

Task 34

Pyrolysis of Biomass

Task Prolongation Proposal for the new triennium 2013-2015

**ExCo70
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**Prepared by:
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And
National Team Leaders**

Proposal for Prolongation – Task 34 – Pyrolysis of Biomass

Task Period 2013-2015

Task Proposal Summary Sheet – First draft for ExCo69

Task Title: Pyrolysis of biomass

Proposer

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Endorsement by ExCo Member of participation country

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Signature:	

Objective

To facilitate commercialization of biomass fast pyrolysis to maximize liquid product yield and quality and production of renewable fuel oil and transportation fuels.

Work Scope

The Pyrolysis Task will continue the activities of the current Task with a focus on technology implementation and the market opportunities. The Pyrolysis Task will continue the activities of the current Task with a focus on information exchange, technology review, implementation, and assessment of market opportunities. A new element will be to review the field of pyrolysis of biomass in order to identify both technical and non-technical barriers to more rapid and wider spread implementation of the technology. There has been considerable success in interaction between group participants in Case Studies and in Round Robins and these will continue to play a role in the new Task, as identified by the participants. The scope of the Task will be production and utilization of liquid products for heat, power, and biofuels, and chemicals/byproducts where there is an energetic or economic contribution. In order to meet the objective, every effort will be made to actively involve industry and decision-makers in the Task and interactions with other Tasks will continue to be exploited.

Work Program

- Regular meetings will include focused seminars/workshops and technical tours and will also review progress and targets.
- Information dissemination will be through the Pyrolysis Task newsletter, which will continue to be published electronically twice per year, and through the Task 34 website.
- The program of work will be based on the traditional approach of IEA Bioenergy with a well-defined technical and non-technical work program, which is delegated to Topic Leaders to form small groups of participants to contribute. Specific actions should result in (1) a critical review of bio-oil applications, (2) a report on a round robin for bio-oil analytical methods, (3) technical support to the standardization efforts in Europe and North America; and (4) a technoeconomic comparison of alternate biomass liquefaction technology routes including upgrading to transportation fuels.
- Information exchange with other IEA Bioenergy Tasks such as the thermal biomass conversion tasks including preparation of comparable technoeconomic assessments for bio-oil gasification and combustion; preparation of LCA studies of the TEAs, and biorefinery activities based on pyrolysis.
- ExCo interaction and support.

Deliverables

The deliverables will be the newsletter twice a year, the Task 34 website, topic reports, annual reports, and a final report, which is planned to be produced from technical reports from the Task participants, the Topic Leaders and any additional outputs.

Management Qualifications

The Task will be led by Doug Elliott of PNNL USA. Doug Elliott has been involved with IEA Bioenergy activities since 1981 (BLTF, DBL, ALPS, EnvironSystems and Task 10) and most recently he has been the U.S. national team leader to Task 34 before taking on the leadership position. He has been working on liquid products from thermal biomass conversion as a research and development project manager at PNNL with expertise in high-pressure process development since 1974.

Annual budget (US\$):	\$100,000 assuming 5 participating countries
Annual budget per participant (US\$):	\$20,000

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1. BACKGROUND

The Pyrolysis Task 34 - is widely acknowledged as having made a major contribution to the science, technology and understanding of biomass pyrolysis through the PyNe Newsletter, the website (whose web address is recognized worldwide), publications and the many meetings and activities over the past 17 years.

This proposal is to continue Task 34 for a further three years from January 2013 to December 2015. It will continue to emphasize fast pyrolysis of biomass focusing on markets and technology implementation in order to support those involved in commercializing and utilizing fast pyrolysis for production of fuel oil and transportation fuels.

2. CHALLENGES FOR FURTHER MARKET DEPLOYMENT

The overall objective of the continuing Task is to facilitate commercialization of biomass pyrolysis and particularly fast pyrolysis to maximize liquid product yield and production of renewable fuel oil and transportation fuels by contributing to the resolution of critical technical areas and disseminating relevant information particularly to industry and policy makers. The scope of the Task will be to monitor, review, and contribute to the resolution of issues that will permit more successful and more rapid implementation of pyrolysis technology, including identification of opportunities to provide a substantial contribution to bioenergy. This will be achieved by all the activities described in Section 5 below.

Pyrolysis comprises all steps in a process from reception of biomass in a raw harvested form to delivery of a marketable product as liquid fuel, heat and/or power, chemicals and char byproduct. The technology review may focus on the thermal conversion and applications steps, but implementation requires the complete process to be considered. Process components as well as the total process are therefore included in the scope of the Task, which will cover optimization, alternatives, economics, and market assessment.

The work of the Task will address the concerns and expectations of the following:

- Pyrolysis technology developers
- Equipment manufacturers
- Chemical producers
- Policy makers
- Investors
- Researchers
- Bio-oil applications developers
- Bio-oil users
- Utilities providers
- Decision makers
- Planners

Industry will be actively encouraged to be involved as Task participants, as contributors to Workshops or Seminars, as Consultants, or as technical reviewers of Task outputs to ensure that the orientation and activities of the Task match or meet their requirements.

3. THE ROLE OF A SPECIFIC TASK ON PYROLYSIS OF BIOMASS

A continuation of the existing task within the IEA Bioenergy Agreement on Pyrolysis of Biomass is proposed to strengthen the existing momentum in market introduction of fast pyrolysis systems in its member countries, as well as the export position of OECD-based manufacturers to non-OECD member countries.

The proposed task will facilitate effective exchange of strategic technical and non-technical information. The main stakeholders of the Task are equipment suppliers, research organizations, technology and process developers, and government agencies. Knowledge transfer to these target groups is done directly through involvement in Task-organized events and direct access to Task-generated information.

The Task will cover issues related to biomass fast pyrolysis technologies to be (potentially) used in its member countries. As the key technical and non-technical issues for the different applications and application scales for fast pyrolysis are similar, current Task members strongly support a Task in which pyrolysis issues are specifically addressed.

The Task is aware that certain aspects of pyrolysis are relevant for further expansion of biomass pyrolysis and gasification technologies. In such cases, effective collaboration and information exchange is anticipated. Consolidation of Task 33 Gasification with Task 34 Pyrolysis has been considered by the Task 34 participants and determined to detract from the effort by losing focus on the key issues for pyrolysis.

4. PRIORITIES FOR THE WORK PROGRAM 2013-2015

The existing structure of Topic Groups has proved very successful in promoting a very high level of member participation, attracting a high proportion of industrialists to meetings, and providing a stimulating and lively forum. The potential topics to be included in the Task for the new triennium are shown in Table 1. These were derived from a list originally identified from task discussions and refined by iterative polling of the Task participants and potential participants. This final list was reviewed and confirmed at the Task meeting in April 2012.

Table 1: Priority Topics for Task 34 Prolongation

Review of bio-oil applications
Bio-oil standardization
Round robin for analytical method validation
TEA of thermochemical liquefaction technologies
Collaboration with Task 32, Task 33, Task 38, Task 39, and Task 42

A more detailed overview of these topics is provided below:

5. WORK PROGRAM

A more detailed description of each of the above topics, with proposed actions and deliverables, is provided below. Comments are requested from current Task 34 members and ExCo members, after which the proposal will be finalised.

5.1 Review of bio-oil applications

The task members will undertake a review of the potential applications for bio-oil within existing markets. The group will identify the leading applications and the technical and non-technical barriers to commercialization. Issues such as market size, resource size, and bio-oil property impacts will be evaluated. One deliverable from this effort will be a journal article to update the Oasmaa, Gust, Peacocke et al. publication on Norms and Standards for End User Specifications

to specifically include the three priority applications being developed toward a CEN standard specification (light fuel oil, heavy fuel oil and internal combustion engines, including turbines).

5.2 Bio-oil standardization

The task will seek to support the implementation of standard methods for the use of bio-oil. Specific efforts will include the establishment of CEN standards as required for use of bio-oil as a burner fuel, both heavy and light grades, internal combustion engine fuel, as well as feedstock to gasification and refinery coprocessing, as specified in the recent Draft Mandate from EC. Support and input toward the ASTM specifications and standards development will continue. An effort will be made to facilitate transfer of the EU developed standards to the ASTM process in order to coordinate standards. Technical input to the REACH process for registering bio-oil for commercial use in Europe will also be provided as needed, including SIEF information exchange forum, assistance to companies in pyrolysis oil data collection and processing, and drafting a new MSDS.

5.3 Round Robin for bio-oil analysis methods validation

The Round Robin process has provided useful feedback on bio-oil analytical methods in previous efforts by Task 34 and its predecessors. In the coming triennium a Round Robin will be organized to further evaluate analytical methods. Suggested candidate methods include analysis of sulfur, nitrogen and chlorine content methods involving the range of modern analytical instrumentation and consideration of the range of sensitivity of each, an improved thermal aging test for evaluating bio-oil stability to use liquid bath heating systems or better controlled atmospheric systems, and sustained combustion.

The Round Robin process will include a preparatory step as part of the confirmation process of a review by the organizers of the details of the analytical methods to be used by each Round Robin participant in order to validate its applicability and appropriateness. The Round Robin is expected to include 10 to 15 laboratories and be limited to the participating countries. If additional participants are needed to fulfill this level of comparison then laboratories from outside the Task participants will be considered. The Round Robin will be organized in such a manner that the initial round of analyses can be revisited for further elucidation within the triennium. The results of the Round Robin will be prepared into a technical journal publication under the authorship of the organizers.

5.4 Technoeconomic assessment of biomass thermochemical liquefaction technologies

The participating countries in Task 34 identified a need to update an earlier IEA Bioenergy technoeconomic assessment of biomass liquefaction technologies in light of new developments in finished fuel production as well as changes in the economic climate since the earlier reports from the 1980s. This effort was initially proposed as a special project for ExCo funding to be initiated in 2012; however, such support was lacking and the effort has now been fully incorporated into Task 34.

The comparative TEAs will be derived from an initial review of potential process options for transformation of biomass to transportation fuels through pyrolytic routes. The expectation is that representative process models can be developed including detailed process flow diagrams, mass and energy balances, equipment sizing and costing with overall operating and capital cost calculations performed on a uniform basis, which allows useful internal comparison. These TEAs should include extensive elemental balance in order that environmental impacts can be judged and Life-Cycle Analyses completed. The outcome of this effort should be valuable to biomass producers, users, government decision makers, as well as other stakeholders.

5.5 Cooperation with other Tasks

In order to address the direction to increase inter-Task collaboration, four topic areas have been identified for cooperation with Tasks 32, 33, 38, 39 and 42. The task should be able to undertake the first two collaborations within existing manpower and budgets. The third, fourth, and fifth will be dependent on the level of participation in Task 34.

5.5.1 TechnoEconomic Assessment of Bio-oil Gasification

To collaborate with Task 33 we propose to complete a TEA of bio-oil gasification as a means to compare to solid biomass gasification. Bio-oil gasification is being studied in Germany by the Karlsruhe Institute of Technology as an optional means to make use of the processing advantages of a liquefied biomass in subsequent utilization. This option use should be assessed to compare to direct gasification to determine cost and other differences. This collaboration will involve development of comparative bio-oil gasification cost models. Once the models are developed then conclusions can be drawn as to the differences.

5.5.2 TechnoEconomic Assessment of Bio-oil Combustion for CHP

To collaborate with Task 32 we propose to complete a TEA of bio-oil combustion for CHP as a means to compare to direct biomass combustion for CHP. Bio-oil combustion is the near-term application for bio-oil and its use should be assessed to compare to direct combustion to determine cost and other differences. The direct combustion of biomass is well understood in Task 32 and cost models have been developed. This collaboration will involve development of comparative bio-oil combustion cost models. Once the models are developed then conclusions can be drawn as to the differences.

5.5.3 Use of TEAs for LCAs

As a point of collaboration with Task 38 we propose to make our process TEAs available to Task 38 for the development of life cycle assessments of the process options. A more complete development of the scope of work for this collaboration will be undertaken at the End-of-Triennium Bioenergy Conference in Vienna in November 2012.

5.5.4 Data Base Development

An existing database structure will be used (e.g., by adapting T33 or T39 or a T33/T39 combined database to the purpose) and the scope of database coverage will be extended beyond gasification and biochemical to also include pyrolysis-based approaches to liquid biofuels. Task 34 will be involved in stewarding the accuracy of information in the database that involves facilities using pyrolysis-based technologies. There are a number of private entities already tracking pilot/demo/commercial scale developments across the entire biofuels space, albeit at a shallow level of due diligence, so within Task 39 a need was recognized to evolve their database effort from trying to maintain up to date listings of advanced biofuels pilot/demo/commercial scale facilities to adding value to the lists that already exist. Vetting/expanding/qualifying the information being aggregated by others is one way to do this and something T39 (and likely T33) will be pursuing in the next triennium. Task 34 will contribute to the joint T33-T34-T39 effort by participating in reviewing information related to pyrolysis-oriented projects.

5.5.5 Biorefinery Pyrolysis TEE Development

This effort is an outgrowth of the work undertaken in the past triennium to develop the link Tasks 34 and 42. In that effort a pyrolysis-based biorefinery concept was studied in The Netherlands. Pyrolysis of biomass is viewed as one of the promising primary biorefinery processes that potentially could be directly upstream (power plants, oil refineries) or downstream (biofuel, pulp/paper) integrated with conventional industrial infrastructures converting these infrastructures to highly-efficient, sustainable, multi-product biobased facilities. Within this Task

a pyrolysis-based concept will be TechnoEconomic and Environmentally (TEE) assessed as part of an overall sustainability assessment. Task42 and Task34 will jointly define the concept and perform the assessment, in which Task34 will focus on the technical and economic aspects, and Task42 will focus on the overall sustainability aspects. Task38 will be involved by performing the LCA work.

5.6 Meetings

Meetings will be held at approximately 6 month intervals and will typically comprise a regular Task meeting with a Seminar or Workshop and/or a Technical Visit. Seminar/Workshops will feature invited speakers with an emphasis on industrial and commercial organizations. This approach has proved very successful in the past Task and has resulted in an excellent two-way interaction between participants of the Task and external organizations. Each meeting will devote a portion of the session to country reports to facilitate exchange of research developments among the participants. The meetings will be open to external participation from those countries participating in the Task.

5.7 Interaction with industry

Fast pyrolysis is a new technology that offers the unique advantage of producing a liquid fuel directly from biomass in high yield. Though much of the recent activity in this area has been at a research level, more companies are becoming interested in the potential of producing and using a biomass derived liquid fuel and the technology is at an early stage of market penetration. There has been extensive interest by industrialists in the workshops, and this interest will be developed and more workshops and meetings will be held to meet the identified requirements of companies involved in producing and using bio-oil and in producing and using equipment for these purposes.

To achieve this objective, the Task will work with pyrolysis technology developers and providers to help identify and define their problems and help to provide solutions both from within the group and externally. Similarly the Task will co-operate with applications developers and equipment manufacturers to help them understand more about bio-oil and its properties and requirements. This close co-operation is considered the most effective way of identifying and promoting opportunities for bio-oil to make a significant impact on renewable energy supplies.

5.8 Publications

The newsletter will continue to be published at approximately 6-month intervals in electronic format to reduce costs and improve timeliness. Information will be gathered from the Task participants and their contacts throughout the world.

In addition, the Website will be maintained and regularly updated. An additional feature that will be evaluated is a database of activities and progress in the fast pyrolysis area that will be contributed to and used by the participants in the field. It is planned that the Website will continuously evolve through the duration of the Task to satisfy the requirements of the Task Participants as well as those organisations the Task is trying to serve.

Much of the work in Task 34 in the past has been published in technical journals. The expectation for the coming triennium is that there will be 4-6 journal publications derived from the collaborations, round robins, and technoeconomic assessments.

6. ACTIVITY STRUCTURE

The work in Task 34 will consist of Task meetings with workshops and Task projects, in addition to the 'usual' Task management and ExCo support actions. A more detailed description follows below.

6.1 Task meetings

Twice every year a formal Task meeting will be held to discuss progress in the various Task projects, plan new actions, provide feedback from ExCo meetings and exchange news from national R&D programs in individual member countries. These meetings are often held in combination with a workshop and often include technical field trips for the participants.

6.2 Task projects

The following specific Task projects are foreseen:

- Review of bio-oil applications (see 5.1)
- Bio-oil standardization (see 5.2)
- Round robin for bio-oil analysis methods validation (see 5.3)
- Technoeconomic assessment of biomass liquefaction technologies (see 5.4)
- Technoeconomic assessments of bio-oil utilization and collaborations (see 5.5)

A good part of the success of Task 34 is due to the fact that Task projects are not specifically covered in existing national R&D programs but provide strategic support to reach the aims of the participating countries. Immediately after the start of the next triennium, more specific agreements will be made with individual Task members that have suggested Task projects listed above and with the other tasks who are subjects of collaboration. Depending on available budget, this action list can hopefully be expanded further.

6.3 ExCo interaction and support

In order to promote effective communication between the ExCo and the Task, the Task will be represented at all ExCo meetings. At these meetings the TL or OA can clarify information provided in the submitted progress reports and effectively receive feedback.

To strengthen the relationship between individual Task members and ExCo, the ExCo member representing the host country will be invited to participate in the Task meeting to be held in their country.

From the Task budget, 10% of the funds will be reserved at the ExCo level to support specific ExCo initiated actions, including the Technology Coordinator.

6.4 Task management

The Task Leader will facilitate effective implementation of the different Task activities, mainly by:

- Planning, organizing and minuting Task meetings;
- Facilitating specific Task projects;
- Dissemination of knowledge through conferences, in magazines and on the Task internet site;
- Providing interaction with the ExCo.

In addition to his management role, the Task Leader will be responsible for the technical direction of the Task. He will plan and co-ordinate all work for the entire Task. The technical results of the deliverables will become available in draft, after which they will be reviewed by the Task Leader before being finalized.

The Task Leader is also the contact person for the ExCo. Twice a year a Task progress report will be produced for the ExCo, containing information of the progress achieved in the various activities, potential delays, unresolved issues, and so on. This information will be communicated with all Task members and presented at ExCo meetings. The Task input to the IEA Bioenergy Annual Report will also be prepared by the Task Leader.

7. INFORMATION DISSEMINATION AND KNOWLEDGE FLOW

Within the proposed Pyrolysis Task, key information is generated and compiled in the following manner:

- By obtaining results from national R&D programs from national team leaders
- Through Task organised workshops in which (invited) speakers present latest insights;
- Through strategic Task initiated projects/studies.

The knowledge generated will be digested and summarised by either the Task Leader or a Task member responsible for a specific activity (usually both in easily readable summaries and detailed reports) and disseminated either directly to the member countries or indirectly through the ExCo. The internet site has proven to be an efficient aid in knowledge transfer.

7.1 Country Representatives

The Task members (National Team Leaders) in this proposed Task are responsible for effective dissemination of the knowledge generated through the Task in their home countries. The Task initiated actions are complementary to national programs and projects but can strategically add on to these results.

7.2 ExCo

The Task Leader will attend ExCo meetings to provide interaction between the Task and the ExCo. In return, the ExCo member of the country where Task meetings are held will be invited for every Task meeting. Progress and Annual reports from the Task to the ExCo will be prepared and presented at the ExCo meetings. Input to the IEA Bioenergy Annual Report will be provided. Key outputs generated by the proposed Task will be published in IEA Bioenergy News.

7.3 Task Website

The existing website for the Pyrolysis Task (<http://www.pyne.co.uk/>) has a long history of providing information to the growing biomass pyrolysis community worldwide. The high level of recognition for “pyne” is noted as it is the most highly cited search term used to access the site. It has proven to be a key vehicle to disseminate information to the target groups. In the coming triennium, the existing website will be kept up-to-date with news items, reports etc.

7.4 Newsletter

An electronic version of the task newsletter will be produced and distributed twice every year to provide information on recent developments related to the work of this Task and biomass pyrolysis in general. The task members routinely review and update the distribution list. Interested stakeholders can subscribe to the newsletter through the website.

7.5 Journal Publications

Another key means to disseminate the information generated by the Task is by technical journal articles. An example is *Results of the IEA Round Robin on Viscosity and Stability of Fast Pyrolysis Bio-oils*, which has recently published in **Energy and Fuels**, a journal of the American Chemical Society. A publication of the *State of the Art of Research in Biomass Pyrolysis* describing advances in the countries participating in the Task is projected for publication in **Renewable & Sustainable Energy Reviews** early in 2013.

8. DELIVERABLES

The following deliverables are planned:

- Task document describing Bio-oil properties and applications
- Round Robin report published in a technical journal
- Technoeconomic assessments of biomass liquefaction processes (at least two)
- Updated and normalized MSDS for bio-oil for international use
- Electronic newsletter (twice a year)
- Regularly updated website
- Task meetings and minutes (twice a year)
- Annual reports to ExCo
- Progress reports to ExCo (at alternate meetings from annual reports)
- State of the Art review of the task participating countries
- Collaborative journal publications (at least two)
- Final report, containing the output of the Task participants as well as any commissioned work.

9. SCHEDULE AND MILESTONES

The provisional schedule and milestones are summarised in the table below:

Item	Date	Milestone
Task meeting— Finland	April 2013	technical visit and development update
Task meeting— Germany	October 2013	technical visits and development update
1 st Annual Report	November 2013	Annual Report
Task meeting— UK	April 2014	technical visit and development update
Task meeting— USA	October 2014	technical visit and development update
2 nd Annual Report	November 2014	Annual Report
Task meeting	May 2015	technical visit and development update
Task meeting	October 2015	Final Reports from Technical Topic Groups
Final Report	November 2015	Submission of Final Report with all Technical Reports and Commissioned Reports.

Task Name	2013												2014												2015												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Task Meetings			X							X					X							X					X								X		
Annual Reports										X						X						X													X		X
Progress Reports			X												X												X										
Newsletter				X							X					X						X						X									X
Bio-oil properties and applications												—————												—————												
Standards development	—————												—————												—————												
Round Robin	—————												—————												—————												
Round Robin results publication	—————												—————												—————												
Technoeconomic assessments	—————												—————												—————												

10. LINKAGES WITH OTHER IEA BIOENERGY TASKS

The thermochemical conversion tasks, #32 Combustion, #33 Gasification and #34 Pyrolysis have many overlapping interests. However, the specific issues addressed by each task have different context for each Task. A direction from ExCo for consideration of combining one or more of

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these tasks has been underway in CY2012. It is the belief of the participants of Task 34 that consolidation with either Task 32 and/or Task 33 would detract from the effort underway specific to pyrolysis. There is no overriding reason to consolidate the tasks, and the participants for Task 34 wish for Task 34 to remain as a separate task. With a minimum of four members and the possibility of 6 or more, maintenance of the Task as structured is the expected path forward.

Linkage of Task 32, 33, and 34 is expected to occur. Two topics for collaboration have been identified: 1) Comparative TechnoEconomic Assessments of bio-oil and biomass gasification, and 2) Comparative TechnoEconomic Assessments of bio-oil and biomass combustion for CHP. The scope of work involves collaborative development of comparable TEA to compare solid biomass utilization versus liquefied biomass (bio-oil) in the combustion and gasification applications.

A new linkage with Task 39 will be established through a collaboration to develop and refine a data base on biomass pilot/demo/commercial scale facilities.

In addition, a linkage to Task 38 is envisioned involving the use of the TEAs developed in Task 34 for LCA analysis in Task 38. A meeting to further develop this scope of work will be arranged at the End-of-Triennium conference in Vienna in November 2012. Further, we will continue to collaborate with Task 42 on the subject of a pyrolysis-based biorefinery, including a technical, economic and environmental assessment and working with Task 38 on an LCA.

11. TASK MEMBERSHIP AND BUDGET

11.1 Key Partners

Currently, six IEA Bioenergy members (indicated in the table below) are participating in the Pyrolysis Task. Because of their expertise, potential for pyrolysis technologies and/or interest in the indicated areas, four of these existing member countries have already confirmed their intention to participate in the next triennium. Another five countries have indicated they might possibly participate. Other member countries of IEA Bioenergy have active research and development or demonstration programs in biomass pyrolysis.

	Member now?	Declared intention to participate	Interest in next triennium	Active R&D
Australia	No		X	X
Belgium	No		X	X
Brazil	No			X
Canada	Yes		X	X
Finland	Yes	X		X
Germany	Yes	X		X
Italy	No			X
New Zealand	No		X	X
South Africa	No			X
Sweden	No			X
The Netherlands	Yes	X		X
United Kingdom	Yes	X		X
U.S.A.	Yes	X		X

11.2 Annual Budget

The work program described above is based on the assumption that a budget of 100,000 US\$ is available, funded by 5 member countries. This is equivalent to an annual contribution per country of 20,000 US\$. This figure of 20,000 US\$ is a contribution per country per year. The

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other major factor in supporting the Task is the in-kind contribution of the technical expert/national team leader from each country. Similarly, the inter-task collaborations will be based on in-kind contribution for the most part. In case more or less than 5 countries participate, the task budget will increase or decrease accordingly and the set of activities might expand (or contract). If there is significant growth in Task participation (>6 members) the country contribution could be reduced.

Annual Proposed Budget, Task 34

Cost/year US \$	Task Administration	Technical Tasks	Inter-task Collaboration	Information Dissemination	TOTAL
Labor	\$28,000	\$5,000	\$5,000	\$5,000	\$43,000
Task meetings and workshops	\$0	\$5,000	\$0	\$4,000	\$9,000
Travel	\$11,500	\$0	\$0	\$0	\$11,500
Website maintenance and newsletter publishing				\$22,000	\$22,000
Materials and supplies	\$500				\$500
Consultants, contracts			\$4,000		\$4,000
ExCo holdback					\$10,000
TOTAL					\$100,000

Budget Justification

From the detailed budget above, the proposed Task expenditures in total and by work-scope area can be identified.

Labor: One of the primary cost categories associated with running the Task will be in labor (including benefits and overheads) paid to dedicated personnel. Included are Task Leader costs as well as funds to support a part-time staff member for bookkeeping activities who also tracks invoices and payments.

Task Meetings and Workshops: Funds are set aside for Task meetings and workshops designed for the task participants. The Task Leader will organize two task meetings per year. Invited expert contributors are also provided through these funds.

Travel: Travel costs are related to Task Leadership participation in the Task 34 meetings and ExCo meeting participation.

Website maintenance and newsletter publishing: Maintenance of the Task 34 website is part of a subcontract which also includes editing and publication of the newsletter.

Materials and supplies: A small sum is requested for materials and supplies related to the administration of the Task, in order to cover the cost of incidentals (paper, binding, mailings, etc.).

Consultants, contracts: This area of funding is requested in order to facilitate access to expertise outside of the Task. The Task Leader will manage the consulting funds.

ExCo held-back funds: 10% of the Task's annual budget is set aside for ExCo specified work.

12. TASK MANAGEMENT

The proposed Pyrolysis Task will be co-ordinated by Doug Elliott of the Pacific Northwest National Laboratory. The Operating Agent for the proposed Task is the US Department of Energy, represented by Paul Grabowski.

12.1 Qualifications of individual leading the Task

Doug Elliott has 38 years of research and project management experience in the Battelle system at the Pacific Northwest National Laboratory (PNNL). His work has mainly been directed toward development of fuels and chemicals from biomass and waste. His experience is primarily

in high-pressure batch and continuous-flow processing reactor systems. This research has also involved him in extensive study of catalyst systems. Mr. Elliott has been involved in the following relevant work:

Bench-Scale Research in Biomass Liquefaction. From 1976 to 1982, Mr. Elliott was project manager of PNNL's bench-scale support and analysis for the Biomass Liquefaction Experimental Facility formerly at Albany, Oregon. From 1982 to 1988, the thrust of this research shifted to involve Mr. Elliott in leading the development of catalytic hydrotreatment processes for biomass liquefaction products through bench-scale testing in batch reactors and a continuous-flow, fixed-bed catalytic reactor. As a result, two patents were issued describing important aspects of this hydrotreating work. More recent work in this area (1993-1996) involved analysis and upgrading of pyrolysis oils under an inter-laboratory agreement with the National Renewable Energy Laboratory and supplemental support from the European Union Directorate General XII on Research and Development. This research was restarted with U.S. Department of Energy (DOE) support in 2003 based on new developments in fast pyrolysis and catalysis. Hydrotreating has been applied both for production of value-added chemicals and to produce product liquids compatible with existing petroleum refinery facilities and capabilities. Recent projects led by Mr. Elliott include a Cooperative Research And Development Agreement with UOP for production of refinery feedstock, the Pyrolysis Core R&D project for the DOE to develop improved pyrolysis methods, and a DOE-funded partnership with a team led by UOP and Ensyn to evaluate bio-oil stabilization technology. Under Mr. Elliott's leadership PNNL also plays a supporting role in the Integrated Biorefinery demonstration project cofunded by DOE and UOP, which involves both fast pyrolysis of biomass and also upgrading the bio-oil to fuel products.

International Activities in Bioenergy Processes. From 1981 to 1989, the DOE work described above also involved Mr. Elliott in the cooperative study of biomass liquefaction Task VII of the IEA Bioenergy. As a result of this expertise, Mr. Elliott managed related research projects sponsored by the governments of Canada and Finland testing catalytic hydrotreatment of pyrolysis oils produced from wood and peat. From 1989 to 1992, Mr. Elliott assisted the government of Finland with its technical contribution to the IEA Assessment of Liquefaction and Pyrolysis Systems (ALPS) activity, the 3rd stage of Task VII. From 1989 to 1995, Mr. Elliott also participated in the IEA Bioenergy Environmental Systems Activity, Task VII, Activity 7 and the subsequent Task 10 with emphasis on environmental issues in thermochemical conversion of biomass and particularly liquefaction and pyrolysis. In 2004 he returned to Task 34 on Pyrolysis as the U.S. representative. Since 2009 he has served as Task Leader for Task 34.