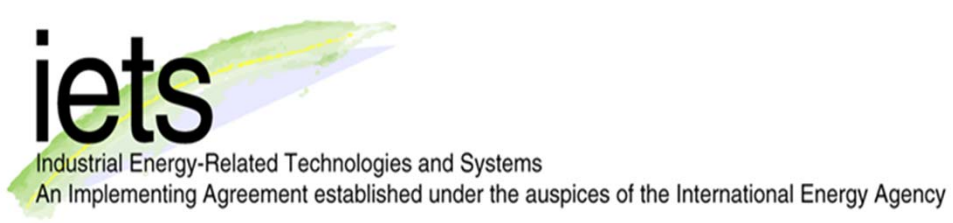
INTERNATIONAL WORKSHOP

System and Integration Aspects of Biomass-based Gasification



Industry-based Biorefineries

ANNEX XI

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Task Managers: Alexandre Gaspar, Henrique Matos & Thore Berntsson

Gothemburg, Sweden

2013, November 19/20th

grupo Portucel Soporcel

Group PortucelSoporcel - Profile

European Leader in UWF

- **Leading European manufacturer of uncoated woodfree (UWF) printing and writing paper,** and the 6th largest producer in the world
- Leading manufacturer, and one of the largest in the world of **bleached eucalyptus kraft pulp** (BEKP)

Annual Industrial Capacity

- 1.6 million tons of paper
- 1.4 million tons of pulp (of which some 1.1 millions tons is incorporated into paper)
- 2.5 TWh of electricity

Annual turnover of more than 1.5 billion euros, with foreign sales of 1.25 billion euros.

95% of pulp and paper sales exported to more than 110 countries, over 5 continents

Source: Portucel Soporcel group

Production Plants, Commercial Subsidiaries, R&D units and Nurseries

EUROPE AMESTERDAM | BRUSSELS | CACIA | COLOGNE | EIXO | FIGUEIRA DA FOZ | GENEVE | LONDON | MADRID | PARIS | SETÚBAL | WARSAW | VERONA | VIENNA

EUA NORWALK, CT

NORTH AFRICA CASABLANCA

PRODUCTION PLANTS

R&D (RAÍZ)

COMMERCIAL SUBSIDIARIES

NURSERIES (ESPIRRA ESTATE)

Business Areas

- Paper Production and Marketing
- Pulp Production and Marketing
- Research & Development
- Agro-Forestry
- Energy

Industrial Structure

The Group has 3 production units on an international scale with sophisticated technology

Cacia

Pulp – 285.000 tAD

Figueira

Pulp– 560.000 tAD / Paper 790.000 t

Setúbal

Pulp – 530.000 tAD / Paper 795.000 t

Source: Portucel Soporcel group

Energy

- **Portugal's leading producer of "green power" from biomass** and wood waste, **accounting around 50% of all electricity generated in the country from this renewable source**
- The Group has invested approximately 200 million euros in energy-related projects and currently has power generation capacity of 2.5 TWh/year.
- In 2012, the Group accounted for 4.4% of the total electricity generated in Portugal

Figueira da Foz

Setúbal

Cacia

Projects for International Expansion

Mozambique (African continent):

- Forestry operations over an area of 360.000 hectares
- Integrated eucalyptus plantation, pulp and energy project
- Estimated $2.3 billion investment
- Expected to generate 7,500 direct jobs

Source: Portucel Soporcel group

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- Scope & Activities
- Annex Structure
- Status & Implemented Actions
- Expected Results
- Plan of Work & Orientation
- Collaboration
- Conclusions

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The concept…

– The biorefinery industrial concept - an integrated process converting biomass available, related to the industrial complex, into valuable products.

Energy

Fuels

materials
Intermediates
end-products & feedstocks

ANNEX XI

Research Partnering
Evaluation of R&D Performance
Assessment & Feasibility Studies
Information Exchange
Dissemination activities

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Focus towards an Ideal Concept?

- Wide range of valuable products
  - Competitiveness
  - Market
- Ability to process different biomass feedstocks
  - Resources
  - Flexibility
  - Economics
- Efficient integration with minimum impacts
  - Energy
  - Waste
  - Emissions
  - Sustainability

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Scope & Activities

The general objective is to provide a sound basis for the integration of biorefinery concept in different industrial sectors, where biomass is used as resource or biomass based waste is available, which could be used for fuel/energy production but also considering opportunities for added value bio-products generation.

- ✓ optimization of energy efficiency in existing and/or new integrated industrial plants, to convert internal biomass and wastes to energy and bio-products
- ✓ implementation of joint projects leading to engine fuels production
- ✓ biofuels production by integration of CO_2 capture and sequestration in the conversion process

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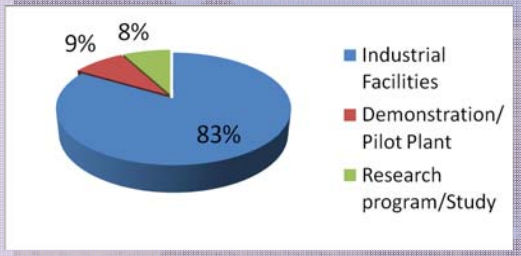
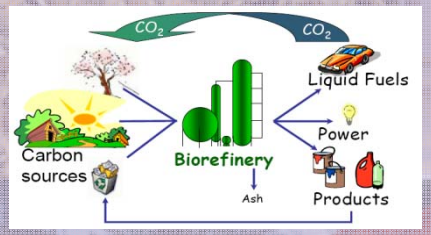
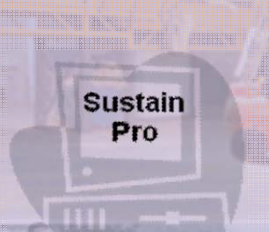
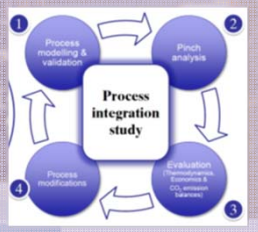
Annex Structure









TASK I

Bioenergy and Biofuels

Task I Manager
Isabel Cabrita

TASK II

Biochemicals and New Fiber Materials

Task II Manager
Alexandre Gaspar

TASK III

Sustainability Studies

Task III Manager
Henrique Matos

TASK IV

Process Integration

Task IV Manager
Thore Berntsson

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Status & Implemented Actions

- Programme of Work 2010-2013
  - »Visibility
  - »R&D needs identification
  - »Project definition
  - »Projets' Implementation
  - »Dissemination and Workshops

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Implemented Projects & Cooperation Areas

- **Project XI/1** BUGWORKERS - New tailor-made PHB-based nano-composites for high performance applications produced from environmentally friendly production routes – *EU funded project R&D based – Dissemination activities (Portugal and Netherlands)*
- **ProjectXI/2** ALGAECASCAD - The biorefinery of Algae, a CASCADE approach – *Information Exchange and projects' definitions for R&D implementation (Portugal, Belgium)*
- **ProjectXI/4** - Integrated Biofuel Production Processes, based on Systematic Optimization Methodologies *(Proposal of Portugal)*
- **Project XI/5 -** Process Integration of Gasification-based Biorefineries *(Proposal of Sweden)*
- **Cooperation in the European "BioConSept" Project**, through the participation in the Advisory Group by the Annex Manager.

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Other Proposals for Projects & Cooperation Areas

- BioBlocks
  - Bio-based products from ligno-cellulosic resources (glucose, xylose and lignin)
- NMC
  - New added-value products from bleached *Eucalyptus globulus* kraft pulp (nanocelluloses and xylanes)

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Expected Results

- Evaluation of technological and economical options focusing on industry integrated biorefineries
- R&D projects on technology specific areas
  - Process Eng towards Biofuels and Biomaterials, including at nano scale
  - Process Integration
- Biorefinery concept with the integration of the capture of CO_2 for enhancing the growth of microalgae and/or other biomass species through process integration
- Sustainability and life cycle analysis

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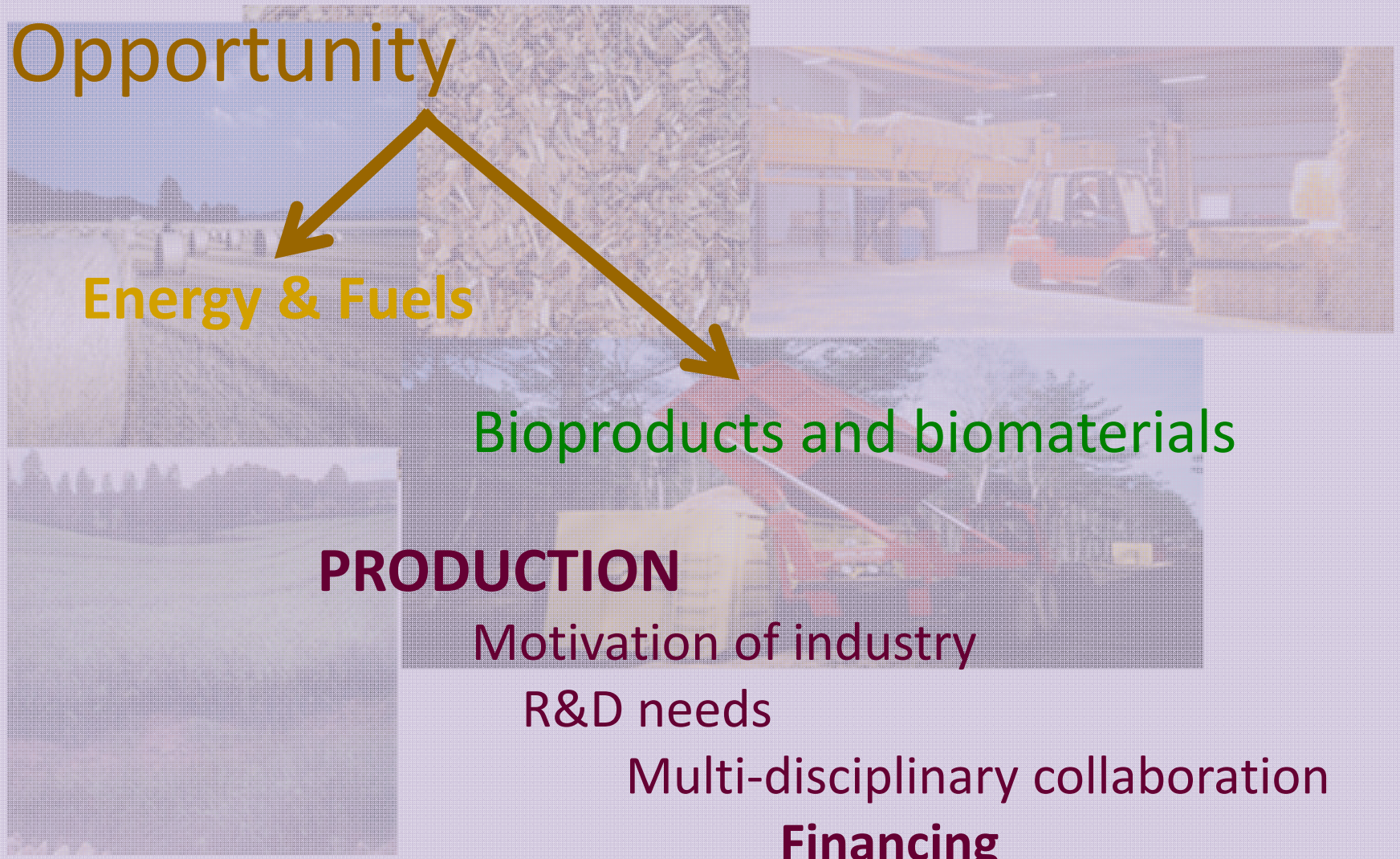

Opportunity

Energy & Fuels

Bioproducts and biomaterials

PRODUCTION

Motivation of industry

R&D needs

Multi-disciplinary collaboration

Financing

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Work Plan & Orientation

- Execution of ongoing projects
- Joint initiatives with other Platforms
- Information Exchange
- RD&T joint implementation within the scope of Tasks

The real challenge and the driver of the R&D work implemented so far and foreseen in the future, is related to the integration of different processes, leading to fuels and high-added value bio-products using cheap resources, guarantying the feedstock availability for energy efficient decentralized applications.

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Collaboration

- International Cooperation with other Implementing Agreements, combining the knowledge of industrial technologies with energy efficiency, and the biomass conversion processes...
- Providing a global forum to exchange information, disseminate knowledge gained and lessons learned, in an atmosphere that promotes interaction and collaboration
- Encouraging participants to engage in truly collaborative, value-adding research and development activities and to promote demonstrations
- Focusing the research efforts by regularly updating a prioritized list of research needs and knowledge gaps
- Involving industry and communicating progress

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Conclusions

- Fully integrated biorefineries in industry needs, a strong collaboration between groups of different disciplines and industrial companies.
- International cooperation will provide expertise in different fields in a cost effective manner and could also provide different challenges for development.

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Thank you for your attention…