



VTT

Metsän / puun käyttömahdollisuudet

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VTT – *beyond the obvious*

VTT is a visionary research, development and innovation partner and one of the leading research organisations in Europe.

Our role is to promote the utilisation and commercialisation of research and technology in business and society. Through science and technology, we turn global challenges into sustainable solutions for business and society in a responsible way.

254 M€
turnover and other
operating income

2,093
employees

45%
of the net turnover
from abroad

32%
a doctorate or a
licentiate's degree

Establishment year
1942

Steered by Ministry
of Economic Affairs
and Employment

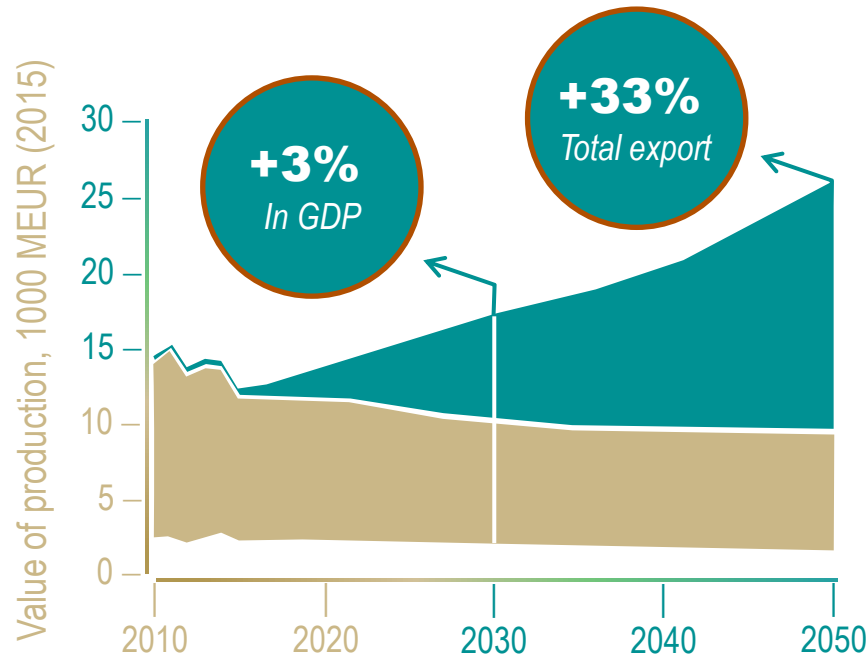
OUR PURPOSE

We bring together people,
business, science and technology,
**TO SOLVE THE WORLD'S
BIGGEST CHALLENGES,**
creating sustainable growth,
jobs and wellbeing.

Key forces reshaping the forest industry landscape

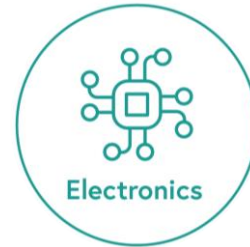
- **EU legislation:** regulation should identify and support introduction of new sustainable bio-based products
- **Trends:** population growth, digitalization, urbanisation, living standards
- **Demand growth:** packaging, textiles, energy storage, construction, health innovations --- circular and durable material solutions!
- **Challenge:** climate change, biodiversity, resource efficiency, resilience
- **Solutions:** minimizing carbon footprint, circular solutions, alternative sustainable products, zero emission processes, utilizing wood residuals for material solutions
- **Business drivers:** delivering renewable and responsible solutions with new value chains

The value of Finnish forest sector can be doubled by 2030's AND the greenhouse gas mitigation targets can be met at the same time!



New value-added products

Current forest products



Metsäteollisuuden tuotanto ja vienti 2022

Kemiallinen metsäteollisuus

Paperi	
Kartonki	
Sellu	

Tuotanto 1000 t	Vienti 1000 t	Viennin osuus tuotannosta, %
3 050	2 950	96 %
4 150	4 050	98 %
7 050	3 600	51 %

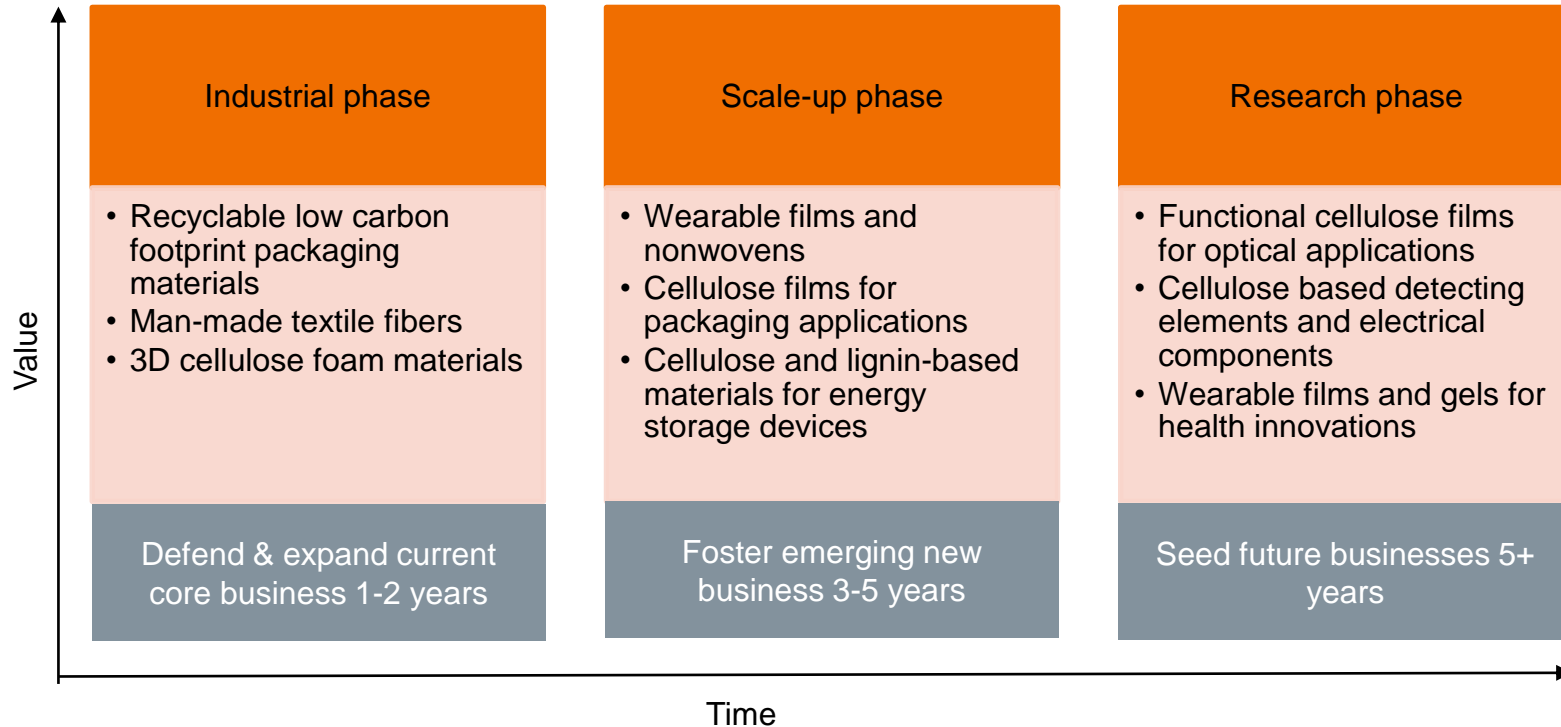
Tuotanto 1000 m³	Vienti 1000 m³	Viennin osuus tuotannosta, %
11 2000	8 600	77 %
1 100	900	81 %

Saha- ja levyteollisuus

Sahatavara*	
Vaneri*	

*Tuotantomäärä on osittain arvioitu
Havusahatavaran vientiluku sis. havusaha- ja höylätavaran viennin
Tuotanto- ja vientimäärät pyöristetty lähimpään 50:een

Lignocellulosic materials goes beyond plastic replacement: significant carbon handprint benefits



Emission free pulping program - drivers for the industry initiative



To maximize the yield of the available forest resources enabling growth opportunities for industry



Reduction of CO2 emissions enabled by burning less biomass



Utilizing less fresh water

Emission free pulping program

- Industry driven program for the renewal of pulping industry
- Program aims to increase wood conversion to products from 50 % to 70 – 80 %

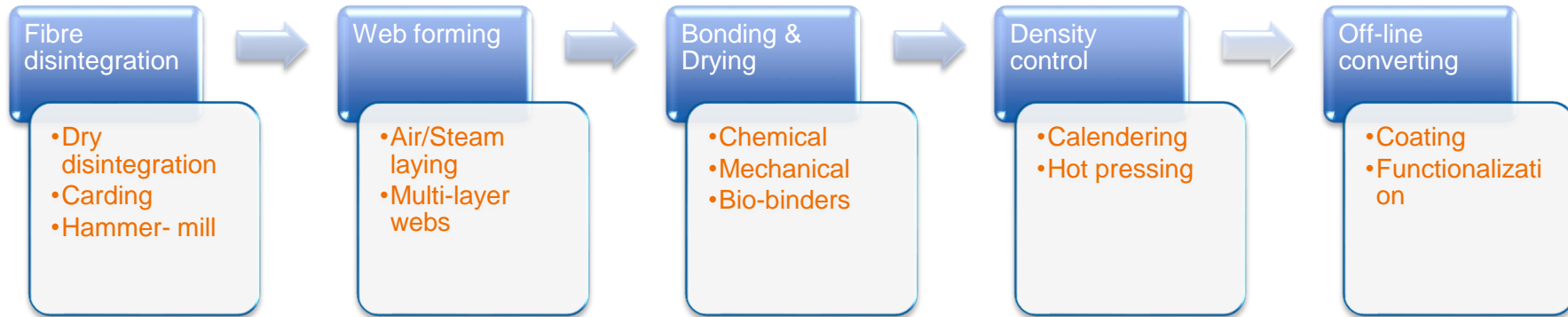
Industrial scale relevance requires a pool of scientists and industry working together internationally

- The target is to minimize burning of biomass and to produce fibres suitable for high volume applications in coming decades.
- There is a lack of research enabling pulp industry to reach emission free processes. Identified research questions are the basis for coming projects with industry steering and guidance.
- Overall sustainability impact and realistic possibilities for industrialization are two key requirements. Incremental fine-tuning of today's processes are not in the focus of the program.

Aim:
**Emission free
pulping at
industrial scale**

Energy 1st Fibre Product Forming

Enabling to reach carbon zero targets of fiber products



- VTT investment
- Energy savings through the waterless forming
- Modular structure
- Hybrid layering
- > 35 companies
- Current products e.g. board grades
- Nonwoven webs
- Multi-ply products
- Budget 4+1 M€
- Scheduled start Q4/2024
- ~10 M€ project portfolio

We excel at:

Packaging from
biomaterials

Bioplastics

Cellulose in textiles

Foams

Biocomposites

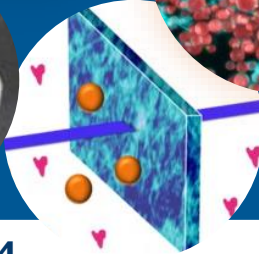
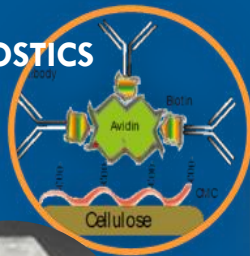
Recirculation of
textiles

Nanocellulose

Lignin solutions

Bark solutions

NANOCELLULOSE APPLICATIONS AT VARIOUS TRL LEVELS



VTT CelluloseFilms: manufacturing process steps available at VTT

Cellulose	Dissolution	Film forming	Washing	Additives	Drying
Raw material and origin Molecular weight Chemistry	Direct dissolution Derivative dissolution Additives Quality	Approach system to VTT CF Feeding of dope Regeneration chemistry and conditions	Removal of dissolution chemicals	Plasticizers Cross-linking agents Functional additives	Film can be rolled as wet Offline or online



LigniOx technology for lignin-based plasticizers

High performance concrete plasticizers

- Higher performance compared to lignosulfonate admixtures and most of the synthetic plasticizers



No plasticizer



Superplasticizer, 0.2%



Lignosulfonate, 0.4%



LigniOx lignin, 0.4%



Substituting petroleum-based polymers with lignin in superplasticizers can lead to a **30% reductions in energy use** and a **50% cut in CO₂ emissions.**

Replacing fossil-based plastic packaging with wood-based alternative



Can be produced with the same machinery as traditional plastic



100% recyclable



70% less fossil-based carbon dioxide emissions

“We chose VTT because we wanted a research partner that excels in the kind of creative product development that we had been engaged in for years.”

**Jaakko Kaminen
CEO
Woodly Oy**

Walki®Agripap – developing a new, sustainable choice for agriculture



Biodegradable
organic mulching
solution made from
natural, biodegradable
fibers



**No plastic
pollution**
when the used mulch
dissolves into the
ground



**Increased
profits**
thanks to
excellent crop yield,
weed control and
durability

“Walki developed this product because, having seen the kind of environmental impact that plastic film can have on the soil, it’s clear that there is a need for a more sustainable mulching solution.”

Peter Martin
Technical Service & Development
Director
Industrial Packaging
Walki

Cellulose-based textiles

Sustainable textiles going towards industrial scale



Image source: [Spinnova.com](https://www.spinnova.com)



Metsä Group and Itochu establish a joint venture that builds an industrial demo plant to produce wood-based textile fibres

Metsäliitto Cooperative | Press Release | 1.10.2018 10:15 EEST



INFINITED FIBER

We have created a miracle: a technology that allows textile waste to be used again and again, preserving 100% quality.



Image source: [infinitefiber.com](https://www.infinitefiber.com)

Case: Alternatives for plastics

50+ organizations piloting alternatives for plastics together

VTT has gathered over 52 international companies and organizations together for a co-funded project that pilots new, bio-based and recycled alternatives to plastics.



Flagship: FinnCERES**Scientists and businesses
co-create the new era of
biomaterials**

FinnCERES is Academy of Finland's flagship project where Aalto University, VTT and companies boost the world's bioeconomy by developing new bio-based materials.

[Finnceres.fi](https://finnceres.fi)

Nanocellulose film as a substrate for printed electronics

Research Case 1) Towards nature driven wearables



Plant-based



Biodegradable

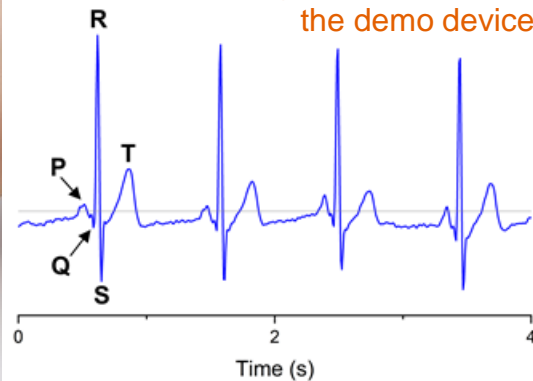


Tunable

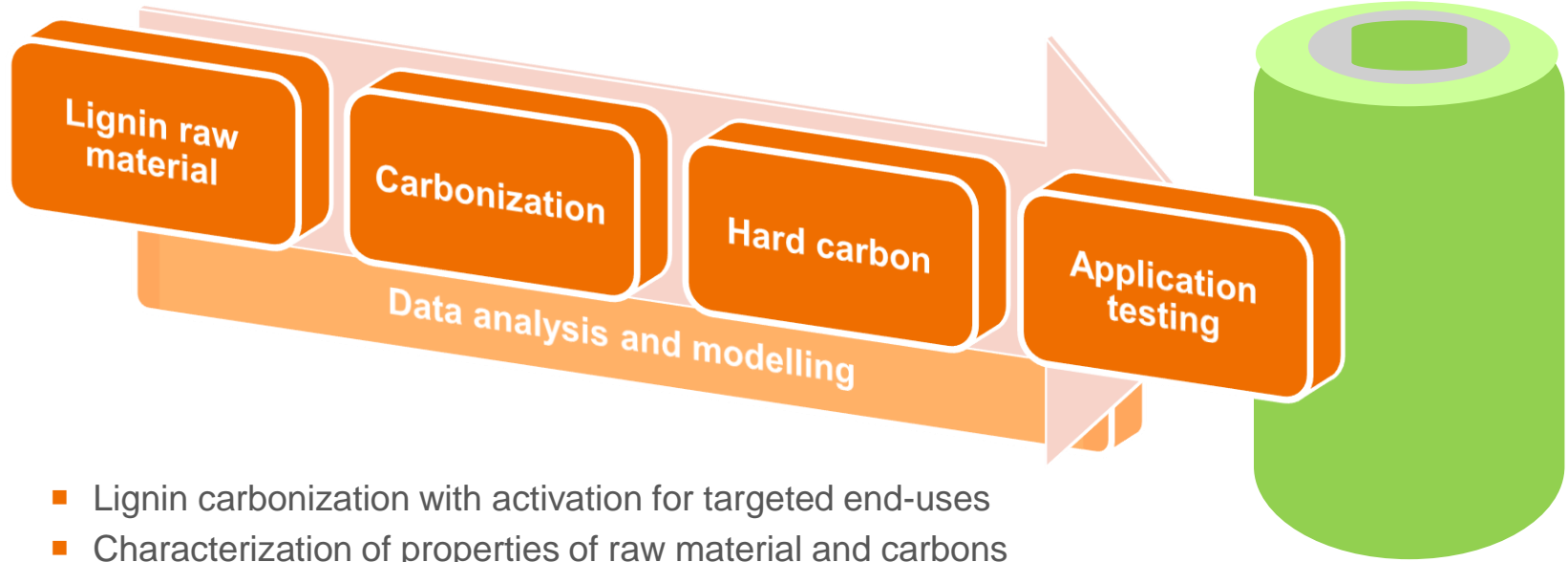
ECG demo
device on
nanocellulose film



ECG signal recorded with
the demo device



Research Case 2: Lignin hard carbon for green energy storage



- Lignin carbonization with activation for targeted end-uses
- Characterization of properties of raw material and carbons
- Electrochemical measurements to verify the performance
- DoE, data analysis, and modelling to **quantify process-property-performance** dependencies of different lignin raw materials

Summary

- **Resource sufficiency** is a global challenge concerning all businesses
- **Increasing the value of wood based materials** is a key
- **New value chains and actors** are needed
- **The whole wood need to be used by cascading way**
- **Durable and long carbon storage material solutions** are preferable in terms of sustainability
- Zero emission processes
- **A lot of options for Finland!**



bey⁰nd

the obvious

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