



# BIORENEW Integrated Project (NMP2-CT-2006-026456) Coordinated by CSIC

**Angel T. Martínez and Ana Gutiérrez**  
*Project Coordination, CIB and IRNAS, CSIC*





## ***Industrial Biotechnology EU project (BIORENEW) Coordinated by CSIC***

### *Content:*

- ✓ *General aspects:* *EU research area, IP general information, Objective and Partners*
- ✓ *Project description:* *Wood biorefinery, Oxidative enzymes, Novel biocatalysts, Novel bioprocesses, New products, Future contributions and Summary*
- ✓ *Project organization:* *Formation of the Consortium, Workplan structure, Management, Budget, Consortium Agreement (and Evaluation)*



### NMP-2004-3.4.4.3 - Mastering “Industrial Biotechnology” - Environmental Technology for sustainable production of added value products

As referred to in the Environmental Technology Action Plan (ETAP), “**industrial biotechnology**” can play an important role in the development and validation of **sustainable production systems** that integrate activities such as research at molecular level (site directed application of biocatalysts), renewable raw materials as **feedstock** and their transformation /conversion processes. Future production routes must **substitute non sustainable** conventional processes **by bioprocesses** under inherently safe and controlled conditions, for the conversion of **renewable raw materials** into non food **added value bio-based products**. The focus would be on **surfactants** and **speciality polymers**.

The expected IPs, having a strong **industrial leadership**, should encompass innovation related activities, like identification of environmental benefits and **life cycle** costing of **bio-based products** and **processes**.

The integration efforts ranging from the **nano-scale level** up to industrial **engineering**. **Particular attention should be given to the improvement of enzyme activity and substrate specificity** for both tuning the reaction and reducing the number of processing stages.

## CSIC Projects related to **BIORENEW** under FP2-FP5

✓ **"Fungal metalloenzymes oxidizing aromatic compounds of industrial interest"** (Pelas, 2000-04, coordinator: CIB, companies: Beldem and Novozymes)

✓ **"New environmentally-sound methods for pitch control in different paper pulp manufacturing processes"** (Pitch, 2000-05, coordinator: CIB, companies: ENCE, UPM and Novozymes)

**FP5 (Life)**

✓ **"Wood extractives in pulp and paper manufacture: Technical and environmental implications and biological removal"** (Web, 1995-99, coordinator: IRNAS, companies: ENCE and Parenco)

**FP4 (FAIR)**

✓ **"Biological delignification in paper manufacture: Optimization of enzyme mixtures for treating cereal straw and other non-woody materials"** (1994-97, coordinator: CIB, company: Saica)

**FP3 (AIR)**

✓ **"Biopulping and biobleaching"** (ECLAIR, 1990-94, coordinator: INETI, company: Saica)

✓ **"Upgrading straw into pulp, paper and polymeric materials"** (1991-95, coordinator: CTP, companies: Saica and StRegis)

**FP2 (ECLAIR)**

# **BIORENEW** (***BIO**technology for added value products from **RENEW**able polymers*) **EU Project** coordinated by CSIC

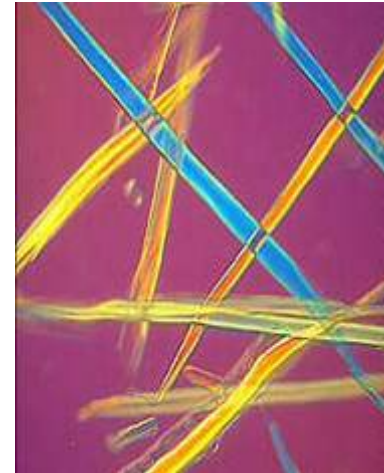
- ✓ Title: “White Biotechnology for added value products from renewable plant polymers: Design of tailor-made biocatalysts and new industrial bioprocesses”
- ✓ Reference: NMP2-CT-2006-026456
- ✓ Call: NMP, 6<sup>th</sup> Framework Programme (FP6-2004-NMP-NI-4)
- ✓ Area: “Industrial Biotechnology – Environmental Technologies”
- ✓ Duration: 4 years (from 1-October-2006)
- ✓ Budget: 15.3 million €
- ✓ EC Contribution: 9.5 million €
- ✓ Coordinator: Angel T. Martínez, CIB, CSIC (Madrid)
- ✓ Information: [info@biorenew.org](mailto:info@biorenew.org) (BIORENEW Secretariat)



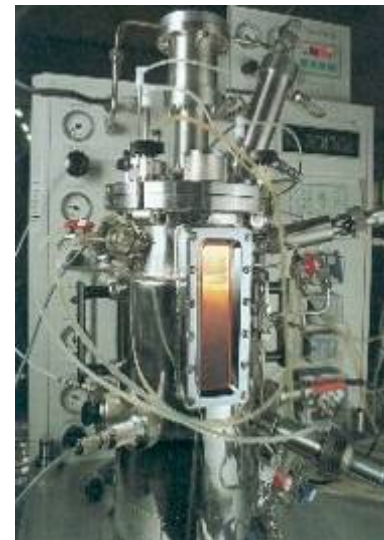
The Objective of **BIORENEW** is to use **BIOTECHNOLOGY tools** to obtain a new generation of **tailor-made enzymes** for sustainable production of added value products from renewable plant polymers **CELLULOSE** and **LIGNIN** (the latter being highly **recalcitrant**)

The availability of enzymes adapted to industrial application conditions (biocatalysts) will permit to substitute harsh chemicals resulting in **ECOFRIENDLY** transformation technologies

Moreover, the new tailor-made biocatalysts will allow to obtain **new BIOPRODUCTS** that are difficult to be obtained by conventional processes

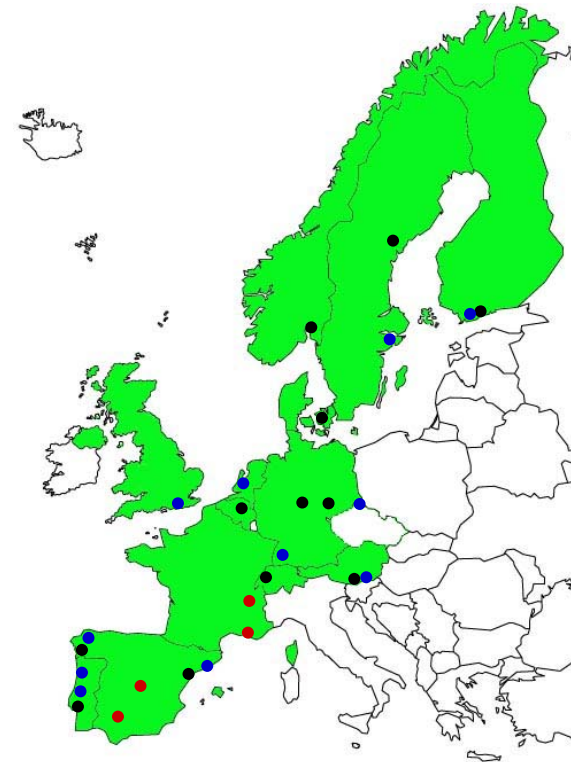


Wood fibres



Biotec tools

- 1a **CIB** (Centro Investigaciones Biológicas, CSIC, ES)
- 1b **IRNAS** (Inst. Recursos Naturales y Agrobiología, CSIC, ES)
2. **Novozymes** (Novozymes A/S, DK)
3. **KTH** (Kungl Tekniska Högskolan, S)
4. **ITQB** (Instituto de Tecnología Química e Biologica, P)
5. **UoS** (University of Sussex, UK)
6. **ULeiden** (University of Leiden, TN)
7. **CTP** (Centre Technique du Papier, F)
8. **CELESA** (Celulosa de Levante SA, ES)
9. **Borregaard** (Borregaard LignoTech, NOR)
10. **Publicampaign** (P)
11. **USC** (University of Santiago de Compostela, ES)
12. **Ahlstrom** (Ahlstrom Corporation, FIN)
13. **GRD** (Granit Recherche Développement SA, CH)
14. **UHel** (University of Helsinki, FIN)
15. **INRA** (Inst. National de la Recherche Agronomique, F)
16. **GERCID** (Gercid Gmb H, D)
17. **IHIZ** (Internationales Hochschulinstitut Zittau, D)
18. **ALU-FR** (Albert-Ludwigs-Universität Freiburg, D)
19. **UMinho** (Universidade do Minho, P)
20. **TUGraz** (Graz University of Technology, A)
21. **UPC** (Technical University of Catalonia, ES)
22. **ENCE** (Grupo Empresarial ENCE, ES)
23. **Domsjö** (Domsjö Fabriker AB, S)
24. **Wood Kplus** (Kompetenzzentrum Holz, A)
25. **Buckman** (Buckman Laboratories SA, B)
26. **Börner** (Georg Börner, D)



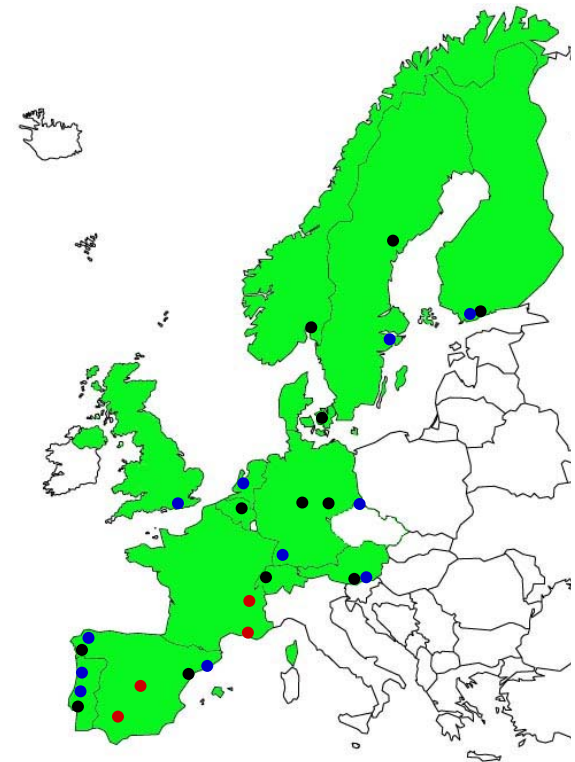
**3 Research Inst.**

**11 Industries (4 SME)**

**11 Universities**

**1 Others**

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The highly **Intersectoral**  
and **Multidisciplinary**  
Consortium is a key  
aspects in **BIORENEW**



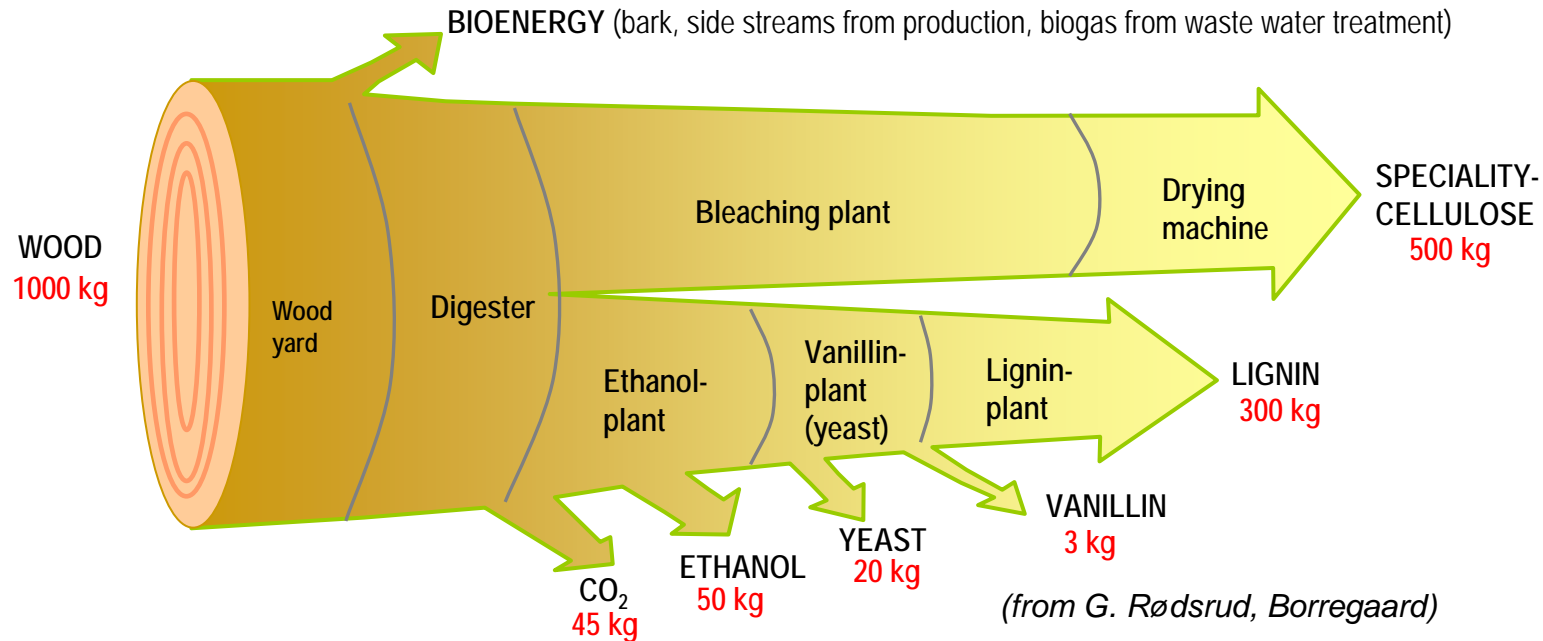


## ***Industrial Biotechnology EU project (BIORENEW) Coordinated by CSIC***

### ***Content:***

- ✓ ***General aspects:*** EU research area, IP general information, Objective and Partners
- ✓ ***Project description:*** Wood biorefinery, Oxidative enzymes, Novel biocatalysts, Novel bioprocesses, New products, Future contributions and Summary
- ✓ ***Project organization:*** Formation of the Consortium, Workplan structure, Management, Budget, Consortium Agreement (and Evaluation)

The BIORENEW IP is based on the **Biorefinery** concept for a more complete utilization of the lignocellulosic resources by the wood-based chemical industries



**Biotechnology** can contribute to Biorefinery by increasing the performances and sustainability of processes and providing new added-value products

**Oxidative enzymes** are involved both in wood lignin **Biosynthesis** and its **Biodegradation**

Therefore, they have the highest **potential** for modifying ligno-cellulosic materials and isolated lignins

However, **natural enzymes** are far to optimally operate under industrial conditions



OXIDATIVE ENZYMES





**Oxidative enzymes** are involved both in wood lignin **Biosynthesis** and its **Biodegradation**

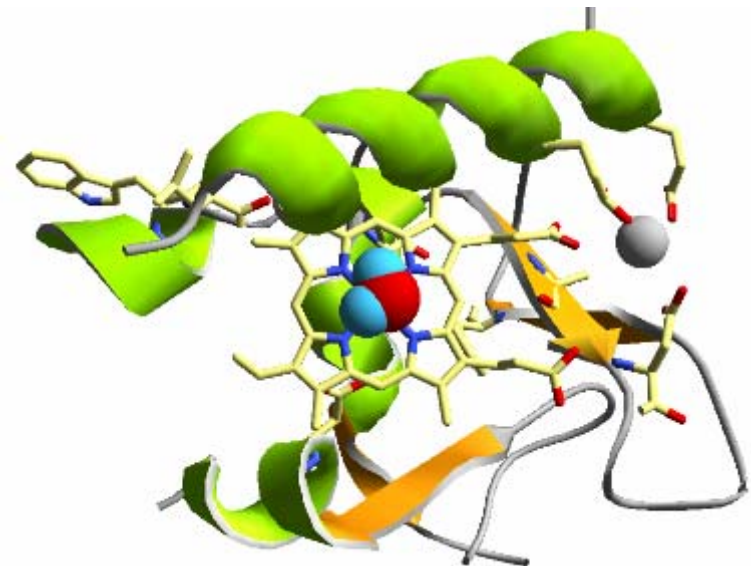
Therefore, they have the highest **potential** for modifying ligno-cellulosic materials and isolated lignins

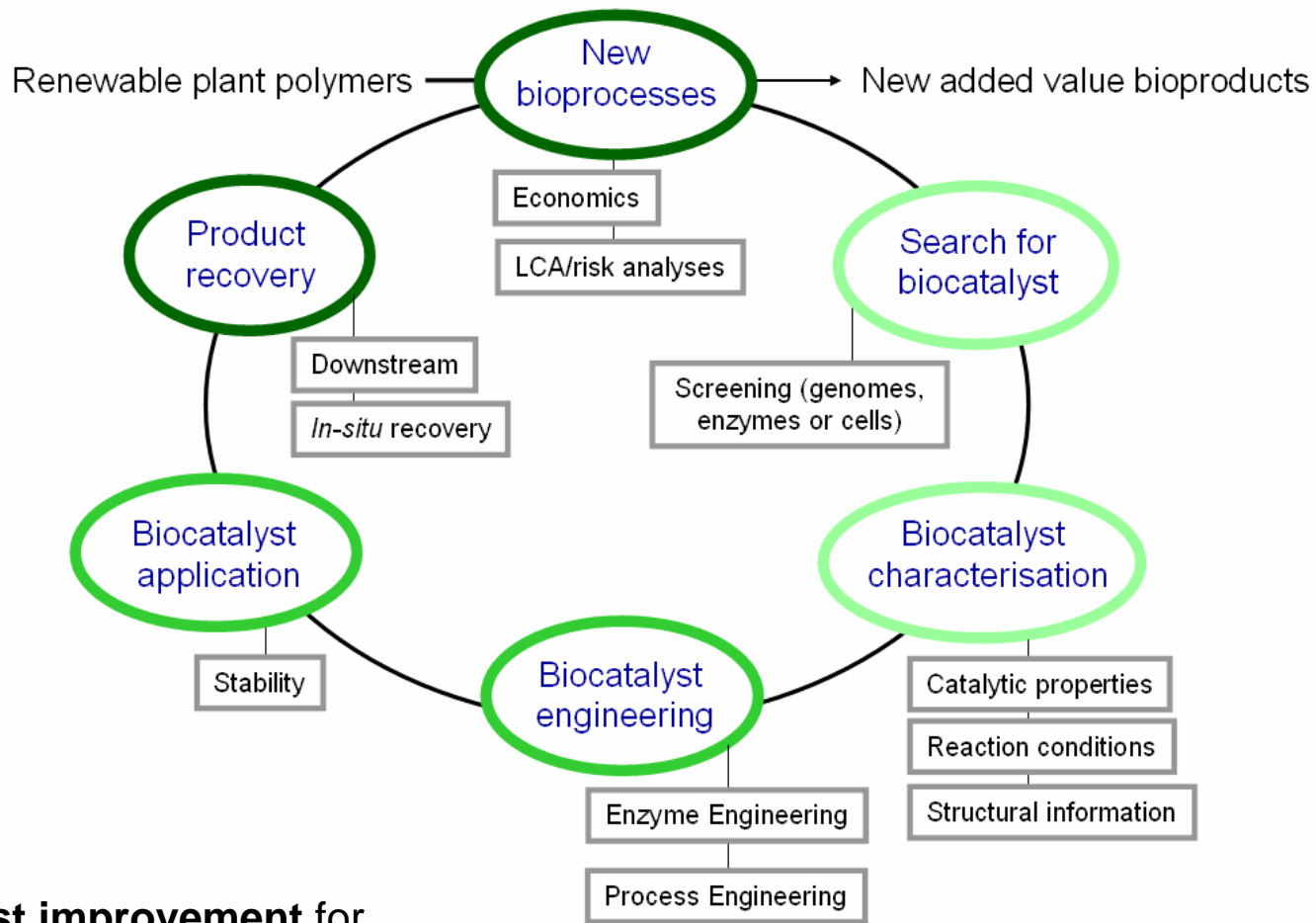
However, **natural enzymes** are far to optimally operate under industrial conditions

Some oxidoreductases have been **extensively investigated** in terms of **structure-function** allowing a new **approach** in the **BIORENEW** IP based on tuning enzyme properties using **molecular biology** and **protein engineering** tools



NOVEL BIOCATALYSTS





**Biocatalyst improvement** for processing plant polymers in **BIORENEW** will include several steps



The new/tailored enzymes will be the basis for **new bioprocesses** in **BIORENEW** with the aim of:

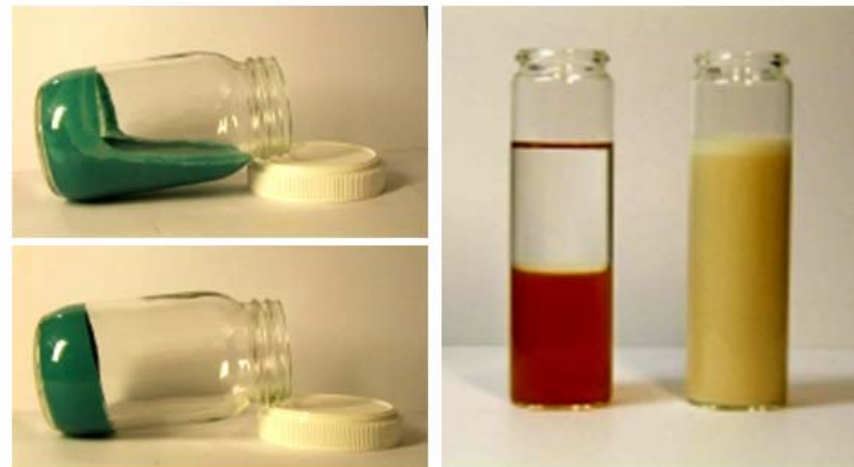
- ✓ Increasing strength and functionalities of **cellulose** fibres, and improve refining
- ✓ Obtaining lignin-free **cellulose** for high-quality **speciality** products
- ✓ Producing **lignin-based** dispersants, nano-emulsifiers, adhesives, and other chemicals



**Fibreboards** (from Funder web-page)



**Cellulose for speciality products** (from CELESA web-page)



**Lignin-based dispersants and emulsifiers** (from Borregaard web-page)

**BIORENEW** will contribute to:

- i) Develop new **bioprocesses** and bioproducts in the **EU forest-based** sector
- ii) Maintain the **EU** leading position in the market of industrial **biotechnology**
- ii) **Transform** part of the **EU chemical** sector (**20%** Biotechnology influence in 2010)



FUTURE CONTRIBUTIONS





**BIORENEW** will contribute to maintain the **world-leading** position of these three EU industrial sectors by improving their:

- ✓ **Sustainability**
- ✓ **Eco-friendliness**
- ✓ **Competitiveness**



FUTURE CONTRIBUTIONS



Future contributions of **BIORENEW** to **ERA** will be produced in the frame of EU Technological **Platforms**:

i) “**Forest-Based Sector**” TP

ii) “**Sustainable-Chemistry**” TP

In collaboration with the European **Industrial Associations**



(Biorenew topics - clean technologies, lignin uses etc - in Forest TP SRA)



(SusChem TP flagship project on Oxidative enzymes as industrial catalysts)





# **BIORENEW** (*BIO*technology for added value products from *RENEW*able polymers) **EU Project coordinated by CSIC**

✓ Title: White Biotechnology for added value products from renewable plant polymers: Design of tailor-made biocatalysts and new industrial bioprocesses

✓ Call: Sixth Framework programme (FP6-2004-NMP-NI-4)

✓ Area: Industrial Biotechnology – Clean Technologies

✓ Duration: 4 years (2006-2010)

✓ Budget: 15.3 million €

✓ EC funding: 9.5 million €

✓ Coordinator: Angel T. Martinez, *Centro de Investigaciones Biológicas (CIB)*, Department of Molecular Microbiology, CSIC

**biorenew**

13 European countries

12 Companies

3 Research institutes

11 Universities



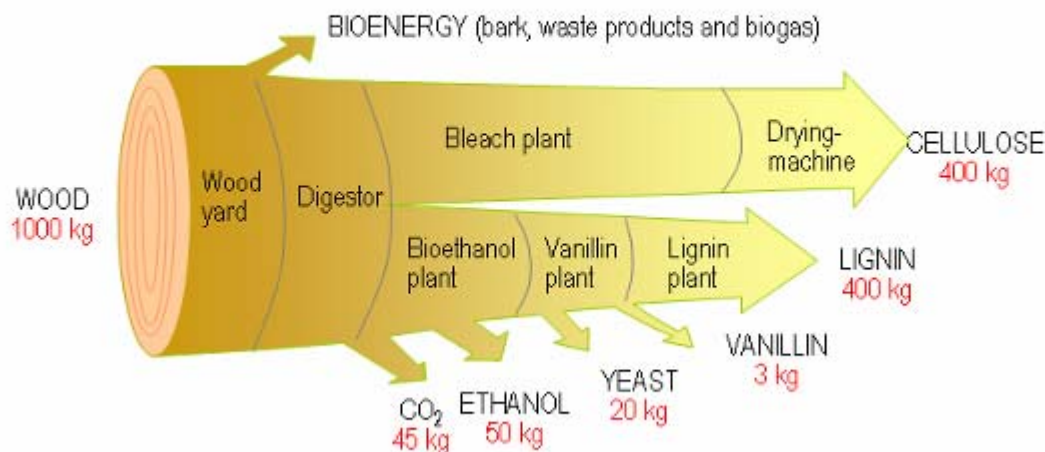
SUMMARY

## **BIORENEW** includes:

### 1) Renewable raw material

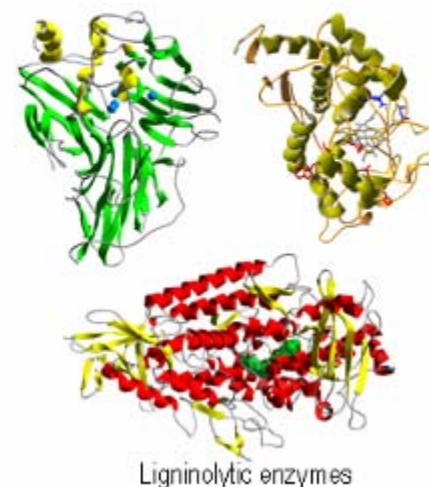


### 2) Integral use of feedstocks



Biorefinery concept (adapted from G. Rodsrud)

### 3) Clean technologies





**BIORENEW** is based on enzyme modification using **Molecular Biology** techniques to be adapted to the different industrial applications ("Tailor-made" biocatalysts)



The new biocatalysts obtained in **BIORENEW** will substitute harsh chemicals causing pollution troubles and will permit to obtain a series of products in new industrial processes characterized by their **Sustainability** and **Environmental Friendliness**



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The **BIORENEW** proposal was first presented to 2003 call of the NMP priority

**NMP-NI-3-2003-3.4.4.3. “Mastering Chemicals and creating new eco-efficient processes and synthesis routes”... (including biocatalysts)**

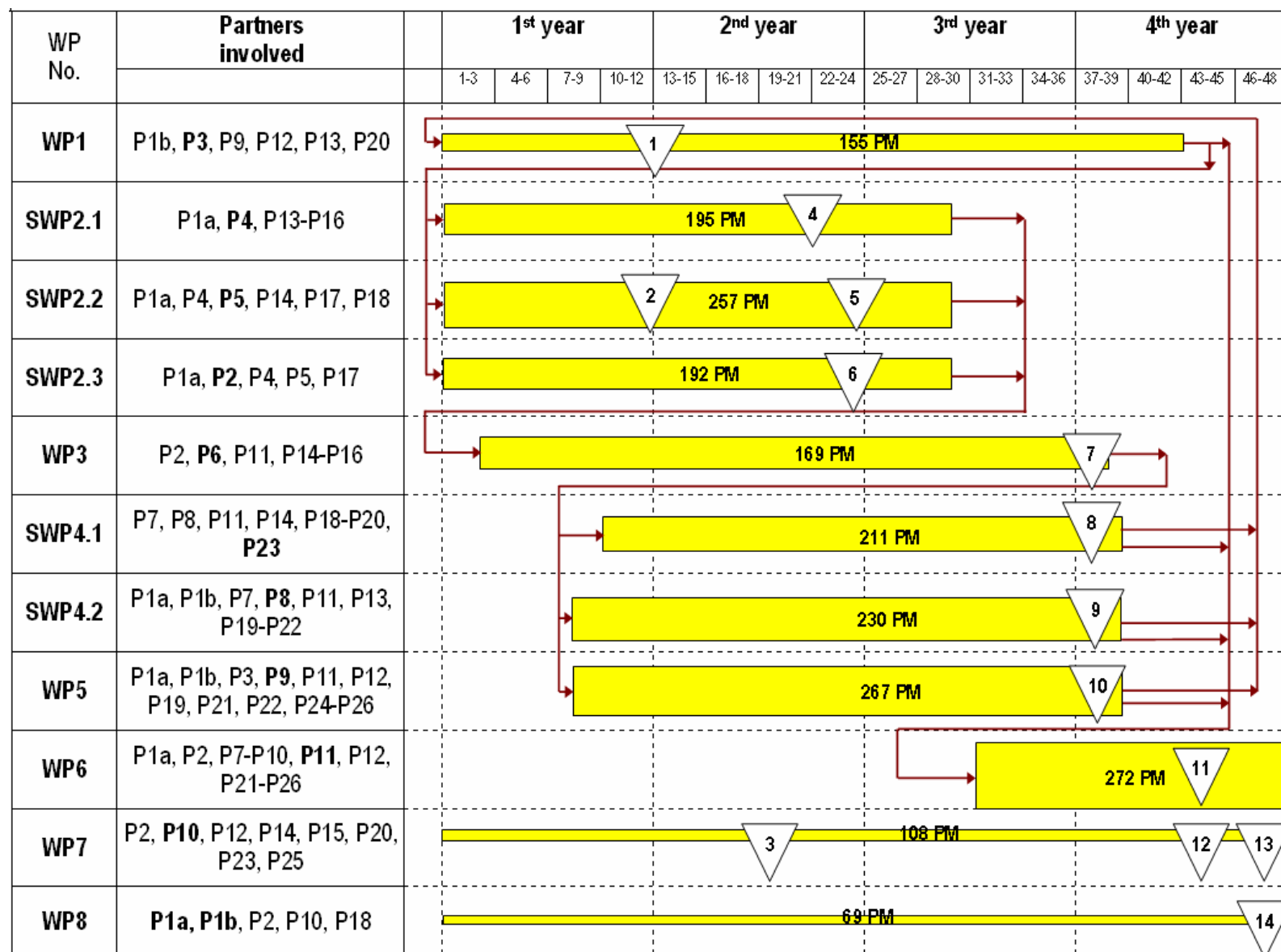
**NMP-NI-4-2004-3.4.4.3. “Mastering Industrial Biotechnology. Environmental Technology for sustainable production of added value products”**

In the whole process (including two-stage evaluation) the composition of the **Consortium** was modified to be adapted to:

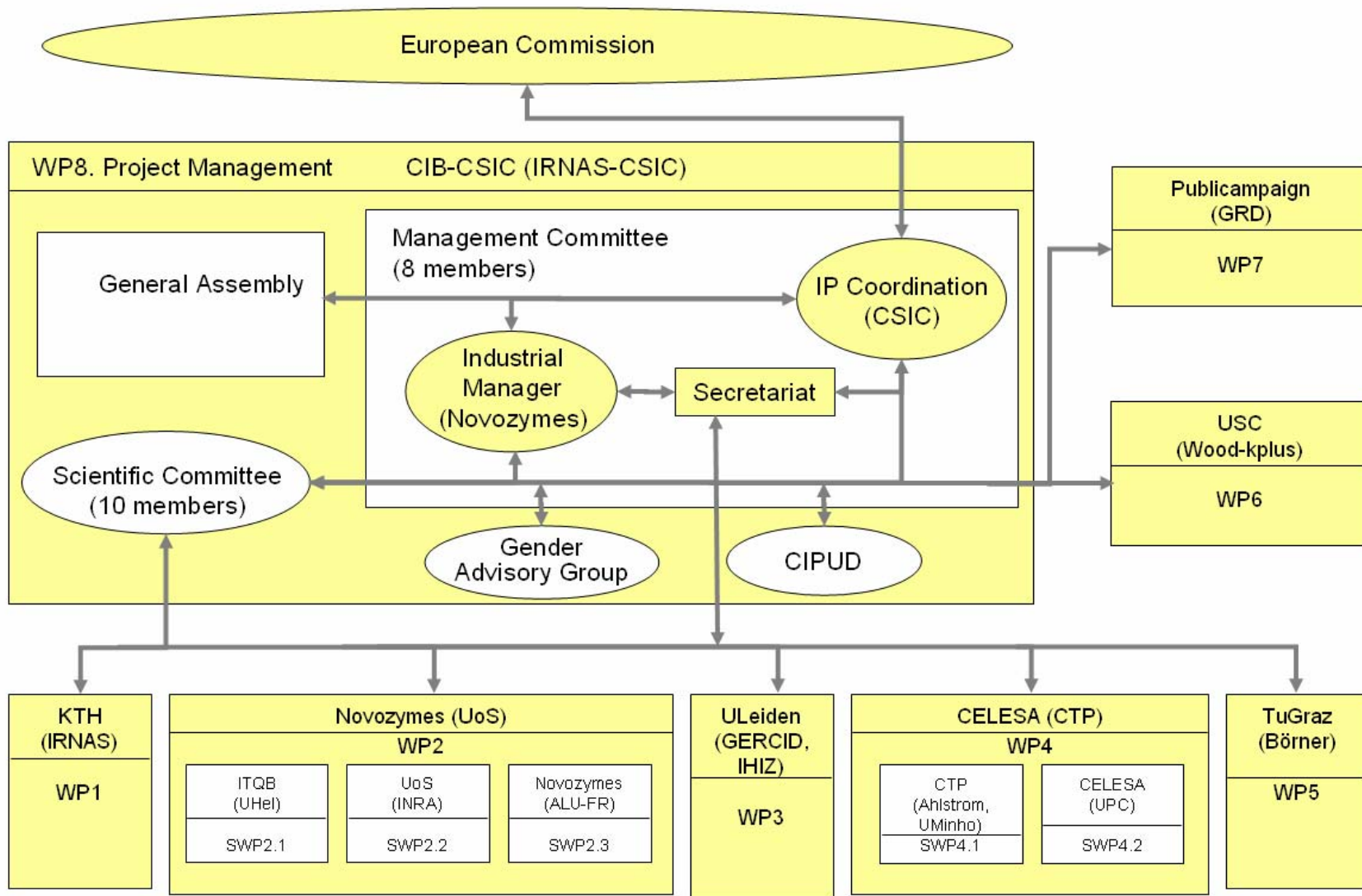
- New **topic**
- **Recommendations** of the experts
- Other **circumstances**

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## Summary of **BIORENEW** budget by partner type and activity

**Table 12. Summary of BIORNEW financial resources by partner Type and Activity**

	RTD		Demonstration		Training		Management		Total	
	Costs	Requested	Costs	Requested	Costs	Requested	Costs	Requested	Costs	Requested
<b>IND</b>	3144656	1572328	595444	208405	35000	35000	73287	73287	3848387	1889020
<b>SME</b>	1510401	755201	471057	164870	168000	168000	48858	48858	2198316	1136928
<b>HE</b>	4016402	3703358	112671	112671	35000	35000	48858	48858	4212931	3899886
<b>RES</b>	3500750	1740391	136890	47912	395000	395000	390863	390863	4423503	2574166
<b>Total</b>	12172209	7771277	1316062	533858	633000	633000	561866	561866	14683137	9500000

Analysis of the whole BIORNEW budget by cost categories showed that the largest budget amount (around 50% of the total) corresponds to **Personnel** followed by **Overheads** (23% of the total), and **Consumables** (12% of the total) together with lower percentages of budget (1-3% each) dedicated to **Travel** and **Equipment** (Subcontracting budget is neglectable). The total budget is completed by the Training and Management costs

**CONSORTIUM AGREEMENT  
for  
the Integrated Project**

*“White Biotechnology for added value products  
from renewable plant polymers: Design of tailor-  
made biocatalysts and new industrial processes”*

*(BIORENEW)*

...and previous **BIORENEW**

**COLLABORATION AGREEMENT**

**that was in force during preparation of the  
proposal (including rules on confidentiality,  
concurrent proposals, etc)**

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ANNEX 3 - List of the excluded Pre-Existing Know-How
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## **Article 9 - The Committee on Intellectual Property, Use, and Dissemination**

- 9.1 In order to implement efficiently the activities concerning innovation and dissemination concerning the\_ Project, described in the corresponding Work-Package, the Parties agree to establish a Committee on Intellectual Property, Use and Dissemination. This committee shall act in advisory capacity supporting the Parties and the relevant Consortium bodies. It has no authority to make binding decisions.

### **Composition**

- 9.2 The members and the Chairperson of the Committee on Intellectual Property, Use and Dissemination shall be appointed by the Project Committee upon proposal of the Management Committee by a maximum number of members to be agreed by the Parties. The Project Committee may decide to extend the aforementioned number of representatives during the Project or any change of its members.



Excluded Pre-existing Know-How.

- 19.9 In the event that the Parties have agreed to exclude any piece of Pre-existing Know- How from a Party or Parties in accordance with the provisions of Article II.35.1 (d) of the EC Contract, such excluded Pre-existing Know- How shall be as detailed in Annex 3 hereof. No Access Rights shall be granted to such excluded Pre-existing Know –How as listed in Annex 3 unless the owning Party specifies otherwise.

Right of First Refusal

- 19.23 The Parties grant to [REDACTED] a right of first refusal to negotiate a license for commercial use and exploitation of all Knowledge generated under the Project concerning the design and production of new or improved biocatalysts for different uses in the scientific and industrial field of application of *BIORENEW* (“*White biotechnology for added value products from renewable plant polymers: Design of tailor- made biocatalysts and new industrial processes*”) as stated on page 1 of the Preamble of this Consortium Agreement.

## Evaluation Summary Report for an Integrated Project

Proposal No. : 026456-2		Acronym : BIORENEW	
+ 1. Relevance <i>(Threshold 3/5; Weight 1)</i>		Mark: 4,4	
2. Potential impact <i>(Threshold 3/5; Weight 1)</i>		Mark: 4,5	
3. S&T excellence <i>(Threshold 4/5; Weight 1)</i>		Mark: 4,5	
4. Quality of the consortium <i>(Threshold 3/5; Weight 1)</i>		Mark: 4,7	
5. Quality of the management <i>(Threshold 3/5; Weight 1)</i>		Mark: 4,4	
6. Mobilisation of the resources <i>(Threshold 3/5; Weight 1)</i>		Mark: 4,5	
Overall remarks <i>(Threshold 24/30)</i>		Total score: 27,0	
Has the proposal passed all evaluation thresholds?		Yes	
Does this proposal have ethical issues that need further attention?		No	

## Final Evaluation:

After

- Stage-1 (only aspects 1-3)
- Stage-2 (whole proposal) and
- Hearing

(including Invitation to start Negotiations)



More Information: [info@biorenew.org](mailto:info@biorenew.org)