

SWEDEN PACKAGING TECHNOLOGY SEMINAR

TOKYO PACK 2018

3 October, 2018

THE SWEDISH TRADE & INVEST COUNCIL



See us in booth: East 3-04

BUSINESS SWEDEN

4 OCTOBER, 2018

2

ROYAL BUSINESS DELEGATION TO JAPAN, APRIL 2018



Dinner with President Abe



Artificial Intelligence



Future of Transport



Energy

- Moderator

UPCOMING EVENTS IN STOCKHOLM OCTOBER 2018



Japanese Fine Food Showcase

Date: October 1, 2018
Place: Hotel Birger Jarl, Tulegatan 8, Stockholm (invitation only)
[Read more](#)



Conference: Sparking Interest in Science through Space

Date: October 8, 2018
Place: IVA Conference Center, Grev Turegatan 16, Stockholm
[Read more](#)



Japan Day in Stockholm-150 years on

Date: October 11, 2018
Place: Epicenter Stockholm, Mäster Samuelsgatan 36, Stockholm
[Read more](#)

Japan Day in Stockholm - 150 years on - 11 October 2018

Sep 06, 2018

Date: Thursday 11th October 2018
Time: 14.00-16.00 (followed by networking reception)
Venue: Epicenter Stockholm, Mäster Samuelsgatan 36, 111 57 Stockholm, Sweden
Language: English

2018 marks the 150th anniversary of the Sweden-Japan diplomatic relationship; therefore, it is an important year to enhance further economic ties between the two countries.

The seminar will provide opportunities for you to learn the current business opportunities in Japan. A case study of successful Swedish company in Japan will be presented, followed by a networking event with like-minded businesses and Japanese companies.

Register [here](#) (free of charge).

Programme* <Moderator: JETRO>

13.30-14.00 Registration

14.00-14.05 Opening Remarks

14.05-14.20 Company Presentation
(Mr Kozaro Zamma, Head of Open Innovation and Business Incubation Section, NTT DATA Corporation)

14.20-14.35 Company Presentation
(Mr Masami Sumiyoshi, Manager, Consulting Services, Hitachi Consulting)

14.35-14.50 Company Presentation
(Mr Akito Nozawa, Deputy Group Director, General Products, ICT & Financial Business, ITOCHU Europe PLC)

<14.50-15.15 Coffee Break>

-

Moderator

PACKAGING TECHNOLOGY TRENDS IN SWEDEN



www.packbridge.se

Picture 1: Intro

Good morning, I am Felix Helander and I represent Packbridge, an industrial network organization around the packaging industry. We are based in Scandinavia and are working for the industry. We are aiming at supporting innovation and industrial development, we want to promote internationalisation and create interactions across all borders.

Trends

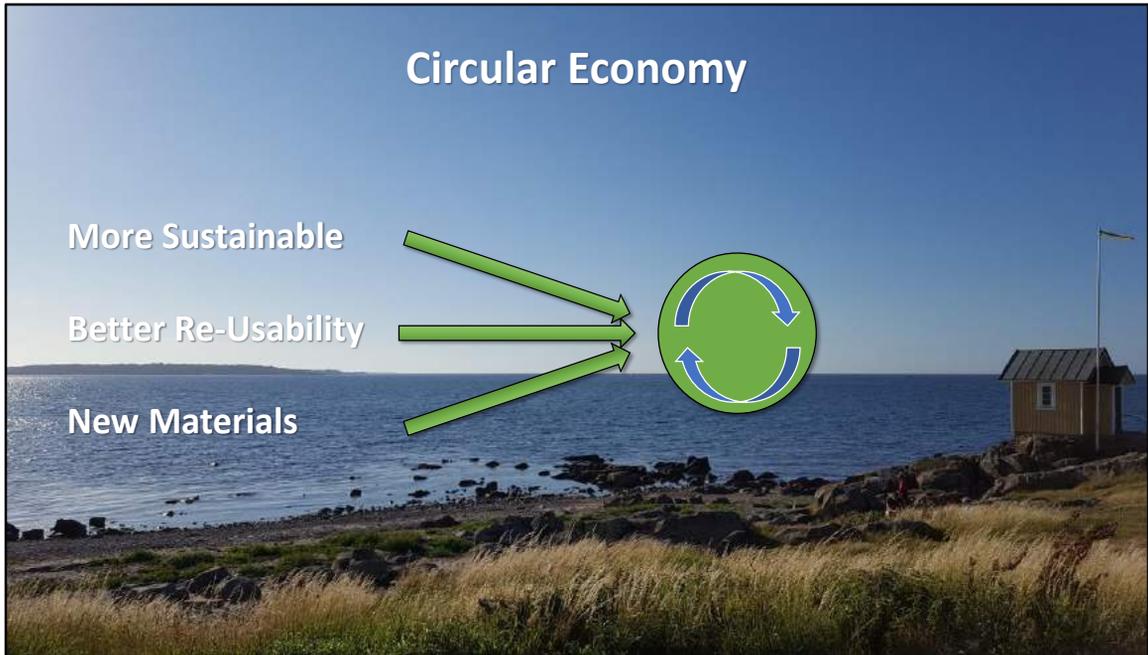
Circular
economy

Industry 4.0

Smart and active
packaging

Picture 2: Trends

I am here today to say a few words on trends and to talk about a few of our member companies. Here I would like to focus on three trends that have a strong impact on the industry. It is the discussions about and aim for a more circular economy, the introduction of Industry 4.0 related models for working and intelligent and active packaging.



Picture 3: Circular economy and sustainability

The discussions about the concept of circular economy are certainly having an impact on the packaging industry. The circular economy is defined as a regenerative system. Translated to packaging, waste is minimised by reuse, recycling and design.

More sustainable

Packaging can be made to become more sustainable by design, to maximise logistics, or by using an alternative material. A good example of what I mean by the latter is a packaging solution developed by **Tetra Pak**, Tetra Rex Bio-based, which is liquid carton laminated with plastics derived from sugar cane. The petrobased polymers are here exchanged for bioplastics. The carbon footprint of a plant-based gable top carton is reportedly less than 50% compared to conventional packaging.

Other examples of how packaging material can be made more sustainable are **ScanFill** and **Gaia Biomaterials**. ScanFill is producing food approved material based on polymers and minerals. Roughly 50/50 polymers and minerals and you can choose from oil based or non-oil based polymers. The material is used for trays and bottles as well as foil.

Gaia Biomaterial is another example of a supplier with an alternative material, Biodolomer. This is a similar material, mineral filled but also biodegradable and can

be used for a wide range of conversion technologies: film blowing, injection molding, sheet extrusion, and bottle blowing.

Better Re-Usability

Recycling and reusability are key words for the concept of circular economy. In Sweden we have since 35 years a deposit system for beverage packaging. Cans and PET bottles are returned to a very high degree, 86% of all beverage cans and 84% of all PET and 90% of glass bottles are returned and the material is reused. More packaging types are being added to the system.

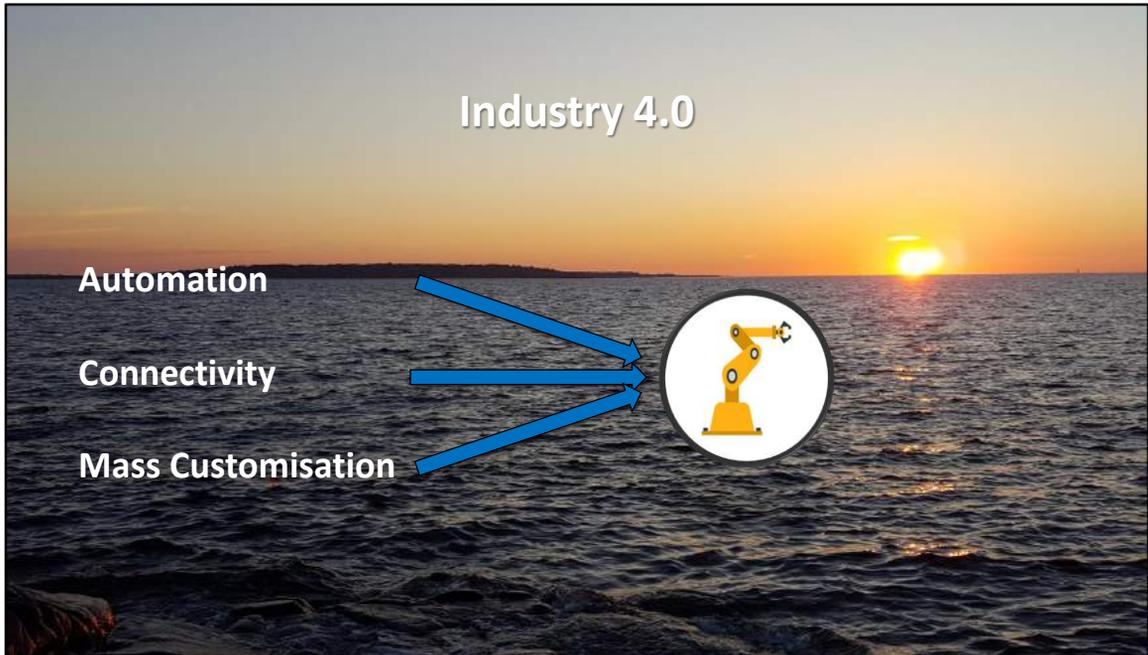
The challenge is to recycle bioplastics and here new materials and innovations could be a solution. PEF (polyethylenefuranoate) is one, a 100% bio-based and recyclable polymer that can be applied in the form of bottles and films to a broad range of applications like beverages, food and non-food products.

New Materials

Interesting new materials are being developed and some are entering the commercial phase. For example, a thermoformed fibre bottle. **BillerudKorsnäs** has joined forces with the Carlsberg, with the purpose to develop ecoXPac's innovative and revolutionary paper bottle "Green Fibre Bottle". Made from biodegradable and organic fibres. Also, for carbonated beverages...

I would also like to mention **SmartFoam**, a new material and a research project at Chalmers aiming to develop extruded foam materials based on by-products from processes used in forestry and the agricultural sector.





Picture 4: Industry 4.0

Industry 4.0 is about using a range of technologies that will change and improve the way we work. It is about the technology that will enable us to convert our existing industrial production plants into “smart factories”. Key elements are Automation, Connectivity and Mass Customisation.

Automation

The industry as we were used to see it is transforming into a globally networked and integrated business. This involves on micro level advanced robots, autonomous industrial robots with integrated sensors and standardised interfaces working together in networks.

We are at a turning point where the growing capabilities of robots are allowing the introduction on a large scale also in the packaging industry. This is happening right now, and the number of installations is expected to grow steadily over the next years, increasing productivity and drastically reducing manufacturing costs.

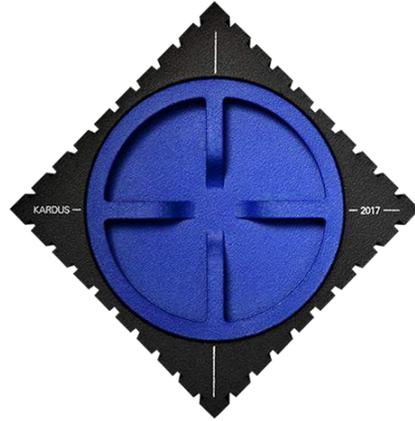
Connectivity

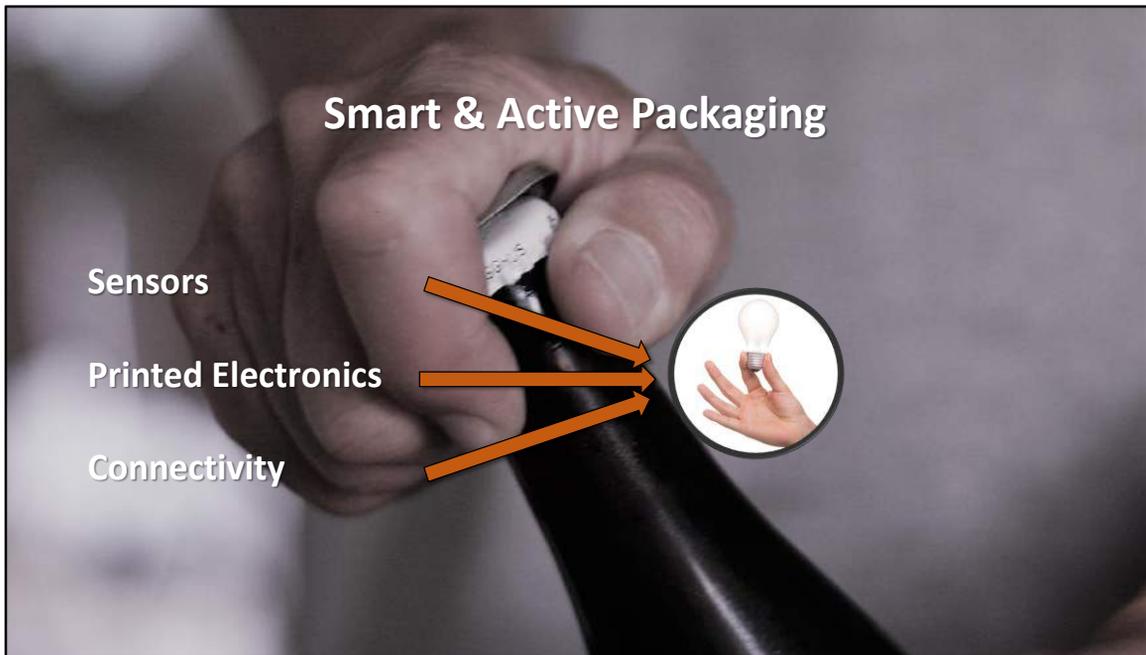
It starts vertical with a manufacturer and a connected production flow empowering the planners to optimise production and stock levels. That is only the beginning. The next step is an entire distribution chain horizontally connected with the same benefits but across a whole connected business eco-system. But this is further away

and will take a while.

Mass Customisation

3D printing, or as it is sometimes called additive manufacturing, has been adopted by industries like medical devices, fashion, and some manufacturing industries. For the packaging industry it is mainly used for mock-ups and when few samples are needed. It can also be used for very exclusive and short runs like when the packaging a box for a tobacco product, General Kardus, was 3D printed in a series of 1500 units by **Acron**. 3D printed spare parts is already explored by producers of packaging machines.





Picture 5: Smart and Active packaging

Smart packaging or active and intelligent packaging. Where active packaging provides functionality of some kind and intelligent packaging communicates information about the packaging and its content.

In the near future, we will see more products on the supermarket shelves in packaging that includes printed electronics. From attracting the customers' attention to providing information about the product, smart packaging offers quite a few benefits compared to conventional packaging.

Using printed electronics, producers can interactively communicate with the customer and give them needed information. The technology can also be used for tracking and to better understand your consumers and how they interact with a product. It can also be applied for authenticity checks or games.

Printed electronics are often NFC applications, but it is far from limited to this. Today you can print battery power, RFID labels, display, sensors and more, either on to the packaging or on a sticker to attach. A company in south Sweden **Beneli** is in the forefront working with printed electronics, RFID and NFC sensors.

Smart sensors mean sensors that can recognize and respond to touch, temperature, position, motion, pressure, etc. These are devices indicating levels of oxygen,

moisture, ethylene or any other substance that degrades a product, food, beverage or pharma.

Time-temperature sensors for instance are packed with foods to indicate if the product has been exposed to environments too hot or too cold.

An RFID tag is considered a sensor, but sensors needn't always be electronic in nature, in the case of food packaging, it could also be in the form of a biologic indicator.

These are exciting days where new concepts are fast entering the commercial market and other are waiting for their turn. But we have to keep up as sometimes technology is developing and maturing faster than organisations.



Further Trends

Lifestyle		Sustainability		Digitalisation	
Food Waste	Internet Shopping	New Materials	Bio Plastics	Digital Printing	The internet of Packaging



Picture 1: The Company

Beneli is based in south Sweden, in Helsingborg. Beneli produce traditional high-quality brand labels, tailor-made technical smart solutions with NFC tags and RFID tags, void solutions up to highest security level within areas such as beverage & food, security & traceability, e-health and functional self-adhesive components within the industry.

They have wide knowledge of adhesives for different surfaces and environments but also production certified ISO 13585 + ISO 9001 and a cleanroom ISO class 8.



Product authentication and enhanced digital marketing with NFC tag



- Communication, brand owner – consumer
- Authenticator
- Anti counterfeiting
- Traceability



Picture 2: Product authentication and enhanced digital marketing with NFC tag

The NFC tag, supplied by Beneli, opens a whole new world of communication between brand and consumer with the quick and easy tap of a mobile smartphone. Bridging the gap between the digital and physical worlds, the NFC tag provides a direct line of communication between product user and brand. It also acts as an authenticator for consumers and can identify a product or package's status as either sealed or open, and so supports product safety along the supply chain. Thin and flexible, the tags are easily integrated with any product label. When read using a smartphone, they provide traceability, electronic verification and anti-counterfeiting protection. They also open a direct dialogue between consumer and brand, allowing brands to collect essential buyer-behavior data, build loyalty by sharing their brand story and send customers personalized information, such as offers or recipes.



Void labels

- Tampering
- Counterfeiting



Picture 3: Void Labels

Security solutions against tampering and counterfeiting with unique Micro Optical 3D labels up to highest level of security that is impossible to replicate. They can be custom made and amplify the brand and the product's authenticity.



Premium labels

- Print flexibility
- Additional functions



Picture 4: Premium Labels

High quality labels up to ten colors in combination of UV, flexo, screen, metallic doming, hot or cold embossing, gloss or matte varnish, relief emboss and laminate. The product label can be integrated with an NFC tag for a more flexible marketing but also for verification of authenticity and/or as a security solution against tampering and counterfeiting.



Monitoring and patches

- Smart labels, information gathering
- Body sensors and E-health



Picture 5: Monitoring and patches

Beneli develops and supplies converted self-adhesive solutions that improve and simplify the monitoring, tracking and digital information services in many different areas such as pharmaceutical delivery and diagnostics in the health care sector. Together with various suppliers we produce near body, wearable sensors that revolutionizing the health care sector. Instead of big devices with wires and batteries, small adhesive sensors perform the task.

With smart labels, new opportunities open to collect information. The market is endless, and you can for example detect temperature, chemical substances and vibrations but also presence of damp and mold in bathrooms. It is now possible to observe an individual product's external influence through the supply chain or detect a house mold damage.

Depending on the product to be produced, requires different production environments. Medical devices require special handling and Beneli have production in cleanroom in certified, validated facilities and is certified class D/ISO Class 8. We work according to GNP-standard to ensure proper monitoring of all processes.

One area of monitoring is E-health, which means that you, in real time, with help of digital tools, can supply information between patient and doctors.



RD&D RESEARCH, DESIGN & DEVELOPMENT -

OUR PHILOSOPHY

Prof. Mikael Lindström

October 2018

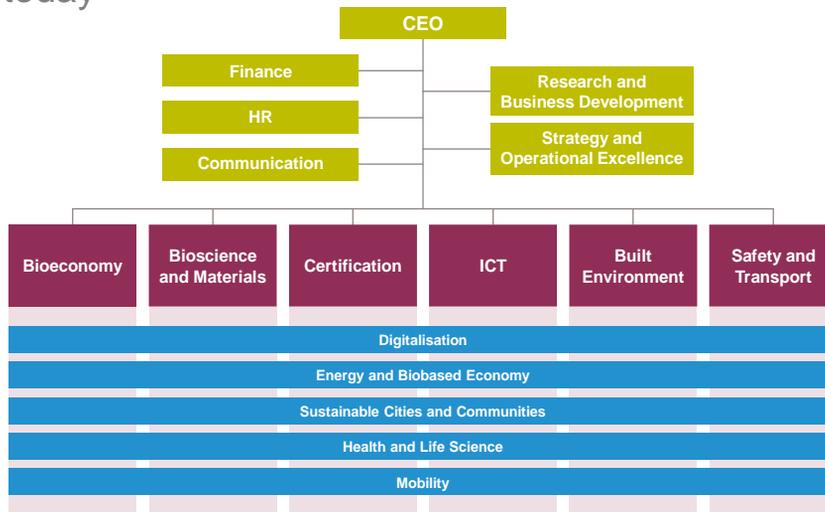
Research Institutes of Sweden

Bioeconomy



My name is Mikael Lindström and I will give a short introduction to RI.SE, Research Institutes of Sweden, Our organisation and a few examples of the philosophy behind our work. I am a Senior Scientist at the division Bioeconomy

RISE today



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The Swedish government has bought and merged four Industrial Research Institutes: The Swedish Technical Research Institute (SP), SWEREA, Swedish ICT and Innventia. The Result is RI.SE Research Institutes of Sweden

We are organized in six divisions: Bioeconomy, Bioscience and Materials, Certification, ICT, Built environment and Safety and Transport. Later this year SWEREA (The manufacturing industries research institute will be included as a seventh division.

In order to facilitate collaborations across divisions we have 5 Business and Innovation areas that are organized across the divisions. These B&I areas are: Digitalisation, Energy and Biobased Economy, Sustainable Cities and Communities, Health and Life Science, and Mobility.

RISE in brief

- Present across the whole of Sweden. And beyond.
- 2,300 employees, 30 % with a PhD.
- Turnover approx. SEK 2.7 billion (2017).
- A large proportion of customers are SME clients, accounting for approx. 30 % industry turnover.
- Runs 100s of test and demonstration facilities, open for industry, SMEs, universities and institutes (RISE is owner and partner in 60 % of all Sweden's T&D facilities).



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Present across the whole of Sweden. And beyond.

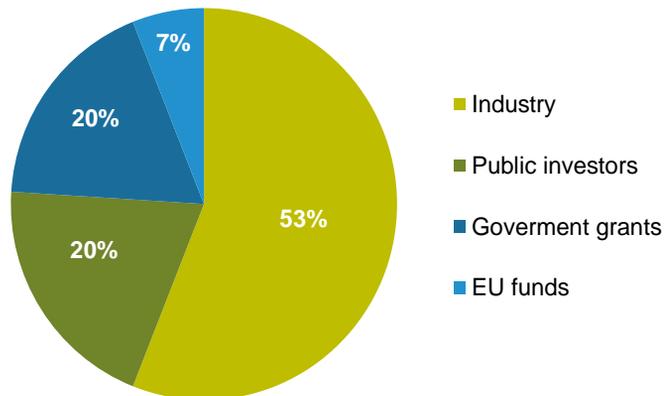
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Breakdown of turnover RISE Group SEK 2,696 million (2017) ¥ 32,700 million



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Global turnover was 2017 almost 2.6 billion Swedish crowns corresponding to 32.7 billion Japanese ¥ .
53% of the turnover comes from Industry 47% are different public fundings including European projects.

Our **vision**

An internationally leading partner for
innovation

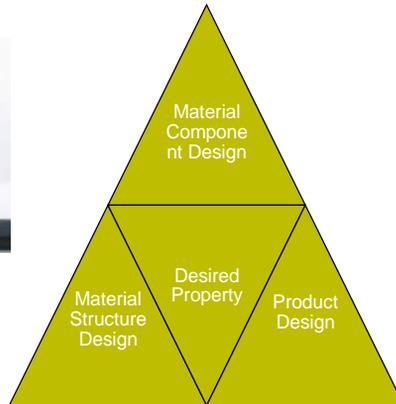
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Our **vision**

An internationally leading partner for innovation In the next few slides I will give some examples of our thinking and business models.

R,D&D Material Design



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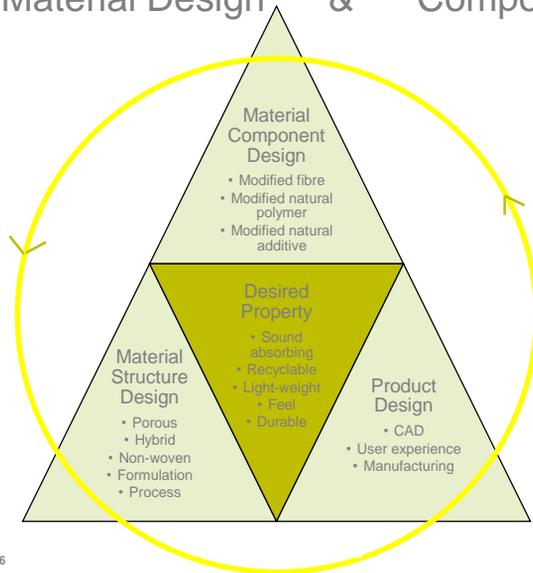
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In a biobased circular economy material handling becomes a critical factor. In our material design group we have developed the concept of research, design and development. For us it is important to include end-users early in the development phase. We have chosen to work with designer as end-user interface.

When a new product is developed it is important choose the right material and in our world it also means to find a biobased alternative to petroleum based materials. In an ideal world we could have a set of material components that can be mixed in different proportions and using different manufacturing process to achieve a large number of different material property combinations. The desired properties of the product can be achieved on different levels, we call it Hierachic design. Some properties are pure design questions, others depend upon the material structure and material properties while still others depend on material components.

All corners have their own KPI's for achieving the desired properties. Those operating in the top triangle rarely understand the KPI's of the bottom triangles and vice versa = big opportunity for innovation.

Material Design & Component Recycling



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In our hierachic design system we include component recycling.

Two examples: space travels & A shopping mall

This was an example of how wetry to change the use and development of biobased material



THE
BIOECONOMY
RESEARCH
PROGRAMME
2018-2020

Research Institutes of Sweden
RISE BIOECONOMY



These are a few slides to explain how we work together with Industrial partners. We work in three year cycles and develop a precompetitive research and development program together with the industry.

2018-2020

38

COMPANIES

12

COUNTRIES

21

M€

INDUSTRIAL, INTERNATIONAL,
INNOVATIVE AND INDEPENDENT

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In the on-going Research programme we have attracted 38 companies as partners, coming from 12 different countries with a budget of 21 M€ (2.7 Billion ¥)

ONLY PROJECTS WITH SUSTAINABILITY DECLARATION

100%



Research Program 2018 will be sustainable evaluated

All the programs will be evaluated by RISE Sustainable Project Declaration that is based on

RISE ethic policy

UN Sustainable development goals

A holistic evaluation of the effects of the project on different sustainable aspects throughout the value chain

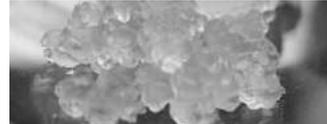
PROGRAMME AREA TOPICS



Pulp & cellulose



Lignin



Nanocellulose



Papermaking



Tissue



Packaging



Corrugated board



Bioplastics & barriers



Bioenergy, fuels & chemicals

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The 2018-2020 programme is based upon these 9 topics.

Pulp & cellulose

Lignin

Nanocellulose

Papermaking

Tissue

Packaging

Corrugated board

Bioplastics and barriers

Bioenergy, fuels and chemicals



THANK YOU!

Mikael Lindström

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Research Institutes of Sweden

RISE BIOECONOMY



Thank you for your attention.



PACKAGING TESTBEDS AND DEMONSTRATION FACILITIES

Dr. Jesper Berthold

Director of packaging development & product testing.

October 2018

jesper.berthold@ri.se

Research Institutes of Sweden

RISE Bioeconomy

Papermaking and packaging

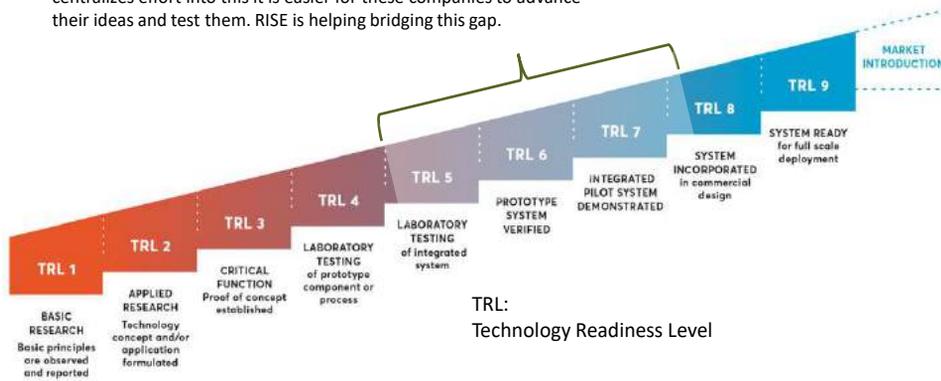


My name is Jesper Berthold and I'm going to give you a presentation called packaging test and demo beds in Sweden.

I am the director of packaging development and product testing within RISE bioeconomy.

Why keep and develop test & demo equipment and facilities?

It is very expensive for SMEs to finance their own pilots why putting a centralizes effort into this it is easier for these companies to advance their ideas and test them. RISE is helping bridging this gap.

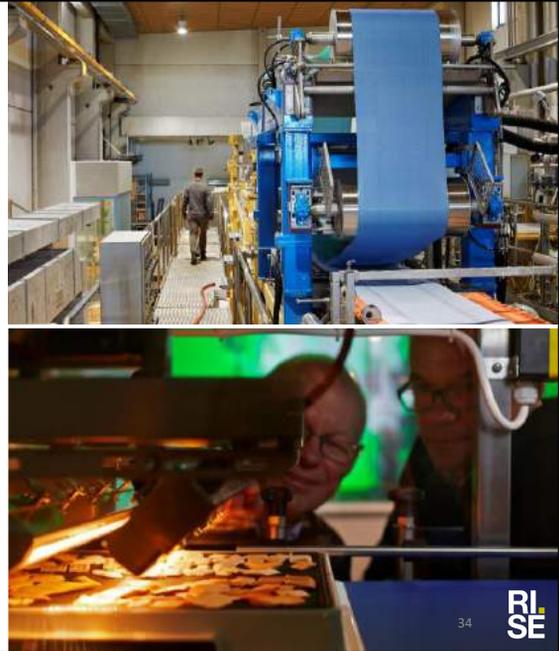


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It is very expensive for SMEs to finance their own pilots why putting a centralizes effort into this it is easier for these companies to advance their ideas and test them. RISE is helping bridging this gap.

RISE testbeds and demonstration facilities

- **Unique infrastructures** for research, development and verification on lab and pilot scale
- **Physical or virtual environments** where businesses, academia, research institutes and the public sector can collaborate
- **Equipment** adapted for industrial applications with **qualified operators and technicians**
- **Expertise** in research, industrial applications and project management
- RISE owns, and has partnerships in, **more than 100 unique test beds and demonstration facilities.**



Unique infrastructures for research, development and verification on lab and pilot scale

Physical or virtual environments where businesses, academia, research institutes and the public sector can collaborate

Equipment adapted for industrial applications with qualified operators and technicians

Expertise in research, industrial applications and project management

RISE owns, and has partnerships in, more than 100 unique test beds and demonstration facilities.

What can be done at a RISE testbed and demonstration facility?

- Test and scale up the products and processes of the future under realistic conditions
- Direct, confidential assignments or, in research and innovation projects, assignments together with multiple stakeholders
- Access to a well-developed network of stakeholders and expertise that can contribute to new solutions and business opportunities



Test and scale up the products and processes of the future under realistic conditions

Direct, confidential assignments or, in research and innovation projects, assignments together with multiple stakeholders

Access to a well-developed network of stakeholders and expertise that can contribute to new solutions and business opportunities

Benefits of RISE testbeds and demonstration facilities

- Effective product, process or method development
- Reduced costs for development and production.
- Shorter time to market
- Reduced investments in own equipment
- Fewer test runs in own production facility
- Opportunity to collaborate with other stakeholders
- Through participation from several stakeholders, a Swedish strategic initiative is enabled.



Effective product, process or method development

Reduced costs for development and production.

Shorter time to market

Reduced investments in own equipment

Fewer test runs in own production facility

Opportunity to collaborate with other stakeholders

Through participation from several stakeholders, a Swedish strategic initiative is enabled.

In the next few slides I will give five (5) examples of Pilots that we are currently working with.

Test and demo – 5 examples

1. FEX Pilot

- Fresh pulp the entire trial day, no circulation of pulp if not required
- Closed white water circulation for dry solids
- Uniqueness: Several forming possibilities
 - Roll, STFI-former (roll + blade), Roll + solid roll
 - Fourdrinier, Fourdrinier + topformer
 - Multi-ply
 - Stratified (multi-layered)
- Press section, interchangeable configuration:
 - One roll press
 - Two shoe presses
- Speed: designed for max 2500 m/min, winding max 1500 m/mi
- Paper width: 0.25 m



The first example is our fix which is a pilot paper machine full-length limited with where we can simulate more or less all condition that happens in a paper machine. The following conditions are valid for the machine and also some specifics of what we can do and have done throughout history .

Test and demo

2. Stock preparation pilot plant



- Extremely flexible to enable any configuration
- Flexible hoses, multiple injection points and controllable processes

<https://www.youtube.com/watch?v=frwjzFhbVE>
<https://www.youtube.com/watch?v=oVGdyT2uXF4>

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This picture shows you our stock preparation area. It is extremely flexible and can enable Morales any combinations of refining grinding Cyclone separation filtering etc etc. The pilot has become very popular recently thanks to its flexibility. It is being used trying to enhance papers strength through mechanically treating the fibers among other things.

Test and demo

3. Transportable MFC demo plant

- Makes it possible to produce microfibrillar cellulose (a type of nanocellulose) on a large scale for use in full-scale trials on paper and board machines.
- The factory is housed in two 12m long containers and is designed to produce 100 kg per hour.
 - Flexibility is key: enzymatic, high-refined pulp and/or homogenized
- The mobile demonstration plant for producing microfibrillated cellulose (MFC) is now at a mill
 - Already two production runs made and this current engagement is its third.



Together with industry partners, we develop new environments of research and development, test and demo.

Now there is a transportable demonstration plant which makes it possible to produce microfibrillar cellulose (a type of nanocellulose) on a large scale for use in full-scale trials on paper and board machines. The plant consists of two containers and has been developed in Vinnova-funded cooperation with BillerudKorsnäs.

Test and demo

4. Highly deformable papers

- Test bed for developing new manufacturing concepts for paper that can be stretched in both directions.
- New equipment placed adjacent to the pilot paper machine FEX.
- Test bed run in cooperation: the Italian company Gruppo X di X Gruppo has developed the technology Papermorphism and owns the equipment.



Another Vinnova project we conducted aimed at establishing an open test bed for developing new manufacturing concept for high deformable papers.

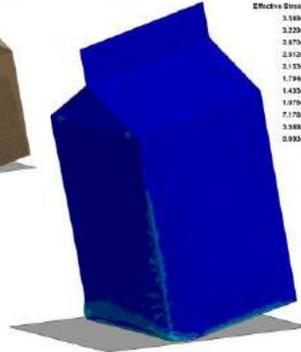
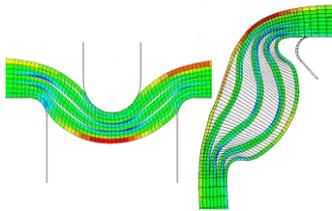
The Italian company Gruppo X di X Gruppo has developed a technology called Papermorphism and has now installed a unit in our pilot papermaking facility FEX. Together, we can now offer customers an environment for producing paper that can be stretched in both directions which opens for totally new paper products.

Test and demo

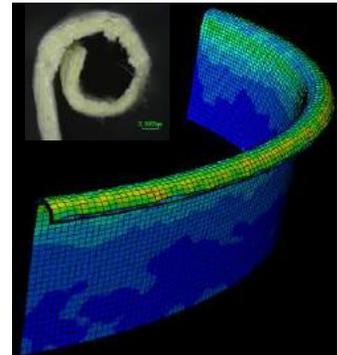
5. Finite element simulations



Creasing and folding



Package Performance



Brim forming

It has become a keen research area trying to simulate various converting operations and packaging performance.

Models are set up using various computer software and then the results from the models are corroborated by in real life experiments making the models stronger and more accurate. We are among other things looking into; creasing and folding, brim forming and various aspects of package performance.

The aim is to be able to very quickly simulate various situations customers want us to study, helping them to advance their product development, choice of material and material design to a commercial level.

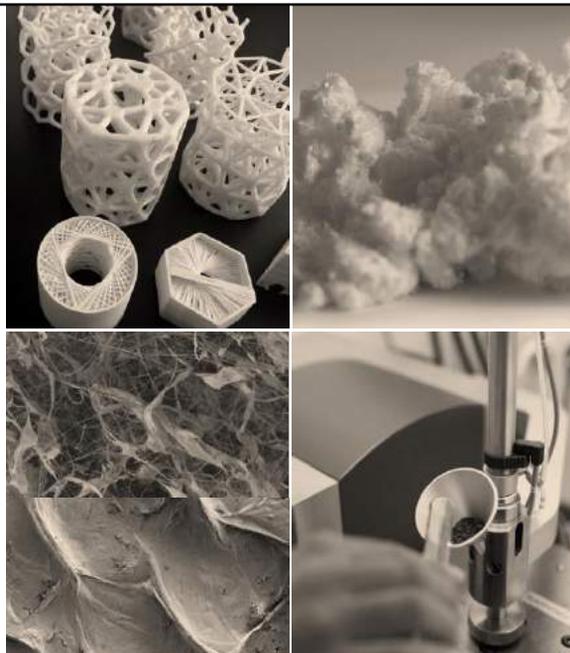
Thank you for your attention.



THANK YOU!

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Research Institutes of Sweden
RISE BIOECONOMY



Thank you for your attention.



PLAPER – PLA IN PAPER

TokyoPack October 2018

DR. FREDRIK BERTHOLD, Fredrik.berthold@ri.se

Research Institutes of Sweden

RISE BIOECONOMY



Ladies and gentlemen, First of all I like to thank the organizing committee for giving me the opportunity to speak to you today.

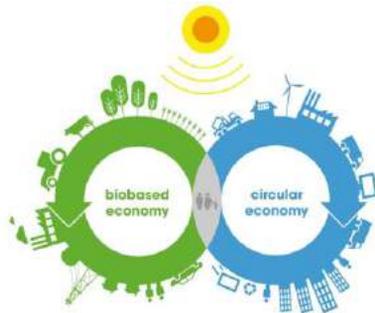
My name is Fredrik Berthold and I hold a PhD in wood chemistry. I have been working as a researcher and project leader at RISE bioeconomy for about 20 years and is today involved in the development of new material concepts in which Cellulose play a critical role

My colleagues Dr J. Berthold and Prof. Lindström has already presented the RISE organization and what its over all goals are

In this and the following presentations I will try to show you a little of how we we work in Rise. I will present two examples of areas where we are actively persuing the development of materials and processes to help meet the challenges that our environment and societies are facing

Challenges for paper

- Decreased use of printed media
- The property space of fiber based products
- Limited shaping possibilities in traditional fiber based materials
- Focused research effort to develop existing products further and make available new products and solutions



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For the pulp and paper industries around the world the need for new material solutions that can enable the visions of a more biobased economy in which also the philosophy of the circular economy is implemented represent a great business opportunity.

The decline in the consumption of printed media such as newspapers has put the industry under pressure to find alternative uses for wood derived fibers.

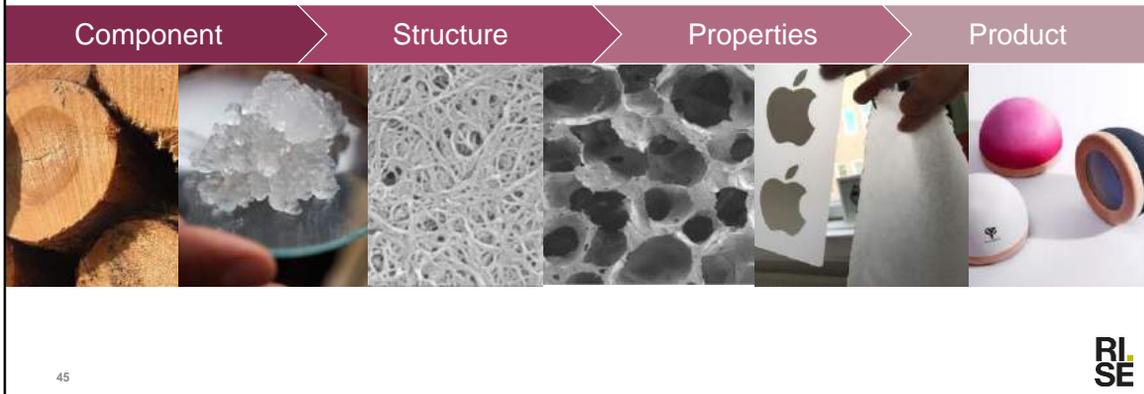
But in order to both make available new material solutions that can substitute especially materials that today are petroleum based and create new markets for cellulose a lot of research and development is needed.

In many cases the properties that can be reached using existing fibers and processes cannot compare to more plastic based products/materials and ways to expand the property space is needed

Traditional cellulose fiber based products tend to exhibit limited shapability and we are often limited to planar surfaces

So at Rise bioeconomy we have initiated research to try to both increase the performance of fiber based materials and to make available techniques for the production of shaped products of high quality

Material Design



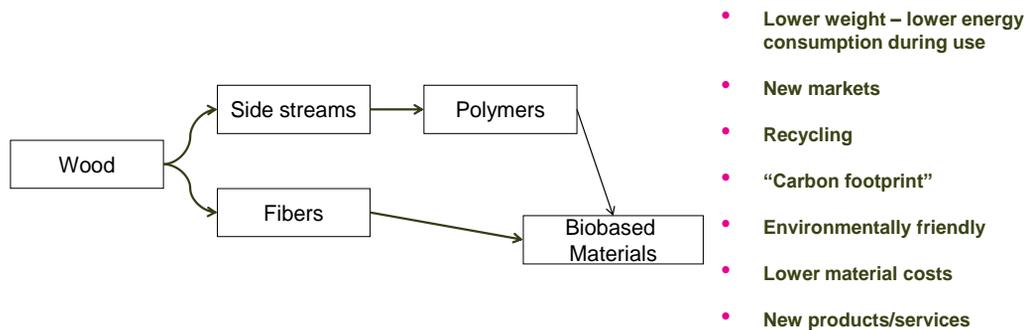
Professor Lindström already presented how we try to approach the development of new materials and processes.

We like to talk about the properties of a material concept as depending not just on the molecular composition on component level

The way the components are arranged and the structure they are forming are also very important for the properties - a good example is for example a polymer that can exist in a highly crystalline, dense structure but the same polymer can also be made into a foam having dramatically different properties

The figure suggest that a linear way of thinking going from very fine structural levels to more macroscopic parameters. This is not really the way we work and actually in most cases the development start with an existing product and based on the demands and performance the process goes backwards.

Wood as a source for new materials – green innovation



RI
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The development of new materials based on wood or other renewable resources could be looked on as green innovation where economic growth is achieved while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies.

There are several general points for this innovation process, examples listed in the slide

One of our strategies to meet the demand for greener or more biobased material solutions is to develop new material according to the strategy illustrated in the diagram:

By using side streams from the pulp and paper industry and upgrading those we have as a vision that polymeric systems enabling an expansion of the property space if combined with cellulose fibers will lead to new concepts/ideas/products

Fiber based materials with changed property space

- Combine cellulose fibers and polymers



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Rise has developed and are continuing to develop effective methods to mix and process polymers and cellulose fibers to achieve new interesting materials.

The method we are using allows us to freely mix cellulose fiber and polymer in any ratio. On the one hand this allows us to make materials dominated by fiber characteristics and the other material that will be more plastics like

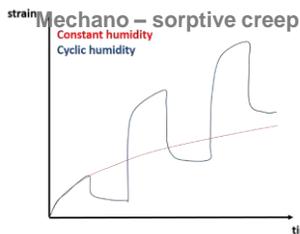
Most of our work in this field during the last 10 years has focused on using Bio-based polymers with an emphasis on polylactic acid (PLA). This work has clearly shown that the combination of pulp fibers and PLA is extremely interesting and can potentially open up for new improved properties of paper products and will also create possibilities for new material concepts and processes

You will hear much more about exiting opportunities this methodology enables in the presentation " Research frontiers in paper development " later today

I will focus on a few applications not covered in that presentation

PLAper – PLA in paper

- The development of the DURAPULP brand - today sold by Södra
 - Close to 10 development projects
- So what can be achieved when combining pulp fibers and PLA?
 - Increased tensile strength
 - Increased Z-strength
 - Increased wet strength
 - Increased creep resistance



PLA	Creep rate (10000 min ⁻¹) FEX paper, CD	
	Constant 80% RH	Cyclic 80% - 50% RH
0% unpressed	28	38
0% laboratory pressed	18	39
5% laboratory pressed	18	30
10% laboratory pressed	21	26



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The first steps combining cellulose or pulp fibers with polymers was taken together with industrial partners

Concepts and ideas from this work was implemented in the product Durapulp that today is sold by Södra. They in turn have several projects ongoing where Durapulp is used in different products..

The combination of pulp fibers with relatively low levels of polymer, often PLA, can result in dramatically improved mechanical properties

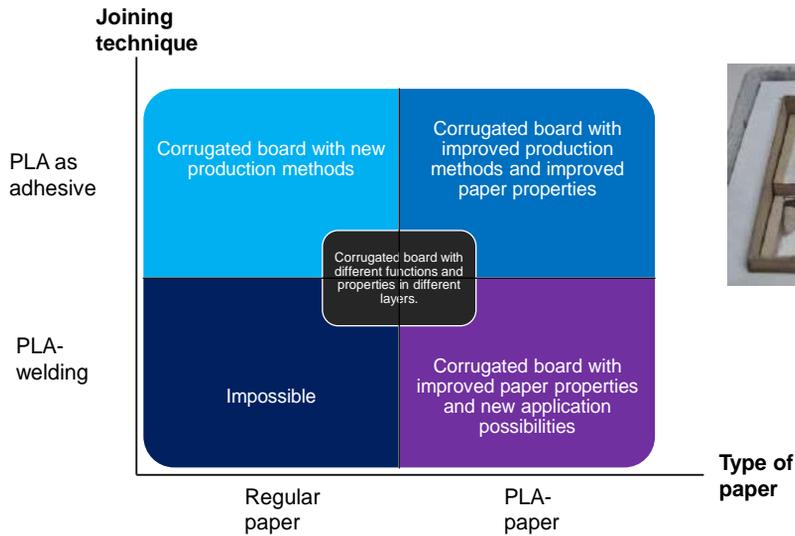
One property that is of special interest in many packaging applications such as carton board is creep or a materials tendency to deform under constant load

Cellulose being a compound that interacts well with humidity is prone to deform under load and this is increased further by changes on humidity. This deformation is called mechano-sorptive creep and we are all familiar with its result – sagging and deformed cardboard boxes.

The use of PLA can have a strong positive effect when it comes to this deformation

and as you can see from this example a reduction of about 33 % was achieved using 10 % PLA in the paper

Joining and welding of corrugated board



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In addition to the improvements to creep, strength and z-strength the addition of PLA can be used to both make direct gluing of flute to the liner possible opening up for potential changes to the production process that can lead to better corrugated board produced more effectively due to the decreased need for drying

Another interesting development are increased possibilities weld corrugated board that will open up for new converting strategies and packaging solutions

Textile-like paper



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As a spin off from the development of the DURAPULP material Rise also initiated investigations into the production of soft, warm and pliable materials directly on the paper machine.

As we already heard earlier today RISE have a pilot scale paper machine on which much work on the production and processing of paper with textile like properties has been performed.

One base material to rule them all

- The base material itself is
 - Twice as flushable as today's wipes
 - Renewable, compostable
 - Sealable, absorbent, warm to the touch
 - Softer than tissue paper but thrice as strong
- Various converting applications and functionalization chemistry are applicable to adapt the base material to textile-like material products.
 - Microcreping for stretch and drapability
 - Weldable for improved strength without loss of textile properties
 - Coating for added functionality
 - Hydrophobic
 - Flame retardant
 - Coloring and Printable
 - Curable for improvement of strength and less creep



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Together this work has today resulted in a material that in itself has many attractive properties such as softness and warmth but that can in a conversion step be turned into a strong and stiff material.

The development of this concept is still in its early stages and the coming years will see further development into new applications and products and of course RISE is always looking for partners that are interested in the development of new attractive materials and products!



THANK YOU!

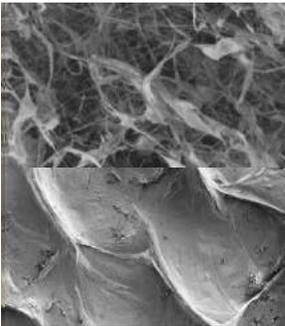
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RISE BIOECONOMY

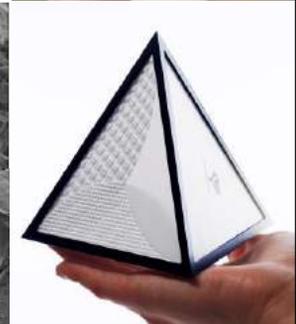
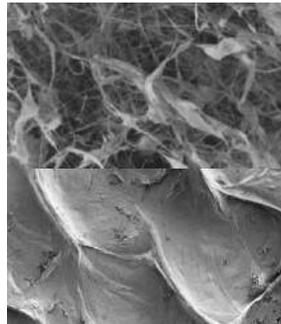




THE LIMITS OF MOLDED PULP

-ARE THERE ANY?

Research Institutes of Sweden
Bioeconomy
Biobased Materials / Material Design



- A main goal of RISE is to research and develop material solutions that can help solve some of the problems we are facing today
- Plastics is one such problem
- Plastics are a great material that have properties that are needed in many products
- Plastics are made from a limited resource – oil
- Plastics often end up in the environment and create problems that we still don't know the full extent of for example the emerging discussion regarding micro sized plastic particles
- Plastics in the waste streams end up contributing to the release of green house gases
- On-the-go packaging and other packages are products that today often are made of plastics

- RISE focusses on the development of alternatives to plastics that can be used in packaging

- “Using sustainable packaging to reflect cleaner and healthier living has become a priority for many consumers. As demand for organic and natural products grows, and the clean label trend continues to increase in popularity, having non-recyclable plastic packaging will start to limit the success of products which rate highly on ethics and sustainability in other parts of the supply chain.”

-”Greener Package”

Pulp molding enables fast and low cost production of packages with high speed and excellent finish that have the potential to replace plastics in many applications



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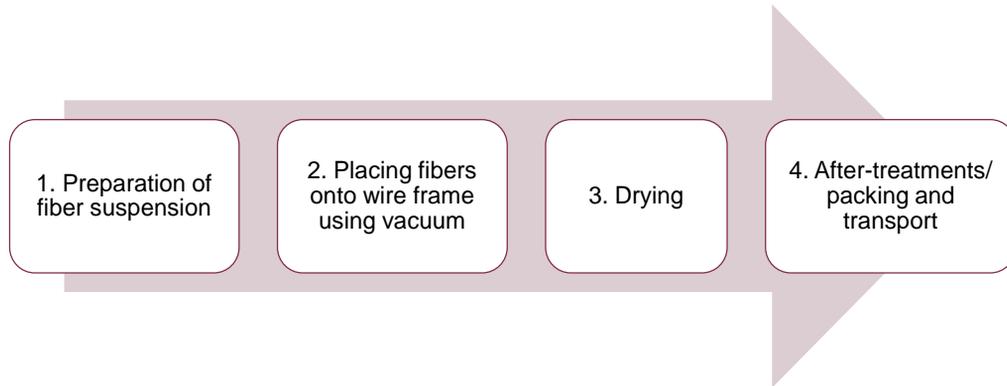
**RI
SE**

The increased awareness that packages in general and plastic packages in particular pose a large environmental problem has increased the need for new solutions where fiber molded products have a great opportunity to become winners in the future

More and more countries are imposing restrictions to the use of plastics in packaging and together this make it necessary to develop new material solutions and processing technologies to enable fiber based packages to replace much of the plastic used today.

This is the reason why RISE is actively working in the field of fiber molding both on a fundamental level to develop fibers that form even stronger networks and dewater more effectively and on an applied level together with customers to develop new packaging concepts

The Molding Process



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- The basic principles of fiber molding are old, the first patents in the area was issued already in the early 1900 hundreds.
- The basic steps of the fiber molding process has remained the same and consists of:
 - 1 The preparation of a fiber suspension suitable for molding
 - 2 A shaping step where fibers are deposited onto a shaped frame, usually made from a metal mesh
 - 3 A drying step. It is this step that differ most between different molding processes. It is also the step where most developmental work are being performed. Simply put the drying will either be performed as free drying where wet products are dried by passing through an oven or the drying is done while the product is inside a tool – so called in tool drying
 - 4 After drying the product can be further modified to improve quality. Examples of after processing are: coating, printing, hot-pressing, die-cutting, trimming et.c.
- Depending of the how this process is run one usually distinguish between four types of molded products

Differentiating moulded pulp product by process

- Type 1 - Thick-walled



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Type 1 definition:

- Single mould with product
- wall thickness from 5mm to 10mm
- One surfaces is relatively smooth, with one side rough
- Support packaging of non-fragile, heavier items. (vehicle parts; furniture, motors etc.), plant, floral and nursery pots and containers

Differentiating moulded pulp product by process

- Type 2 - Thin-walled or Transfer



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Type 2 definition:

- One forming mould and one transfer mould
- Wall thickness between 3mm and 5mm
- Relatively smooth on one side
- Examples are egg cartons and trays New and many types of electronic product packaging such as cell phones, DVD players etc. Also, used for hospital disposables, electrical appliances, office equipment, tableware and fruit and drink trays.

Differentiating moulded pulp product by process

- Type 3 - Thermoformed/thin-walled
- Type 4 – After Processed



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The third category is often referred to as thermoformed or in-mold dried. This kind of product is distinguished by its high finish and smooth surfaces. The level of detail can be very high.

Type 3 definition:

- Multiple heated moulds
- wall thickness of about 2mm to 4mm or thinner
- Smooth surfaces and forms are well detailed with minimal draft angles.

The high pressures that can be applied leads to higher densities than what is achieved in type 1 and 2. This increased density also lead to increased mechanical performance.

Done the right way the formed product can come to resemble a thermoplastic material!

Type 4 definition:

- Secondary or special treatment other than simply being moulded and cured.

- After pressed - Die-cut or perforated - Printed – Coloured
- Special mould- Special slurry formulations - Embossments - Special design features
 - Special additives

Advanced Fiber molding and Thermoforming

- The development of new fiber molding technologies are driven by new demands on packaging
- New drying technologies are key for high final properties
- Continued development of new fiber qualities and additives



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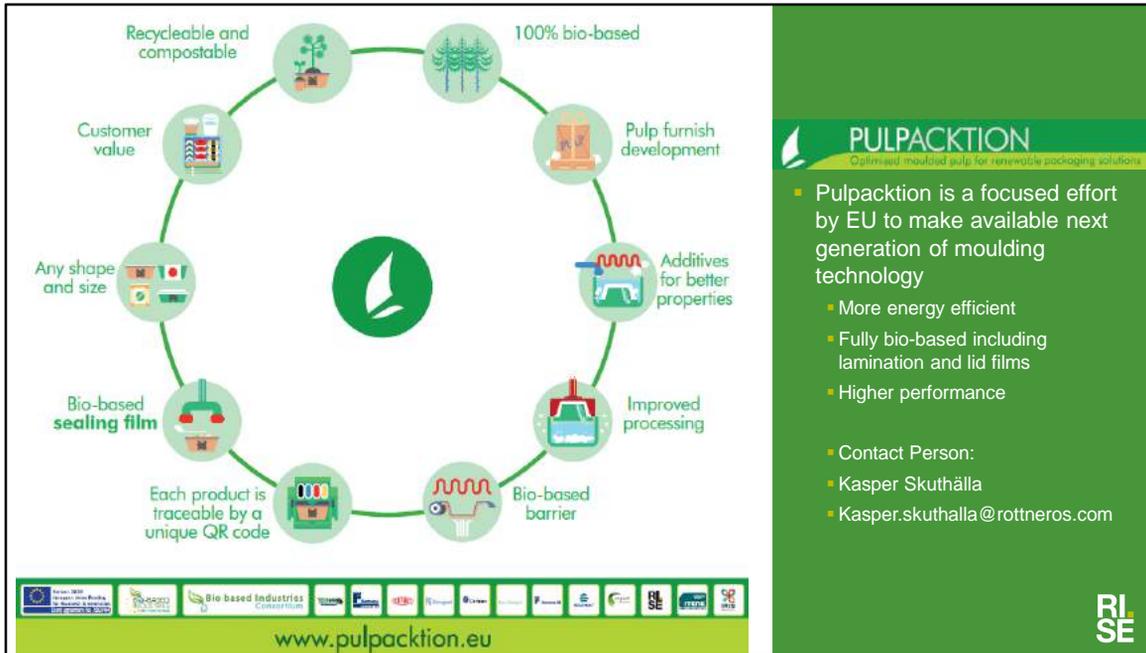
The fiber molding technology is developing rapidly to meet the demands for new high performing solutions that can substitute products made of plastics.

Although type 1 and type 2 products are interesting in themselves the main focus is on the thermoforming process.

Key improvements are needed both in the process and in the performance.

The wet molding technology uses a lot of water and on the process side methods to decrease the energy demand, especially energy needed to dry away water from the formed fiber network is of interest

The choice of fibers and the use of additives to improve key properties such as strength and stiffness can translate to less fibers needed that in turn can decrease drying needs



RISE is one of two research partners in a EU funded research project aimed at the next generation of Molded pulp products for food and electronics

The project addresses several of the key steps in the production of products made using this technology

- Choice of raw materials
- Pulp furnish development including additives
- Process development
- Bio-based barrier film and sealing film
- Customer value and recycling

The project works on two product demonstrators:

- Food packaging
- Electronics packaging

Project data:

- 12 partners from 8 countries
- Four year project
- Total budget – 12 MEUR
- Relevant stakeholders and relations represented in BOAC

Over-all project objectives:

- 100 % bio-based and biodegradable solution
- 10 % lighter than competing solutions
- At least 50 % CO₂ reduction compared to today's process

Main Task

What

Organization names

I RESEARCH

Support project with research capacity and excellence



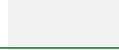
II PULP AND MOLDING

Production of wood derived fibers and fiber molding technology



III FILMS AND BARRIERS

Development and production of new bio-based film solutions



IV CHEMICAL SUPPLIERS

Additives and printing/ printing inks



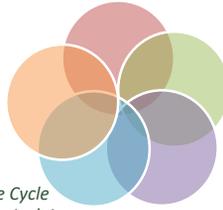
Specific Objectives

- 100 % bio-based and biodegradable solution
- 10 % lighter than competing solutions
- At least 50 % CO₂ reduction

Five performance indicators

Obtain cellulose based blends with a good balance between mechanical properties, processability and final cost

Produce and validate a final package solution at semi-industrial scale: final package performance characterization, Food contact and shelf-life studies, and Distribution simulation test results



Obtain cellulose wet moulded packages at semi-industrial scale with competitive price and performance

Packaging Eco-design and Life Cycle Analyses (LCA) and Carbon Footprint.

Produce bio-based films with improved barrier, mechanical and thermal properties by implementing compounding and film production at industrial scale.



The future

- Examples of development of fiber molding at RISE:
 - The development of molded bottles for liquids and carbonated drinks
 - New high performing bio-based barriers
 - New ways to improve dewatering and performance through choice of fiber and use of additives
 - Large parts for e.g. vehicle interiors
 - Dry forming



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RISE

RISE thinks that fiber molding has the potential to become an interesting area not only as a substitute to plastics in packaging applications. Actually the potentials even larger and in the future we might encounter molded cellulose based in many more applications and products

Some examples of where research and development are ongoing are e.g.

-The development of bio-based/green treatments and barriers to achieve protection against water, oxygen and other key gases. Success in this work will make it possible to use molded in many more products .

-Several projects has shown the possibility to mold large products such as chairs and caskets. These products are proof of concepts that the technology can be used to make high performing details and future developments are under way. The combination of polymers and cellulose fibers in a molded product will enable the production of complex products such as vehicle interiors or coverings to appliances.

-RISE is also conducting research on a more fundamental level to devise new methods and strategies to further improve performance with regard to energy

demand, mechanical properties and surface finish.

Taken together the potential of molded products in which cellulose is dominating is large and we can expect dramatic improvements regarding energy consumption, esthetics and performance

If this sound interesting to you, please don't hesitate to contact RISE Bioeconomy for further discussions!



THANK YOU!

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If you are interested in contacting the Pulpaktion project please either talk to me or the project coordinator

Kasper Skuthälla
Kasper.skuthalla@ri.se



Picture 1: A global player

GAIA is based in South Sweden where they develop and produce biodegradable biomaterials for a wide variety of applications. With their vast know-how and experience within the production industry they have found new solutions to improve and broaden the use of biomaterial.



Renewable materials in Biodolomer®

- Calcium carbonate
- Sugar cane (polylactic acid)
- Rape seed oil
- PBAT (ester)
- PBS (amber acid)

Picture 2: GAIA – Biodolomer®

Biodolomer® consists of renewable materials

Calcium carbonate

Sugar cane (polylactic acid)

Rape seed oil

PBAT (ester)

PBS (amber acid)

Biodolomer® is also certified for composting. The Pouch is additionally certified for home composting.



Biodolomer® provides benefits in the form of:

- Considerably lowered CO and CO₂ emissions when incinerated
- Fully biodegradable and compostable
- Improved shelf life for packaged food
- Lower bacteria growth as compared with both paper and fossil plastic gives better hygiene and less smell from waste



Picture 3: Advantages with Biodolomer®

Biodolomer® provides benefits in the form of:

Considerably lowered CO and CO₂ emissions when incinerated

Fully biodegradable and compostable

Improved shelf life for packaged food

Lower bacteria growth as compared with both paper and fossil plastic gives better hygiene and less smell from waste

When storing food in packaging made by Biodolomer®, a significantly increased shelf life has been achieved, both for meat and fish, as well as fruit and vegetables.

For meat and fish, an increased shelf life of up to 5 days has been observed while packaging without gas barrier material.

The savings potential in the form of reduced food waste is significant from an economic, as well as an environmental, perspective.

Require that your food is delivered in packaging made from biomaterial.



Picture 4: Increased shelf life for food

When storing food in packaging made by Biodolomer®, a significantly increased shelf life has been achieved, both for meat and fish, as well as fruit and vegetables.

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Require that your food is delivered in packaging made from biomaterial.



Biodolomer® is fully biodegradable and compostable, which means that the material can be disposed of in an environmentally friendly way by digging a hole, putting it directly into the ground and covering it.



Picture 5: A sustainable solution!

Biodolomer® is fully biodegradable and compostable, which means that the material can be disposed of in an environmentally friendly way by digging a hole, putting it directly into the ground and covering it.

POLYKEMI GROUP

- Turnover appr. 120 million EUR 2017
- Family owned
- ISO 9001 & 14001
- >80 000 MT production capacity
- >35 production lines
- >300 employees

polykemi 
BRINGS OUT THE BEST IN PLASTICS

rondo 
BRINGS OUT THE BEST IN PLASTIC RECYCLING

scanfill 
BRINGS OUT THE BEST IN PACKAGING

polykemi 
BRINGS OUT THE BEST IN PLASTICS
柏力开米（昆山）

Picture 1: Scanfill

Scanfill is a part of the Polykemi group who has a very diverse material portfolio, which is a competitive advantage for Scanfill.

Scanfill can produce locally on three different continents. This helps the group to have a local presence to support and visit customers more easily. Our office in Kunshan, China supports the entire Asian market.

We can produce both granules and sheet on multiple production sites. HQ in Ystad, Sweden.



Scanfill

- Excellent formability
- Low CO₂ emission
- Mineral reinforced
- Faster production
- High heat conductivity

Scanfill BIO

- Bio-based polymer
- CO₂ neutral
- High heat conductivity
- Mineral reinforced
- Faster production

Scanfill is fully Recyclable



Picture 2: The Product

Scanfill = PP polymer base with 50% minerals

Scanfill BIO = BIO HDPE polymer base with 50% minerals

Due to the mix of minerals, Scanfill material has a much lower CO₂ emission rate.

Scanfill is fully recyclable



50% mineral
in the final packaging

How is it possible?

Compounding!

scanfill
BRINGS OUT THE BEST IN PACKAGING

Picture 3: Mineral

We produce a compounded granule, not a masterbatch. The difference is that our material grades are ready-to-use materials in the final product to 100%. No need to mix it with anything else.

The compounds are designed for:

Sheet = Thermoforming sheet – with layer structure up to 7 layers including EVOH.

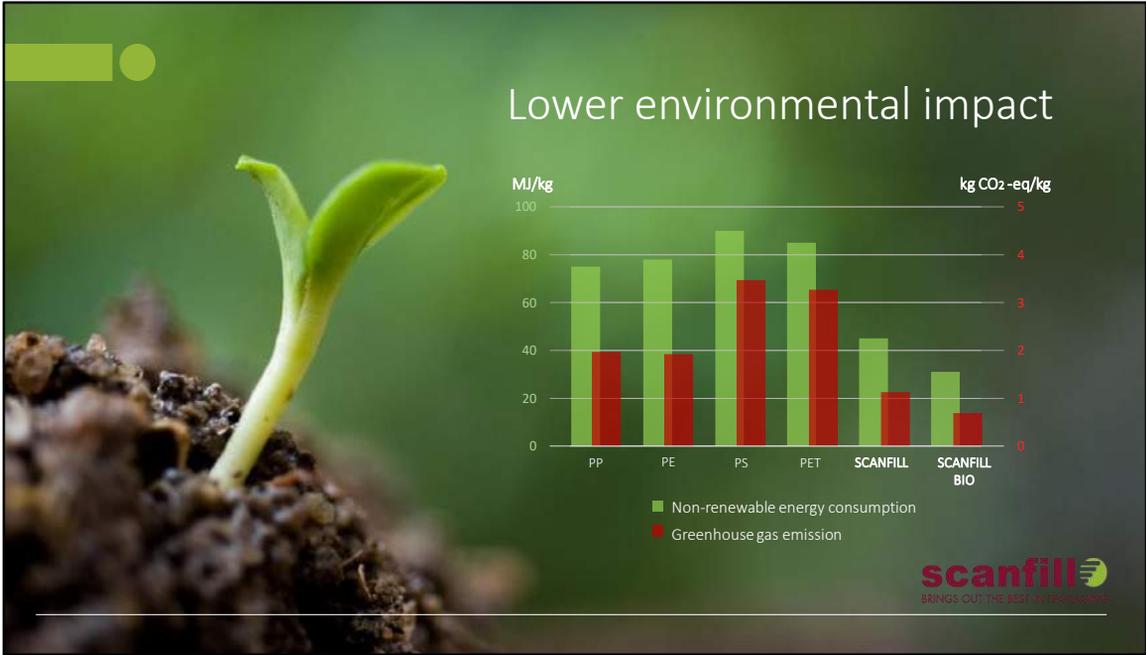
Most common is 2 layers resulting in one matte layer and one glossy layer.

Foil = granules for sheet production

Bottle: granules for extrusion blow moulding

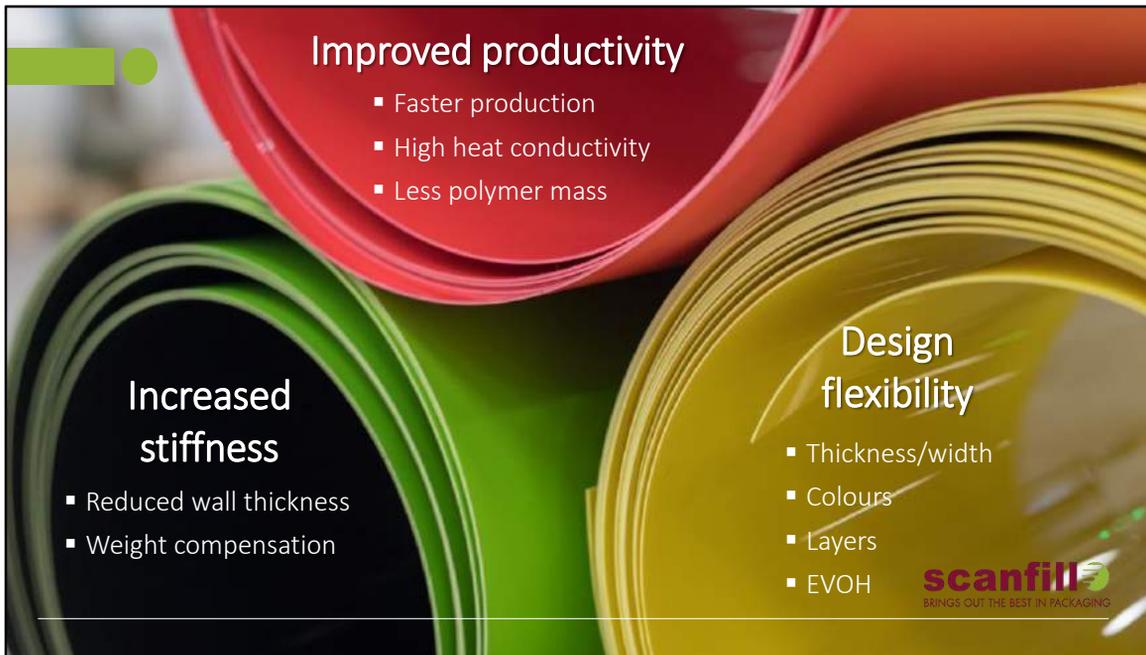
Injection: injection moulding grade

Pack = blown film grade



Picture 4: Environmental impact

Cradle to cradle LCAs comparing Scanfill grades with other materials on the market.



Picture 5: The Benefits

In combination with only 50% polymer mass and the much higher heat conductivity rate, Scanfill materials speeds up the heating and cooling phase making it possible to shorten the cycle times and produce faster.

The mineral mix helps the forming phase and helps giving excellent formability. The reduced sheet or wall thickness will also help for improved productivity since there is less material to process.

Even though the density is higher, Scanfill materials can weight compensate in the most cases, keeping the same weight and top load.

Scanfill’s biggest advantage is the flexibility the company and production have. We can customer adapt all materials. Sheet production is based on customer demands with width and thickness, the number of layers, EVOH barrier and other specific properties needed. Most common is 2 layers resulting in one matte layer and one glossy layer. Being able to stand out in the market with specific colours, a matte surface and having a soft touch feeling helps marketing and differentiation on the shelves.

Better Barriers



- Excellent insulation properties
- Low density
- Environmentally harmless
- Silica based
- Extremely porous

Quartzene® as powder



Quartzene® as gel



Quartzene® as pellets



Picture 1: The company

Svenska Aerogel started in 2000 as a R&D company based on product and process patents for the amorphous silica material called Quartzene®.

Quartzene:

Excellent insulation properties

Low density

Environmentally harmless

Silica based

Extremely porous

Packaging industry



Thermal insulation

- Cups for hot beverages
- Instant dishes heated in a microwave
- Home delivery of chilled and frozen food products

Barrier – super hydrophobic

- Paper and cardboard

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Picture 2: Thermal insulation

Using Quartzene® in paper -, board- and pulp products has quickly advanced to become one of the top priority areas for Svenska Aerogel. By adding Quartzene® the final product will improve the thermal insulation properties and add a hydrophobic barrier.

Thermal insulation used for

Cups for hot beverages

Instant dishes heated in a microwave

Home delivery of chilled and frozen food products

Barrier – super hydrophobic

Paper and cardboard

Packaging industry



Ethylene and VOC removal

- Absorb ethylene- fruits and vegetables
- Absorb VOC – formaldehyde and more

Filter units

Embedded in paper or cardboard

Separate absorption units included in packaging

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Picture 3: Ethylene removal

It can also capture the harmful gas Ethylene to improve the shelf life for fruit and vegetables. Apples gets a prolonged shelf life using Quartzene® and can also be used for capturing harmful VOC gases.

Ethylene and VOC removal

Absorb ethylene – fruits and vegetables

Absorb VOC – formaldehyde and more

Filter units

Embedded in paper or cardboard

Separate absorption units included in packaging

Packaging industry



Printability

- Paper and card board
- High speed ink jet printing
- Improved printing
- Improved drying time of ink

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Picture 4: Printability

By adding Quartzene® in coated paper or board for printing, you will significantly improve the printing quality, and potentially increase the productivity.

Printability

Paper and card board

High speed ink jet printing

Improved printing

Improved drying time of ink

General Quartzene® properties

- Excellent insulation properties
- Low density
- Fire proof
- Environmentally harmless

- Silica based
- Extremely porous
- Large inner specific surface



Picture 5: Properties

Quartzene° in packaging for

Thermal Insulation

Filtering and barrier properties

Improved print quality

Environmentally harmless, Silica based