Plastic waste: between addiction, threat and miracle solutions, a range of complementary knowledge-based actions are emerging

1950 – Today- 2050

Nathalie GONTARD DR INRA

10e édition des rendez-vous de l'emballage de l'ITEGA- Montréal, Avril 2019

1950 - Today

Nathalie GONTARD
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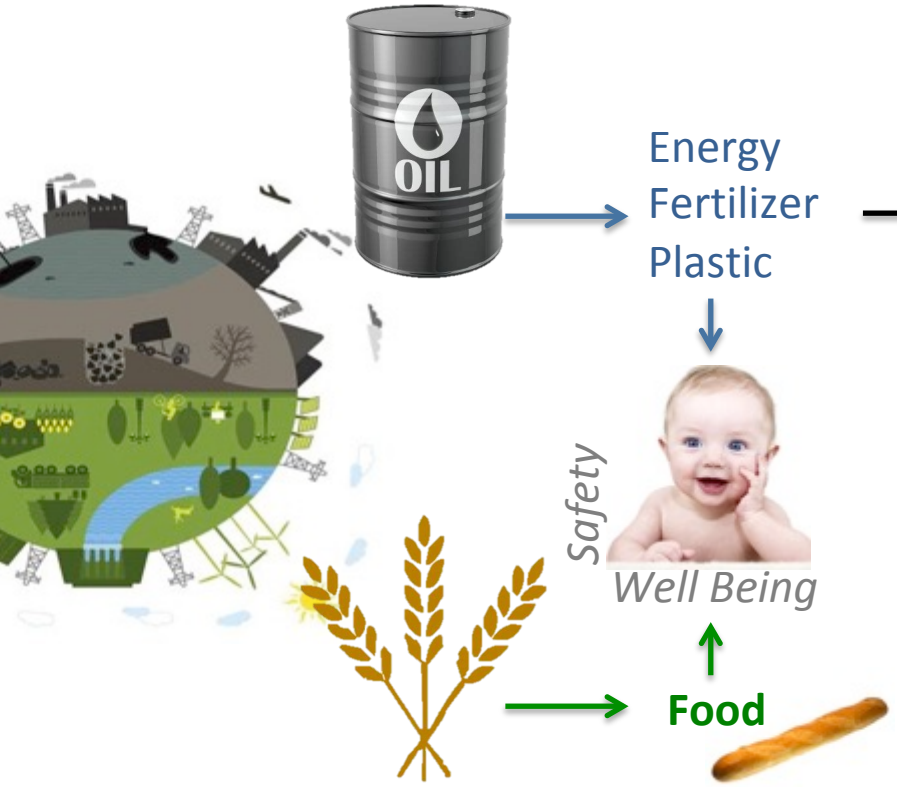
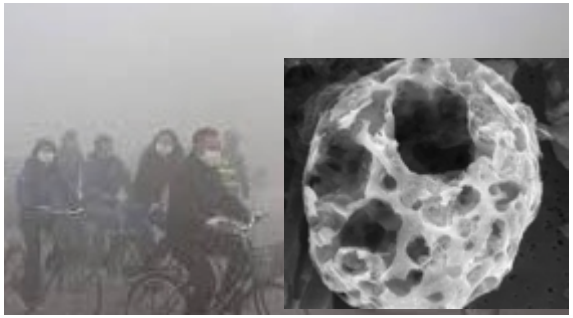


Emission + accumulation

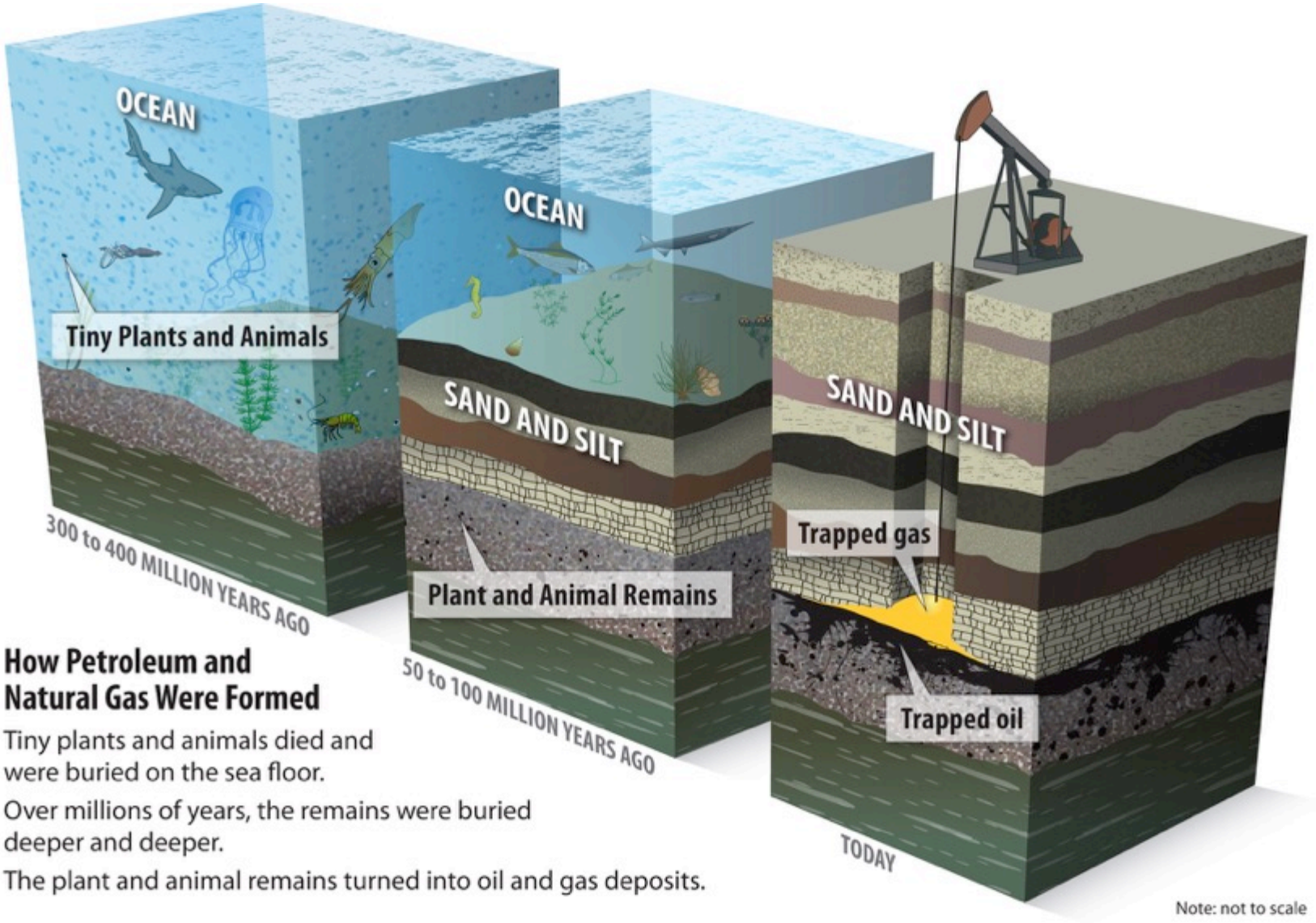
Global warming
GHG

Major contamination
Fine Particles

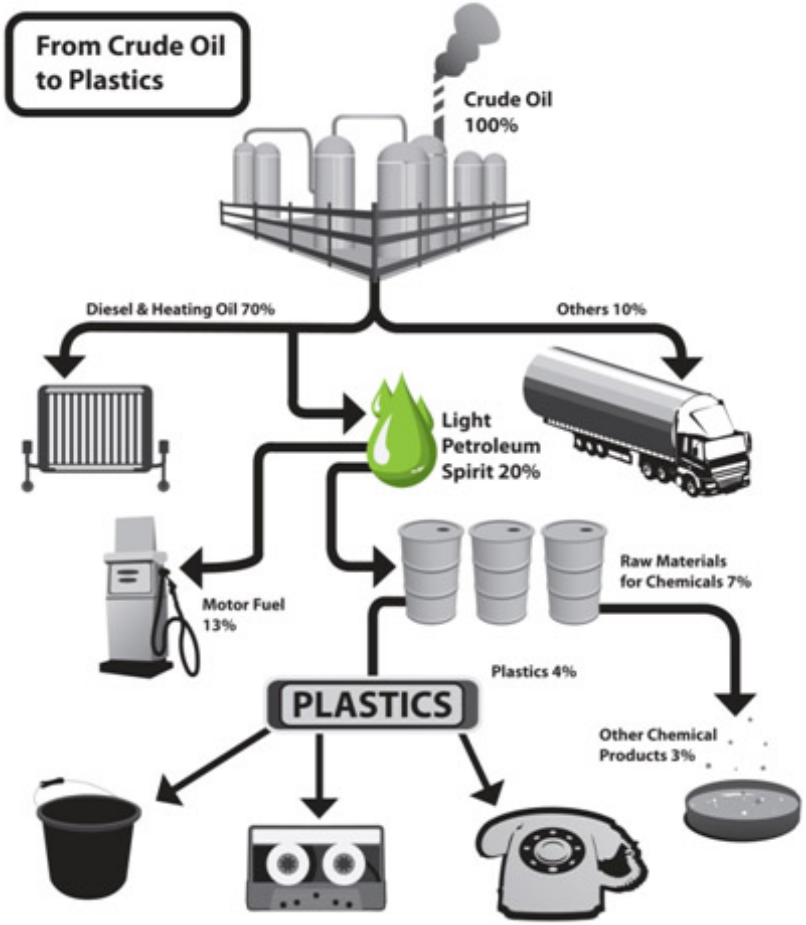


"What is the use of a fine house if you haven't got a tolerable planet to put it on." Thoreau (1817-1862)

Petrochemical plastic



Plastic production



Key plastics dates

1953 PE and PP synthesized in Germany and Italy

1963 Nobel prize for catalyzers of plastic polymerization

1977 PET enters the market

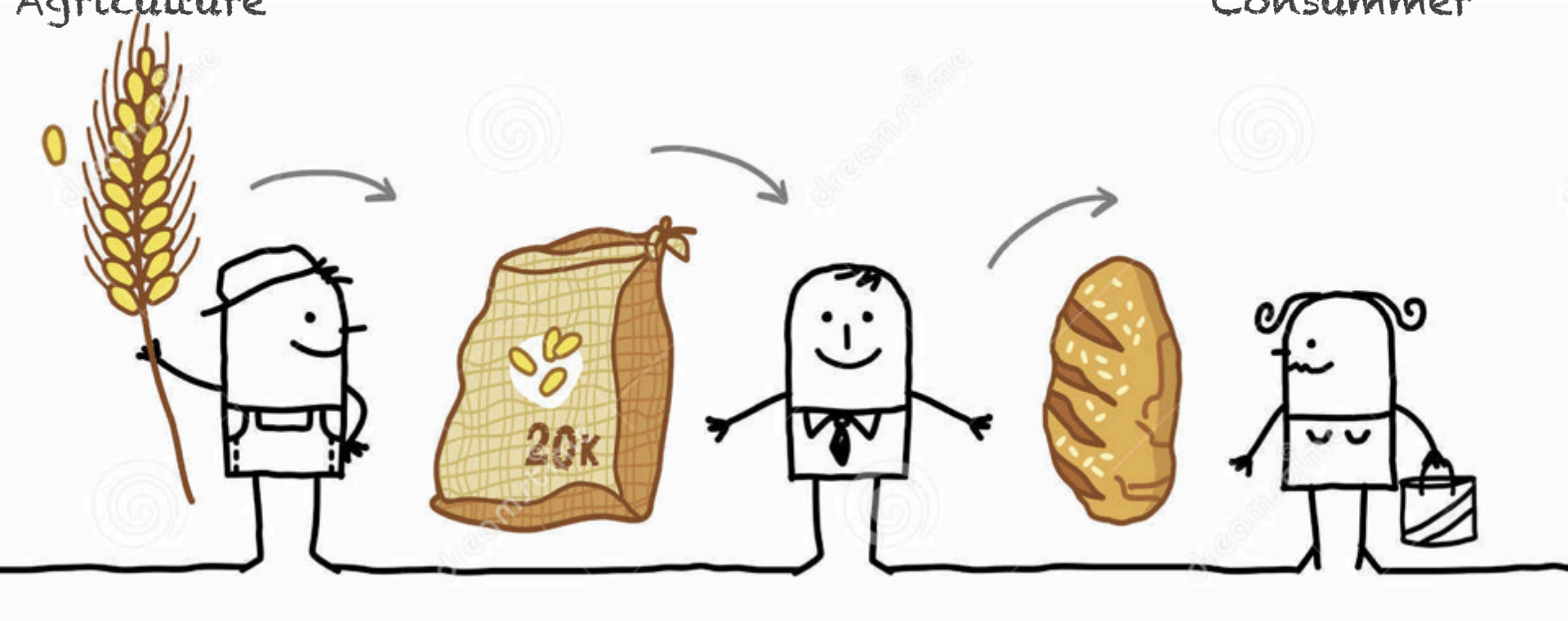
Plastics

become key actors of food consumption

Processing, storage, transport, marketing, consumption..

Agriculture

Consummer



Plastics

are replacing vegetal leaves

as food packaging

in Africa, South America & Asia

Vegetal leaves are active, intelligent, bio-sourced and biodegradable

Plastics

1950-2015

7800 Mt. total resins & fibers manufactured (3900 in the last 13 years)
6300 Mt plastic waste (12% incinerated , 9%recycled / 1% recycled › once)
4900 Mt (60% of plastics produced) in landfills and environment.

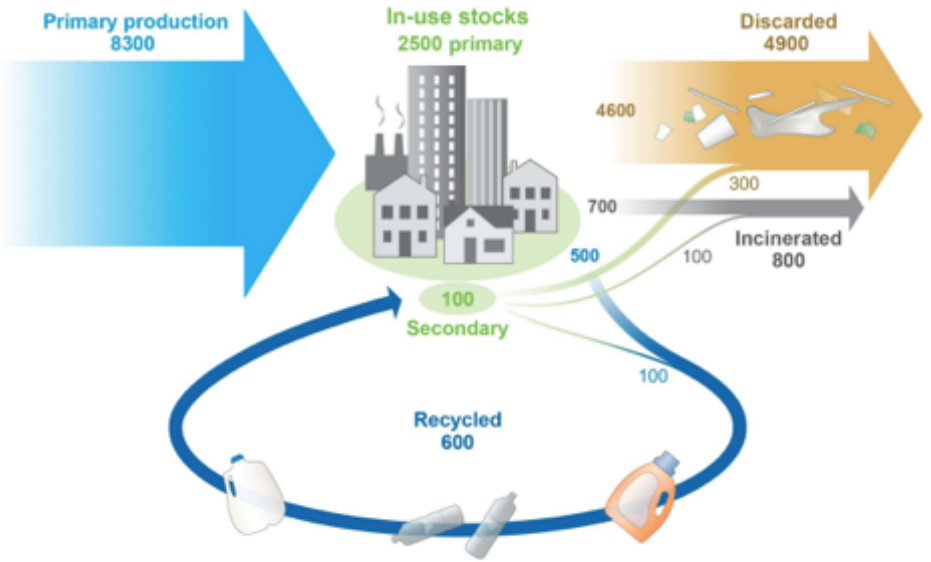


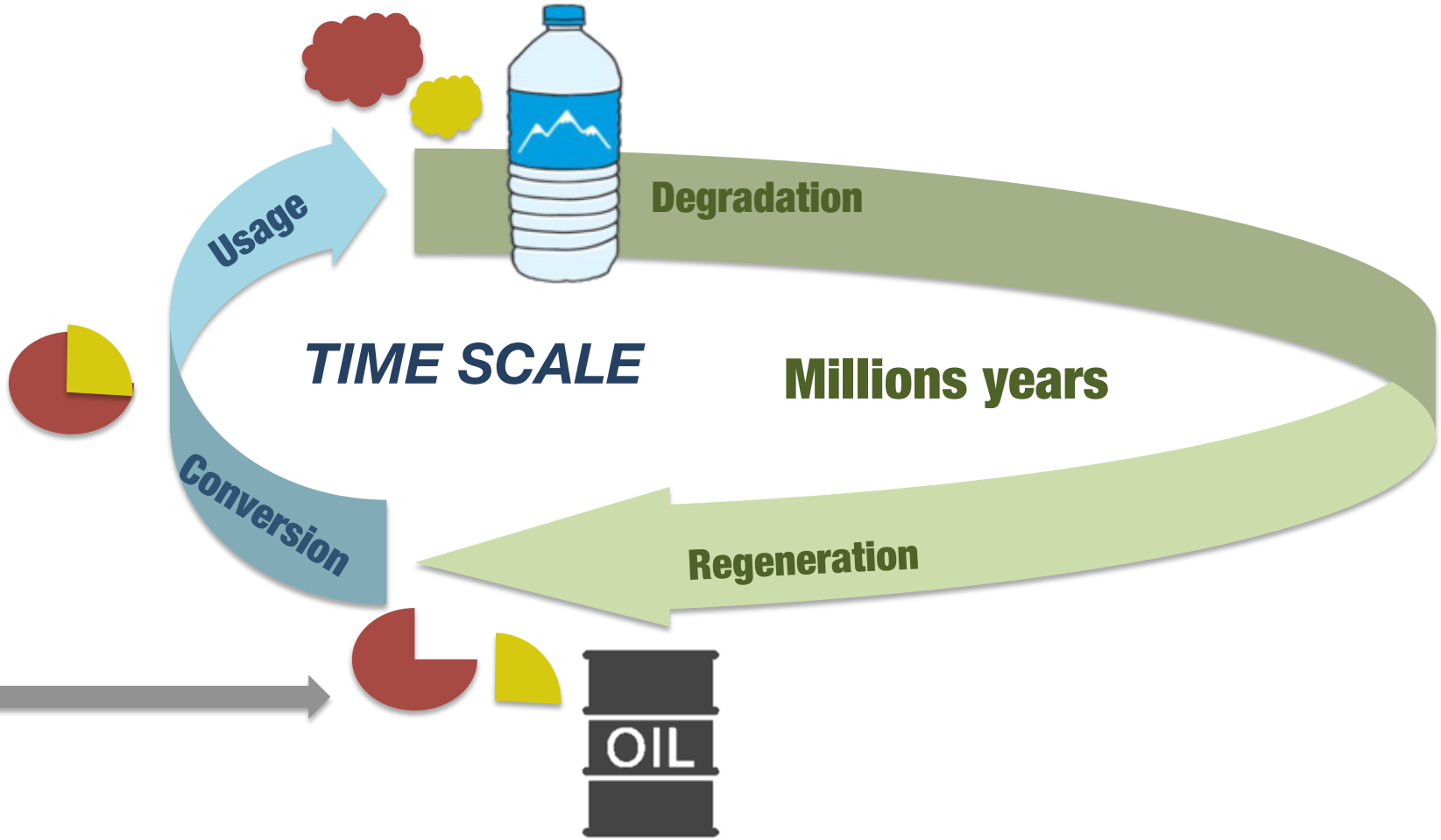
Fig. 2. Global production, use, and fate of polymer resins, synthetic fibers, and additives (1950 to 2015; in million metric tons).

Today

- 60 kg plastic/pers/year in average (›100 kg plastic/pers/year in the richest countries
- 50 years old: you have produced 3 tons of plastic waste that will last 2 or 3 times longer than you, heritage to your children, grand children and beyond
- 15 tons of plastics waste is available for you only in your environment whether you would be able to recycle

Plastic = linear system

Resources regeneration time >>> human consumption time scale = accumulation



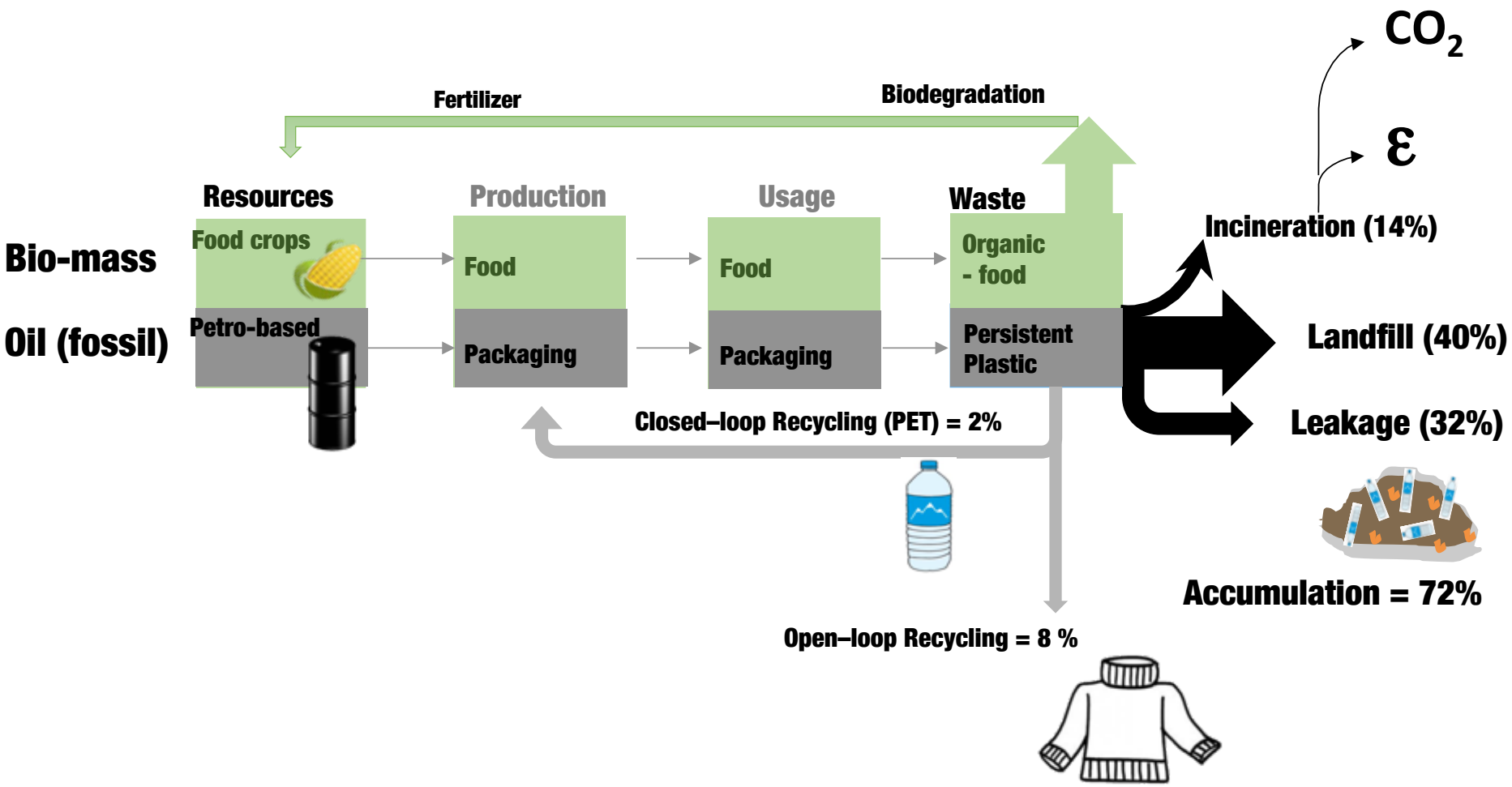
INPUTS
Raw materials

Food (40%) and agriculture (5%) represent the largest plastic consumption sector and >75% of uncollectable and dispersed plastic in our environment

Ishigaki Island, Hokinawa, Japan, march 2018.

Where we are now - Today

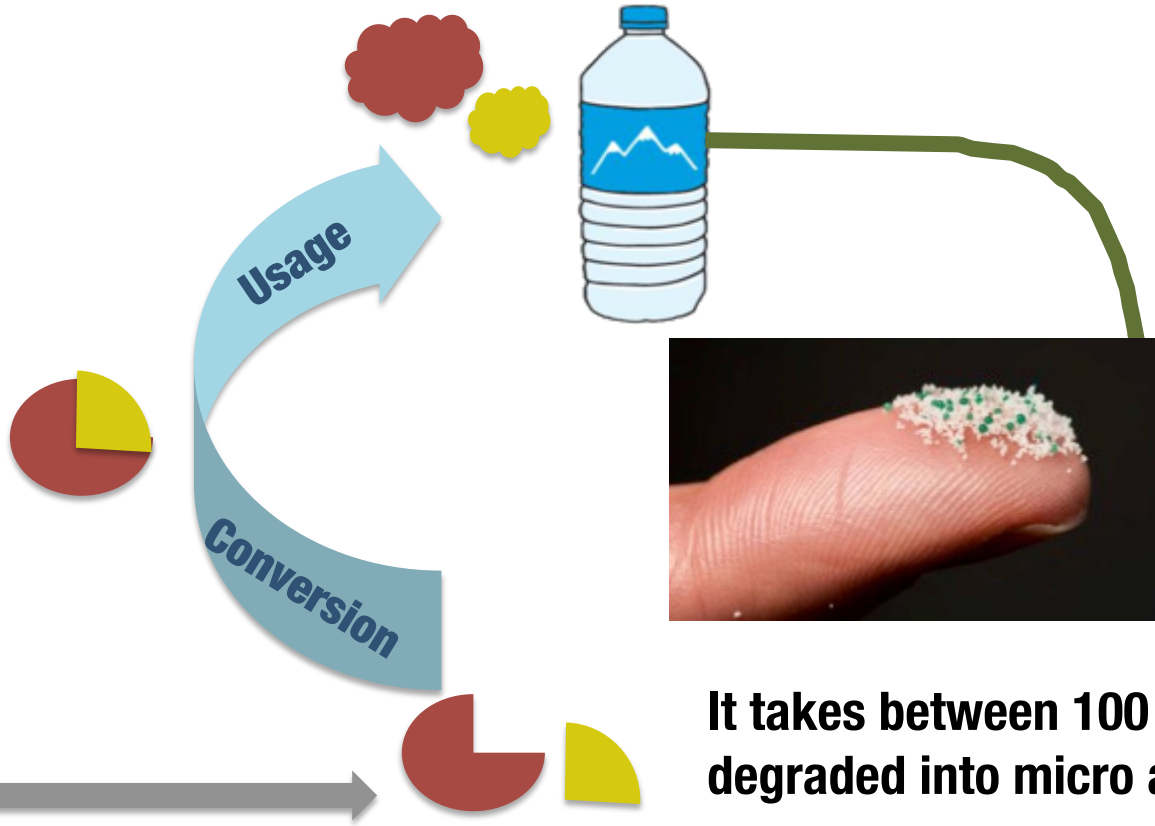
Environmental accumulation of persistent oil-sourced wastes



Global flow of food & packaging

Plastic = linear system

Resources regeneration time >>>>>> human consumption time scale = accumulation



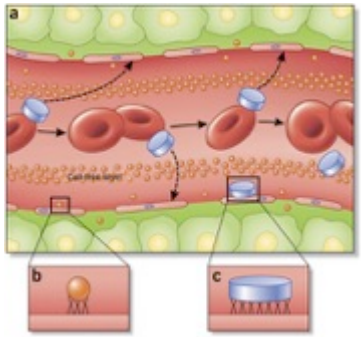
INPUTS
Raw materials

Plastic degradation & diffusion

It takes between 100 and 200 years to be degraded into micro and nano-particles

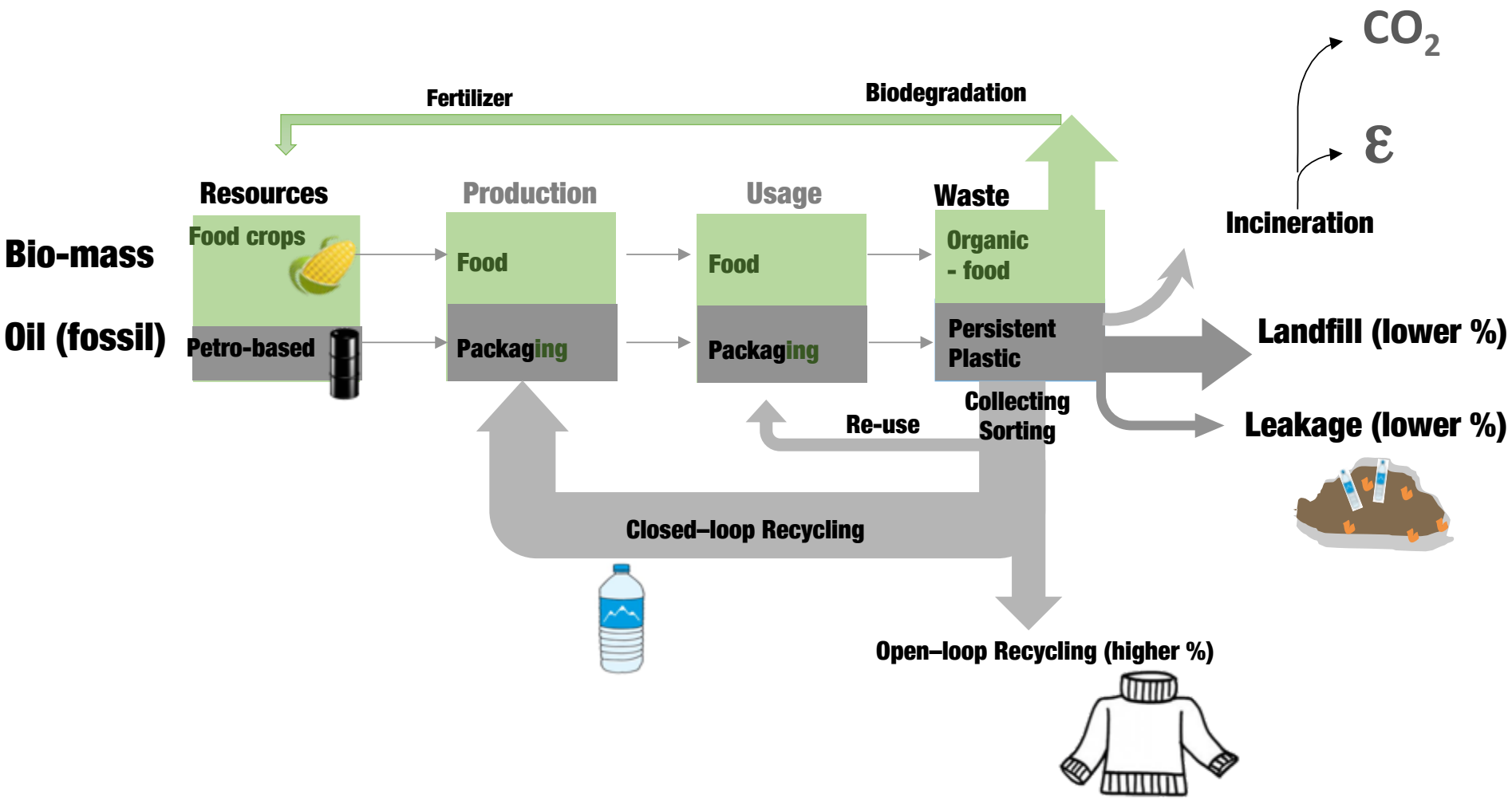
Plastic micro-particules were detected in tap water, honey, seafood & many foods

Nano-particles have the ability to cross organs barriers, accumulate and lead to dysfunctions.



Where we are planning to go - 2030

Recycling and bio-sourced efforts



Global flow of food & packaging

Earthbound Farm. ORGANIC

Food to live by.

Post-consumer recycled PET lifecycle

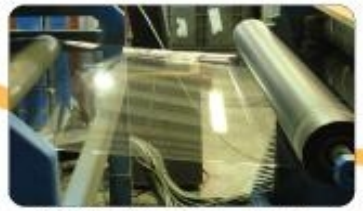
PET retail package

Post-consumer-use retail package

Post-consumer PET plastic stays out of landfill, gets recycled

Post-consumer recycled (PCR) PET crushed and sent to reprocessor

PCR PET ground into flake and washed



PCR PET flake extruded into film

PCR PET film thermoformed into clamshell

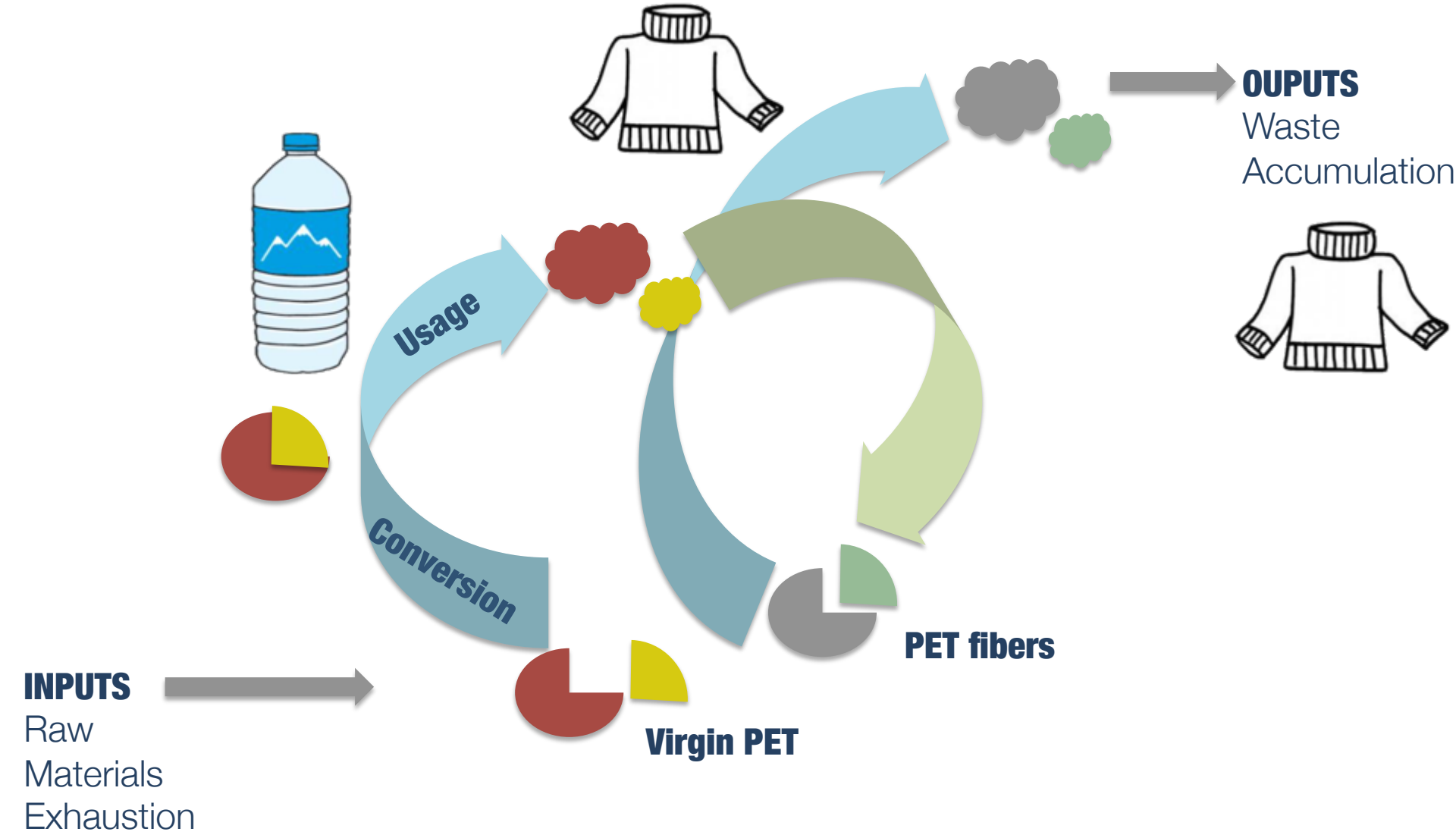
PCR PET retail package

PCR PET package recycled again

What about recycling? 12% open loop recycling

Process to produce another good that is not recyclable anymore = **down cycling**

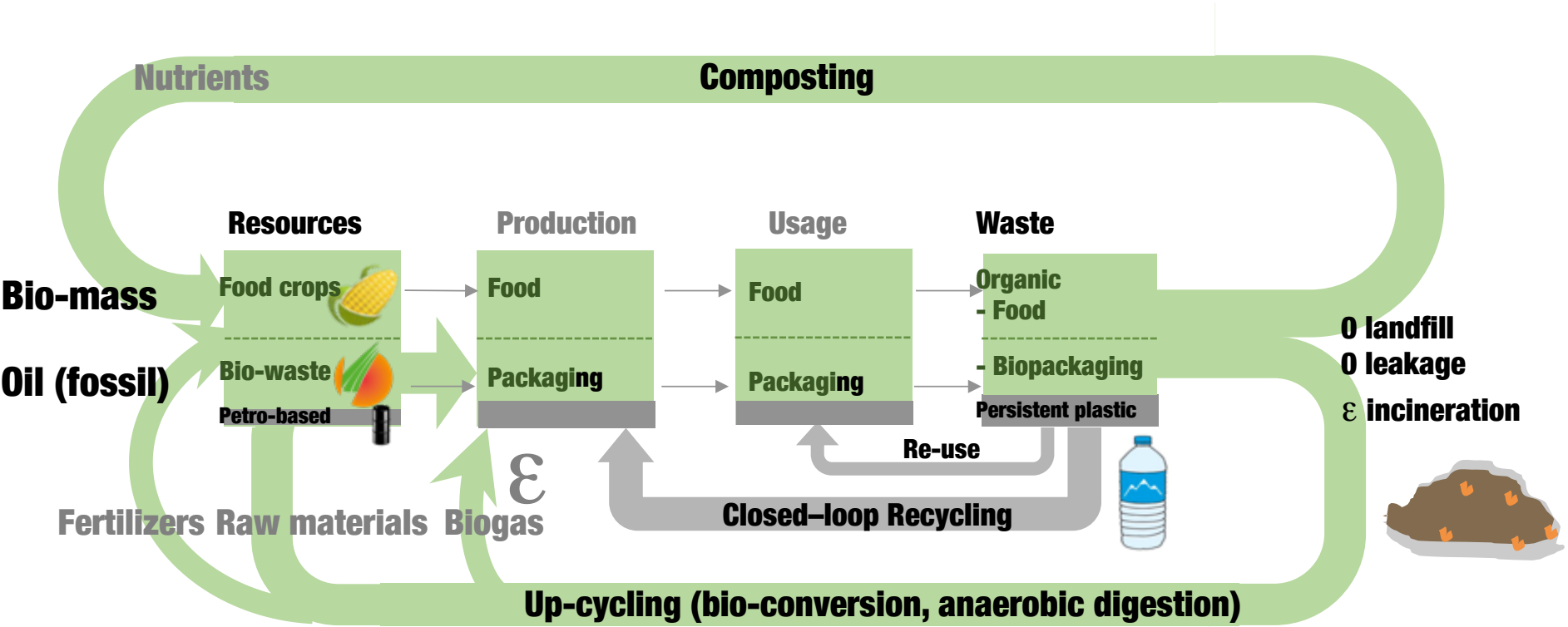
delayed waste accumulation



2050

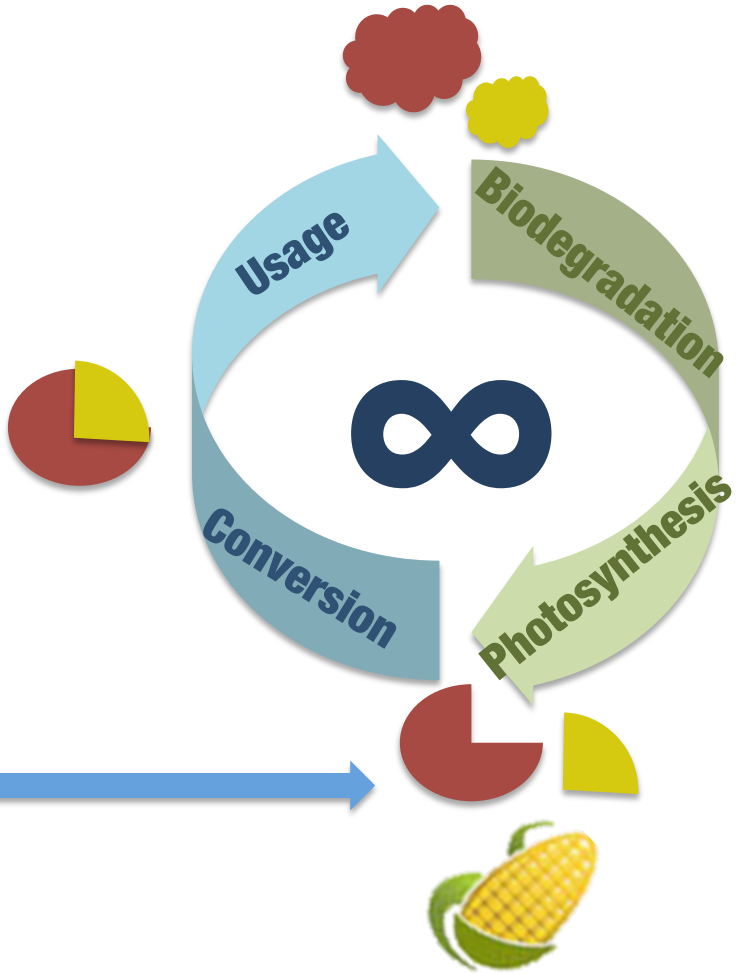
Where we need to go - 2050

Bio-waste up-cycling efforts toward a circular bio-economy



Global flow of food & packaging

Closed loop system : rapid enough regeneration for an unlimited number of times



Theoretically **Bio-Economy** is circular as all biological resources can be regenerated endlessly

Unless consumption rate > regeneration time

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Energy
Fertilizer
Plastic

Emission + accumulation

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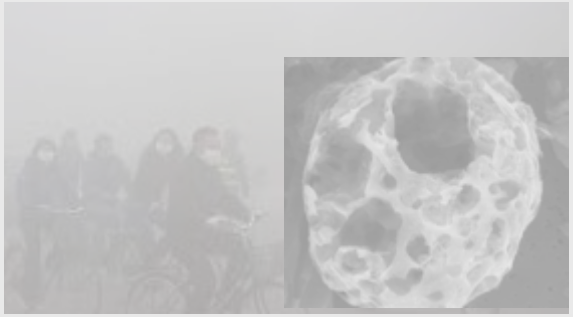

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Safety

Well Being

Food

Residues
50% by weight

PHA is bio^3
Bio-sourcé NA
Bio-produit
Bio-dégradable

PHA
Bio-residues refinery
Agricultural & urban
Bio-energy & fertilizers

Photosynthesis

Biodegradation

INRA coordinates, and participates to, European initiatives around PHA

HORIZON 2020
LE PROGRAMME DE RECHERCHE ET D'INNOVATION DE L'UNION EUROPÉENNE

BIO-BASED INDUSTRIES
Public-Private Partnership

SEVENTH FRAMEWORK PROGRAMME

2025

2020

2015

2010

2005

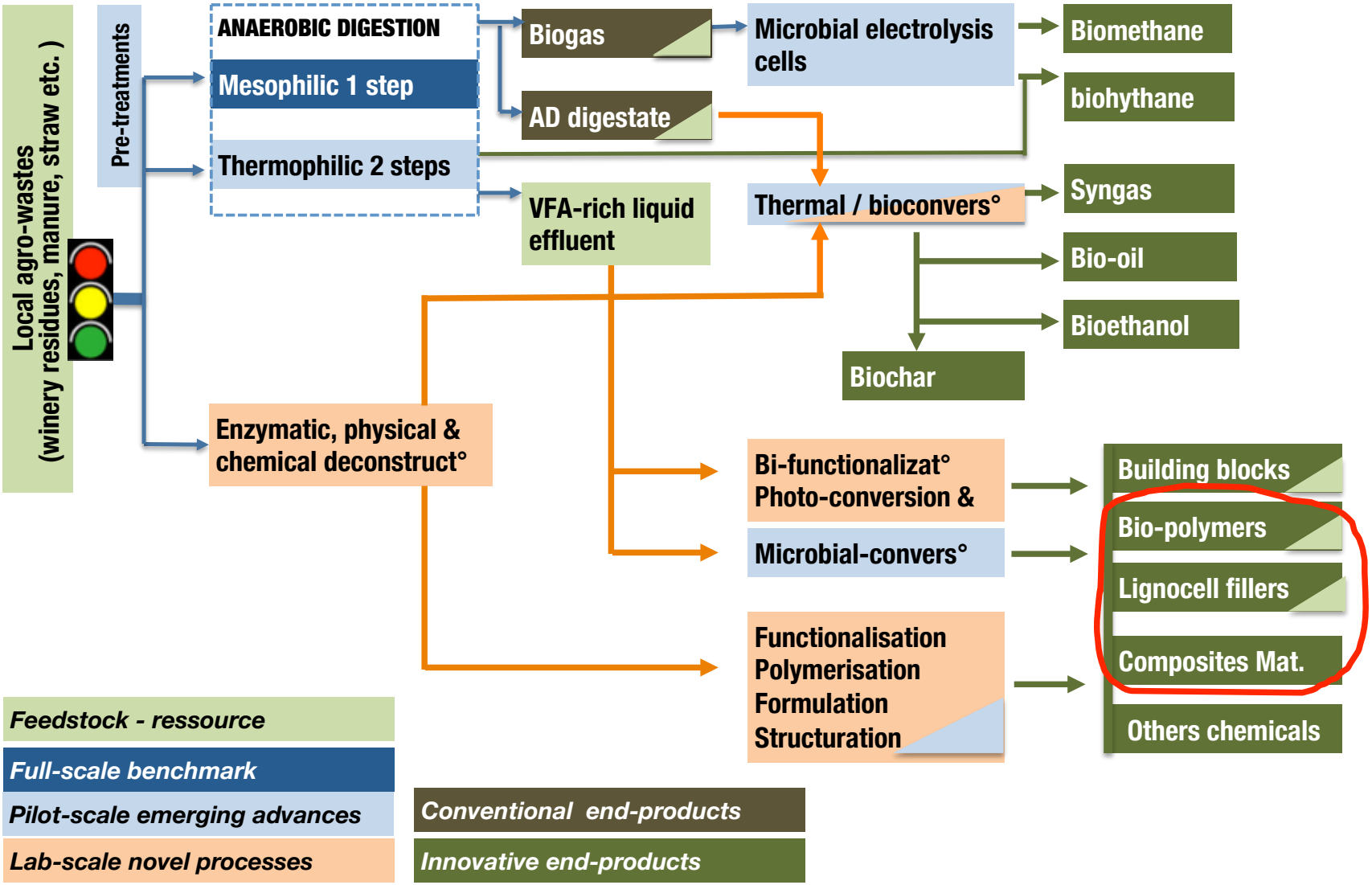
NCAW

RE URBIO

GLOPACK

ECOBIOCAP

Euro-Chinese NoAW H2020 :
agricultural residue refinery centred around AD and PHA production



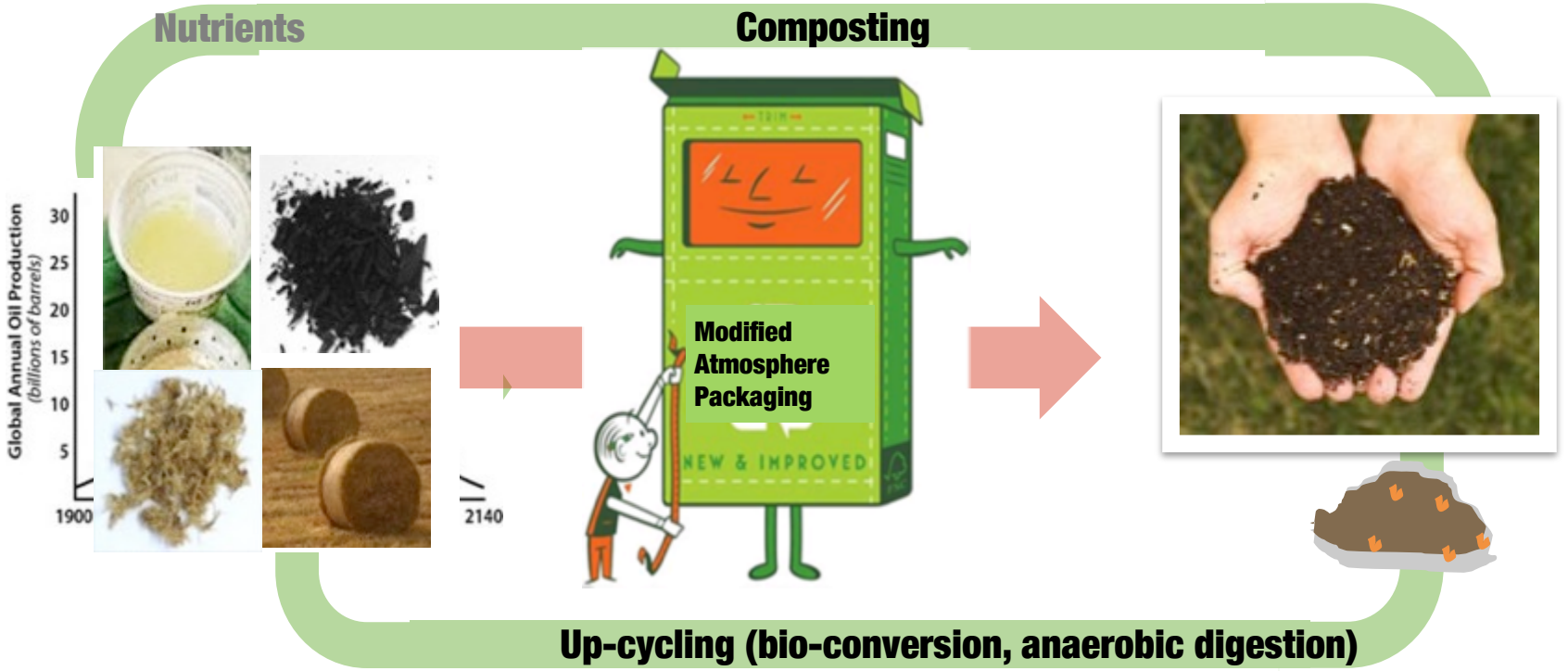
PHA production from urban organic waste

= Towards integrated processes

urban biowaste becomes bioplastic

mauro.majone@uniroma1.it

Web site: www.resurbis.eu



Non food renewable resources

Tailored properties

Naturally biodegradable

The Next Generation of plastic substitute is an eco-efficient safe material for

- its source
- its usage benefit & safety
- its end of life

GLOPACK

The packaging sustainability indicator

Raw material origin

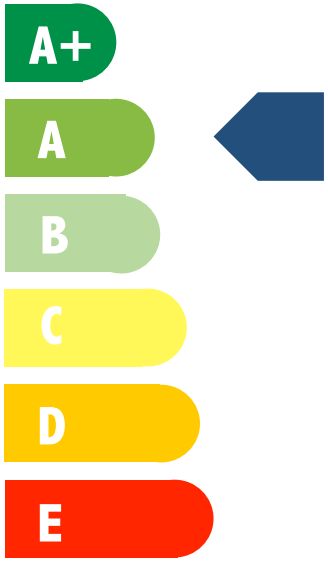
B

Food losses reduction

A+

Material end of life

B



Thank you for your attention