



Workshop: From food waste to innovative bio-based products

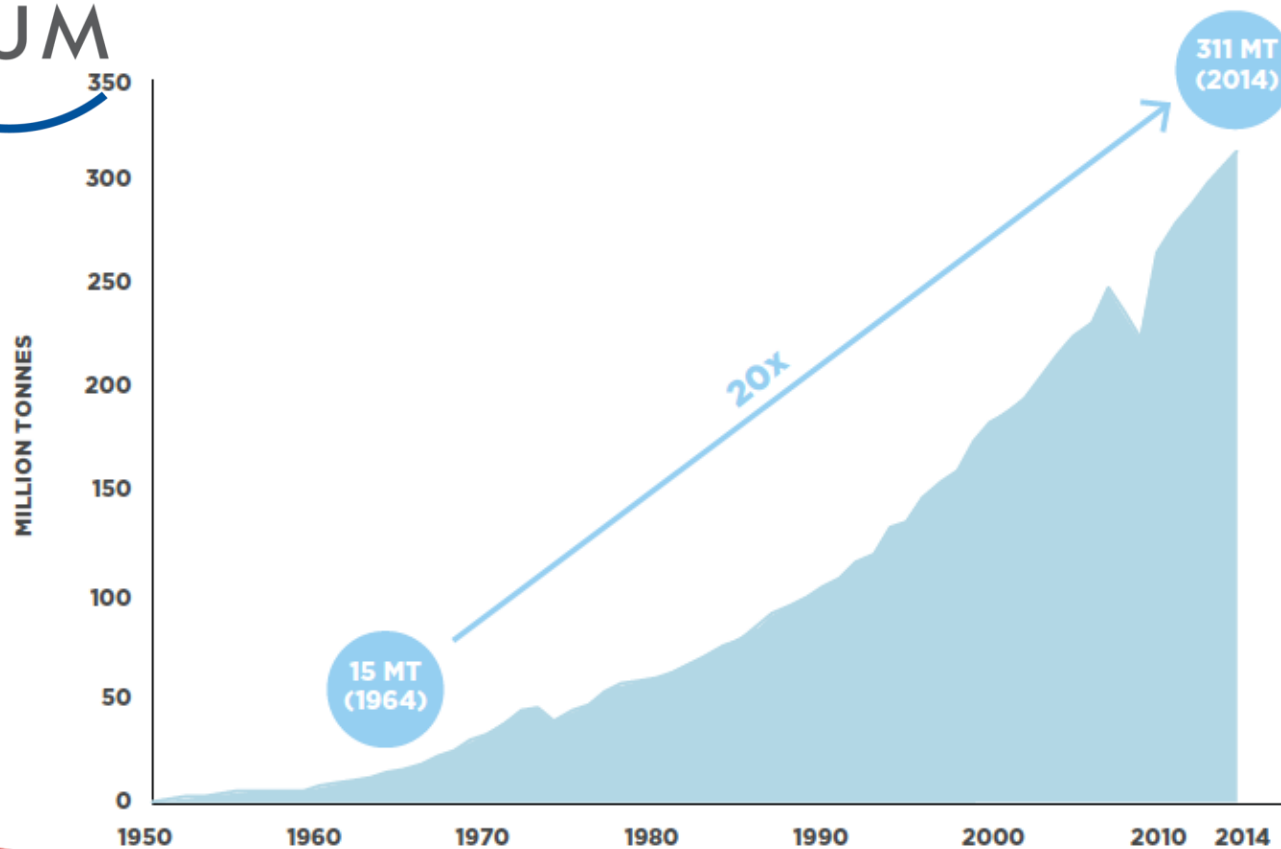
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From by-products of potatoes processing to PHAs biopolymers ... through fermentation



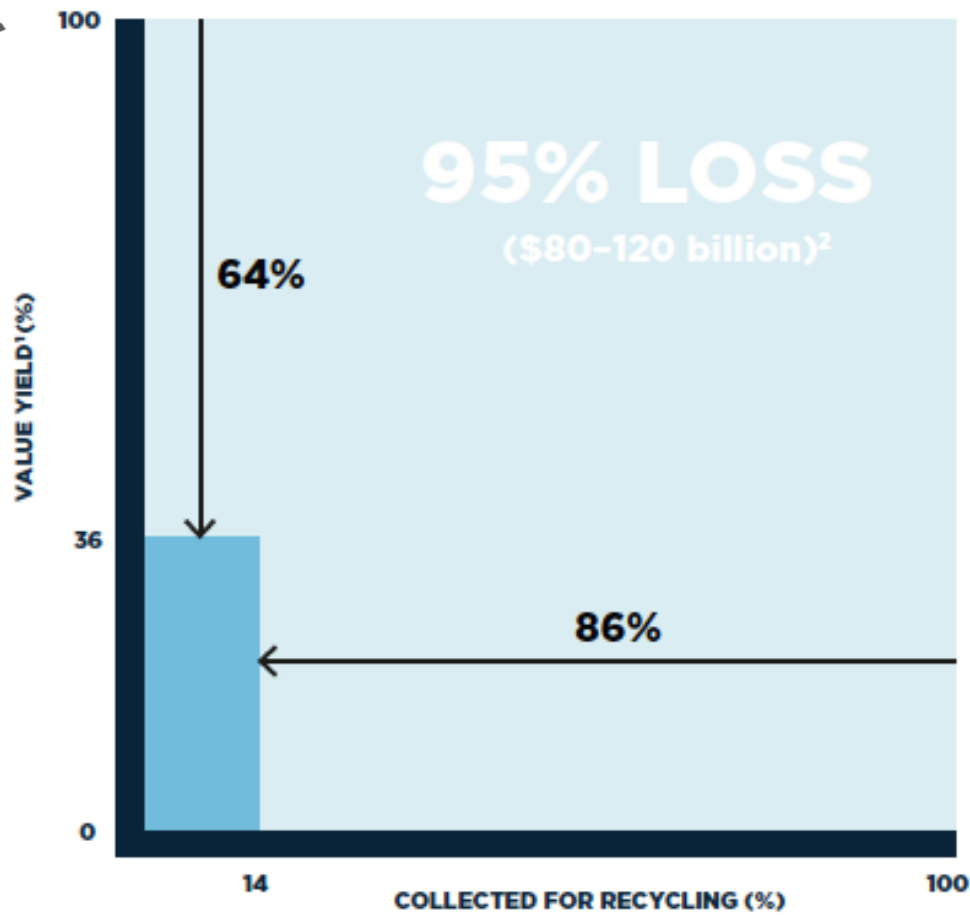
# GROWTH IN GLOBAL PLASTICS PRODUCTION 1950-2014

WORLD  
ECONOMIC  
FORUM



# PLASTIC MATERIAL VALUE LOSS AFTER ONE USE CYCLE

WORLD  
ECONOMIC  
FORUM



# FORECAST OF PLASTIC GROWTH EXTERNALITIES AND OIL CONSUMPTION

WORLD  
ECONOMIC  
FORUM

PLASTICS  
PRODUCTION

2014



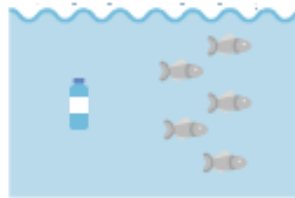
311 MT

2050

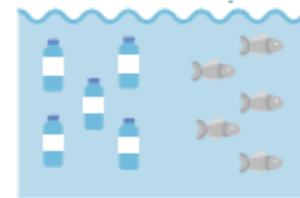


1,124 MT

RATIO OF PLASTICS TO  
FISH IN THE OCEAN¹  
(BY WEIGHT)



1:5



>1:1

PLASTICS' SHARE  
OF GLOBAL OIL  
CONSUMPTION²



6%



20%

PLASTICS' SHARE  
OF CARBON BUDGET³

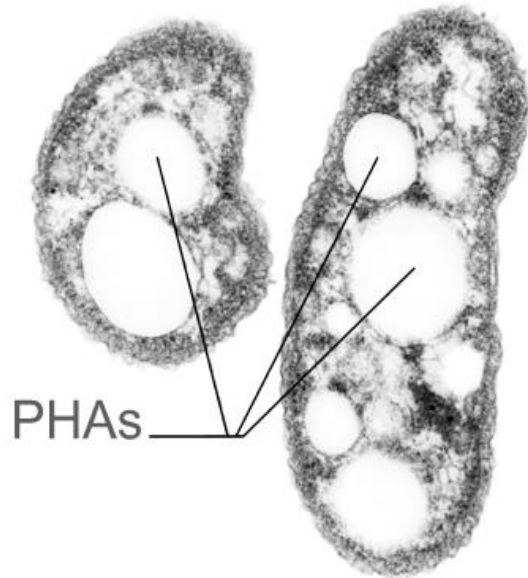


1%



15%

# WHAT IS PHAs (Polyhydroxyalkanoates)



**Plastic has existed for millions of years.**  
It is bacteria's way of storing energy.

Bacteria store it to ensure their survival,  
just as humans do with fat.

On eating carbon sources, the bacteria  
produce white spheres inside themselves:  
**this is natural polyester. This is how PHA,**  
**Polyhydroxyalkanoates, is made.**

**The only real alternative to oil!!**

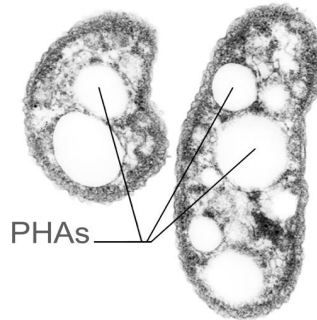


# PHAs: KEY FACTORS

We use agricultural  
by products materials.  
**NO FOOD preferred**

**bio-on**  
turn off pollution

We can  
also **replace**  
**costly plastics**



**GMO FREE**  
No genetic  
modification

**minerv**<sup>®</sup>

**PHAs is a platform product**  
from which many  
Bio-plastics  
can be made

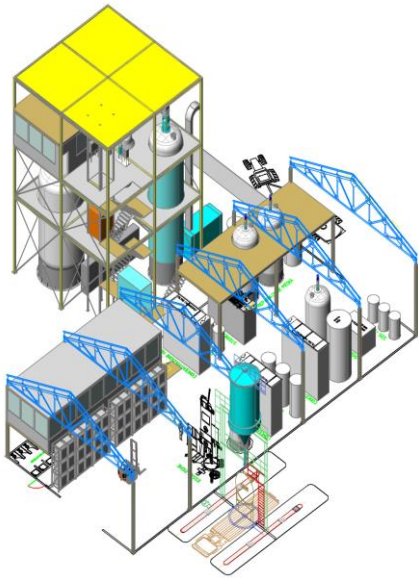
**ORGANIC SOLVENT  
FREE**

We do not use solvents  
to extract biopolymers

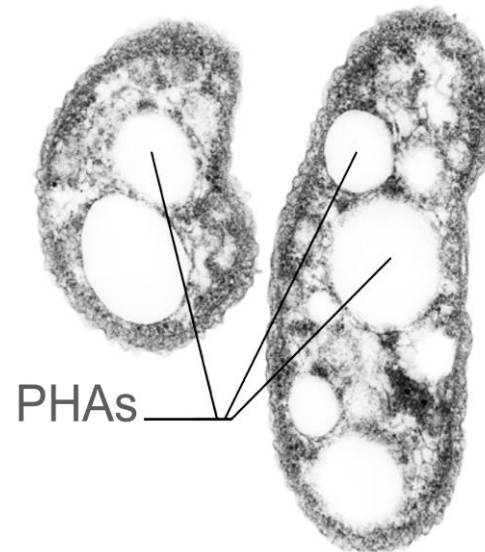
**100%  
BIODEGRADABLE**  
Our product is  
biodegradable in  
compost and water

# Bio-on IP business model: a winning and forward-looking idea

## 1. Plant Licenses



## 2. Technological Research

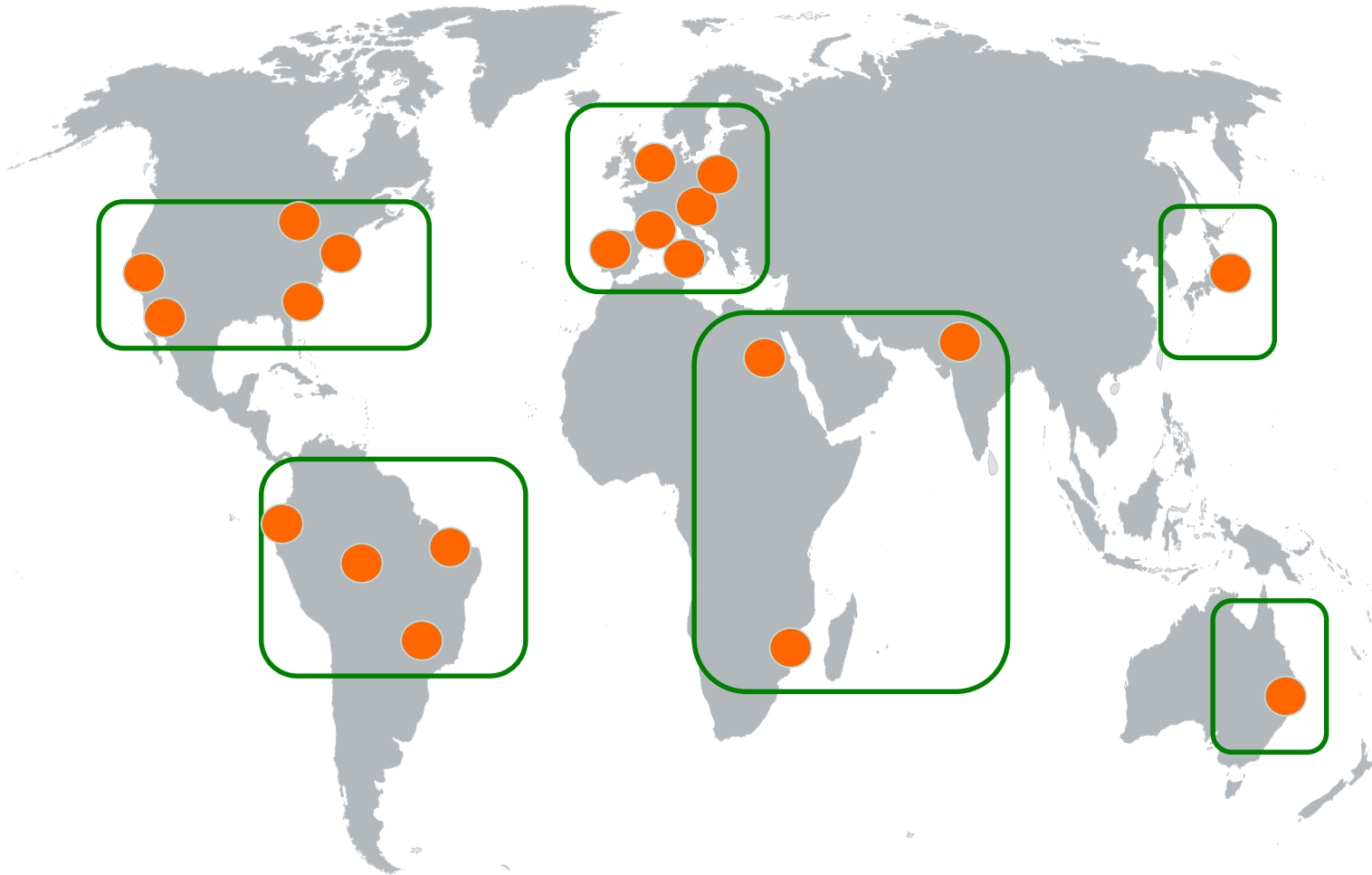


## 3. Innovative Products



# 1: Industrial Licenses

## Bio-on Expected Business Plan



**20+ licensed PHAs plant in the next four years**



# 2: Technological Research PHAs Scale-up Department

Bio-on has developed an exclusive process to produce PHAs from different carbon sources from agricultural and agro-industrial productions, such as by-products and wastes from sugar beet, sugar cane, potatoes, glycerol from biodiesel production and many other feedstock. It has an on-going investment in 4 laboratories. *Scientists and prestigious universities worldwide are involved through exclusive contracts.*



# 3: Innovative Products

## Material Development Department

Bio-on S.p.A., has created the world's first facility for developing and making MINERV PHAs bioplastics. It will be reserved to Bio-on technicians and managers and to the licensees of Bio-on technology, which make PHAs formulations to replace the majority of widely used plastics (PP, PE, PS, PC and many more).



# EU PHAs production / feedstock availability

Some example of feedstock Availability in EU


 **France:**  
Sugar Beet  
Potato & Glycerol

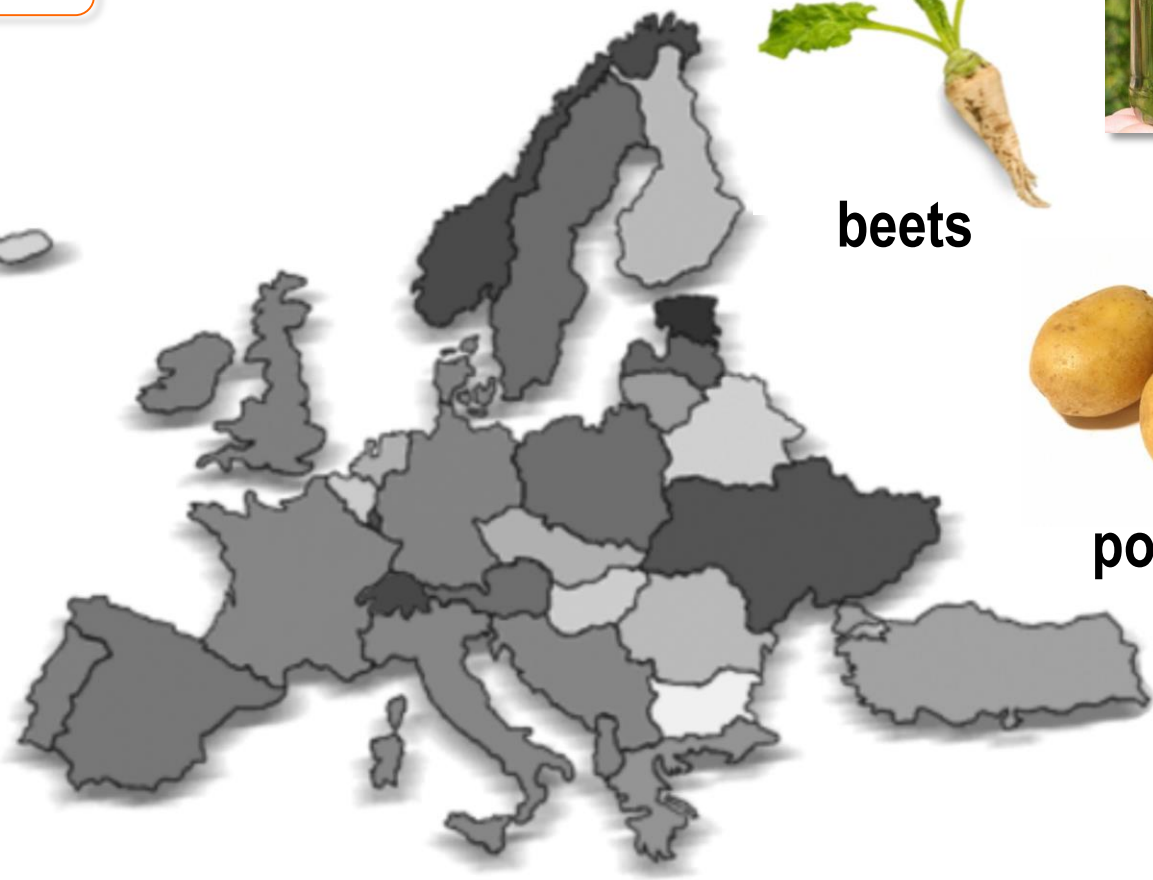
 **Germany:**  
Sugar Beet  
Potato & Glycerol

 **Italy:**  
Sugar Beet  
Potato & Glycerol

 **Belgium:**  
Sugar Beet  
Potato

 **Netherland:**  
Sugar Beet  
Potato

 **Poland:**  
Sugar Beet  
Potato & Glycerol



beets



glycerol



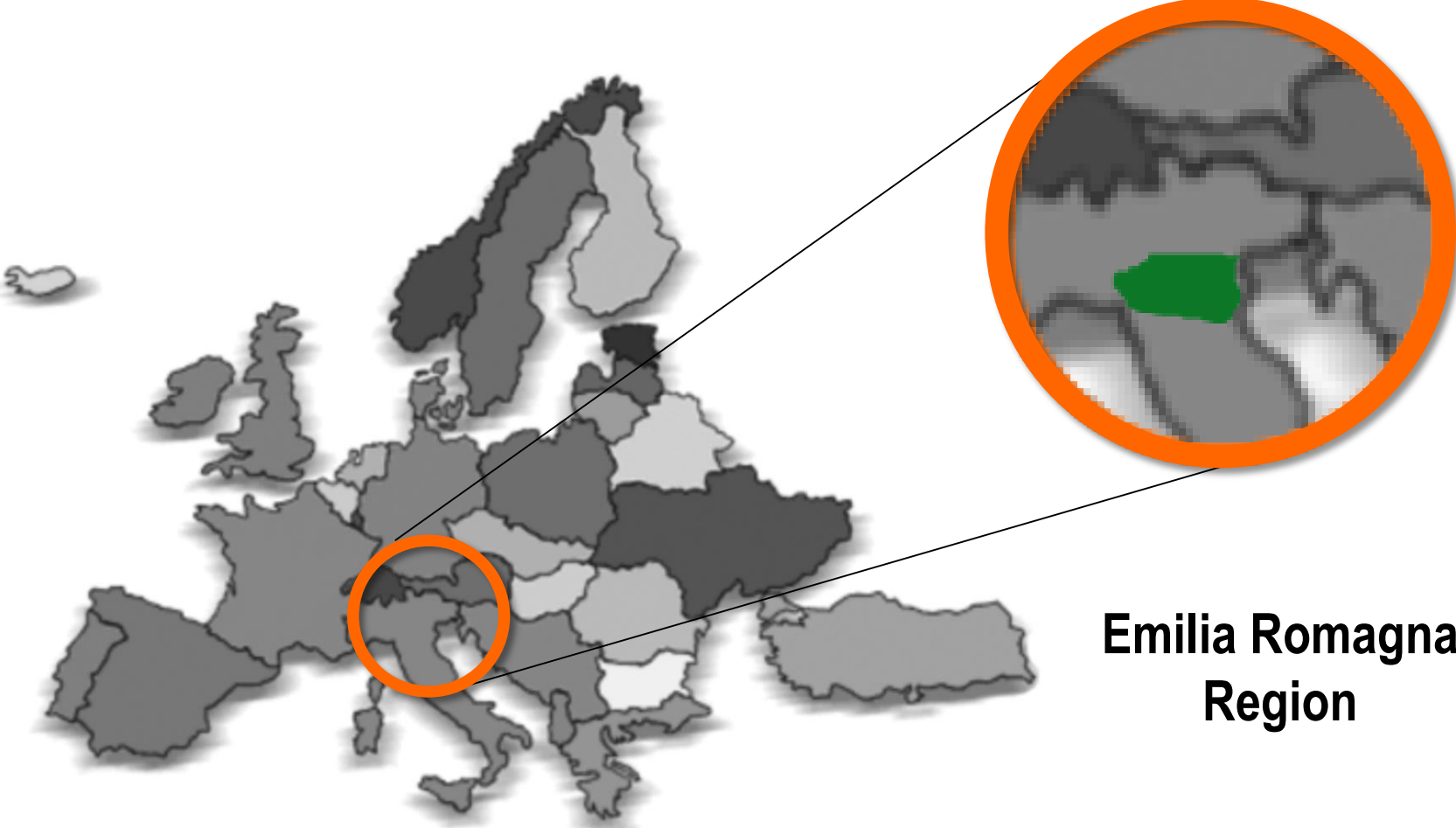
potatoes

... and many more.

Each EU country is self sufficient in term of feedstock availability



# EU PHAs production / feedstock availability



**Emilia Romagna  
Region**

**EXAMPLE:** In Italy, in our region, each year,  
20 mio tons of wastes carbon sources are available



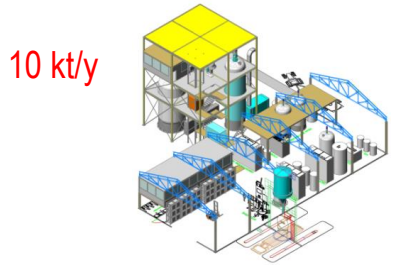
# EU PHAs production / feedstock availability

Some other examples (not comparable)



**Sugar chain**  
world wide

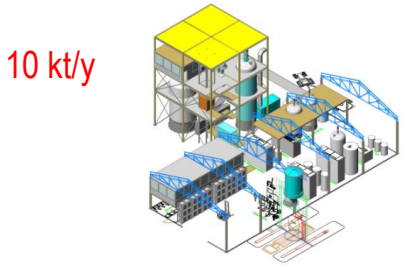
**180 mio tons Y**  
(plus by-products)



**5-6.000 plants**



**Emilia Romagna**  
Region

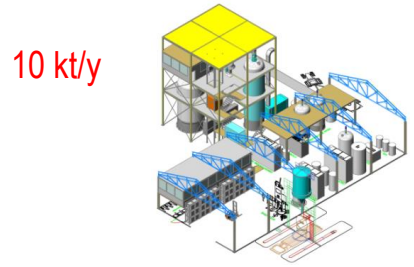


**50-60 plants**



**Potato production**  
Europe

**130 mio tons Y**



**500-600 plants**



# WHO USE PHAS

SHAMPOO



LIPSTICK



MAKE-UP

MACRO  
MOLECULES  
PHA-BM-BAS



GEL



CREAMS



SUN PROTECTION



# COSMETICS



minerv<sup>®</sup>  
bio  
cosmetics | natural  
beauty  
ingredients

COSMETICS

bio-on  
turn off pollution

# WHO USE PHAS

# PACKAGING

## Revolution in food packaging

## The milk carton goes bio



turn off pollution

**TAMPERE UNIVERSITY OF TECHNOLOGY**

PRESS RELEASE

Bio-on S.p.A.

**Revolution in food packaging. The milk carton goes bio**

Researchers at Bio-on and the University of Tampere (Finland) have created the first material to team paper and bioplastic designed for the food packaging of the future. It will also be the only biodegradable material

...near now, in which cartons for



turn off pollution

**TAMPERE UNIVERSITY OF TECHNOLOGY**

COMUNICATO STAMPA

Bio-on S.p.A.

**Rivoluzione nel packaging alimentare. Il cartone del latte diventa bio**

I ricercatori Bio-on e dell'Università di Tampere (Finlandia) hanno realizzato il primo materiale che unisce carta e bioplastica pensato per il packaging alimentare del futuro. Ed è l'unico biodegradabile

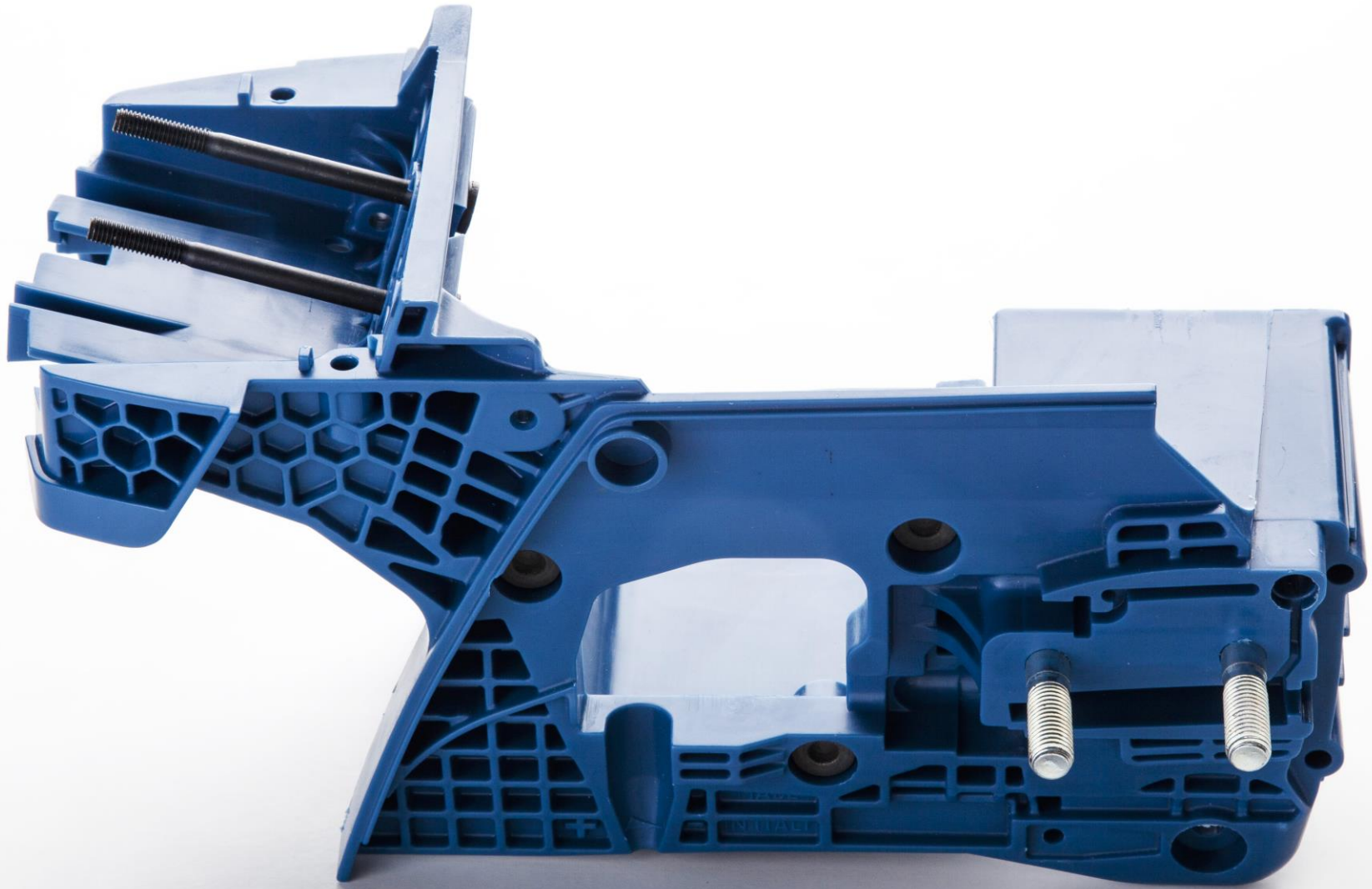
COMUNICA Italia - TAMPERE Finlandia, 14 aprile 2016 - Immaginate un futuro, molto vicino, in cui il cartone per altri alimenti, sarà biodegradabile al 100%. Bio-on annuncia oggi un

...University of Technology Finlandia,



WHO USE PHAS

Metal Replacement **AUTOMOTIVE**





**WHO USE PHAs**

**ELETRONICS**



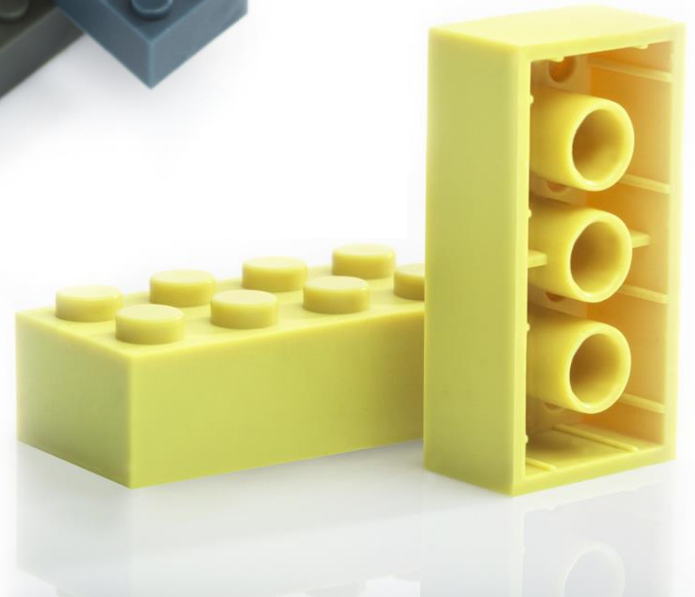
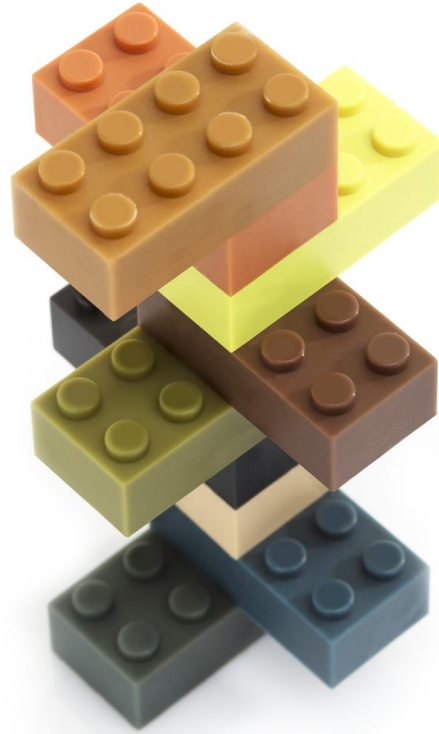
**WHO USE PHAs**

**ELETRONICS**



WHO USE PHAs

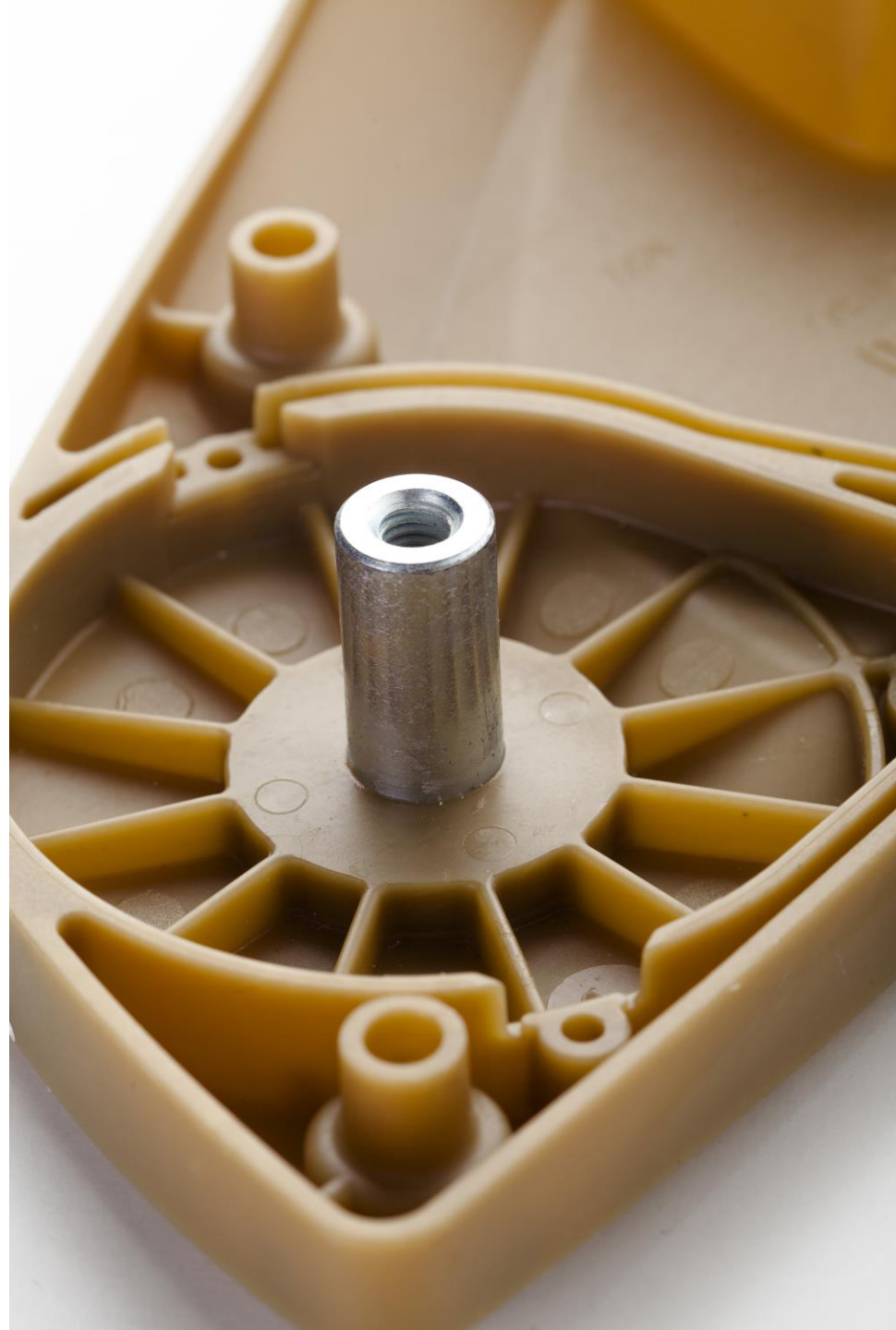
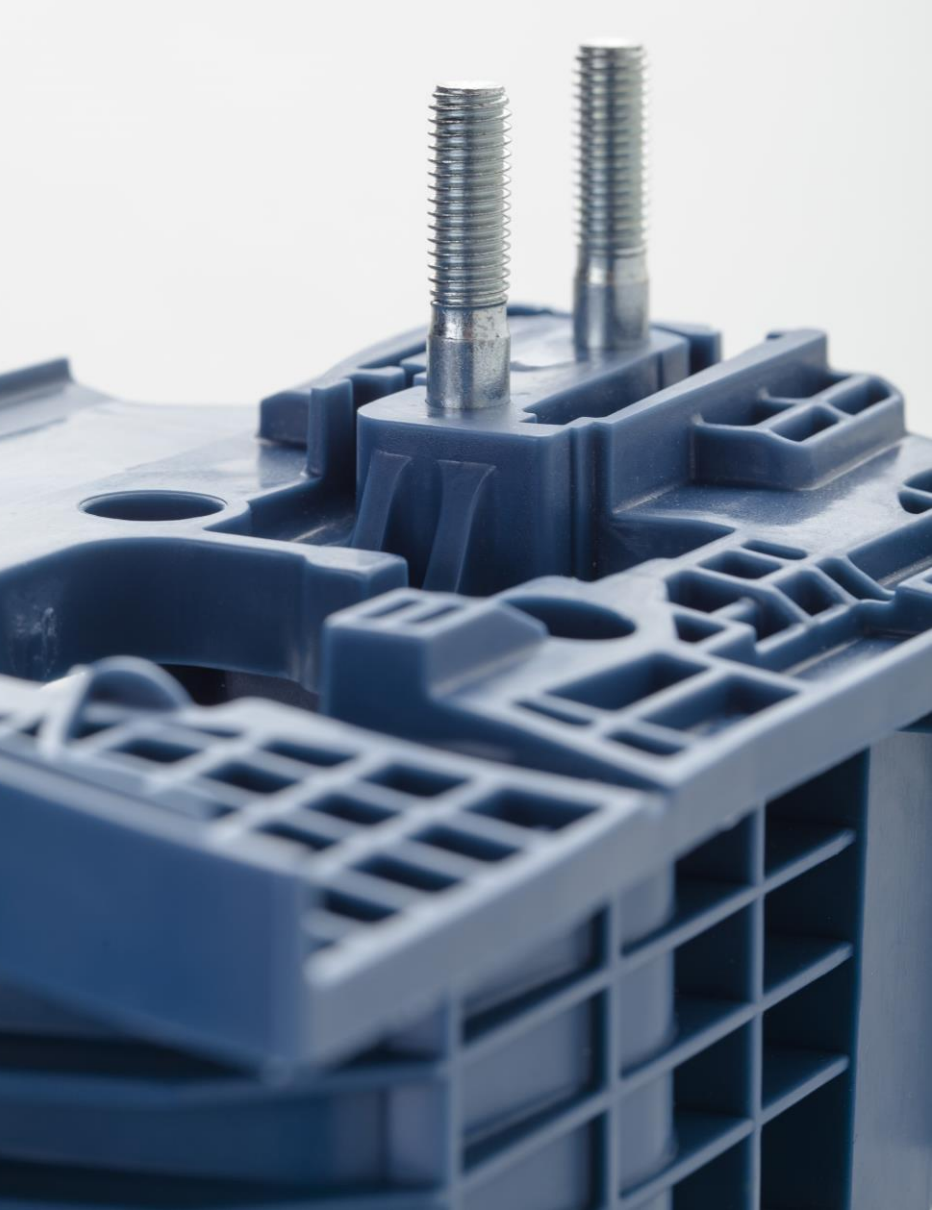
TOYS

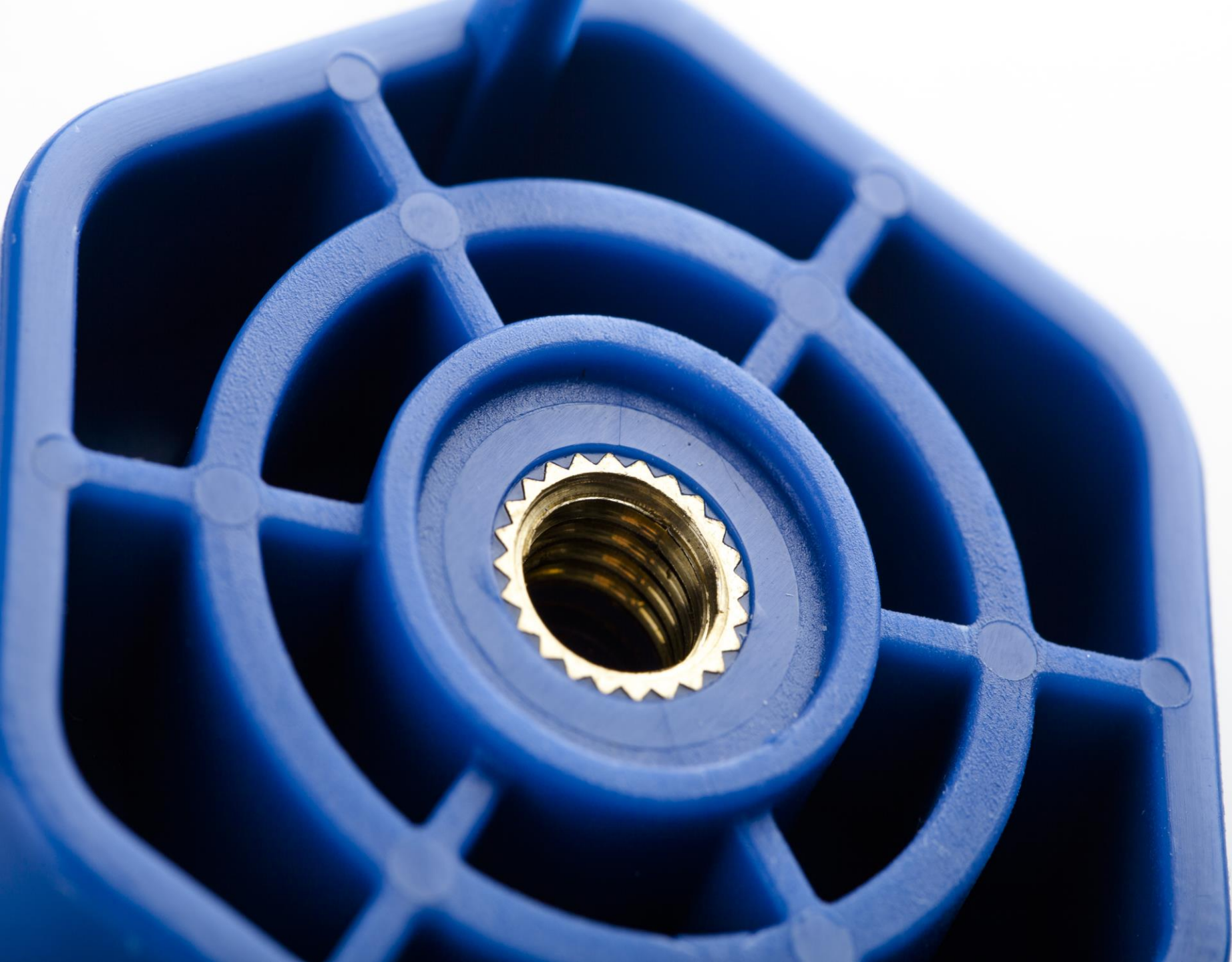














# Bio-on: certifications and awards



MinervPHA™ (BIO-ON) certified for its 100% biodegradability (not forced) in water by Vincotte.

Year 2008



MinervPHA™ (BIO-ON) is certified as 100% Bio-Based by the U.S. Department of Agriculture - USDA.

Year 2014



Special mention to BIO-ON by the Innovazione amica dell'Ambiente Prize .

Year 2013



MinervPHA™ (BIO-ON) selected among the 100 solutions from around the world tangible, readily available and with a positive impact on communities and industries by SUSTAINIA100.

Year 2014



BIO-ON announced as winner of EuropaBio's Most Innovative Biotech SME Award 2014 for designing and patenting the first fully bio-based plastic PHAs obtained from agricultural waste, co- and by-products

Year 2014



Special mention to Bio-on by the Impresa Ambiente Prize.

Year 2014



MinervPHA™ selected among the 100 innovations to be presented at the Global Forum for Innovations in Agriculture in Abu Dhabi.

Year 2015



MinervPHA™ (BIO-ON) certified by the prestigious Certificate of Material Excellence issued by Material ConeXion.

Year 2015

Year 2015



# Pizzoli S.p.A.

- Pizzoli is an Italian potato processing Company
- Established in 1926, located in Bologna (Italy)
- Pizzoli produces Fresh Table Potatoes and Frozen French Fries



# POTATOES BY-PRODUCTS

**In fields:** some potatoes (est 2-4%) remain on the fields after mechanical harvesting operations



# POTATOES BY-PRODUCTS

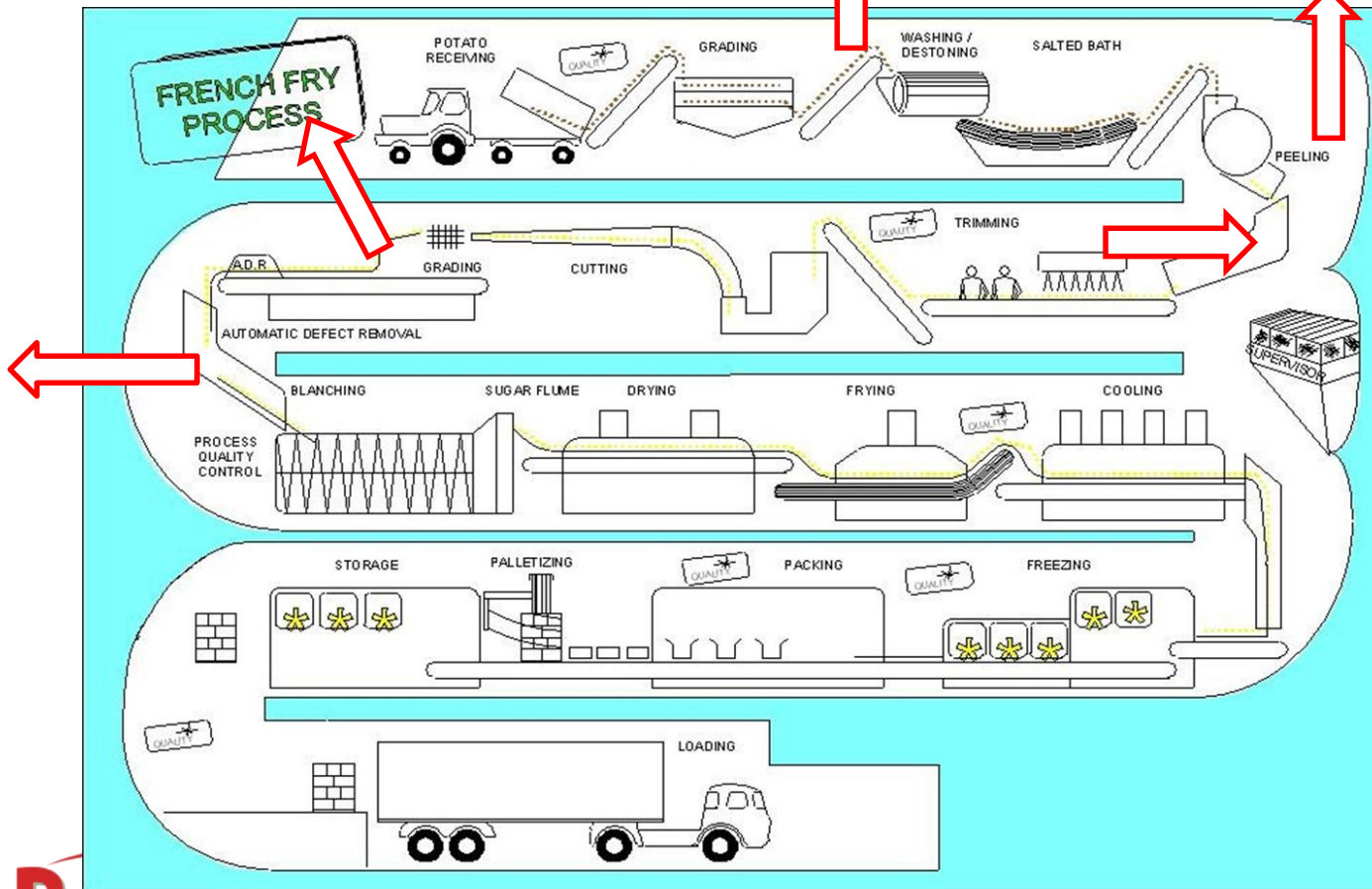
**Fresh Product:** automatic sorting generate a total 15% to 20% not conform product to be packed (rotten, green, misshaped, small/big grade)



# POTATOES BY-PRODUCTS

waste = 10÷16%

- **Frozen Fries:**



# POTATOES BY-PRODUCTS

**Frozen Fries:** peeling operation generate 6-10% of waste. Sorting of fries, generate further 4 to 6% of by-products from processing (small parts, defects etc)



# PIZZOLI BY-PRODUCTS VALORISATION

- **Current usage of WASTES (peel, rotten potatoes):**
  - Energy production (Biomass digester) and fertilizers
  - Animal feed
- **Current usage of by-products:**
  - Potato flake
  - Mashed potato

## NEW PHA PROJECT

**Project in collaboration with Bio-on:**

**an integrated industrial plant which turns and valorize potato wastes and by-products into new-generation bio-based and biodegradable plastics: PHAs**



# CARBON SOURCES = RAW MATERIALS

**ALL**



**CRISP/FRIES**



**TABLE**



**FRIES**

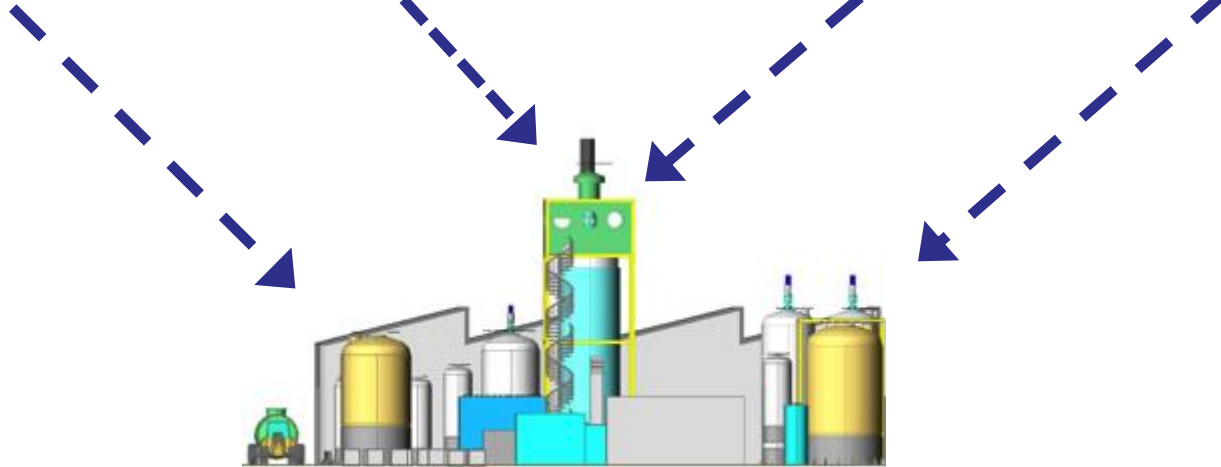


**Harvest left**

**Potato peel**

**Misshaped, rotten**

**slivers**



**Bio-on PHAs production plants**



# CONTACTS

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Thanks for your attention

