This consists of generating energy, biofuels (bioethanol and biodiesel), biopolymers and basic chemicals using mechanical, thermal, chemical or biochemical processes from biomass from agricultural, agro-industrial waste and municipal solid waste. The first generation biorefineries based on food crops are not sustainable with the environment and also increases the price of food and drawback that is dealt with the second and third generations that support a larger variety of biomass (agricultural, livestock and municipal solid waste).

**ORIGIN OF THE INVESTMENT OPPORTUNITY**

**ECONOMIC/BUSINESS**

Western economies are highly vulnerable to oil price increases, which is the reason for the search for alternatives to fossil fuels in order to reduce energy dependence, the solution to which are second and third generation biorefineries.

Regarding the legislation, Directive 2009/28/EC for Renewable Energy and the 2011-2020 Renewable Energy Plan in Spain have the aim of consuming 20% of energy from renewables. The transport sector consumes 6% from first generation biofuels (initial target for 2013 was 10%) and 2.5% of second generation, with the latter producing demand for second generation refineries.

To facilitate the complex technological transition towards new biorefineries, the H2020 program (with a budget of 3.7 billion € for the period 2014-2020) open periodic applications for funding for research projects concerning the synthesis of chemicals from lignocellulosic raw material, as for example, H2020-BBI-PPP-1/1/2015 had a budget of €100 M (September 2015).

**DEMAND**

**REGULATIONS**

**TECHNOLOGY**

**LOCATIONAL INVESTMENT OPPORTUNITY IN THE SECTOR VALUE CHAIN**

The opportunity is in the industrial scaling link The strength of the previous link ensures the number of projects with the potential to scale industrially. The "research" link is the one that concentrates most of the activity of the value chain in the generation of research. The proofs of concept, although relatively expensive, are becoming more viable due to the appearance of pilot scale plants such as the ClaMber project in Castilla-La Mancha.

**DIFFERENTIATING FACTORS OF THE INVESTMENT OPPORTUNITY**

**CONSUMER/USER**

- Innovation
- Price
- Quality

**COMPANY/INNOVATION**

- Operations
- Supplies
- New business lines

**SOCIETY**

- Environment
- Well-being
- Safety

- For corporate social responsibility reasons, corporate energy consumers support the migration towards clean, sustainable technologies and are committed to local employment
- Second generation biorefineries represent a cut emissions of between 80% and 90% compared to petrol and they consume agricultural waste in the process. In addition, the resulting products offer the same user experience as petrol.
- The introduction of new biorefineries creates the opportunity to transform the old value chain of first-generation biorefineries.
- Opportunities for suppliers such as forestry companies and suppliers of agricultural and livestock waste are opened; as they are for engineering of bioindustrial processes, installers and maintenance companies and plant genetics laboratories with the aim of reducing the amount of lignin in plants for bioenergy purposes.
- Using second and third generation refineries at the expense of the first generation, corrects the negative effects of biofuel demand on increased food prices, the mass clearing of forests in Asia and Latin America to increase the surface for production and reduces the CO2 footprint.
- The new biorefineries minimise the impact of agro-industrial waste, create jobs and secure population in rural areas.

**INVESTMENT OPPORTUNITY LIFE CYCLE**

Because the EU promotes the perfection of technologies through the H2020 programme and ensures market share for the consumption of the products, the opportunity is in the introduction phase with hints of growth from 2020.

The decision by the European Union to limit the use of biofuels made from food crops to 6% compared to the initial target of 10%, and the obligation of the Parliament with respect to second-generation biofuels provide at least 2.5% of total energy consumption in the transport sector in 2020, accelerating the transition to a new generation of biofuels made from algae and organic waste.

CHARACTERISTICS OF THE SECTOR (1)

Turnover

<table>
<thead>
<tr>
<th>Year</th>
<th>Consolidated turnover</th>
<th>Annual Change in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td></td>
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<tr>
<td>2012</td>
<td></td>
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</tr>
<tr>
<td>2013</td>
<td></td>
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</tbody>
</table>

Geographical distribution of biotechnology companies (2013)

- Catalonia: 19.43%
- Madrid: 17.54%
- Andalusia: 15.49%
- Valencia Community: 10.09%
- Other: 37.45%

Geographical distribution of companies using biotechnology (2013)

- Catalonia: 14.89%
- Madrid: 12.13%
- Pais Vasco: 11.88%
- Andalusia: 9.27%
- Other: 51.83%

SUPPLY

TOP 5 COMPETITORS IN SPAIN

<table>
<thead>
<tr>
<th>#</th>
<th>Company</th>
<th>Net sales</th>
<th>Last available data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CEPSA</td>
<td>€26,178.00 M</td>
<td>2014</td>
</tr>
<tr>
<td>2</td>
<td>Abengoa</td>
<td>€7,150.60 M</td>
<td>2014</td>
</tr>
<tr>
<td>3</td>
<td>Bioetanol Galicia</td>
<td>€164.30 M</td>
<td>2013</td>
</tr>
<tr>
<td>4</td>
<td>Neol Bio</td>
<td>€0.043 M</td>
<td>2013</td>
</tr>
<tr>
<td>5</td>
<td>Inkemia IUCT Group</td>
<td>€0.040 M</td>
<td>2013</td>
</tr>
</tbody>
</table>

DEMAND

GROWTH

- In Spain, biofuel consumption in 2014 increased to 6.6% to reach a total production of 1.16 million metric tons.
- According to ASEBIO, Spain is very well placed for a position among the world leaders in the industrial biotechnology sector (white biotechnology). Mainly because Spain has a prolific research sector and now has 58 biodiesel plants and 21 further projects. Regarding the production of second generation bioethanol, Spain has 11 bioethanol plants.

SUCCESS STORIES

The W2B (waste to biofuels) technology of the Spanish company is a world leader in the production of second generation bioethanol from lignocellulosic and municipal solid waste. The company has a pilot plant in Salamanca with capacity to process 25,000 tons of municipal solid waste (MSW), and capability to produce up to 1.5 million litres of bioethanol fuel. Abengoa was selected in 2015 to build the first US biorefinery for municipal waste for €185M and it will be the first biorefinery using gasification technology to convert municipal solid waste (MSW) into synthetic crude, to be transformed into fuel for aviation.

NEOL is a company that develops innovative industrial biotechnology processes for application to the oleochemical, bioenergy and biopolymers sectors. Bioproduction for obtaining PUFA (polyunsaturated fatty acids), polyunsaturated fatty acids from microalgae in 2014 stand out. Among the technology assets of the company Neol® Microbiotools stands out. It is a bioprocesses development platform based on an exclusive collection of over 9,000 microorganisms isolated by Neol in extreme ecosystems. The company won two tenders for the biorefinery in Puertollano (CLaMber project) in 2015 to produce, from various agricultural residues, high value-added products: oils rich in Omega-3 DHA. The implementation of these projects will see a turnover of over one million euros in 2015.

The CLaMber project in Puertollano, pursues the promotion of bio-economy in the region of Castilla-La Mancha as its main objective. The aim is to induce biofuels based on the use of industrial waste from the primary sector and contract R+D services to improve the competitiveness of SMEs in the region. CLaMber represents a total investment of 20 million euros and is 80% funded by the ERDF with funds for IVICAM (Institute of Vine and Wine of Castilla La Mancha), the Ministry of Economy and Competitiveness and Castilla-La Mancha.

Favourable factors for the sector in Spain

Macroeconomic situation
For weight of the sector in GDP (sales of companies using biotechnology respect to national GDP), the ratio continues to grow another year and reached 9.07% of GDP at constant prices (compared with 7.61% in 2012 and the low 2.91% in 2008). 88% of companies carried out some international activity, mainly in Europe and North America. (2)

Labour market
The average productivity per employee in the chemicals sector is 91,400 euros per year. Their average individual remuneration is 51,300 euros per year. The Unit Labour Cost accounts for 56.1% of the ratio between the remuneration per employee and the individual productivity (productivity defined as value added per employee). (3)

Incentives
The Centre for the Development of Industrial Technology (CDTI) finances R+D projects in four categories: Individual R+D projects, National Cooperation R+D projects, International Technological Cooperation Projects and specific announced R+D projects. Furthermore, there are other cross-sectional programmes such as the línea Directa de Innovación, the línea de Innovación Global, Innvierte and FEDER (ERDF) interconecta. Also, the ICEX-IIS Technology Fund funded by the ERDF and ICEX offers companies with foreign capital aid of up to 75% of the project to carry out new R+D+i in Spain.

I+D+I
The Spanish biotechnology companies involved in R+D+i are small: 84% of companies have fewer than 100 employees, 68% no more than 25 employees and 38% have less than 10 employees (micro), mostly spin-offs. (4)

Suppliers, Supplies, Raw materials
Biomass and municipal solid waste (MSW) are the main raw materials used by biorefineries. Spain is a country rich in both commodities. Regarding biomass, Spain generates 46 million tons annually, of which 18 million are not currently exploited. As for MSW, it is generated in homes and in Spain there were 22.4 million tons of municipal waste in 2012.

Geographic location
Spain is within reach of three main regions: the European region, the Mediterranean region and the Atlantic region. Spain is considered to be the gateway between North Africa and Europe, and a key link to Latin America, not only because of its geographical location but also because of its strong historical and cultural ties with the region. In Spain the Canary Islands play a key role with regards to maritime traffic with West Africa.

Technological and research infrastructure
The Healthcare Reputation Monitor (MRS) establishes the best public and private hospitals based on indicators such as human and material resources, number of beds, availability of basic and high-tech equipment, total admissions and average time of stay, and satisfaction with the service. The top five public hospitals are La Paz, Hospital Clinic i Provincial de Barcelona, the Gregorio Maranon, Vall d’Hebron Hospital and 12 de Octubre. The five best private centres are the Navarre University Hospital, the HM Montepríncipe, the HM Sanchinarro, the Quirón de Madrid and the Hospital Ruber Internacional. (5)

Transport infrastructure and logistics networks
There are 250 airlines operating in Spain in its 47 airports; its high-speed rail network is the 2nd best in the world and the best in Europe; it is ranked 1st in the EU for its motorway network; and it has excellent sea connections to its 46 ports distributed along the Atlantic and Mediterranean coasts. (6)