

Project no.: **038994 – (SES6)**

Project acronym: **Biosynergy**

Project title:

**BIOmass for the market competitive and environmentally friendly SYNthesis  
of bio-products together with the production of secondary enERGY carriers  
through the biorefinery approach.**

Instrument: Integrated Project

Thematic Priority: SUSTDEV 1.2.5 (Biomass)

### **D 8.1.1**

## **A technical workshop to present the lab and pilot-scale results for as far as already available.**

Proceedings of the International BIOSYNERGY Workshop on Biorefineries,  
22 June 2009, Ministry of Industry, MADRID, SPAIN

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<b>Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)</b>		
<b>Dissemination level</b>		
<b>PU</b>	Public	<b>X</b>
<b>PP</b>	Restricted to other programme participants (including the Commission Services)	
<b>RE</b>	Restricted to a group specified by the consortium (including the Commission Services)	
<b>CO</b>	Confidential, only for members of the consortium (including the Commission Services)	



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## 1. Introduction

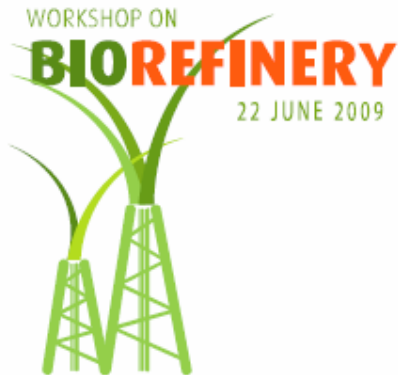
The Deliverable 8.1.1: ‘EU technical workshop to present the lab and pilot-scale results, potentially at Abengoa’s demo-site to combine it with a technical tour’; was originally due at Month 24, but, in order to maximize the impact of the workshop, it was rescheduled to month 30: June 2009. In this way it was possible to organize the workshop jointly with other major institutions and to have a higher level of invited speakers and a bigger audience. Furthermore the scope of the Workshop could be widened to cover the perspectives of biorefinery and its various aspects in the context of developments in Spain as well as in the international, European arena.

The workshop was held at the Spanish Ministry of Industry, in Madrid. The foreseen technical tour to the BCyL demonstration facility for the project consortium could not be combined with this much larger workshop and had to be scheduled on Wednesday 28<sup>th</sup> October 2009 during the 6<sup>th</sup> BIOSYNERGY Plenary Meeting in Madrid (27-29<sup>th</sup> October 2009) for attendance by the members of the BIOSYNERGY consortium and the members of the BIOSYNERGY Scientific Advisory Board. A report on the technical tour will be provided separately as D8.1.1.A.

With regards to the IP BIOSYNERGY, the goal of this workshop was to present and discuss the project results, R&D highlight and challenges with stakeholders from the public sector, industry and R&D organizations. An overview of the project and the results and (preliminary) conclusions thus far were presented by project coordinator Hans Reith in a dedicated session of the workshop with approximately 60 attendees. This presentation, entitled *Lignocellulosic feedstock biorefinery for co-production of chemicals, transportation fuels, electricity and heat – Overview of the IP BIOSYNERGY (FP6)*, by J.H. Reith, R. van Ree, R. Capote Campos, R. R. Bakker, P.J. de Wild, F. Monot, B. Estrine, A.V. Bridgwater, A. Agostini, is available at the project website.

With the very high relevance of the speakers and the round tables participants and more than 220 attendees, this workshop can be considered a major success in terms of knowledge dissemination and stakeholder involvement on the perspectives of biorefinery and its various aspects in the context of international sustainable development and the dissemination of results from the IP BIOSYNERGY.

## 2. Programme



# Workshop on Biorefinery

Madrid, 22nd June 2009  
Ministry of Industry

Organised by:



ABENGOA BIOENERGIA  
NUEVAS TECNOLOGIAS

Genoma España 





Time	Responsible	Topic
8:30		Registration
9:00	Pedro Marín Uribe (Secretary of State on Energy) Enrique Jiménez Larrea (IDAE General Manager)	Opening <ul style="list-style-type: none"> <li>Welcome to participants</li> <li>Objectives</li> </ul>
9:30	Carlos Alberto Fernández (IDAE) Ricardo Arjona (ABNT)/ Carlos Franco (CDTI)/ Joaquín Ancín (Acciona)/	<u>Round-table meeting</u>  New projects financing <ul style="list-style-type: none"> <li>US and European financing scheme</li> <li>Requirements/Features</li> </ul> Regulation – Directives on Biofuels/ Biorefinery promotion & Sustainability
11:00		Coffee / Tea break
11:30	Frederic Monot (IFP)/Hans Reith (ECN) Pablo Vera (IBMCP-UPV)/ Pablo Gutiérrez (ABNT)/ Antonia Rojas (Biópolis)	<u>Working Groups</u> (Parallel sessions)  Session 1: Biochemical biomass conversion processes <ul style="list-style-type: none"> <li>Sugars extraction from Biomass <ul style="list-style-type: none"> <li>Advanced biomass fractionation processes</li> <li>Enzymatic hydrolysis of pre-treated biomass</li> </ul> </li> <li>Sugars fermentation <ul style="list-style-type: none"> <li>C5 sugars fermentation</li> <li>C5 &amp; C6 sugars co-fermentation</li> <li>Other sugars fermentation models (ABE)</li> </ul> </li> </ul>
11:30	Tony Bridgwater (Aston University) Javier Gil (CENER)/ Francisco García (Elcogas) / Matthias Rudloff (Choren Industries GmbH)/ Jesús Arauzo (University of Zaragoza)	Session 2: Thermochemical biomass conversion processes <ul style="list-style-type: none"> <li>Thermochemical biomass treatment <ul style="list-style-type: none"> <li>Gasification</li> <li>Fast pyrolysis</li> <li>Torrefaction</li> </ul> </li> <li>Catalytic synthesis of ethanol from syngas</li> <li>New applications of Bio-oil</li> </ul>
12:00		Discussion round
13:00		Lunch

Time	Responsible	Topic
14:30	Klaus Neumann (Borregaard) / Henri Gruenbauer (DOW Chemical) / Mercedes Ballesteros (CIEMAT)/ Boyan Kavalov (JRC)	<u>Working Groups (cont.)</u> Parallel sessions)  Session 1: Bio-based products <ul style="list-style-type: none"> <li>• Potential bioproducts from biomass sugars</li> <li>• Potential bioproducts from biomass lignin</li> <li>• Market projection</li> </ul>
14:30	René Wijffels (WUR) / Yusuf Chisti (ITSPN) / Emilio Molina (University of Almeria) / Eduardo Romero (REPSOL)	Session 2: Microalgae <ul style="list-style-type: none"> <li>• CO<sub>2</sub> Capture               <ul style="list-style-type: none"> <li>• Microalgae development for CO<sub>2</sub> fixation</li> <li>• Microalgae business development: perspectives</li> </ul> </li> </ul>
15:00		Discussion round
16:00		Coffee/ Tea break
16:30	Hans Reith (Biosynergy Project coordinator)	<u>Working Groups (cont.)</u> (Parallel sessions)  Session 1: European Project on Biorefinery: IP-Biosynergy <ul style="list-style-type: none"> <li>• Project presentation</li> <li>• Main results obtained so far</li> <li>• Conclusions</li> </ul> 
16:30	Juan Carrasco (CIEMAT) / Iván Rodríguez (Ecofys) /Inés Echeverría (CENER) / Matías Llorente (Agricultural Cooperative of León)/ Sergio Ugarte (Ecofys)	Session 2: Energy Crops <ul style="list-style-type: none"> <li>• New energy crops</li> <li>• Logistic aspects</li> </ul> 
17:00		Discussion round
18:00		Conclusions of the different working groups <ul style="list-style-type: none"> <li>• Environmental perspectives of the biofuels business</li> <li>• Measures for biofuels promotion</li> <li>• Conclusions on Biofuels regulation</li> <li>• Current status of the technology</li> <li>• Short/Medium-term perspectives</li> <li>• New opportunities on biofuels development</li> <li>• Recommendations</li> </ul>
19:00		Closing

### 3. Workshop Summary

The main objectives of the workshop, organised in collaboration with **Abengoa Bioenergía Nuevas Tecnologías**, **Genoma España**, **IDAE** and **CIEMAT**, were:

- General review of the state-of-the-art of different technologies on Biorefinery
- Identification of new opportunities for the biofuel sector
- Analysis of perspectives for the development of the Biorefinery business in a short/medium/long term, and
- Evaluation of incentives in terms of financing of new projects, regulatory aspects and sustainability.

The event, which was co-organised and sponsored by CIEMAT – Centre for Energy, Environment and Technology Research through the Singular and Strategic Project “On Cultivos” of the Spanish Ministry of Science and Technology, and the Biosynergy Project, was held at the Spanish Ministry of Industry in Madrid and counted on attendance of about 200 people.

The workshop comprised several working groups devoted to each step completing any biorefinery process, from obtaining raw material, with special attention to algae and energy crops, to bio-based products synthesis, including different biochemical and thermochemical biomass conversion processes. Furthermore, a round table meeting was included with the aim of evaluating incentives for the development of biorefinery business in terms of financing of new projects, regulation and sustainability issues.

A special session on BIOSYNERGY, one of the most important projects on biorefinery supported by the European Commission through its 6th Framework Programme was also included in the programme with the aim of presenting the project itself and the main results obtained so far.

The workshop was opened by Enrique Jiménez Larrea (IDAE General Manager) and Juan Antonio Rubio (CIEMAT General Manager) who acknowledged the input of well-known experts in each working area: companies such as Abengoa Bioenergía Nuevas Tecnologías, Acciona, Elcogas, Choren Industries, Borregaard, DOW, Repsol and Ecofys; and public centres including the high level Spanish and European Universities and Research Centres: Aston University, IFP, Energy research Centre of the Netherlands, CENER, CIEMAT and the Joint Research Centre of the EC.



## 4. Proceedings

### **Round-table meeting: project financing, regulation and sustainability issues**

#### *Part 1: Financing of new projects on Biorefinery*

During this session, a comparison between different financing schemes was made. In that sense, perspectives of the European Commission and the Spanish Ministry of Innovation were analyzed. Spain and Europe support similar financing schemes, where the presence of small/medium size enterprises (SME) and public-private cooperation are well appreciated.

The composition of consortia applying for a financed project was also discussed. From the point of view of a financing entity, a good selection of partners is very important and a consortium that integrates at least one SME is sought in the majority of cases. Participation in integrated projects makes possible to promote innovation and technology development carried out by SMEs, but the most difficult hurdle to overcome is to make SMEs aware of the positive help that subsidies entail, which are intended to support the extra risk that such enterprises assume. On the other hand, from the point of view of an enterprise applying for a financed project, the selection of members of the consortium highly depends on the state of maturity of the technology being developed. In the case of immature technologies, for which research and development are needed, the presence of public research centres is very important, since they provide the scientific basis that the technology needs to be developed, whereas scale-up to commercial size and market implementation of well-developed technologies is a major challenge that only specialised industrial enterprises are able to face.

#### *Part 2: Regulation and sustainability issues*

Regulation and sustainability issues were discussed during the second part of the round-table discussion. The role of the new European Directive on Promotion of Use of Renewable Energy Sources (2009/28/EC) as well as the relationship between first generation (1G) and second generation (2G) biofuels were presented.

Definitely, the new European Renewables Directive demands high support to the biofuels industry, especially due to the fact that 2G bioethanol counts double in terms of energy use from renewable sources. However, this fact is not enough to promote the development of 2G bioethanol. From the point of view of the panel of experts, well defined regulation is clearly a necessity. First generation bioethanol production has not been sufficient to fulfil the objectives of the first European biofuels directive of 2003 and therefore research and development on 2G Bioethanol is definitely needed. To regulate biofuels is probably not easy, but from the standpoint of the panel of experts, there is still work to do to completely define the regulation framework of the bioethanol business.

With regard to the question about the relationship between 1G and 2G bioethanol, the panel of experts agreed for the need of continued work on 1G bioethanol and for development of 2G. 1G bioethanol has created a market, demand and regulation that has open opportunities to 2G bioethanol. Moreover, diversity of raw materials for a technology under development (i.e. lignocellulose) should lead to reduction of risk.

## **Working group: Biochemical biomass conversions processes**

### *Viability of second generation biofuels: round table conclusions:*

It is believed that second generation technologies should be viable as long as they are further developed. The viability highly depends on the framework in which they are developed, e.g. market, support my means of legislation and financing, etc. Development of suitable raw materials supply chains is very important as well and of course environmental aspects such as sustainability.

The situation in the United States is far different from Europe. There are currently 8 projects for demonstration of 2nd generation technologies aimed at the construction of 4 industrial facilities, whereas in Europe, from the point of view of members of the panel, support seems to be a lot less,. Nevertheless, there are different drivers in the USA and Europe, which makes the respective situations different.

### *Main bottlenecks of the technology*

There are some different but very important bottlenecks to be overcome:

- Raw material market and logistics
- Energy efficiency of the pretreatment step
- Enzyme development and cost
- Knowledge of the cell wall constitution – from which suitable raw materials can be obtained for the biorefinery processes (Raw material design)
- Improvements in separation technologies and increased energy efficiency

It is expected that current biochemistry tools will help to overcome these difficulties.

### *Diversification of products*

Diversification of products is desirable; however, it is important that the different products obtained from the biorefinery have a well known market when when produced on a large scale.

## **Working group : Thermochemical biomass conversion processes**

### *Conclusions*

Fast pyrolysis conclusions:

- Pyrolysis is of particular interest due to its flexibility and potential utilisation of all products.
- It provides a liquid/bio-oil for storage and/or transport as an energy carrier or fuel
- Decentralised pyrolysis plants can improve overall system performance
- Pyrolysis bio-oil can be used directly as a fuel; for chemicals; or transport fuels
- Fast pyrolysis technology should be improved to reduce costs and increase bio-oil yield and quality
- Fast pyrolysis bio-oil upgrading should be further developed and demonstrated on large scale

Gasification conclusions:

- The minimum scale of gasification and cleaning has not been demonstrated
- Gas cleaning is a significant technical and economic challenge due to:
  - Biomass contamination.

- Mixed / variable feedstocks require gas cleaning for the most extreme contaminants.
- Clean and consistent energy crops are favoured, but face increasing competition (due to land use considerations)
- In all cases, economies of scale and feed costs dominate biofuel product costs
- Co-processing with coal is an interesting possibility and has been demonstrated.
- For development, large scale thermal gasification and gas cleaning & conditioning needs to be demonstrated
- For biofuels, small scale hydrocarbon synthesis should be developed and demonstrated
- Develop integrated Biorefineries
- Improved catalysts are needed for fuel production
- Reduce costs
- Gasification and pyrolysis can be complementary

Economy of scale and feed cost dominate bioenergy and biofuel applications so technology and biomass cost are critical

### *Questions & answers*

#### Q1 Gasifier choice

*Entrained flow and circulating fluid bed gasifiers are alternative technologies, but there is no consensus on their relative merits. What is their medium term potential?*

- Agreement that entrained flow is “better” due to lower tar and experience from coal processing.
- Feedstock pretreatment is necessary but justified by benefits.
- Co-processing experience with coal have highlighted benefits at Buggenum and Puertollano
- Biomass availability might limit size unless decentralised pre-treatment is used.

#### Q2 Economy of scale

*How is the economy of scale affected for each technology?*

- Higher complexity e.g. Fischer Tropsch, requires larger scale of operation to justify cost
- Biomass availability may limit size and restrict economy of scale
- There are limits to economy of scale as some equipment items reach a practical upper size limit for construction, but this is unlikely for biomass
- Gasifier size limits are well known
- Fast pyrolysis limits are probably 250 t/d for technical limitations
- Multiple units offer operating benefits so economy of scale is not so important

#### Q3 Feed flexibility

*How flexible are different feedstocks and how interchangeable are they?*

- Flexibility will be important as biomass supplies become scarce
- Flexibility creates problems in feeding and gas cleaning as the design has to account for the most extreme feeds and gas qualities, thus increasing cost.
- Gasifiers dedicated to specific feeds or feed mixtures are likely
- Co-processing will become more important for stability and economy of scale.

#### Q4 New synthesis routes

*What are the prospects for new biofuel synthesis routes and what are the medium term prospects?*

- Need fuels that are entirely compatible with gasoline, diesel, and kerosene
- Catalyst developments are required that are more selective and/or higher yielding
- Matching catalysts to biomass derived gas characteristics offers advantages
- For contaminants, chlorine seems to be a serious problem, although solutions are available.
- Downscaled processes offer better matching to biomass supplies and will need modified or new processes.

#### Q5 Biochemical & Thermochemical

*What are the synergies between biochemical and thermochemical conversion and how well developed are they?*

- Biochemical processes can readily tolerate wet materials for processing, whereas thermochemical processes require dry feed materials.
- The potential for biological processing of side streams and residues must not be overlooked; and similarly for thermal processing of side streams and residues.
- A good example is lignin from lignocellulosic bioethanol production which can be processed into a variety of products.
- Biorefineries will help to ensure that integration is optimised.

#### Q6 Bio-oil to replace crude oil

*Can bio-oil from fast pyrolysis be considered a sustainable substitute for crude oil?*

- Bio-oil is an intermediate energy carrier in processes for electricity and biofuel production.
- It can be upgraded to hydrocarbons and oil refineries offer the benefits of economy of scale and experience for refining to marketable products
- It can be gasified and to create building blocks/intermediate feedstocks for the chemical industry
- In the long term, bio-oil can be considered a replacement for crude oil.
- The widely held negative concerns about bio-oil need to be addressed to improve understanding and awareness of the reality.

### **Working group: bio-based products**

#### *Conclusions*

- Biobased products refer to non-food products derived from biomass (e.g. plant residues, algae, bacteria, trees, etc).
- Biorefinery: fractionation of biomass allows processing to an optimized products mix based on:
  - Biochemicals
  - Biomaterials
  - Biofuels
  - Bioenergy
- Ligno-cellulose materials contain 50-80% carbohydrates and 10-30% lignin

- 50% penetration of biomass products is the maximum expected in the market.
  - There is a big market for lignin to be used for plastic production
  - Lignin can be used to produce vanillin and modified lignin (already achieved in Borregard).
  - Biorefining has a lot of solutions to offer:
  - How should we use fossil oil today ?:
    - Flexible (conventional transport): 30% ?
    - Stationary: 70% ?
- We do not need to use fossil carbon for this 70% stationary application as we can use renewable alternatives; for the other 30% we do need to use this carbon, but to produce plastics, etc.
- Opportunities for integration; this is a way to save costs; this issue needs to be developed in the industry; this is the main challenge.
  - Regulators should look for a biomass strategy and to determine which technologies are and are not sustainable. Big issue.
  - Incentives are needed for costumers and producers so bio-based products are competitive.
  - Bio-based products can compete with fossil-based products, and in so doing would reduce the carbon footprint.

#### Questions:

1. *Mercedes Ballesteros, CIEMAT*: Advantages and disadvantages are the same: the wide range of technologies and raw biomass materials available. We could substitute ANY fossil product with bio-based products. But for that, we should be able to develop the technology. We need to specify the product and thus, the technology desired. Sectors involved in the biomass production are diverse (agricultural, industries, etc.) need to be coordinated. There are so many people involved in the fossil chain. There are many kinds of biomass raw material (therefore many compositions) as opposed to the crude oil (with relatively homogenous composition) We can also obtain many products from biomass materials. The protein industry needs to be developed. Biomass processing requires big plants with complex technology. The use of the biomass needs to be determined and fixed. Bio-based products can make the global process more economically appealing. Limited biomass quantity when scale up is performed.

*Henry Gruenbauer, DOW*: There is no point in being just green; you also need to be economically competitive. We can obtain better products or cheaper products. “People don’t buy green: people buy on cost”. You have to meet the quality criteria, you have to overcome the seasonal production of the raw material, you have to handle you biomass (logistics). The drivers are cost and value.

2. *Mercedes Ballesteros, CIEMAT*: It is difficult to predict which will be the most successful product as there are many. The big challenge is to process the lignin to get different valuable products (they also have the biggest impact).

*Boyan Kavalov, JRC* : Targeted markets: not to replace but complement fossil-based products. Lignin has some uncertainties in the way it should be processed.

*Henry Gruenbauer*: Enzymatic breakdown of materials is the one that has the most optimistic future.

As we are a very small part of the whole transport fuels producer market, the oil producers control the price. So finally they control the feedstock costs. Regulators should incentivise the production of biomass. Petrol dependence for chemical products is carrying bio-based products producers to avoid petrol as raw material.

3. *Mercedes Ballesteros*: Integration is the first challenge; we should integrate the complete production chain. Also coordinate all the industries involved in the production chain. Those industries worked separately in the past and now they have to work together.

*Boyan Kavalov*: Challenges: research and development. You do not normally know what you are going to sell and the price in the market. Patents can also be a bottleneck as they constrain the spread of the knowledge.

*Henry Gruenbauer*: Commercialization should be better. Regulation should be as tough as possible. Conversions efficiencies should be improved. Feedstock quality and control can also be bottlenecks.

## **Working group : Microalgae**

### *Conclusions*

- Energy requirements have the greatest impact on biomass price.
- Productivity is key to improve profitability of the microalgae business. However, it is necessary to improve the photosynthetic yield by means of metabolic engineering and genetics.
- Taking into account the economy of scale and potential improvements the biomass price could decrease from 4 €/kg to 0,4 €/kg
- Microalgae offer a great potential, although technology is still immature
- Development still requires important R&D programmes

## **Working group: IP BIOSYNERGY**

The overall goal of the Integrated Project BIOSYNERGY (2007-2010) is to develop sound techno-economic processes (from lab-scale to demonstration at pilot-scale) for integrated production of fuels, chemicals, power and heat from lignocellulosic biomass. The aim is to

develop integrated, synergetic biorefinery concepts, using advanced fractionation and conversion processes, and combining biochemical and thermochemical pathways. Furthermore the project will identify the most promising biorefinery chains for Europe based on energy efficiency, environmental performance, socio-economic aspects and costs.

The project budget is EU€ 13.4 million and is supported with a grant up to EU€ 7.0 million by the European Commission through its Sixth Framework Programme under contract number 038994 – (SES6). The project is performed by a consortium comprising 17 partners from industry, research institutes and universities from 10 EU countries, coordinated by ECN. The project started on the 1st of January 2007 and has a duration of 48 months.

The IP BIOSYNERGY places particular emphasis on valorisation of residues from cellulose ethanol production. The assessed feedstocks include wheat straw and soft and hard wood as representatives of major European biomass streams.

The presentation in the workshop highlighted the objectives, the partnership, an outline of the R&D and the preliminary results of the IP BIOSYNERGY approximately half way in the project life cycle. At the current stage of the project the following preliminary conclusions can be drawn.

- The Research and Technological Development in the IP BIOSYNERGY shows good progress and provides a basis for large-scale valorization of C5 sugars and lignin. In the final project phase scale-up is planned for several conversion routes.
- Development of integrated lignocellulose biorefinery technology combining bioprocesses, chemical processes + Combined Heat and Power production offers good perspectives to fully exploit the potential of lignocellulose feedstocks.
- Pretreatment and enzymatic hydrolysis are critical process steps for fractionation and important cost drivers in the biorefinery and therefore for the quality of the end products and overall techno-economic feasibility.
  - Pretreatment technologies need to be optimised toward a particular goal.
  - Enzymes are a major processing tool in the lignocellulose biorefinery. Further development and cost reduction are needed.
  - Integrated development of the trajectory feedstock-pretreatment-hydrolysis-fermentation is required.
- Lignin valorization (at least in part) to chemicals is an important tool for economic profitability and for reduction of the carbon footprint of a lignocellulose biorefinery. Within the IP BIOSYNERGY the direct application of (organosolv) lignin and enzymatic lignin conversion show promising results for lignin valorization.
- Separation technology development is vital for both biochemical and thermochemical processing technologies
- Development of integrated biorefinery processes including chain optimisation forms a major success factor and is also one of the major challenges. This includes technical process integration but also the integration of environmental and socio-economic aspects.

For more information, publications, workshop proceedings and other dissemination activities please consult the project website: [www.biosynergy.eu](http://www.biosynergy.eu) or approach project coordinator Hans Reith, ECN via [reith@ecn.nl](mailto:reith@ecn.nl)

#### 4. List of participants

Name	Surname	Company
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Rafael	Miguel	GAIKER
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Pablo	Gutiérrez	ABNT
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Henri	Gruenbauer	DOW Chemical
Mercedes	Ballesteros	CIEMAT
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Tony	Bridgewater	Universidad de Aston
Matthias	Rudloff	Choren Industries GMBH
René	Wijffels	WUR
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Sergio	Ugarte	ECOFYS
Matías	Llorente	Cooperativa Agraria de León
Iván	Rodríguez	ECOFYS
Javier	Gil	CENER
Jesús	Arauzo	Universidad de Zaragoza
Antonia María	Rojas	Biópolis
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Cayetano	Hernández	Iberdrola
José	Causí Rielo	ASPAPEL
Fernando	Sánchez Sudón	CENER
Armengol	Grau Franquet	RESA
Antonio	Canseco	FUELEC
José	Andrés Martínez	PRADO Energía y Medio Ambiente
Cristina	Pérez Molinero	Acciona Biocombustibles, S.A.
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Miguel	Vega	Genoma España
Belén	Gilarranz	Genoma España
Emilia	Gómez Pardo	Genoma España
Mercedes	Escribano	Genoma España
Olga	Ruiz	Genoma España
Luis	Martín	Genoma España
Marta	Tortajada	Biópolis
Maria	Fé Elía	CEPSA
Borja	Izquierdo	CDTI
Enrique	Torres Espejo	Telvent Energía
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Bruno	Díez	ABNT
Tom	Elgin	ABBK
Maria Ángeles	Gutiérrez	ABNT
Jesús Yañez	Vidal	ABNT
Rocio Garcia	Encinas	ABNT
Nieves	Valenzuela	ABNT
Francisco	Reyes	ABNT
Maria	Piera	ABNT
Jesús	López López	ABNT
María	Díaz Muruaga	Befesa
Vanessa	Ramos Garcés	Befesa
Francisco	Salazar	Telvent, GIT
Fernando	Martínez Salcedo	Abengoa
Beatriz	Alonso Martínez	ABNT
José Caraballo	Bello	ABNT
Mario	Ramos Sanchez	ABNT
Juan	Luis Sanz	ABNT
Carlos	Sánchez Pérez	Abengoa
Juan José	Lallave García	Abengoa Bioenergía
Thelmo Alejandro	Lu Chau	USC
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Ignacio	Sahuquillo	Abengoa Bioenergía
Jose Luis	Pardo Rodriguez	ABNT
Alvaro	Martin de Agar y Ruiz	ABNT
Yolanda	Peña	ABNT
Pedro	Ollero	Universidad de Sevilla
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Mª José	Negro Álvarez	CIEMAT

José Miguel	Oliva Domínguez	CIEMAT
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Alberto	González Sáez	CIEMAT
Felicia	Sáez Angulo	CIEMAT
Elia	Tomás Pejó	CIEMAT
Pablo	Alvira Iraizoz	CIEMAT
Ignacio	Ballesteros	CIEMAT
Paloma	Manzanares	CIEMAT
José María	Toro Trujillo	Genoma España
Alicia	González Céspedes	CAJAMAR
Elena	Campos Sánchez	IBMCC – CSIC
Rita	Almela	Caixa Capital Risc
Gloria	de la Viña	Corporación Tecnológica Andaluza
Pablo	Rodríguez Palenzuela	Centro de Biotecnología y Genómica de Plantas UPM-INIA
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Francisco Javier	Gutiérrez	CARTIF
Juan Manuel	Antolín	CARTIF
Belén	Alonso	Lewis
Elena	de la Cal	Lewis
Susana	Herranz	Infoenviro
Antonio	Muñoz	Público
María	Pérez Fernández	Inabensa
Raquel	Díaz Molist	ABNT

## 5. Annex I: Presentations

The following workshop presentations are available in the Biosynergy website ([www.biosynergy.eu](http://www.biosynergy.eu))

- Biochemical biomass conversion processes (Frederic Monot - IFP)
- Thermochemical biomass conversion processes (Tony Bridgwater – Aston)
- Bio-based products (Klaus Neumann – Borregaard)
- Microalgae (Rene Wijffels – WUR)
- Energy Crops (Juan Carrasco – CIEMAT)
- Lignocellulosic feedstock biorefinery for co-production of chemicals, transportation fuels, electricity and heat – Overview of the IP BIOSYNERGY (FP6) (Hans Reith – ECN on behalf of the BIOSYNERGY Consortium)

## 7 Annex II: Organising entities

**Genoma España** is a non-profit organization dependant on the Spanish Ministry of Science, Innovation and Health whose aim is to promote research and development on Genomics and Proteomics in order to improve health and life quality.

**Institute for Energy Diversification and Saving**, which is a public body dependant on the Spanish Ministry of Industry, Tourism and Trade whose aim is to promote energetic efficiency and strategies for energy saving.

Sponsor and co-organising entity: **CIEMAT** – Centre for Energy, Environment and technology Research, through the Singular and Strategic Project “On Cultivos” supported by the Spanish Ministry of Science and Technology

**Joint Research Centre (JRC)** on behalf of the BIOSYNERGY consortium, is a service of the European Commission whose mission is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of European Union policies. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.