Annex I

NEW TASK PROPOSAL

Biorefineries
Co-production of Fuels, Chemicals, Power and Materials from Biomass

Planning for the New Triennium 2007-2009

Submitted by
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and

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Content

1. BACKGROUND AND OBJECTIVES

1.1 Current status biomass use

In most countries the use of biomass for the production of biofuels, and to a lesser extend energy, is still more costly than the use of traditional petrochemical resources. By integrating conversion processes and equipment to co-produce multiple products (i.e. fuels, chemicals, (CH)Power, and materials) from biomass, by a so-called "biorefinery approach", advantage can be made of differences in biomass components and intermediates, maximising the total value derived from the biomass feedstock. A general overview of the Biorefinery concept is shown in Figure 1.1.

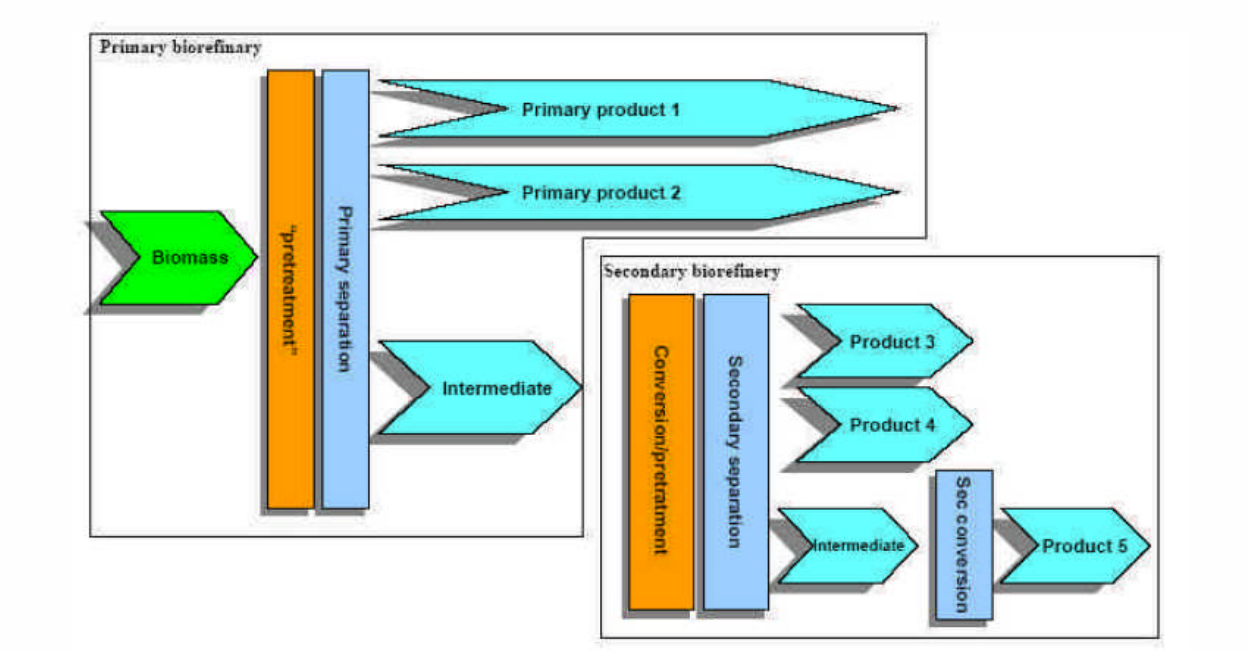


Figure 1.1: Schematic overview of a general Biorefinery concept.

A biorefinery might, for example, produce one or several low-volume, but high-value, chemical products, and relatively low-value, but high-volume, liquid transportation fuels; while generating power and process heat for its own use, and perhaps enough for external sale.

Industrial biorefineries already exist in some agricultural and forest products facilities (e.g. pulp mills, corn wet milling, starch and sugar refining). At present, the main processes in the biorefinery involve ethanol fermentation and lactic acid fermentation. Biomass from plant materials are the most important feedstock for food, feed, and non-food applications. In the processing of plant materials e.g. maize, corn and sugarcane for starch and sugar and subsequently ethanol and wood for paper, substantial amounts of potentially valuable by-products can be and are produced. One could say those industries are biorefineries "avant la lettre".

The next step for the paper industry challenge is to have integrated pulp and paper mills that operate totally without auxiliary fuels producing a net surplus of electricity from 100 % biomass fuels. Other biomass utilising industries will likely have to follow this route.

In recent years considerable progress has been achieved in the conversion of lignocellulosic biomass into fermentable sugars for fermentative bulk products, e.g., bioethanol, 1,3-propanediol and lactic acid, which are at present the major biorefineries.

In the first step of a biorefinery, the precursor containing biomass is separated by physical methods. The main products (M1-Mn) and the by-products (B1-Bn) will subsequently be subjected to microbiological or (thermo) chemical methods. The follow-up products (F1-Fn) of the main and by-products can furthermore be converted or enter the conventional refinery.

Currently four complex biorefinery systems are forced in research and development, [Kamm and Kamm. 2005[1].] viz.

1. "Lignocellulosic Feedstock Biorefinery", using "nature-dry" raw material such as cellulose-containing biomass and wastes.
2. "Whole Crop Biorefinery", using raw materials, such as cereals or maize.
3. "Green Biorefineries", using "nature-wet" biomasses, such as: green grass, alfalfa, clover, or immature cereals.
4. "Two Platform Concept Biorefinery", including the sugar and the syngas platforms.

1.2 Drivers for the development and implementation of biorefineries

In a number of industrialized countries (i.e. USA, EU) government, business, society, and science have been engaged in outlining the contours of future developments in the energy, transportation fuels, and chemical industry. Most of these foresight exercises are led by the view that there will be an increased demand for energy, fuels, and chemicals, which will place additional pressure on the use of resources and the environment. Accordingly, the thrust is in finding new technologies and creating novel processes, products, and capabilities to bring this growth in line with the societal demand for sustainability. The perspectives indicate a shared interest in shifting from a sole dependence on fossil resources to an industry founded in the application of plant-based resources, either derived from secondary streams (i.e. waste and recycling) or from primary streams (i.e. dedicated production). The shift to a bio-based chemical and material industry will alter the technological basis of the industry quite radically. To substantiate the sustainable credentials of new products and processes, further research and actual implementation will indicate what specific technological routes in fact contribute to sustainability. This will be necessary for communication with non-governmental organisations (NGOs), the general public, regulators and policy makers about, for example, CO_2-emissions.

[1] Kamm B. and Kamm M. (2005) Principles of Biorefineries. Appl. Microbiol. Biotechnol. **64**:137-145

From the perspective of the industry striving for sustainability with sound economic foundations, this draws the attention to three key areas:

- Production: The actual production process has a major environmental impact both on efficient use of energy and resources and on emission and waste production; this is especially so in bulk industries. This links the provision of multi-quality biomass and the industrial production process. Due to the large volumes used, it may have a far reaching impact on the environment. Cost reduction, due to cheaper raw materials or processes with less extreme conditions, will be an important consideration.
- Integration: Implementing a strategy for sustainability requires coordination between different levels of a supply chain, product portfolio and fine-tuning between distributed technological capabilities. Key technologies in conversion, extraction, and separation will lay the foundation for further improvement in bulk production and the development of products with well defined functionalities. This requires an integrated view on resource use and a strategic view on technology development. Linking life sciences, chemistry, energy technology, and process engineering is required for taking up such a challenge.
- Use and re-use: In terms of specific functionality, life-cycle and recycling or safety, the actual performance of end-products importantly defines the contours of a market oriented strategy for sustainable resource use. Increased revenues by generating value-added products will also be an important consideration. This links production processes with product design, and defines a new terrain for innovative business enterprises. Communicating the sustainability benefits to consumers or users in (new) end-use market will allow them to make better informed choices.

For developing a sustainable perspective for the industry a combinatorial approach integrating functionality provided by new molecules or materials, improved efficiency and safety of production processes, and use and re-use of materials has to be applied. Integrating criteria like design for functionality or recycling properties of new materials will encourage the search for new sustainable solutions in the chemical industry. The biorefinery concept has been identified to address these challenges best. The concept focuses on maximising valued added compounds while minimising waste streams. A low cost collection and converting of the biomass to feedstock is critical to the success of these emerging industries.

Biorefineries contribute to the following overall and specific objectives by:

- Complying to the Kyoto demands by substantially lowering the emission of green house gasses. Biomass in the EU can absorb 60-70 million metric tonnes (MMt) of CO2 per year. This is 19-21% of the EU first phase Kyoto commitment.
- Increasing certainty of supply by decoupling the chemical, fuel and energy industry from fossil feedstocks
- Increasing biomass production for industrial uses, so revitalising rural areas
- Offering new value generating opportunities to the agricultural, forest and food processing industries
- Serving the needs of a broad range of industries, so improving competitiveness
- Safely unlocking and converting a wide range of new feedstocks into a defined portfolio of value added chemicals, materials, and energy carriers

- Creating breakthrough knowledge in many fields of Science and Technology, so serving the knowledge based society
- Translating new knowledge into industrial applications serving existing and new markets
- Substantially increasing employment numbers and opportunities

The Biorefinery approach strongly contributes to the development of worldwide Bioenergy policies. The European Commission White Paper (1998), Green Paper (2002) and "Biofuels in the European Union - A Vision for 2030 and beyond" have established targets for a renewable materials based Energy production. The European Parliament and the Council (2003) have formulated targets for the use of renewable resources for the production of Transportation Fuels. No directives are available in Europe at present that establish targets for the use of renewable resources for the Chemicals Industries. However, at national level (The Netherlands) a target of 30% renewable resources in 2030 have been formulated. Basic research on the use of renewable materials for the production of chemicals is very limited, small-scale, and fragmented throughout Europe. Carbon-based feedstocks represent a viable alternative to fossil feedstocks for the EU energy, biofuel, and chemical industry when integrated into biorefineries.

EU Targets for the use of Renewable Resources

Year	2001	2005	2010	2020-2050
Energy	7.5 %	-	12.5 %	26% (2030)
Transport fuels	1.4 %	2.0 %	5.75%	30% (2030)?
Chemicals	8-10%	?	?	?

A revolution spurred by the expanded use of renewable products, far beyond energy and transport only, will have enormous impact. The "Vision and Roadmap for Bioenergy and Bio-based Products in the United States" was formulated through the Biomass R&D Act of 2000 of the US Federal Government[2]. Several programs are active. The US Department of Agriculture has just released a proposed "Rule for a Federal Bio-based Products Preferred Procurement Program" that should spur the growth of bio-based product industries within the United States.[3]

US Targets for the use of Renewable Resources

Year	2002	2010	2020	2030
Energy	2.8 %	4 %	5 %	5 %
Transport fuels	0.5 %	4 %	10 %	20 %
Chemicals and Materials	5 %	12 %	18 %	25 %

[2] US Biomass R&D Technical Advisory Committee, Oct. 2002 and Dec. 2002
[3] Section 9002 of the 2002 Farm Bill, www.biobased.oce.usda.gov , February 19th, 2004

The development and rapid implementation of renewable technologies for the energy, transportation fuels, and chemical industry is an important route towards reductions in Green House Gas emissions in the short and medium term and in line with the Kyoto Protocol.

1.3 Drivers for the definition of a new IEA Bioenergy Task and added value

The Biorefineries Task is a new and very broad biomass-related field with a very large application potential. To open up the biorefinery-related potential, international system and technology development together with industry is a necessity. Joint international priorities and RD&D-programmes between industry, research institutes, universities, governmental bodies and NGOs are necessary; whereas identification of market introduction strategies together with industry will be inevitably for the creation of a proper RD&D-framework.

In contrast to most of the other IEA Bioenergy Tasks, the proposed Biorefineries Task will cover 1) a variety of market sectors (a.o. transport sector, chemical sector, power sector, agricultural sector) with a lot of interested stakeholders, and 2) a variety of biomass conversion technologies and, more important, integrated concepts of both (bio)chemical and thermochemical conversion technologies. Concerned integrated biorefinery concepts convert a variety of feedstocks, including residues, into a portfolio of products with improved energetic chain efficiency, economy and environmental effects, compared to stand-alone processes often producing only one or two products.

It might be considered that some of the technologies and unit operations which are most likely to be included in biorefineries are already dealt with in the various other IEA tasks and therefore a separate biorefinery task is not worthwhile. However, the design and further development of biorefinery systems clearly show that the combination of technologies and the setup of an integrated multi-product process is indeed very challenging. One dimension is technical integration of production processes in order to design utilization pathways with optimised efficiency. The second dimension is networking and communication which potential partners and industry which is very important for co-production concepts. The implementation of the biorefinery philosophy requires the intense co-operation of different sectors including energy and biofuels, bulk chemicals, materials ...even the food sector. Several sectors might even run a joint production plant in the biorefinery future
The proposed IEA Task is ambitious to meet the challenge which is involved in a multi-sectoral co-production.

This methodology of integrated system approach – optimising the overall added-value of the portfolio of biomass-derived products, within an acceptable overall ecological framework – is one of the major aspects in which this Task distinguishes from the other IEA Bioenergy Tasks.

1.4 Objectives for the short term (1-3 year)

The major objective of this IEA Task for the first three years is to asses the worldwide position and potential of the biorefinery field and to gather new insides that will indicate the possibilities to come to new breakthrough, competitive, sustainable, safe and eco-efficient processing routes for the simultaneous manufacture of transportation fuels, added-vale chemicals, (CH)power, and materials, the so-called Biorefineries. The following subgoals are defined:

- Preparation of a common definition on Biorefineries, including a clear widely accepted classification system.
- Get a better insight in the current processing potential of existing biorefineries in the participating countries.
- Assessment of biorefinery (related) RD&D-programmes in participating countries to help national governments to define their own biorefinery policy goals and related RD&D-programmes.
- Prove the advantages of biorefinery concepts over more conventional single product processes by assessment and comparison of their financial-economic and ecological aspects.
- Bring together key stakeholders normally operating in different market sectors (a.o. transportation fuel sector, chemical sector, energy sector) in multi-disciplinary partnerships to discuss common biorefinery-related topics, to foster necessary RD&D trajectories, and to accelerate the deployment of developed technologies. A.o. create opportunities for (new) SME's.
- Identification of most promising added-value chemicals – a.o. functionalised chemicals and platform chemicals (building blocks) – to be co-produced with energy, to optimise overall process economics and minimise the overall environmental impact.
- Co-operation with ongoing national and international activities and programmes, a.o. other IEA Tasks and EU Technology Platforms.
- Dissemination of knowledge, including teaching aspects, to make students familiar with the integral concept thinking of biorefineries.

Depending on the number of participants (available budget) in this Task, and the expertise and interests of these participants and participating countries, some of the subgoals will be emphasized.

1.5 Objectives for the long term (4-10 year)

This IEA Task can have huge potential economically. Within this Task the potential for the integration between the production of transportation fuels, added-value chemicals, (CH)Power, and materials from the renewable resource biomass by the Biorefinery concept will be assessed. The following impacts and benefits for the longer term can be mentioned:

- Innovation driven science and technology of renewable feedstocks and quickly incorporate the science into technology and market development.
- New commercial opportunities for renewable materials that are supplied by the agricultural-, the forest- and the food processing-industry.

- Development and market implementation of: a) lignocellulosic feedstock, b) whole crop, c) green and d) two-concept based biorefineries.
- Dynamic model on market demand and biorefinery-related supply of materials, chemicals, and secondary energy carriers that takes influencing factors into account.
- Costs of supply chains and of quality, risks, and dependability.
- Integrated thermochemical/biochemical conversion systems.
- Area dependent, impact of biorefineries on rural development, employment and environment.
- Implications for possible agricultural regulations.
- Guidelines for pre-normative standards for renewable feedstock selection and handling, process technology, fractionation technology, and product performance.
- Knowledge dissemination by a.o. published results for target groups and de general public on internet, via workshops, in journals, and by development of specific teaching programmes.

2. WORK SCOPE AND PROGRAMME

2.1 Work scope

The work will be carried out in two parts:

- Gathering and combining information in participating countries to achieve an industry oriented but yet future focused view on the working field.
- Building a network on biorefineries in participating countries with industry, governments, and researchers. Expand the focus to an European and global level, develop best practice guidelines, and test them regarding their ability to support the long term objectives.

The first activity of this new Task will be fine-tuning of the work scope and objectives in a way the results will better suit to the needs of the stakeholders (industries, research institutes, universities, governmental bodies, and NGOs) in the participating countries. However, the main activities within this Task will concentrate on gathering and combining information, and bringing together key experience, from all kind of stakeholders for different agendas regarding biorefineries.

The work will provide necessary information for building best practice guidelines. It is very likely that the overview obtained of already available information will also identify gaps in knowledge. Part of the Task activities therefore aim for identification and subsequent advising of the Executive Committee for the need for one (or more) special project(s) linked to the Task. The Task could therefore also be involved in identifying possibilities to get such work done, e.g. through the IEA itself, combinations of national activities (a.o. within ERANET), or support from bodies as the EC or DOE.

The work in this Task builds on existing work in participating countries. The results will help national governments to define their own biorefinery policy.

2.2 Work programme 2007 - 2009

Two events per year for this Task are foreseen. One of these events will normally be a combination of an open workshop for stakeholders, and a meeting of the Task members. The other event will be an annual large workshop "IEA Biorefinery Seminar" with industry of participating countries. During this workshop information on concrete projects and implementations will be exchanged. The events will potentially be coupled to specific site visits, further increasing the knowledge transfer. In between, Task management with various experts involved will prepare necessary documents (leaflets, position papers, ...), and maintain a website.

Since this is a new Task, the emphasis on specific objectives and preferences for assessments can only be fixed once there is certainty about participating countries and their stakeholders, especially interested industrial parties.

Initially, the following activities are identified:

0. Building and operationalising a Task web-site.
1. Development of a common definition and classification system on Biorefineries.
2. Identification, current processing potential, and mapping of existing biorefineries in participating countries. Both small, medium and large-scale initiatives will be assessed.
3. Identification of biorefinery (related) RD&D programmes in participating countries.
4. Assessment of financial-economic and ecological advantages and disadvantages of biorefinery-based co-production over single product processes. Integration of biorefinery processes in existing industrial infrastructures will be part of this assessment.
5. Fostering multi-disciplinary partnerships of key stakeholders normally operating in different market sectors to discuss common biorefinery-related topics (platform function).
6. Assessment of biorefinery-based co-production of chemicals and secondary energy carriers, addressing a.o. favourable functionalised chemicals and platform chemicals (building blocks) to be co-produced, and market compatibility aspects.
7. Co-operation with ongoing international activities, a.o. other IEA Bioenergy Tasks and EU Technology Platforms.
8. Dissemination of knowledge, including teaching.

Primary production and logistics of the biomass will be an integral part of the assessments performed.

The activities are closely linked to existing national programmes, so the larger part of the budget has to be allocated from these national initiatives. A limited Task budget (25%) will be available for some specific activities (a.o. case studies), not covered in the national programmes.

3. DELIVERABLES 2007 - 2009

D0. Web-site IEA Task Biorefineries [010407].

D1. Brochure with common definition and classification system on Biorefineries [31122007].

D2. Country Reports with results identification, current processing potential, and mapping of existing biorefineries [31122007].

D3. Country Reports with results identification biorefinery (related) RD&D programmes [31122007].

D4. Report with financial-economic and ecological advantages and disadvantages biorefinery-based co-production over single product processes [010708].

D5. Platform with stakeholders from different (industrial) market sectors discussing biorefinery related aspects. These stakeholders will meet annually at the IEA Biorefinery Seminar [01072007 – 31122009].

D6. Report with biorefinery-based co-production of chemicals and secondary energy carriers, addressing a.o. favourable chemicals to be co-produced, and market compatibility aspects [31122008].

D7. Co-operation with ongoing international activities, a.o. the other IEA Bioenergy Tasks, European-based Technology Platforms, Specific Support Actions, Integrated Projects, Networks-of-Excellence [01012007 – 31122009]. This co-operation will be shaped by a.o. organising joint events (workshops) with other IEA Bioenergy Tasks, and meeting regularly with ongoing EU-initiatives. The results of these activities will be reported in the annual Task Progress Reports.

D8. Dissemination of knowledge, including teaching [01012007 – 31122009]. Concerning teaching, it will be tried to develop a joint biorefinery course that could be given to students in participating countries. If not achievable, international experts potentially will be exchanged between participating countries to give lectures in existing courses. The results of these activities will be reported in the annual Task Progress Reports.

D9. Final report [31122009]
Final report includes besides of an overall project activities summery also recommendations and a comprehensive biorefinery vision statement of participant countries. Additionally an action plan for future handling of the topic will be presented.

4. SCHEDULE AND MILESTONES

Activity	2007				2008				2009			
0	wbs											
1				B								
2				CR								
3				CR								
4						R						
5			sem1					sem2				sem3
6								R				
7												
8												
meetings	ws1		sem1		ws2			sem2			ws3	sem3
task progress reports				X				X				X

wbs: web-site, B: brochure, CR: country report, R: report, ws: workshop, sem: (industrial) seminar

WS1: Task Kick-off meeting. Session with Task participants in the Work Programme, drafting of the overview reports/notes, and set-up of the Task website.

SEM1: First Seminar with industry, discussing definition, classification, identification and mapping activities (activities 1-3).

WS2: Workshop on financial-economic and ecological advantages and disadvantages of biorefinery-based co-production over single product processes.

SEM2: Second seminar with industry, discussing financial-economic and ecological advantages and disadvantages of biorefinery-based co-production over single product processes; emphasising the perspectives of the co-production of functionalised and platform chemicals with secondary energy carriers (fuels, (CH)Power).

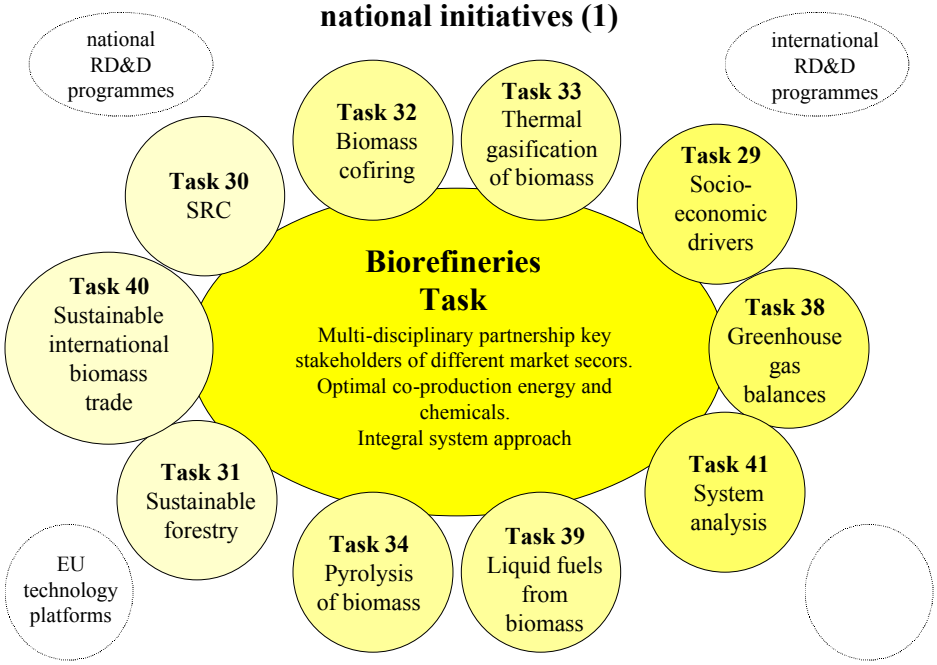
WS3: Closing working session of the Task – drafting of the Final Task Report, recommendations, and action plan on the topics handled, decision on effort for prolongation of the Task.

SEM3: Presentation of the Task results and recommendations at open Seminar. Large scale industrial participation is foreseen.

5. INTERLINKAGES WITH OTHER IEA TASKS AND FRAMEWORKS

As can be seen in the figure below this Biorefinery Task overlaps to some extent with already existing Tasks within IEA Bioenergy.

Interlinkages with other IEA Tasks, international and national initiatives (1)



For execution of the activities within this Task existing information and knowledge available in other IEA Tasks and Frameworks will be used as far as possible.
The tables below *show potential specific interlinkages* with other IEA Bioenergy Tasks and international and national activities.

Task no.	Biorefinery-related interests
30	SRC as raw materials for biorefineries
40	Trading of raw biomass versus intermediates or final products
31	Sustainable forestry products as raw materials for biorefineries
32	Upstream refinery of raw materials for power production optimising economics and/or conversion behaviour
33	a) See 32 and b) BioSyngas production and downstream applications – thermochemical refinery
34	a) Advance state-of-the-art fast pyrolysis processes and b) biorefinery activities Thermalnet – thermochemical refinery
39	Optimising economics conventional and advanced biofuels by co-production added-value products

Task no.	Biorefinery-related interests
29	Socio-economic impacts biorefineries at local, regional and international level
38	Analysis greenhouse gas reduction potential of biorefineries
41	Integral technical, economic and environmental chain analysis biorefineries
International RD&D programmes	EU: IPs, NoEs, STREPs, CAs, …
European Technology Platforms	Biorefinery-related data should be integrated in Vision documents and SRA for 7th FWP
National RD&D programmes	Overview national biorefinery initiatives both RD&D, implementation and running initiatives

Information exchange is foreseen by various activities, i.e. by organising joint workshops or by executing joint projects. Further, information exchange is guaranteed by the selected participants, which are all international key actors within different parts of the broad biorefinery-field, participating in various other IEA Tasks and international frameworks.

6. PARTICIPATING PARTNERS

Country	Contracting party	Country representative in this Task
Australia	Stephen Schuck and Associates Pty Ltd	?
Austria	The Republic of Austria	Joanneum Research and Technical University of Vienna
Belgium	-	-
Brazil	The National Department of Energy Development of the Ministry of Mines and Energy	?
Canada	Natural Resources Canada	?
Croatia	-	-
Denmark	The Ministry of Transport and Energy, Danish Energy Authority	?
Finland	TEKES	VTT
France	ADEME	IFP/ARD/INRA?

Germany	Federal Ministry of Consumer Protection, Food and Agriculture	
Ireland	Sustainable Energy Ireland	?
Italy	ENEA	
Japan	-	-
New Zealand	New Zealand Forest Research Institute Limited	?
Norway	The Research Council of Norway	
South Africa	The Department of Minerals and Energy	?
Sweden	Swedish Energy Agency	Un. of Lund / IIIEE
Switzerland	-	-
Netherlands	SenterNovem	WUR-A&F/ECN
United Kingdom	The Department of Trade and Industry	Aston University
U.S.A	DOE	NREL?
EC	DG Energy and Transport	DG Research

Legend

Expected to participate	Undecided
Probably will not participate	Still to respond

7. ANNUAL BUDGET

The annual contribution per participant is proposed at US$12,500; so if eight countries participate initially the annual budget for the Task will be US$100,000 ex. VAT. With more or less parties participating, the budget will be adjusted accordingly. These funds will be paid through the IEA Bioenergy Secretariat in the same way as all the other Tasks. A small part of the annual budget – maximally 25% - will be used to (co-)finance specific activities. The major part of the budget will be used for the management of this Task, including the organization of the annual workshops and seminars.

Other contributions (mainly in-kind): a) available research budgets in participating countries; this IEA Task builds on existing programmes running in participating countries, b) required national co-funding of national delegates, and c) inputs from international institutions, e.g. for specific seminars or workshops to be organised.

8. MANAGEMENT

The Task will be co-ordinated by Dr.ir. Ed de Jong of WUR-A&F, assisted by Drs.ing. René van Ree, rea of ECN. The activities in the Task will be back-upped by the Dutch programmatic co-operation between WUR and ECN on Biorefineries: "Bio2Value" (www.bio2value.nl).

Dr.ir. Ed de Jong

Head of Department of Fibre and Paper Technology, one of the three departments in the Business Unit Biobased Products. Involved in biomass research (pretreatment, fibre modification, enzymatic hydrolysis) for the last 15 years, author and co-author of more than 40 peer-reviewed papers in international journals, inventor of 3 patents relating biomass transformation. President of the International Lignin Institute (ILI). Editor in Chief of the Elsevier Journal Industrial Crops and Products.
He has extensive project management experience (among others the EU projects Eurolignin, Ecobinders and Sustainpack).

Drs.ing. René van Ree, rea

René van Ree became Bachelor of Science in Chemical Engineering at the College of Utrecht in 1989. In 1992 he became Master of Science in Chemistry at the Department of Chemistry, Technology and Society (Research Group Energy and Environment) of the University of Utrecht. In 1998 he became Registrated Energy Consultant at the General Association of Energy Consultants (AEC). Since 1992 he is working at the Energy research Centre of the Netherlands ECN in the System Assessment Group, previously part of the Unit Fuels, Conversion and Environment. He has a lot of experience in technical, environmental and economic assessments of a variety of fossil fuels and/or biomass/waste-fired energy conversion systems, for both power production, CHP production, and/or the production of secondary energy carriers/transportation fuels.
Further, he has a lot of expertise concerning biomass conversion systems, biorefinery systems, fossil fuel and biomass (co-)fired IGCC processes, CO2 recovery technologies, and the possibilities to use and/or dispose the separated CO2. His current position is Programme Manager Biotransportation Fuels and Refinery Processes at the Biomass, Coal and Environmental Research Department of ECN. Further, he is the co-ordinator of the biorefinery-related EU IP BIOSYNERGY (18 partners, total budget: 13.5 M€), which is selected for funding within the EU 6th Framework Programme, and will be executed from 2006 – 2010.

WUR Agrotechnology and Food Innovations B.V. (WUR-A&F)

Agrotechnology and Food Innovations is part of Wageningen UR and is an organisation for strategic and applied-scientific research for the industries and national and international authorities.

The market-driven research covers the whole productions chain; from optimising growing techniques via sustainable development and quality improvement to consumer product perception. Our expertise in all separate links of the production and sale chains enables us to realise - together with our clients- creative, and innovative solutions based on scientific insights and technological know-how.

A&F has a great variety of research facilities and equipment, that range from lab-scale to semi-industrial (pilot) scale. As a result the institute is able to optimise new technologies and products, and to offer tailor-made solutions to industries. A&F's contract partners can be found, among others, in the food industry, the chemical industry, the pharmaceutical industry, the motor-car industry, the industries manufacturing building materials, the paper-making industry, retailers, auctions, transport companies, the European Commission and national authorities. In the Business unit Bio-based Products, Fourteen research programmes were defined in order to protect the existing knowledge and technologies in the business unit and to enable new and innovative developments.
Among these are the programmes biomass conversion and bioenergy, agrofibres utilisation and valorisation. WUR-A&F is one of the co-ordinators of the Dutch Knowledge Network on Biorefineries "Biorefinery.nl" (www.biorefinery.nl).

Energy research Centre of the Netherlands (ECN)
The Energy research Centre of the Netherlands (ECN) is the leading institute for energy research in the Netherlands. ECN carries out basic and applied research in the fields of renewable energy sources, fossil fuels, environmental aspects of energy supply, policy studies, and the development and application of new materials.
ECN Biomass, Coal and Environmental Research (BCER) is a.o. dedicated to R&D on the (thermal) conversion of biomass and waste (and coal) into power, heat, gaseous and liquid fuels, and chemicals; with 60-70 full-time equivalent staff, of which more than half are academics with specialisation in chemical process technology and mechanical engineering. For more than ten years, ECN has addressed various aspects of the thermal conversion (combustion, gasification and pyrolysis) of biomass and waste in a broad range of national and international projects for government and industry. The expertise of the Unit BCER of ECN is a.o. focussed on thermal conversion of biomass and waste, both theoretically and experimentally. A large number of experimental facilities (combustion, gasification, pyrolysis, gas cleaning, gas engine, Fischer-Tropsch synthesis, fuel cells) are in use for tests both at lab-scale and pilot-scale. The development of integral Biorefinery concepts – for the co-production of chemicals, fuels, power and/or heat – to maximise the added value of the biomass used – is a key activity area within ECN's research activities. Projects have been performed on detailed modelling of thermal conversion processes (combustion, gasification and pyrolysis), evaluation of integral energy production and refinery systems and on technical, environmental, and economic system assessments. ECN is the co-ordinator of the biorefinery-related EU IP BIOSYNERGY and one of the co-ordinators of the Dutch Knowledge Network on Biorefineries "Biorefinery.nl" (www.biorefinery.nl).