3D printing material is sold as granulates. Photo: UPM

Life cycle of biobased products

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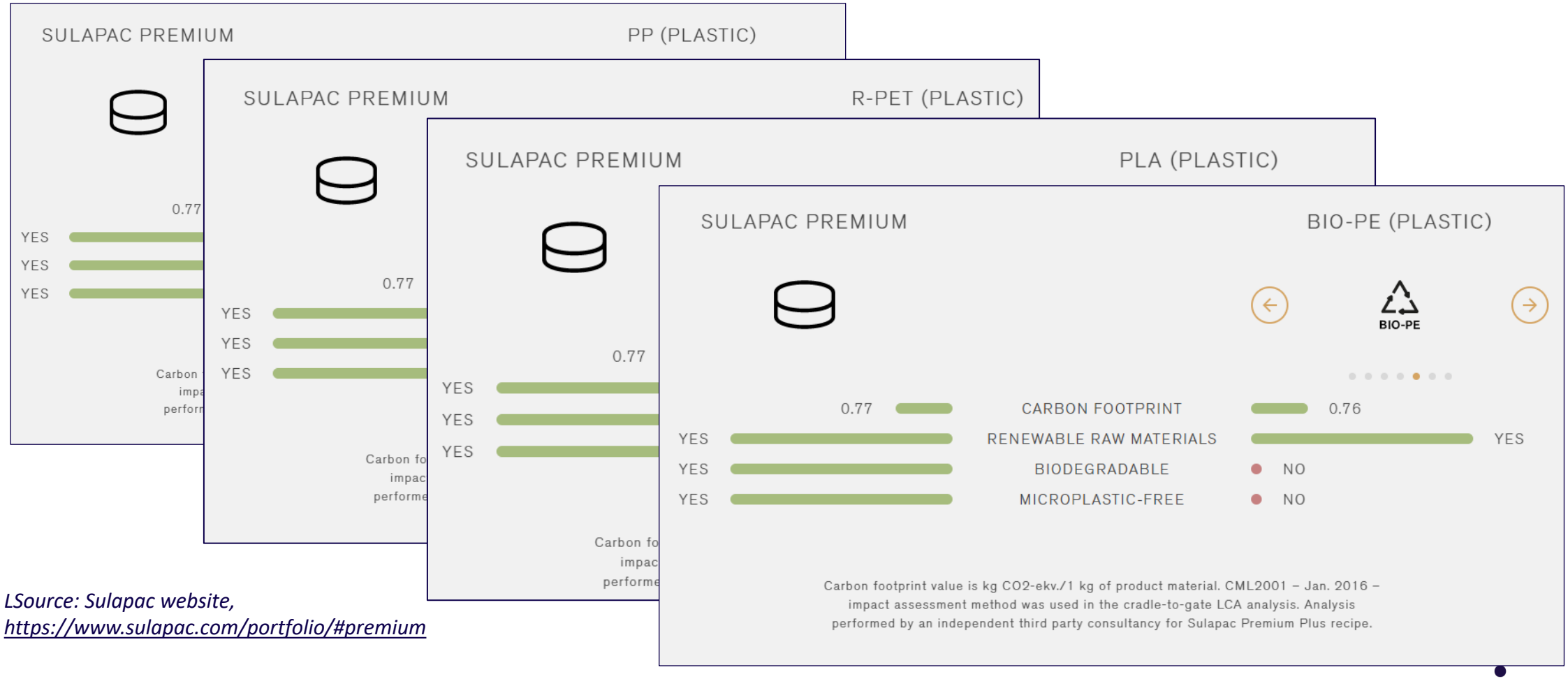
Life cycle analyses – case Sulapac

Comparison to different kind of packing materials



LSource: Sulapac website,
https://www.sulapac.com/portfolio/#premium

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Important issues to consider in biobased products

- **Biobased ≠ ecological**
- What is the orgigin of the biobased materials component/ material?
  - Is the raw-material use sustainable and responsible?
- How relevant is to use biobased material in a specific product? E.g. replacing plastic straws with biobased straws
- Is biobased materials/raw material replacing some material that has major challenges in life cycle?
  - Supply, processing, use, end of life cycle
- Is the impact on sustainability transparent?
  - Less CO2, lower water consumption or chemical use?
  - Can it be verified?

Some samples of sustainable materials described in cardboards of material tree. (Photo: Aino Voutilainen)

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Important issues to consider in biobased products

Impact of product life cycle

- Biobased materials are often more expensive than fossile based materials
  - Do biobased material provide additional value for the product?
- Project using time length and durability
  - Long lasting product is typically the most sustainable!
- Biobased products have often safe image (chemicals, hygien) and considered as ecological option
  - Do they cover customer expectations?
- Does the use of biobased products decrease Vähentävätkö disposable production?
  - Instead of just replacing fossile material with biobased material, the customer behavior should be paid attention as well! Do we really need all we purchase?

Wise use of renewable and non-renewable resources!

Expendable cups and covers are constantly seeked more sustainable materials – should we change the business idea and impact on customer behavior?

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Achieving wise use of resources

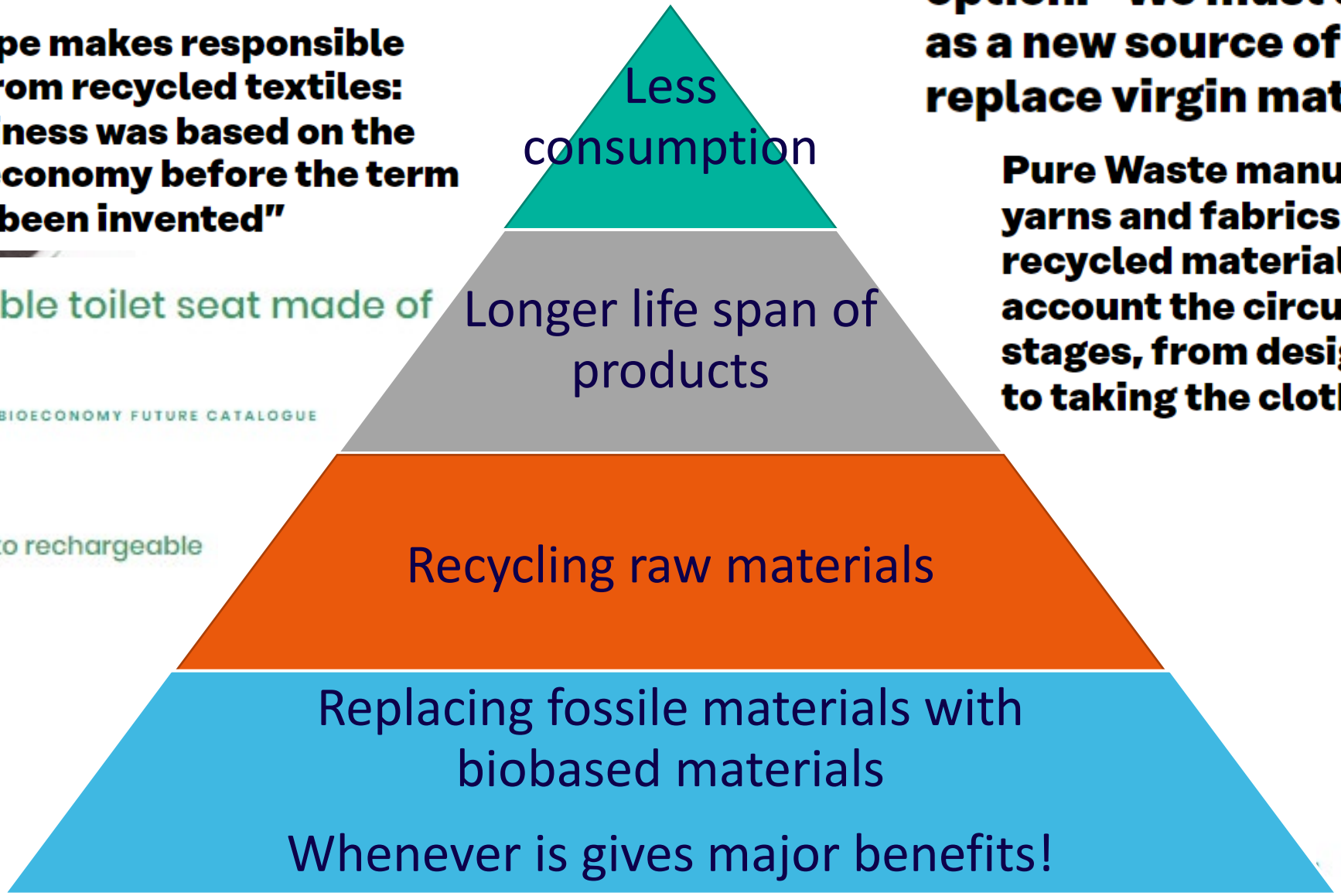
Globe Hope makes responsible fashion from recycled textiles: "Our business was based on the circular economy before the term had even been invented"

Unbreakable toilet seat made of wood

14.9.2021 / FOREST BIOECONOMY FUTURE CATALOGUE INNOVATIONS

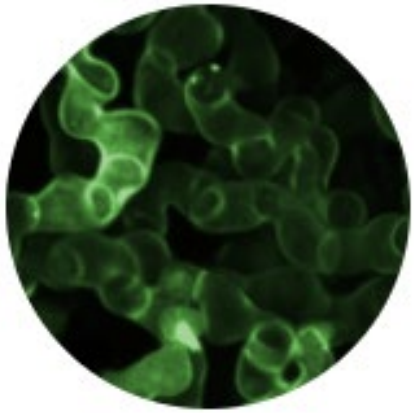
5.9.2020 /

Wood goes into rechargeable batteries



Betolar replaces cement with a low-emission circular economy option: "We must see side streams as a new source of raw material to replace virgin materials"

Pure Waste manufactures clothes, yarns and fabrics from 100% recycled material: "We take into account the circular economy in all stages, from designing the product to taking the clothes back"



8.12.2020 /

Biorefinery produces protein for fish feed

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THANK YOU VERY MUCH!
SIZGA KATTA RAHMAT!

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