



GLOBAL CIRCULAR BIOECONOMY FUTURE OPPORTUNITIES

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Finland

70° N
Arctic Circle
60° N

- 5.5 million inhabitants
- 33.8 million ha
- 18.1 inhabitants per km²

Finland has the most forests in Europe

- 0.5 % of world's forest area
- 0.4 % of world's forest resource

The happiest country in the world

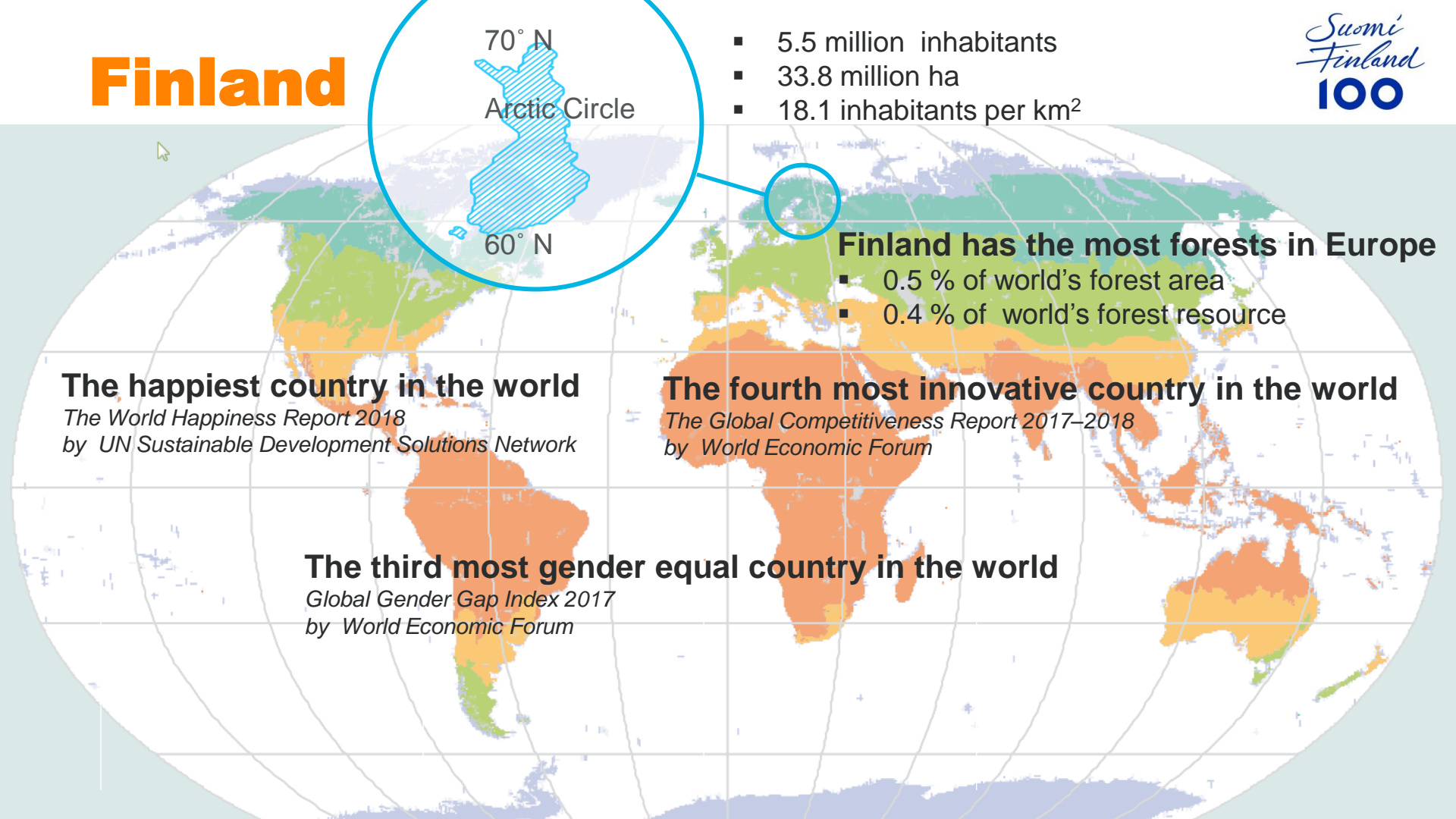
The World Happiness Report 2018
by UN Sustainable Development Solutions Network

The fourth most innovative country in the world

The Global Competitiveness Report 2017–2018
by World Economic Forum

The third most gender equal country in the world

Global Gender Gap Index 2017
by World Economic Forum



Natural Resources Institute Finland (Luke) supports sustainable development through research on forestry, agriculture, food, game, and fisheries.

Value generating primary production

Solid base for formation of policies

Research-based solutions for sustainable biobased economy

Holistic approach to sustainability

RESEARCH PROGRAMMES

- Boreal green bioeconomy
- Blue bioeconomy
- Innovative food system
- BioSociety

120 M€

Turnover

90 M€

Research & customer portfolio

30 M€

Statutory services

25

Locations in Finland

HQ in Helsinki

Present in 12 campuses with universities, research institutes and polytechnics

1300

Employees

50 research professors
650 researchers

We are one of the four Statistical Authorities in Finland.

Bioeconomy and Circular Bioeconomy – Case EU – Case Finland

CLIMATE CHANGE & IPCC



1,5C
2050

luke.fi
#biotalous

Bioeconomy is a central element to the functioning and success of the EU economy.

- With a turnover value of €2.3 trillion and accounting for 8.2% of the EU's workforce
- A sustainable European bioeconomy is necessary to build a carbon neutral future in line with the **Climate objectives of the Paris Agreement.**



https://ec.europa.eu/research/bioeconomy/pdf/ec_bioeconomy_strategy_2018.pdf#view=fit&pagemode=none

Key objectives in the updated EU bioeconomy strategy

- ensuring food and nutrition security
- managing natural resources sustainably
- reducing dependence on non-renewable, unsustainable resources whether sourced domestically or from abroad
- mitigating and adapting to climate change
- strengthening European competitiveness and creating jobs

The Bioeconomy Strategy

Bioeconomy: the European way to use our natural resources

Action plan 2018

SUSTAINABLE AND **CIRCULAR**, THE EU BIOECONOMY CAN:

- **Preserve nature**, and restore **healthy ecosystems**
- Create **1 million new green jobs** by 2030, in particular in rural and coastal areas
- **Turn waste** from farming, cities, food & forests **into new added values products**
- Provide **additional income for farmers, foresters and fishermen**
- **Replace fossil** material with **renewable alternatives**
- **Increase the carbon sink capacity** of soil, forest and ocean
- Develop substitutes to fossil based materials that are **bio-based, recyclable and marine biodegradable**



<https://ec.europa.eu/research/bioeconomy>

The graphic features the text 'Europe's bioeconomy weaving it all together' in a dark purple font. The word 'bioeconomy' is stylized with a circular arrow icon in the 'o'. Above the text are illustrations of clouds, birds, and a sun. Below the text is a partial illustration of a sun.

Europe's
bioeconomy
weaving it all together

MAIN PRIORITIES

1. STRENGTHEN AND SCALE-UP THE BIO-BASED SECTORS; this will be done for example by:

- unlocking investments and markets
- deploying innovative bio-based solutions, and
- developing substitutes to plastics that are bio-based, recyclable and marine biodegradable

Bioeconomy: the European way to use our natural resources
Action plan 2018

2. RAPIDLY DEPLOY LOCAL BIOECONOMIES ACROSS THE WHOLE OF EUROPE

for example via the transition to:

- sustainable food and farming systems
- sustainable forestry, and
- more diversified revenues for farmers, foresters and fishermen

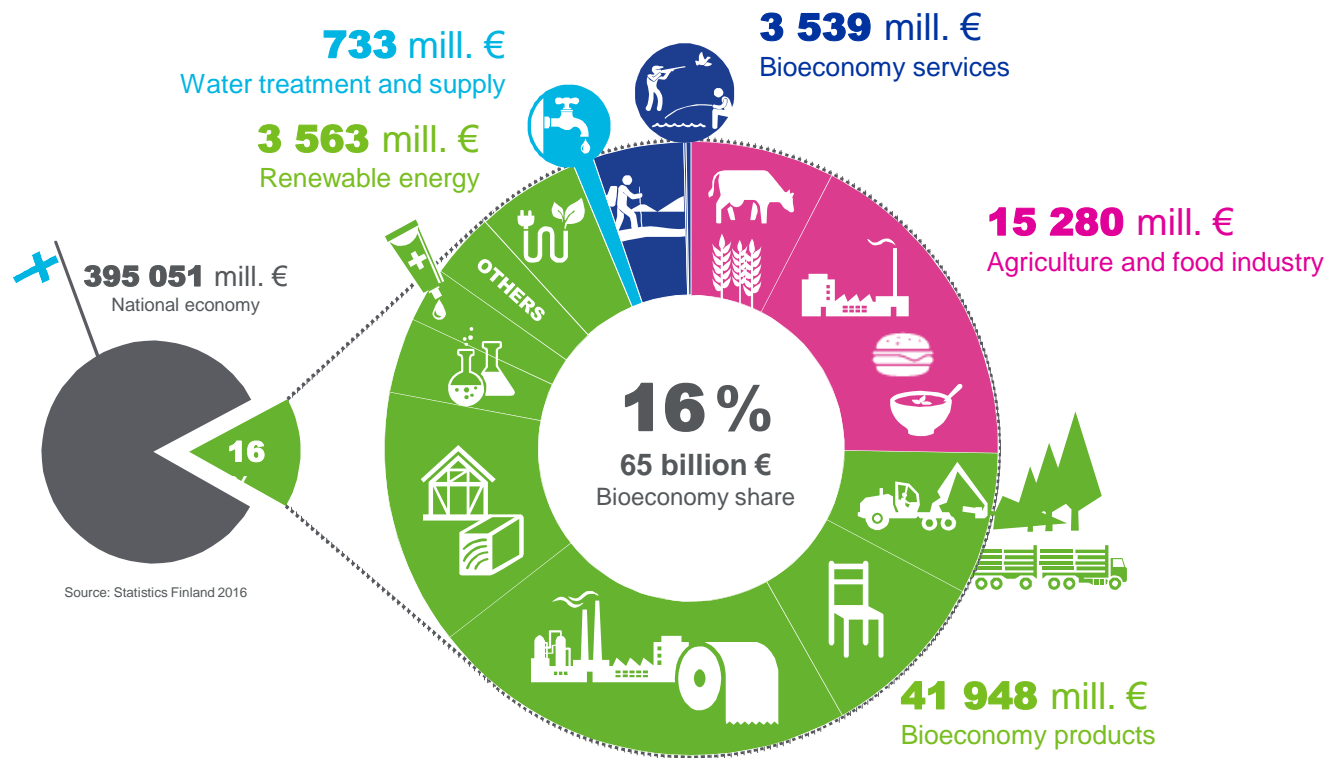
3. UNDERSTAND THE ECOLOGICAL BOUNDARIES OF THE BIOECONOMY

for example by:

- monitoring progress towards a sustainable bioeconomy, and
- enhancing benefits of biodiversity in primary production



Case Finland: Bioeconomy share

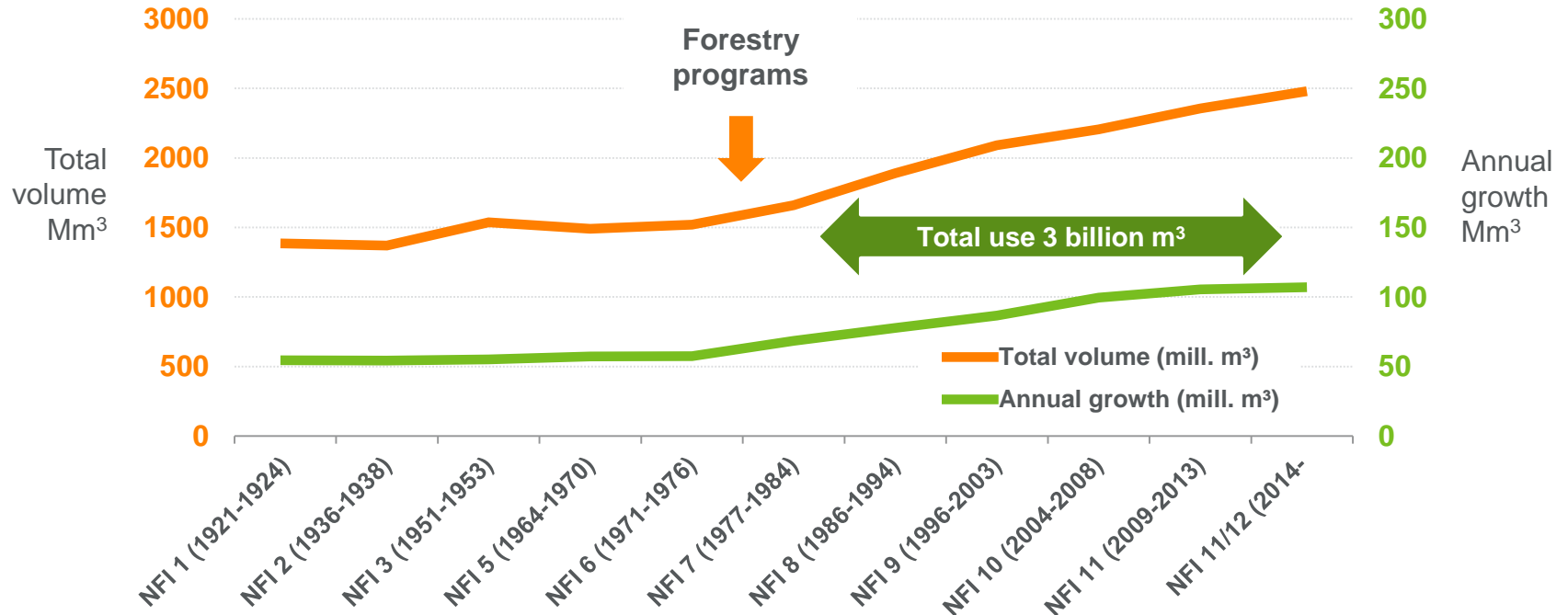


Graphics: Vihreä biotalous – 100-vuotiaan Suomen hyvinvoinnin ja kilpailukyyn perusta.

Forest bioeconomy as Finland's asset

- **Boreal location as strength**
- **Whole value chain – from raw materials to end-products**
- **Global proactivity – in research and in innovations**
- **Cross-disciplinary collaboration throughout the value-chain**
 - Industrial stakeholders
 - Research institutes and universities
- **Branding sustainability**

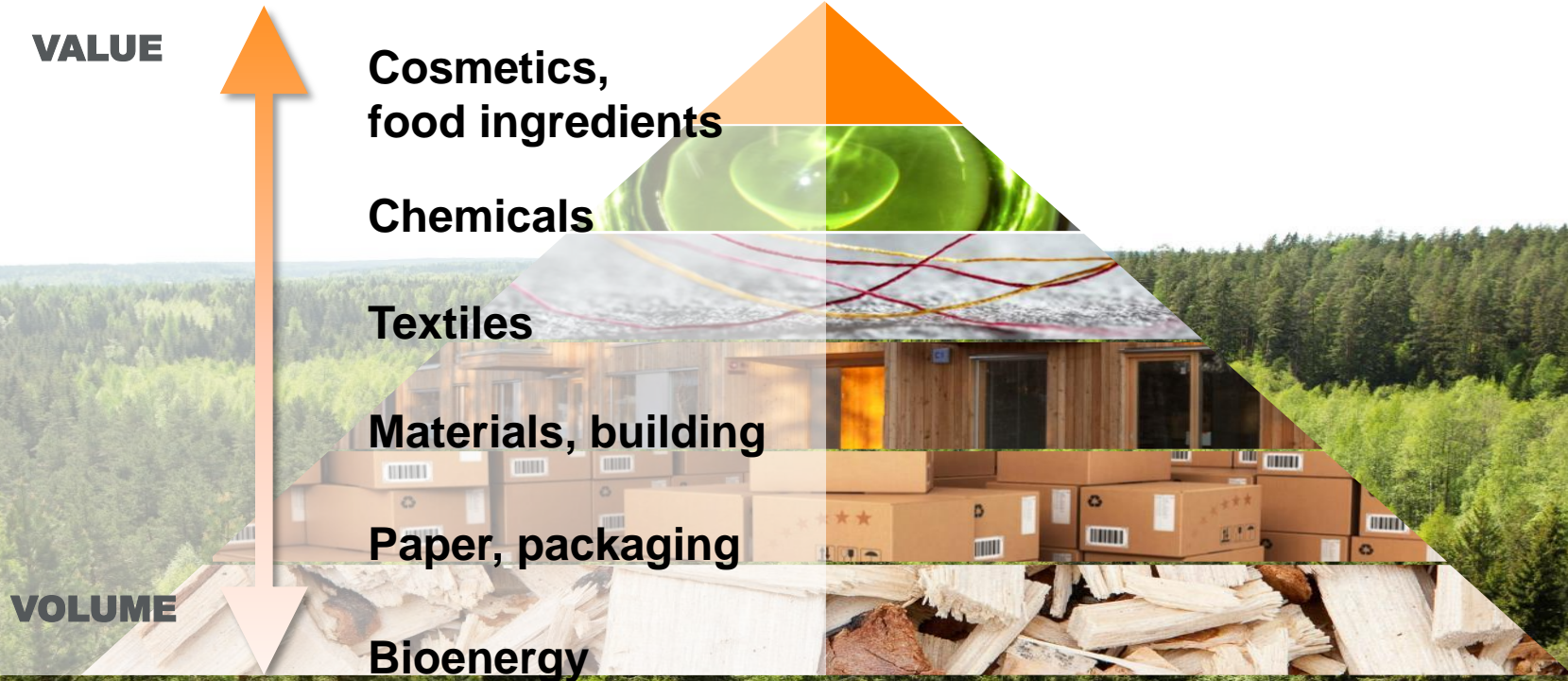
Case Finland- National Investment on Sustainable Forest Management



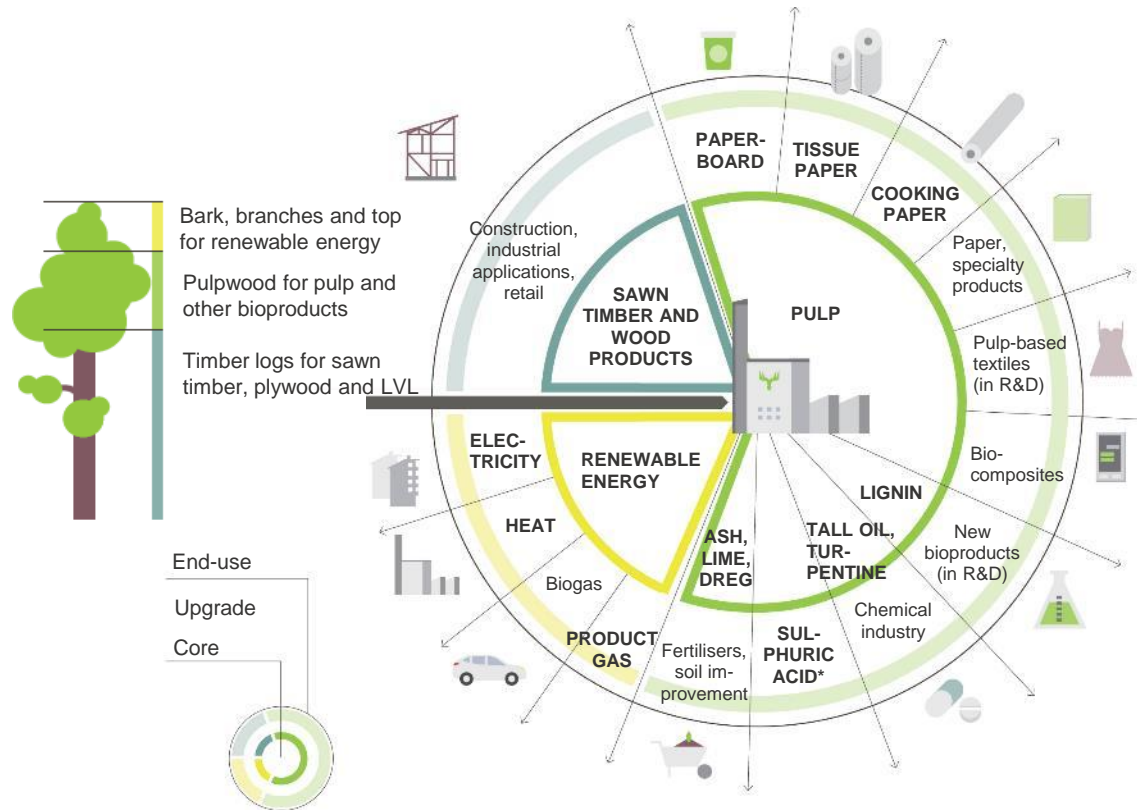
Annual harvest and natural removal was 81% of the annual growth (2017)

Towards a multiproduct bioeconomy

Sustainable utilization of the raw materials to various products with different values,
no waste production



The 'Bioproduct mill' vision



- Part of a local business ecosystem
- Maximising resource efficiency
- Balanced development of all three pillars of sustainability
- Materials first, then bioenergy
- Fully free of fossil energy
- The Äänekoski bioproduct mill is not static, rather an evolving example on the way to the vision

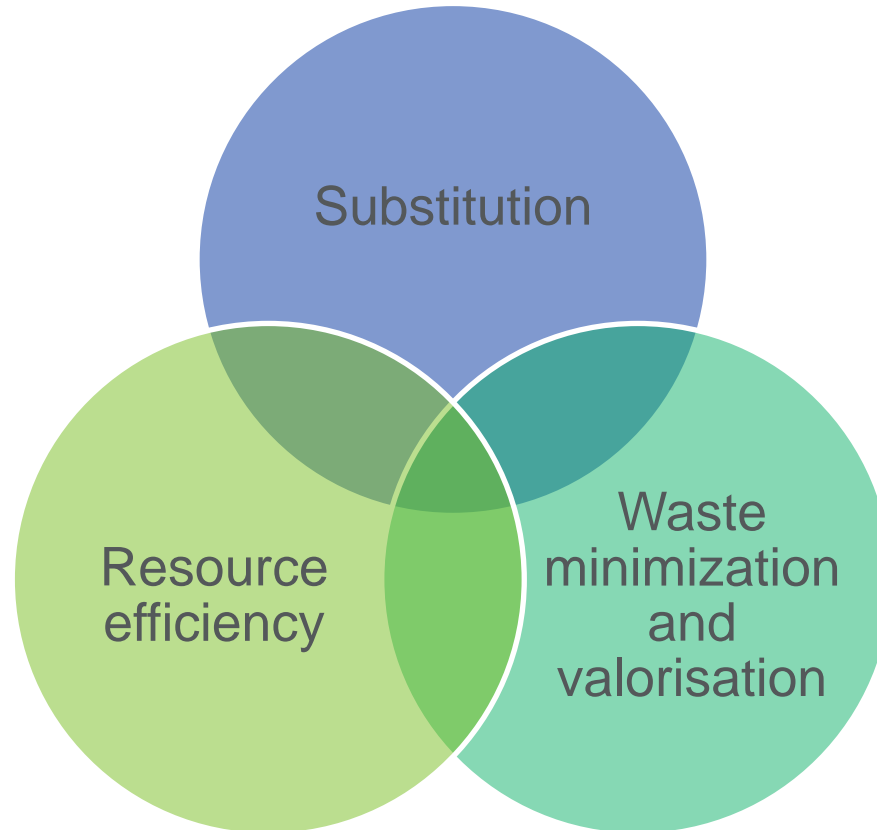
All products in **BOLD** are manufactured by Metsä Group.
All other products are manufactured within the industrial ecosystem.

Slide kindly supplied by Niklas Von Weymar, CEO Metsä Spring
<Niklas.VonWeymar@metsagroup.com>

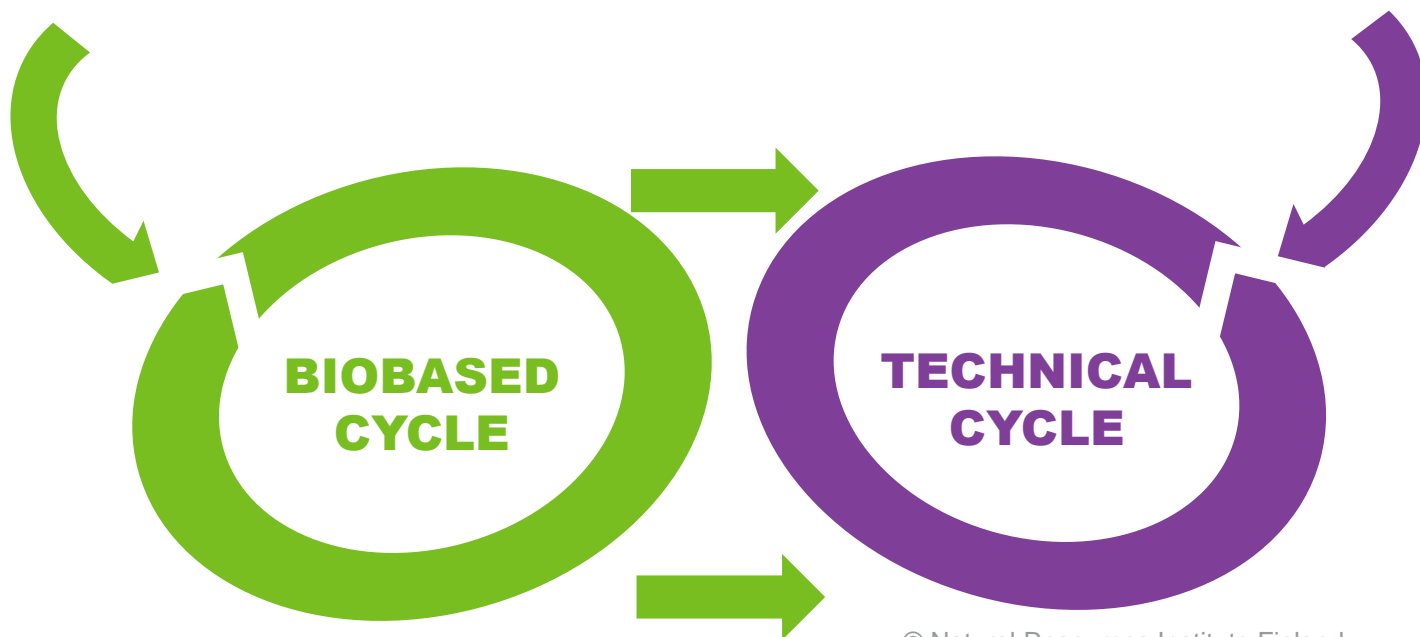


Research and innovation challenges and opportunities in circular bioeconomy

Objectives in circular bioeconomy



In bioeconomy we should target for **holistic and cascaded use of the biomass** in value-added products, with utilization of the waste and by-products, ending finally as bioenergy sources.







We are losing a lot of valuable biomass as food waste

In Europe

- 88 Mton food waste / a
- 173 kg per capita
- 20% of produced food goes to waste

Edible food waste in the Finnish food chain

– 400–500 million kg per year



Corresponding CO₂-emissions of around 400 000 passenger cars

Katajauuri, J.-M. et al. 2014.
Food waste in the Finnish food chain.
J. Cleaner Prod. 73: 322–329.

Protein demand in increasing – capitalizing the potential of by-products and waste



Manure as raw material - Finnish Government, LUKE and SMEs working together for Circular Bio-Economy

GOVERNMENT KEY PROJECT

Abundance of nutrient-rich biomasses in Finland

Total of nutrient-rich biomasses

21 100 000 t / year



259 000 t

Food industry side streams



578 000 t

Sludges from pulp and paper industry



667 000 t

Municipal sewage sludge



809 000 t

Municipal biowaste



1 510 000 t

Surplus grass



17 300 000 t

Livestock manure

Comparisons

The mass of the world's largest pyramid, Cheops, is 5.75 million tonnes. The annual mass of nutrient-rich biomasses in Finland corresponds to...

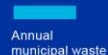


3.7 pyramids

The Sijja Serenade cruiser weighs about 27 000 tonnes. The annual mass of nutrient-rich biomasses in Finland corresponds to...



780 cruisers



Annual municipal waste

2 740 000 t



Nutrient-rich biomasses suitable for nutrient recycling

21 100 000 t

SOURCE: Marttinen et al. - Towards a breakthrough in nutrient recycling – State-of-the-art and recommendations for developing policy instruments in Finland. Natural resources and bioeconomy studies, Luke 45/2017.

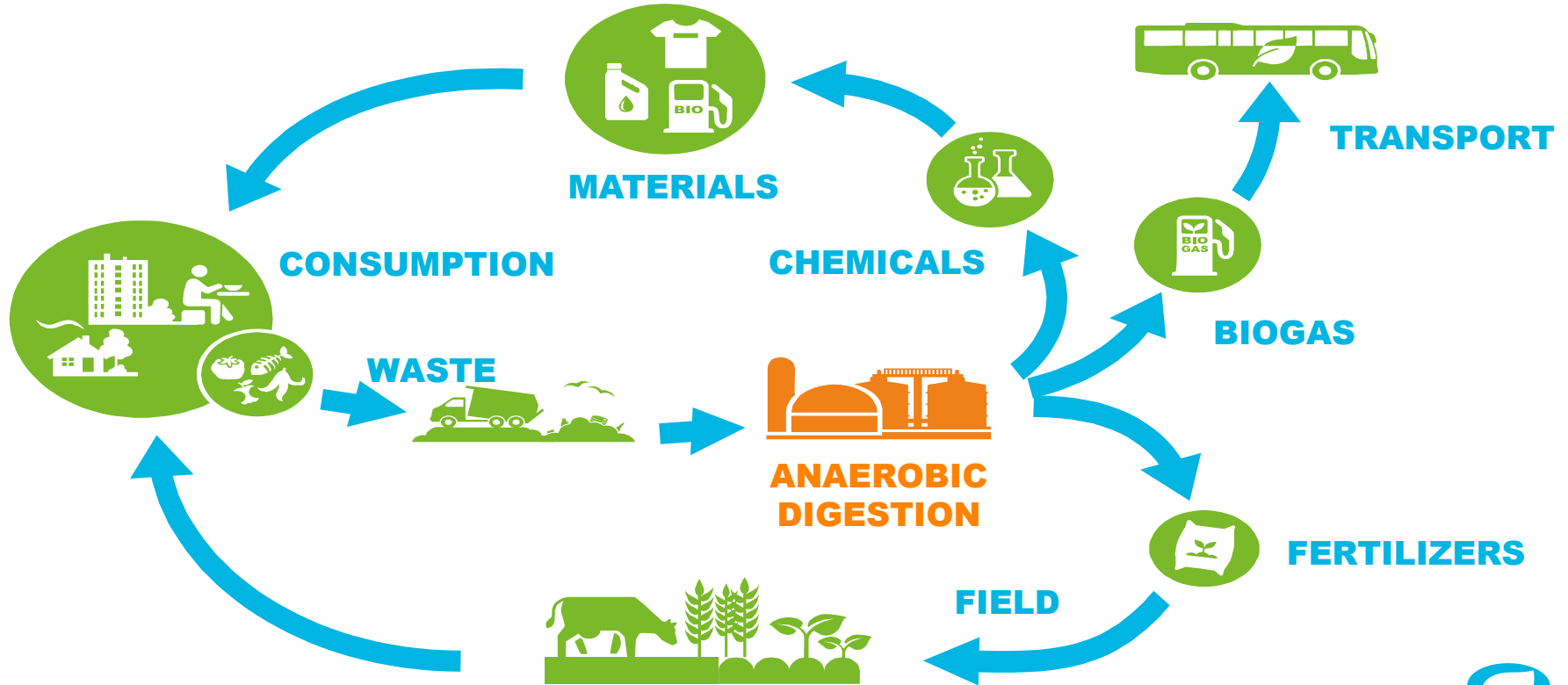
Case: Project “Making use of Agricultural Nutrients” (2016-2019) - coordinating innovation and financing of SMEs in bioeconomy sector.

Results: Over 40 pilots, i.e. local farm and business symbioses, nutrient recovery techniques and development of recycled nutrient fertilizers.

Biomass-atlas: location of different biomasses can be evaluated with 1 km x 1km accuracy.

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Anaerobic digestion as robust tool to valorize waste



Ref. Raija Rasi, Luke

Versatile solutions from insects

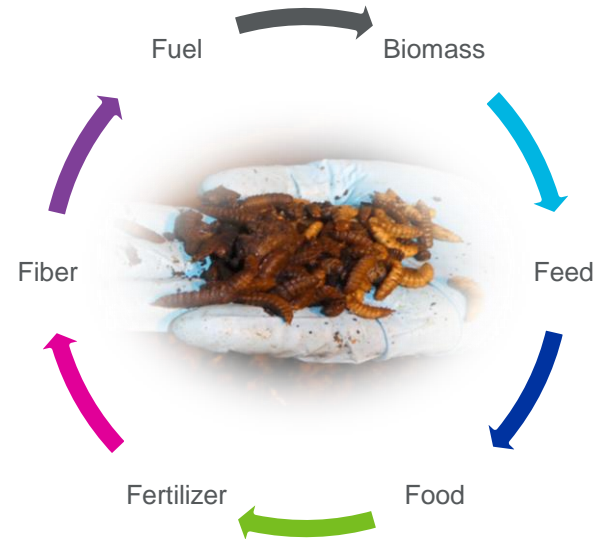
-Insects can be exploited to different steps in biomass cycle

Today's solutions

- Accepted as food and feed
- History as food for humans and animal

Future potential

- Sustainable food and feed production, biomass processing and nutrient recycling etc.
- New business opportunities for the rural micro enterprise, keeping country side viable
- An important agent in agro-industrial symbioses
- ***Insects*** – an important driver in structural change of rural areas and food production systems!



Creation of circular ecosystems- case Blue Pulpmill



From research to business in circular bioeconomy – challenges and opportunities

- Low volume streams
- High water content
- Logistics
- Heterogeneity
- Microbial stability
- Safety

- Value co-creation
- Market opportunities
- Industrial symbioses
- Branding
- Consumer awareness/ demand
- Legislation/ regulation



13.3.2019

Sustainable use of natural resources requires balance between



Global research collaboration as tool to solve the global challenges



Thank you!