#biorefineryAINIA

Jornada Técnica Internacional

Biorrefinería de residuos

Paterna, 14 Junio 2018

Bioetileno, bioplásticos y biofertilizantes a partir de la fracción orgánica de residuos municipales

Caterina Coll, IMECAL

ainia centro tecnológico

Patrocinadores:

DAM Depuración de Aguas del Mediterráneo

innovarum

TETma

IMECAL | perseo bioethanol

bionet ENGINEERING

facsa ciclo integral del agua

Biomasa Peninsular

urbaser

CLaMber IRIAF Castilla-La Mancha

BIOWAYS

INDUSTRIAS MECÁNICAS ALCUDIA S.A.

- Metal mechanical company founded in 1979.
- Located in L´Alcúdia (Valencia – Spain)
- High technological capacity. Experience in petrochemical and refinery sectors.
- 25.000 m2 of facilities. 180 employees.

244 Mt MSW generated in Europe (Eurostat – 2016)

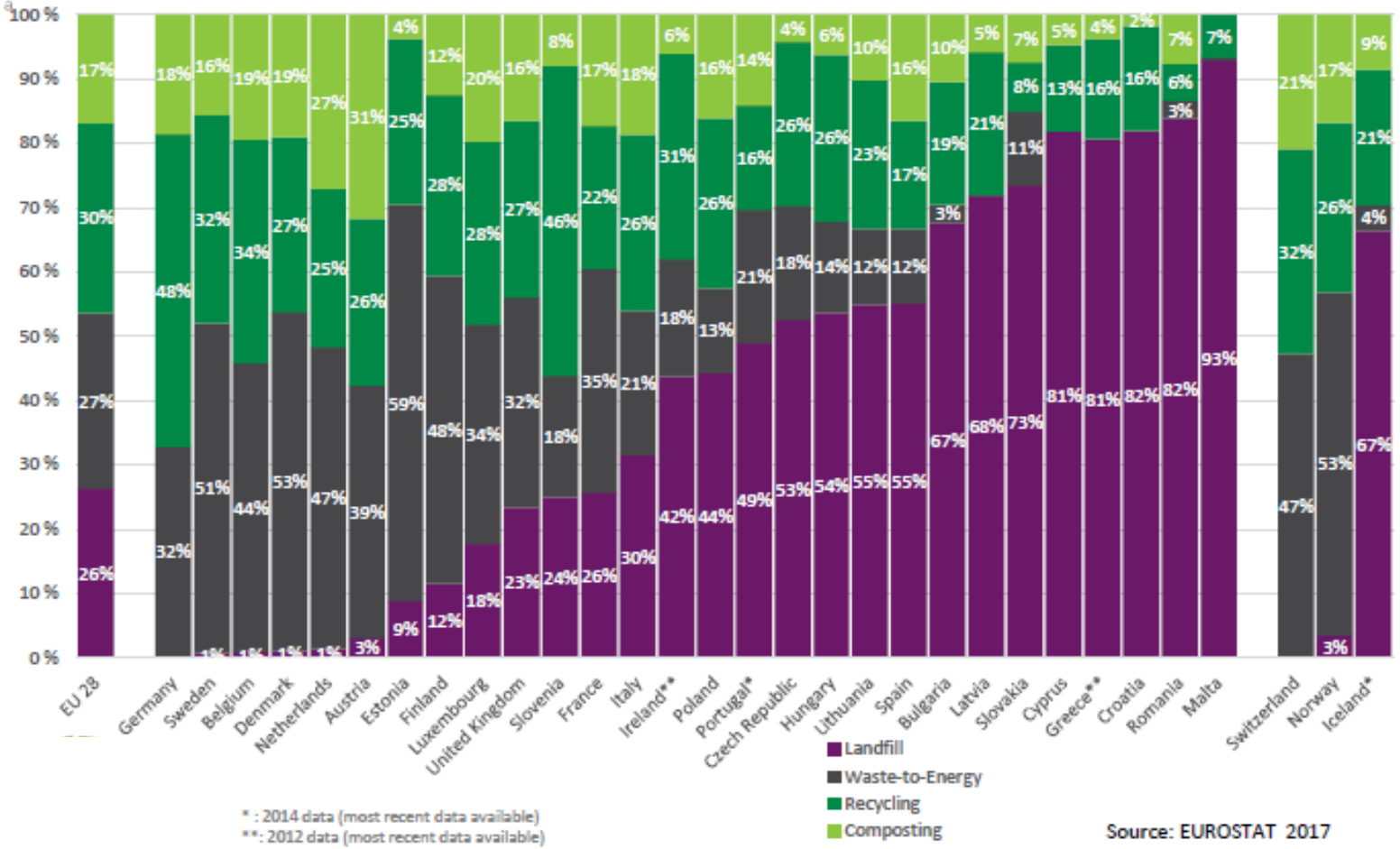
Recycling 29%
Landfill 24%
Incineration 27%
Composting and Digestion 16%

About 100 Mt of municipal biowaste is generated every year in Europe.

Only about a third (30 Mt) of this was separately collected and composted and/or digested (European Compost Network (ECN))

Municipal solid waste treatment in 2015

EU 28 + CH/N/ICE



* : 2014 data (most recent data available)
**: 2012 data (most recent data available)

Source: EUROSTAT 2017

New Waste legislation (22 may 2018)

- Mandatory separate collection of bio-Waste: 31/12/2023
- Maximum 10% landfill of MSW 2035.

COM (2015) 614 Circular economy. From residue to resource.

Biowaste treatment is a big issue in Europe and Worldwide, demanding **Sustainable and competitive waste treatment process.**

perseo bioethanol

BIOREFINERY FROM ORGANIC URBAN WASTE

IMECAL perseo bioethanol

Biotechnological process:
Transform the organic fraction of municipal waste into advanced bioethanol, bioproducts and bioenergy.

perseo bioethanol

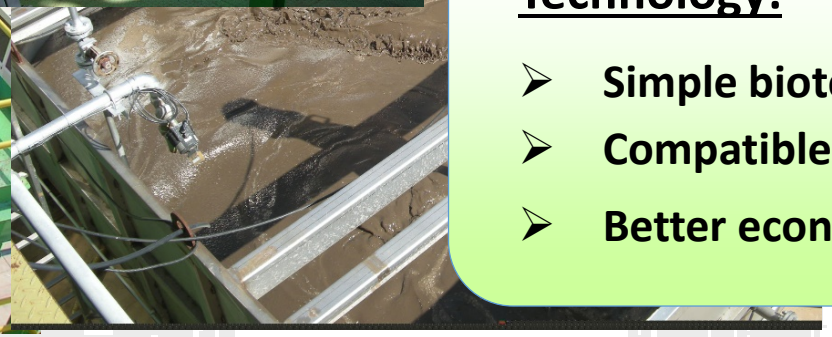
IMECAL

perseo bioethanol®

✓ **The Process is Real, Feasible, Replicable and Profitable.**

✓ **Proven Pre-industrial process.**

Pilot plant 25 t/d from 2007.



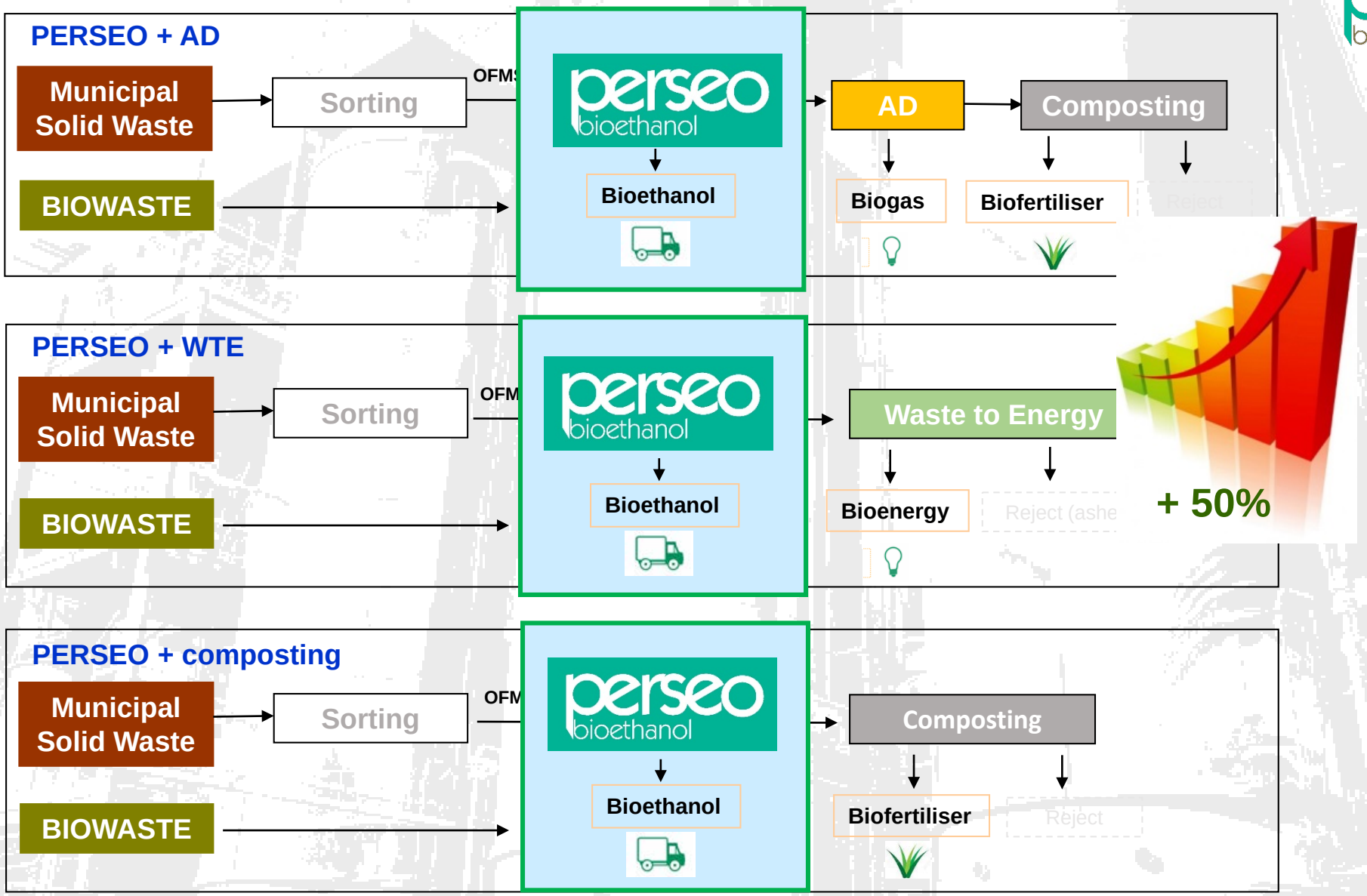
Technology:

- **Simple biotechnological process.**
- **Compatible with the existing MSW treatment facilities.**
- **Better economical results than current MSWT**

PERSEO Bioethanol® Process

BIOREFINERY FROM ORGANIC URBAN WASTE

*From sorted OFMSW



Biorefinery Projects

2017-2021 URBIOFIN urban biorefinery	***Demonstration of an integrated innovative biorefinery for the transformation of Municipal Solid Waste (MSW) into new BioBased products. (GA No. 745785)***	BIO-BASED INDUSTRIES Public-Private Partnership Bio-based Industries Consortium Horizon 2020 European Union Funding for Research & Innovation
2017-2020 PERCAL	***Chemical building blocks from versatile MSW biorefinery. (GA No. 745828)***	
2017-2020 W2B Waste2Bio	***Valorization of urban wastes to new generation of bioethanol (EXP-00098459 / SERA-20171009)***	*Este proyecto ha recibido financiación del programa ERA-NET CO-FUND BESTF3 con cofinanciación de CDTI y MINECO en España y DECC en Reino Unido así como del Programa Marco de Investigación e Innovación, H2020, de la Unión Europea.* MINISTERIO DE ECONOMÍA, INDUSTRIA Y COMPETITIVIDAD CDTI Centro para el Desarrollo Tecnológico Industrial Horizon 2020 European Union Funding for Research & Innovation BESTF3

BIO-BASED INDUSTRIES Public-Private Partnership

Bio-based Industries Consortium

Horizon 2020 European Union Funding for Research & Innovation

IMECAL

perseo bioethanol®

URBIOFIN urban biorefinery

Demonstration of an integrated innovative biorefinery for the transformation of Municipal Solid Waste (MSW) into new BioBased products (GA 745785)

Project Budget: 15 M€ (Grant 10.9 M€).
4 years project (6/2017 – 5/2021)

IMECAL www.imecal.com/perseo (Coordinator)	Universidad de Valladolid www.uva.es	WAGENINGEN www.wur.nl/en.htm	IRIAF clamber.castillalamancha.es
ainia centro tecnológico www.ainia.es	exergy www.exergy.uk.com	www.ciemat.es	BioEconomy Cluster www.bioeconomy.de
urbaser www.urbaser.es	novozymes www.novozymes.com	visum www.seeingnewdata.com	www.ses-packaging.com
Biomasa Peninsular www.bpeninsular.com	www.gidynamics.nl	NaturePlast www.natureplast.eu	www.natrue.org

The objective

Landfill
Composting
Anaerobic Digestion

NEW MODEL OF OFMSW TREATMENT

URBIOFIN
urban biorefinery

Biorefinery

OFMSW

URBIOFIN - Biorefinary

BIO-BLOCKS	BIO-POLYMERS	ADDITIVES
- Bioethanol - Volatile fatty acids - Biogas	- Polyhydroxyalkanoates - Combined PHA's	- Bioethylen - Biochemical products

VALUE

BIO-BASED INDUSTRIES Public-Private Partnership
Bio-based Industries Consortium
Horizon 2020 European Union Funding for Research & Innovation
IMECAL
perseo bioethanol®

Project Challenges

- ✓ **To tackle the issues inherent to MSW treatment**, such as variability in composition (seasonality and geographic location) and presence of inhibitors to downstream biotechnological processes.
- ✓ To **validate the whole value chain at demonstration scale** (TRL 5-7).
- ✓ To **demonstrate the large-scale, economically competitive deployment** of treatment and conversion technologies of the OFMSW into final or intermediate products.
- ✓ To **validate safety, quality and purity of the products** in order to meet commercial and/or regulatory requirements.
- ✓ To **assess the environmental and socio-economic performance** of the whole value chain throught a Life Cycle Assessment (LCA)

URBIOFIN
urban biorefinery

BIO-BASED INDUSTRIES
Public-Private Partnership

Bio-based Industries Consortium

Horizon 2020
European Union Funding
for Research & Innovation

IMECAL

perseo
bioethanol®

Non-organic (Recycling)

MSW → Sorting → OMSW → AD1 → AD2

BIOGAS → Upgrading → BIOMETHANE

Microalgae → Hydrolysis + concentration → SPBD

PHA production + Extraction

Vinasse

OMSW → Pre-treatment + Hydrolysis + Fermentation → BIOETHANOL → Catalysis

AD1 → VFAs → Elongation → MCFAs → PHA production (pure culture) → Extraction

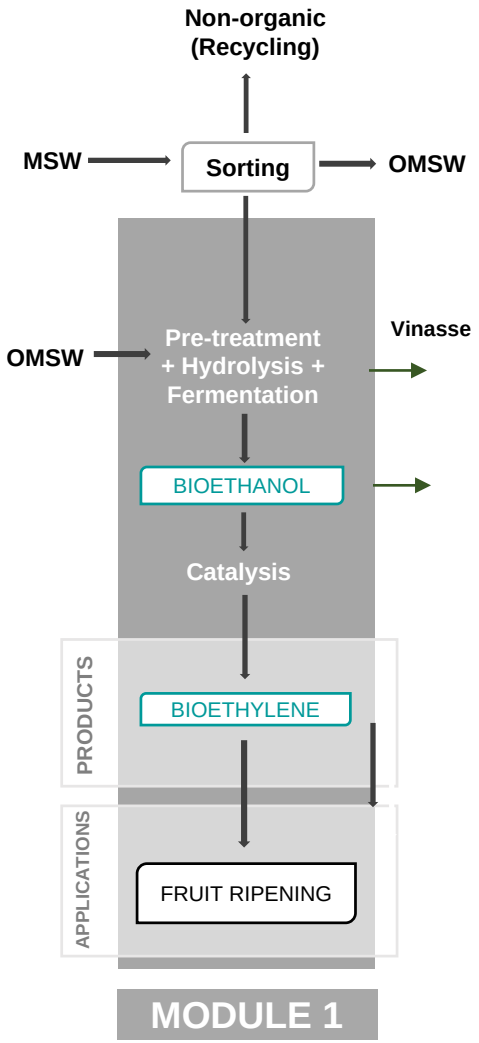
Biomass (pure culture)

PHA enrichment → PHA production (mixed culture) → Extraction

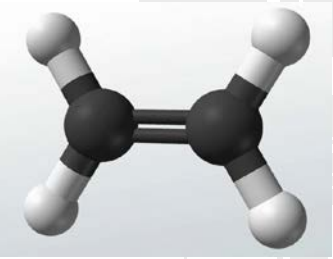
AD2 → SPBD

	MODULE 1	MODULE 2	MODULE 3
PRODUCTS	BIOETHYLENE	MCL-PHA	DRY GRANULES
		SCL-PHA	AA
			SCL-PHA
APPLICATIONS	FRUIT RIPENING	COSMETICS BIOPLASTICS	SOLID FERTILIZER
		AGRICULTURE BIOPLASTICS	LIQUID FERTILIZER
			AGRICULTURE BIOPLASTICS

Module I.
Conversion of OFMSW to bioethanol and bioethylene



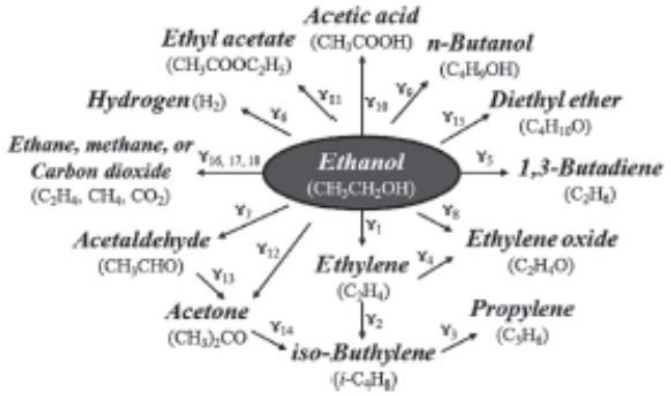
Bioproducts:



Market of bioproducts

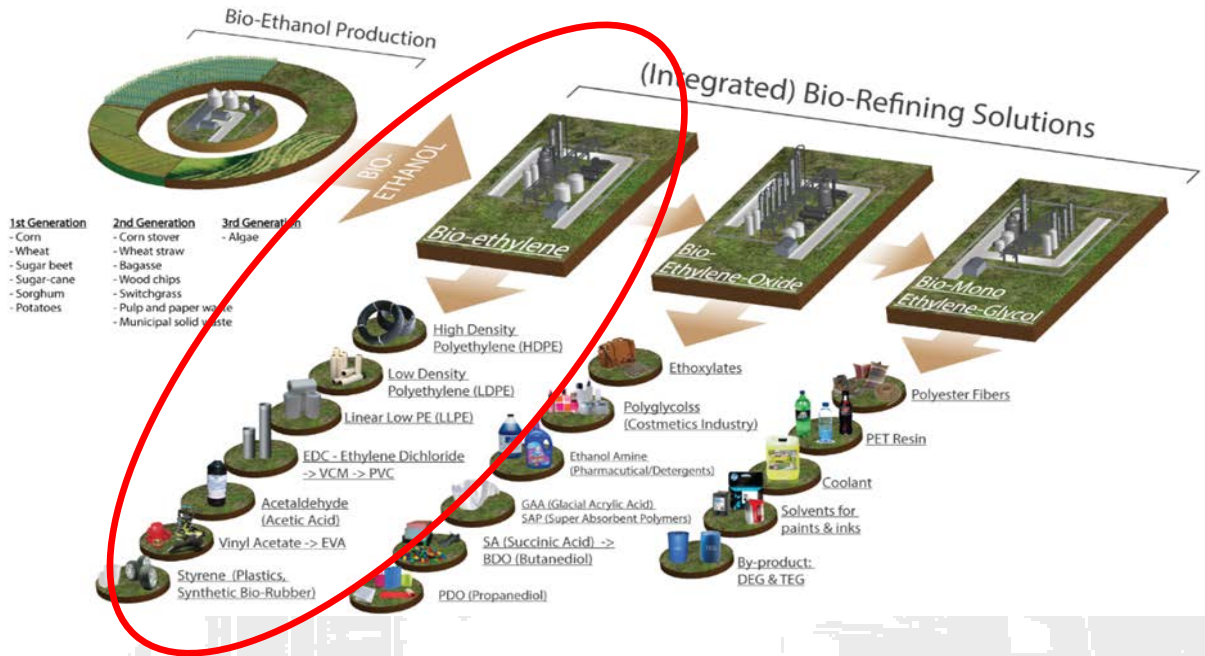
➢ Bioethanol:

- ✓ **Biofuel: 90% of total biofuels.** In **Europe** 13 billon € in 2030
- ✓ **Chemical Building block**: Bioethanol is considered as one of the **"top 10"** potential biobased raw materials for the chemical industry. (US Energy Department)

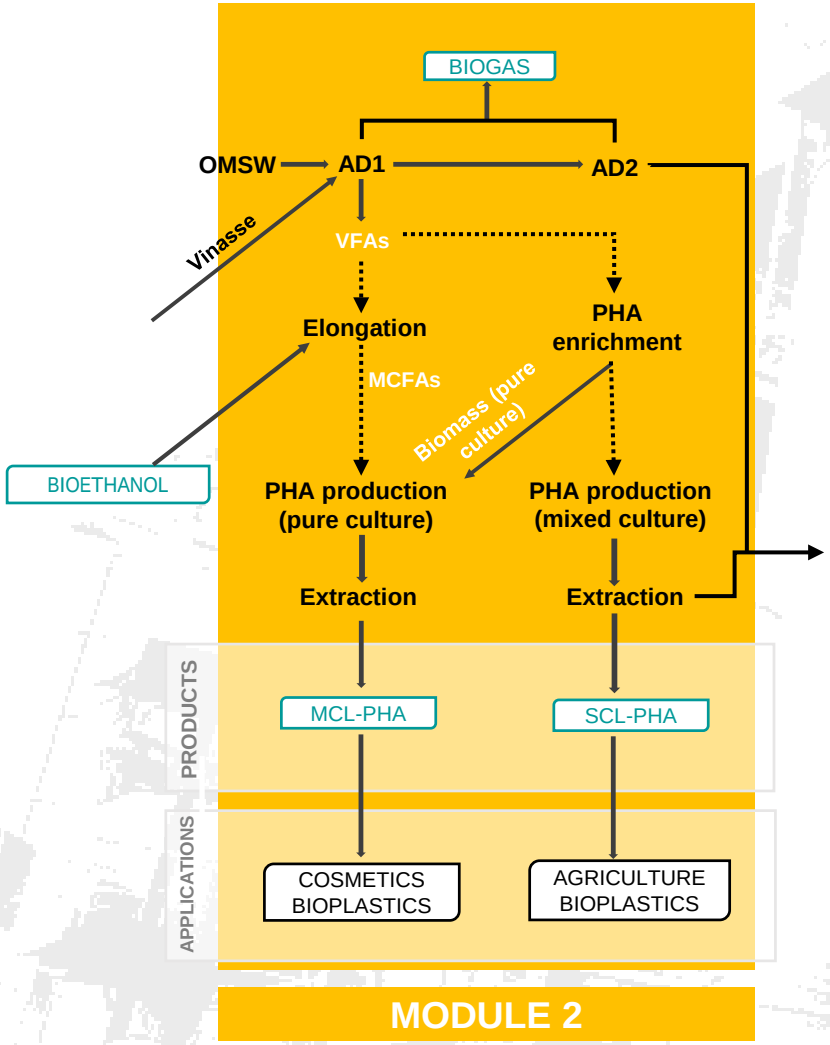


➢ Bioethylene:

- ✓ Global bioethylene market size was over USD 160 billion in 2015 and is foreseen to exceed USD 235 billion valuation by 2024



Module II. Conversion of OFMSW to VFAs for production of PHA.

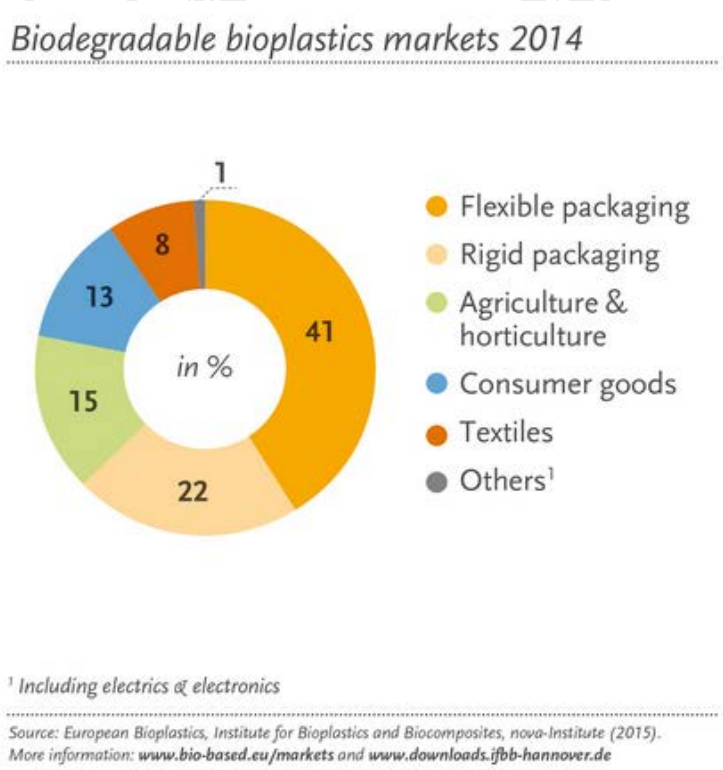


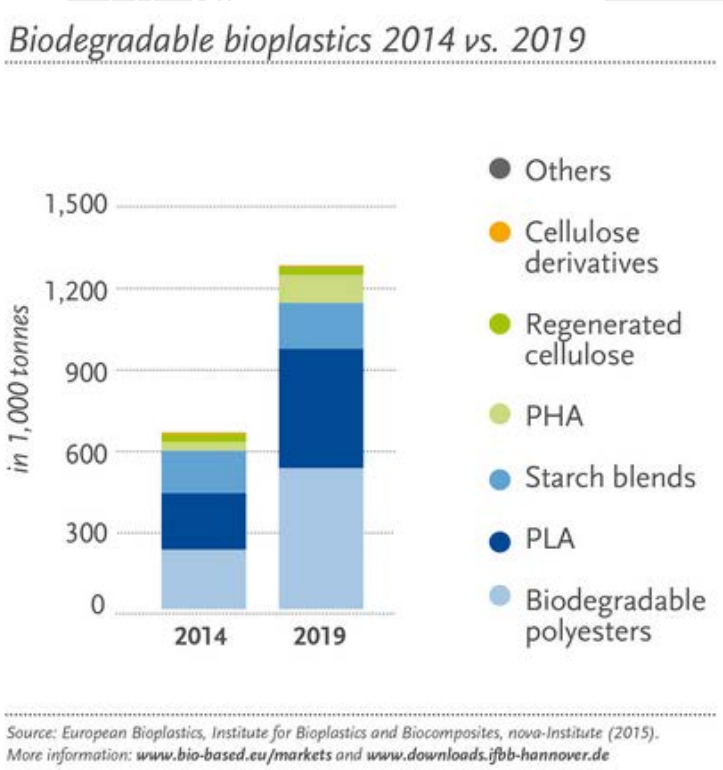
Bioproducts:

Market of bioproducts

➢ Bioplastics:

- ✓ Biodegradable bioplastics market is expected to double in 2019.
- ✓ In the case of PHA market it is expected a growth from 32 to 104 Mton, mainly related to flexible or rigid packaging and agriculture purposes.





URBIOFIN urban biorefinery

BIO-BASED INDUSTRIES Public-Private Partnership

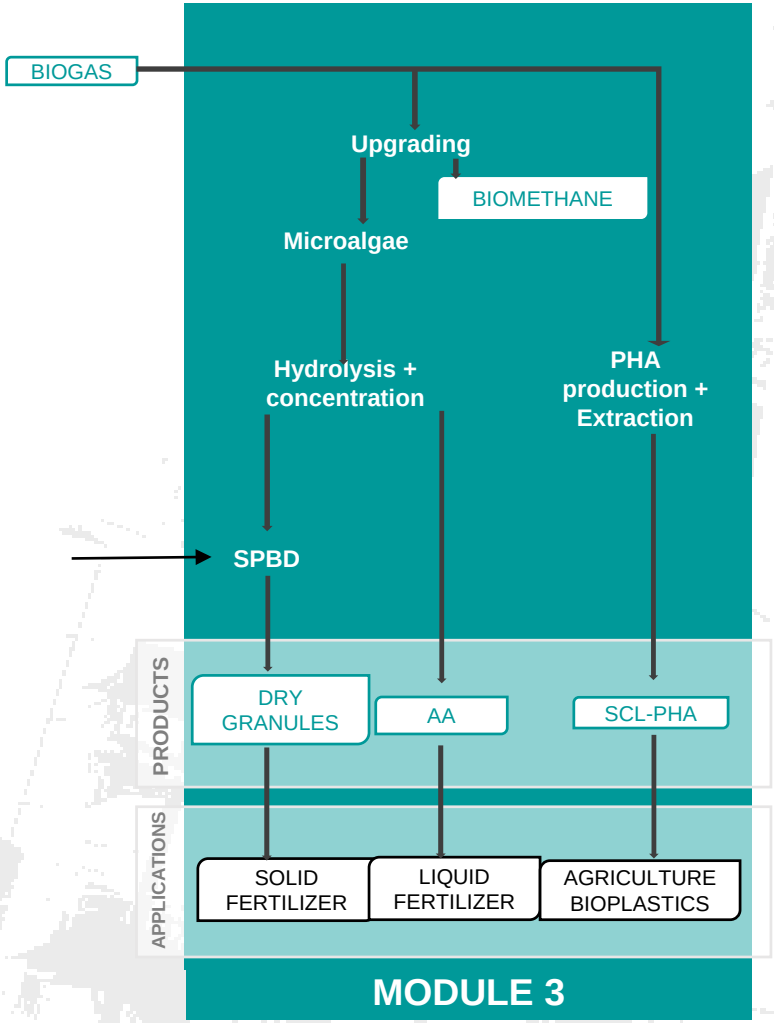
Bio-based Industries Consortium

Horizon 2020 European Union Funding for Research & Innovation

IMECAL

perseo bioethanol®

Module III. Biogas bioconversion to biomethane and added value products

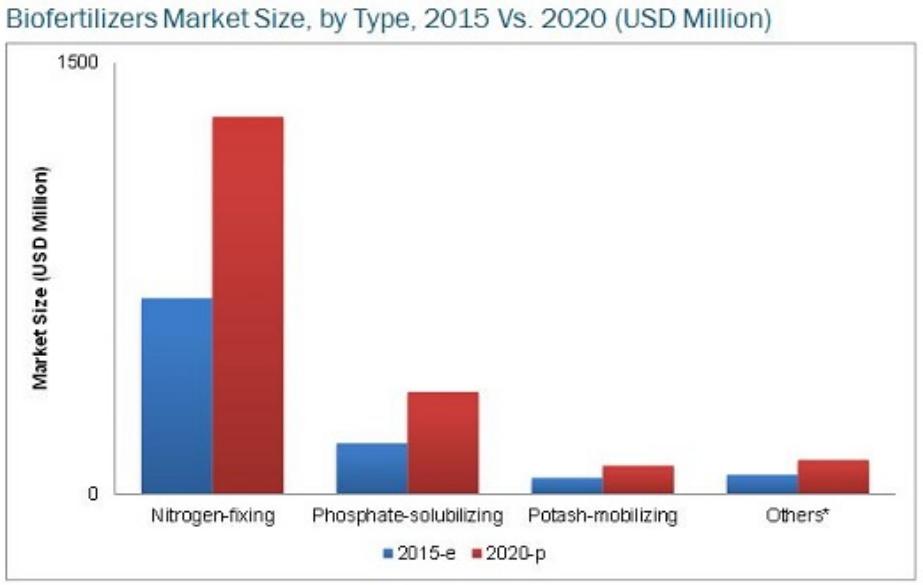


Bioproducts:

Market of bioproducts

➢ Biofertilizers

✓ Global bio-based fertilizers market is expected to reach USD 1.9 Billion by 2020 at a CAGR of 14.0% from 2015 to 2020



*Others include zinc, boron, and sulfur-solubilizing biofertilizers
E – Estimated; P - Projected
Source: Expert Interviews and MarketsandMarkets Analysis

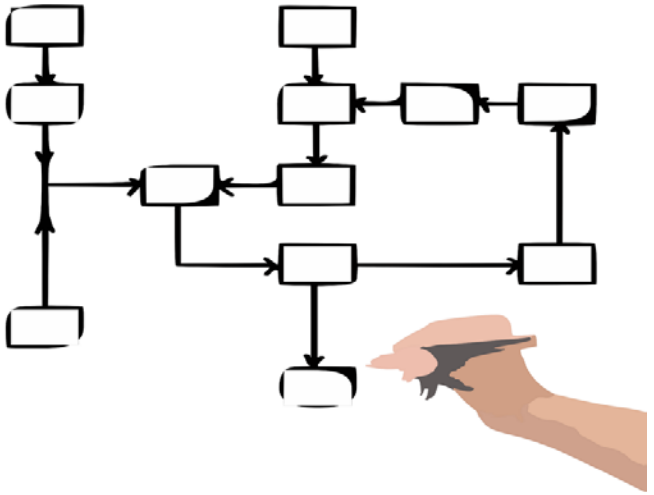
Advantages of bio based fertilisers vs conventional (mineral) fertilisers

- ✓ It is a recovered / renewable origin bioproduct
- ✓ It improves soil quality/health and not only crop productivity
- ✓ It contains higher components and nutrients concentration
- ✓ It offers easy manipulation and application in field
- ✓ Slow release of nutrients and improved crop yield
- ✓ It reduces the environmental footprint of crop production

The achivements

✓ **Feedstock requirements**

✓ **Process definition and improvements**



✓ **Final products requirements**

Pilot plants start the DEMO activitiy.

Benefits of an urban biorefinery:

Profitability

Higher annual benefits, when compared to current MSW technologies

ZEROWASTE

Improvement of the performance through the **use of by-products generated** in their own processes – **landfill diversion**

Circular Economy

Evolution towards the path of the bioeconomy defined by the EU.

Waste is a resource: Circular economy.

Versatility

Versatility to treat different fractions of waste to obtain maximum added value and profitability

Bioresources

Reduction of fossil resources dependence in energy and products.

Sustainability

Boost competitiveness, foster sustainable economic growth and generate new jobs

URBIOFIN
urban biorefinery

IMECAL
perseo bioethanol

Follow us on:

URBIOFIN Project

@URBIOFIN

www.urbiofin.eu

imecal@imecal.com

This project has received funding from the Bio-Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement Nº 745785

BIO-BASED INDUSTRIES Public-Private Partnership

Bio-based Industries Consortium

Horizon 2020
European Union Funding
for Research & Innovation

#biorefineryAINIA

Muchas gracias por su atención

caterina@imecal.com
+34699626947

Caterina Coll, IMECAL

ainia centro tecnológico

Patrocinadores:

DAM Depuración de Aguas del Mediterráneo

innovarum

TETma

IMECAL | perseo bioethanol

bionet ENGINEERING

facsa ciclo integral del agua

Biomasa Peninsular

urbaser

CLaMber IRIAF Castilla-La Mancha

BIOWAYS