



# cascatbel

## D10.5 Highlights of CASCATBEL's annual progress for public dissemination

### Version 1.0

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## 1. SUMMARY

This public deliverable summarizes the objectives and achievements of the project in its first 12 months of activity. This is a separate document from the First Periodic Report that is due at the end of the first period.

## 2. PROJECT OBJECTIVES, WORK PROGRESS AND ACHIEVEMENTS AND PROJECT MANAGEMENT

### 2.1 Project description

CASCATBEL aims to design, optimize and scale-up a novel multi-step process for the production of second-generation liquid biofuels from lignocellulosic biomass in a cost-efficient way through the use of next-generation high surface area tailored nano-catalysts. On the one hand, the sequential coupling of catalytic steps will be an essential factor for achieving a progressive and controlled biomass deoxygenation and reduce hydrogen consumption, avoiding the previously highlighted problems that hinder one/two-step bio-oil upgrading processes. On the other hand, the use of tailored nano-catalysts will allow optimising reaction yields (increasing liquid yield and preventing bio-oil contamination) and facing limitations of current catalysts in terms of selectivity and deactivation rates. Finally, the scaling up of the process will be important for fully exploring and understanding the catalytic and reaction dynamics, assessing catalysts life-cycles and demonstrating the viability of the CASCATBEL process in relevant environments, from both technical and economic perspectives.

The strategy proposed in CASCATBEL will lead to the preparation of advanced biofuels having composition and properties very similar to petroleum-derived fuels. This is a very relevant advantage regarding the commercial implementation of this technology, as it would not require any significant changes in the already existing infrastructures and engines.

CASCATBEL activities are structured in eleven work packages (WP) that are tightly linked to each other as shown in Figure 1.

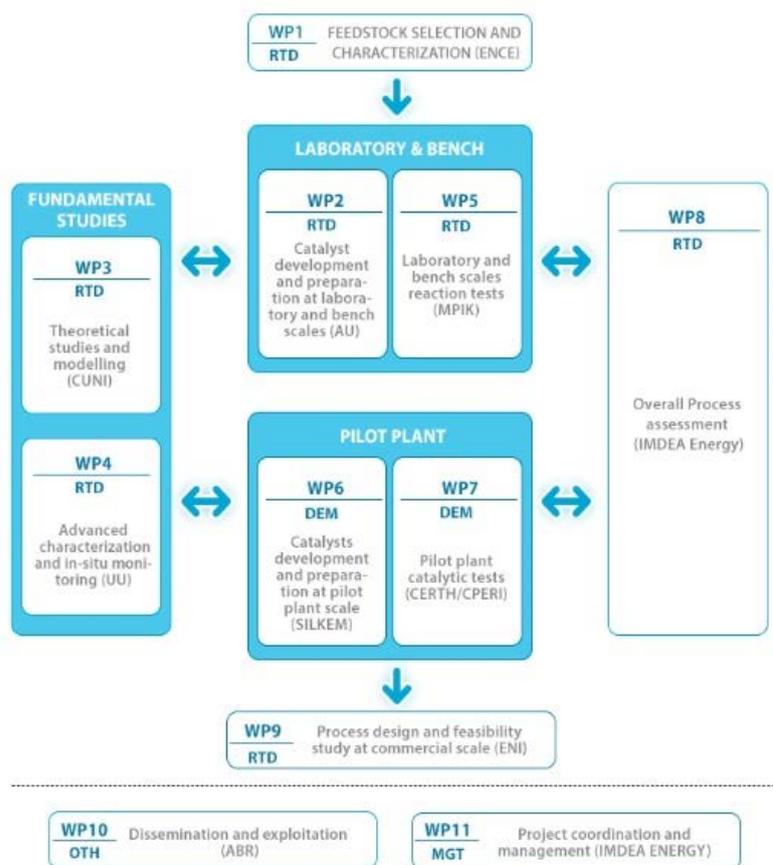


Figure 1 Work programme

## 2.2 Project objectives for the first year of the project

During this first year of execution, CASCATBEL aimed at the objectives summarized in Table 1.

Table 1 Objectives of the CASCATBEL Project during the first year

OBJECTIVE	DESCRIPTION	DELIVERABLES/MILESTONES
<b>O1</b>	To set up the basis for the correct dissemination of the project results to scientific and general public as well as to foster relations with stakeholders.	D11.1 Project website. D10.1 Dissemination plan. D10.4 Summer School.
<b>O2</b>	To lay the foundations for project results exploitation by facilitating its protection, analysis and transfer.	D10.2 Standardization plan. D10.3 Industrialization plan.

<b>O3</b>	Selection of six different raw materials representative of the resources readily available across Europe.	D1.1 Report on the availability of biomass resources in the EU. D1.2 Supply and characterization of six representative biomass types MS1 Representative biomass types.
<b>O4</b>	Definition of the non-catalytic pyrolysis as the reference process for further comparison with the catalytic pyrolysis outcomes at lab scale.	D5.1 Report on the biomass pyrolysis tests at laboratory scale. D8.1 Assessment of the reference process.
<b>O5</b>	Selection of the most adequate biomass pretreatment and bio-oil stabilization method.	D8.2 Assessment of the results obtained at laboratory scale in biomass pyrolysis to aid in the selection of the biomass pretreatment and bio-oil stabilization methods. MS2 Biomass pretreatment.

In addition to the above mentioned objectives, some goals related to the project management have been also targeted:

- Creation of a committees-based management structure.
- Stablish efficient communication procedures within the consortium.
- Put in place effective monitoring and supervision mechanisms.
- Generate and promote a fruitful cooperation atmosphere.

### 2.3 Work progress and achievements

Eight out of the eleven WPs started their activities in the first year of the project and one of them was completed before the end of that period. In the following lines the progress and achievements of each of those WPs is summarized.

#### WP1- Feedstock selection and characterization

WP1 was successfully completed on the eight month of the project. This WP was devoted to the analysis of the European context of biomass availability and to the selection and characterization of the optimum raw materials for bio-oil production. For the bioresource-assessment different types of lignocellulosic biomass were taken into account for each of the nine representative countries:

- Forestry residues
- Agricultural crop residues
- Energy crops
- Industrial wood residues and waste

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Impact, cost, availability and chemical composition of different lignocellulosic species were studied and compared. Finally 2 forestry residues, 1 agricultural residue and 2 energy crops were selected for use in the project (milestone MS1).

WP1 has been led by ENCE I+D ([www.ence.es](http://www.ence.es)) and it has involved three other partners: IMDEA Energy ([www.energy.imdea.org](http://www.energy.imdea.org)); Outotec ([www.outotec.com](http://www.outotec.com)); TUHH Technische Universität Hamburg– Hamburg ([www.tuhh.de](http://www.tuhh.de)).

### **WP2- Catalyst development and preparation at laboratory and bench scales**

This WP is oriented to the synthesis and basic characterization of the catalyst samples to be tested in the different chemical reactions considered in the cascade process. Most of the catalytic systems are materials that have been recently developed, for with the proof of concept has already been demonstrated. During this first year of WP2 activities, a large number of catalyst samples have been synthesized and characterized, as well as exchanged between the partners.

### **WP3- Theoretical studies and modelling**

Only Task 3.1 of this WP was programmed to start in the first year of the project. This task aims at defining the basic DFT model for describing theoretically a number of catalytic systems selected as representative of those employed at laboratory and bench scales. During this year, accurate models have been developed. Three scientific publications have resulted from the theoretical investigation of zeolites based catalytic systems.

### **WP4- Advanced characterization and in-situ monitoring**

Task 4.1 was launched on the third month of the project. This task is oriented to monitor in-situ and characterize the catalytic systems to be employed at laboratory scale. The final goal is to feed back into WP5 the resulting quantitative structure-function relations in order to optimize the concentration and stability of the desired active sites.

FTIR spectroscopy + UV-VIS Spectroscopy and In-situ monitoring by operando XAS are some of the techniques that have been already applied to CASCATBEL's catalytic systems.

### **WP5- Laboratory and bench scales reaction tests**

In order to evaluate the different biomass feeds selected in WP1 and to investigate on different and effective separation methods of char microparticles and metals in bio-oil and biomass pretreatments methods, different tests at laboratory scale have been performed. The best pretreatment treatment has been selected (milestone MS2).

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### **WP8- Overall process assessment**

The first task of this WP is oriented to the definition of the model scheme for the process developed in the project as well as those corresponding to traditional processes that are used as reference. The process assessment has been performed taking into consideration a variety of criteria such as technical, cost, environmental and toxicological criteria. Assessment reports are critical for the catalyst selection. Assessments of the reference project as well as of the results obtained at laboratory scale in biomass pyrolysis are the subjects of the two first deliverables of this WP.

### **WP10- Dissemination and exploitation**

The dissemination and communication activities carried out within this period are detailed in Section 3.

Regarding the exploitation activities a preliminary exploitation plan has been drafted and will be updated at the end of the project. In order to evaluate the exploitability of the results and the normative applicable to the process, a deep study on existing related standards and regulation gaps has been developed. Both, the industrialization plan and the standardization plan were presented as deliverables of the project.

### **WP11- Financial and administrative management.**

Main management activities were oriented:

- To create an effective project management structure.
- To ensure efficient communication mechanisms within the consortium partners.
- To organize the information of the project.
- To synchronize the efforts of the WPs with the project time schedule, and to supervise the overall activities and ensure the proper level of coordination and cooperation within the consortium.
- To compile technical deliverables.
- To develop and sustain quality control procedures for the delivered documentation.

During the first Governing Board meeting, the structure and composition of the Committees was established and, in order to facilitate the communication and information exchange within the consortium, a website was launched at the beginning of the project.

In addition to the Kick-off meeting, a first Governing Board (GB) meeting was held in Hamburg on the 27<sup>th</sup> of February, 2014. A second GB was held in Zurich during the 29<sup>th</sup> and 30<sup>th</sup> of October, 2014. Those meetings served to review the activities carried out up to that moment and to organize the actions of the next period. Besides, decisions on milestones MS1 and MS2 were made.

## 2.4 Deliverables and Milestones

The following table shows the Deliverables and Milestones that have come out from CASCATBEL activities during this first year of implementation.

Table 2 Deliverables and Milestones

DELIVERABLE	TITLE	DELIVERY DATE
D11.1	Project Website	31/01/2014
D10.1	Updated Dissemination plan	31/01/2014
D1.1	Report on the availability of biomass resources in the EU	28/02/2014
D10.2	Standardization Plan	31/03/2014
D10.3	Results exploitation strategy	31/03/2014
D 1.2	Supply and characterization of six representative biomass types	30/06/2014
D10.4	Summer school for training of young researchers on biomass conversion technologies	30/06/2014
D5.1	Report on the biomass pyrolysis tests at laboratory scale	30/09/2014
D8.1	Assessment of the reference process	31/10/2014
D8.2 a)	Assessment of the results obtained at laboratory scale in biomass pyrolysis to aid in the selection of the biomass pretreatment and bio-oil stabilization methods. (Part I)	31/10/2014
MS1	Representative biomass types	28/02/2014
MS2	Biomass pretreatment.	31/10/2014

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### 3. DISSEMINATION AND COMMUNICATION ACTIVITIES

#### 3.1 Project Website

The project website is the space where CASCATBEL project's members, aims and achievements are openly accessible to the general public and stakeholders. It represents a mainstay of the dissemination strategy, given that it serves as a platform to amplify the impact of the dissemination activities.

The private site is accessible to partners by logging in through the intranet access page of the main web portal. This site provides a tool for project management, internal communication between partners and document management. Besides, it serves as an information pool ensuring the availability of updated information to the consortium members.

#### 3.2 Dissemination plan

The dissemination plan is a strategic document of the project that provides an overview of the strategies for dissemination. A successful dissemination of the project achievements helps to create opportunities for collaboration and prepares the ground for the subsequent exploitation of the results.

At the beginning of the project, a dissemination plan was prepared aiming to present the key aspects of the dissemination approach including target stakeholders, message, channels and timing selection. It also contained guidelines for project partners on effective communication as well as procedures to be followed in this framework. Finally, a work plan of the dissemination activities is included.

#### 3.3 Scientific publications

Five CASCATBEL's scientific works have already been published in different peer reviewed journals:

- **Two-Dimensional Zeolites: Current Status and Perspectives**

Wieslaw J. Roth, Petr Nachtigall, Russell E. Morris and Jiří Čejka  
Chemical Reviews, 114 (2014) 4807. ACS Publications

- **Computational Investigation of the Lewis Acidity in Three- Dimensional and Corresponding Two-Dimensional Zeolites: UTL vs. IPC-1P.**

Ho Viet Thang , Miroslav Rubeš , Ota Bludský , and Petr Nachtigall  
J. Phys. Chem. A , 118 (2014) 7526. ACS Publications

- **Theoretical investigation of layered zeolites with MWW topology: MCM-22P vs. MCM-56**

M. Položij, Ho Viet Thang, M. Rubeš, P. Eliášová, J. Čejka and P. Nachtigall  
Dalton Transaction, 43 (2014) 10443

- **Ketonization of Carboxylic Acids in Biomass Conversion over TiO<sub>2</sub> and ZrO<sub>2</sub> Surfaces: A DFT Perspective**

Gianfranco Pacchioni  
ACS Catal., 2014, 4, pp 2874–2888

- **Hydroxyapatite, an exceptional catalyst for the gas-phase deoxygenation of bio-oil by aldol condensation**

E. G. Rodrigues, T. C. Keller, S. Mitchell and J. Pérez-Ramírez  
*Green Chem.*, 2014, Advance Article  
First published online 02 Sep 2014

### 3.4 Oral communications

Two oral presentations about CASCATBEL were made in two relevant events:

- GENERA, Energy and Environment International Trade Fair 2014 (8<sup>th</sup> of May 2014) -
- EMTECH, Emerging Technologies for Chemicals and Fuels production 2014 (1<sup>st</sup> July 2014).

### 3.5 Summer School

The three-days Summer School took place from 8<sup>th</sup> to 11<sup>th</sup> of June. Castle Liblice in Czech Republic was chosen as the venue of the School as it brings optimum place for such school providing all necessary options including modern lecture hall, number of rooms for speakers and participants as well as other services. The main goals of the School were to summarize the up-to-date knowledge of the development of new catalysts for biomass transformations, to discuss the appropriate routes in biomass upgrading, and to propose new ways for biomass utilization.

This event mainly targeted young (predoctoral and postdoctoral) researchers involved in the CASCATBEL consortium, although it was also open to young researchers from other groups and institutions external to the project interested in this topic.

The Summer School focused on reviewing the main catalytic transformations currently under development for biofuels production, highlighting the relevance of controlling and tuning catalyst properties to optimize performance towards the complex feedstock mixtures typically present during biomass conversion.

The program consisted of 12 Plenary lectures, 12 short oral presentations of PhD students and postdocs, and 16 posters. Prof. Jiří Čejka (J. Heyrovsky Institute) and Prof. D. Serrano (IMDEA Energy) organized this Summer School attended by 75 students and 12 renowned lecturers from the biomass world.

### 3.6 Networking

With the aim of exploding synergies with different groups working on thematic areas related to CASCATBEL, the project has joined the following clusters:

- **Nanosafety cluster:** The goal of this cluster is to maximise the synergies between the existing FP6 and FP7 projects addressing all aspects of nanosafety including toxicology, ecotoxicology, exposure assessment, mechanisms of interaction, risk assessment and standardisation.

- **European cluster on catalysis:** The main aim of this initiative is to better integrate fragmented activities in Europe, create synergies between European projects and provide input on potential future catalysis-related research to the European Commission.

- **Engineering and upscaling cluster:** This cluster intends to: identify common interests (scientific, technical and commercial) in on-going research and innovation activities; support policy making ; identify methods to support and strengthen dissemination activities of the projects of the cluster; help projects to support their individual and common innovation and exploitation activities.

In addition, and in order to approach stakeholders and related project managers, CASCATBEL was present at the 6<sup>th</sup> Stakeholder Plenary Meeting of the European Biofuels Technology Platform.

### 3.7 Newsletter

Two issues of CASCATBEL's electronic newsletter have been distributed among more than 250 stakeholders. Besides, the newsletters have been made available for download from the project's website and their publication has been announced through the LinkedIn page of CASCATBEL.

### 3.8 Leaflets

Two informative leaflets have been prepared and distributed within this period. A first leaflet was oriented to disseminate the organization of the Summer School.



Figure 2 Summer School Leaflet

Another leaflet giving information about the project goals, partners and key data was prepared and distributed at the 6<sup>th</sup> Stakeholder Plenary meeting of the European Biofuels Technology Platform.



Figure 3 CASCATBEL Leaflet

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### 3.9 General Public Communications

CASCATBEL has appeared in various publications and events oriented to the dissemination of scientific activities to the general public. For instance:

- Biorrefineria.blobspot.com.es – Biorrefineraías: 2014-08\_BIO-OIL (3ª parte).
- IMDEA Energy Website
- [www.energynews.es](http://www.energynews.es)
- [www.energias-renovables.com](http://www.energias-renovables.com)
- [www.europapress.es](http://www.europapress.es)
- [www.biofuelstp.eu](http://www.biofuelstp.eu)
- [www.huelvainformacion.es](http://www.huelvainformacion.es)
- [mostolestecnologico.es](http://mostolestecnologico.es)
- Diario Torredonjimeno
- [www.lct.ugent.be](http://www.lct.ugent.be)
- [www.inorganic-chemistry-and-catalysis.eu](http://www.inorganic-chemistry-and-catalysis.eu)
- [www.zeo4.info](http://www.zeo4.info)
- AENOR - Estandarización en el Horizonte 2020 - Workshop

## 4. GOALS AND OBJECTIVES FOR THE NEXT YEAR

According to the project chronogram, seven WPs will be running during 2015. The scientific work will be oriented to the synthesis and characterization of new catalysts conducting to an efficient upgrading of the bio-oil. Catalytic pyrolysis experiments will be upscaled to bench scale tests. Ten deliverables are expected to be prepared and two milestones achieved. A more intensive scientific articles production is projected for this period.

## 5. CONCLUSIONS

During this first year, CASCATBEL has achieved its set objectives within the designed time frame and no significant deviation has been detected. The mechanisms established for management, communication and quality control have proved to be effective. In general, sound planning and high quality and proactive consortium members have been the keys for a successful implementation of the project.