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Biomass Conversion Task IV 1988 Program of Work

International Energy Agency Bioenergy Agreement

Don J. Stevens, Operating Agent

December 1987

Prepared for the
International Energy Agency
Bioenergy Agreement
under a Related Services Contract
DE-AC06-76RLO 1830
with the U.S. Department of Energy

Pacific Northwest Laboratory
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Printed in the United States of America
Available from
National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161

NTIS Price Codes
Microfiche A01

Printed Copy

Pages	Price Codes
001-025	A02
026-050	A03
051-075	A04
076-100	A05
101-125	A06
126-150	A07
151-175	A08
176-200	A09
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276-300	A013

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1988 PROGRAM OF WORK

INTERNATIONAL ENERGY AGENCY
BIOENERGY AGREEMENT

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Biomass Program Office

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1. EXECUTIVE SUMMARY

Biomass materials represent a major and often under-used resource for producing energy. Biomass includes feedstocks such as wood, wood wastes, agricultural wastes, and other cellulosic residues. These feedstocks are renewable and offer the potential for stable national energy sources relatively isolated from international fluctuations in petroleum availability. Biomass is also the only renewable energy technology capable of addressing the future need for transportation fuels.

For biomass to meet its potential as an energy resource, conversion processes must be available which are both efficient and environmentally acceptable. Conversion can include direct production of heat and electricity as well as production of intermediate gaseous, liquid, and solid fuels. While many biomass conversion processes are commercially available at present, others are still in the conceptual stage. Additional research and development activities on these advanced concepts will be necessary to fully use biomass resources.

Ongoing research on biomass conversion processes is being conducted by many nations throughout the world. In an effort to coordinate this research and improve information exchange, several countries have agreed to a cooperative effort through the International Energy Agency's Bioenergy Agreement (IEA/BA). Under this Agreement, Task IV deals specifically with biomass conversion topics. The cooperative activities consist of information exchange and coordination of national research programs on specific topics. The activities address biomass conversion in a systematic manner, dealing with the pretreatment of biomass prior to conversion, the subsequent conversion of the biomass to intermediate fuels or end-product energy, and then the environmental aspects of the conversion process. This document provides an outline of cooperative work to be performed in 1988.

2. PROGRAM OF WORK FOR 1988

2.1 INTRODUCTION

For over ten years, the International Energy Agency (IEA) has provided a framework for the coordination of research on bioenergy technologies. Beginning in 1976, the IEA Forestry Energy Agreement allowed participating countries to exchange information and coordinate national research programs in the areas of forestry growth, harvesting, and conversion. In 1986, the scope of this cooperation was broadened to include other biomass resources. Within the new Bioenergy Agreement, three topic areas, called Task Annexes, were established including Short Rotation Forestry, Conventional Forestry, and Biomass Conversion.

The organization of the Bioenergy Agreement is shown in Figure 1. Within each of the Task Annexes, cooperative Activities were established to deal with specific research topics. The Activities consist of information exchange and coordination of the national research programs of the participants. Each Task Annex is administered by an Operating Agent, and a Technical Advisory Committee provides guidance to ensure that the needs of the participating countries are met. This document provides an outline of the 1988 Program of Work for the Biomass Conversion Annex.

2.2 1988 BIOMASS CONVERSION PROGRAM

2.2.1 Areas of Activities

Biomass conversion is a very diverse field and national interests often vary widely. In developing the Program of Work, five major areas dealing with conversion research were identified as having highest priority for cooperative interaction. These are:

(a) Thermal conversion
(b) Biochemical conversion
(c) General conversion
(d) Environmental issues
(e) Voluntary standards

Individual Cooperative Activities within these five areas have been established on specific topics. A list of Activities and Activity Leaders for 1988 is provided in Table 1. The 1988 budget table for these Activities is shown in Table 2. A list of participating countries and the representative to the Task IV Technical Advisory Committee is given in Table 3. A tentative list of 1988 meetings for the Biomass Conversion Annex is given in Table 4.

Detailed Activity Plans for cooperative Activities over the period 1986-1988 have been prepared and are available elsewhere.[a] Progress anticipated for each Activity in 1988 and changes from the previous plans are described on the following pages.

2.2.2 Task Administration

The Operating Agent (OA) for the Biomass Conversion Annex is USA and is represented by Don J. Stevens at Pacific Northwest Laboratory. The OA has overall responsibility for the administration of the Task Annex. In 1988, the Operating Agent for Task IV will continue to provide reports, financial data, and other information as provided in the Agreement. The Operating Agent will also prepare a draft for a post-1988 cooperative program on biomass conversion. The preparation of the draft is necessary to allow for consideration of future activities by the Executive Committee.

A Technical Advisory Committee (TAC) composed of representatives of the participating countries provides advice and direction to the Operating Agent. A meeting of the TAC is planned for spring of 1988.

(a) Stevens, D. J. August 1986. Biomass Conversion Task IV. 1986-1988 Program of Work. Report No. PNL-5992, Pacific Northwest Laboratory, P.O. Box 999, Richland, WA 99352 USA.

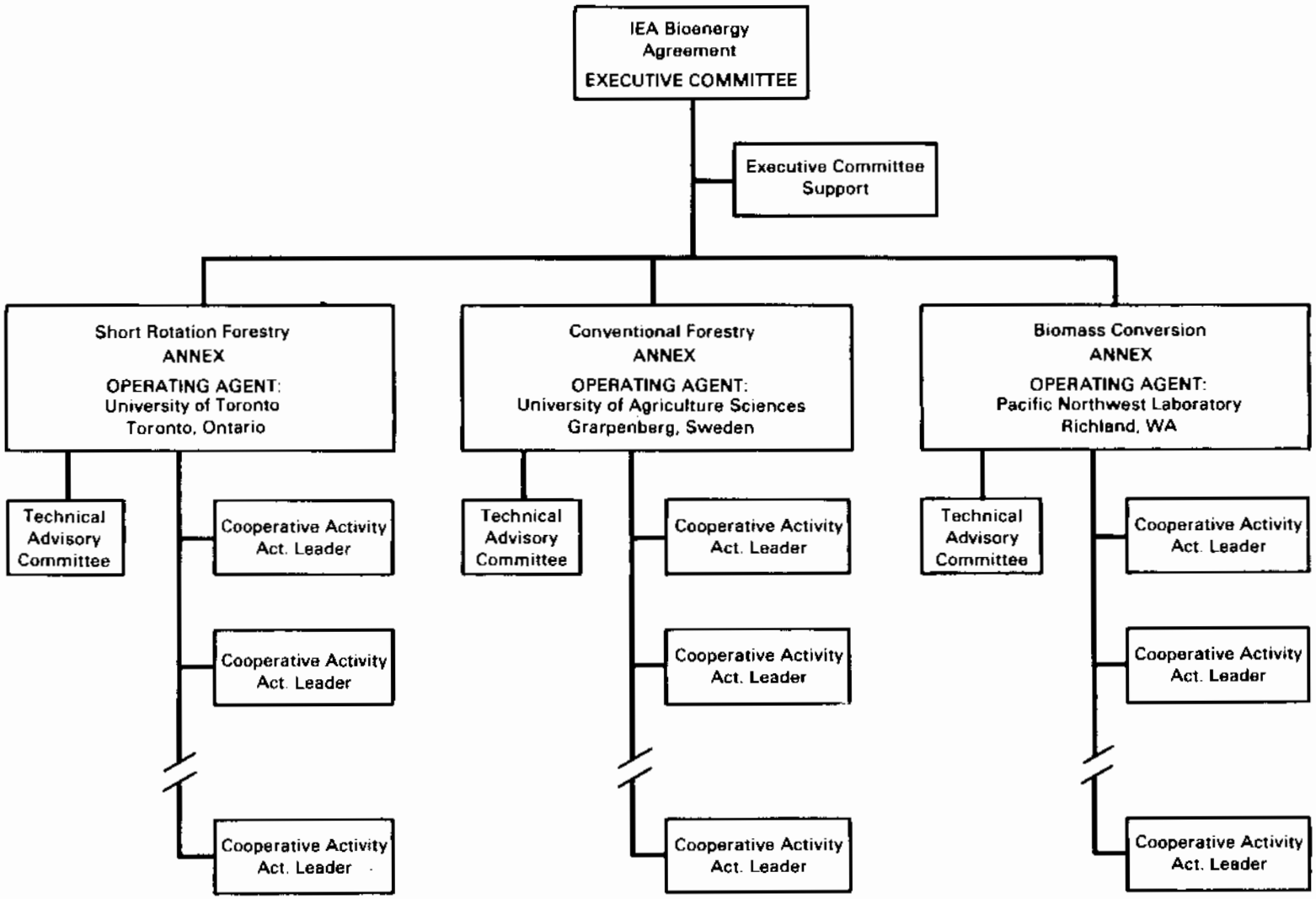

Figure 1. Organization Chart

TABLE 1. Biomass Conversion Annex
Project Activity Leaders

ACTIVITY	ACTIVITY LEADER	INSTITUTION	COUNTRY
Thermas Conversion			
- Direct liquefaction	Bjorn Kjellstrom	Energetics AB	SWE
- Combustion safety	Erling Oesterboe	SINTEF	NOR
- Thermal Conversion Conf.	A. V. Bridgwater	University of Aston	UK
- World-wide date base	A. V. Bridgwater	University of Aston	UK
Biochemical Conversion			
- Bioconversion of lignocellulosics	John Saddler	Forintek Canada Corporation	CAN
General Conversion			
- Municipal solid waste conversion	Chris Dent	AERE Harwell	UK
Environmental Issues			
- Combustor emissions	Christel Benestad	Center for Industrial Res.	NOR
- Aqueous Effluents	Paul McFarlane	Forest Research Institute	NZ
Voluntary Standards	Thomas Milne	Solar Energy Research Institute	USA
Operating Agent	Don J. Stevens	Battelle Pacific Northwest Lab.	USA

Revised May 1987

TABLE 2. ANNEX IV

ACTIVITIES AND BUDGET FOR 1988

Each budget figure for a Participant and an activity in the matrix corresponds to a declared interest from the Participant to the activity.

Activity	In-cash Contributions from Participants (1000 US$)											
	AUS	CAN	DEN	FIN	IRE	JPN	NZ	NOR	SWE	UK	USA	TOTAL
Thermal Conversion												
- Direct liquefaction		4.8		4.8					4.8		4.8	19.2
- Combustion safety		6.3						6.3	6.3			18.9
- Thermal conv. conference[1]												
- World-wide data base[1]												
Biochemical Conversion												
- Bioconversion of ligno-cellulosics	8.2	8.2				8.2	8.2		8.2		8.2	49.2
General Conversion												
- Municipal solid waste conversion		25.0							25.0	25.0		75.0
Environmental Issues												
- Combustor emissions	3.2		3.2	3.2				3.2	3.2		3.2	19.2
- Aqueous effluents				4.0	4.0		4.0					12.0
Voluntary Standards		4.8		4.8			4.8				4.8	19.2
Subtotal	11.4	49.1	3.2	16.8	4.0	8.2	17.0	9.5	47.5	25.0	21.0	212.7
Costs of the Operating Agent	1.4	6.0	0.2	1.4	0.5	0.8	1.9	1.1	5.8	2.9	2.8	24.8
Total (1000 US$)	12.8	55.1	3.4	18.2	4.5	9.0	18.9	10.6	53.3	27.9	23.8	237.5

[1]Activity will conclude in 1988 with 1987 funds

TABLE 3. The following is a list of participating countries and corresponding members of the Technical Advisory Committee for Task IV.

Participant	TAC Representative
Austria	Alfred Schmidt
Canada	Doug Hayes
Denmark	Peter Bach
Finland	Dan Asplund
Ireland	Bob Hanna
Japan	Hideaki Takamatsu
New Zealand	Keith Mackie
Norway	Edward Karlsvik
Sweden	Gert Karlsson
United Kingdom	Adam Brown
United States	Simon Friedrich
Operating Agent	Don Stevens

TABLE 4. Biomass Conversion Annex 1988 Meeting Schedule (Tentative)

Tentative Date	Meeting	Location
April 1988	Direct Liquefaction Activity Working Group Meeting	To be determined
April 1988	Combustor Emissions Activity Working Group Meeting	To be determined
May 2-6, 1988	International Biomass Thermochemical Conversion Conference	Phoenix, USA
May 10-11, 1988	Bioenergy Agreement Executive Committee Meeting	Oxford, UK
May 1988	Conversion Annex Technical Advisory Committee Meeting	To be determined
June 13-16, 1988	Bioconversion of Lignocellulocis Activity International Symposium	Ottawa, Canada
June 27-29, 1988	Municipal Solid Waste Activity Workshop	Cambridge, UK

2.3 1988 ACTIVITIES

2.3.1 Direct Biomass Liquefaction

Activity Leader: Bjorn Kjellstrom, Sweden

Objective: The objective of this Activity is to coordinate ongoing biomass direct liquefaction research to generate an improved data base for converting biomass into hydrocarbon fuels.

1986 Progress: The working Group for this Activity met in Magog, Quebec, Canada on 2-4 September 1986 to review progress which had occurred since the prior cooperative program ended in 1984. Initial effort centered on updating the state-of-the-art literature review with particular emphasis on upgrading the biocrude oils. The group also produced a Progress Report newsletter. The Project Advisory Group met in Canada in September and approved the Working Group proposal.

1987 Progress: The Working Group completed the state-of-the-art literature review. The group also began a technoeconomic analysis of processes for converting biomass to light hydrocarbon fuels. During 1987, the conversion processes to be evaluated were selected and process flowsheets were made. The final technoeconomic analysis will be completed in 1988. Working Group meetings were held in Denver, USA in April and in Helsinki, Finland in December.

1988 Anticipated Progress: The Working Group will complete the technoeconomic analysis of the selected processes and will issue a final report. A Working Group meeting is anticipated for April 1988.

Meeting Schedule

April 1988: To be determined

Participating Countries

Canada
Finland
Sweden
United States

Budget

1986: $25,200 US
1987: $25,200 US
1988: $19,200 US

2.3 1988 ACTIVITIES

2.3.2 Combustion Safety

Activity Leader: Erling Oesterboe, Norway

Objective: The objective of this Activity is to examine safety issues including fire and explosion risks in small wood-fired central heating plants.

1986 Progress: Further inspection and examination of wood-fired boilers in Norway was made. Results of the Phase I activities were published in an English-language report dated December 1986.

1987 Progress: In 1987, additional data was collected to more closely document fire and explosion risks in small boiler systems. The regulations covering biomass combustion safety are also being compared. Common rules, proposals, and test procedures are being identified. A comparison of differences and experiences will be made for further discussions and work.

1988 Anticipated Progress: The collection of data on combustion safety issues will continue in 1988. The Activity Leader is planning visits to the participating countries. The data will include case studies and comparisons of existing systems. A final report will be issued in 1988.

Participating Countries

Canada
Norway
Sweden

Budget

1986: $ 9,300 US
1987: $15,000 US
1988: $18,900 US

2.3 1988 ACTIVITIES

2.3.3 Thermal Conversion Conference

Activity Co-Leaders: A. V. Bridgwater, UK; J. Kuester, USA

Objective: The objective of this Activity is to help organize an international biomass thermal conversion conference similar to the one held in 1982 in Estes Park, Colorado.

1986 Progress: During 1986, a Steering Committee was formed to guide this Activity. Tentative plans were formulated regarding meeting time (spring 1988), and a format for content was finalized.

1987 Progress: During 1987, remaining questions of meeting location and format were resolved. The meeting will be held in Phoenix, Arizona, USA during 2-6 May 1988. A call for papers was issued and approximately 90 expressions of interest have been received by the co-chairmen.

1988 Anticipated Progress: The conference will be held in Phoenix in May as scheduled. Papers for the meeting will be reviewed in early 1988, and final drafts will be due at the meeting. The reviewed papers will then be published by a major publishing company during 1988.

Participating Countries

Canada
Norway
United States

Budget

1986: $ 9,300 US
1987: $18,900 US
1988: Activity to be completed with funds from 1987.

2.3 1988 ACTIVITIES

2.3.4 World Wide Data Base

Activity Leader: A. V. Bridgwater, United Kingdom

Objective: The objective of this Activity is to establish a comprehensive data base of thermochemical conversion research and development activities throughout the world.

1986 Progress: The Activity Leader initiated evaluation of computer data base capabilities and identification of suitable input. Contacts with key groups and organizations were established for collaboration in the data collection process.

1987 Anticipated Progress: Collection and collation of input data continued. Data sheets were distributed to known biomass conversion projects, particularly in North America and Europe. The information returned is being correlated with Biomass Abstracts, and a matrix evaluation system is being initiated on the data received. Based on responses received, an initial report with approximately 500 references has been issued. Summaries of individual projects are listed by country.

1988 Anticipated Progress: Data collection and correlation will continue through 1988. A final reference volume will be published documenting the data base.

Participating Countries

Denmark
New Zealand
United Kingdom
United States

Budget

1986: $12,400 US
1987: $16,000 US
1988: Activity to be completed with funds from 1987.

2.3 1988 ACTIVITIES

2.3.5 Bioconversion of Lignocellulosic

Activity Leader: Jack Saddler, Canada

Objective: The objective of this Activity is to coordinate research on the bioconversion of biomass to ethanol and other products. Areas of emphasis include pretreatment technologies, methods for converting five-carbon sugars, and integrated system analysis.

Background: Through 1987, the cooperative work on bioconversion of biomass to alcohol consisted of three separate cooperative Activities. In an effort to better focus the work, the three separate Activities have been consolidated into a single, integrated Activity. The consolidated Activity will officially begin in January 1988. The progress described below summarizes overall accomplishments in this area.

1986 Progress: A major international symposium on the pretreatment of lignocellulosics was held in Graz, Austria in June. The symposium attracted wide-spread interest with over 50 participants from a variety of countries. Approximately forty papers were presented and extra time was designated for round-table discussions. Session topics included pretreatment technologies, analytical methods, and enzyme technologies.

1987 Progress: Work during 1987 focused on consolidating the three previous Activities into a single, integrated one. The Activity Leaders closely coordinated their work to facilitate the consolidation. Visits were made to participating countries in September and October, and a new round of topics was introduced into the computer communication system for discussion. Plans were also initiated to have a symposium in Canada in 1988.

1988 Anticipated Progress: A second international symposium on bioconversion topics will be held. The meeting is tentatively planned for 13-16 June in Ottawa, Canada. Exchange of research ideas on selected topics via the computer communications system will also continue, and a final report will be issued in 1988.

Participating Countries:

Austria
Canada
Japan
New Zealand
Sweden
United States

Budget: (Total for integrated Activities)

1986: $32,000 US
1987: $58,200 US
1988: $49,200 US

2.3 1988 ACTIVITIES

2.3.6 Municipal Solid Waste Conversion

Activity Leader: Chris Dent, United Kingdom

Objective: The objective of the Activity is to establish and organize cooperative research and development between the participating countries in the area of municipal solid waste conversion. Emphasis is on the recovery of energy and materials from municipal and industrial wastes and attention is also placed on the need to minimize environmental impacts.

1986 Progress: The Activity Leader made contacts and held discussions with representatives of the participating countries. Initial work gave priority to conversion of domestic and commercial wastes and concentrated technoeconomic and institutional factors. A literature search was made to provide a data base for future effort. The literature search included applications of MSW conversion technologies in the participating countries as well as current research and development activities.

1987 Progress: Work in 1987 focused on documenting the national R&D programs of the participating countries. A report summarizing projects in Sweden was published in mid-1987. Similar overviews of municipal waste conversion technologies in United kingdom and Canada were also being completed. A presentation of the IEA work was also presented in Montreal at the Canadian Waste Incineration Workshop in October.

1099 Anticipated Progress: The overview documents describing municipal waste conversion projects in Canada and United Kingdom will be distributed for review. Following review, these documents will be published. A summary document which compares the programs in the thre. participating countries and suggests areas for further coordination will also be issued. A workshop on waste conversion is also scheduled. The workshop will tentatively be held 27-29 June in Cambridge, UK. The Activity Leader will also present an overview of the IEA work at an MSW conference in Coventry, UK in March.

Participating Countries

Canada
Sweden
United Kingdom

Budget

1986: $37,500 US
1987: $75,000 US
1988: $75,000 US

2.3 1988 ACTIVITIES

2.3.7 Combustor Emissions

Activity Leader: Christel Benestad, Norway

Objective: The objective of this Activity is to measure and characterize biomass combustion emissions. The intention is to contribute to the development of appliances with decreased pollution emission and increased efficiency.

1986 Progress: The Activity Leader initiated the collection of information about sampling methods and characterization of particulates and micropollutants in emissions from wood combustion. Evaluation of data was started.

1987 Progress: The collection and analysis of methods for sampling and characterizing emissions continued. Stack gas samples of actual particulates and organics were made using the different methods identified. Chemical analysis of the samples also started to allow direct comparison of the results of the different sampling methods. A draft report summarizing results to date was issued in November.

1988 Anticipated Progress: Collection of stack gas analytical methods and experimental analysis of actual gas samples will continue. A meeting of contact persons is planned for spring of 1988 to discuss progress and plan for future cooperation.

Participating Countries

Austria
Denmark
Finland
Norway
Sweden
United States

Budget

1986: $19,200 US
1987: $31,800 US
1988: $19,200 US

2.3 1988 ACTIVITIES

2.3.8 Aqueous Effluents

Activity Leader: Paul McFarlane, New Zealand

Objective: The objective of this Activity is to develop methods for analysis and effective treatment of aqueous waste streams from biomass conversion systems.

1986 Progress: This Activity was approved by the IEA Bioenergy Agreement Executive Committee in October 1986. Start-up of cooperative work was scheduled for 1987.

1987 Progress: Initial work concentrated on aqueous effluents from biological conversion systems. The Activity Leader visited countries which are participating or have shown potential interest in participating in this Activity. Based on the discussions held, an extensive report providing introductory information was compiled and distributed. A computer communication network has also been implemented.

1988 Anticipated Progress: The cooperative program of work for this Activity will be finalized, and further discussions on selected topics will be held using the computer communication network. A working meeting on the aqueous effluents from bioconversion systems is planned and may be held in conjunction with the bioconversion symposium in Ottawa in June.

Participating Countries

Finland
Ireland
New Zealand

Budget

1986: -0-
1987: $12,000 US
1988: $12,000 US

2.3 1988 ACTIVITIES

2.3.9 Voluntary Standards

Activity Leaders: Thomas Milne, USA

Objective: The purpose of this Activity is to identify key analytical methods which can be voluntarily applied to biomass conversion research. By using the best analytical methods available, individual laboratories can improve information exchange.

1986 Progress: The Activity Leader contacted participating countries and established contacts within participating laboratories. Information was gathered to formulate a Work Plan in conjunction with the Working Group.

1987 Progress: During 1987, the Activity Leader established a wide base of research contacts and distributed information on the IEA Activity. A major Working Group meeting was held in Denver, USA in November. The meeting consisted of representatives from nine countries in the areas of thermal and biological conversion as well as feedstock characterization. The participants narrowed the scope of the work by identifying specific topic areas where cooperation on analytical methodologies would be most beneficial. Various participants accepted key roles to continue the work in topics such as round-robin tests.

1988 Anticipated Progress: Continued work in 1988 will expand on the progress made in 1987. Round-robin tests on selected analytical procedures will be performed. References to key analytical methods will be collected, and a reference volume detailing these methodologies will be compiled.

Participants

Canada
Finland
New Zealand
United States

Budget

1986: $12,200 US
1987: $12,200 US
1988: $19,200 US

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