

2nd SMIBIO WORKSHOP

Small-scale Biorefineries for Rural Development in LA and EU

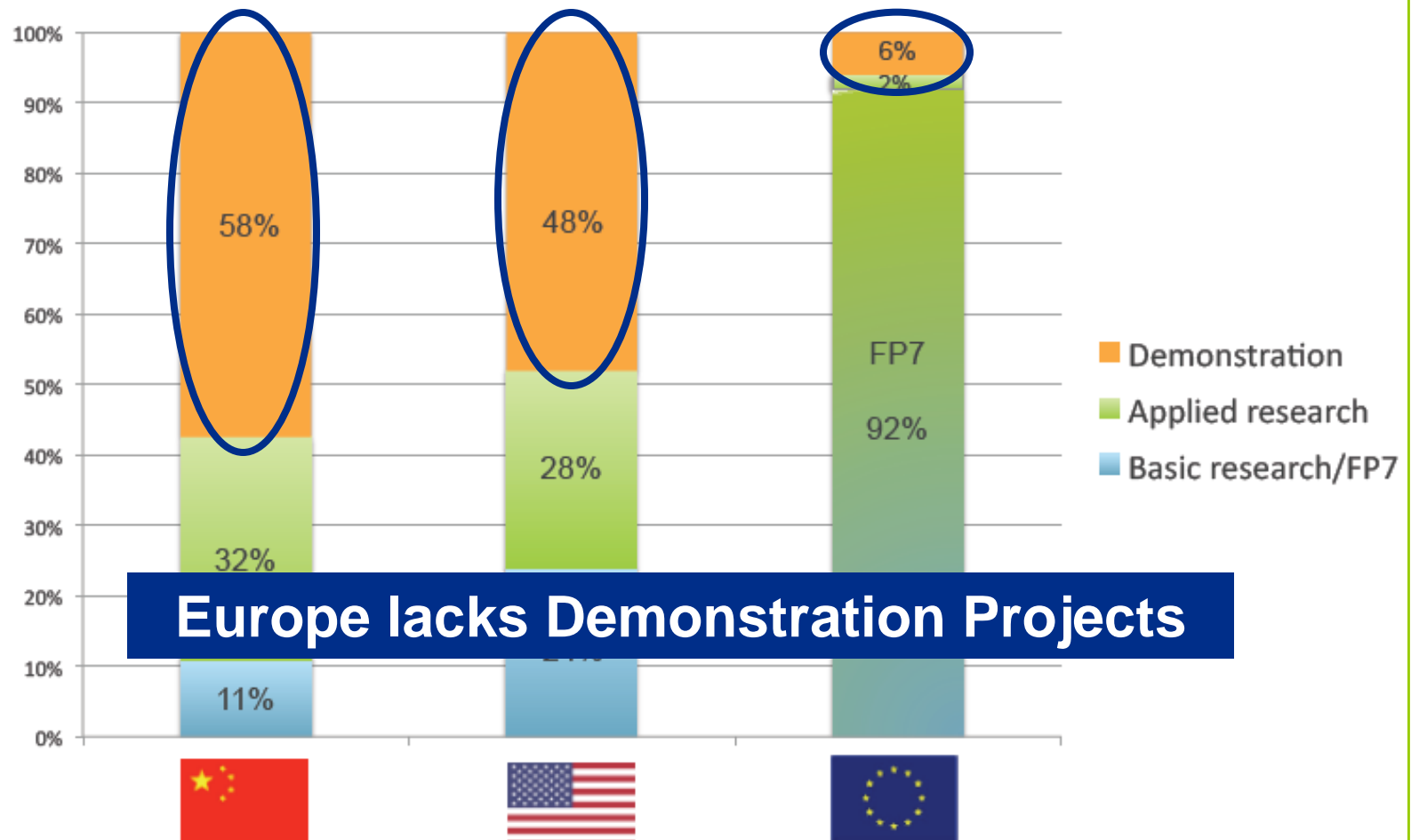
Planta CLAMBER de Demostración de Biorrefinería: Un impulso al desarrollo de los bioprocesos

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CIEMAT*

FUNDED BY:



International benchmark on the share of basic, applied and development activities



Europe lacks Demonstration Projects

Source: Key Science and Engineering Indicators, National Scientific Board, 2010 Digest, NSF, <http://cordis.europa.eu/erawatch>, OECD "Research & Development Statistics"

CLAMBER is an initiative of the Regional Government of Castilla-La Mancha with EU-Funds to support the strategic sector of bioeconomy.



- **Surface:** 79.461 Km² **Population:** ~ 2x10⁶
- **Agricultural** sector represents a **high percentage** of the region GDP (12%): Vineyard, Olive, Cereals).
- Castilla- La Mancha region has a **high potential** of agricultural, forestry and agroindustrial **residues**. 3 Mton lignocellulosic biomass, 9.5 Mt biodegradable residues

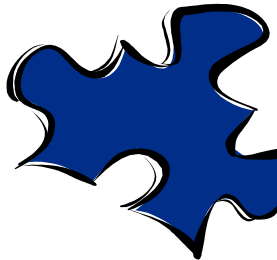
CLAMBER specific objectives are:

- ▶ To create a technologically advanced biorefinery pilot/demo plant that allows the research on production of innovative bioproducts.
- ▶ To develop a technology hub in the region to enable synergies with both companies producing biomass and bioproducts users and encourage the creation and exploitation of new market niches.
- ▶ To revitalize the local economy and reverse the negative demographics that characterizes rural areas.
- ▶ To contribute to an efficient public-private cooperation system in order to increase scientific and technological progress and to stimulate European and international research initiatives.

CLaMber Funding



4 M€



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"Una manera de hacer Europa"

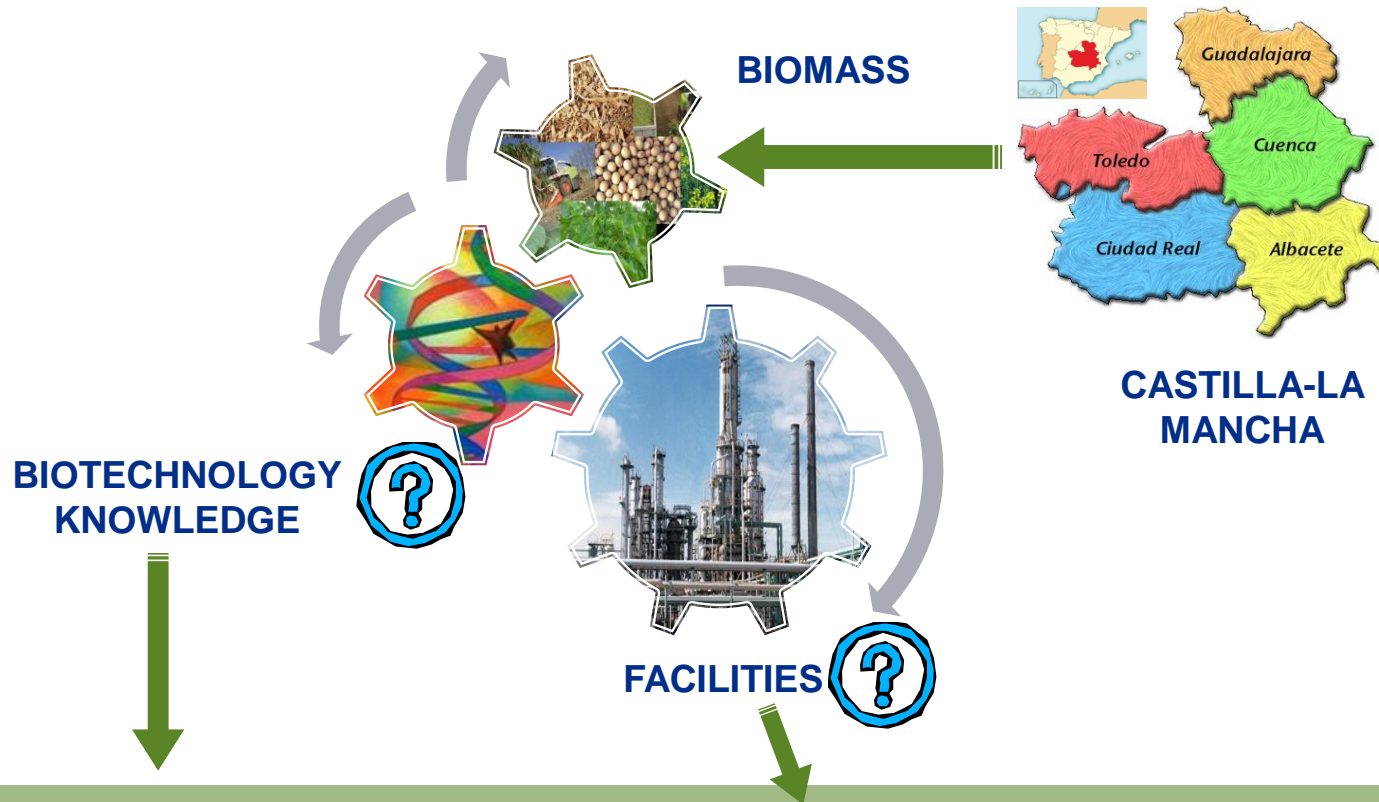
16 M€



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20 M€

CLaMber actions

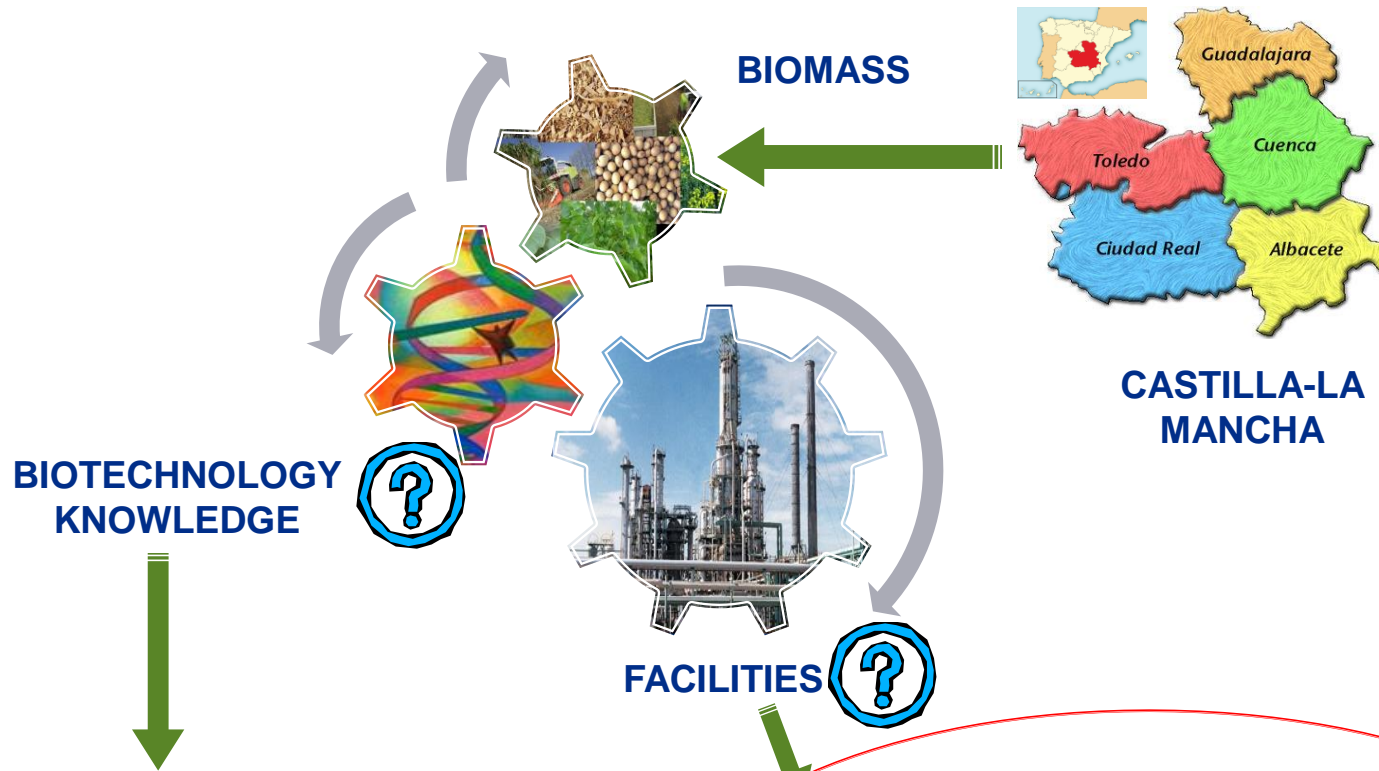


Promotion of R&D activities on biotechnology developed by companies in Castilla La Mancha.

Pre-Commercial Public Procurement (PPP)
(19 projects - 5,8 M Euros)

Construction of a demonstration scale biorefinery to test innovative process for the production of high value added bioproducts and bio-fuels from biomass on a larger scale

CLaMber actions



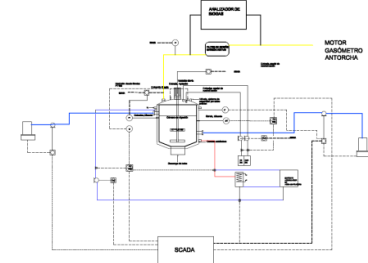
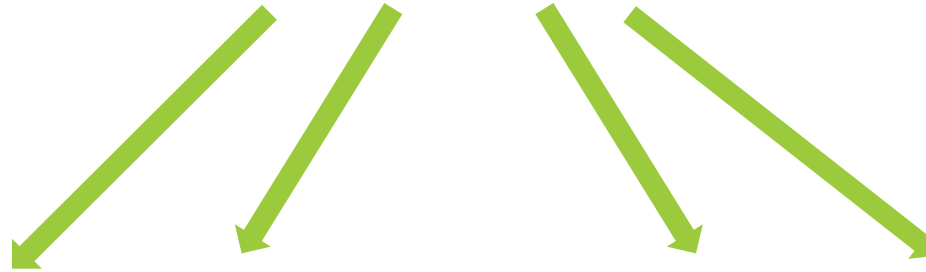
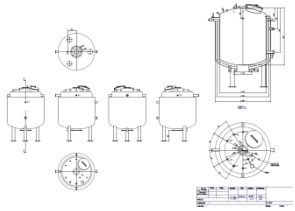
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First action involved in the CLaMber Project

CONSTRUCTION OF A DEMONSTRATION SCALE BIOREFINERY



INTEGRAL

MODULAR

FLEXIBLE

INNOVATIVE

1 t dry material per day



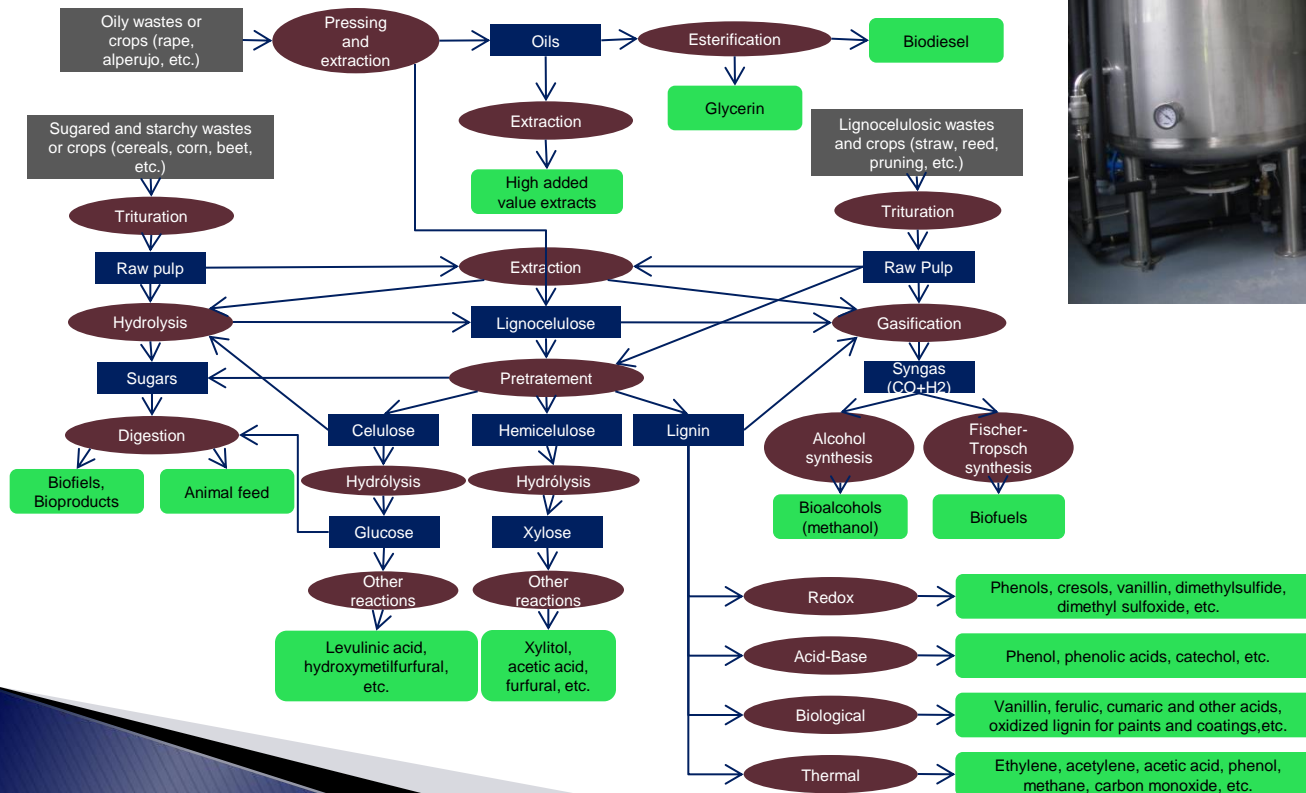
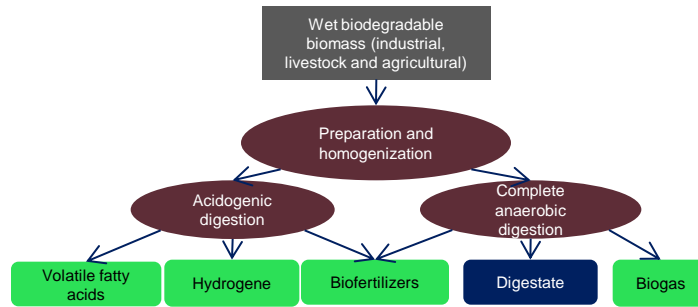
KEY ASPECTS FOR FOCUSING :
EFFICIENCY,
COST REDUCTION
VALIDATION OF NEW BIOPROCESSES

SERVICES:

- RENTAL OF FACILITIES
- PROCUREMENT OF R&D PROJECTS
- PARTNER FOR COMPETITIVE FUNDINGS
- TRAINING IN BIOTECHNOLOGY

- ▶ **Flexibility** to develop several processes from very different raw materials. Also, it must be able to integrate different technologies temporarily, specially in up-stream and down-stream areas.
- ▶ **Relevant Size** of basic operations and technologies, because the objectives are the concept trials and the information for process scale-up.
- ▶ **Technologically Robust**, which allows the development of innovative processes.
- ▶ **Complementary** to existing capacities in Spain and specially in Castilla La Mancha Region.
- ▶ **Modular**, bearing in mind two points of view : a) it can work on isolated areas and processing units without using the whole plant and b) It can be extended to other technologies not covered in the initial project.
- ▶ **Sustainable**, in its demonstrative activity of processes, and feasible in terms of energy consumption and effluent management.

Simplified flow diagram



CLAMBER PLANT LOCATION

- ▶ *It is located in an area of 19,000 m²* in Puertollano and close to REPSOL Petrochemical Industrial Complex.



Clamber Plant Building

- ▶ ***The plant has a surface of 5,130 m²***
 - ▶ 1,400 m² are for the biorefinery
 - ▶ 600 m² are offices and laboratory



Front Plant View



Back Plant View



The demonstration pilot plant is organized into several areas:

- ✓ **Up-stream:** Storage, Milling (200 kg/h), Biomass Preconditioning, Two-step Steam Explosion Reactor (400 L), Solid- liquid separators (2 x 15 m³/h)

Up-stream – Covered Solid Biomass Storage



Up-stream: Pretreatment section



Up- stream Area : Cooking tank & Steam explosion reactor



The demonstration pilot plant is organized into several areas:

- ✓ **Up-stream:** Storage, Milling (200 kg/h), Biomass Preconditioning, Two-step Steam Explosion Reactor (400 L), Solid- liquid separators (2 x 15 m³/h)
- ▶ **Mid-stream:** Microbiology laboratory (starters, inoculants, etc.), reactors for hydrolysis and aero and anaero fermentation (2 x 3 L , 2 x 30 L , 1 x 300 L, 1 x 3,000 L , 1 x 20,000 L), Substrate Preparation System (1 x 1 m³ , 1 x 5 m³), Sterilization, Addition of sterile reactants, CIP and other utilities.

Media Preparation & Sterile Reactants Area



30 L bioreactors



300 – 3,000 & 20,000 L Bioreactors



ANAEROBIC DIGESTION PLANT



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- Liquid storage tank (20 m³)
- Solid storage hopper (10 m³)
- Pasteurization tank (1 m³)
- Homogenization tank (3 m³)
- Digester (11 m³)
- Digestate tank (5 m³)
- Gasometer (10 m³)

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- ▶ **Down-stream:** Harvesting tanks 2x10000 L 2x1500 L, Microfiltration (1 m³/h), Centrifugation system (1.5 m³/h).

DOWN-STREAM



DOWN-STREAM



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- **Up-stream:** Storage, Milling (200 kg/h), Biomass Preconditioning, Two-step Steam Explosion Reactor (400 L), Solid- liquid separators (2 x 15 m³/h)
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- **Down-stream:** Harvesting tanks 2x10000 L 2x1500 L, Microfiltration (1m³/h),Centrifugation system (1,5 m³/h).
- **Utilities: (Electrical Power Supply, Steam Boilers, Process water, Cooling tower water, Chiller water, Glycol water, Compressed process air, Instrumentation & service air, Process Gases - NH₃, N₂, O₂, CO₂.**
- **Waste Management**

UTILITIES



Waste Water Plant



Laboratory



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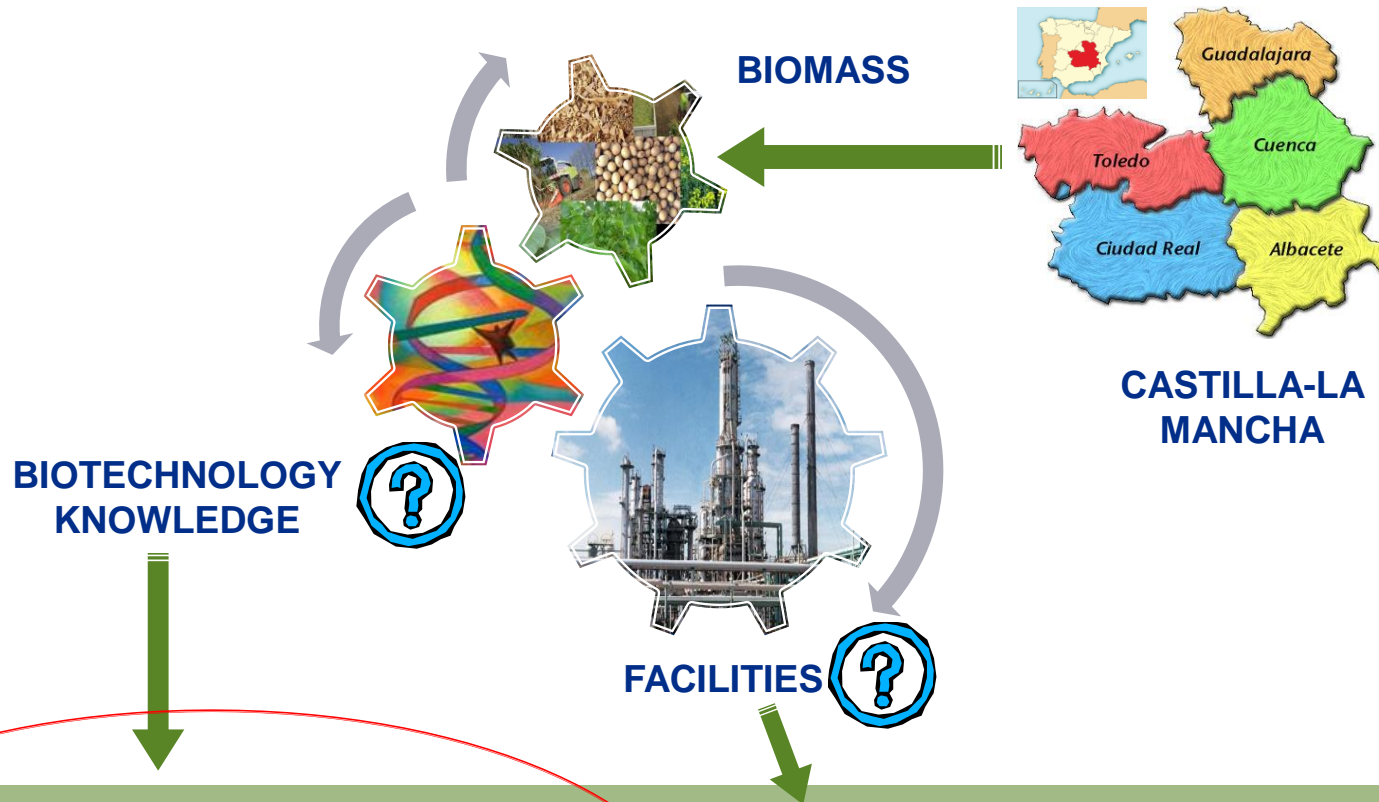
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Compra Pública de Innovación (en inglés, **Innovation Procurement**) son actuaciones administrativas cuyo objetivo es el fomento de la innovación a través de la contratación pública.

Impactos:

- ▶ La administración o los entes públicos correspondientes se modernizan mediante la adquisición de bienes y servicios novedosos.
- ▶ Las empresas desarrollan e introducen por primera vez en el mercado dichos bienes y servicios, con la consiguiente mejora de su competitividad.
- ▶ La innovación se dirige desde el lado de la demanda –en este caso del sector público– y no desde la oferta, como es habitual cuando las empresas tratan de introducir nuevos productos y servicios en el mercado.

Tipos:

- ▶ **Compra pública** (de tecnología) **innovadora** (CPI, CPTI) (en inglés, Public Procurement of Innovative solutions, PPI). **Soluciones incipientes**, que están a punto de llegar al mercado o empezando a introducirse en el mismo. **No es necesario realizar actividades de I+D**. La contratación pública “abre” el mercado y facilita que las empresas puedan escalar la producción y comercialización.
- ▶ **Compra pública precomercial** (CPP) (en inglés, Pre-Commercial Procurement, PCP). Soluciones que están aún **lejos de llegar al mercado** y, por tanto, **es necesario llevar a cabo un esfuerzo de I+D considerable**.
- ▶ Es una contratación de servicios de I+D en los que el comprador público comparte con las empresas los riesgos y beneficios de la investigación necesaria para desarrollar soluciones innovadoras que superen las que hay disponibles en el mercado. La CPP se circunscribe a actividades de I+D, no incluye el desarrollo comercial.

ALINEADAS CON LA ESTRATEGIA EUROPEA DE INVESTIGACIÓN DEL H2020, LAS LICITACIONES PUBLICADAS ENGLOBAN LOS SERVICIOS DE INVESTIGACIÓN, DESARROLLO E INNOVACIÓN PARA LA UTILIZACIÓN INTEGRAL DE:

➤ **BIOMASA LIGNOCELULÓSICA:**

- BIOMASA RESIDUAL LEÑOSA
- BIOMASA RESIDUAL HERBÁCEA
- CULTIVOS LIGNOCELULÓSICOS
- LIGNINA

➤ **BIOMASA OLEAGINOSA**

➤ **BIOMASA RESIDUAL AGROALIMENTARIA:**

- HOLLEJOS, PEPITAS Y LÍAS
- ALPERUJO
- LACTOSUERO
- RESIDUOS CÁRNICOS
- ALPECHÍN, VINAZAS Y OTRAS AR

➤ **BIOMASA RESIDUAL GANADERA Y NO AGROALIMENTARIA**

- ESTIERCOLES
- FORSU
- LODOS DE EDAR
- GLICERINA
- BIOGÁS NO ENERGÉTICO



ORUJO DE UVA

ALVINESA

PIQUETAS

HOLLEJOS

PEPITA DE UVA

ETANOL

ÁCIDO
TARTÁRICO

ACEITE DE
PEIPTA

Purificación
cromatográfica de
extractos

Purificación de
triterpenos

Extracción fluidos
supercríticos

Procesos de
Purificación
Complejos de
extractos

ANTOCIANOS
20%

ÁCIDO
OLEANÓLICO 95%

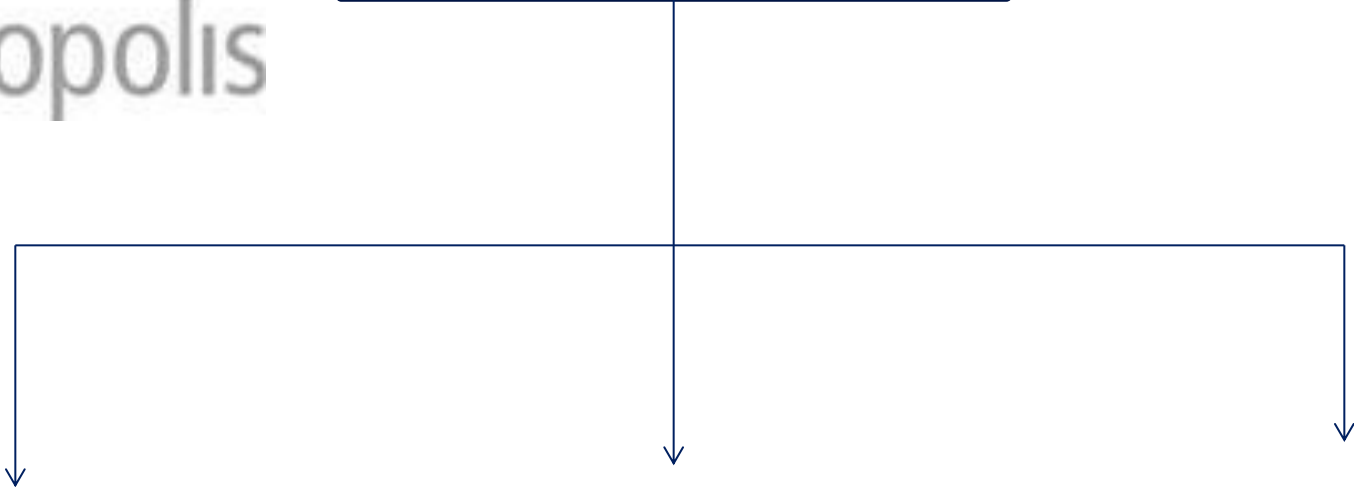
ACEITE
FUNCIONAL

OPCs



BIOPOLIS

LACTOSUERO



Fermentación enzimática

Fermentación
microorganismos
propios

Fermentación
bacterias propias

LACTULOSA

PHA

ÁCIDO
D-LÁCTICO



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Gracias por la atención

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