REGIONAL COUNCIL OF
North Karelia

Non-food use of agricultural products

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FOSSIL OIL FREE
NORTH KARELIA

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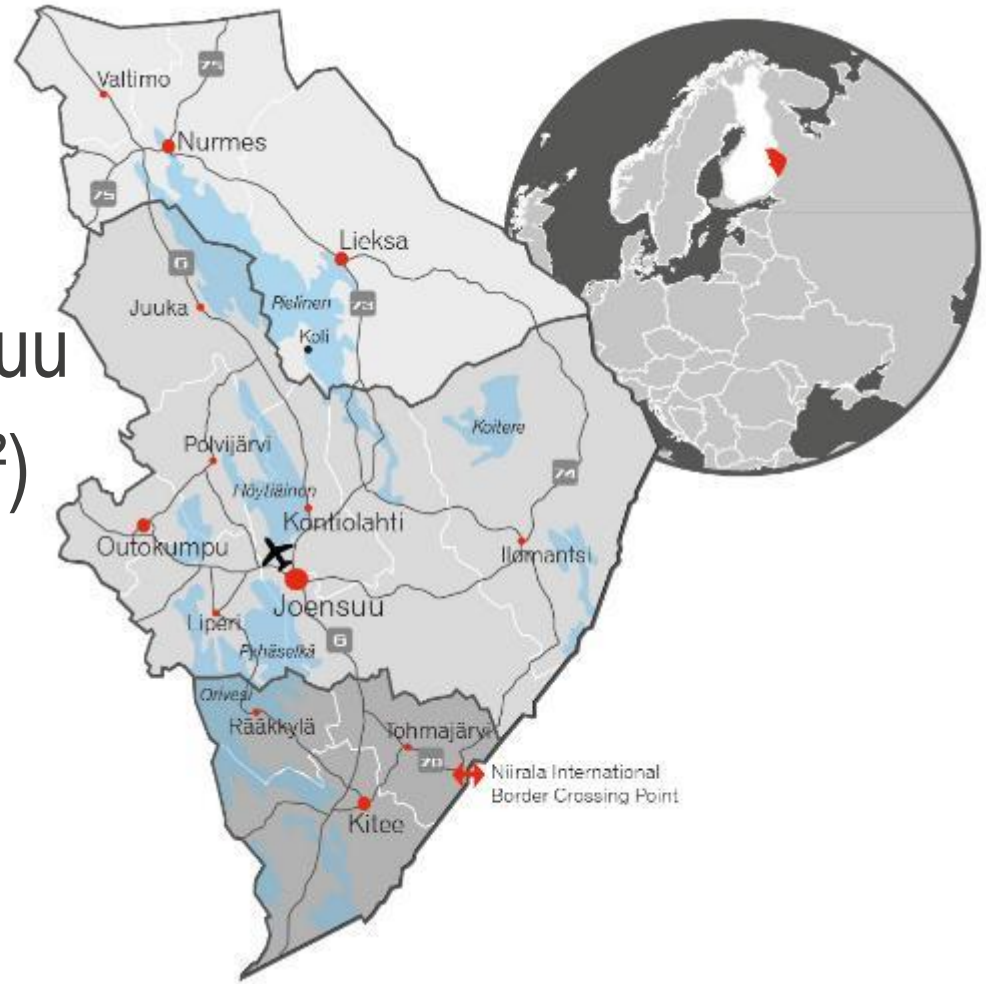
NORTH KARELIA

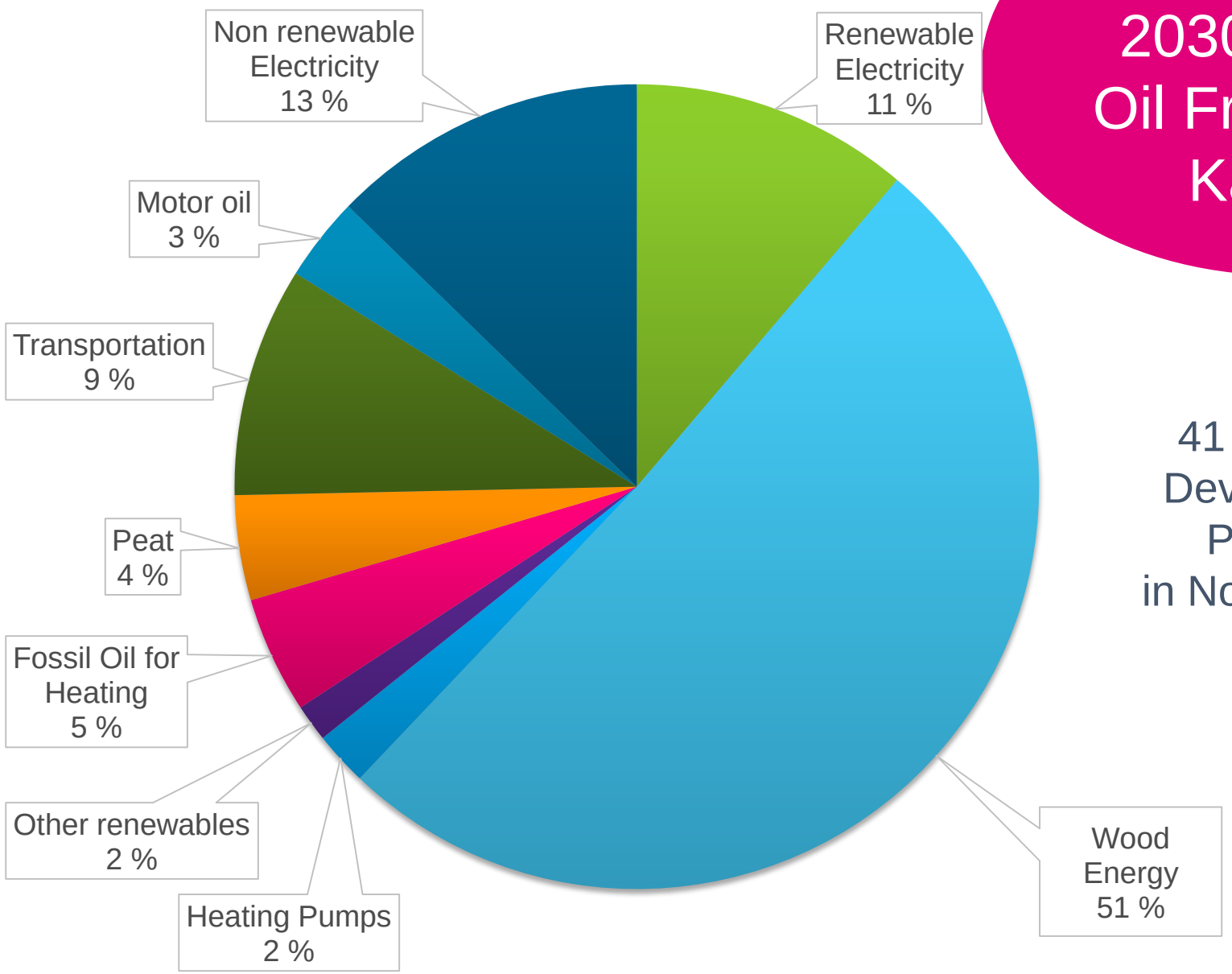
North Karelia in a nutshell

– the easternmost edge of the continental Europe

- 165 000 inhabitants (< 8 inhabitants / km²)
- 13 municipalities, regional capital city of Joensuu
- Size of the region 21 585 km² (lakes 3 803 km²)
- 300 km border with Russia
- North to south 240 km, East to West 153 km
- Temperatures from +37C to -42C
- “Forest Bioeconomy Region”
  - Annual growth of forests 9,4 million m³ - usage 5.4 million m³



Energy in North Karelia



TARGET 2030: Fossil Oil Free North Karelia

41 ongoing Development Projects in North Karelia

FOREST BIOECONOMY

- Forest based bioenergy
- Decentralized bio-refinery and wood based materials
- Forest technology and logis-tics of forest harvesting
- Bioinformation economy
- Sustainable multiuse of forests and natural resources

NEW ERA OF NATURAL RESOURCES!

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Forest bioeconomy cluster is a driver in North Karelia!

Karelia

arbonaut

Forest bioeconomy cluster in North Karelia:

- 500 companies
- 6 000 jobs
- Turnover ~ 1,7 billion €
- 600 specialists (R&D, education and public administration)
- Renewable energy 1350 jobs, 160 M€

binderholz
tiptop timber

UNIVERSITY OF EASTERN FINLAND

teri

TULIKIVI

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NATURAL RESOURCES INSTITUTE FINLAND

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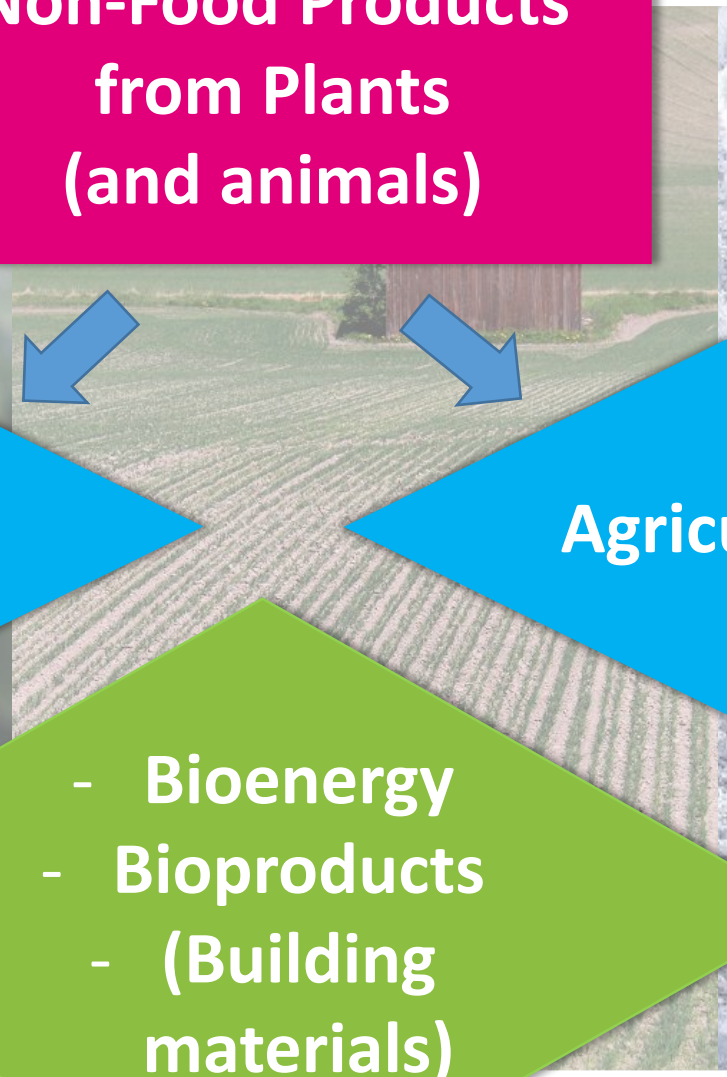
Non-Food Products from Plants (and animals)



Forests

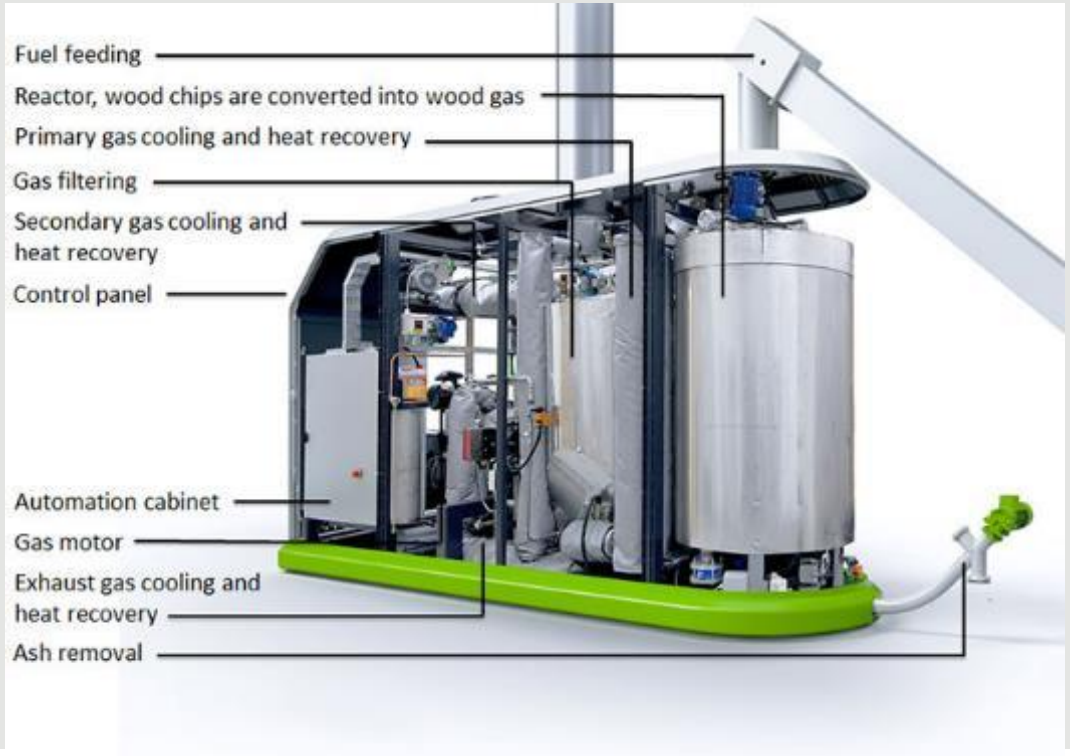
Agriculture

- Bioenergy
- Bioproducts
- (Building materials)

Bioenergy production

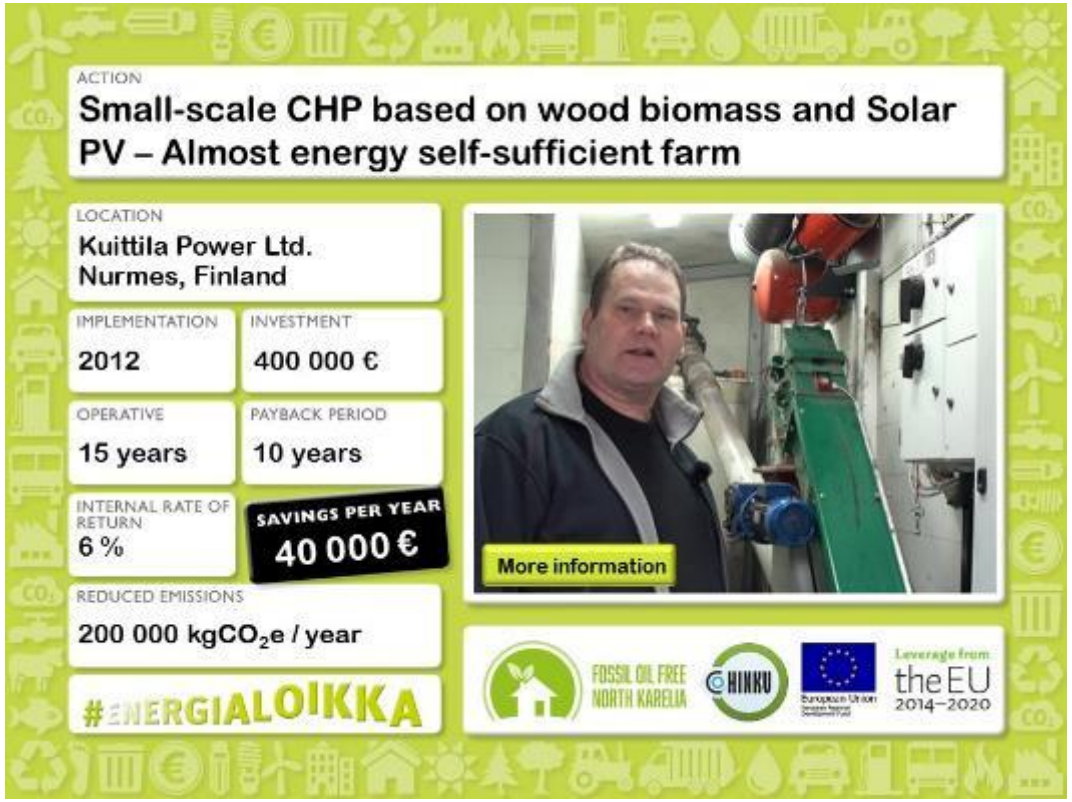
- Combined Heat and Power production
  - Forest biomass (residues, wood chips)
  - Also Straw and Reed Canary Grass (Phalaris arundinacea) are possibilities
  - Innovations: **Small scale CHP-plants** for example for small communities and energy self-sufficient farms
    (For example Volter Company)

  - Gasification of wood chips
  - Electric power: 40kW
  - Heating power: 100kW to water
  - http://volter.fi/



Small-scale CHP based on wood biomass and Solar PV

- Investment on combined heat and power took place 2012 ja in photovoltaic (50 kW) in 2015
- CHP plant is based on the woodchips gasification technology
  - 140 kW (47 kW electricity and 100 kW heat) plant can produce annually up to 1200 MWh energy.
  - Biomass is harvested from local forest (most of it from their own forests). Harvesting of small-sized wood improves the forest growth and provides high-quality fuel.
  - The plant uses annually about 1 400 loose cubic of wood chips that are dried by using natural drying and excess heat from the plant.
- Currently there are about 10 domestic applications and over 20 exports of this specific technology
- Kuittila Dairy farm has 150 cows
  - Heat recovery unit for milk cooling system
  - Warming up the drinking water for the cattle



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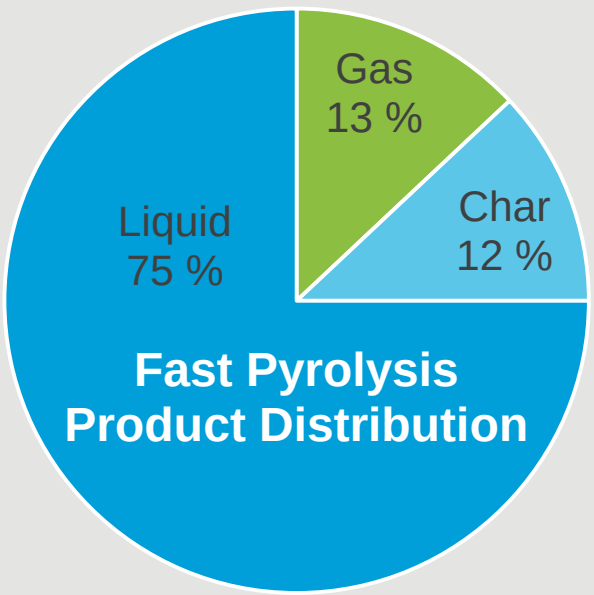
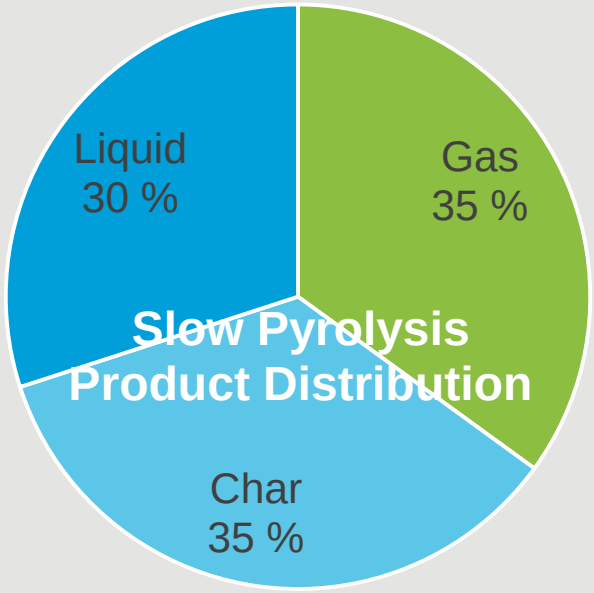
Energy production from biomass

- Traditional: Wood chips, (Straw and Reed Canary Grass)
- Advanced: Wood pellets, wood prickets from sawdust
- Innovations: Biocoal and Bio-oil
  - Fast and slow pyrolysis of the biomass





Fortum Otso Bio-oil production in Joensuu

- Fast pyrolysis
- Production of bio-oil integrated with CHP plant
- Annual production 50 000 tons
- Replaces fossil oil used for heating. Reduces Greenhouse gases up to 90 %.
- In future: Raw material for renewable transportation fuels

Bioenergy from agricultural biomass

- Biogas production from agricultural biomass
  - Plant materials include **agricultural crops** such as sugar cane, corn etc, **agricultural residues** like cereal straw, corn cobs etc, wood and **wood residues** (saw dust, pulp wastes).
  - **Manure** and **waste water treatment sludge**
  - **Bio-organic waste** (food waste from community, trade and industry)
  - **Silage**
  - **Animal wastes**
- Renewable energy
- Reduces emissions of greenhouse gases, nitrogen and odors
- Intensifies the recycling of nutrients within agriculture

Biogas Production based on bio-organic waste and waste water treatment sludge

- Bio 10 Ltd
  - Produces biogas from bio-organic waste and waste water treatment sludge
  - Produces heat and power, organic fertilizers with anaerobic digestion
- Kitee Power Ltd – District heating
  - Produces district heat with local wood chips
  - Consumption of fossil oil has dropped from 30 % to 3 %
  - Uses biogas for CHP
  - Produces 60 % of the electricity needed at the district heating plant with biogas
  - 10 % of the total production of district heat is covered with biogas
- In Future: Biogas as transportation fuel
- www.bio10.fi

Renewable Fuels for Transportation

- Biogas
- Biodiesel
- Biopetrol
- Bio-Ethanol
- Hydrogen
- Renewable Electricity
- Hybrids, flexi-fuels etc.
- Agricultural and forest biomasses as an important raw material

- Greenhouse gas emissions from the transportation sector are still a huge challenge
- Technologies and new fuels has to be implemented
→ Huge market
→ New business opportunities, new incomes, new products also for export, tools for developing employment

Innovations in Forest Sector

- Innovations can be made
  - In the factory production processes
  - In the Product Development
  - But also in the forests
- Tornator is a Finnish company which owns forests in Finland, in Estonia and in Romania.
  - In Romania Tornator owns 12 000 hectares of forests.
  - In Finland Tornator is actively developing bioeconomy innovations that consider on site activities in the forests.
  - For example they are producing innovations in tree water –sector which is growing rapidly. They are also seeking other possibilities for diversification of production and the economy.

Innovations in Forest Sector

- On-site innovations in forests
  - How to produce more qualified raw materials for (new) bioproducts?
  - Forest management and logistic can have effects for different extractives
  - Growing trees can be manipulated in a way that they change naturally woods chemical consistent. This innovation was already used during tar production in the late 1800s.

  → It was possible to triplicate the intake of the tar

  → This same manipulation can be used also for biofuel production (pineoil)

  → One way for this is to bark up the trees that are used for biofuel production

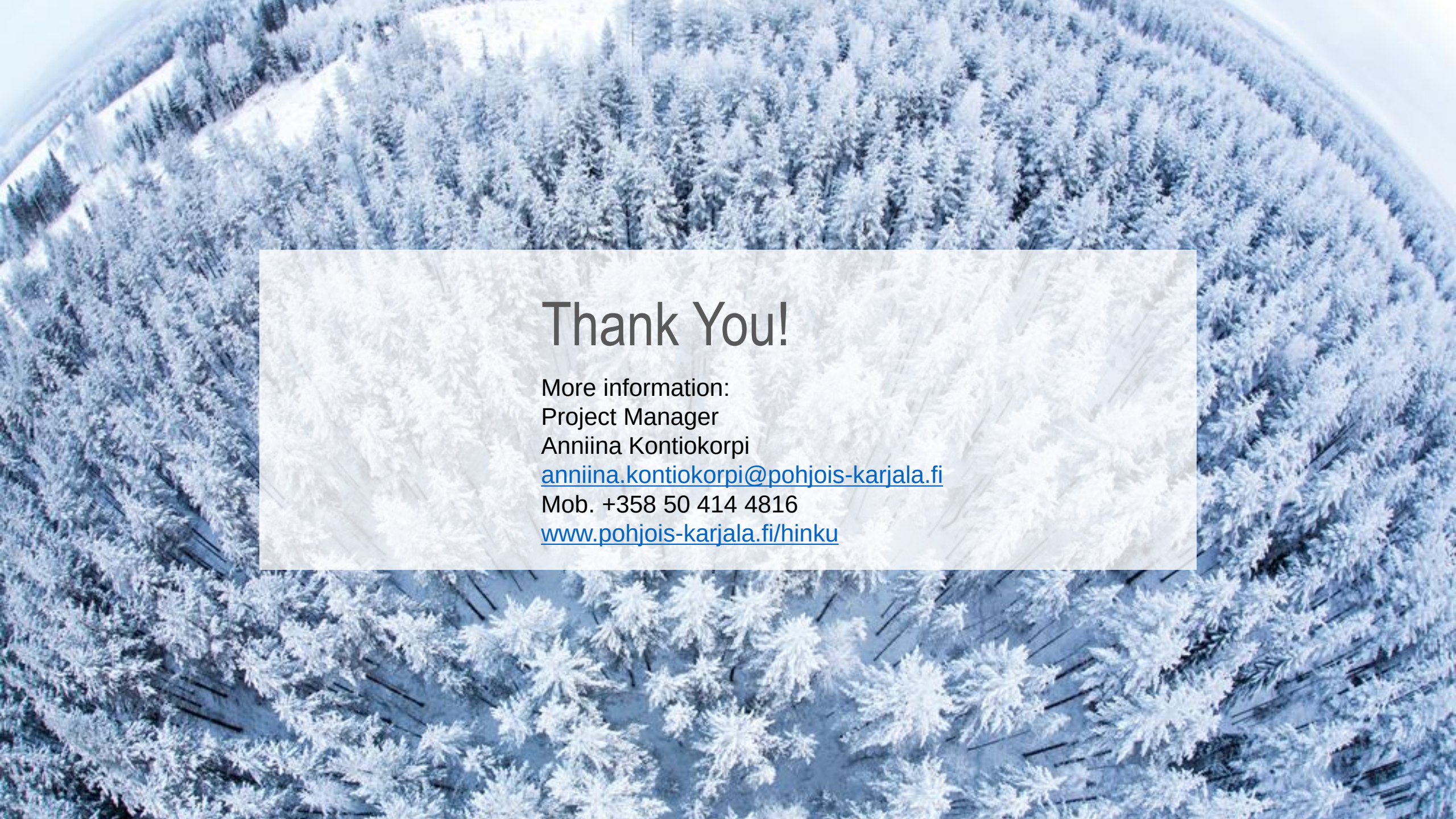
  → Thinning and pruning can also effect on chemical properties and content

  → Natural manipulation by mammals, insects, fungi, pollutants

Forest-based Innovations

- Cosmetic and pharmaceutical products (extractives from bark, fatty acids, herbs, berries)
- Natural Resources Institute and University of Eastern Finland are developing new non-wood based business methods, new raw materials and new products from forests, ”New Business Opportunities from NWFPs –project”
- Wood can be raw material for almost everything
  - ”Glass like material”, stronger than carbon fiber
  - Textiles from dissolving pulp
  - Prosthesis from nano-pulp
  - Different composite materials
  - Biofuels

- Instead of ordinary pulp production and sawmill production can development actions be directed directly to higher value-added products (mostly for export)



Thank You!

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