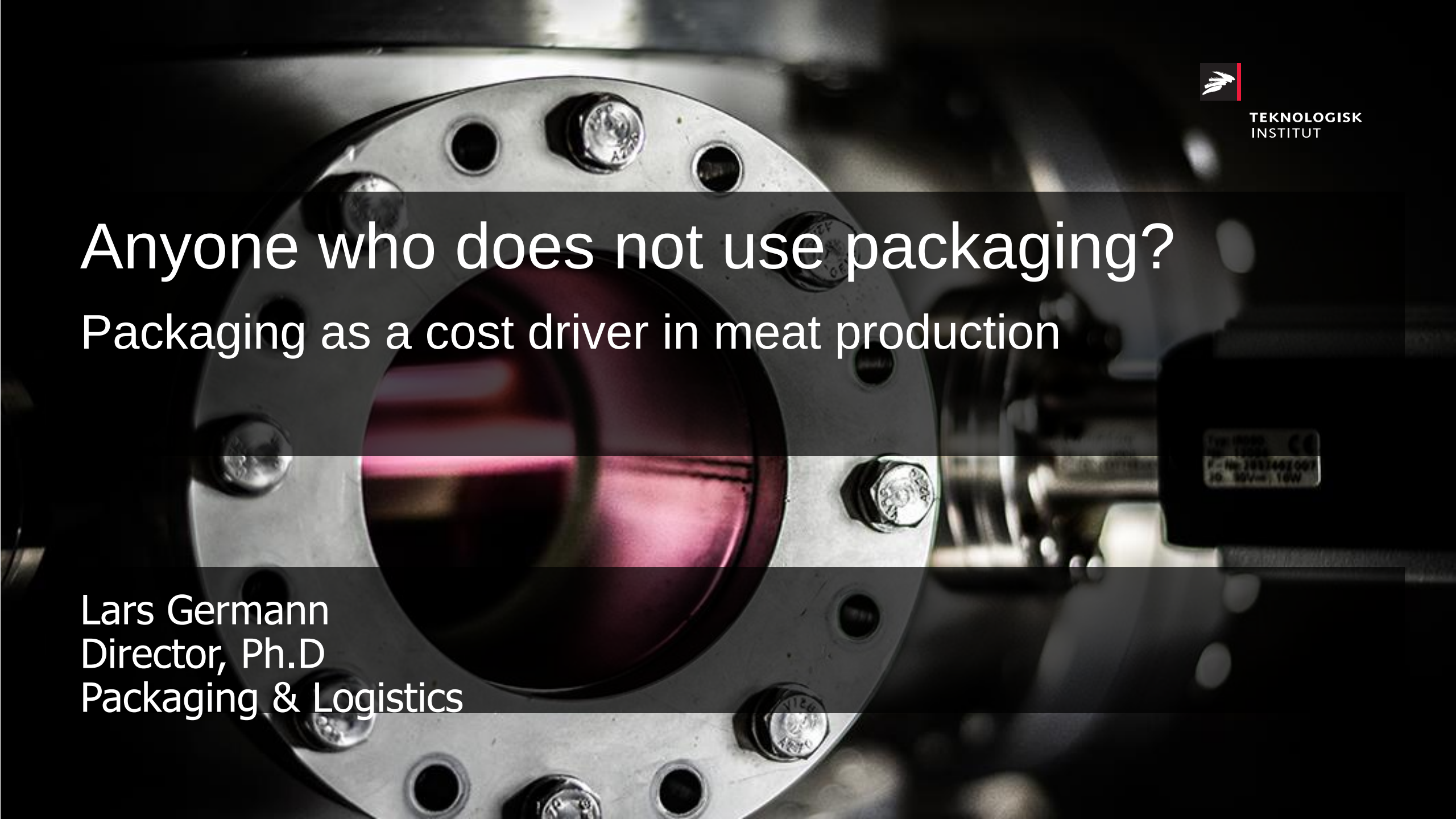

TEKNOLOGISK INSTITUT

Anyone who does not use packaging?

Packaging as a cost driver in meat production

Lars Germann
Director, Ph.D
Packaging & Logistics

TEKNOLOGISK INSTITUT

Focus:

- Packaging solutions of the future – what is possible and what is available right now?
- Innovation in packaging: Sustainability, safety, convenience and food waste reduction - megatrends to secure your market share
- Production and packaging hand in hand: Low volume, high mix: Flexible packaging solutions in production line

Packaging makes all the difference…

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Tap water: 0.007 Euro/liter
Safe?
Convenient ?

Fresh milk
1 Euro/liter

Tap water: 2 Euro/liter
Bottle: 0.13 Euro
Safety + convenience + personal branding

Looking into the past…

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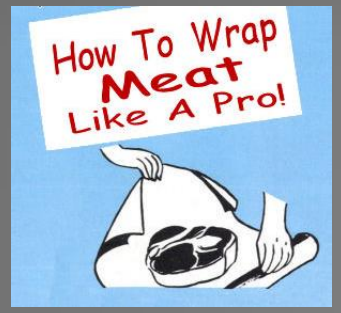
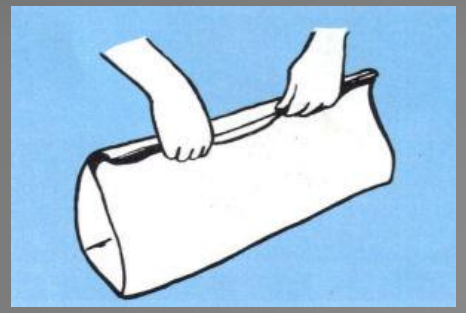
"The more distant we look into the past, the farther we can see into the future."

Winston Churchill

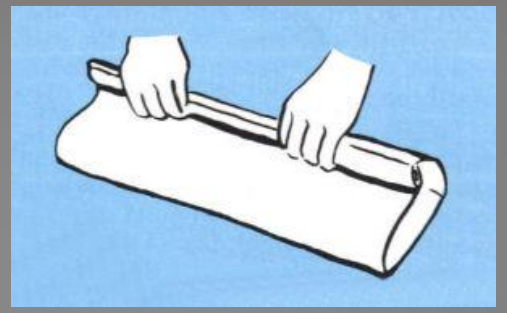
1961 **"How To Prepare Foods For Freezing"; Sears, Roebuck & Co.**



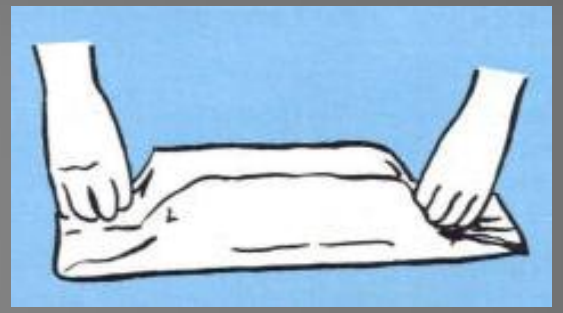
1. Place meat on paper



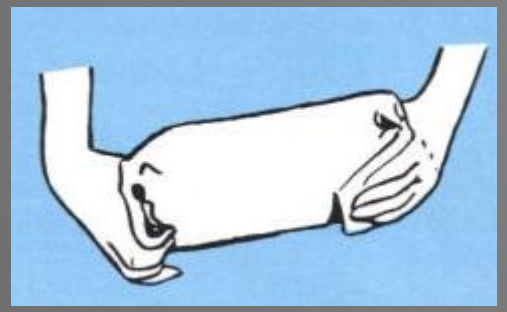
2. Bring ends together



3. Fold to meat



4. Fold ends



5. Turn under ends

6. Seal and label

"The Drug Store Meat Wrap"

- **Sustainable**
- **Safe**
- **Convenient**
- **Multifunctional**
- **Simple**
- **Flexible**
- **Cheap**

And this is what we will always need …

In 1961, proper packaging methods meant:

- Using moisture-vapor-proof paper
- Removing as much air as possible from package
- Carefully sealing tightly wrapped package
- Labeling package for usage within recommended storage time

And looking into the present…

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What trends experts have outlined as likely to affect packaging?

	Trend 1	Trend 2	Trend 3	Trend 4
Jane Chase Institute of Packaging Professionals	Sustainability	Economy	Food Safety	
Pat Conroy Deloitte, Consumer Products	Economy	Sustainability	Product Safety	
Marla Donahue Flexible Packaging Assn.	Sustainability	Consolidations	Food Safety	Material Cost / Availability
Lynn Dornblaser Mintel Corp.	Product Value Promise	Sustainability	Color Coding	Private Brands
Michael Richmond Packaging & Technology Integrated Solutions	Open Innovation	Sustainability	Private Brands	
Glenn Ventrell Sara Lee Corp.	Private Brands	Sustainability	Microwave Packaging	
Chuck Yuska PMMI	Sustainability	Economy	Private Brands	Packaging/ Processing

Recyclability
Circular Economy
Reduction of food waste

Circular economy – the partnership between the EU Commission and the consumers is very powerful

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Sustainable Materials Management is a systemic approach to using and reusing materials more productively over their entire lifecycles. It represents a change in how a society thinks about the use of natural resources and environmental protection. By looking at a product's entire lifecycle new opportunities can be found to reduce environmental impacts, conserve resources, and reduce costs

~~No packaging – sustainability?~~

Environmental impact:

Production 70%
Logistics, processing, cooling 29%
Packaging 1%

Another look into the future

PACKAGING - TEN TRENDS FOR THE NEXT TEN YEARS

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1. **Electronic Business Processes**
   Electronic business processes or information transfers will eventually link the entire supply chain - raw material suppliers, packaging manufacturers, packaging users, retailers and consumers.
2. **Supply Chain Management**
   At every point in the supply chain, costs are added. Reducing those costs, simplifying the supply chain and increasing efficiency is now an overriding goal.
3. **Concentration of Ownership**
   The creation of the single EU market is fostering a European approach with packaging companies required to produce a product - and deliver a service - across all EU member countries. This requires considerable resources, both financial and human. Smaller companies will be limited to supplying products for niche markets.
4. **Convenience Packaging**
   Consumers are demanding a wider range of products and greater segmentation within those products. Convenience packaging goes beyond the essential purpose of preserving and protecting the product. Consumers want conveniently packaged food products that can be quickly made into meals without sacrificing quality. This is obvious in the range of products displayed in supermarkets that preserves shelf-life and maintains freshness - microwavable products, salad kits, modified atmosphere and zippered packaging.
5. **The Aged**
   The proportion of the elderly (over 65) is expected to increase to 22% of the population in the first half of the Century...
6. **Shorter Runs - Greater Flexibility**
   "Mass customization" will result in a greater differentiation of products and those products will be brought onto the market more quickly than ever before. Technological advances in printing mean that the packaging industry can now create personalized, individual products at high speed and with a minimum of notice. Packaging can now be targeted to specific market segments.
7. **Marketability**
   There will be an increasing demand for higher quality graphics and promotional links between graphics and advertising.
8. **The Environment**
   Issues involving recycling, reducing the amount of waste going to landfill and source reduction will remain on the agenda of all countries
9. **Other Demands** - Freshness, Tamper Evidence, Labeling
   Freshness - While consumers want convenience, they also want freshness. In the United States and Europe, sales of products in modified atmosphere packaging are increasing significantly. Other products to extend shelf-life are also gaining ground.
   Tamper Evidence - The demand for tamper evident packaging will increase - that is, packaging which possesses a barrier to entry which, if breached or missing, will provide visible evidence to consumers that tampering had occurred.
   Labeling - The demands on labels to provide information will increase. Instruction details, nutritional information, promotional material, bar-coding, environmental aspects etc. will all need to be included on a standard label.
10. **The Core Functions of Packaging - No Change**

Packaging for Better Meals Cooked in Microwave Oven

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Developed commercially viable packaging concepts:

- Microwave steaming of frozen fish or meat in sauce
- Frying frozen fish, meat and poultry products coated with breadcrumbs
- Re-heating buns and sandwiches from frozen
- Backing traditional Danish Rye Bread, Cakes, and Pâtés from raw frozen dough
- Microwaving Multicomponent Frozen Sandwiches

Microwave packaging for **Jimmy Dean** breakfast sandwiches with Meat and Egg Patties:

Formula of a generic MW packaging concept

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Packaging for microwaveable food =
Core food-packaging functions +
Thermal insulation +
Microwave-reflective elements +
Microwave-susceptive elements

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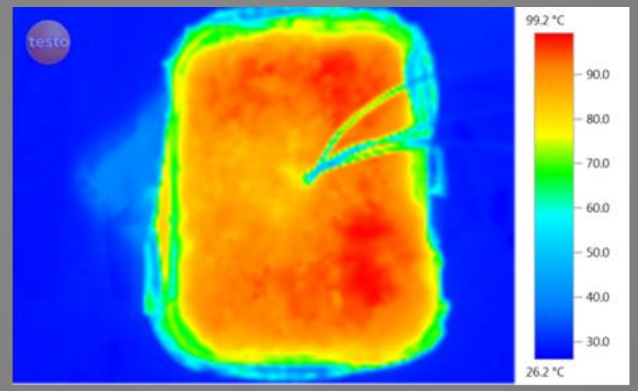
Proof of Concept study: Bake-it-yourself *Liver pâté*

Liver pâté baked in domestic microwave oven from frozen dough…

- Baking time 10-12 min

  400 g (from frozen) => 11 min @ 850 W (650 W effective microwave output)



Shorter Runs - Greater Flexibility

PicknPack

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Flexible robotic systems for automated adaptive packaging of fresh and processed food products

- 2012-2015
- 14 participants, including WUR, Fraunhofer, DTI, Tecnalia
- DTI's total budget 1.4 M€, granted 1 M€
- Total budget 12 M€, granted 9 M€ (KBBI's largest!)

DTI:

- Packaging WP leader
- Flexible packaging for fresh produce and ready meals, including flexible molding of trays and their flexible decoration by means of ink-jet printing
- Packaging for ready meals including development of flexible heating system for Microwaving: patterned reflectors and susceptors ink-jet printed on the packaging

PicknPack video

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https://www.dti.dk/specialists/european-project-delivered-picknpack/37637?cms.query=picknpack

PicknPack

EUROPEAN COMMISSION
Community Research
SEVENTH FRAMEWORK PROGRAMME

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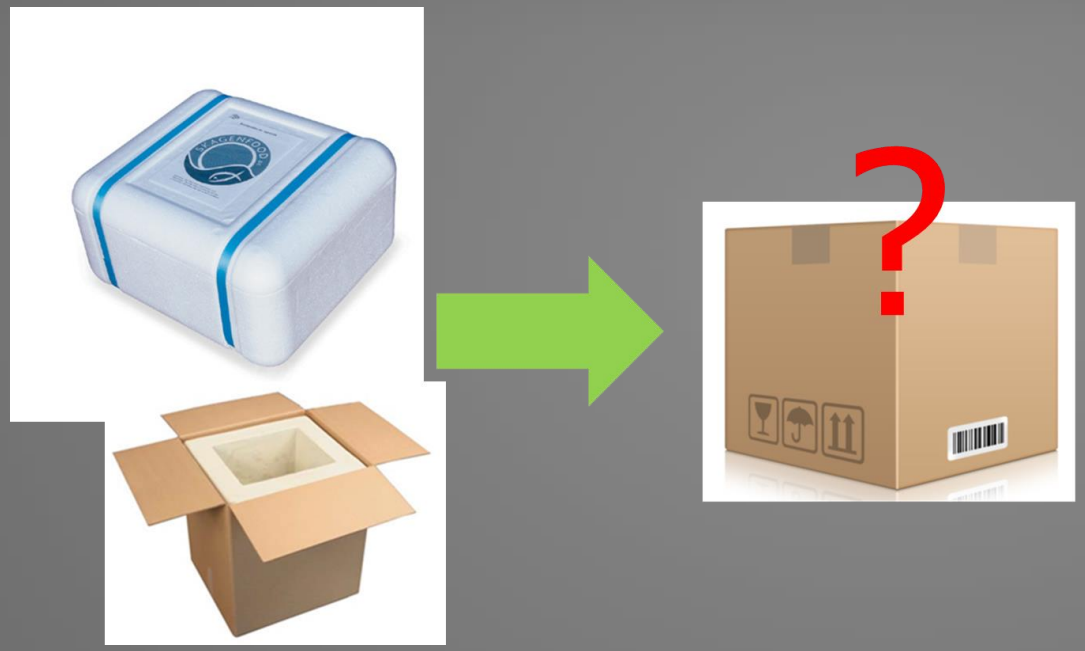
Packaging for Easy Distribution of Temperature-Sensitive Food Products



Sustainable Biodegradable Solution

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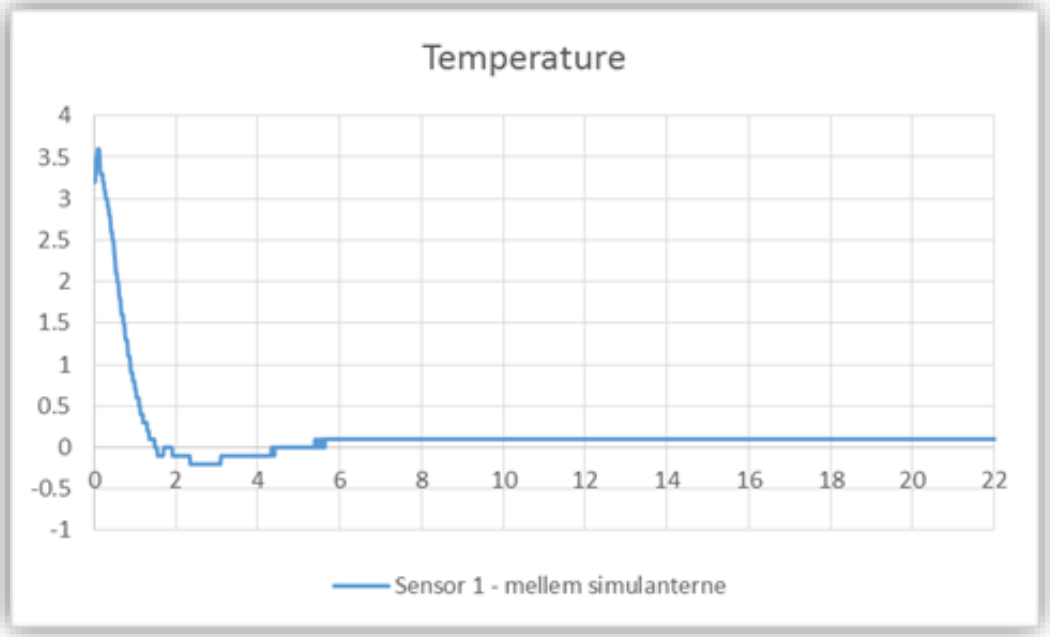
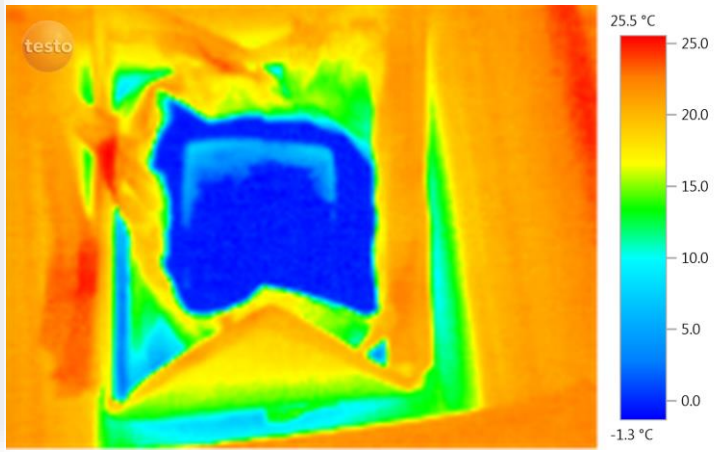
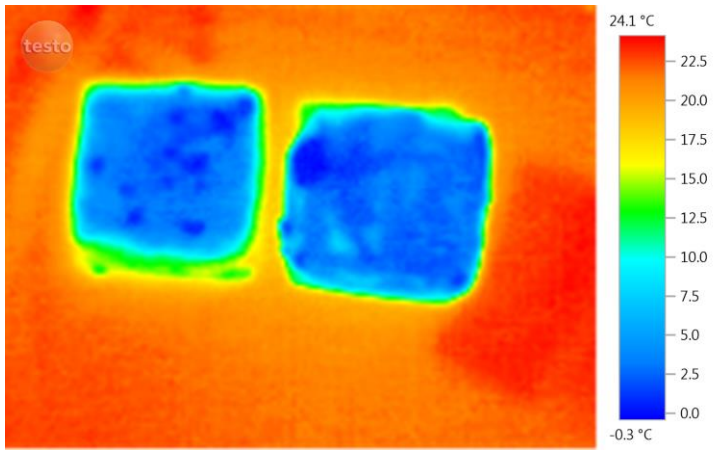
- Thermal insulation + Waterproofing
- Corrugated box, paper pouch, biodegradable bioplastic bag…
- 2 × 450-g meat simulators, 1.5 kg of ice, below 1°C for 24 hours

After 22 hours…







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Sustainable materials for food packaging applications

Is compostable liquid food packaging feasible?

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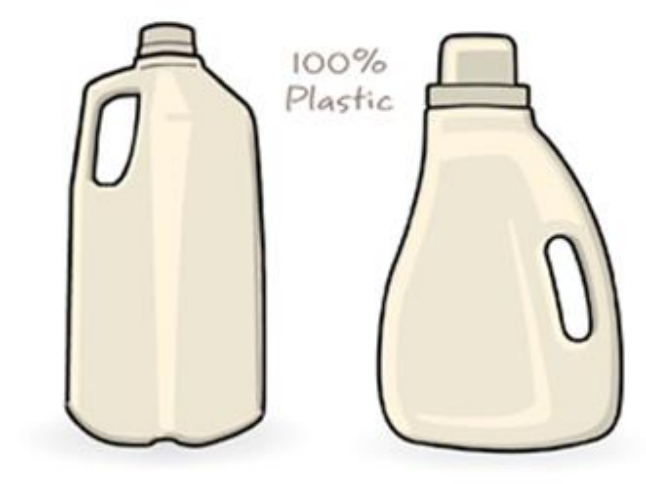

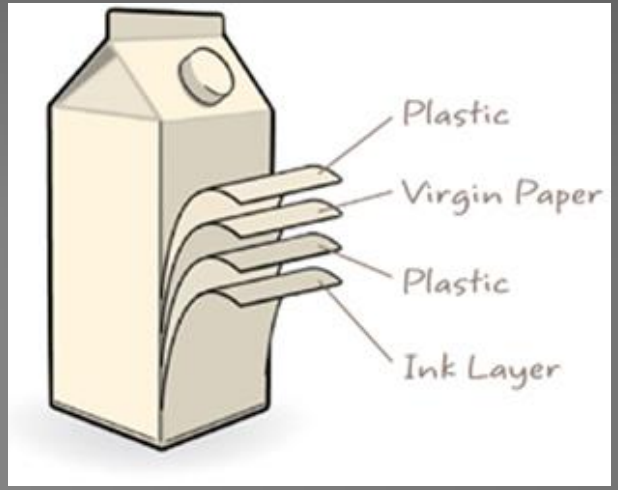

Clipsable shells of moulded cellulose with inner plastic pouch

The Environment

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Fully molded paper bottles are 100% biodegradable

ecoXpac A/S (Denmark) and DTI have developed a bottle prototype made of molded cellulose. The waterproof coating on the bottle's interior based on biopolymer and SiOx films is less permeable for oxygen and moisture than polypropylene or polyethylene bottles.

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Molded paper packaging

- Trays
- Cups
- Bottles

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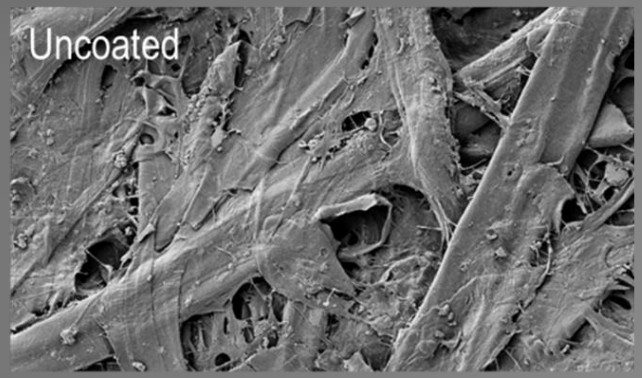
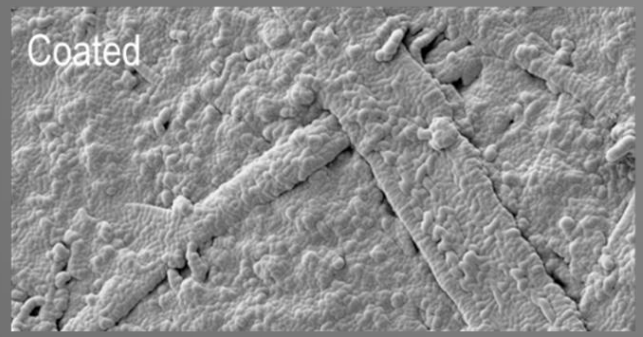
Water-repellent PECVD coatings





Product applications versus barriers

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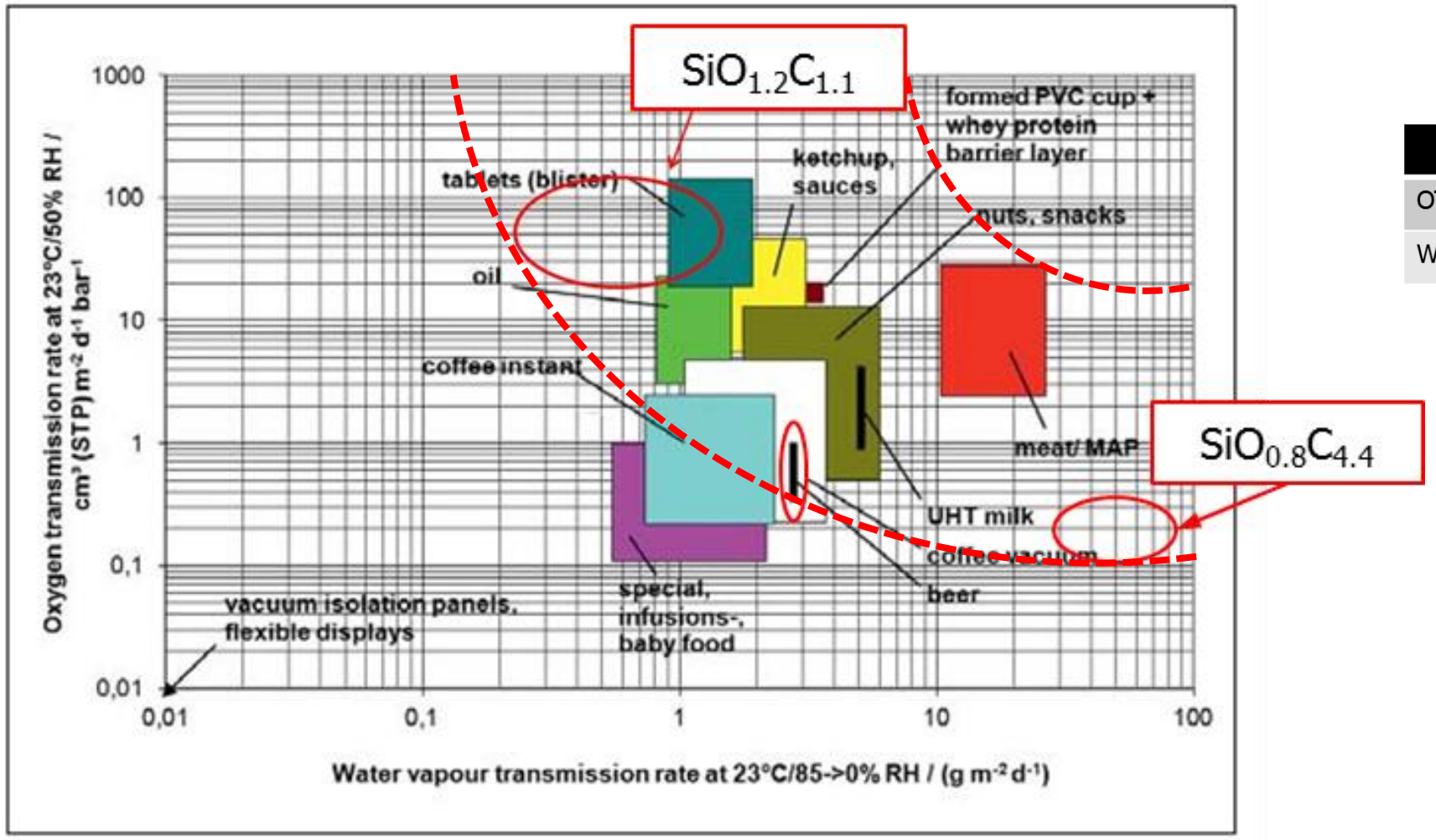
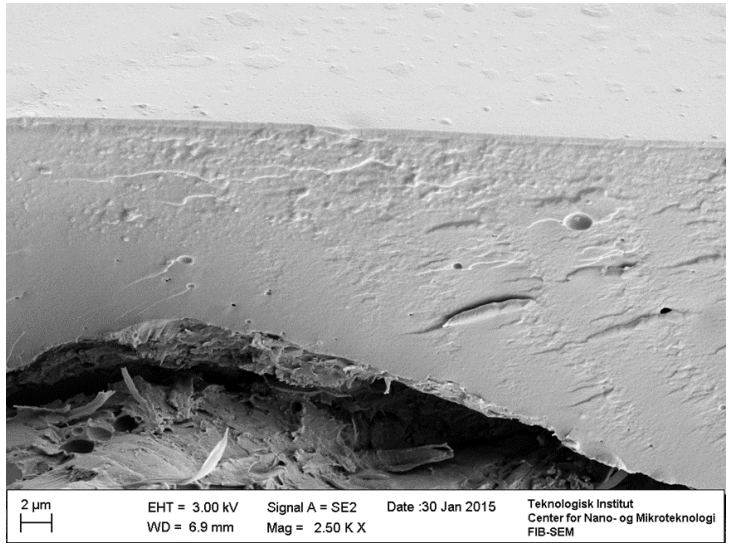
Oils, snacks, chips, ketchup, sauces, dairy products, meat (MAP), pills …



$SiO_{1.2}C_{1.1}$	$SiO_{0.8}C_{4.4}$
OTR ~ 15 ml·m^{-2} ·day^{-1}	OTR ~ 0.3 ml·m^{-2} ·day^{-1}
WVTR ~ 0.3 g·m^{-2} ·day^{-1}	WVTR ~ 50 g·m^{-2} ·day^{-1}



Implementation of active and intelligent packaging films

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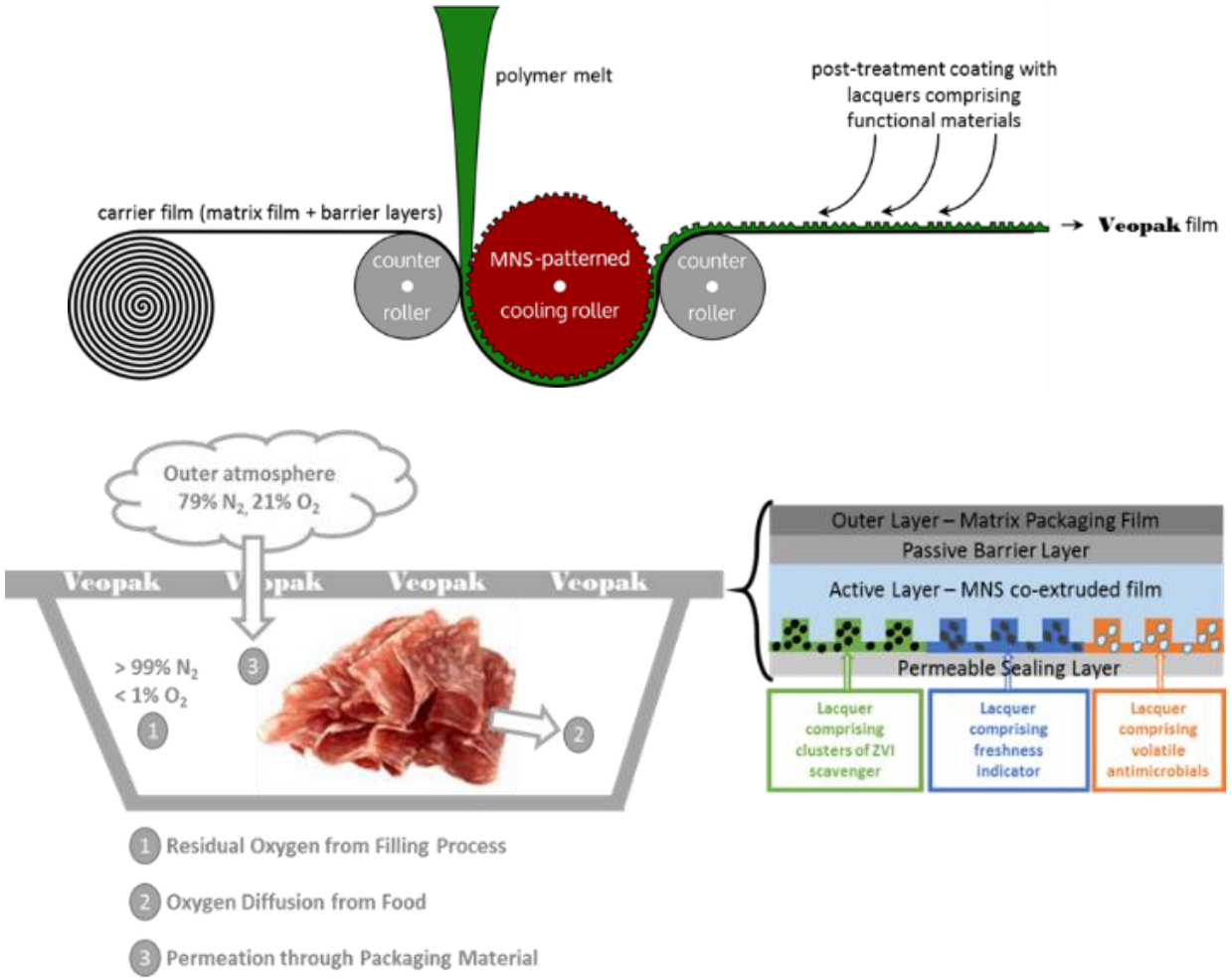
Active and intelligent packaging with following three functionalities:

1. **Oxygen scavenger** based on sub-microscopic agglomerates (clusters of ~ 200 nm in diameter) of zero-valent iron nanoparticles (ZVI powder)
2. **Antimicrobial compounds** based on volatile liquid plant extracts (essential oils of e.g. thyme, oregano, cinnamon etc.)
3. **Freshness indicator** particles based on specialized sensor dyes, which comprise trifluoroacetyl and secondary amines receptor groups and carboxyl or vinyl linking groups for stable immobilisation of the pigments, and incorporated in silica or poly(methyl methacrylate) sub-microscopic capsules (200-500 nm diameter particles)



Micro-Nano Structured (MNS) Films

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- Fabrication of MNS at line-speed of 60 m/min by large-area roll-to-roll extrusion coating has been recently demonstrated at production line in Denmark