Schlussbericht 2004, 24. November 2004

Projekt
Arbeiten für das IEA Geothermal Implementing Agreement (GIA) 2004

Autor und Koautoren	Prof. L. Rybach
beauftragte Institution	Geowatt AG
Adresse	Dohlenweg 28
Telefon, E-mail,	01 242 1454
Internetadresse	rybach@geowatt.ch
BFE-Nummern	Projekt: 100'802 Vertrag: 150'913
Dauer des Projekts	vom 01.01.2004 bis 24.11.2004

ZUSAMMENFASSUNG

Im Berichtszeitraum fanden das 11th Meeting in Paris (18./19.03.2004) sowie das 12th Meeting (Pisa, 14./15.10.2004) des GIA Executive Committe (ExCo) statt. In Paris wurde der Swiss Country Report 2003 präsentiert, in Pisa der Bericht „Swiss Geothermal Scene 2004" vorgetragen. Die weiteren, vielfältigen Arbeiten des Berichterstatters als GIA ExCo Vice Chairman sind im Schlussbericht aufgeführt, wie auch Vorschläge zu einer verstärkten Beteiligung der Schweiz am GIA.

Der Projekt-Zwischenbericht (August 2004) enthielt ausführliche und aufschlussreiche Dokumente, mit sonst unzugänglichen Direktinformationen aus Ländern, die in der Geothermie führend sind.

Als Mitglied und Vice Chairman des GIA Executive Committee wurde regelmässiger Erfahrungsaustausch mit Ländern gepflegt, die in der Geothermie führend sind. Durch die Mitarbeit ergab sich auch Zugang zu sonst unzugänglicher Information. Die Schweizer Resultate und das spezifische Know-how konnten im internationalen Rahmen eingebracht und werden nun durch die Informationskanäle der IEA verbreitet.

BFE OFEN UFE SFOE

Bericht über die Tätigkeiten von L. Rybach als Vice Chairman, IEA Geothermal Implementing Agreement (GIA) Executive Committee (ExCo)

In der Zeit von 1.1. – 15.11.2004

ARBEITEN IM ExCo

Das 11. Meeting des IEA GIA ExCo fand am 18. und 19. März 2004 in Paris statt. Die notwendigen Vorbereitungsarbeiten (u.a. Mitwirkung an den Arbeiten für die zu behandelnden Geschäfte) begannen schon im Januar 2004. Anlässlich dieses Meetings wurde der Swiss Country Update 2003 präsentiert, welches im GIA Annual Report 2003 vollständig wiedergegeben wurde (Beilage zum Projekt-Zwischenbericht August 2004). Das 12. ExCo Meeting fand am 14. und 15. Oktober in Pisa statt; auch hierfür mussten umfangreiche Vorbereitungen getroffen werden (u.a. für die Präsentation des „Swiss Geothermal Scene 2004").

Dem Unterzeichneten obliegen im ExCo u.a. die Arbeiten für neue *GIA Participating Countries*. Anlässlich der ExCo Sitzungen wurde der Stand der Bestrebungen präsentiert, für die GIA weitere Teilnehmerländer (insbesondere China, Frankreich, S.Korea, Türkei) zu gewinnen.

WEITERE ARBEITEN

- Der umfangreiche und aufschlussreiche GIA Jahresbericht 2003 wurde nach diversen Vorläuferversionen, an denen der Unterzeichnete massgebend beteiligt war, im Juni 2004 abgeschlossen (BEILAGE im Projekt-Zwischenbericht August 2004).

- Bei der Redaktion des ausführlichen und aufschlussreichen Protokollentwurfs der 11. ExCo-Sitzung wurde ebenfalls mitgearbeitet. Dieser wurde im Juli 2004 fertiggestellt und wird an der 12. ExCo Sitzung offiziell genehmigt (BEILAGE 1).

- Für die 12. ExCo Sitzung wurden die Schweizer Beiträge zur IEA-Publikation *Highlights 2003–2004* vorbereitet*;* wozu die Schweiz den EGS Project Management Decision Assistant (Produkt des Annex III/Subtask C) beitrug (BEILAGE 2).

- Einen weiteren Schwerpunkt bildet die Vorbereitung der Teilnahme des GIA am *World Geothermal Congress 2005* (25.-29.4.2005, Antalya/TR). Die entsprechende Publikation wurde (unter Mitwirkung des Unterzeichneten) fertiggestellt (BEILAGE 3). Neben diversen Vorträgen wird die GIA auch einen Ausstellungsstand betreiben.

- Ausserdem wurde im Rahmen einer Einladung von Th. Mégel durch das AIST (National Institute of Advanced Industrial Science and Technology, Japan) der Project Management Decision Assistant (EGS-PMDA) am Annex III Task Meeting am AIST präsentiert und das weitere Vorgehen diskutiert. Der diesbezügliche Zeitaufwand wurde von der Geowatt AG übernommen (BEILAGE 2).

LAUFENDE ADMINISTRATION

Der Unterzeichnete wirkt als GIA ExCo Officer an allen Vernehmlassungen und Entscheidungen mit. Die weiteren Officers sind Dr. David Nieva/Mexico (ExCo Chairman), Dr. Allan Jelacic/USA (ExCo Vice Chairman) sowie Dr. Mike Mongillo (New Zealand (ExCo Secretary). Diese Arbeiten werden weitgehend per e-mail abgewickelt. Im Durchschnitt erfolgen etwa drei e-mail-Wechsel pro Tag (!). Dies neimmt entsprechend viel Zeit in Anspruch.

AUSBLICK

Gegenwärtig wird im Rahmen von GIA Annex III (EGS, Enhanced Geothermal Systems) ein neuer Subtask E eingerichtet (*Field Studies of EGS Reservoir Performance*), worin insbesondere die Erschaffung und das Verhalten von EGS-Reservoiren, auch im Hinblick auf Nachhaltigkeit behandelt wird. Die Teilnahme der Schweiz, angesichts des nun voranschreitenden Deep Heat Mining-Projektes, ist mit Sicherheit vorteilhaft. Ferner eröffnet sich nun die Gelegenheit, am neuen Annex VIII (*Direct Use of Geothermal Energy*) teilzunehmen.

SCHLUSSBEMERKUNG

Durch die Teilnahme der Schweiz am GIA (und insbesondere durch die verantwortungsvolle Rolle des Unterzeichneten im ExCo) wird ein regelmässiger Erfahrungsaustausch mit Ländern, die in der Geothermie führend sind, überhaupt erst ermöglicht. Hier sind insbesondere die Informationen bezüglich den neuesten Tätigkeiten des USA im Bereich von EGS (*Engineered Geothermal Systems*) für das schweizerische Deep Heat Mining Projekt (DHM) zu erwähnen. Anderseits kann das spezifische know-how der Schweiz (vor allem für das EU-Projekt Soultz entwickelt und eingesetzt) im internationalen Rahmen Anerkennung erfahren. Es sind weiterhin interessante und wertvolle Informationen und Kontakte zu erwarten, z.B. zum ZIP-Programm/Deutschland mit zahlreichen DHM-artigen Vorhaben.

BEILAGE 1: Minutes of the 11th GIA ExCo Meeting

BEILAGE 2: GIA Highlights 2003-2004

BEILAGE 3: GIA paper at WGC2005

BEILAGE 4: Präsentation T. Mégel „Annex III/Subtask C“

Zürich, 25. November 2004

(Prof. Dr. L. Rybach)

Beilage 1

International Energy Agency

Geothermal Implementing Agreement

DRAFT

Minutes
of the
11th Meeting of the Executive Committee (ExCo)

Paris, France
18-19 March 2004

Prepared
by

IEA-GIA Secretariat
Institute of Geological and Nuclear Sciences Limited
Wairakei Research Centre
Private Bag 2000
Taupo
NEW ZEALAND

International Energy Agency- Geothermal Implementing Agreement

Minutes of the
11th Meeting of the Executive Committee (ExCo)
Paris, France
18-19 March 2004

TABLE OF CONTENTS

		Page
1.	MINUTES	1
2.	AGREED ACTION ITEMS FROM 11th ExCo MEETING	1
3.	STATUS OF AGREED ACTION ITEMS FROM 10th EXCO MEETING	2
4.	CONTINUING ACTION ITEMS FROM 9th EXCO MEETING	3
5.	CALL TO ORDER	3
6.	ADOPTION OF AGENDA OF 11th ExCo MEETING	3
7.	APPROVAL OF MINUTES OF 10th ExCo MEETING	3
8.	STATUS AND DISCUSSION OF ACTIONS OF THE 9th and 10th ExCo MEETINGS	4
9.	MATTERS ARISING	4
10.	OTHER ExCo ISSUES	4
11.	ELECTION OF CHAIRMAN AND VICE-CHAIRMEN	6
12.	REVIEW OF SECRETARIAT OPERATION AND WORK PLAN	6
13.	FINANCIAL REPORT	7
14.	PROGRESS REPORTS AND WORK PLANS OF CONTINUING ANNEXES	8
15.	STATUS OF PENDING AND PROPOSED ANNEXES	13
16.	PROSPECTIVE PARTICIPATING COUNTRIES	14
17.	NATIONAL (COUNTRY) REPORTS	15
18.	OTHER BUSINESS	18
17.	NATIONAL (COUNTRY) REPORTS (continued)	19
18.	OTHER BUSINESS (continued)	20
19.	DATES AND VENUE FOR THE 12th and 13th ExCo MEETINGS	22
20.	THANKS TO IEA SECRETARIAT	22
21.	ADJOURNMENT	22

LIST OF APPENDICES **Page**

APPENDIX 1:	**List of Meeting Participants (signature and business card pages)**	**23**
APPENDIX 2:	**Revised Agenda for 11th GIA ExCo Meeting (Paris)**	**26**
APPENDIX 3:	**List of IEA-GIA ExCo Members (March 2004)**	**28**
APPENDIX 4:	**E-mail Sent to ExCo re. Amendments to the GIA**	**30**
APPENDIX 5:	**IEA-GIA Secretary's Report (including Secretary's Draft Work Plan for 2004, Report on Secretary's Total Time for 2003 and letter from Colin Harvey re. NZ GIA Secretariat Operations Costs for 2003)**	**31**
APPENDIX 6:	**The IEA Geothermal Implementing Agreement Document**	**38**
APPENDIX 7:	**Statement of GIA Common Fund Activities (Gerry Nix, NREL)**	**43**
APPENDIX 8:	**Annex I Environmental Impacts of Geothermal Development Report**	**45**
APPENDIX 9:	**Annex III Enhanced Geothermal Systems Report**	**49**
APPENDIX 10:	**Annex IV Deep Geothermal Resources Report**	**58**
APPENDIX 11:	**Annex VII Advanced Drilling Techniques Report to Paris Meeting**	**65**
APPENDIX 12:	**Letter of Invitation to Join Annex VIII**	**68**
APPENDIX 13:	**Description of Annex VIII**	**69**
APPENDIX 14:	**Germany Country Report**	**73**
APPENDIX 15:	**New Zealand Country Report**	**76**
APPENDIX 16:	**Open Energy Technology Bulletin Document**	**79**
APPENDIX 17:	**Report from the IEA Secretariat (prepared by Peter Tulej)**	**81**
APPENDIX 18:	**E-mail re. Greece's Withdrawal from the GIA**	**91**

International Energy Agency- Geothermal Implementing Agreement
Minutes of the
11th Meeting of the Executive Committee (ExCo)

Paris, France
18-19 March 2004

1. MINUTES

The 11th meeting of the IEA-GIA Executive Committee (ExCo) was held at the Headquarters of the International Energy Agency (IEA), Paris, France, on 18-19 March 2004.

Chairman David Nieva called the meeting to order at 9:40 AM, 18March 2004. Nieva welcomed the ExCo members, observers and guests.

Eight members and three alternates of the IEA-GIA ExCo were present, satisfying the quorum requirements of a minimum of six members (Appendix 1).

1.1 ExCo Members and Alternate Members Present

ExCo members Aldo Baldacci (Italy), Kenji Haruguchi (Japan), Allan Jelacic (Vice-Chairman, USA), David Nieva (Chairman, Mexico), Dieter Rathjen (Germany), Ladsi Rybach (Vice-Chairman, Switzerland), Jeroen Schuppers (European Commission), Helga Tulinius (Iceland) and alternate members Harald Gorhan (Switzerland), Colin Harvey (New Zealand) and Hrefna Kristmannsdóttir (Iceland) attended (see Appendix 1 for signature and business card pages; Appendix 3 for list of ExCo Members and contact information).

1.2 Observers Present

Roy Baria (European Geothermal Project, Soultz-sous-Forêt), Manuela Caruso (IEA Deputy Chief Legal Council), Christophe Debouit (NEDO Representative, Paris Office), Kazunori Fukasawa (NEDO Chief Representative in Paris Office), Satoshi Kubo (Annex VII member), Isao Matsunaga (Annex III Leader), Antonio Pflüger (IEA Headquarters), Rick Sellers (IEA), Peter Tulej (IEA Desk Officer) and Marry Harries White (IEA).

Mike Mongillo, IEA-GIA Secretary.

1.3 Apologies

Doone Wyborn (Australia) and Chris Bromley (New Zealand).

2. AGREED ACTION ITEMS FROM 11th ExCo MEETING

Action 11/1: Secretary to contact the authors of the annex and country reports submitted for inclusion in the 2003 GIA annual report to request further information where needed.

Action 11/2: Secretary to send ExCo Members the website address so they can access the GIA annual reports.

Action 11/3: Secretary to arrange with NREL to send a second invoice notice, in July rather than September, to Members who have not yet paid their Common Fund contribution.

Action 11/4: Nieva to re-send (via e-mail) the IEA "suggested" re-wording for the IA changes. (Superseded by Action 11/15.)

Action 11/5: Jelacic to contact Jim Koenig to attempt to arrange for the GIA WGC 2005 paper to be presented at a Plenary Session.

Action 11/6: Secretary to provide work plan for 2005 at the Pisa meeting (October 2004), and from then on, the next year's work plan at every autumn meeting.

Action 11/7: Secretary to provide an up-to-date financial statement to ExCo, taking into account all GNS expense invoices to date.

Action 11/8: Harvey to notify Nieva as soon as he hears if he will be attending the Bonn Conference.

Action 11/9: Secretary to include statement in 2003 annual report that there is an "overlap" of work in Annexes III and IV and that it is presently being sorted out.

Action 11/10: Nieva to ask CFE if they would agree to be the Subtask A Leader for Annex VII.

Action 11/11: Participants in Subtask B of Annex VII to provide a list of references covering information for the Handbook to the Subtask Leaders (Hector Gutierrez, CFE (Mexico); Sverrir Thorhallsson, Orkustofnun (Iceland)).

Action 11/12: CFE and Iceland to provide information on their "wells of opportunity" for equipment testing.

Action 11/13: Secretary to place "THE IEA GEOTHERMAL IMPLEMENTING AGREEMENT-It's Goals, Activities, Benefits, Obligations and Costs" document in a prominent location on the GIA website.

Action 11/14: Secretary to include a statement that the first German geothermal power station went on-line at Neustadt-Glewe in November 2003, in the 2003 GIA annual report.

Action 11/15: Secretary to distribute to the ExCo the IEA letter with the exact wording changes for the new IEA IA framework. (Supersedes Action 11/4.)

Action 11/16: Secretary to send Mary Harries White a list of GIA ExCo Members' e-mail addresses.

Action 11/17: All ExCo Members to submit a logo design for the GIA by early-May for a competition.

3. STATUS OF AGREED ACTION ITEMS FROM 10th ExCo MEETING, PRIOR TO THIS MEETING

Action 10/1: IEA-GIA Secretary to pursue GIA signatory issues with Peter Tulej, IEA Secretariat.
- ***Completed***

Action 10/2: Rybach to obtain more confident values from IGA for the future development potential of worldwide geothermal resources.
- ***Completed***

Action 10/3: Bromley and Mongillo to discuss with Trevor Hunt and/or Ian Thain (Organizing Committee on WGC 2005) arranging IEA-GIA sessions at WGC 2005.
- ***Completed***

Action 10/4: The Secretariat's operating year should be changed to agree with the calendar year, i.e. January to December.
- ***Completed***

Action 10/5: Secretary to organize the Archive of GIA documents.
- ***Continuing***

Action 10/6: GIA Secretary to notify NREL that the cost per share has been reduced to US$ 2,500/year and that credit towards future payment should be calculated for those who have already paid US$ 3,600.
- ***Completed***

Action 10/7: The Secretary is to direct NREL to send invoices in January and September of each year.
- ***Completed***

Action 10/8: Haruguchi to discuss whether NEDO wishes to continue as Operating Agent for Annex III with Matsunaga and report decision to Nieva.
- ***Completed***

Action 10/9: Task Leaders to submit Annex Reports to IEA-GIA Secretary for inclusion in the 2003 IEA-GIA Annual Report by a date to be specified.
- ***Completed***

Action 10/10: All ExCo Members to investigate the possibility of contributing to a Common Fund for certain tasks (e.g. Annex V Sustainable Geothermal Energy Production).
- ***Continuing***

Action 10/11: Bromley to investigate NZ government agencies for possible "sustainability" study funding.
- ***Continuing***

Action 10/12: Nieva to make changes to Annex IX document to include only those activities that the GIA can provide.
- ***Continuing***

Action 10/13: Secretary to notify Peter Tulej (IEA Secretariat) of the results of Motion 10/3.
- ***Completed***

Action 10/14: Secretary to send out formal letters of invitation after Rybach is notified of Peter Tulej's response. Rybach will provide contact details to the Secretary.
- ***Completed***

Action 10/15: ExCo Members to distribute the Annex and Country Report formats to the Operating Agents.
- ***Completed***

Action 10/16: Secretary to place UK's official letter of resignation (e-mail) into the GIA archives.
- ***Completed***

Action 10/17: Nieva to notify Greece and Australia of the new share cost (US$ 2,500) and request their action on outstanding payments.
- ***Completed***

Action 10/18: Nieva to contact the IEA Secretariat in response to some requests for action included in the IEA Secretariat's Report to the GIA.
- ***Completed***

Action 10/19: Participants from European countries and organizations are to consider the possibility of one of them attending the 1 March 2004 IEA meeting.
- ***Completed***

Action 10/20: Nieva to circulate the new IEA framework that requires revision of GIA.
- ***Continuing***

Action 10/21: Nieva to contact the IEA to determine if the revised GIA, compliant with the new IEA Framework, would have to be re-signed by the Participants.
- ***Completed***

Action 10/22: Secretary to revise the Strategic Plan with the help of Allan Jelacic and distribute it for ExCo acceptance before the end of the calendar year.
- ***Completed***

Action 10/23: Secretary to contact Peter Tulej (IEA) regarding suitability of 18-19 March 2004 date for the 11th GIA ExCo Meeting in Paris.
- ***Completed***

4. CONTINUING ACTION ITEMS FROM 9th ExCo MEETING, PRIOR TO THIS MEETING

Action 9/8: Rybach to continue membership discussions with China, France, Russia and Turkey.
- ***Continuing***

Action 9/11: Mexico and Italy provide drilling cost data to Finger and Kubo.
- ***Continuing*** on Italy.

Action 9/13: Nieva (potential Annex IX task leader) to write draft proposal on marketability of a Latin American prospect.
- ***Continuing*** (see Action 10/12 above).

---

5. CALL TO ORDER

Chairman Nieva called the meeting to order at 9:40 AM, Thursday 18 March 2004.

Nieva noted in his opening that it was a sad event that Greece was withdrawing from the GIA (Appendix 18). However, he was happy that Australia was fairly confident that they would be able to obtain the funds to make their Common Fund contribution, hence remain a Member.

Motion 11/1: Rybach moved that the ExCo endeavour to end the meeting by 3:00 PM tomorrow. Schuppers seconded, and the motion was carried unanimously.

6. ADOPTION OF AGENDA OF 11th ExCo MEETING

The draft agenda for the 11th ExCo meeting prepared by the IEA-GIA Secretary was approved with minor revision by the Chairman (Appendix 2).

7. APPROVAL OF MINUTES OF 10th ExCo MEETING

The final draft minutes of the 10th ExCo meeting prepared by the IEA-GIA Secretary were adopted.

Motion 11/2: Nieva moved that the ExCo accept the Minutes of the 10th ExCo Meeting. Jelacic seconded, and the motion was carried unanimously.

8. STATUS AND DISCUSSION OF ACTIONS OF THE 9th and 10th ExCo MEETINGS

The Secretary presented a review of the continuing actions for the 9th and 10th ExCo Meetings.

Action 10/3: Discussions with the WGC 2005 Organizing Committee regarding having Special GIA Sessions have ceased. Jelacic asked how GIA work was to be presented at the WGC 2005. Nieva stated that we are still pursuing having a GIA review paper presented at a Plenary Session (see discussion below, p. 6 of these Minutes). Rybach pointed out that the issue was to be discussed under Agenda Item 3d, so we should leave it until then.

Action 10/5: The Secretary has created an Archive of important GIA documents, which was up-to-date as of the 11th ExCo Meeting, except for the Minutes of the 1st ExCo Meeting. Schuppers is providing a scanned version of the missing minutes.

Action 10/9: All of the Annex reports have been received as of the time of this meeting.

Action 10/10: To date, only Iceland has stated that they would be able to contribute to a common fund for certain tasks (e.g. Annex VIII- Direct Use).

Action 10/11: Bromley is still investigating possible NZ Government agency "sustainability" study funding, though there is nothing to report yet.

Action 10/12: Nieva will be discussing the status of Annex IX later at this meeting under Agenda Item 8.

Action 10/14: This action is now complete, with Rybach having received comments from Peter Tulej.

Action 10/18: Nieva has completed this action.

Action 10/19: This action is completed, with the decision not to send someone to the 1 March 2004 IEA meeting.

Action 10/20: Nieva distributed the new IEA IA framework on 18 February 2004, completing this action. It is to be discussed under Agenda Item 3c.

Action 9/8: Rybach has continued discussions with prospective member countries. Results to be discussed under Agenda Item 9a.

Action 9/11: Drilling cost data was sent from Mexico with action still on Italy to provide some data.

Action 9/13: Nieva discussed this item at this meeting under Agenda Item 8b.

9. MATTERS ARISING

Rybach noted that the IEA had made several requests for input from the GIA and it was very important to discuss the revised IEA IA framework document (Appendix 4). Discussion was included under Agenda Item 12 Other Business along with Peter Tulej's IEA report.

10. OTHER ExCo ISSUES

10.1 Status of 2003 Annual Report

The Secretary noted that, in general, contributors had followed the annex and country report formats, though important material was missing in some cases. Nieva requested that contributors be contacted to provide further information where needed.

Action 11/1: Secretary to contact the authors of the annex and country reports submitted for inclusion in the 2003 GIA annual report to request further information where needed.

Rybach stated that country reports were a very important part of the GIA annual report. Nieva pointed out that the quality of the annual report was more important than the "promptness" in submitting it to the IEA, and it should be as complete a document as possible for use of the IEA.

Rybach asked how to access the 2002 GIA Annual Report since the "old" address no longer worked. The Secretary noted that since the IEA had created a new homepage, it seemed no longer possible to access the IA annual reports directly. The Secretary will investigate the problem.

Action 11/2: Secretary to send ExCo Members the website address so they can access the GIA annual reports.

10.2 Action on Non-Paying GIA Members

Nieva informed the meeting that Greece withdrew from the GIA because they were against contributing to the Common Fund (Appendix 18). However, he noted that the Australian ExCo Member (Wyborn) had stated that Australia would probably make their contribution, though it was not clear when. Nieva recommended that the ExCo give them more time to pay.

Rybach asked what if Australia said they would pay from now on, but not for the previous years. Jelacic stated that he believed they should pay for all arrears as bound by their original membership. Nieva replied that he believed that Australia was considering paying the total amount, and that the issue should be decided on at the next ExCo meeting, after he has had time to pursue the matter.

Motion 11/3: Nieva moved that the ExCo wait until the next ExCo meeting to make a decision on Australia's position in the GIA. Rybach seconded, and the motion was carried unanimously.

Harvey suggested that the second notification and invoice for the annual Common Fund payment be sent out in July rather than September.

Action 11/3: Secretary to arrange with NREL to send a second invoice notice, in July rather than September, to Members who have not yet paid their Common Fund contribution.

10.3 Required Amendments to the GIA

Nieva presented the IEA's request that the GIA should be modified. He referred to the e-mail he sent to all Members on 18 February 2004 (Appendix 4), in which he listed the IEA's suggested amendments.

Schuppers stated that the EC was opposed to all four of the IEA's suggested changes. Therefore, it would be impossible for the changes to be accepted since a "unanimous" vote is required by the ExCo for changes in the GIA to be made. The EC must follow internal procedures in order to make the requested changes, which require a formal decision. Consultation has begun but it is not clear how long it will take for the EC to make a decision on the matter. Nieva asked if a decision could be expected by the time of the next ExCo meeting, but Schuppers did not know. Sellers noted that this is an EC problem that is being worked on and that Tulej would be reporting on it later in the meeting.

Nieva said it would not be useful to spend the time discussing the matter further since the EC would not be accepting the modifications at this time. Jelacic requested a brief review of the changes and Nieva presented them (Appendix 4): (1) extend participation so just about any country could be a Member, (2) formally remove the term "Guiding Principles" and replace it with "Framework", (3) that "abstention" would not be counted as a vote and (4) the new Framework gives us more freedom. Since several of the ExCo Members were not familiar with the document, Nieva agreed to re-send it.

Action 11/4: Nieva to re-send (via e-mail) the IEA "suggested" re-wording for the IA changes. (Superseded by Action 11/15.)

Sellers stated that Tulej would be distributing and commenting on the document later in the meeting.

10.4 Participation in the WGC 2005

Several of the meeting participants, including Baria (Soultz-sous-Forêt), Jelacic (USA), Kristmannsdóttir (Iceland), Matsunaga (Japan), Mongillo (NZ), Nieva (Mexico) and Rybach (Switzerland) noted that papers would be submitted to the WGC 2005.

Rybach noted the great success the GIA had at the WGC 2000, with three full IEA-GIA sessions held. He would like special GIA sessions to be arranged at the WGC 2005. However, Nieva pointed out that Roland Horne (WGC 2005 Organizing Committee) was against this and wanted all sessions organized by "topics", which would probably result in better attendance to the GIA papers than if they were presented at a special small GIA session.

Rybach wanted recognition of the GIA's efforts, and thought the inclusion of "GIA" in the papers' titles would suffice. Jelacic noted that having a GIA paper in the Plenary Session that highlights the GIA's work and

achievements would help. Kristmannsdóttir agreed with Jelacic. Nieva noted that there were two options: (1) having "GIA" in the title of papers and (2) having the general GIA paper presented in a Plenary Session. Jelacic will talk to Jim Koenig (IGA) about arranging for the general GIA paper to be presented at the Plenary Session.

Action 11/5: Jelacic to contact Jim Koenig to attempt to arrange for the GIA WGC 2005 paper to be presented at a Plenary Session.

Nieva requested that every contributor make reference to the annex and GIA in their paper's title. He also agreed to present the general GIA paper at the Plenary Session.

Rybach suggested having a GIA booth at the WGC 2005. Jelacic agreed with Rybach and suggested using Common Fund money to pay for it. However, Rybach pointed out that the GIA does not have much material to present in such a booth, but Jelacic said that it could be a modest affair and could include annex material.

Harvey noted that this latter discussion raised the issue of the Bonn (Germany) Conference to be held on 1-4 June 2004. Nieva stated that the Common Fund could pay for travel expenses. However, Harvey said that IGNS had been invited to participate and that he could make the GIA presentation at no cost.

Nieva noted that the GIA is afraid of having a booth because there is not enough material to offer. We must face reality- that the GIA and geothermal has generally "come down". We have less to show than 5 years ago, and must somehow make up for the deficit. However, perhaps we should decide that the roll of the GIA is to "positively influence" geothermal research in all participating countries- the GIA could become the "force" that does this. We must make up for the deficit of results. Rybach stated that the GIA must do its best and take advantage of its active Secretariat.

11. ELECTION OF CHAIRMAN AND VICE-CHAIRMEN

Jelacic nominated Nieva for Chairman of the GIA. Nieva accepted nomination and the vote was unanimous, with Nieva re-elected as Chair of the GIA.

Nieva nominated Rybach and Jelacic as Vice-Chairmen. They both accepted nomination and again the vote was unanimous, with Rybach and Jelacic re-elected as Vice-Chairmen.

12. REVIEW OF SECRETARIAT OPERATION AND WORK PLAN

Mongillo presented the IEA-GIA Secretary's Report (Appendix 5), which included a review of work conducted since the last ExCo Meeting, a draft work plan for the 2004-year (Appendix 1 to the Secretary's report) and a detailed accounting of the Secretary's time and costs for the 2003-year (Appendix 2 to the Secretary's report). An estimate of costs for the operation of the GIA Secretariat by IGNS for the 2004 calendar year was presented by Harvey and is also included as Appendix 3 to the Secretary's report.

Mongillo noted that he placed an emphasis on maintaining regular and timely communications with the ExCo Chairman and Vice-Chairmen, within the GIA and with IEA Headquarters. The Secretary attended the 10th ExCo Meeting in September 2003, in Reykjavik, Iceland and "Minutes of the 10th ExCo Meeting" were completed and distributed. Arrangements were made with the IEA Headquarters for their hosting of the present meeting, and documents prepared and distributed to the ExCo Members for this meeting. The Secretary assisted Jelacic with the final editing of the 2002-2007 GIA Strategic Plan, which was accepted unanimously (with Greece abstaining). A document for prospective GIA members was written: "The IEA Geothermal Implementing Agreement- It's Goals, Activities, Benefits, Obligations and Costs" (Appendix 6) and an abstract for a general GIA paper: "The IEA Geothermal Implementing Agreement - Its Goals, Status, Achievements and Prospects" was written and submitted for the WGC 2005. The 2003 GIA Annual Report was reported to be in draft form, with significant work remaining to complete it.

An archive of important GIA documents was initiated and was reasonably complete, though it will be continually added to as new documents are created. It will be accessible to all ExCo Members through the GIA website. Significant headway was made on the GIA website, a draft of which is available for viewing at: http://www.gns.cri.nz/GIA/index.html .

The Secretary, as a representative of the GIA, participated in the Budapest Forum in October 2003, presenting a PowerPoint talk, "The IEA Geothermal Implementing Agreement- Its Status, Highlights and Future Prospects" (by Mongillo and Nieva) describing the GIA, its activities and strategic plan (posted on the IEA website at: http://library.iea.org/dbtw-wpd/textbase/work/2003/budapest/geother.pdf). Since the GIA website was given priority over the GIA brochure at the last ExCo meeting, no further work was done on the latter since that meeting.

Mongillo reported that 372 hours had been spent on duties performed by the Secretary during the period September 2003-February 2004. The total time and cost for the GIA Secretary's time for the first year of operation, March 2003 to December 2003, were: 594 hours and NZ$ 44,546.25 (~US$ 30,736.91 @ 0.69). Based upon this information and the original IGNS bid, a budget estimate for the 2004 year was produced and submitted to the ExCo by Harvey with the following highlights: (1) the total estimated time and cost for the Secretary's time for the 1 January-31 December 2004 year are: 800 hours and NZ$ 60,000 (~US$ 41,400 @ 0.69); (2) office and consumables, the Secretary's travel expenses, brochure production, website construction and maintenance are: NZ$ 36,000 (~US$ 24,840 @ 0.69). Thus, the total estimated cost for the 2004-year of operation (January –December 2004) is: NZ$ 96,000 (~US$ 66,240 @ 0.69).

Nieva agreed that the Secretariat's first year of operation was an unusual one because of the up-grade in the 2002 annual report and the two presentations (GRC and Budapest) made as part of the GIA's move to maintain a high profile and encourage new membership. Rybach stated he was happy with the active Secretariat and glad to see it operate in its present manner. Jelacic also noted he was happy with the Secretariat's work to date and Schuppers complimented the report.

Harvey asked if it was necessary to continue to approve the NZ Secretariat contract. Nieva stated that IGNS must continue to submit a work plan for ExCo acceptance, however he believed that the NZ Secretariat was chosen for the 5-year period of operation (i.e. 2003-2007) and it would not be practical to change Secretariats every year. Kristmannsdóttir agreed that the NZ Secretariat was for the period covering the extended lifetime of the GIA.

Motion 11/4: Nieva moved that unless there are strong reasons for the Secretary to be replaced that the NZ Secretariat should remain for the rest of the GIA's operation. Rybach seconded, and the motion was carried unanimously.

Jelacic stated that since the Secretariat is already well into the work plan for the year, the next year's annual work plan should be submitted at the autumn meeting.

Motion 11/5: Jelacic moved that the Secretary's work plan for 2005 be submitted at the autumn 2004 meeting. Baldacci seconded, and the motion was carried unanimously.

Action 11/6: The Secretary to provide the 2005 work plan at the Pisa ExCo meeting and from then on for the "next" year at autumn meetings.

Motion 11/6: Nieva moved that the Secretary's 2004 work plan be accepted. Harvey seconded, and the motion was carried unanimously.

13. FINANCIAL REPORT

The financial report of GIA activities as of 29 February 2004 (Appendix 7) was supplied by NREL and presented to the meeting by the Secretary.

Though the NREL report stated that the total balance of available funds was US$ 117,731.93, Harvey noted that it did not include all of the un-billed and unpaid IGNS invoices and he estimated the total funds available to be in the range US$ 90-95,000 as of March 2004.

Rybach stated that with Greece withdrawing, the total number of shares dropped from 26 to 25, decreasing the GIA Common Fund. Nieva's opinion was that the GIA currently has enough money so the share cost would be able to remain at US$ 2,500 per share per year. Harvey said the Secretariat could distribute a more accurate financial statement taking into account IGNS's outstanding invoices.

Action 11/7: The Secretariat to provide an up-to-date financial statement to the ExCo, taking into account all IGNS expenses and invoices.

Harvey inquired whether the GIA required "audited" financial statements, and Nieva answered that it was not necessary at this time.

Rybach noted that Agenda Item 6b regarding Common Fund "shares and share cost" was just included as a standing item and there was nothing to discuss related to it at this meeting. Nieva pointed out that the Common Fund share price might have to be re-adjusted in the future.

The issue of providing support from the Common Fund for a representative of the GIA to attend important meetings was discussed. Nieva stated that travel expenses would be provided, preferably for a person nearest the meeting location (e.g. a GIA representative from Europe to attend the Bonn Conference). Jelacic pointed out that the Chairman is "legally" able to allocate funds from the Common Fund, and then report the action at the next ExCo meeting. However, Nieva wished to obtain the ExCo's "official" permission to be allowed to allocate Common Fund money to attend meetings and present papers, as this is a category of actions that would likely be repeated. Though there were no objections, Nieva requested a motion be made and voted on.

Motion 11/7: Nieva moved that the Chairman be given permission to allocate money from the Common Fund to support meeting attendance and paper presentation. Jelacic seconded, and the motion was carried unanimously.

The Bonn (Germany) renewable energy conference was discussed and Harvey volunteered to represent the GIA there at no expense, if his participation through IGNS was confirmed. He expected to know within a few weeks.

Action 11/8: Harvey to notify Nieva regarding his attendance at the Bonn conference as soon as possible.

Rybach volunteered to represent the IGA if Harvey was unable to attend.

Rybach also noted that if the GIA wished to have a booth at the WGC 2005, e-mail could be used to obtain ExCo Members' decisions regarding the plans and costs.

14. PROGRESS REPORTS AND WORK PLANS OF CONTINUING ANNEXES

14.1 Annex I Environmental Impacts of Geothermal Energy Development (presented by Colin Harvey)

Harvey presented this report orally for Bromley who was unable to attend. A written report will be sent to the Secretary later (Appendix 8).

Harvey reported that there was increased geothermal work in New Zealand with subsidence being a major issue. He noted that the New Zealand Resource Management Act imposes strict control on geothermal development and use, and requires several types of monitoring. Because natural gas resources are being depleted there is more interest in geothermal now, including deep resources and enhanced geothermal systems.

Jelacic noted that there are micro-earthquake problems in California, with some concern in the communities around the SE Geysers where substantial reinjection of wastewater is occurring and where there has been a major increase in their number. He has seen some damage "purportedly" caused by these quakes. The public have had meetings with some of the operators of the Geysers (e.g. Calpine and NCEAC) and Calpine is attempting to work with the citizens on the matter. The Santa Rosa pipeline is now in operation, however, the area where this water is being reinjected is nearer the centre of the field and some distance from populated areas, so probably not a problem. These micro-earthquakes could be a problem for EGS development. Lawrence Berkeley Laboratory (LBL) is presently investigating the issue. Jelacic believes this is an issue for the GIA ExCo to investigate in Annex I or Annex III.

Rybach supports Jelacic's suggestion, but commented that the problems appeared site specific, though this could definitely be an issue for EGS. The problems have also occurred at the Soultz (France) and the Coopers Basin (Australia) EGS sites (based on Wyborn's report to this meeting), so it is not an isolated Geysers problem.

Nieva asked if the US DOE had defined a plan to assess the problem, and Jelacic answered that there is no long-term plan, however, they are encouraging LBL work with developers and citizens to provide an opinion and review of induced seismicity. Jelacic also noted that a long-term plan was needed and that if there was a problem with public perception, it could be a serious enough problem to stop EGS.

Rybach noted that at the deep heat mining site, in the Basel earthquake area, a seismic station has been installed to map background seismic activity before EGS begins. It was necessary to obtain more data on this important issue. Baria believes there is a fundamental lack of knowledge and that once the seismicity is understood; it might be possible to design stimulation procedures that alleviate the seismicity.

Nieva said that because of the micro-seismicity problems in California, the increased seismicity associated with reinjection is now being discussed in Mexico. It would be desirable to be able to give an estimate of the "expected" size of induced earthquakes, e.g. "not greater than..."

Kristmannsdóttir stated that there were no earthquakes during a test at the Svartsengi field in Iceland. However, fewer larger earthquakes occurred, hence there was a change in the baseline activity. She thinks it is a good idea to monitor earthquake activity, but it is expensive. Now reinjection is required for disposal of "waste" water in Iceland, and is now conducted at Krafla.

Baria pointed out that geological conditions must be considered and understood.

Nieva noted that "perception" of induced earthquakes by the public could be a problem and work must be done to overcome it. He asked if someone could gather information from sites that have been in operation for a reasonable length of time to help identify the magnitude of the problem. He could obtain data for Cerro Prieto. Baria stated that discussions were being conducted behind scenes and that with Jelacic's help a literature search could be done to lay the foundation for a study. Nieva agreed with the idea of starting a review. Baria believes that field experiments are needed to develop an understanding of the mechanism.

Jelacic stated that the GIA needs to consider establishing a subtask in Annex I to formally highlight the issue. He would be reluctant to play a dominant role, but would be very active in supporting it and even provide funds to a special common fund for such a study. Schuppers believes that the EC would be willing to participate, but needs to become formally involved in Annex I first. Nieva stated that it is only necessary for a statement in the Minutes to be made for a new participant to join an Annex.

There was general agreement that a proposal for a new Annex I Subtask D be produced, with the participation and leadership of EC. Matsunaga noted that Japan had much experience with micro-seismic activity and that he would ask others to join the new Subtask D on induced seismicity when it is formed.

Kristmannsdóttir stated that the work on Iceland's environmental remote sensing project had been slow and there was no report to be presented.

Baldacci reported that work on ENEL's H_2S abatement process was proceeding and will be installed at all plants in Italy.

14.2 Annex III Enhanced Geothermal Systems (presented by Isao Matsunaga, Task Leader)

Matsunaga presented the report and work plan for Annex III, which is included as Appendix 9.

The objective and subtasks were reviewed and the participants identified as Australia, EC, Germany, Italy, Japan, Switzerland and USA. Subtask B, which is sponsored by US DOE and operated by the Idaho National Engineering and Environmental Laboratory (USA), conducted several projects including: testing of a new down-hole motor for horizontal drilling, completion of a shear-wave splitting technique for monitoring stress patterns and fractures and plans to use it at a major hydraulic fracture (MHF) test at Coso geothermal field, conduct of laboratory tests to analyze effects of injection into The Geysers reservoir, and examination of tracers for characterizing heat transfer in fractured reservoirs.

Subtask C, led by Geowatt of Switzerland, has been compiling data for a project management decision assistance (PMDA) for EGS and has almost completed development of the loose-leaf ring binder presentation format.

Subtask D, lead by the National Institute for Advanced Industrial Science and Technology (AIST), Japan, has compiled and reviewed a major collection of R&D data for Hijiori test site; including the technical aspects and problems associated with the overall design, site characterization, reservoir creation and circulation-heat extraction.

The work conducted at the Cooper Basin project, Australia, was outlined, noting that the first geothermal well was completed in September 2003 to 4,421 m depth with the bottom hole temperature ≥ 250 º C. Subsequent hydraulic fracture tests stimulated a volume of 3,000 m by 1,000 m by 350 m. Germany was reported working on the European EGS Soultz and Bad Urach projects.

Japan reported that all NEDO funds for EGS R&D will be stopped at the end of March 2004, though NEDO will continue to fund travel and expenses for GIA meetings. Some research will continue with funding from a small in-house budget of AIST and science grants from the Ministry of Education, Culture, Sports, Science and Technology (MEXT). Funding will be requested for the new Annex I Subtask D on induced seismicity in EGS.

During the 2004-year work will be conducted in: Subtask B- the MHF at the Coso field, the high temperature acoustic televiewer will be completed and studies will continue on injection in depleted fields and tracer analysis; Subtask C- distribute the draft PMDA and use the comments to compile inputs and update the classifier; Subtask D- publish, translate and distribution CD-ROM the report of the review of the Hijiori EGS study.

Rybach commented in detail on Subtask C work, noting that after 7 years of work the PMDA is nearing completion. It is now ready for comment on the technical input and legal issues by the Annex III participants. It will provide a guide for making decisions on EGS from the beginning to de-commissioning. All data is on CD-ROM. Jelacic recognized that the PMDA was a substantial tool and major outcome for Annex III, and he thanked the participants for it. Gorhan asked what would be done with the completed results and Nieva answered that they would be made widely available.

Nieva informed the meeting that the report on the Soultz project would be presented tomorrow.

Jelacic pointed out that it was curious that many countries were participating in Annex III, however, there seemed to be very little "joint" work on the tasks, i.e. there was significant "individual" effort being reported, but no "cooperative" work. He identified this situation as of concern. Nieva agreed but was not sure what to do about it, though he added that the work in Annex VII and the discussion of and agreement to produce a proposal for a new Annex I Subtask D showed good cooperation in the GIA. Jelacic hoped that there would be more close participation among the participants in Annex III.

Rybach noted that it was important for participants to know what work others were doing and that the information dissemination is what the GIA does. He stated that cooperation must grow "organically" and it was difficult to formalize and institute it. Perhaps once a major breakthrough occurred at Soultz there would be more cooperation. However, much has been learned through the Annex III work, regardless of the lack of cooperation.

Jelacic presented Peter Rose's report: *Creation of an Enhanced Geothermal System Through Hydraulic and Thermal Stimulation*, which describes the US DOE work at Coso geothermal field (located in eastern California) for Subtask B. Due to the size of this report it is not appended to these Minutes, however it will be accessible through the GIA website at: http://www.gns.cri.nz/GIA/index.html.

The concept of this study is that well stimulation can produce permeability enhancements due to hydraulic, thermal and chemical effects; and the results can be applied to other geologic settings where appropriate tectonic and thermal conditions exist. The study objectives are to design, create and evaluate an EGS within the margins of the Coso field and to demonstrate an increased electrical production of 20 MW_e upon creation of the Coso EGS. The east flank of the Coso reservoir was the chosen location for this investigation because of its high temperatures (often > 300 º C), abundant fracturing and good wells for stimulation testing. A large team of researchers are working on this investigation that includes: well drilling, completion and testing; hydraulic stimulation and monitoring; geomechanical/structural analysis; geochemical modelling; geology; structural modelling and 3-D visualization; fluid-flow modelling, electrical geophysics; and microseismics.

14.3 Annex IV Deep Geothermal Resources (presented by Dieter Rathjen, Task Leader)

Rathjen presented the progress report for Annex IV (Appendix 10).

The annex participants were identified as: Australia, Germany, Italy, Mexico, New Zealand, the Philippines and the USA. Rathjen commented that progress reports were only available for Australia, Germany and Italy; and that the USA does not pursue any activity in this annex.

The first deep geothermal well in Australia, Habanero #1, was completed in the Cooper Basin to a depth of about 4.9 km and attaining a bottom hole temperature of 290 ºC, at a cost of A$ 5.4 M. A second well is planned. More details can be found at the Geodynamics Ltd. homepage: http://www.geodynamics.com.au/.

Italy (ENEL) drilled 14 deep (> 3,000 m deep) wells during the 5-year period 1999-2003. Eight wells were drilled with depths in the range: 4,002-5,100 m. Two of these 8 were at Soultz-sous-Forêts (France) as part of the EGS project, with depths of 5,036 m and 5,100 m. The remaining 6 were drilled in Italy for steam production: 4 wells in the Travale area at depths of 4,002-4,379 m and 2 in Larderello with depths of 4,216-4,350 m. One of the 6 Italian wells is not productive and is used for field control, another requires a workover to remove a "salt plug" and the other 4 produce about 130 t/h of steam. The other 6 Italian wells were drilled to depths of 3,380-3,944 m. All of these are productive, with a total steam flow of about 220 t/h.

Germany's current project at Bad Urach, involves the development, verification and demonstration of EGS concepts for heat and electricity production. The first well was drilled, with successful stimulation creating a reservoir between 3,300-4,200 m and a temperature of 170 ºC. Germany was also participating in the EU Soultz project, having contributed 9.1 million euros. Details of the Soultz project were presented by Schuppers and Baria during the second day of the meeting and can be found below.

Nieva responded that a Mexican report had been sent to Rathjen describing a study of the production history of Mexican geothermal fields, especially Los Azufres, from the initial state through the changes induced by production and injection.

Rathjen's report again raised the issue of the "crossover" of work between Annexes III and IV and discussion of this matter followed.

Schuppers pointed out that there was a mix-up of work between Annexes III and IV, and that Soultz results would be reported on tomorrow in the EC "country" report.

Rybach stated that he was happy that Germany had taken over as Leader of Annex IV. However, there were problems in the crossover of work in Annexes III and IV. Apparently, the definition of Annex IV studies was not clear, that it included all resources with fluid, at depths > 3,000 m. EGS is not Annex IV work. Rybach believes that the Gross Schönebeck project is the only German Annex IV project, and he will discuss this tomorrow during the Germany country report.

Nieva believes that Rybach's definition for Annex IV, i.e. resources deeper than 3 km and containing natural fluid, was not quite correct, since it is possible to have enhanced "natural' geothermal systems. He suggested moving some of the work now conducted in Annex IV into other annexes, though it is not clear how best to do this. Rybach did not think it was a good idea to mix the Annex IV work with other annexes.

Schuppers suggested having Annex IV deal with "high temperature" rather than "deep geothermal with fluid". Jelacic pointed out that "deep geothermal" is not correct, that there is not much new in the annex and that it does overlap with other annexes, so the US is working in Annex III. He thought that "high temperature" would be better, though this re-definition would require re-writing, which the Secretary could do.

Baria pointed out that wherever you have reinjection you have EGS!

Nieva suggested the possibility of cancelling Annex IV and moving the existing tasks into Annexes III and V (Sustainability of Geothermal Energy Utilization). After further consideration, he agreed that Schuppers' and Rybach's suggestion might be better- "high temperature with fluid in place" was a clear definition and would keep Annex III separate.

Rybach noted that there was a definition of "> 3,000 m", but what exactly would "high temperature" mean? Nieva pointed out that a "natural" definition of high temperature could be > 300 ºC, because there are particular difficulties with such high temperature fluids: get acid fluids, acute scaling from SiO_2 and these temperature problems are not depth problems. Rybach agreed with Nieva, that there is more to consider than depth and temperature; hence perhaps it is not good to continue with Annex IV as it is now defined.

Harvey suggested re-naming Annex IV to "Advanced Research" or "Advanced Technology", which interested Jelacic.

Nieva proposed moving gradually by separating those topics that can be clearly distributed to Annexes III and IV.

Rybach stated that there would be a "mix" of work between Annexes III and IV in the 2003 GIA Annual Report and questioned if it would be left. Nieva suggested including a statement in the 2003 GIA Annual Report that could explain that there is a mixing of work in the annexes that is now being sorted out.

Action 11/9: Secretary to include statement in 2003 annual report that there is an "overlap" of work in Annexes III and IV and that it is presently being sorted out.

14.4 Annex VII Advanced Geothermal Drilling (presented by Allan Jelacic)

Jelacic stated that there had been a meeting of Annex VII participants the previous day, with the EC, Iceland, Italy (who is considering joining the Annex), Japan, Mexico, New Zealand and the USA present. He informed the meeting that Ed Hoover, the Task Leader, had left Sandia, so there was no longer a Task Leader for the Annex. Minutes of this Annex VII meeting are included as Appendix 11.

The leader of Subtask A (Cost Performance Data), Satoshi Kubo, returned to JAPEX from his position in NEDO, consequently, NEDO is no longer participating and a new subtask leader is needed. Nieva was requested to ask CFE if they would become the subtask leader.

Action 11/10: Nieva to ask CFE if they would agree to be the Subtask A Leader for Annex VII.

Jelacic reported that there is a substantial amount of data, but much of it is proprietary, so effort will be concentrated on the "performance" data. A decision was made at the Annex VII meeting held on the previous day to canvas and provide well drilling reports that are in the format that NEDO developed. Harvey volunteered to obtain data from other countries, e.g. Indonesia. The data is to be sent to Jelacic.

Jelacic stated that work on the Subtask B drilling handbook could not be performed as previously outlined because of the major effort required and, therefore, the possible need for an associated common fund. It was decided that the participants would provide a list of references for the information, then decide how to proceed (e.g. publish the reference list).

Action 11/11: Participants in Subtask B of Annex VII to provide a list of references covering information for the Handbook to the Subtask Leaders (Hector Gutierrez, CFE (Mexico); Sverrir Thorhallsson, Orkustofnun (Iceland)).

Jelacic noted that an outline for the handbook had been produced.

There have been no firm proposals for the testing of participants' equipment (e.g. US is working on developing drill bits and high-temperature logging tools) received for Subtask C. However, CFE and Iceland are able to provide wells for these studies and were requested to provide information on the wells that would be available

Action 11/12: CFE and Iceland to provide information on their "wells of opportunity" for equipment testing.

Jelacic was optimistic about the progress made so far in the Annex.

Rybach stated the hope that a successor to the Task Leader, Ed Hoover, would be found soon and noted that the drilling handbook would be a very good product of the Annex. Jelacic replied that he will do his best to find a Task Leader.

Nieva pointed out that Annex VII is a model annex being jointly planned, etc.

Harvey asked if it was possible to obtain common fund for production of the handbook. Nieva stated that the present GIA Common Fund can only be used for the Secretariat and the GIA as a whole, not for specific annex projects. Jelacic pointed out that **Action 10/10**, which was continuing, was for all participants to check on support for special common funds.

Action 10/10: All ExCo Members to investigate the possibility of contributing to a common fund for certain tasks (e.g. Annex V Sustainable Geothermal Energy Production).

- ***Continuing***

14.5 Annex VIII Direct Use of Geothermal Energy (presented by Helga Tulinius)

Tulinius stated that work had not yet started in this new annex, but will begin in earnest this autumn.

A letter of invitation to join Annex VIII (Appendix 12) and a draft description of it (Appendix 13) had been prepared and were distributed at the meeting.

Harvey asked if/how John Lund (Geo-Heat Center, USA) would fit into this annex. Jelacic stated that he had discussed this with Lund, but that the US did not have much funding for direct use applications; however, the US is interested and will provide a description of how they will participate.

15. STATUS OF PENDING AND PROPOSED ANNEXES

15.1 Annex V Sustainable Geothermal Energy Production (presented by Allan Jelacic)

As an aid to these minutes, I include the following paragraph from the Minutes of the 10th ExCo Meeting (see pages 8-9 therein and Appendix 12 of those minutes for the revised draft of this proposed annex):

> *Jelacic provided a revised draft of Annex V Sustainable Geothermal Energy Production (Appendix 12). This sustainability approach was developed by Mike Wright to counteract criticism against geothermal being "renewable". The annex will evaluate the worldwide potential of sustainable geothermal energy production and contribute significantly to resolving the issues of renewability and sustainability of geothermal energy production. It will also help provide a basis for policy decisions regarding development of geothermal resources.*

Jelacic stated that the US could contribute some money to a common fund for this annex. Baldacci noted that Italy might be able to contribute and Tulinius stated that Iceland might also. Harvey said that NZ might be able to participate in activities related to NZ research, but would only be able to contribute "in time", not financially.

The EC, Germany and Switzerland would not be able to contribute financially. However, Rybach stated that Switzerland might be able to provide an "in-kind" contribution.

Rybach also noted that geothermal sustainability is a very important issue and that the GIA is the group that should deal with it.

Haruguchi stated that NEDO cannot participate in any new annexes, but there may be other possibilities for Japan's participation.

Rybach thought that maybe something would be possible on an individual basis.

Nieva said that creating a common fund for Annex V and other new annexes was not yet hopeless.

Kristmannsdóttir pointed out that the GIA was running out of time, therefore decisions would need to be made soon about starting Annex V if any useful work was to be done. Nieva agreed.

15.2 Annex IX: Geothermal Energy Market Acceleration (presented by David Nieva)

Nieva did not circulate a proposed draft of this annex because he discovered at the 2003 GRC Annual Meeting in Morelia, Mexico (October 2003), that the GEF offer to provide funding for geothermal development was for East Africa. Consequently, he did not pursue this issue.

However, there is now something new- the Renewable Energy Working Party (REWP) decided to have a market acceleration annex for all renewables. Therefore, the GIA would not require a common fund to participate. At this point, Nieva suggested letting the IEA move with market acceleration; he would raise the issue with Peter Tulej at tomorrow's session of the ExCo meeting.

Rybach noted that market acceleration was not a GIA invention, that a request had come from the IEA to all IAs to implement an annex on market acceleration. Now the IEA will have a specific annex on market acceleration with participation by country. Hence, market acceleration is out of the GIA's hands.

Motion 11/8: Nieva moved that today's session of the 11th ExCo meeting adjourn until tomorrow. Rybach seconded, and the motion was carried unanimously.

The first day's session of the 11th ExCo Meeting ended at this point at 4:10 PM.

Meeting Recommenced at 9:40 AM on Friday, 19 March 2004.

16. PROSPECTIVE PARTICIPATING COUNTRIES (reported by Ladsi Rybach)

Rybach pointed out that though the GIA decided to invite several countries to become Members, it was not an easy task to get them to join.

The main obstacle was that only governments and higher organizations can participate, therefore bureaucrats such as high government officials must sign the agreement. Rybach has contact only with the lower levels, making this a long process.

Several efforts have been made by the IEA with China, and several meetings held previously to bring them into the IEA. The last contact the GIA had was between Nieva and Rybach and a member of the Chinese Academy of Science. The problem is that China is against all financial contributions, so they are not able to join the GIA. Rybach noted that China will be holding the "Green Summer Olympics" in 2008, and they will be using geothermal heating- so maybe this will encourage China to join.

Rybach has been trying to convince France to join the GIA for over 5 years. He gave a presentation to high French officials 5 years ago and there has been a flow of information to them ever since. Discussions are still in progress. Baria stated that the new Minister is optimistic and he has sent material to him and is now waiting for a response.

Rybach reported that Turkey had significant geothermal direct use, 100's of MW_t. In addition, some of the cities struck by a large earthquake a few years ago were planning to install geothermal heating as part of the re-building process. The MTA (the State geological survey) has a geothermal department with a new Head of Department who was becoming familiar with the job; however, they have a small budget therefore it was unlikely that they would be able to contribute to the Common Fund.

Rybach mentioned the GIA document prepared by the Secretary, *THE IEA GEOTHERMAL IMPLEMENTING AGREEMENT- It's Goals, Activities, Benefits, Obligations and Costs* (Appendix 6), which he was sending to prospective members and which he requested be placed on the GIA website.

Action 11/13: Secretary to place "THE IEA GEOTHERMAL IMPLEMENTING AGREEMENT-It's Goals, Activities, Benefits, Obligations and Costs" document in a prominent location on the GIA website.

Rybach had sent the Philippines GIA membership information and an invitation to join the GIA, but had only received confirmation that they had received the material, no comment about their intent to join.

Rybach also said that there had been communication with Russia through the IEA where there had been bureaucratic hold-ups.

Nieva asked why it was so difficult for people to convince their governments to join the GIA? Perhaps it was the bureaucrats who made the decision not to join, rather than those with more geothermal knowledge.

Rybach noted that each country is different and that the high-level people in geothermal and in the pertinent ministries need to be identified.

Rybach asked Tulej about Russia and whom he should contact through the IEA. Tulej noted that there is an MOU on energy policy with Russia, but so far Russia only participated in solar. Tulej stated that the IEA has no contacts, though they published a book on Russia. Rybach stated that he had a list of Russian contacts and that there had been a conference on funding geothermal with World Bank funds.

Rybach asked Tulej about China and noted that there was a heat pump meeting there. Tulej replied that there were now new rules of participation with both OECD and non-OECD members and private companies as Sponsors. He said that China was participating in some IEA areas, but that they were not interested in joining the renewables. Tulej hoped that the ExCo would be discussing the changes to the GIA, since the "old" GIA limits GIA participants. He had asked the IEA Legal Council to join the meeting later. Nieva stated his desire to sort out the GIA legal problems soon.

17. NATIONAL (COUNTRY) REPORTS

This topic began with the Soultz report at Nieva's request.

17.1 Soultz-sous-Forêt (presented by Roy Baria)

Baria presented a review of the current state of European HDR at Soultz.

Funding for the Soultz project for the 2002-2004 period was 26 M euros (€), split about equally among the EC, France and Germany. The current phase of investigation includes drilling, stimulation, technical development, stimulation development and modelling.

Soultz is located in the central west of the Rhine Graben.

Well GPK-1 passed through 1,400 m of sedimentary cover, then granite to a depth of 3,600 m. It was stimulated, producing an "upper" reservoir. GPK-2 was then drilled and when stimulated microseismics data indicated that the stimulated volumes of both wells overlapped. Higher temperatures were desired, so GPK-2 was deepened to 5,000 m and stimulated.

GPK-3 was drilled along a deviated path to the exact location planned, about 600 m from the bottom of GPK-2. The casing was designed to expand/contract by ~ 8 m as a result of heating during production and cooling during reinjection. The bottom hole temperature was about 200 ºC.

Stimulation of GPK-3 caused an earthquake of magnitude 2.6. Consequently, a new stimulation programme was designed to reduce the strength of induced earthquakes, which involved performing a "slow increase-slow decrease" stimulation. This resulted in a magnitude 2.9 earthquake, which was a cause for concern as it was hoped that this procedure would result in smaller magnitude earthquakes.

During circulation tests, the micro-earthquakes were concentrated in the "reservoir" stimulated area, not above it.

Stimulating both GPK-2 and GPK-3 simultaneously resulted in the shearing pressure being reached between the wells very quickly, in < 3 hours.

It is believed that a volume of rock ~ 3 km^3 was stimulated.

GPK-4 is being drilled at present, is at a depth of ~ 4,000 m, and looks good for reaching the desired target.

Phase 2004-2007 has a budget of 22 M €.

Jelacic asked about whether the 9-12 month circulation test was long enough? Baria said that 9 months will give an idea of the temperature drawdown, etc. and that there was a need to demonstrate (as soon as possible) to the funding agencies that power could be produced.

Rybach asked Baria what the prerequisites were for a successful EGS? Baria stated that what Soultz demonstrates is the "skeleton" of techniques and that local variations would need to be made for local conditions at new areas. However, depths of 5-6 km were required for successful EGS. He does not believe that micro-earthquake events can be eliminated, but thinks that they can be "controlled".

Schuppers provided copies of three papers describing: the Soultz project, seismic source parameter use in development of EGS systems and microseismic monitoring at Soultz; and two CD-ROMS with Soultz 1998-2001 final publishable report and 2001-2004 1st and 2nd year reports. This information may be made available on the GIA website.

17.2 Germany (presented by Dieter Rathjen)

Rathjen provided a brief review of the German geothermal projects and it is included as Appendix 14.

He noted that Germany was involved in five geothermal projects within Germany: Bad Urach, Bruchsal, Groß Schönebeck, Hannover and Neustadt-Glewe. In addition, Germany is also participating in the Soultz project.

He noted that funding for geothermal had decreased from 9 M € in 2002 to 6 M € in 2004, and he thinks it will decrease in the future.

Rybach noted that Germany was now a geothermal electricity producer, with the first German geothermal power station having gone on-line at Neustadt-Glewe in November 2003 using a 250 kW_e generator. Rybach wished this important event to be included in the 2003 GIA annual report.

Action 11/14: Secretary to include a statement that the first German geothermal power station went on-line at Neustadt-Glewe in November 2003, in the 2003 GIA annual report.

17.3 United States (presented by Allan Jelacic)

Jelacic stated that his report would cover the EGS work that the US DOE is conducting.

The DOE provided funding of US$ 6-7 M for EGS. Since it was decided to give EGS top priority, funding will increase to US$ 10 M next year and continue to increase in coming years. However, the total geothermal budget is flat within the US and probably will not increase in coming years.

The EGS strategy is: (1) to emphasize basic research on how to produce and maintain EGS for economic electricity production and (2) conduct field projects and demonstrations with industrial partners to: (i) create EGS within existing operating fields, (ii) apply EGS at the margins of fields and (iii) create EGS in unexplored geothermal areas.

There are three projects currently in place: (1) with Caithness at Coso in southern California (on US Navy land), (2) with Ormat at Desert Peak in northern Nevada where attempts are being made to expand the field and (3) with Calpine at The Geysers, where an injection well at the Aidlin Plant is being stimulated and where induced seismicity is being studied.

The remainder of Jelacic's presentation dealt with the Coso project, where attempts are being made to induce permeability by opening fractures. Both thermal and chemical effects are being examined. Along the east flank of the Coso reservoir where temperatures are > 300 ºC, candidate wells are available. This is a large team effort which includes geophysics, geochemistry, modelling, stimulation and monitoring, well drilling and testing, microseismics and structural analysis. The objectives are to design, create and evaluate an EGS and to produce an additional 20 MW of electricity.

17.4 Australia (presented by Mike Mongillo for Doone Wyborn)

Mongillo presented Wyborn's report on Australian geothermal activities.

Four companies have acquired geothermal exploration tenements in Australia: Geodynamics Limited (Cooper Basin in South Australia and Hunter Valley in New South Wales), Scopenergy Limited (Cooper Basin), Mngi Pty Ltd (Northern Flinders Ranges, South Australia) and Perilya Limited has an application for an area around the Olympic Dam mineral deposit in South Australia). This report concentrated on the Geodynamics effort at Cooper Basin, South Australia.

There is a gravity low in the Cooper Basin area being investigated. Geodynamics Limited drilled the first deep EGS geothermal well in Australia, Habanero 1, which was completed to a depth > 4,400 m in September 2003. The well underwent hydraulic stimulation in November-December 2003, with 20,000 m^3 of water injected at pumping pressures up to 65.5 MPa. Approximately 11,700 seismic events were located and ranged in magnitude from 2 to 3.7. These events extended over an area of > 3 km^2 and a volume of > 0.7 km^3. Existing joints and fractures were found to contain water under pressure, with natural over-pressures greater than 35.5 MPa found. Temperatures > 250 ºC at 4,400 m were found and a horizontal reservoir confirmed. Drilling of a second well, Habanero 2, is scheduled to begin in May 2004, with a circulation test scheduled for the 2nd half of 2004.

Rybach pointed out that Geodynamics had been doing some good work, but noted that the largest EGS reservoir was now at Soultz (3 km^3). He asked when the 3.7 magnitude earthquake occurred, but the answer was not in the report.

Jelacic asked where the 2nd well was sited and Matsunaga answered that the exact location had not yet been decided.

Baria stated that 65 MPA was a very high pressure to drive the system.

17.5 Italy (presented by Aldo Baldacci)

Baldacci stated that Enel Green Power was in charge of all geothermal electricity generation in Italy.

Effort had been concentrated in three areas in 2003: (1) to make all existing power plants operate at full load, (2) to define an exploration program to find new fields and to check if the exploited fields are larger than previously thought and (3) to overcome local opposition to local development.

A total of 12,000 m had been drilled in 2003 and 50 MW of electricity generation recovered. In 2003, over 5 billion kWh of electricity had been generated for the first time. The plan for the future is to increase generation to 6 billion kWh.

It is also planned to drill 6-7 exploration wells to investigate if existing fields are larger, and if some are possibly connected.

Efforts have been made to improve environmental aspects of geothermal generation. There is local opposition to the bad smell of H_2S produced that ENEL is working to overcome. Baldacci has invented a method for reducing H_2S (a very economic catalytic reduction method) and Hg that removes 90% of the H_2S and 95 % of the Hg.

Rybach asked about the "production" of CO_2 versus its natural production. Baldacci stated that studies are in progress and the IGA is examining this issue. The Italians have the concept that if CO_2 is produced from power plants, there is a reduction of natural emission of an equal amount, so the total production of CO_2 remains unchanged.

Harvey noted that New Zealand is studying the CO_2 issue and could work cooperatively with Italy.

Hrefna also noted that Iceland is looking at the CO_2 to see if there are any changes before and after production and that these studies should be a part of Annex I.

Harvey also reported that New Zealand has been examining the presence of CO_2 as a method of fault location.

17.6 Iceland (presented by Helga Tulinius)

Tulinius reported that 58% of Iceland's primary energy supply comes from geothermal and that geothermal use will grow in the future. Iceland has 200 MW_e installed and 200 MW_e more is on the table now. Geothermal plays a very important role in the Icelandic energy policy.

Geothermal energy is more favourable than hydro due to the environmental issues associated with developing more hydro since the best hydro sources have already been used.

One problem with the use of geothermal for electricity production is the "left over' hot water. Iceland is looking at using more of it for tourist applications.

About 100,000 €/year are now being spent in the use of heat pumps, but their use has not yet become widespread.

Energy intensive industry is very important for Iceland because they have such an abundance of energy.

18. OTHER BUSINESS

18.1 IEA Deputy Chief Legal Council Presentation (made by Manuela Caruso)

Manuela Caruso, IEA Deputy Chief Legal Council, was invited to speak at the ExCo meeting by Nieva to address the problem of the EC not agreeing with the changes the IEA has proposed for the IAs.

Caruso pointed out that the acceptance of the changes being recommended by the IEA requires "unanimous" agreement within the GIA (and other IAs). Since the EC is now investigating these changes and has not yet made a decision about them, it is not appropriate to vote on them at this time. The difficulty seems to be only related to EC internal procedures.

The IEA voted on the change in Framework in 2003 and it now applies to all new IAs automatically. However, it is not retroactive to existing IAs, so the ExCos must make their own decisions.

Schuppers noted that since the EC is not on the IEA Board i.e. it is not a Member country of the IEA, it has no voting rights, hence did not participate in the new Framework acceptance by the IEA. Consequently, the Framework issue must be decided upon internally by the EC, so he does not have a mandate to vote on the issue at the present ExCo meeting.

Caruso again pointed out that the new Framework cannot be adopted if the GIA vote is not unanimous. She hopes that the EC makes their decision soon and recommends that each country write to the EC stating that their "holding-up" is preventing the smooth operation and work of the GIA.

Jelacic asked if the GIA had to accept the new Framework, to which Caruso answered "no", the GIA does not have to accept it. However, Caruso noted that the new Framework provides more freedom to operate. Since the "associate Member" category no longer exists, non-Members of the IEA may not be able to join the GIA. Also, in the new Framework, Sponsors have the right to vote, but with the present GIA, Sponsors cannot be a Member of the ExCo therefore cannot vote.

Rybach asked how many IA's had adopted the new Framework and Caruso stated that a few had, though all IA's in which the EC is a Member had not yet agreed.

Caruso noted that the only participant who should not be in the GIA, i.e. the EC, is the one who objects.

Action 11/15: Secretary to distribute to the ExCo the IEA letter with the exact wording changes for the new IEA IA framework. (Supersedes Action 11/4.)

Schuppers had no idea when the EC would make its decision regarding the new Framework.

Nieva thanked Manuela Caruso for her participation at the meeting.

Caruso said that the GIA could contact her with any questions that she might be able to help with.

17. NATIONAL (COUNTRY) REPORTS (continued)

17.7 New Zealand (presented by Colin Harvey)

Harvey reported (Appendix 15) that New Zealand had signed the Kyoto Protocol in 2003, and that New Zealand has hydro development problems and a natural gas shortage, thus good conditions for further geothermal development. Geothermal electricity production is expected to double in the next 10 years.

Currently, geothermal energy provides 5% of the installed capacity (~ 430 MW_e) and 7% of the national energy production.

Six deep wells were drilled in the past 12 months, with half on existing producing fields. The average cost for drilling a geothermal well to 2 km was ~ NZ$ 3 M.

There was a slight increase in direct use with about 210 MW_t used in the timber industry.

The cost of electricity production in New Zealand is expected to be about 6.5-8 NZ-cents for the next several years.

The Institute of Geological and Nuclear Sciences Limited research budget was ~ NZ$ 1.4 M in 2003, with effort concentrated in four areas: low enthalpy, better use of waste fluids, environmental and deep high temperature resources. There are also some microbiological studies being conducted on geothermal fluids, which are turning out some very interesting results, i.e. a bacterium that uses arsenic as an energy source.

Harvey noted that the Geothermal Institute (Auckland University) would formally close in July of 2004.

Rybach stated that CO_2 production should be included as part of the country reports and asked what it was for New Zealand. Harvey answered that work was presently being conducted to determine New Zealand's CO_2 production.

17.8 Switzerland (presented by Ladsi Rybach)

Rybach stated that the Country Report format developed for the GIA annual report was a step forward. He also noted that it was important to present quantitative values for the geothermal information that were based on fact and that surveys are conducted in Switzerland to obtain them. See the GIA 2003 Annual Report for a published version of this Switzerland country report.

The numbers being presented for Switzerland's geothermal information for 2003 were, however, determined by Rybach and Harald Gorhan using trends, since no detailed surveys had been conducted in the country in 2003. Geothermal surveys would be performed soon to provide accurate values for 2004.

In Switzerland, hydro produces roughly 60% and nuclear 40% of the electricity used. Consequently, there is practically no CO_2 produced during electricity production.

Geothermal energy use in Switzerland is not well defined in legislation. There is no tax on geothermal energy use and environmental impact reports are required for use of > 5 MW_t.

Two deep heat-mining projects in which EGS are to be used to produce electricity are underway in Basel and Geneva.

There is significant direct use, especially through heat pump utilization, with an average of 1 heat pump per 2 km^2. About 550 MW_t are installed as heat pumps, with 78% using borehole heat exchangers.

There were no wells drilled deeper than 500 m, however, a total depth of > 500 km of was drilled for borehole heat exchangers in 2003!

It is estimated that 1,123 GWh were produced from geothermal energy in 2003 and geothermal is also now used for "cooling".

Government support for geothermal energy is decreasing and is expected to be severely cut in 2004.

Switzerland participates in the EU Soultz project and in the IEA-GIA, in Annex III, with the project assistant, and has an interest in Annex VIII.

Gorhan stated that there would be no decrease in geothermal research funding. However, the support for demonstration plants is finished as a purely political decision, because they are seen as a form of subsidization, which is not wanted. There will also be some funding available for information dissemination and education.

17.9 Japan (presented by Satoshi Kubo)

A history of the geothermal production and funding was presented.

The first geothermal power station with a capacity of 12 MW_e was commissioned in 1966. At present there is a total of 20 geothermal power plants, with a total installed capacity of 535 MW_e.

There were no new geothermal power stations constructed after 1998.

In 1999, "new energy" was defined to include all renewable resources except for geothermal and the geothermal budget was cut very quickly. All NEDO projects were terminated in 2002.

In April 2004 three new geothermal areas are to be surveyed.

Gorhan asked why there was a sudden decrease in research funding? Matsunaga replied because geothermal energy is now established, so NEDO did not wish to support more research. However, research funding can still be obtained from the Ministry for Environment and from some private companies.

17.10 Mexico (presented by David Nieva)

Nieva presented a review of the 2003 Mexico country report (see 2003 GIA Annual Report for details).

In Mexico, geothermal is the most important renewable energy source after hydro.

At present, there is 953 MW_e of installed capacity in Mexico making it third in the world after the Philippines and USA. Electricity generation from geothermal sources represented > 3% of the total in 2003. The geothermal contribution to electricity generation is > 1.5 times higher than its contribution to the installed capacity, reflecting the very high capacity factor. About 86% of the installed capacity is owned by two Government utilities: Comisión Federal de Electricidad (CFE) and Luz y Fuerza del Centro (LyFC).

Four geothermal fields contribute to Mexico's geothermal generation, with La Primavera having wells but no power generation due to environmental objections.

In 2003 four x 25 MW_e were commissioned at Los Azufres, and five new wells were drilled at Cerro Prieto and eight at Los Azufres.

Rybach asked if there was much geothermal direct use in Mexico. Nieva said that about 164 MW_t was used for balneology.

18. OTHER BUSINESS (continued)

18.2 IEA Secretariat Report for 11th GIA ExCo Meeting (presented by Peter Tulej, IEA Secretariat)

Tulej welcomed the ExCo to the IEA Headquarters and introduced Mary Harries White from the IEA Office of Energy Efficiency, Technology and R&D.

Harries White distributed and discussed the IEA/CERT Open Energy Technology Bulletin, which is a service that provides on-line energy news (Appendix 16). It allows the GIA to circulate messages regarding meetings, conferences, etc. and disseminate news. She invited the GIA to make contributions to the Bulletin.

Action 11/16: Secretary to send Mary Harries White a list of GIA ExCo Members' e-mail addresses.

Rybach asked if this was purely electronic in form and Harries White confirmed it was.

Rybach pointed out that it gives the GIA a very good opportunity to spread the work about the Agreement. The GIA should make a good appearance when we first use the Bulletin, i.e. do a good job, rather than be hasty.

Jelacic asked about graphics and Harries White replied that for the sake of speed there are no graphics or pictures included. This is to provide "instant" impact upon opening the Bulletin.

Tulej then presented the IEA report to the ExCo meeting describing the developments within the IEA Secretariat and issues related to the GIA (see Appendix 17). He noted that the CERT approved the REWP Strategy and Mandate for 2004-2006 and included a brief outline of major points, including the mission and vision statements. The four objectives were stated: (1) Primary source of information and analysis on renewables, (2) Oversight and support of the renewable Implementing Agreements, (3) Identify and describe policies, financial and other market-related factors and (4) Develop and help implement accelerated market deployment.

Tulej discussed the upcoming International Conference for Renewable Energies to be held in Bonn, Germany, on 1-4 June 2004 (see website: http://www.renewables2004.de/). This event is expected to create further impetus for the global development of renewable energy. Such topics as: financing instruments and market development, formation of enabling political framework conditions, capacity building (education, research, networks, cooperation, etc.) would be covered. He informed the meeting that there would be an IEA side event in which several IA's will participate and reiterated his invitation to the GIA to participate in it (e.g. make a presentation) and the associated technology exhibition.

Antonio Pflüger, Head of the Energy Technology Collaboration Division of the IEA, also spoke. He is preparing a major book based on the Bonn Conference. He noted that geothermal is the third largest renewable and important that it be included in the book. He stated that the IEA would have a large booth at the Bonn Conference and that the Conference would be good for geothermal. The IEA was also producing a new *IA Highlights* book in 2005 and he wanted to include information from the GIA.

Of great interest was Pflüger's comment that the IEA made brochures of 2-16 pages and that the IEA would produce a glossy brochure for the GIA with our design and data, etc. at no cost to the GIA.

Rybach thanked Pflüger and stated that the GIA looked forward to the IEA's support and confirmed that the GIA could provide material to the IEA for distribution at their booth at no cost to the GIA.

Tulej then continued with a review of IEA potential collaborative projects including the R&D Seminar at REWP 47 to be held in the spring of 2005 (see Annex 1 in Appendix 17). The mid- to long-term R&D priorities for renewable energy will be defined in collaboration with the IA's. The GIA was requested to communicate with the IEA Secretariat regarding interest in attending and speaking at the Seminar. The GIA was also asked to consider and comment on the draft programme.

Several actions were placed on the GIA related to providing information and support to IEA projects (See Appendix 17) as follows:

1. GIA requested to communicate to the IEA Secretariat interest in attending and speaking at the R&D Seminar at REWP 47 (spring 2005). The GIA is also asked to consider, comment and make suggestions on the tentative programme and its contents.

2. The GIA is requested to consider providing information for the OPEN Bulletin. It is also possible to have a special issue of the Bulletin on geothermal energy. Contact Tulej.

3. The GIA is requested to consider providing support to the application of geothermal energy for the large-scale production of hydrogen by sharing information and experience with the IEA Secretariat and by verifying reports. The GIA's interest in participating is to be communicated to Tulej.

4. The GIA is requested to consider providing support to the project dealing with assessing the degree to which renewable energy resources are limited by their intermittency, and technical options and regulatory strategies for overcoming them. The GIA's interest in participating is to be communicated to Tulej.

In conclusion, Tulej noted the information support that the IEA can provide to the GIA through its *Highlights of Implementing Agreements* book, the IEA OPEN Energy Technology Bulletin and the IEA website and links.

18.3 General Comments and Business

Mongillo presented a list of actions generated at the 11th ExCo Meeting.

Gorhan noted the GIA's need for a logo and Nieva agreed that the GIA could use a poster and logo. After brief discussion it was decided to have a competition for the best GIA logo design.

Action 11/17: All ExCo Members to submit a logo design for the GIA by early-May for a competition.

19. DATES AND VENUES FOR THE 12th and 13th ExCo MEETINGS

The 12th IEA-GIA ExCo Meeting will be held in Italy on 14-15 October 2004. This decision was accepted unanimously.

Nieva requested that ExCo Members consider holding the 13th ExCo Meeting in conjunction with the WGC 2005, which will be held in Antalya, Turkey on 24-29 April 2005.

20. THANKS TO THE IEA SECRETARIAT

GIA Chairman Nieva expressed the IEA-GIA Executive Committee's thanks to the IEA hosts for their hospitality and efforts in hosting this 11th ExCo Meeting. Their assistance with the meeting arrangements was very much appreciated.

21. ADJOURNMENT

The 11th GIA ExCo Meeting was adjourned at 2:53 PM on 19 March 2004 with unanimous agreement.

APPENDIX 1: List of Meeting Participants (Signature Page)

11th Executive Committee Meeting
Paris, France
18-19 March 2004

Signature Page

ExCo Members/Alternates

1. Aldo Baldacci .....
2. Harald Gorhan .....
3. Kenji Haruguchi .....
4. Colin Harvey .....
5. Allan Jelacic .....
6. Hrefna Kristmannsdottir .....
7. David Nieva .....
8. Dieter Rathjen .....
9. Ladislaus Rybach .....
10. Jeroen Schuppers .....
11. Helga Tulinius .....

Observers

1. Roy Baria .....
2. Jörg Baumgärtner .....
3. Christophe Debouit .....
4. Kazunori Fukasawa .....
5. André Gerard .....
6. Ed Hoover .....
7. Satoshi Kubo .....
8. Isao Matsunaga .....
9. Mike Mongillo (Secretary) .....

APPENDIX 1 (cont'd): List of Meeting Participants (Business Card Page)

EnelGreenPower

Aldo Baldacci
Manager, Environment Quality, Health and Safety

56122 Pisa, Via Andrea Pisano 120
Tel. +39 050 535744 Fax +39 050 533290
Cell. +39 329 2258358
E-mail: baldacci.aldo@enel.it

EEIG heat-mining

Roy BARIA
Project Coordinator
European geothermal project - Soultz-s/s-Forêts

EEIG "Heat Mining"
Route de Soultz - BP 38
67250 KUTZENHAUSEN
France

Tél. : (33) 3-88-80-53-63
Fax : (33) 3-88-80-53-51
Home : (33) 3-88-96-29-87
E-mail : baria@soultz.net

Dr. Harald L. Gorhan, M.Sc.

Programmleiter Geothermie Schweiz

Neudoerfli 10
CH-5600 Lenzburg,
Schweiz

Tel. = Fax: +41(0)62/891 83 68
Mobile: +41(0)76/388 27 33
mailto: harald.gorhan@bluewin.ch
http://www.geothermal-energy.ch

NEDO
http://www.nedo.go.jp

KENJI HARUGUCHI

Director
Energy and Environment Policy Department

New Energy and Industrial Technology Development Organization (NEDO)

MUZA KAWASAKI Central Tower 18F,
1310 Ohmiya-cho, Saiwai-ku, Kawasaki-city,
Kanagawa, 212-8554, JAPAN

TEL : +81-44-520-5183
FAX : +81-44-520-5186
E-Mail: haruguchiknj@nedo.go.jp

UNIVERSITY OF AKUREYRI

Hrefna Kristmannsdóttir
Professor
Geothermal Research

Faculty of Natural Resource Sciences
Glerargata 36
IS-600 Akureyri
ICELAND

Tel.: +354-463-0974
Fax: +354-463-0998
E-mail: hk@unak.is
Home Tel.: +354-463-1530

NEDO
http://www.nedo.go.jp

Kubo Satoshi
Chief Officer
Energy and Environment Policy Department
New Energy and Industrial Technology
Development Organization

MUZA KAWASAKI 18F, 1310 Ohmiya-cho
Saiwai-ku, Kawasaki, Kanagawa
212-8554, JAPAN

E-Mail: kubosts@nedo.go.jp
TEL : +81-(0) 44-520-5183
FAX : +81-(0) 44-520-5186

National Institute of Advanced Industrial Sciences and Technology
Deputy Director, Institute for Geo-resources and Environment

Isao Matsunaga

AIST Tsukuba west, 16-1 Onogawa, Tsukuba,
Ibaraki 305-8569, JAPAN
Tel: +81-29-861-8201, 8700
Fax:+81-29-861-8708
E-mail:matsunaga-isao@aist.go.jp

Dr. Dieter Rathjen
Division ERG
Project Management Organization Jülich
of BMBF and BMWi

Forschungszentrum Jülich
GmbH

52425 Jülich
Phone: +49-2461-614233
Fax: +49-2461-612840

http://www.fz-juelich.de/ptj
e-mail: d.rathjen@fz-juelich.de

APPENDIX 1 (cont'd): List of Meeting Participants (Business Card Page)

GEOWATT AG
SWISS GEOTHERMAL EXPERT GROUP
GEOTHERMAL ENERGY
HYDROGEOLOGY
ENGINEERING
NUMERICS
Ladislaus Rybach
Prof. Dr. Ing. ETH / sia
Managing Director
Dohlenweg 28, CH-8050 Zürich
Tel +41 (0)1 242 14 54 Fax +41 (0)1 242 14 58
rybach@geowatt.ch www.geowatt.com

Jeroen SCHUPPERS
New and Renewable Energy Sources
European Commission
Directorate-General for Research
Mail: European Commission - Office: MO75 07/11 - B-1049 Brussels
Address: Rue Montoyer/Montoyerstraat 75, B-1050 Bruxelles/Brussel
Tel.: + 32-2-295.70.06 - Fax: + 32-2-299.36.94 - E-mail: jeroen.schuppers@cec.eu.int

ORKUSTOFNUN
National Energy Authority
Energy Resources
Orkustofnun
Grensásvegur 9
IS-108 Reykjavík
ICELAND
Tel.: +(354) 569 6000 / 6007
Home Tel.: +(354) 588 4484
Mobile: +(354) 899 7264
Fax: +(354) 568 8896
E-mail: htul@os.is
http://www.os.is
Helga Tulinius
Project Manager
Energy projects and computing

Institute of
GEOLOGICAL & NUCLEAR SCIENCES
Limited
A Crown Research Institute
M A (Mike) Mongillo
PhD, MSc, BSc (Hons), DipEnergyTech (Geothermal)
Secretary
Geothermal Implementing Agreement (GIA)
International Energy Agency (IEA)
Wairakei Research Centre
114 Karetoto Road, SH1, Wairakei
Private Bag 2000, Taupo
New Zealand
Telephone: +64-7-374 8211
Facsimile: +64-7-374 8199
Home: +64-7-378 9774
Email: iea-giasec@gns.cri.nz
http://www.gns.cri.nz

APPENDIX 2: Revised Agenda for 11th ExCo Meeting

REVISED AGENDA

The 11th Executive Committee Meeting of the I.E.A. Geothermal Implementing Agreement

18 & 19 March 2004 at IEA Headquarters Paris, France

The meeting will start at 9:30 AM on Thursday 18 March

---

1. Opening at 9:30 AM (welcome, apologies, adoption of Agenda)

2. Minutes of the 10th ExCo Meeting (18-19 September 2003, Reykjavik, Iceland)
   a. Approval of minutes
   b. Status of actions
   c. Matters arising

3. Other ExCo Issues
   a. Status of 2003 Annual Report
   b. Action on non-paying GIA Members
   c. Required amendments to the GIA
   d. Participation in WGC 2005

4. Election of Chairman and Vice-chairmen

5. Review of Secretariat Operation and Work Plan
   a. Work conducted since 10th ExCo Meeting
   b. Costs of operation/budget for 2004
   c. Proposed work for remainder of year (routine duties, GIA website, GIA brochure)
   d. IGNS secretariat contract for 2nd year

6. Financial Report (Common Fund)
   a. Status of Common Fund (contributions for 2002 and 2003, un-paid contributions, expenditure, balance, forecast)
   b. Shares and share cost for participants (reminder)
   c. Fund use for attending important meetings

7. Progress Reports and Work Plans of Continuing Annexes
    a. I Environmental Impacts (Chris Bromley)
    b. III Enhanced Geothermal Systems (I. Matsunaga)
    c. IV Deep Geothermal Resources (Dieter Rathjen)
    d. VII Advanced Geothermal Drilling (Ed R. Hoover)
    e. VIII Direct Use of Geothermal Energy (Einar Gunnlaugsson)

8. Status of Pending and Proposed Annexes
    a. V Sustainability (USA, Allan Jelacic)
    b. IX Market Acceleration (draft proposal on marketability of a Latin American prospect (David Nieva)

9. Prospective Participating Countries
    a. Potential membership (China, France, Russia, Turkey, Philippines and Sweden (Ladsi Rybach)

10. National (Country) Reports

11. Dates and Venue of next ExCo Meetings
    a. 12th ExCo Meeting: Thursday and Friday, 14-15 October 2004; Pisa, Italy.
    b. 13th ExCo Meeting: Consider week prior to WGC 2005: 18-22 April 2005, in Turkey.

12. Other Business
    a. IEA report (Peter Tulej, Friday 19 March 2004)
    b. IEA new IA framework (Manuela Caruso, Friday 19 March 2004)
    b. Review of Actions for the 11th ExCo Meeting (Secretary)

APPENDIX 3: List of IEA-GIA ExCo Members as of March 2004

IEA Geothermal Implementing Agreement Executive Committee (March 2004)

Country / Name	Delegate	Organization / address	e-mail / tel / Fax	Alternate	Address, etc. (where different)
AUSTRALIA	**Doone Wyborn**	Geodynamics Limited PO Box 2046 Milton Queensland 4064 Australia	dwyborn@geodynamics.com.au Tel. +61-7-3721-7500 Fax +61-7-3721-7599	**Prame Chopra**	Australian National University Department of Geology Canberra, ACT 0200 AUSTRALIA prame.chopra@anu.edu.au
EUROPEAN COMMISSION	**Jeroen Schuppers**	European Commission DG RTD / (MO75 07/11) B-1049 Brussels BELGIUM	Jeroen.schuppers@ cec.eu.int Tel. ++32-2-295-7006 Fax ++32-2-299-3694	**William Gillett**	European Commission DG TREN / D-2 (DM24 03/126) B-1049 Brussels BELGIUM Tel. ++32-2-299-5676 Fax ++32-2-296-3765 william.gillett@cec.eu.int
GERMANY	**Dieter Rathjen**	ForschungszentrumJülich GmbH Project Management Organization D-52425 Jülich GERMANY	d.rathjen@fz-juelich.de Tel. ++49-2461-61-42-33 Fax ++49-2461-61-28-40	**Norbert Stump**	ForschungszentrumJülich GmbH n.stump@fz-juelich.de Tel. ++49-2461-61-31-72 Fax ++49-2461-61-28-40
ICELAND	**Helga Tulinius**	Orkustofnun (National Energy Authority) Grensavegi 9 IS-108 Reykjavik ICELAND	htul@os.is Tel. ++354-569-6000 Fax ++354-568-8896	**Hrefna Kristmannsdóttir**	University of Akureyri Faculty of Natural Resource Sciences Solborg, Nordurslod, 600 Akureyri ICELAND hk@unak.is Tel. ++354-463-0974 Fax ++354-463-0998
ITALY	**Aldo Baldacci**	ERGA SpA (Gruppo ENEL) Via Andrea Pisano 120 I-56122 Pisa ITALY	baldacci.aldo@enel.it Tel. ++39-050-535-744 Fax ++39-050-535-5940	**Guido Cappetti**	ERGA SpA (Gruppo ENEL) cappetti.guido@enel.it Tel. ++39-050-535-781 Fax ++39-050-533-290

IEA Geothermal Implementing Agreement Executive Committee (continued) (March 2004)

Country / Name	Delegate	Organization / address	e-mail / tel / Fax	Alternate	Address, etc. (where different)
JAPAN	**Kenji Haruguchi**	Director Energy and Environment Policy Department NEDO MUZA KAWASAKI, 18F, 1310 Ohmiya-cho Saiwai-ku, Kawasaki, 212-8554 JAPAN	haruguchiknj@nedo.go.jp Tel: ++81-44-520-5183 Fax:++81-44-520-5186	**Yumi Kiyota**	NEDO kiyotayum@nedo.go.jp Tel: ++81-44-520-5183 Fax:++81-44-520-5186
MEXICO	**David Nieva** *Chairman*	Manager of Technology Transfer Instituto de Investigaciones Electricas Av. Reforma N˚113, Col. Palmira 62490 Temixco, Mor. MEXICO	dnieva@iie.org.mx Tel. ++52-777-318-3811, ext. 7495 Fax ++52-777-318-9542	**Victor Manuel Arellano Gómez**	IIE vag@iie.org.mx Tel. ++52-777-3-62-38-03 Fax ++52-777-3-62-38-04
NEW ZEALAND	**Chris Bromley**	Institute Geological & Nuclear Sciences Wairakei Research Centre Private Bag 2000 Taupo NEW ZEALAND	c.bromley@gns.cri.nz Tel. ++64-7-374-8211 Fax ++64-7-374-8199	**Colin Harvey**	IGNS c.harvey@gns.cri.nz
SWITZERLAND	**Ladislaus Rybach** *Vice Chairman*	ETH Zurich Institute of Geophysics ETH-Hoenggerberg CH-8093 Zurich SWITZERLAND	rybach@ig.erdw.ethz.ch rybach@geowatt.ch Tel. ++41-1-633-2605 Fax ++41-1-633-1065	**Harald L. Gorhan**	Neudoerfli 10 CH-5600 Lenzburg SWITZERLAND harald.gorhan@bluewin.ch Tel. ++41-62-891-8368 Fax ++41-62-891-8368
USA	**Allan Jelacic** *Vice Chairman*	Office of Geothermal Technologies US Department of Energy, EE-2C 1000 Independence Ave SW Washington, DC 20585 USA	allan.jelacic@hq.doe.gov Tel. ++1-202-586-6054 Fax ++1-202-586-8185	**Roy Mink**	US Department of Energy roy.mink@ee.doe.gov Tel. ++1-202-586-5463 Fax ++1-202-586-8185
STAFF	**Mike Mongillo** *IEA-GIA Secretary*	IEA-GIA Secretariat Institute Geological & Nuclear Sciences Wairakei Research Centre Private Bag 2000 Taupo NEW ZEALAND	IEA-GIASec@gns.cri.nz m.mongillo@gns.cri.nz mongillom@reap.org.nz (home office) Tel. ++64-7-378-9774 (home office) Tel. ++64-7-374-8211 Fax ++64-7-374-8199	-	-

APPENDIX 4: E-mail Sent to ExCo re. Amendments to the GIA

E-mail sent to ExCo from David Nieva on 18 February 2004
Re. Amendments to the GIA

Dear Members of the GIA Executive Committee:

As mentioned at our 10th. ExCo Meeting (Item 18.2 of the Draft Minutes) the Legal Counsel of IEA has suggested that we make amendments to our Implementing Agreement, in order to:

a) Make the IA compatible with our current practices,

b) Make the best use of the lower restrictions than the new IEA Framework for International Energy Technology Cooperation establishes, as compared with the original Guiding Principles for Co-operation in the Field of Energy Technology and Development.

Fortunately, there is a provision in our current IA that allows the Executive Committee to make amendments acting by unanimity. That is, we would not be required to have the IA signed again by our countries' authorities.

In view of the above, I ask you to be prepared to define your position on the following recommendations by the Legal Counsel:

i) Modify the current Article 11 of the GIA in order to allow participation of governments from both OECD member and OECD non-member countries, of the European Communities, of international organizations in which the participating governments have a stake, and of any national agency, public organization, private corporation or other entity designated by the participating governments or by the European Communities.
ii) Modify Article 10(c) so as to make reference to the new Framework as opposed to the original Guiding Principles (which have been annulled).
iii) Specify that an abstention does not count as a vote (therefore not blocking a unanimous decision without taking a definite position).
iv) Modify Article 12 so that we could invite as a "Sponsor" an entity of OECD member countries AND OECD non-member countries, and also no to be required to obtain a clearance from the Committee on Energy Research and Technology (CERT) to make such invitation.

The IEA Legal Counsel offers a specific wording for each one of these amendments. However, as mentioned above, they must unanimously be accepted by the ExCo.

The IEA Framework for International Energy Technology Cooperation could be consulted on the IEA's webpage under Technology Agreements.

I look forward to seeing you all in Paris next month.

Best regards,

David Nieva

APPENDIX 5: IEA-GIA Secretary's Report (including Secretary's 2004 Draft Work Plan)

IEA-GIA Secretary's Report

11th Executive Committee Meeting
Paris, France
18-19 March 2004

Introduction

This report covers the GIA Secretary's work for the period beginning with the 10th ExCo Meeting held in Reykjavik, Iceland, on 18-19 September 2003 and ending 29 February 2004.

The general duties of the Secretary are specified in the IEA-GIA Implementing Agreement (Article 5). The work plan for this period was based on Article 5, the IGNS bid, action items specified at the 10th ExCo Meeting and specific requests made by the Chairman and Vice-Chairmen. The Secretary's work has proceeded as planned, though a change in priorities caused some projects to be sidelined. A brief review of the work conducted follows.

A work plan for the 2004-year is included as Appendix 1.

A detailed outline of the time and costs associated with the operation of the New Zealand based GIA Secretariat for 2003 is also included with this report (Appendix 2).

A letter from Dr Colin Harvey (New Zealand ExCo Alternate Member, and Manager, Geothermal, Minerals and Groundwater Research, IGNS) that provides an estimate of costs for the operation of the NZ GIA Secretariat by IGNS for the 2004 calendar year is included as Appendix 3.

General Administrative Work

The IEA-GIA Secretary has strived to maintain regular and timely communication with the ExCo Chairman, Vice-Chairmen, committee members and IEA Headquarters. Minutes of the 10th ExCo Meeting were written, edited and distributed (50 hours); arrangements were made with the IEA Secretariat for their hosting of the 11th ExCo and Annex VII meetings; and documents for the 11th ExCo Meeting were prepared and distributed.

Smaller projects arising from 10th ExCo Meeting Actions on the Secretariat were also completed, including: investigation into how GIA could participate in the WGC 2005; submission of abstract an to the WGC 2005 for the general GIA paper; working with NREL to change Common Fund share cost and invoicing based upon the new share cost and calendar year operation. Other miscellaneous administrative tasks were also performed.

(September 2003-February 2004: 200 hours)

Attendance at 10th ExCo Meeting and Budapest Forum

The Secretary attended the 10th ExCo Meeting (September 2003) and participated at the Budapest Forum (October 2003). A PowerPoint presentation describing the GIA, its activities and Strategic Plan and geared to gaining new membership was presented at the Budapest Forum, and is posted on the IEA website at: http://library.iea.org/dbtw-wpd/textbase/work/2003/budapest/geother.pdf

(September and October 2003: 80 hours)

GIA Strategic Plan

The Secretary assisted Allan Jelacic with the editing of the 2002-2007 GIA Strategic Plan and its distribution to ExCo members for ratification. The Plan was accepted unanimously, with Greece abstaining.

(November 2003-January 2004: 20 hours)

GIA Document Archive

An archive of important GIA documents was initiated as actioned at the 10th ExCo meeting. It is reasonably complete and will be available through the GIA website via a password protected option. At present the archive includes the Implementing Agreement, Annex descriptions, Annual and End of Term Reports, all but one of the ExCo meeting minutes, the 2002-2007 Strategic Plan, a few GIA produced papers, etc.

(December 2003: 6 hours)

IEA-GIA 2003 Annual Report

We are still working towards the production of high quality GIA Annual Reports in the re-designed format that was begun with the IEA-GIA 2002 Annual Report. To this end, a Country Report section was added in 2002 and detailed Country and Annex Report formats were produced by the Secretariat, and distributed both at the 10th ExCo Meeting and again on 6 November 2003. All of the reports have arrived at the Secretariat, most by early February 2004.

The current status of the 2003 Annual Report is that a draft document exists, consisting of ONLY the Annex and Country reports. Several of the reports remain to be edited, then the general information, summary and introductory sections will be written. It is estimated that about 100 hours will be required to complete the report, with about 6 hours already spent.

(January-February 2004: 6 hours)

GIA Website

A basic GIA website has been drafted and is available for demonstration at this meeting. Comments and suggestions are welcome from Members. NOTE that this is by no means complete, and significant changes are still anticipated.

A mock-up is available for demonstration purposes for this meeting.

(December 2003-February 2004: 60 hours)

GIA Brochure

Since the website was given priority over the brochure at the 10th ExCo meeting, no further work has been done on the GIA Brochure since that meeting. It remains in its initial design stage (about 40% complete) as reported at the Reykjavik Meeting.

(September 2003-February 2004: 0 hours)

Submitted in March 2004 by:

Dr Mike Mongillo
IEA-GIA Secretary
Wairakei Research Centre
Institute of Geological and Nuclear Sciences Limited
Private Bag 2000
Taupo 2730
NEW ZEALAND

Phone: Wairakei office: +64-7-374-8211 extension 875
Home office: +64-7-378-9774
Fax: Wairakei office: +64-7-374-8199
E-mail: Wairakei office: IEA-GIASec@gns.cri.nz
Home office: mongillom@reap.org.nz

APPENDIX 1

IEA-GIA SECRETARY'S DRAFT WORK PLAN FOR January-December 2004

M.A. Mongillo
March 2004

The following is an outline of the Secretary's work plan for 2004. It is based on the list of secretarial duties as specified in the IEA GIA Implementing Agreement, the IGNS Bid and 10th ExCo Meeting Action items.

1. Prepare and distribute documents (agenda, discussion papers, etc.) for the 11th ExCo Meeting, attend the meeting; take notes, prepare, edit and distribute the minutes.

2. Complete the IEA-GIA 2003 Annual Report and submit to IEA in April 2004.

3. Write the Minutes of the 11th ExCo Meeting.

4. Complete the development of the IEA-GIA website.

5. Assist with writing the WGC 2005 GIA paper. Due date is the end of May 2004.

6. Complete the IEA-GIA Brochure, arrange its production and distribute it.

7. Prepare and distribute documents (agenda, discussion papers, etc.) for the 12th ExCo Meeting, attend the meeting; take notes, prepare, edit and distribute the minutes.

8. Maintain regular and timely communication with the ExCo Chair, Vice-Chairs, Committee Members, Operating Agents and IEA Headquarters.

9. Continue with maintenance of the GIA Secretariat document archive (GIA Archive).

10. In general, conduct work for the GIA ExCo as specified for the Secretary in the Implementing Agreement and as requested by the Chairman and Vice-Chairmen of the ExCo.

APPENDIX 2

GIA Secretary's Total Time for 2003 Financial Year
M.A. Mongillo
March 2004

A. 21 March – 20 April 2003

a. Set-up of GIA Office, General Communication and Administration, and Production of the 2002 Annual Report.
Monthly Total: 158 hr @ $ 75/hr: NZ$ 11,850.00

B. 21 April – 21 May 2003

a. General Communications and Administration (10.75 hr) and Brochure Design and Writing (27 hr).
Monthly Total: 37.75 hr @ $75/hr: NZ$ 2,831.25

C. 22 May – 23 June 2003

a. General Communications and Administration, Strategic Plan, etc. (23.85 hr), Brochure Design and Writing (3 hr) and GRC Paper (59.25 hr).
Monthly Total: 86.1 hr @ $ 75/hr: NZ$ 6,457.50

D. 24 June – 20 July 2003

a. General Communications and Administration, etc.
Monthly Total: 32 hr @ $ 75/hr: NZ$ 2,400.00

E. 23 July – 31 August 2003

a. General Communications and Administration, Preparation for 10th GIA ExCo Meeting in Iceland and Budapest Forum (25.5 hr) and GRC PowerPoint Presentation (16.5 hr).
Monthly Total: 42 hr @ $ 75/hr: NZ$ 3,150.00

F. Expenses for Attending 10th ExCo Meeting and Budapest Forum

a. 10th ExCo Meeting in Reykjavik, Iceland.
- Airfare for Iceland: NZ$ 4,400.00
- ExCo Hotel, Meals, etc. Expenses: NZ$ 1,187.92
Total Secretary's Cost for Attending ExCo Meeting: NZ$ 5,587.92

b. Budapest Forum.
- Airfare: NZ$ 1,016.30
- Hotel, Meals, etc. Expenses: NZ$ 789.00
Total Secretary's Cost for Attending Budapest Forum: NZ$ 1,805.30

G. Time for Secretary to Travel and Attend Meetings

a. 10th ExCo Meeting in Reykjavik, Iceland (50 hr): NZ$ 3,750.00

b. Budapest Forum (30 hr): NZ$ 2,250.00

H. 1 September – 14 September 2003

a. General Communications and Administration, Preparation for 10th ExCo Meeting (19.7 hr), GRC and Budapest PowerPoint (12.2 hr).
Monthly Total: 31.9 hr @ $ 75/hr: NZ$ 2,392.50

I. 17 October – 31 October 2003

a. General Communications and Administration, and Preparation of Minutes for 10th ExCo Meeting.
Monthly Total: 22.3 hr @ $ 75/hr: NZ$ 1,672.50

J. 1-30 November 2003

a. General Communication and Administration (17.5 hr), editing Strategic Plan (17.7 hr), Completion of Draft Minutes 10th ExCo Meeting (20.4 hr).
Monthly Total: 55.6 hr @ $75/hr: NZ$ 4,170.00

K. 1-30 December 2003

a. General Communications and Administration (15.5 hr), editing Strategic Plan (2.25 hr), GIA Archive (5.55 hr), Completion of 10th ExCo Draft Minutes (13.75 hr) and Webpage Design (11.25 hr).
Monthly Total: 48.3 hr @ $75/hr: NZ$ 3,622.50

L. Total Cost for Secretary in 2003 (@ exchange rate of 0.69)

a. Secretary's Time (594 hours): **NZ$ 44,546.25**
US$ 30,736.91

b. Travel Expenses for 10th ExCo Meeting and Budapest Forum: **NZ$ 7,393.22**
US$ 5,101.32

c. Total Cost: **NZ$ 51,939.47**
US$ 35,838.23

APPENDIX 3

Letter from Colin Harvey to ExCo Officers (8 March 2004)

Subject: Re: Secretarial hours and costs.

As the project manager for the IEA-GIA Secretariat contract I am pleased to present our cost estimate for secretarial services for the 2004 calendar year (1 January– 31 December 2004).

A. SECRETARIAL TASKS AND TIME ESTIMATE

1. GIA Annual Report 2003	100 hours
2. Correspondence & miscellaneous small projects 32 hrs per month x 12	380 hours
3. Assist in preparation of papers, etc. (e.g. GIA exhibit, WGC 2005 Paper)	50 hours
4. GIA Brochure (underway but to be completed)	40 hours
5. Attendance at 2 ExCo Meetings (Paris and Italy) 50 hours/meeting including international travel time	100 hours
6. Reporting and Minutes of 2 ExCo Meeting at 40 hrs/meeting	80 hours
7. Website design	50 hours
Estimate of Secretary's Time for 1 January-31 December 2004	**800 hours**

b. Other Costs for related activities and disbursements

1. Office, consumables etc. (based on bid estimate)	NZ$ 6,000
2. Travel and accommodation for meetings (March 2004 and Oct 2004)	NZ$10,000
3. Cost of producing the brochure (based on the estimate)	NZ$10,000
4. Website construction and maintenance for 2004	NZ$10,000
The Total Other Costs for 1 January-31 December 2004 Year	***NZ$ 36,000***

C. TOTAL ESTIMATED COST FOR 2004 CALENDAR YEAR

1. SECRETARY'S TIME: 800 HRS AT NZ$ 75/HR	**NZ$60,000**
2. OTHER COSTS FOR RELATED ACTIVITIES AND DISBURSEMENTS	**NZ$36,000**
Total Estimated Cost for Second Year	**NZ$96,000**
At the current exchange rate of 0.69 this equates to	**US$ 66,240**

D. Comments

1. The cost estimates in Section A are based on the time that Dr. Mike Mongillo has taken to carry out the secretarial services during the 2003 year.

2. The cost estimates in Section B are based on 2003 costs.

3. The website cost estimate was provided in last year's budget and has been reduced because of preliminary work already carried out.

4. Design and writing of the GIA brochure was begun in 2003 by the Secretary in preparation for its final production and printing in 2004.

E. PREVIOUS ANNUAL BUDGET

1. The IEA-GIA Secretariat cost estimate presented in September 2003 totalled NZ$99,000.

2. Since that time the NZ$ has moved positively from 0.58 to 0.69 against the US$.

Dr. Colin Harvey
Manager
Geothermal, Minerals and Groundwater Research
Institute of Geological and Nuclear Sciences
Private Bag 2000, Taupo
New Zealand

Phone: +64-7-374-8211
Fax: +64-7-374-8199
Cell Phone: +64-27-289-0250
Email: c.harvey@gns.cri.nz
Website: http://www.gns.cri.nz/

APPENDIX 6: The IEA Geothermal Implementing Agreement Document

THE IEA GEOTHERMAL IMPLEMENTING AGREEMENT
It's Goals, Activities, Benefits, Obligations and Costs

March 2004

THE IEA GEOTHERMAL IMPLEMENTING AGREEMENT (GIA)

The GIA officially went into effect on 7 March 1997, being designed to operate for an initial period of five years. In late 2001, the GIA's mandate was extended for another 5-year term, to 31 March 2007.

The GIA provides an important framework for wide-ranging international cooperation on geothermal issues. It brings together important national programmes for exploration, development and utilization of geothermal resources, emphasizing the assemblage of specific expertise and increasing effectiveness by establishing direct cooperative links among the geothermal experts in the participating countries. The GIA's present activities are directed primarily toward the coordination of the ongoing national programmes of the participants.

As of March 2004, the European Commission (EC) and nine countries: Australia, Germany, Iceland, Italy, Japan, Mexico, New Zealand, Switzerland and the United States were members. The present involvement of these 10 members in the Annexes is shown in Table 1. Participants take part in those Annexes to which they can contribute, hence are not necessarily active in every one.

GOALS AND OBJECTIVES OF THE GIA

According to the IEA World Energy Outlook 2002, the total share of non-hydro renewable energy sources used for electricity generation is expected to increase from 2% in 2000 to 4-6% in 2010 in the OECD countries, with the geothermal energy contribution forecasted to grow at a rate of 4%/yr during this 10-year period. The IEA GIA can play a significant role in helping achieve these ambitious growth targets.

In fact, the overall goal of the GIA for its second term, as stated in the GIA 2002-2007 Strategic Plan, is to advance and support the use of geothermal energy on a worldwide scale by pursuing following objectives:

- Expanding R&D collaboration by implementing new annexes where additional collaboration will be useful
- Increasing outreach to non-Member countries with large geothermal energy potential
- Evaluating market stimulation mechanisms to expand the use of geothermal energy
- Improving the dissemination of high quality information about geothermal energy through the production of easily understandable and attractive products
- Leveraging limited R&D funding using the IEA's reputation of technical competence and broad unbiased excellence to obtain support from industry and other multilateral organizations and financial institutions

ACTIVITIES OF THE GIA

The scope of GIA's activities consist of international collaborative efforts to:

- Compile and exchange information on geothermal energy research and development worldwide concerning existing and potential technologies and practices

- Develop improved technologies for geothermal energy utilization and
- Improve the understanding of the environmental benefits of geothermal energy and ways to avoid or minimize environmental impacts

Work is presently being conducted on five diverse tasks that are specified in five annexes to the implementing agreement, with the activities of each divided into subtasks. Each annex has a minimum of two participants and is coordinated by an Operating Agent (appointed by the Member country) through a chosen Task Leader, with Subtasks supervised by Subtask Leaders.

Currently, there are five active annexes:

(1) Annex I: Environmental Impacts of Geothermal Energy Development: The main activities of this Annex are directed at clearly identifying possible environmental effects and devising and adopting methods to avoid or minimize their impact.

(2) Annex III: Enhanced Geothermal Systems: This Annex investigates new and improved technologies that can be used to artificially stimulate a geothermal resource to allow commercial heat extraction.

(3) Annex IV: Deep Geothermal Resources: Issues associated with the commercial development of deep geothermal resources at depths greater than 3,000 m are addressed by this Annex.

(4) Annex VII: Advanced Geothermal Drilling Techniques: This Annex pursues advanced geothermal drilling research and investigates all aspects of well construction with the aim of reducing the costs associated with this essential and expensive part of geothermal exploration, development and utilization.

(5) Annex VIII: Direct Use of Geothermal Energy: This Annex addresses the direct use of geothermal energy and the identification and removal of barriers to use.

A list of the GIA Operating Agents, Task Leaders and participating countries is provided in Table 1 below.

The results from the annex work include: numerous technical papers, databases (on CD–ROM), meetings and conference proceedings, and annual reports. In addition, a new interactive GIA website is being completed that will provide basic GIA information to the public, including access to GIA reports, papers and links to the IEA and participant sites. A password-protected section will provide GIA participants with an information archive; specially collected data, reports and other documents and meeting information.

Funding for all five existing annexes is of the *task-sharing* mode, whereby the participants allocate specified resources and personnel to conduct a portion of the annex work at their own expense. However, *cost-sharing* tasks, in which participants contribute to a common fund that is used for research, equipment purchase, information processing and exchange, *etc*. may be considered in the future.

BENEFITS OF BEING A GIA MEMBER

The research, government, industry and academic sectors are the main beneficiaries of membership in the GIA, at both technical and policy levels.

Collaboration within the GIA provides researchers with the opportunities for joint R&D cooperation and information exchange on recent R&D developments via meetings, symposia, workshops and networking. Members from industry are able to participate together on R&D projects and to develop databases, models and handbooks. Policy and decision makers are able to gain an international perspective on geothermal issues, opportunities and development. In addition, there are benefits to society that arise from the acceptable development of geothermal resources in an environmentally acceptable manner.

More specifically, membership within the GIA provides the following benefits:

- Increases R&D capabilities beyond that of single a country/group by combining the efforts of several nations
- Provides appropriate focus for R&D, hence avoids duplication and unproductive research
- Provides opportunities for research networking
- Develops skills and knowledge required to meet future technical challenges
- Improves R&D cost effectiveness by sharing research costs and technical resources
- Provides wider and easier access to key information, research results and technological capabilities
- Makes accessible a strong technical base provided by R&D activities in the participating countries
- Provides impartial information and analysis to help guide national policies and programmes
- Provides the opportunity to review current issues, ongoing research and the need for future research
- Provides opportunity to draw upon expertise and efforts of our sponsoring organization, the OECD/IEA
- Knowledge and ability to help avoid or minimize environmental impacts of development
- Helps build a common understanding of the technical basis for various geothermal issues
- Investigates barriers to development
- Helps develop technical standards and methodologies
- Contributes to the development of energy policies
- Opportunities to join in cooperative efforts with the United Nations Environment Programme (UNEP), the Global Environmental Fund (GEF) and other project financing agencies

STRUCTURE OF GIA AND OBLIGATIONS OF MEMBERS

Members of the GIA shall participate in one or more tasks described by the Annexes to the implementing agreement. They will coordinate their activities with other task participants in order to avoid duplication and enjoy mutual benefits from existing resources and expertise. They will also cooperate in coordinating the annex work and will endeavour, on the basis of an appropriate sharing of burdens and benefits, to encourage cooperation among other participants with the objective of advancing the state of understanding of all participants.

Member countries shall designate an Operating Agent for each task in the relevant annex. Each annex is binding only upon its Operating Agent and the participants therein, and shall not affect the rights or obligations of other members.

Supervisory control of the GIA is vested in the Executive Committee (ExCo). Decisions made by the ExCo are binding on the members. The ExCo consists of one voting member from each member country. An alternate may serve on the ExCo if the designated member is unable to do so. The ExCo meets twice a year and members and/or their alternates should endeavour to attend. The ExCo manages all administrative activities resulting from or affecting the GIA. During ExCo meetings the members report on national programmes, exchange information and results of work under annexes, and consider ongoing or arising issues.

Members will continue to cover the travel expenses for their representatives to attend meetings and workshops. Travel costs will be minimized by doing business by mail and e-mail whenever possible. To the extent practicable, meetings will be scheduled to coincide with other events to minimize travel costs. Each participant bears all the costs they incur in carrying out its task activities, including reporting and travel expenses. Unless otherwise specified, the cost of publishing annex reports and summary assessments shall be borne by the Operating Agent.

The GIA ExCo has established a Secretariat, now based in New Zealand, and managed by a Secretary who provides secretarial, administrative and other duties as required for the organization (basic duties are defined fully in the Implementing Agreement).

GIA FINANCIAL STRUCTURE AND COSTS

The expenses for the operation of the GIA Secretariat, including the Secretary's salary, and other common costs of the ExCo are met from a Secretariat Common Fund, administered by the Custodian, presently the National Renewable Energy Laboratory (NREL) (USA).

To support the Common Fund, the IEA has provided general guidance on a fair apportionment of monetary contributions in the form of shares assigned to different Member States of the OECD. Based on current membership, the apportionment for the GIA is:

Australia	2	Japan	4
European Commission	4	Mexico	1
Germany	4	New Zealand	1
Greece	1	Switzerland	2
Iceland	1	United States	4
Italy	2		
Total = 26 shares			

The ExCo has set the present cost per Common Fund share at US$ 2,500/year.

With the addition of new members, or the withdrawal of current members, the total number of shares will increase or decrease, affecting each member's contribution. Contributions will be made annually on a calendar year basis. The number of shares assigned to new members who are non-Members of OECD will be determined by the ExCo acting in unanimity. The Custodian will be responsible for administering the Common Fund and providing periodic accounting reports to the ExCo.

Other common funds may be established as required to meet the needs of new annexes. The costs will be shared among the participants of the relevant annex in accordance with the shares established by the IEA and set out in the Table above. The designated Operating Agent will serve as the Custodian of the annex common fund. Arising issues of finance and budgeting will be decided based upon the conditions and requirements of Art.7 of the GIA.

Table 1. List of GIA Annex titles, operating agents, task leaders & contact e-mail addresses, participating countries and operating status.

Annex Number	Title Operating Agent (OA) Task Leader (TL); Contact E-mail Participants	Status
I	Environmental Impacts of Geothermal Development OA: Institute of Geological and Nuclear Sciences Limited (IGNS), New Zealand TL: Chris Bromley; IGNS, New Zealand; c.bromley@gns.cri.nz Participants: Iceland, Italy, Japan, Mexico, New Zealand, USA	Active, Continuing through 2006
II	Shallow Geothermal Resources	Closed
III	Enhanced Geothermal Systems OA: New Energy & Industrial Technology Development Organization (NEDO), Japan TL: I. Matsunaga; AIST, Japan; matsunaga-isao@aist.go.jp Participants: Australia, EC, Germany, Italy, Japan, Switzerland, USA	Active, Continuing through 2006
IV	Deep Geothermal Resources OA: Forschungszentrum Jülich (F-J), Germany TL: Dieter Rahtjen; F-J, Germany; d.rathjen@fz-juelich.de Participants: Australia, Germany, Italy, Japan, Mexico, New Zealand, USA	Active, Continuing through 2006
V	Sustainability of Geothermal Energy Utilization	Draft
VI	Geothermal Power Generation cycles	Draft
VII	Advanced Geothermal Drilling Techniques OA: Sandia National Laboratories, United States TL: Ed Hoover, Sandia, USA; erhoov@sandia.gov Participants: EC, Iceland, Japan, Mexico, New Zealand, USA	Active, Continuing through 2004
VIII	Direct Use of Geothermal Energy OA: Federation of Icelandic Energy and Waterworks TL: Einar Gunnlaugsson, Reykjavik Energy, Iceland; einar.gunnlaugsson@or.is Participants: Iceland, New Zealand, Switzerland, USA	Active, Began Sept 2003
IX	Geothermal Market Acceleration	Draft

FOR FURTHER INFORMATION CONTACT

Dr Mike Mongillo
IEA-GIA Secretary
e-mail: mongillom@reap.org.nz; iea-giasec@gns.cri.nz

APPENDIX 7: STATEMENT OF GIA COMMON FUND ACTIVITIES (Gerry Nix, NREL)

2002-2004 IEA GEOTHERMAL IMPLEMENTATION ACTIVITIES ACCOUNT 3201 02/29/04

SPONSOR/ MEMBER COUNTRY	INVOICE AMOUNT	PAID AMOUNT	DATE PAID	PAYMENTS MADE	AMOUNT	DATE PAID	FUNDS PAID AVAIL
Beginning Balance		($9,022.76)					
2002 European Commission IEAGEO-01	$14,400.00	$14,400.00	4/12/02	George Frye	$333.40	6/01/03	
2003 European Commission IEAGEO-15	$14,400.00	14,400.00	3/10/03	George Frye	$466.76	7/01/03	
2004 European Commission IEAGEO-32	$1,200.00			George Frye	$533.44	7/01/03	
2002 Germany IEAGEO-02	14,400.00	$14,400.00	14/11/02	George Frye	$1,300.26	7/01/03	
2003 Germany IEAGEO-16	$14,400.00	$14,400.00	4/11/03	George Frye	$1,652.35	10/04/03	
2004 Germany IEAGEO-33	$1,200.00	$1,200.00	20/02/04	George Frye	$533.44	6/05/03	
2002 Iceland IEAGEO-04	$3,600.00	$3,582.00	09/30/02	George Frye	$2,067.08	6/05/03	
2003 Iceland IEAGEO-17	$3,600.00	$3,575.00	08/11/03	George Frye	$2,133.76	6/05/03	
2004 Iceland IEAGEO-28	$300.00	$275.00	02/02/04	George Frye	$350.07	6/06/03	
2002 Japan IEAGEO-06	$14,400.00	$14,400.00	12/03/02	Clifton Carwile	$450.00	7/07/03	
2003 Japan IEAGEO-18	$14,400.00	$14,400.00	09/08/03	IGNS	$6,932.40	13/09/03	
				IGNS	$12,316.79	15/12/03	
				IGNS	$10,719.06	5/03/04	
2004 Japan IEAGEO-34	$1,200.00						
2002 New Zealand IEAGEO-08	$3,600.00	$3,080.00	4/10/02				
2003 New Zealand IEAGEO-20	$3,600.00	$2,482.00	18/02/04				
2004 New Zealand IEAGEO-29	$300.00						
2002 Switzerland IEAGEO-09	$7,200.00	$7,200.00	11/19/02				
2003 Switzerland IEAGEO-21	$7,200.00	$7,175.00	01/21/03				
2004 Switzerland IEAGEO-35	$600.00						
2002 Greece IEAGEO-10	$3,600.00						
2003 Greece IEAGEO-22	$3,600.00						
2004 Greece IEAGEO-30	$300.00						

SPONSOR/ MEMBER COUNTRY	INVOICE AMOUNT	PAID AMOUNT	DATE PAID	PAYMENTS MADE	AMOUNT	DATE PAID	FUNDS PAID AVAIL
2002 Italy IEAGEO-11	$7,200.00	$7,174.50	02/24/03				
2003 Italy IEAGEO-23	$7,200.00	$7,200.00	10/02/03				
2004 Italy IEAGEO-36	$600.00						
2002 Mexico IEAGEO-12	$3,600.00	$3,600.00	5/11/02				
2003 Mexico IEAGEO-24	$3,600.00	$3,600.00	13/11/03				
2004 Mexico IEAGEO-31	$300.00						
2002 Australia IEAGEO-13 Revised	$7,200.00						
2003 Australia IEAGEO-25 Revised	$7,200.00						
2004 Australia IEAGEO-37	$600.00						
2002 United States IEAGEO-00	$14,400.00	$14,400.00	01/21/02				
2003 United States IEAGEO-26	$14,400.00	$14,400.00	01/21/02				
2004 United States IEAGEO-38	$1,200.00	$1,200.00					
TOTALS	**$195,000.00**	**$157,520.74**			**$39,788.81**		**$117,731.93**

Prepared by: Kerry Walker; (303) 275-4547; e-mail: kerry_walker@nrel.gov

APPENDIX 8: Annex I Environmental Impacts Report to Paris Meeting

IEA GIA Annex I

ENVIRONMENTAL IMPACTS OF GEOTHERMAL ENERGY DEVELOPMENT
2003 ANNUAL REPORT
Prepared by Task Leader Chris Bromley (IGNS, Wairakei, New Zealand)

Annex 1. Environmental Impacts of Geothermal Energy Development

1. Introduction

Environmental effects of energy use are a world-wide concern. Geothermal is generally regarded as a benign energy source. There are, however, some environmental problems associated with its utilization. To further the use of geothermal energy, possible environmental effects need to be clearly identified, and countermeasures devised and adopted to avoid or minimize their impact. Annex I (Task 1) of the GIA was set up to address this. The goals of this Task are: to encourage the sustainable development of geothermal energy resources in an economic and environmentally responsible manner; to quantify any adverse or beneficial impacts that geothermal energy development may have on the environment, and to identify ways of avoiding, remedying or mitigating such adverse effects. The term "development" here is used in a broad sense to encompass not only energy production but also use for social and economic purposes such as tourism.

Plans for the period 2002-2005 include:

- Data collection and analysis of environmental effects;
- Expansion of material presently on the IEA Web site (http://www.iea.org/tech/gia/gia-env.htm) and the organization of lectures and courses to widen the understanding of environmental impacts among technical non-specialists;
- Further publications in journals and conferences, and preparation of an Environmental Manual;
- Appropriate dissemination of information to the general public.

Specific objectives are:

- To study the effects that existing geothermal developments have had on the environment and determine their cause.
- To identify the most likely and serious adverse effects that geothermal developments can have on the environment.
- To identify the development technologies that have proven to be environmentally sound.
- To publish the results of the studies in international journals and present the results at international forums.
- To improve communications between individuals and organizations in different countries, and between different professional groups involved in geothermal development by involvement in collective presentation of the results in international forums.

During 2003, five countries were participating in Annex I: Iceland, Japan, Mexico, New Zealand, and United States of America. The participation of other geothermal countries that may join the IEA GIA agreement in future (particularly Turkey, China, Philippines and Russia) was actively encouraged.

The Operating Agent for Annex I is the Institute of Geological & Nuclear Sciences (IGNS), a Crown Research Institute owned by the New Zealand Government. The Task Leader is Chris Bromley, replacing Dr Trevor Hunt who retired in October 2002.

2. Subtasks

The Annex is sub-divided into three Sub-Tasks:

1. Sub-Task A: Impacts on natural features. Leader: Chris Bromley (NZ),
2. Sub-Task B: Discharge and reinjection problems. Leader: Trevor Hunt (NZ)
3. Sub-Task C: Methods of impact mitigation and Environmental Manual . Leader: Chris Bromley (NZ)

3. Work performed in 2003

3.1 General

Some results of ongoing environmental work have been published in 2003 (see below).
Information about environmental tasks for the Internet website is undergoing further preparation.
Organisation of a further Special Issue of *Geothermics* journal on geothermal environmental matters has continued.

Planned general work tasks in 2003 were:

- *Continue website development to inform the general public about the aims of the Task and results obtained.* Further material was collected, but needs to be processed for the website.
- *Continue collecting material for a further Special Issue of Geothermics journal.* Six draft papers collected and currently under review. Further attempts were made to encourage other authors to submit suitable papers
- *Organize a Session on Environmental Aspects of Geothermal Development at WGC-2005 geothermal conference, and plan another Environmental Short Course for international participants at the Geothermal Institute, Auckland University.* Still under discussion.
- *Provide support for collaborative publications on topical geothermal environmental issues at leading international workshops in New Zealand (NZGW), Philippines (PNOC-EDC), United States (GRC, Stanford), Japan (JGA) and Iceland (IGC-2003).* Papers were produced at NZGW and IGC-2003.
- *Define longer-term R&D needs.* Discussions with geothermal industry representatives (both developers and regulators) have identified new research requirements, particularly in the areas of monitoring CO_2 and convective heat flux from naturally steaming ground, classification of the vulnerability of thermal features to reservoir pressure changes, testing of mitigation and remediation methods, and development of bioremediation methods to remove arsenic from waste water discharges..

3.2 Sub-Task A: Impacts on Natural Features

This Sub-Task focuses on documenting known impacts of geothermal developments on natural geothermal features such as geysers, hot springs and silica terraces. The aim of this Sub-Task is to provide a sound historical and international basis on which to devise methods to avoid or mitigate the impacts of development on such natural geothermal features which generally have significant cultural and economic value.

Projects which examine the effects of geothermal developments on natural geothermal features occur in Iceland, Japan, New Zealand and United States of America.

3.3 Sub-Task B: Discharge and reinjection problems (Sub-Task Leader: Dr Trevor Hunt, Institute of Geological & Nuclear Sciences (Wairakei), New Zealand)

Work in this Sub-Task is focused on identifying and determining methods of overcoming the impacts of geothermal developments on other aspects of the environment. This includes the effects of gas emissions from geothermal power plants, effects of toxic chemicals in waste fluid that is discharged both into the ground and into rivers, effects of ground subsidence, and induced earthquakes.

Projects have been organised which examine the problems associated with disposal of waste geothermal fluids from existing geothermal developments in Iceland, Turkey and New Zealand. The effects of CO_2, Hg and H_2S gas emissions in Italy, New Zealand, Iceland and USA, and Mexico are being investigated. The effects, causes and possible remedies for subsidence have been researched in New Zealand and Iceland.

3.4 Sub-Task C: Methods of impact mitigation and Environmental Manual (Sub-Task Leader: Chris Bromley, Institute of Geological & Nuclear Sciences (Wairakei), New Zealand

The objective of this Sub-Task is to contribute to the future of geothermal energy development by developing an effective, standard environmental analysis process. Field management strategies that result in improved environmental outcomes will be identified and promoted based on operational experience. Successful mitigation schemes that provide developers and regulators with options for compensating unavoidable effects have also been identified, documented and promoted.

4. Highlights of Annex Programme Work for 2003

- Attendance and participation of environmental task participants in the IGC2003 conference in Iceland during September, which facilitated discussions on recent research results, and future plans.
- Development of improved carbon dioxide and heat flux monitoring techniques in areas of steaming ground.
- Improvements in subsidence modelling, which will provide a more reliable basis for future predictions, and possible mitigation, remediation or avoidance strategies.
- Advances in understanding of the processes involved in reducing hydrogen sulphide and mercury emissions, and removing arsenic from waste water.

5. Work Planned for 2004

- Continue website development to inform the general public about the aims of the Task and results obtained.
- Continue processing papers for a Special Issue of *Geothermics* journal.
- Provide support for collaborative publications on topical geothermal environmental issues at leading international workshops in New Zealand (NZGW), Philippines (PNOC-EDC), United States (GRC, Stanford), Japan (JGA) and Turkey (WGC2005).
- Provide support and contacts for collaboration between geochemical researchers in Italy, Iceland, USA and New Zealand to study means of more reliably monitoring natural CO2 emissions from thermal areas, in order to quantify the net long-term effects of geothermal development on global warming through CO2 emissions.
- Encourage collaboration between researchers investigating the potential for thermophilic bacteria to reduce toxic chemical contaminants from geothermal waste waters by bio-remediation.

List of specific ongoing projects by country:

Iceland:
1. Interpretation of TIR imagery over geothermal areas. (Arnason, Kristmannsdottir; *Univ Iceland*).
2. Changes to natural thermal features as a result of development. (Armannsson, Torfason, Kristmannsdottir).
3. Environmental effects of surface water disposal in Iceland. (Thorhallson, Kristmannsdottir).
4. Production-induced ground subsidence and gravity changes in Iceland. Eysteinsson, Kristmannsdotti*r*).

Japan:
1. Environmental effects of acidic fumarole gases on rainwater chemistry (Itoi, Kyushu Univ.)
2. Chemical changes in hot spring waters (Oue, Beppu)

Mexico:
1. Chemical and isotopic monitoring of atmospheric sulfur associated with H_2S emissions from geothermalsystems in the Mexican Volcanic Belt. (Verma *et al*, *IIE*)

New Zealand:
1. Documentation of renewed hydrothermal activity in Rotorua from bore closures (Scott; *IGNS*)
2. Numerical modelling of production-induced changes to hot springs and subsidence. (Hunt, Bromley, *IGNS*)
3. Natural and induced variations to geothermal features. (Bromley, *IGNS*)
4. Quantification of heat and CO2 flux changes from steaming ground (Bromley,Hochstein,Mroczek,Werner *IGNS*)
5. Impacts of developments on thermophyllic vegetation (Sylvester, *Waikato Univ*)
6. Biodiversity and biomineralisation associated with thermophyllic bacteria in waste water from geothermal power plants (Mountain, *IGNS*)

Turkey:
1. Environmental changes at Kizildere field (Simsek, *et al*)
2. Removal of boron from Kizildere waters (Badruk *et al*)

USA:
1. Abatement of H2S emissions from power plants (various)
2. Injection of CO2 into underground aquifers (various)

6. Recent Outputs (publications, meetings, workshops)

Proceedings of International Geothermal Conference (IGC2003), September 2003, Reykjavik, Iceland:

Andresdottir A,. Sigurdsson O., Gunnarsson T. "Regulatory framework and preparation of geothermal power plants in Iceland- practical experience and obstacles"

Armannson H. "CO2 emission from geothermal power plants"

*Axelsson G, Stefansson V. "*Sustainable management of geothermal resources"

Bromley C.J "Practical methods of minimizing or mitigating environmental effects from integrated geothermal developments, examples from New Zealand"

*Gallup D. "*Simultaneous hydrogen sulphide abatement and production of acid for scale control and well stimulation"

*Lawless J. Okada W. Terzaghi S. White P. Gilbert C. "*Two-dimensional subsidence modelling at Wairakei-Tauhara, New Zealand."

Wetang'ula G. , Snorrason S. "Ecological risk assessment of Nesjavellir co-generation plant wastewater disposal on Lake Thingvallavatn, SW-Iceland"

Proceedings of the 25th New Zealand Geothermal Workshop, Nov. 2003:

Brockelsby M "Issues facing Waikato Regional Council in managing geothermal resources."

Bromley C. Currie S. "Analysis of subsidence at Crown Rd Taupo, a consequence of declining groundwater."

White S. Allis R, Moore J, Chidsey T,Morgan C. GwynnW., Adams M, "Injection of CO2 into an unconfined aquifer located beneath the Colorado Plateau, Central Utah."

G R E
INSTITUTE FOR GEORESOURCES AND ENVIRONMENT

Report and Work Plan of Enhanced Geothermal System Task

Isao Matsunaga
National Institute for Advanced Industrial Science and Technology, AIST
matsunaga-isao@aist.go.jp

Hot Dry Rock Task (Annex III)

- **Object:** Address new and improved technologies, which can be used to artificially simulate a geothermal resource to enable commercial heat extraction.
- **Participating countries and organization :** Australia, Germany, Japan, Switzerland, USA, Italy, and EC.
- **Subtasks**
  - Subtask B: Application of Conventional Geothermal Technology to Hot Dry Rock Technology (Joel Renner, Idaho National Engineering and Environmental Laboratory, USA)
  - Subtask C: Data Acquisition and Processing (Thomas Mégel, Geowatt AG, Switzerland)
  - Subtask D: Reservoir Evaluation (Tsutomu Yamaguchi, AIST, Japan)

Subtask B activities

- **U. S. DOE sponsored activities using hydrothermal technology for enhanced geothermal systems. New projects for Subtask B and Subtask D.**
  - **Drilling:** A new down-hole motor was tested for horizontal drilling at The Geysers geothermal filed.
  - **Enhancement of productivity in the Coso geothermal field:** The stress pattern and fractures in anticipation of conducting a MHF.
  - **Shear-wave splitting:** The current phase of work has been completed. Apply in the Coso MHF test.
  - **Injection into depleting steam reservoirs:** Analyze the effect of injection into The Geysers reservoir. Conducted laboratory tests.
  - **Tracers for heat transfer characterization in fractured reservoirs:** Extend the techniques currently available for test analysis.

Subtask C activities

GRE
INSTITUTE FOR GEORESOURCES AND ENVIRONMENT

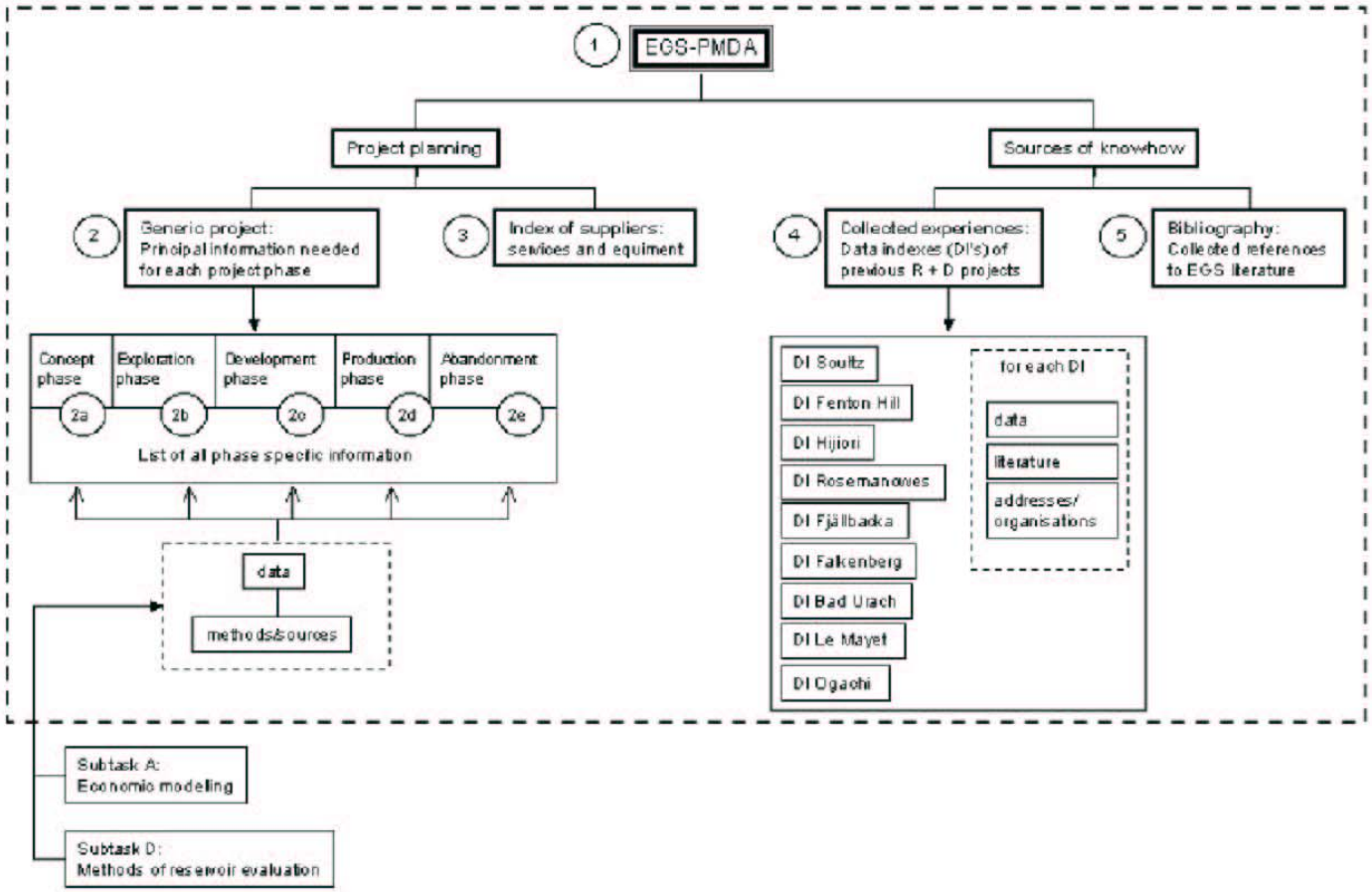
■ Compiling a Project Management Decision Assistant (PMDA)

- Document the experiences of various R&D projects
- A list of literature references
- An index of potential suppliers, service operators and consultant
- An overview of data requirements during planning and construction of a commercial EGS plant.

■ Developing the presentation format of PMDA

- A loose-leaf ring binder containing the output of Subtask C

The structure of the assembly of data collections making up the PMDA



Subtask D activities

Questionnaire

- Compile and make clear what kind of methods, techniques and tools are effective for reservoir evaluation, and then establishing the evaluation method that can be applied to develop a new HDR site, through the Internet questionnaire
- Answers were not sufficient to complete the task

Compile and review of R&D activities in Hijiori

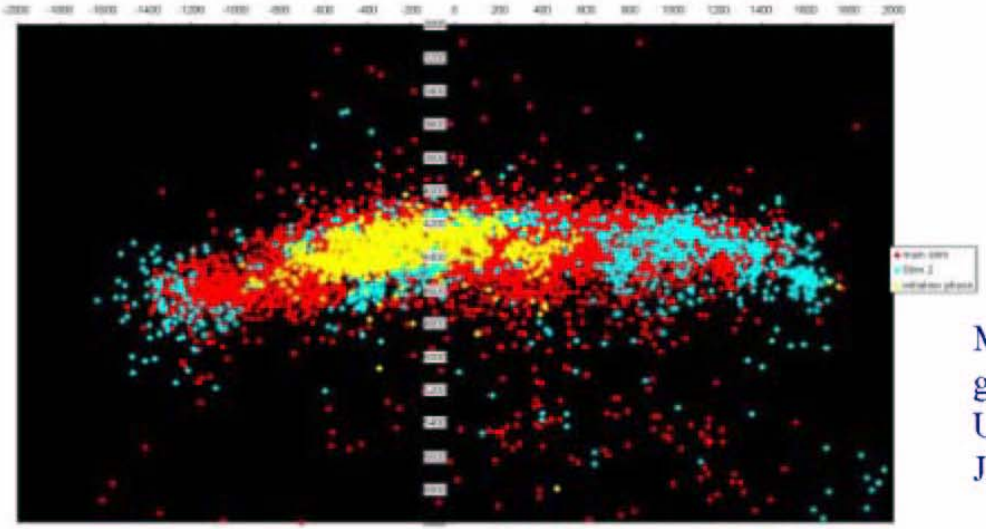
- AIST compiled major data acquired at Hijiori test site. This data consists of drilling, acoustic emission, hydraulic fracturing, and simulation/simulation
- The working group has discussed and reviewed technological aspect and problems of overall design, site characterization, reservoir creation, circulation-heat extraction based on the R&D program at Hijiori

Activities in Australia

G R E
INSTITUTE FOR GEORESOURCES AND ENVIRONMENT

Cooper Basin project

- The Australia's first geothermal well **Habanero 1** was completed at a depth of 4421m on 18 September. Bottom-hole T ≥ 250°C.
- Hydraulic stimulation took place over November and December 2003.
- The stimulated reservoir is up 3000m by 1000m by 350m thick forming a flat pancake shape



Monitored by a group of Tohoku U., CRIEPI, JAPEX, and AIST

Activities in participating countries

GRE
INSTITUTE FOR GEORESOURCES AND ENVIRONMENT

Germany

- European HDR Project Soultz
- GeneSys Project
- Bad Urach Geothermal Project
- Resources for Geothermal Power Production in Germany

JAPAN

- Except for IEA/GIA participation, all R&D fund for EGS from NEDO will be terminated at the end of March
- Activities will be kept by a small in-house budget of AIST and Science Grants of MEXT to Tohoku University

Work plan in 2004

GRE
INSTITUTE FOR GEORESOURCES AND ENVIRONMENT

- **Subtask B**
  - MHF at the Coso geothermal field.
  - Complete a high temperature acoustic televiewer
  - Two R&D, injection in depleted fields and tracer analysis will be continued
- **Subtask C**
  - Dissemination of the PMDA classifiers and assembling of the feed-back
  - Analyze fee-back, compile the inputs and updating PMDA classifier
- **Subtask D**
  - The report of Hijiori reviews will be published in 2004. The summary of this report will be translated and distributed by a media of CD-ROM.

APPENDIX 10: Annex IV Deep Geothermal Resources Report to Paris Meeting

Project Management Organization Jülich
Division Renewable Energies EEN
Dr. Dieter Rathjen

Jülich, 01/23/2004

Annex IV – Deep Geothermal Resources

1. Introduction

a) Brief description

The Deep Geothermal Resources Task was started in 1997 as a four-year international collaborative program under the IEA Geothermal Implementing Agreement (GIA). The continuation of this Annex was approved by the Executive Committee (ExCo) in 2001.

b) List of participants

Australian National University, Australia
US Department of Energy, USA
ENEL Green Power SpA, Italy
Forschungszentrum Jülich GmbH, Germany
Institute Geolocical & Nuclear Sciences, New Zealand
Instituto de Investigaciones Electricas, Mexico
Philippines (Non-Member)

c) Operating Agent

Forschungszentrum Jülich GmbH, Germany
Task Leader
Andrea Ballouk in 2003
Dr. Dieter Rathjen in 2004

2. Subtask Names

A) Exploration Technology and Reservoir Engineering

Leader: to be appointed

The objective of subtask A is to carry out collaborative research on exploration technology, including geothermal modelling, geophysical, geological and geochemical explorations and on reservoir engineering, Including reservoir characterization and reservoir modeling. As of December 2001 four countries were participating in Subtask A:
New Zealand, Mexico, Italy and Japan.

B) Drilling and Logging Technology

Leader: to be appointed

The objective of Subtask B is to carry out collaborative research on drilling and logging technologies, including the reviews of drilling and logging reports of deep geothermal wells, and exchange of information on

improvements in drilling and logging tools. There are 13 organizations in the subtask B network, from Australia (1), Italy (2), Japan (4), Mexico (1), USA (4) and Philippines (1).

C) Reservoir Evaluation

Leader: to be appointed

No information about the situation in the subtask C.

3. Work Performed in 2003

Australia

Remarks on the energy policy:

- Australia's industry is currently in a state of flux
- National energy policy is under review what will lead to a restructuring process
- By now it is accepted that renewable energy supply will play an increasing role on a global basis
- HDR geothermal energy is still in the pioneering stage in Australia and is therefore not yet considered "mainstream"
- T he HDR project of Geodynamics, namely "Habanero", is the attempt to enable the production of electricity at lower costs than other mainstream renewable energy resources due to the sufficiently high rock temperatures

Habanero #1

- First deep geothermal well in Australia and the deepest well ever drilled on onshore Australia
- One of the hottest (290 °C) geothermal resources 4,9 km under the Cooper Basin
- Costs: 5,4 Mio. $
- Second well Habanero #2 is planned
- Heat bearing granites were intersected at a depth of 3.675 m
- Next important step is the development of the underground heat exchanger:
- Hydraulic stimulation program will include a short duration high pressure pumping test ("Super Leak-off Test");
    - Stimulation will be done by Halliburton;
    - Water (5.000 m3) will be used as high pressure agent
- The micro seismic acoustic monitoring network is developed:
    - It consists of geophones in four 100 m deep drilling holes in a distance of 5 km from Habanero #1, two close area network sondes in 850 m deep drill holes 2 km away from Habanero 1 and one deep sonde in 2.350 m depth nearby McLeod.
- The progress at Habanero #1 was slower than expected due to the discovery of over-pressures in the target granites:
    - The over-pressured joints in the granites indicates the presence of inter-connected joints over a wide area, which bodes well for the development of an underground heat exchanger, designed to allow the flow of water (and heat energy) between wells;
    - On the other hand the over-pressure leads to unforeseen expenses i. e.
        - Additional safety management etc.
- The 7 inch casing was cemented up to a depth of 4.135 m (467 m below the top of the granite):
    - In consequence the well is now effectively isolated and secured from oil and gas-bearing over-pressure zones present in the overlying sedimentary rocks
- Prior to the setting of the 7 " casing an electrical logging was done:
    - Horizontal joints and fractures were found with positive effect on the development of the horizontal heat exchanger

- Last message of Doone:
- On account of the overpressure it was not possible to maintain the drilling performance as expected. A problem is the movement of the joint planes due to the overpressure.
    - The mud weight must be maintained above 15 ppg.
    - Hundreds of barrels of mud are lose into the granite.
    - As result formation water influx comes back (with the same pressures).
    - This breathing process in the well cannot be controlled.
    - The well has actually a depth of 4320 m, primary target is now 4400 m and an open hole section of 250 m (for hydraulic stimulation).

USA

USA does not have any activities in the area of "Deep Geothermal Resources".
Future: Program "enhanced Geothermal Systems" ongoing.

Italy

Deep drilling activities in Italy in the past 5 years

Year	Number of wells with depth 3000÷4000 m	Number of wells with depth > 4000 m
1999	2	1
2000	1	2
2001	3	1
2002*	1	1
2003*	1	1
Total	8	6

* In the year 2002 ENEL has also drilled the well **GPK_3** at Soultz-sous-Forêts (France) for the "European HDR/HFR project". The depth of this well is 5092 m.

New Zealand

New Zealand didn't report any activities.

Mexico

The Instituto de Investigaciones Eléctricas (IIE) worked on:

1. Updating of the conceptual models of the Mexican geothermal fields with deep reservoirs:

- Analysis of data from 42 wells of the Los Humeros geothermal field
- Estimation of temperature and pressure profiles for the unperturbed reservoir fluids
- Development of 1-D and 2-D models

2. The rigorous simulation of heat and mass transport in high temperature reservoirs and especially the simulation of the effect of high no condensable gas concentrations was done with a new developed FORTRAN code based on the equation of state (EOS) for the system H2O-CO2-CH4. The code delivers following possibilities:

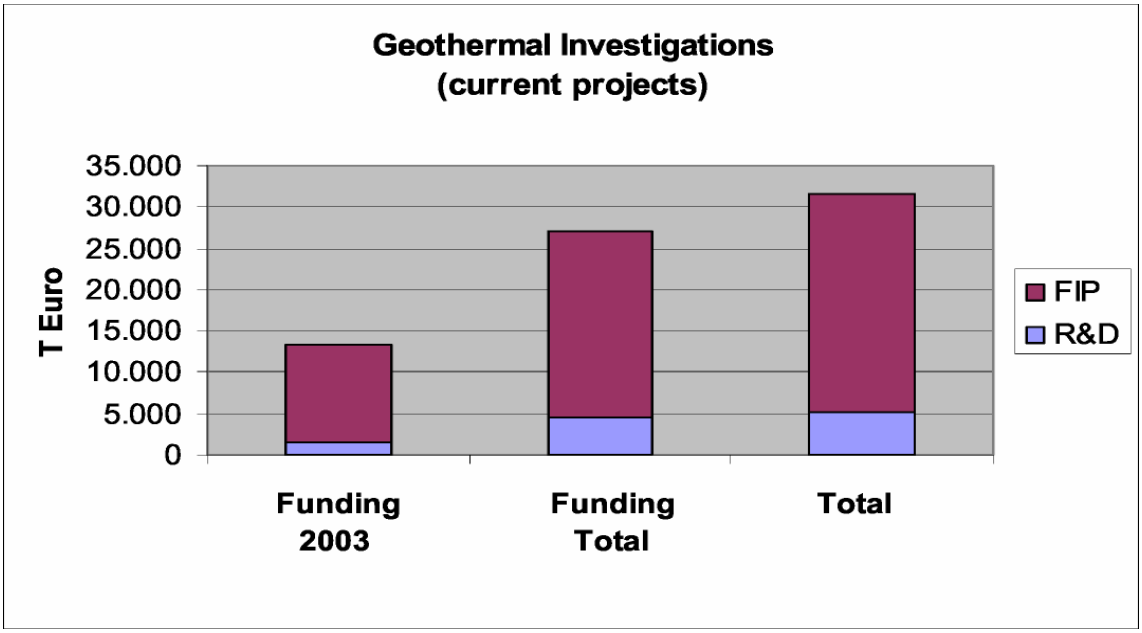
- Mathematically modeling of two-phase, two-component flow (pressure and composition of the gas phase)
- Calculation of phase equilibria and/or molar volumes of H2O and binary mixtures (pressure and temperature);
- Calculation of phase equilibria for ternary mixtures (pressure, temperature, mole fraction of water in gas phase)
- The accuracy of EOS was extensively tested by comparison with experimental data in the range of 50-1000 °C and 0-1000 bar.

Germany

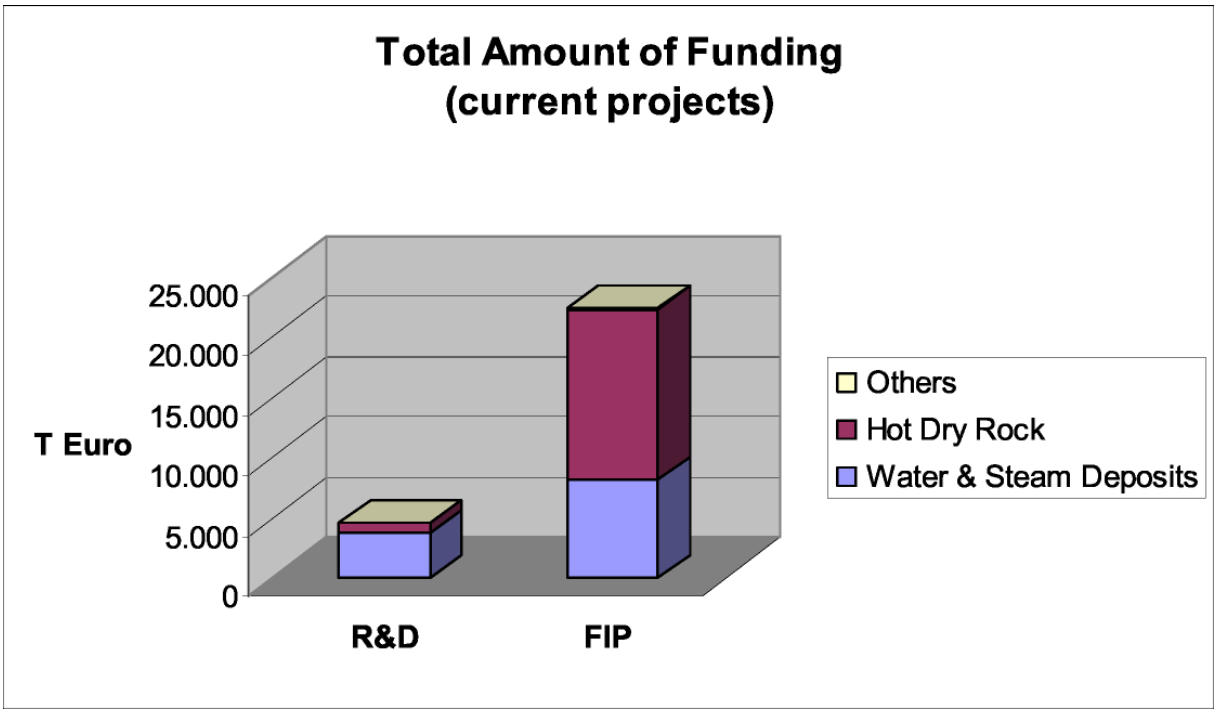
Remarks on the Development of Renewables Energies (government strategy)

Past:
Federal Economy Ministry and Federal Environment Ministry were both responsible for funding of renewable energies in the R&D-Program and the Future Investment Program (FIP).

Present:
Federal Environment Ministry alone is responsible for funding of renewable energies;
R&D-Program still exits, the decision if the FIP will be continued in the sense that additional money is given will come end of 2003.



FIP Future Investment Program:



Current Projects:

1. Bad Urach

Task: Development, verification and demonstration of location independent HDR concepts for the production of electricity and heat (HDR pilot plant)

Status: First borehole is drilled, stimulation tests are done, production rate increased, an heat exchanger is created in depths between 3300 m and 4200 m, temperature is 170°C.

Costs: 6,7 Mio. Euros Total project costs 6,5 Mio. Euros Funding FEM

2. Soultz-sous-Forêts (Alsace, France)

Task: Installation of a scientific geothermal pilot plant (first phase), European project is funded by funding agencies of EC, France and Germany and by the industry.

Status: Three boreholes are drilled, stimulation tests were with very much success, two heat exchangers in two horizons were created, there is no connection between the two exchangers, and temperatures are 165°C and 200°C.

Actually the fourth borehole is drilled without any problems.

Costs: 9,1 Mio. Euros Total project costs (for Germany only) 8,4 Mio. Euros Funding FEM (before FELM) (The costs accumulated over all parties amount to 30 Mio. Euros.)

Law on Energy Supply (Energie-Einspeise-Gesetz EEG)

To promote the use of "regenerative electricity" the German government introduced the Law on Energy Supply (from 2000-04-01).

Operating companies that supply the public net with regenerative electricity get a guaranteed minimum payment. See the payment below:

Electricity by wind:	6,1 – 9,0 €-Ct/kWh
Electricity by photovoltaic:	48,1 €-Ct/kWh
Electricity by water:	6,65 – 7,67 €-Ct/kWh
Electricity by biomass:	8,6 – 10,1 €-Ct/kWh
Electricity by geothermal:	7,16 – 8,95 €-Ct/kWh

4. Highlights of Annex IV Programme Work for 2003

No Information

5. Work Planned for 2004

The Soultz project is ongoing with phase II. Planned is a time of 3 years (2004–2006) with government aid of the EC, France and Germany (if EC decision regarding funding is positive, still outstanding). Approx. 6,2 Mio. Euros are funded by the German government for the German project partners.

The content of the renewable energy program stays as it is, but the amount of funding will be reduced (for geothermal energy one can assume that an amount of 5 Mio. Euros per year will be allocated).
International Conference for Renewable Energies, Bonn, Germany, 01.-04.06.2004,

Project Bad Urach: The second borehole is planned and will be drilled soon (depth 4500 m).

6. Outputs

International Congress Geothermie, Reykjavik 2003

Australia

- Reports and Announcements (Quarterly Reports) about the geothermal well Habanero 1

Mexico

- An updated conceptual model of the Los Humeros geothermal reservoir (Mexico) J.Volcanol. Geothermal Research 124 (2003) pp. 67-88
- HCO-Ternary: A Fortran code for calculation P-V-T-X properties and liquid vapor equilibria of fluids in the system H_2O-CO_2-CH_4 Computers & Geosciences 29 (2003) pp. 469-485

Germany

- Fachkongress Geothermischer Strom 12.-13.11.2003 in Neustadt-Glewe (only in the German language)
- Kreuter,H.; Harthill,N. Geothermal Power Generation in the Upper Rhine Valley-The Project Offenbach/Pfalz Reykjavik 15.-17.09.2003
- Harthill,N. A New Interpretation of the Rhine Graben Geothermal Region, Siena, 24, 27.09.2003

- Baria,R.; Baumgärtner,J.; Gerard,A. European Hot Dry Rock Programme 2001-2004 2nd Year Report for the EC; October 2003

7. Websites Related to Annex IV

Australia
www.geodynamics.com
www.geodynamics.com.au/IRM/content/05 investor/05.5.html

Italy
http://www.enea.it/com/ingl/default.html

Mexico
www.iie.org.mx

New Zealand
www.Reap.org.nz

Germany:
www.bmu.bund.de
(Federal ministry for the Environment, Nature Conservation and Nuclear Safety)
www.Renewables2004.de
(International Conference for Renewable Energies, Bonn, Germany, 01.-04.06.2004)
www.fz-juelich.de/ptj/
(Forschungszentrum Jülich, Project Management)
www.Soultz.net
(EU-Project in Soultz-sous-Forêt)
www.geothermie.de/badurach2.html
(Project in Bad Urach; only German)

8. Authors of the Annex Report

Dipl.-Geol. Andrea Ballouk
Dr. Dieter Rathjen
Forschungszentrum Jülich
Project Management Organization Jülich
Division Renewable Energies EEN
52425 Jülich
Germany

Phon: +49-2461-61-4233
Fax: +49-4261-61-2840
mailto: dieter.rathjen@fz-juelich.de

APPENDIX 11: Annex VII Advanced Drilling Techniques Report to Paris Meeting

Minutes of the Meeting of GIA Annex VII, 17 March 2004

Geothermal Implementing Agreement
Annex VII Meeting Notes - 17 March 2004

Introduction

Interested parties for Annex VII of the IEA Geothermal Implementing Agreement met in Paris on 17 March 2004. The meeting, which had been scheduled for 10:00 am, was rescheduled for 1:00 pm to allow more participants to attend. The following persons attended the meeting, either as a participant in the Annex or as an observer:

Sverrir Thorhallsson, Orkustofnun, Iceland (participant)
Satoshi Kubo, NEDO, Japan (participant)
David Nieva, IIE, Mexico (observer)
Aldo Baldacci, Enel Green Power, Italy (observer)
Jeroen Schuppers, European Commission (participant)
Roy Baria, EEIG, France (observer)
Colin Harvey, IGNS, New Zealand (participant)
Allan Jelacic, DOE, United States (participant)

Five of the six participants in the Annex were represented at the meeting; CFE (Mexico) was unable to send a representative. John Finger, representative of Sandia National Laboratories the Operating Agent for the Annex had retired, and his replacement was unable to attend. Allan Jelacic assumed the role of the Operating Agent and chaired the meeting.

Each attendee provided brief introductory remarks and indicated his organization's interest in geothermal drilling in general and Annex VII in particular.

The principal objectives for the meeting were to update progress on the sub-tasks and to determine further actions needed to maintain progress. A summary of the discussions of the three sub-tasks, points raised in discussion about them, and actions assigned at the meeting are given below. (Note that at the meeting Subtask B was discussed first, but for continuity of these notes the subtasks are presented in their usual order.)

Subtask A: Compile Geothermal Well Drilling Cost and Performance Information
Subtask Leader: The New Energy and Industrial Technology Development Organization (NEDO), Japan.

Data on well cost are difficult to obtain. Thus far, the cost database only has information for 3 Japanese wells, 3 Mexican wells, and 1 US well. Information for 3 more Mexican wells was in preparation as of the last meeting in Reykjavik, but the current status of that data is unknown.

Well performance data, especially well depth versus drilling time, are much easier to obtain than cost data. The database contains performance information on 27 wells from Iceland. New Zealand may be able to offer data from six wells, and the European Commission can provide data from two wells at Soultz. Sandia has thus far been unsuccessful in obtaining data from U.S. companies.

Satoshi Kubo informed the participants that he would be leaving NEDO at the end of March. Kubo-san had been an active leader of Subtask A, and he will be missed. Apparently, NEDO has not named a replacement, and they intend to withdraw from the Annex. NEDO's departure leaves the question of who will succeed as Subtask Leader. David Nieva indicated that he would consult with CFE about becoming the leader.

Actions to be taken for Sub-task A:

David Nieva will determine whether CFE would be willing to serve as Subtask Leader. Action due: 15 April 2004
Allan Jelacic will see if Sandia can assume the leadership should CFE decline.
All Participants will provide additional well data for the database from their available sources. Action due: 01 June 2004
Colin Harvey will contact sources in the Philippines and Indonesia for possible well data from those countries.

***Subtask B**: Geothermal Drilling Best Practices*
Co-Subtask Leaders: Comisión Federal de Electridad (CFE), Mexico (Electricity); Orkustofnun – Iceland (Direct use)

David Nieva, reporting for CFE, indicated that enough material exists to move ahead with a Handbook of best practices, but the subtask needs support in the form of funding for CFE researchers or an outside contractor.

The Handbook will document practices that have been found safe, efficient, and cost-effective in international geothermal drilling. Sverrir Thorhallsson pointed out that Iceland is drilling over 200 meters per day; the Handbook would be quite useful in helping to reduce costs. Colin Harvey indicated that in New Zealand a code of practice exists; the code might serve as a reference for the Handbook.

At the meeting in Reykjavik, two steps were proposed for this subtask: attempt to identify existing literature references that are applicable to various sections of the Handbook, and post the Handbook outline on the GIA web site and solicit comments. No progress was reported on these items.

Two options for completing the Subtask were discussed: (1) compile a set of references that would serve as a guide to the literature of best practices; (2) proceed with the Handbook as originally planned. Option (1) could be accomplished with nominal cost; option (2) would require the establishment of a common fund. No decision was made as to which option to pursue, but the participants felt that references could be obtained without difficulty.

Actions to be taken for Sub-task B:

Allan Jelacic will check on the status of posting the Handbook outline on the website. Action due: 15 April 2004
All Participants will provide a list of references to best drilling practices in their countries. Action due: 01 June 2004
Allan Jelacic will provide the name and coordinates of a contact person at Sandia to whom the references should be sent

***Subtask C**: Advanced Drilling Collaboration*
Subtask Leader: Sandia National Laboratories - USA

Sverrir Thorhallsson reported on activities in Iceland that may affect this subtask. The Iceland Deep Drilling Project (IDDP) provides an excellent opportunity for collaboration in the testing of a variety of new tools. He expressed specific interest in memory tools. Besides the IDDP, other wells in Iceland could be used for field testing. Iceland has experience with fracture stimulation and thermal stress cracking by pumping water over a wide range of flow rates. Sverrir reported improvements due to stress cracking in 5 of 6 wells.

Allan Jelacic pointed out that interest in collaboration would depend on the facilities being offered to conduct the collaborative testing. A full description of those facilities would be helpful for a participant to decide on whether to collaborate.

Actions to be taken for Sub-task C:

Sverrir Thorhallsson will provide a description of facilities available in Iceland for future collaboration by participants. Action due: 01 May 2004
David Nieva will inquire as to what CFE may be able to offer for collaboration.

Other Actions Resulting from the Meeting

Aldo Baldacci will obtain a decision on whether Italy wishes to join the Annex.

Next Meeting

No meeting was scheduled, pending a decision on the next ExCo meeting.

APPENDIX 12: Letter of Invitation to Join and Description of Annex VIII

Doone Wyborn
Geodynamics Limited
PO Box 2046
Milton
Queensland 4064
AUSTRALIA

Reykjavík 11.03.2004

Dear Sir

The Executive Committee of the I.E.A. Geothermal Implementing Agreement has decided to establish a new annex of Direct Use of Geothermal Energy. The Federation of Icelandic Energy- and Waterworks (Samorka) has agreed to be the Operating Agent for this Annex. The main objectives of the Direct Use Annex are according to the proposal:

(a) define and characterize the direct use applications for geothermal energy, with emphasis on defining barriers to widespread application
(b) identify and promote opportunities for new and innovative applications
(c) define and initiate research to remove barriers, to enhance economics and to promote implementation
(d) test and standardize equipment
(e) develop engineering standards.

In the proposal (see attached document) 5 subtasks are further described.

A kick-off meeting is planed in the autumn either in Iceland or along with Executive Committee Meeting. With this letter your country is encouraged to participate in this Annex, nominate participant, the main subtask you would like emphasis on and state if you would like to undertake a subtask leadership.

On behalf of Samorka
Sincerely

_____
Einar Gunnlaugsson

Orkuveita Reykjavíkur
einar.gunnlaugsson@or.is
einarg@or.is
Bæjarháls 1
110 Reykjavík
Iceland
tel: +354 516 6680
fax: +354 516 6608
mobile: +354 617 6680

APPENDIX 13: Description of Annex VIII

Draft for Review by the Executive Committee

Proposal for a new Annex to the Geothermal Implementing Agreement

Annex VIII: Direct Use of Geothermal Energy

1. Definition

Geothermal energy can be used directly as heat for many applications such as building and district heating, industrial process heating, commercial uses such as greenhouse heating and temperature control of water for fish farming, bathing and swimming, and many other uses. Many applications are well developed and are economically viable, while others are challenged by implementation difficulties and unfavorable economics. The Direct Use Annex will address all aspects of the technology with emphasis on improving implementation, reducing costs and enhancing use.

2. Objectives

The objectives of the Direct Use Annex are:

(a) define and characterize the direct use applications for geothermal energy, with emphasis on defining barriers to widespread application

(b) identify and promote opportunities for new and innovative applications

(c) define and initiate research to remove barriers, to enhance economics and to promote implementation

(d) test and standardize equipment

(e) develop engineering standards

3. Means

The Participants shall share the coordinated work necessary to perform this task:

(1) The proposed objectives of the Direct Use Annex will be achieved by the Participants in the following subtasks:

(a) Subtask A: Resource Characterization - definition of available resources in various Participant countries.

(b) Subtask B: Cost and Performance database - collect, analyze and disseminate the characteristic cost and performance data for installations in Participant countries, with emphasis on establishing a baseline and then validating the improvements from innovative components and better designs.

(c) Subtask C: Barrier and Opportunity Identification - based on subtasks A and B, define the barriers which must be overcome to gain widespread use of geothermal heat for various applications. Define and initiate the needed research activities necessary to take advantage of these opportunities.

(d) Subtask D: Equipment Performance Validation - define and test critical and innovative equipment; such as submersible and line shaft pumps, compact heat exchangers, down-hole heat exchangers, non-metallic piping, heat pumps and

other equipment to characterize performance for various applications and for various geothermal brines. The testing can be at multiple sites or can be round robin.

(e) Subtask E: Design Configurations and Engineering Standards - develop and characterize standardized designs for various applications, with the goal of minimizing the engineering related to various applications. Develop engineering standards for designs, equipment and controls.

(2) Subtask Leaders: The subtask leader for each of the foregoing Subtasks shall:

(a) coordinate the work performed under that Subtask
(b) assist the Operating Agent in preparing the detailed Program of Work;
(c) direct technical workshops and provide the Operating Agent with written summaries of workshop results; and
(d) edit technical reports resulting from the Subtask, and organize their publication.

Each subtask Leader shall be a Participant with a high level of expertise who undertakes substantial research and development in the field of the Subtask. Each Subtask Leader shall be designated by the Operating Agent with the unanimous approval of all the Participants in the Annex.

4. Results

The Primary results of the Direct Use Task will be improvements in systems and equipment, reduction in cost of delivered heat and an increase in the number of direct use applications. Further, enhanced cooperation between the countries and increased exchange of technical and scientific information within the field of direct use of geothermal energy.

Results of this Task shall include:

(a) development of an international database on direct use applications by each of the Participant countries. The database will be based on standardized instruments and reporting techniques.

(b) Reports on state-of-the-art in direct use of geothermal energy, including areas needing improvement.

(c) Cooperative research to accomplish the needed improvements.

(d) Participant reports on the status of research and development in new and improved technology which shall be presented in appropriate journals and meetings.

5. Time Schedule

This Annex shall commence on the day the agreement enters into force and shall continue for a period to be determined by the Participants, acting in unanimity. Within the limits of the terms of the Agreement, this Annex may be extended by two or more Participants, acting in the Executive Committee and shall thereafter apply only to those Participants.

6. Specific Obligations and Responsibilities of the Participants

In addition to the obligations enumerated in Article 8 of this agreement:

(a) Each Participant shall provide the Operating agent with detailed reports on his country's experience in relevant direct use technologies and applications, and

(b) Each participant shall participate in the editing and review of draft reports on the task.

7. Specific Obligations and Responsibilities of the Operating Agent

In addition to the obligations enumerated in articles 4 and 8 of this Agreement, the Operating Agent shall:

(a) Prepare and distribute the results mentioned in paragraph 4 above;

(b) Organize workshops, seminars, conferences and other meetings, as provided in the annual Program of Work for the task;

(c) Prepare the detailed Program of Work for the Task in consultation with the Participants and submit the Program of work for approval by the Executive Committee;

(d) Provide, at least annually, reports to the Executive Committee on the progress and the results of the work performed under the Program of Work;

(e) Provide to the Executive committee, within six months after completion of all work under the Task, a final report for its approval and transmittal to the Agency;

(f) In coordination with the Participants, use the best efforts to avoid duplication with activities of other Tasks of this Agreement and other related programs and projects implemented by or under the auspices of the agency or by other competent bodies;

(g) Provide the Participants with necessary guidelines for the work they carry out, ensuring minimum duplication of effort;

(h) Coordinate the efforts of all Participants and ensure the flow of information within the Task; and

(i) Perform such additional service and actions as may be decided by the Executive Committee, action by unanimity.

8. Funding

The collaborative direct use technology research to be carried out under this Annex will involve cost sharing and task sharing. A common fund will be established to cover the special duties of the Operating Agent as presently indicated in the Implementing Agreement (Article 7):

(a) Publications: The cost of publishing the reports and summary assessments as described in paragraph 4 shall be borne by the Operating Agent using common funds.

(b) Database: the cost of maintaining and distributing the cost database described in paragraph 4 shall be borne by the Operating Agent using common funds. The costs associated with collecting the information in the database shall be borne by the respective Participants

(c) Individual Financial Obligations: Each Participant shall bear all costs it incurs in carrying out the Task activities, including reporting and travel expenses.

(d) Task-Sharing: The level of effort to perform the work specified in this Annex is estimated to be no more than one person year per year for each Participant.

9. Operating Agent

The Operating Agent shall be The Federation of Icelandic Energy- and Waterworks.

10. Participants

The Contracting Parties acting as Participants in this Task are the following:

The Federation of Icelandic Energy- and Waterworks
The United States Department of Energy (DOE, USA)
The New Energy and Industrial Technology Development Organization (NEDO, Japan)
Italy
New Zealand
Others ?

Reference - Proposed Timeline

2003-2004: Refine the subtasks in a complete work plan, conduct an organizing workshop, form a steering committee of interested Participants. Adopt final subtasks and work plan, obtain agreement from Participants and gain approval from the Executive Committee

2004-2005: Complete compilation of the database for resource characterization and the baseline database for cost and performance of current applications in Participant countries.

Organize a special session for presentations of results at the World Geothermal Congress, with reports to the Executive committee.

Define the opportunities for improvement and initiate research to provide the bases for accomplishing the opportunities.

2006-2007: Conduct an annual workshop of Participants in association with an important international geothermal meeting. Participants continue research in their respective countries per the work plan. Report results to the Executive Committee.

Prepared by:

APPENDIX 14: Germany Country Report

International Energy Agency (IEA)

Geothermal Implementing Agreement (GIA)

2004

Progress Report Germany

Author: Dieter Rathjen, Germany

Forschungszentrum Juelich GmbH
Project Management Organization Juelich
Department of Renewable Energies (EEN)
D-52425 Juelich

d.rathjen@fz-juelich.de

Overview on the Actual Projects

Location	Operator	Wells	Depth [m]	Temperature [°C]	Volume [m^3/h] or Power [W]
Bad Urach	Stadtwerke Bad Urach (swbu)	1 1	4.450 2.600 u.c.	170	1 MWel.
Bruchsal	Energie- und Wasserversorgung Bruchsal	1 1	1.932 2.542	135	50 m^3/h
Groß Schönebeck	GeoForschungsZentrum Potsdam	1 1	4300 u.c.	140	25 m^3/h MS 75 m^3/h

Overview on the Actual Projects

Location	Operator	Wells	Depth [m]	Temperature [°C]	Volume [m^3/h] or Power [W]
Hannover	Bundesanstalt für Geowissenschaften und Rohstoffe & Partner	1	4.000 u.c.	120	MS 50 m^3/h
Neustadt-Glewe	LanGeo / ErdwärmeKraft Neustadt-Glewe	1 1	2.455 2.335	98	40-100 m^3/h 6,75 MW_{therm}
Soultz-sous-Forêts (F)	Bundesanstalt für Geowissenschaften und Rohstoffe & inter-/nat. Partner	1 1 1 1	3.590 5.000 5.000 5.000	165 202 198 198	360 m^3/h 10,0 MW_{therm}

Explanations:
u.c. = under construction
n.r. = not realized
MS = Milestone
test= in the first test phase 2 wells, both ~ 3,590 m deep, deliver 10 MW_{therm}

APPENDIX 15: New Zealand Country Report

Progress Report for New Zealand

Colin Harvey and Chris Bromley
Institute of Geological and Nuclear Sciences Limited, New Zealand.

1. Introduction

Geothermal energy continues to play a significant role in both electric power production and direct uses in New Zealand. The NZ government signed the Kyoto Protocol in 2003 and this policy will encourage further development of geothermal.

The drop in natural gas reserves, combined with increases in gas and coal prices and problems with the reliability of hydro resources due to El Nino weather patterns places great emphasis on the development of geothermal resources.

2. New Zealand National Policy

2.1 Strategy

Energy supply planning for New Zealand anticipates that geothermal power will at least double over the next 10 years to replace depleting gas supplies. Even more geothermal production will be needed by 2020 to meet increasing demand without resorting to coal, and thereby compromising New Zealand's commitment to the Kyoto Protocol of reducing greenhouse gas emissions. Research objectives are expected to help achieve this goal.

The government has a number of policies in place designed to encourage more development of renewable energy resources, including geothermal. These initiatives include:

- **The National Energy Efficiency and Conservation Strategy (NEECS)**

This strategy aims to improve energy efficiency by 20%, and increase use of renewables, including geothermal, which has been identified as one of the priority sectors.

- **The National Climate Change Policy Package (CCPP)**

This is designed to reduce CO_2 emissions by reducing dependence on fossil fuels and placing more emphasis on renewable sources.

- **Sustainable Development Programme of Action for Energy**

One of the outcomes of this programme is to ensure that renewable sources of energy are developed and maximised.

- **Resource Management (Energy and Climate Change) Amendment Bill**

This bill seeks to align national energy objectives (such as those described above) with local government plans. If passed, the bill will require decision makers to have regard to efficient energy use, climate change, and consider the benefits of renewable sources of energy.

- **Development of Geothermal Assets Owned by the Crown**

The Crown has indicated that it would like to develop its geothermal assets further.

- **Energy Outlook to 2025**

This document, published by the Ministry of Economic Development, projects that use of geothermal energy for electricity generation will increase to 600 MW_e by 2025.

2.2 Progress Towards National Targets

With at least three power companies currently actively exploring and developing geothermal fields there was some progress towards achieving national targets in 2003.

3. Current Status of Geothermal Energy Use

3.1 Electricity Generation

The total installed geothermal generating capacity for the 2002 March year was 431MW_e, with the total electricity generated amounting to 2,643,888 MWh.

Geothermal drilling during 2003 was conducted by Century Drilling (Wairakei) and Parker Brothers of New Plymouth. Several work-overs of existing wells were carried out. Four new wells in the producing fields of Rotokawa and Mokai were drilled during 2003 with more planned for 2004.

Magneto-telluric surveys were carried out at the Putauaki Project, adjacent to the developed Kawerau field during 2003 to guide the planned 2004 drilling.

The geothermal installed capacity amounted to about 5% of New Zealand's total, with geothermal contributing about 7% of the total generation.

3.2 Direct Use

At the Kawerau geothermal field, production of geothermal steam to the local pulp and paper mill has continued at a level of 210 MW_t. In addition, surplus steam and hot water have been used to generate electricity. The electrical equivalent of the total geothermal energy output is about 40 MW_e. Deep pressure drawdown over the life of the field has been very small and local Maori land owners are intending to expand field development to the east of the existing borefield.

Direct use of heat from reinjection pipelines at Ohaaki geothermal field is presently being used for drying timber at the old lucerne drying facility.

At Wairakei, the Prawn Farm continues to use heat from reinjection pipelines to maintain temperatures in prawn breeding ponds. In addition, a new tourist facility has been established by diverting waste hot water from the drains into the historic *Te Kiri o Hinekai* thermal stream; and by using separated water from the reinjection line to create artificial silica terraces and a geyser.
At Mokai, some of the surplus direct heat is used in glasshouses for horticulture.

In addition, geothermal is used for bathing purposes at many thermal pool establishments.

4. Market Development and Stimulation

The costs associated with well drilling are a significant portion of total geothermal development costs. In New Zealand, the average cost of a typical geothermal well, drilled to a depth about 2 km, is about NZ$ 3 M.

The capital costs for geothermal development in New Zealand amount to about US$ 3,200/kW for a 25 MW_e development and about US$ 3,000/kW for a 50 MW_e development.
Operation and maintenance costs are about US$ 93/kW/year (station + steamfield).

5. Development Constraints

Environmental regulations are relatively strict but manageable. However, the Resource Management Act has limited the scale of geothermal development, in part due to the costs associated with the long regulatory process.

6. Economics

6.1 Trends in Geothermal Investment

There has been a very definite increase in geothermal investment in both developed and undeveloped fields.

6.2 Trends in the Cost of Energy

The cost of energy continues to rise. The Ministry of Economic Development predicts that the wholesale price of electricity is likely to be in the range of 6.5 NZ cents/kWh (5 US cents/kWh) to 8 NZ cents/kWh (US 6 cents/kWh) for the next 10 years.

7. Research Activities

New Zealand's geothermal research budget was about $NZ 2,000,000 (US$ 1,400,000) in 2003. This NZ Government funded research has been focussed into four target areas: deep high-temperature resources, use of low-enthalpy resources, better use of waste geothermal fluids and environmental effects. Special emphasis has been placed on the application of deep MT to exploration/development of geothermal fields. There has also been potential interest in deep geothermal development.

8. Geothermal Education

Due to the withdrawal of New Zealand Government funding for the Geothermal Institute in 2002, there were no students enrolled in the diploma course. However, several graduate students were supervised in the MSc and PhD programmes in engineering and geology at the University of Auckland.

Other geothermal educational events included the 25th annual NZ Geothermal Workshop, which was successfully held at Auckland University in November 2003, attracting the usual large number of local and overseas participants; and The New Zealand Geothermal Association's 7th Annual Seminar held in Taupo in June 2003.

9. International Cooperative Activities

New Zealand has collaborative research relationships and links with many international agencies including: USGS (USA), KIGAM (South Korea), GSJ (Japan), AEA (Switzerland), University of Utah, Energy and Geoscience Institute (USA), University of Alberta (Canada) and Tohoku University (Japan).

10. References

Fairclough, R. (2003) *Electricity generation opportunities*. Paper presented at the NZ Geothermal Association seminar, 2003.

Ministry of Economic Development (2003) *New Zealand energy data file July 2003*. Wellington: Ministry of Economic Development. 160 p.

Ministry of Economic Development (2003) *Energy Outlook to 2025*. Wellington: Ministry of Economic Development. 62 p.

Thain, I.A., Dunstall, M. (2000) 1995-2000 update on the existing and planned use of geothermal energy for electricity generation and direct use in New Zealand. *Proceedings of the World Geothermal Congress 2000*: 481-489.

White, B.R. (2003) Some recent and current government initiatives related to geothermal energy. *Proceedings of the 25th New Zealand Geothermal Workshop 2003*: 1-8.

APPENDIX 16: Open Energy Technology Bulletin Document (from Marry Harries White)

GETTING VALUE FROM THE

OPEN ENERGY TECHNOLOGY BULLETIN

- Information When and Where it is Needed -

What is the *OPEN* Bulletin?

The *OPEN Energy Technology Bulletin* is a service providing **O**n-line **P**ublication of **E**nergy **N**ews. Issued periodically *from* the IEA Secretariat bye-mail, it circulates news of activities, findings, events and publications originating within the " IEA Family"[1], and notably within entities coming under the guidance of the IEA's Committee on Energy Technology Research and Technology (CERT). It is a vehicle to generate broader cross-fertilisation of energy technology information and ideas between different players in the energy policy community, between different energy technology disciplines and among different countries, both within and outside IEA membership. Its goal is to create wider awareness of the results of work carried out within the IEA Family.

Why the *OPEN* Bulletin format?

According to a survey carried out among members of the IEA energy technology network, some 80% of respondents prefer to receive information of this sort through electronic bulletins offering summaries and links to more detailed material. Conducted as part of the CERT's broader Communication, Information and Publications Strategy *(CW),* this survey sought feedback on how best the IEA Secretariat could respond to the widely felt need *for* speedier, more systematic circulation of information.

How can Implementing Agreements benefit from the *OPEN Bulletin?*

The *OPEN Energy Technology Bulletin* offers enhanced visibility *for* the programmes and achievements of Implementing Agreements. Such visibility can be crucial if new membership and funding is sought. News of your activities is broadcast spontaneously to other IEA Implementing Agreements and to members of the CERT, the--CERT Working Parties and their expert groups, also to a. world-wide readership outside the IEA Family. Similarly, regular, updated news *from* other Implementing Agreements, and *from* the CERT network in general, is delivered direct to your screen, creating an instantaneous link to a wide range of sources. Implementing Agreements thus benefit also *from* a steady incoming flow of broad-based, recent information on energy technology R&D developments in a variety of sectors.

How does the *OPEN Bulletin* function?

You can send information items to the *OPEN* team at IEA Headquarters easily, using a dedicated electronic input *form.* This can be found at: http://spider.iea.org/impag/cip/form.htm.(To be reminded of the password, contact: mary.harries@iea.org). You will be asked to suggest a headline and a summary, and to provide a link giving access to the source material in question. The *OPEN* editor will process items of input and integrate them into a forthcoming issue of the *OPEN Energy*

[1] The term " IEA Family" signifies the network *of* IEA Committees, Working Parties, Implementing Agreements, Expert Groups and subsidiary bodies that represent IEA Member countries and are served by the IEA Secretariat.

Technology Bulletin. Each issue will be e-mailed to subscribers both inside and outside the IEA Family. Contributors themselves are responsible for deciding which items of their material should be given wide circulation via the *OPEN* network.

What information can be contributed?

Information should be related to energy technology research, development, demonstration and deployment (RDD&D); it should originate from within the IEA Family; and it should be of interest to subscribers in both IEA member countries and non-members of the IEA. The objective is to provide updated information on energy technology status, technology availability and markets- and notably information produced or collected by the IEA Implementing Agreements - as well as RDD&D policy studies and analysis. For example, so long as there is an IEA -connection of some sort, items can report on the following:

- Technology breakthroughs;
- Surveys of technology development status, technology availability, market information;
- Awards for technology achievements (e.g. to industry for energy-efficient appliances); Upcoming events - workshops, conferences, seminars, symposia - in which IEA entities are organisers;
- Proceedings from such events;
- Forthcoming publications, including technical data books; lists of already existing publications; Ongoing projects (Implementing Agreement programmes, links with other national/international projects);
- Initiation of new projects, both within the Implementing Agreements and under other national or international auspices;
- Initiatives by national governments (e.g. partnerships with industry);
- National energy technology programmes and results of studies and analysis.

How should input be presented?

To ensure homogeneity, but also to protect ownership and raise the profile of IEA energy technology activities, a few simple guidelines need to be followed. *OPEN Bulletin* contributors from. IEA Implementing Agreements are notably requested to ensure that their source material includes:

- A clear statement of the origin of the material (for example, where applicable, the name of the Implementing Agreement, the number and title of the annex);
- An acknowledgement that the work is the output of an IEA Implementing Agreement, plus a brief description of the IEA's collaborative programme (for example, "This report was produced by the Implementing Agreement on . . . , which forms part of a programme of international energy technology collaboration, undertaken under the auspices of the IEA.");
- Links, where appropriate, to further relevant information.

Information provided for distribution through the *OPEN Energy Technology Bulletin* will be freely available to any subscriber, in both IEA Member countries and non-Member countries. Implementing Agreements wishing to restrict the availability of reports to participants in their programmes may prefer to provide access to only an abstract or summary through the *OPEN* Bulletin.

The IEA Secretariat welcomes feedback on the service provided by the *OPEN Energy Technology Bulletin,* which has been designed to help meet your information requirements. You can contact the *OPEN* Bulletin's editor: mary.harries@iea.org.

To consult back issues, visit *OPEN's* Archive at:
http://spider.iea.org/impagr/cip/archived bulletins/index.htm.

APPENDIX 17: Report from the IEA Secretariat (prepared by Peter Tulej)

11th Executive Committee Meeting
of the Geothermal Implementing Agreement

Report from the IEA Secretariat

Prepared by P. Tulej, Desk Officer

This note includes brief information on the developments within the IEA Secretariat and issues related to the Geothermal Implementing Agreement.

1. Renewable Energy Working Party

1.1. Strategy and Mandate 2004-2006

In November 2003, the CERT approved the REWP Strategy and Mandate for the years 2004-2006. The full text of the document can be obtained from the Desk Officer. Below the major points are presented.

1.1. Mission of the REWP.

REWP's mission is to help achieve steady and significant increases in renewable energy's technological performance and market share by:

- supporting and adding value to its Implementing Agreements;
- collaborating with other public, private, and multilateral organisations;
- helping to educate the various publics on the status and value of renewable energy and the conditions necessary for its market success;
- supporting the leadership efforts of the IEA, its Committees and Working Parties.

1.2. Vision of the REWP.

Through the next several decades, renewable energy technologies, due to their continually improving performance and cost, and growing recognition of their environmental, economic and social benefits, will grow increasingly competitive with traditional energy technologies, so that by the middle of the 21st century, renewable energy, in its various forms, should be supplying half of the world's energy needs.

1.3. Objectives

REWP defined the following four objectives:

(a) Objective 1: Primary source of information and analysis on renewables
(b) Objective 2: Oversight and support of the renewable Implementing Agreements
(c) Objective 3: Identify and describe policies, financial and other market-related factors
(d) Objective 4: Develop and help implement accelerated market deployment

1.4. Strategic focus 2004-2006
The Strategic focus of the REWP in the coming years will concentrate around the following areas:

(a) RE Technology Issues such as buildings, power, heat and transport, and also cost, learning, intermittency and renewable energy scenarios.
(b) Cross-cutting/enabling Technologies such as hydrogen (as a follow-on to the Seminar in 2003), DG, storage and grid interconnection.
(c) Market Mechanisms Analysis: Tradable Renewable Certificates, Green Power, CDM, taxes, externalities.
(d) Organisational and institutional issues including consistency of membership vis-à-vis new challenges, funding for REU projects, visibility within and outside the IEA and institutional structure vis-à-vis new programmes.
(e) RE industry engagement.
(f) Implementing Agreements including co-ordination of REWP and IA Strategies, facilitation of inter-IA co-operation, higher profile collaborative projects with REWP/REU, outreach to new membership, private sponsorship vs. national prerogatives and interaction with Desk Officer and IEA bodies.

1.2. 45th Meeting of the Renewable Energy Working Party

The 45 Meeting of the REWP took place on 2-3 March 2004 in Paris. The main points of the meeting included:

- Review of Public Seminar on Distributed Generation on 1 March 2004.
- Presentation by Vice Chairman Bob Dixon of the activities and expected deliverables of the Hydrogen Coordination Group.
- A presentation on hydrogen produced from renewable resources by Dr. A. Bauen of Imperial College.
- A discussion about IA issues and possible areas of collaboration. These issues included the end-of-term process and schedule for 2004 – 2006, the proposed R&D Seminar at REWP 47, and a review of possible topics for collaborative action.
- Discussion of a new Implementing Agreement for Renewable Energy Technology Deployment.
- Review of Hydrogen Implementing Agreement End of Term Report.
- An update of the preparations the 2004 International Conference for Renewable Energies in Bonn (1-4 June) and discussion of options for IEA involvement.
- Status of Renewable Energy Unit projects.
- Preparations for WEO 2004 and ETP Scenarios.
- REWP leadership update.

Information
For more details please contact the Desk Officer.

2. International Conference for Renewable Energies, Bonn, 1-4 June 2004

From June 1 to 4, 2004, Germany will host the International Conference for Renewable Energies, as announced at the World Summit on Sustainable Development in September 2002 in Johannesburg. The conference is expected to generate further impetus for the global development of renewable energy. It is also expected to add to the momentum of the coalition of like-minded countries for promotion of renewable energy known as the Johannesburg Renewable Energy Coalition (JREC).

The conference will address the following main themes:
* Financing instruments and market development
* Formation of enabling political framework conditions
* Capacity building (education, research, networks, cooperation, etc.)

The IEA is considering organising a side event during the conference to highlight IEA activities in renewables. On the part of the Secretariat, the IEA/REU would present the findings of the Policies and Measures Analysis Project which provides analysis of the efficacy of various policies and measures being used to stimulate renewable energy markets in IEA Member countries. In addition, the IEA/REU is planning to launch a new database on renewable energy policies and measures in the JREC countries. We would like to invite the Renewable Energy Implementing Agreements to participate in this side event, as well. We believe that the Bonn Conference would be a good venue to present the activities of the IAs, and to invite the participation of IEA Non-Member Countries and the private sector in those activities, according to the new rules and procedures.

Action
If GIA is interested in making a presentation at this planned IEA side event, please communicate with your Desk Officer.

3. R&D Seminar at REWP 47 (Spring 2005)

One of the priority projects identified by the REWP and the Implementing Agreements is The Report on Renewable Energy R&D Priorities that would define with mid to long term R&D priorities for renewable energy. In collaboration with RE Implementing Agreements, IEA/REU intends to explore R&D needs in the domain of renewable energy. The IEA/REU proposes a 1 day seminar with a working title “Reaching Towards Large Scale: Electricity, Hydrogen, Fuels and Heat” on the margins of the 47th REWP meeting.

Annex a presents a tentative programme of the Seminar.

Action
GIA is requested to communicate to the IEA Secretariat interest in attending and speaking at the Seminar. GIA is also requested to consider the tentative programme and provide comments or suggestions as to the contents of the sessions

4. New potential collaborative projects IA-REWP-REU

4.1. Renewable Energy Statistics

Efforts will be made to improve the quality and coverage of renewable energy statistics in collaboration with the IEA Energy Statistics Division. This effort will focus on understanding and reconciling the current data, comparing differing sources as cross-validation and looking at national data collection to see if best practice can be identified.

Action
As in previous years, IEA/REU will communicate with your Implementing Agreement on the upcoming Renewables Information 2004.

4.2. Renewables Scenarios Analysis

Scenarios for renewable energy will be developed to provide information on renewables' costs and benefits at different levels of market growth as well as about the implications of resulting energy portfolios. One of the threshold issues regarding renewables is a cost/benefit understanding of the investment needed to bring renewables into more widespread use, and the implications for fossil fuel demand, and potential reduced emissions. Several scenarios will be developed based on different investment assumptions.

Principal sources of data for the analysis include the Energy Technology Perspectives analysis (ETP) and renewable energy Implementing Agreements (IAs). The effort will extend to non-Member Countries, resulting in a global renewables scenario.

Action
The Secretariat has already requested Implementing Agreements to review the initial ETP information. The Secretariat would like to thank GIA for provided input to this project.

4.3. Distributed Energy Resources (DER)

The Secretariat will work on the project where recent examples of the treatment of renewables in the context of distributed generation in liberalised markets in IEA Member countries will be reviewed and options to treat renewables in will be developed. The objective is to review the treatment of distributed renewables in electricity network organisation in selected OECD Member Countries and to identify "best practice" distributed generation rules that recognise the specific technical characteristics of distributed renewable energy resources. The study will take into account the results of the IEA seminar on distributed generation and its role.

The study will explore novel technological approaches in the areas such as electricity generation by DER, the role of hydrogen, and the potential DER contribution to the creation of sustainable energy markets in collaboration with the Renewable Energy Implementing Agreements.

Action
The Secretariat will be seeking contributions from all IAs.

4.4. Analysis of Renewable Energy Policies and Measures

Further work on analysis of policies and measures will be undertaken after additional statistics and data has been compiled. An assessment and analysis of renewable energy policies and measures will provide insights as to the cost-effectiveness of various types of policies.

Action
The Secretariat may be soliciting from the GIA their input on technologies.

4.5. Renewable Constraints: Seasonal Fluctuations and Intermittency

Electricity network organisation, regulation and pricing are undergoing rapid change, particularly in liberalised markets. In many cases, this has led to new conditions for feeding electricity from renewable energies into the grid. Recent examples of the treatment of renewables in IEA countries will be reviewed, and options to treat renewables will be

developed. Implications for the operation and technical design of electric grid in the future will be investigated. The role of back-up power and storage will also be addressed.

Action
GIA will be contacted and requested to provide technology information.

4.6. Energy Security Implications of Renewables

Renewable energy is considered to contribute to energy security to a certain extent: (i) it is domestic, in the sense that every IEA country hosts some potential cost-effective resources, and (ii) it is frequently deployed in a distributed modality, making it a less likely target of terrorists. The Secretariat proposes to assess these factors, and other energy security aspects and implications of renewables, as part of a more robust, diversified portfolio of energy resources.

Action
The Secretariat will be seeking input from the GIA into the report.

4.7. Highlights of Implementing Agreements

In 2004 another IEA publication Highlights on IAs is planned.

Action
The Secretariat will be requesting the GIA to provide their valuable input.

4.8. The IEA OPEN Energy Technology Bulletin

The Bulletin now has 4,000 subscribers world-wide. The Secretariat would like to report on news from IEA Implementing Agreements. Examples: announcements and proceedings of workshops, conferences (as long as your programme is an organiser), publications (especially downloadable free of charge), technology status reports, awards, new annexes.

IEA/REU supports the renewable energy IAs in providing information items to the OPEN team and is encouraging using OPEN Bulletin as an information tool for the IAs.

Action
GIA is requested to consider providing information to the OPEN Bulletin. It is also possible to have a special issue of the Bulletin on geothermal energy. For details please contact the Desk Officer.

5. Ongoing Projects

5.1. Renewable Hydrogen

The objective of the project is to provide comprehensive analysis of technological feasibility, cost level, and likely market entry time scale of various renewable energy technologies to produce hydrogen and to identify the renewable technologies and R&D needs specific to them to contribute to accomplish large scale hydrogen supply in the most ambitious timeframe.

The project will investigate and report on the long-term potential for renewables to generate hydrogen on a cost-competitive basis, and the technical solutions that might soonest become available.

The activities include desk research on technological and cost feasibility, desk research and interaction with Implementing Agreements on R&D needs specific to renewable hydrogen supply and verification of the findings with the relevant IAs.

Action
GIA is requested to consider providing support to this project by sharing information and experience with the IEA Secretariat and by verifying the reports. Please contact the Desk Officer for more details and to communicate your interest in this project.

5.2. Implications of Intermittency on Renewable Energy Market Potential

The project will assess the degree to which renewable energy resources are limited by their intermittency, and technical options and regulatory strategies to overcome them. The resulting paper will address the R&D needs for storage, interconnection and grid controls, and the degree to which these options can enlarge the ultimate market potential.

The report will focus on the significance of the issue as a limiting factor to market potential, costs associated with overcoming it through technical solutions and regulatory strategies. A goal will be to provide input to scenarios that are being elaborated by the IEA.

Action
GIA is requested to consider providing support to this project by sharing information and experience with the IEA Secretariat and by verifying the reports. Please contact the Desk Officer for more details and to communicate your interest in this project.

6. Use of the IEA Logo

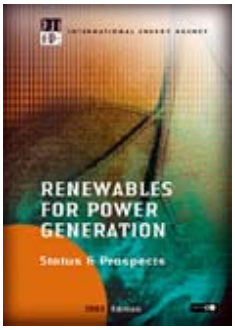
The Implementing Agreements are welcome to use their own logo for events (such as workshops, conferences, seminars etc.) that they are supporting. However, the IEA Office of the Legal Counsel would like to remind all interested parties that the use of the IEA logo is restricted.

The IEA logo must not be used without proper authorisation from the IEA Secretariat. The Secretariat will however entertain solicitations from interested Implementing Agreements to use the IEA logo for the events they are supporting.

Information
For more details please contact the Desk Officer.

7. IEA Publications

7.1. Renewable Technologies for the Power Industry



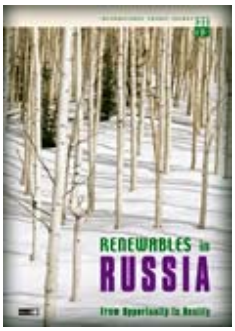
This book assesses the outlook for six leading renewable energy technologies: small hydro power, solar photovoltaic, concentrating solar power, biopower, geothermal power and wind power. It provides an update on current costs and analyses what future costs might be under different market scenarios. It looks at how these rapidly evolving technologies and their markets are developing, how the technologies complement each other and how they fit within the overall energy sector. It also identifies key areas for further research and development.

7.2. Highlights of Implementing Agreements

This publication provides information on results and achievements of the IEA Implementing Agreements in 2002/2003. Almost three decades of experience have shown that these international collaborative projects are contributing significantly to achieving faster technological progress at lower cost. Co-operation of this sort eliminates technological risks and duplication of effort, while offering further benefits like swifter expansion of the knowledge base and easier harmonisation of standards.

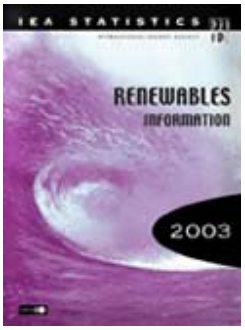
The Secretariat wishes to thank all the Implementing Agreements for their valuable input.

7.3. Opportunities for Renewable Energy in Russia



The report defines the potential contribution of RE in a more open, market-based Russia. It shows areas where policy makers can adapt energy policy and legislation in order to fully capture the benefits of renewable energy. The report shows that Russia's RE potential is enormous and is spread over many resources: wind; geothermal; biomass; hydro; and solar energy. It demonstrates market applications that can yield immediate economic returns with very small initial investments.

7.4. Renewables Information 2003



This annual publication of comprehensive information on the use of renewables and waste in the OECD region was first published in 2002. The report addresses a need for development of reliable statistics on this energy form. Support for increasing renewable energy's role in the energy sector has never been greater, and this publication seeks to increase understanding of the current market and trends over recent years. The report contains analysis of renewables and waste energy supply, electricity production and installed electricity generating capacity in OECD countries.

Information
The publication is available free of charge in PDF format on the or in a paper copy from the Desk Officer.

8. New Staff at the IEA Secretariat.

Mr. Antonio Pflüger has been appointed Head of the Energy Technology Collaboration Division of the International Energy Agency. Mr. Pflüger, a German national, has been Head of the Energy and Environment Division in Germany's Federal Ministry of Economics and Labour since 1999. He has been with the Ministry since 1990, where he has held various

positions. He was also co-spokesperson for the Ministry in 1992-1993. Prior to that, he worked on research and development projects for energy conservation in the Federal Ministry for Research and Technology's Division for Renewable Energies and Rational Use of Energy. He has written a number of publications and articles on issues such as combined heat and power, wind energy, and sustainable energy supply.

Ms Carrie Pottinger, an American national, was appointed to the post of the Energy Technology Co-ordinator in the Office of Energy Efficiency, Technology and R&D. Ms Pottinger's principal duties include co-ordination relating to the IEA Implementing Agreements, overseeing the IEA Implementing Agreements database and liaison between IEA Desk Officers. Ms Pottinger was previously responsible for collecting and publishing energy statistics, including RD&D budgets, short- and long-term forecasts, monthly/annual oil supply and demand, basic energy statistics/balances, and energy prices and taxes.

Mr. Timur Gül, a German national, joined the Renewable Energy Unit in 2003 and is doing research work on the projects such as "Renewable Hydrogen" and "Implications of Intermittency on Renewable Energy Market Potential". Mr Gül is a graduate of the Stuttgart University where he specialised in Energy, Air Pollution and Flue Gas Cleaning, Biological and Chemical Process Engineering. He will soon graduate in Environmental Engineering and Sustainable Infrastructure from the Royal Institute of Science and Technology in Stockholm, Sweden, as well.

For more detailed information regarding the IEA Secretariat, CERT, Working Parties, upcoming events and publications please contact your Desk Officer.

Annex 1

Proposed Programme for a
Joint Seminar of the IEA Renewable Energy Working Party and
IEA Renewable Energy and Hydrogen Implementing Agreements on R&D Priorities

"Towards Large Scale Renewables"

9.30	Welcome Address
9.45	**Introduction and Objectives of the Seminar** Roberto Vigotti, REWP Chair
10.00	**Session 1** **Setting the Context and the Vision** Session 1 is to provide context for the seminar and provide a critical look at technological and economic resource potential for renewable energy technologies by 2050. The first speaker will present a vision of renewable energy technologies market share and cost in 2050, including the hydrogen vector and a distributed and decentralised energy infrastructure. The second speaker will present an industry vision of practicalities of the transformation of the energy systems by 2050. The third speaker will present a vision policy and regulatory framework aspects of the paradigm shift which is required to meet the 50% share of renewables in 2050. A discussion will follow. Moderator: Rapporteur: Speakers: (15 minutes per presentation, discussion 15 minutes) TBA TBA (industry) TBA (policy think-tank)
11.00	Break
11.30	**Session 2** **Electricity from Renewables - Technology Path for Distributed and Decentralised Generation** Session 2 is to present and discuss of the potential and application of selected renewable energy technologies in electricity generation and the R&D needs to meet the 2050 vision. The speakers will present ultimate and economically-recoverable resource potential, current and future costs, technology R&D challenges and priorities for medium and long term work for large scale integration of renewable energy,

	especially through distributed and decentralised generation modalities. Moderator: Rapporteur: Speakers: (15 minutes per presentation, discussion 15 minutes) Geothermal Hydropower Ocean Energy Solar Photovoltaics Wind Energy
13.00	Lunch
14.30	**Session 3** **Heat and Fuels from Renewables - Technology Path for Production of Heat and Fuels, including Hydrogen** Session 3 is to present and discuss of the potential and application of selected renewable energy technologies in production of heat and fuels and the R&D needs to meet the 2050 vision. The speakers will present technical and economic potential of production of heat and fuels, including hydrogen by means of renewable energy, focusing on both the "fast-track" options for near-term, cost-competitiveness, as well as the options that are only possible in the mid to longer term. The speakers will outline the current state of R&D and will outline the needs, priorities and challenges to create a renewable option to contribute to an emerging infrastructure. Moderator: Rapporteur: Speakers: (15 minutes per presentation, discussion 15 minutes) Bioenergy Concentrating Solar Power and Chemical Energy Systems Hydrogen Solar Heating and Cooling
15.45	Break
16.15	**Rapporteurs Panel** Rapporteurs will provide summaries of the sessions and will draw key conclusions and recommendations for future R&D collaborative work and its priorities. Consultant: Rapporteur 1: Rapporteur 2: Rapporteur 3:
16.45	**Plenary Discussion** Following the Panel Discussion, the floor will be open to the audience. Moderator:
17.30	**Conclusions and Next Steps** Roberto Vigotti, REWP Chair

APPENDIX 18: E-mail re. Greece's Withdrawal from the GIA

From: "Costas Karytsas" <kkari@cres.gr>

To: "David Nieva" <dnieva@iie.org.mx>

Cc: "Ladsi Rybach" <rybach@geowatt.ch>; "Mike Mongillo" <mongillom@reap.org.nz>

Subject: GREECE WITHDRAWING FROM GIA

Date: Tuesday, 24 February 2004 22:17

Dear Sirs,

This is to inform you that, since GREECE is not in agreement, in principle, with the constitution of a Common Fund for the Geothermal Implementing Agreement (GIA) of the IEA, GREECE is obliged to withdraw from the GIA of the IEA.

Sincerely yours,

Dr. C. Karytsas
CRES-GREECE

Beilage 2

GEOTHERMAL ENERGY RESEARCH AND TECHNOLOGY

Future economic exploitation of total worldwide geothermal resources could provide about 150 EJ/yr for electricity generation and 350 EJ/yr for direct uses. A growth of 45% in geothermal electricity generation is possible by 2010, and 5% of the global electricity could be supplied by 2020.

In 2003, electricity from geothermal resources was being generated in 22 countries, with a total installed capacity of over 8,400 MW_e and load factors in excess of 90%. The installed capacity for direct use was estimated at about 16,200 MW_t, with 55 countries using 162,000 TJ/a. The ten Member countries of the IEA Cooperative Programme on Geothermal Energy Research and Technology (GIA) had a total installed capacity of 5,180 MW_e and reported generating more than 29,200 GWh and utilizing over 18,660 GWh in direct use applications.

All members of the GIA have national policies that strongly encourage, and in many cases, set targets for renewable energy implementation. Geothermal energy is recognized as a significant renewable and sustainable resource and it provides many benefits: low emissions of pollutants such as particulates and greenhouse gases, especially CO_2; less dependence on imported fuels, hence reduced problems caused by their price fluctuations; increased security and more diversity in supply; and independence from weather fluctuations.

In 2004, mid-way through its second term, the GIA continued its work on a broad front to advance and support the use of geothermal energy worldwide by addressing major issues that pose barriers to its development. The success of this work, which continues in 2005, is illustrated by the following selection of achievements.

More than 30 scientific papers and reports were published in 2003 and GIA members attended several international conferences and workshops, including the: GRC 2003 Annual Meeting (Mexico), IEA Budapest Forum, 25th New Zealand Geothermal Workshop, International Geothermal Congress Reykjavik 2003 and 28th Workshop on Geothermal Reservoir Engineering. The GIA also distributed information with the help of the IEA at the 2004 International Conference for Renewable Energies, 1-4 June 2004, Bonn. In addition, many papers were written for the World Geothermal Congress 2005, at which the GIA will also participate as a group with an exhibition booth.

Improvements made in subsidence modelling are providing a more reliable basis for future prediction and possible mitigation; and a second GIA special Environmental Impacts of Geothermal Development issue of *Geothermics* is in final preparation and will be published in 2005.

Excellent progress continued at the European (Soultz) and Australian (Cooper Basin) Enhanced Geothermal System (EGS) projects with very successful deep drilling (4,000-5,000 m) and reservoir stimulation tests performed at both. The first version of a Project Management Decision Assistant handbook was completed which provides a synthesis of data and information to support successful EGS project planning and conduct. A significant compilation of data for EGS reservoir evaluation was also completed for the Hijiori (Japan) HDR experiment.

A new computer code that models liquid-gas equilibrium and calculates thermodynamic properties of fluids was developed and successfully tested, providing the basis for rigorous simulation of heat and mass transport in deep, high temperature, high gas reservoirs (Mexico). In addition, the first deep well (>4,000 m) was drilled at Bad Urach (Germany) with subsequent successful reservoir stimulation performed.

The geothermal well drilling cost/performance database was established and initial data were input. Agreement was also reached on the form for the high-temperature part of Geothermal Drilling Best Practices Handbook.

Three new projects were initiated to coordinate research in: several topics related to the direct use of geothermal energy, EGS induced seismicity and field studies of EGS reservoir performance.

The GIA produces a comprehensive annual report that describes, in a non-technical manner, its geothermal activities as well as those in its member countries.

An enhanced public GIA website (www.iea-gia.org) went online in 2004 to disseminate information, making available its current geothermal papers and reports, its annual reports; and provide links to other important geothermal sites.

References:

IEA Geothermal Energy website: www.iea-gia.org

Mongillo, M.A. and Nieva, David, The IEA Geothermal Implementing Agreement-
Its Status, Highlights and Future Prospects, *GRC Transactions*, vol. 27, 443-448, 2003.

World Geothermal Congress 2005 website: www.wgc2005.org/

Beilage 3

Proceedings World Geothermal Congress 2005
Antalya, Turkey, 24-29 April 2005

The IEA Geothermal Implementing Agreement - Its Goals, Status, Achievements and Prospects

M.A. Mongillo and Participants in the IEA GIA

Institute of Geological and Nuclear Sciences Limited, Wairakei Research Centre, Private Bag 2000, Taupo, New Zealand

IEA-GIASec@gns.cri.nz

Keywords: Geothermal Implementing Agreement, GIA, International Energy Agency, IEA, geothermal cooperation.

ABSTRACT

The International Energy Agency Implementing Agreement for a Cooperative Programme on Geothermal Energy Research and Technology, or Geothermal Implementing Agreement (GIA), provides an important framework for wide-ranging international cooperation in geothermal R&D. The activities of the GIA, which began in March 1997, are directed primarily to the coordination of existing national programmes and focus on assembling specific capabilities and enhancing their effectiveness by establishing direct cooperative links among geothermal experts in the participating countries. The R&D activities are conducted under Annexes to the GIA, of which there are currently five: Environmental Impacts of Geothermal Energy Development, Enhanced Geothermal Systems, Deep Geothermal Resources, Advanced Geothermal Drilling Techniques and Direct Use of Geothermal Energy.

The GIA is now operating in its second 5-year term, which ends in March 2007. The overall goal for this term, defined in the 2002-2007 Strategic Plan, is to support and advance the worldwide use of geothermal energy by seeking to overcome the barriers to its development. To help meet this challenge, the GIA recently expanded its R&D activities by adding a fifth annex, Direct Use of Geothermal Energy; and is preparing to include other new topics, which are now defined as draft annexes. These include: Sustainability of Geothermal Energy Use, Geothermal Power Generation Cycles, and Geothermal Market Acceleration. In addition, efforts are underway to extend official GIA membership and to encourage qualified non-Member participation. As of May 2004, the European Commission (EC) and nine countries: Australia, Germany, Iceland, Italy, Japan, Mexico, New Zealand, Switzerland and the United States, were Members.

A brief review of the IEA and GIA structures is presented; and the goals, status and achievements of the GIA and its future prospects are summarized.

1. INTRODUCTION

This review provides an update and amplification of the papers by Rybach (1998), which introduced the Geothermal Implementing Agreement (GIA) shortly after its formation in March 1997, and Mongillo and Nieva (2003a, 2003b). Refer to these papers and the IEA GIA annual reports (IEA-GIA Webpage) for more details about the IEA, its early involvement with geothermal R&D and the background and extensive work of the GIA. Note that all webpage addresses referred to in this paper are listed in the Reference section.

1.1 The IEA

The International Energy Agency (IEA) was created in 1974 in response to the 1973-74 oil crisis. It is an autonomous international governmental agency, based in Paris, France, and comprising a cooperative group of most of the Member countries of the Organization for Economic Cooperation and Development (OECD).

At present, the IEA is the energy forum for 26 Member countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The Commission of the European Communities also participates in the work of the IEA. The IEA Member countries strive to create conditions in which their energy sectors can promote sustainable economic development for the welfare of their citizens and environment. They recognize the importance of the growing interdependence of the global economic and energy markets, and thus have created a framework for working together to coordinate their energy policies, share energy information and cooperate in the development of rational energy programmes. Significant joint measures include developing alternative energy sources, increasing efficiency of energy use and assisting with the integration of energy and environmental policies. In addition to their many other responsibilities, the IEA encourages international collaboration in energy technology in the areas of: information centres and energy modelling, fossil fuels, renewable energy technologies, energy end-use technologies and fusion power through a large network of Implementing Agreements (IEA Webpage).

1.2 IEA Implementing Agreements

Implementing Agreements (IA) provide the management structure and legal mechanism for guiding the activities of the IEA's collaborative multilateral programmes. They are specific contracts that establish the obligations and rights of the participants and the objectives of the projects. Participants can include government organizations, private organizations formally designated by their governments, international inter-governmental organizations, and others, and typically comprise research institutions, utilities and industrial concerns. There are two categories of Participants in the IA: Contracting Parties and Sponsors. OECD non-Member countries, or entities of OECD non-Member countries, may also participate. There are currently over 40 active IAs covering a wide range of energy technologies. The IA participants benefit from the pooling of skills, knowledge, financial resources and regular scientific interaction, as well as by avoiding costly duplication in their national research programmes.

The projects, or tasks, undertaken in IAs are defined and organized in annexes to the IA. The annexes specify the R&D task objectives, schedules, funding provisions, and identify the participants and define their obligations. An Executive Committee (ExCo), consisting of one Member and one Alternate from each Participant (i.e. Contracting Party or Sponsor), coordinates and manages the activities of the IA and is also responsible for disseminating results and reporting annually to the IEA. Each annex is coordinated and administered by an Operating Agent (generally an institution), which is usually designated by the participating country and confirmed by the ExCo. New task annexes can be added to an IA project as it progresses if the ExCo determines that new specific issues should be examined collaboratively. Funding for IA activities can be of two types: *task-sharing*, whereby the participants allocate specified resources and personnel to conduct a portion of the Annex work at their own expense; or *cost-sharing*, in which participants contribute to a common fund that is used for research, equipment purchase, information processing and exchange, operation of a secretariat, *etc*. (Rybach, 1998). Often a combination of these funding mechanisms is used to finance IA operations.

2. THE IEA GEOTHERMAL IMPLEMENTING AGREEMENT (GIA)

2.1 Overview

The GIA officially went into effect on 7 March 1997, reviving IEA cooperation in geothermal research after a 16-year hiatus. The Agreement was designed to operate for an initial period of five years. However, in late 2001, the GIA was extended for a second 5-year term, to 31 March 2007, with the approval of the Renewable Energy Working Party (REWP) and the IEA Committee on Energy Research and Technology (CERT).

The GIA provides an important and flexible framework for wide-ranging international cooperation in geothermal R & D, which seeks especially to overcome barriers to the development of geothermal energy utilization. It brings together important national programmes for exploration, development and utilization of geothermal resources, with the focus on assembling specific expertise and enhancing effectiveness by establishing direct cooperative links among geothermal experts in the participating countries.

The GIA's present activities are directed primarily toward the coordination of the ongoing national programmes of the participants, and encompass a range of geothermal topics, from "traditional" uses like power generation and direct use of heat, to new technologies pertinent to enhanced geothermal systems (EGS) and deep resources. New activities are also initiated and implemented when needs are established. The GIA is available on the web (IEA-GIA Webpage).

As of May 2004, the European Commission (EC) and nine countries: Australia, Germany, Iceland, Italy, Japan, Mexico, New Zealand, Switzerland and the United States were Members. The present involvement of these 10 Members in the GIA programme is shown in Table 1. Participants take part in those annexes to which they can contribute, hence are not necessarily active in every one

2.2 The Strategic Plans and Objectives

The GIA's first Strategic Plan, produced at its formation in 1997, identified the organization's goal as: *to encourage and support the worldwide use of geothermal energy*. To attain this goal, objectives were specified that included conducting international collaborative efforts to:

- *Compile and exchange improved information* on worldwide geothermal energy research and development concerning existing and potential technologies and practices.
- *Develop improved technologies* for geothermal energy utilization.
- *Improve the understanding of the environmental benefits* of geothermal energy and methods to avoid or ameliorate its environmental drawbacks.

These efforts kept the GIA well on track during its initial years. However, as the first term drew to a close, it became clear that the environment in which the GIA operated had evolved since 1997, and would continue to do so.

Consequently, a new strategic plan was designed and implemented to guide the organization through its 2002-2007 term. The Strategic Plan reflects the actions underway, and those being considered, by the GIA in response to market, management and government policy dynamics, as well as technological advances. It also recognizes the challenges presented by the IEA World Energy Outlook 2002 forecasted growth of 4% per annum in global geothermal electricity production for the 2000-2010 period (WEO, 2002), the desire to increase worldwide geothermal direct use, and the growing acceptance and consequences of the Kyoto Protocol.

Geothermal energy must become cost-effective in the marketplace and overcome the difficulty of characterizing the resource prior to major financial commitment and the discrimination against its capital-intensive nature. Barriers to market penetration arising from a general lack of public awareness and experience with the technologies, and the environmental and social barriers linked to the lack of experience with planning, regulation and gaining public acceptance must also be overcome. Geothermal energy has significant positive environmental benefits on the global scale; however, local impacts must be clearly identified and dealt with in an open manner. To meet these challenges, the GIA Strategic Plan 2002-2007 was designed with the specific mission for the second term as being: *to advance and support the use of geothermal energy on a worldwide scale by overcoming barriers to its development*. To do this, the original GIA objectives were augmented with additional ones specifically focused to:

- *Expand R&D collaboration*: Geothermal technology development is progressing and new areas of collaboration are required. Table 1 contains a summary of current collaborative efforts under the GIA. The Executive Committee (ExCo) will consider and implement new subtasks and annexes where additional collaboration could be useful.
- *Increase the number of participants*
- *Increase outreach to non-Member countries with large geothermal energy potential*: The electricity markets in many countries were opened to competition in the 1990s. As energy markets deregulate, they are driven more by market forces and less by government programmes and intervention. New regions are opening up as international energy markets expand and the GIA will embrace this opportunity and explore ways to accelerate development of the world's

geothermal resources through invited participation in its programmes.

- *Evaluate market stimulation mechanisms*: In the ExCo's efforts to expand geothermal heat and power markets in both OECD and non-OECD countries, research actions are clearly important and indeed essential, but they are not in themselves sufficient to open up markets. Market stimulation is also needed to create an expanded market for geothermal energy.

- *Improve dissemination of information about geothermal energy*: The ExCo has recognized its role in promoting the use of geothermal energy, but more emphasis is needed on the open distribution of high quality and attractive information products.

- *Leverage limited R&D funding*: The R&D budgets of many of the participants have been declining, and the need for cost-shared collaboration is increasing. An affiliation with the IEA brings added value to activities rather than funding. The IEA's reputation for technical competence and broad unbiased excellence can be leveraged to obtain support from industry and other multilateral organizations and financial institutions.

2.3 The GIA Annexes

GIA participants presently work on five research tasks that are specified by five annexes to the GIA, with the activities of each divided into several subtasks. The operating agents, task leaders, participants and status of activity are presented in Table 1. Three of these annexes were part of the original GIA:

(1) Annex I: Environmental Impacts of Geothermal Energy Development: In order to expand the use of geothermal energy, it is necessary to clearly identify possible environmental effects and devise and adopt methods to avoid or minimize their impact. The main activities of this annex are divided into three subtasks: to investigate the impacts of development on natural features; to study the problems associated with discharge and reinjection of geothermal fluids; and to examine methods of impact mitigation and produce an environmental manual.

(2) Annex III: Enhanced Geothermal Systems (formerly Hot Dry Rock): This annex investigates new and improved technologies that can be used to artificially stimulate a geothermal resource to allow commercial heat extraction. The work currently being conducted is spread over three subtasks: to review the use of conventional and new geothermal technology to enhanced geothermal system (EGS) technology; to collect information necessary for decision making, design and the realization of a commercial EGS energy producing plant; and to review and evaluate geochemical and modelling techniques for determining reservoir characteristics.

(3) Annex IV: Deep Geothermal Resources: Issues associated with the commercial development of deep geothermal resources at depths greater than 3,000 m are addressed by this annex. The activities are pursued in three subtasks: research on exploration technologies and reservoir engineering for deep, hot reservoirs; investigation into drilling and logging techniques; and exchange of information and establishment of a database on fluid chemistry, material properties and corrosion issues, together with field-testing.

The work in this annex is closely related to that in Annex III (EGS) because enhanced geothermal systems studies are being pursued in several regions where the desired high temperatures are reached at much greater depths (>4,000 m) than in the "normal" high-temperature geothermal fields. Consequently, some of the projects over-lap, with related activities being conducted in both annexes.

The fourth annex was established in 2001:

(4) Annex VII: Advanced Geothermal Drilling Techniques: This annex pursues advanced geothermal drilling research and investigates all aspects of well construction with the aim of reducing the costs associated with this essential and expensive part of geothermal exploration, development and utilization. The investigation extends over three subtasks: the compilation of geothermal well drilling cost and performance information and its storage and maintenance on a database; production of a geothermal drilling best practices handbook; and monitoring and exchange of information on drilling technology development and new applications.

The fifth annex became active in September 2003:

(5) Annex VIII: Direct Use of Geothermal Energy: Geothermal energy can be used directly as heat for many applications such as building and district heating, industrial process heating, commercial uses such as greenhouse heating and temperature control of water for fish farming, bathing and swimming; through geothermal heat pumps to provide heating, cooling and domestic hot water; and for many other purposes. Many applications are well developed and economically viable, while implementation problems and unfavourable economics challenge others. This annex will address all aspects of the technology with emphasis on improving implementation, reducing costs and enhancing use.

Funding for Annexes I, III, IV and VII is of the *task-sharing* mode, with that for Annex VIII intended to be both *task-sharing* and *cost-sharing*.

2.4 Membership Benefits

The main beneficiaries of membership in the GIA are the research, government, industry and academic sectors, at both technical and policy levels.

Collaboration within the GIA provides researchers with the opportunities for joint R&D cooperation and information exchange on recent R&D developments via meetings, symposia, workshops and networking. Members from industry are able to participate together on R&D projects and to develop databases, models and handbooks. Policy and decision makers are able to gain an international perspective on geothermal issues, opportunities and development. In addition, there are benefits to society that arise from the acceptable development of geothermal resources in an environmentally appropriate manner.

More specifically, membership within the GIA provides the following benefits:

- Increases R&D capabilities beyond that of single a country/group by combining the efforts of several nations

- Provides appropriate focus for R&D, hence avoids duplication and unproductive research

- Provides opportunities for research networking

- Develops skills and knowledge required to meet future technical challenges
- Improves R&D cost effectiveness by sharing research costs and technical resources
- Provides wider and easier access to key information, research results and technological capabilities
- Makes accessible a strong technical base provided by R&D activities in the participating countries
- Provides impartial information and analysis to help guide national policies and programmes
- Provides the opportunity to review current issues, ongoing research and the need for future research
- Provides the opportunity to draw upon expertise and efforts of our sponsoring organization, the OECD/IEA
- Helps build a common understanding of the technical basis for various geothermal issues
- Investigates barriers to development
- Helps develop technical standards and methodologies
- Contributes to the development of energy policies
- Opportunities to join in cooperative efforts with the United Nations Environment Programme (UNEP), the Global Environmental Fund (GEF) and other project financing agencies

2.5 Structure of the GIA and Membership Obligations

Members of the GIA participate in one or more tasks described by the annexes. They coordinate their activities with other task participants in order to avoid duplication and enjoy mutual benefits from existing resources and expertise. They also cooperate in coordinating the annex work and endeavour, on the basis of an appropriate sharing of burdens and benefits, to encourage cooperation among other participants with the objective of advancing the state of understanding of all participants. Each annex is binding only upon its Operating Agent and the participants therein, and does not affect the rights or obligations of other Members.

Supervisory control of the GIA is vested in the Executive Committee (ExCo) and decisions made by the ExCo are binding on the Members. The ExCo consists of one voting Member from each Member country. An Alternate may serve on the ExCo if the designated Member is unable to do so. The ExCo meets twice a year and Members and/or their alternates are expected to attend. The ExCo manages all administrative activities resulting from or affecting the GIA. During ExCo meetings the Members report on national programmes, exchange information and results of work conducted in the annexes, and consider ongoing or arising issues.

The ExCo provides a comprehensive annual report describing its annex and national activities to the IEA (IEA-GIA Webpage) each year. In turn, the ExCo can rely upon the IEA Secretariat in Paris to provide it with assistance in its operation when necessary, especially in legal and administrative matters.

Members cover the travel expenses for their representatives to attend meetings and workshops. Travel costs are minimized by conducting business by mail and e-mail whenever possible. To the extent practicable, meetings are scheduled to coincide with other events to minimize travel costs. Each participant bears all the costs they incur in carrying out their task activities, including reporting and travel expenses. Unless otherwise specified, the cost of publishing annex reports and summary assessments is borne by the Operating Agent.

The GIA ExCo has a Secretary based in New Zealand who provides secretarial, administrative and other services as required for the organization under a contractual arrangement.

2.6 GIA Financial Structure and Costs

The operational expenses for the GIA Secretariat, including the Secretary's salary and other common costs of the ExCo, are met from an ExCo common fund that is administered by a Custodian, presently the National Renewable Energy Laboratory (NREL, USA).

Monetary contributions to support the common fund are made by Members through an apportionment system based upon the assignment of shares according to IEA guidelines. Table 2 shows the share apportionment based on current membership. The ExCo has set the current cost per common fund share at US$ 2,500/year.

Table 2: Share distribution among the GIA Members as of September 2004.

Australia	2	Japan	4
European Commission	4	Mexico	1
Germany	4	New Zealand	1
Iceland	1	Switzerland	2
Italy	2	United States	4
Total = 25 shares			

With the addition of new Members, or the withdrawal of current Members, the total number of shares will change, and may affect each Member's contribution. The contributions are made annually on a calendar-year basis.

Other common funds may be established as required to meet the needs of new annexes, with costs shared among the participants of the relevant annexes in accordance with the shares established by the IEA and set out in Table 2.

3. GIA ACHIEVEMENTS 1999-2004

3.1 General

The GIA clearly recognizes as one of its major objectives the importance of disseminating the information and results of work conducted in its programmes. An indication of its success is the over 175 publications produced during the 1999-2003 period. Many of these were presented at major international forums, including the World Geothermal Congress (WGC) 2000, International Geothermal Congress Reykjavik 2003, GRC Annual Meetings and annual NZ Geothermal Workshops, where large international

participation provided opportunities for widespread exchange and interaction. A comprehensive reference list is not included here due to space limitations, but may be found in the IEA-GIA Annual Reports (IEA-GIA Webpage).

In late 2001, the decision was made to extend the GIA for a second 5-year term, to 31 March 2007. Annexes I, III and IV were continued into the new term, and Annexes VII and VIII were subsequently added to the programme, extending the GIA's range of geothermal activities.

In 2002, the ExCo decided to increase the scope of its activities as described in the 2002-2007 Strategic Plan (see above). This necessitated the establishment of a dedicated Secretariat, which officially began operations on 14 March 2003. The Secretariat is the first GIA activity financed by *cost-sharing*, operating through a GIA common fund.

In 2003, the GIA presented papers at the Budapest Forum (Mongillo and Nieva, 2003a) and GRC 2003 Annual Meeting in October 2003 (Mongillo and Nieva, 2003b). GIA promotional material was also distributed, with the assistance of the IEA, at the international Conference for Renewable Energies held in Bonn, Germany, on 1-4 June 2004.

The new, more comprehensive GIA website (IEA-GIA Webpage) also went on-line in June 2004, updating and expanding the amount and kind of information base available to both Members and non-Members.

Several papers relating to work conducted in the GIA programmes are also being presented at this World Geothermal Congress (WGC 2005 Antalya, Turkey, 24-29 April 2005).

3.2 Annex I: Environmental Impacts of Geothermal Energy Development This is a Subsection

Significant amounts of information have been compiled, documented and interpreted on the impacts of geothermal development on the natural features of many fields around the world. Improved techniques have been developed for the monitoring of heat flux and carbon dioxide in areas of steaming ground; and subsidence modelling has been improved, providing a more reliable basis for future prediction and possible mitigation, remediation and avoidance strategies. A better understanding of processes for reducing hydrogen sulphide and mercury emissions, and removing arsenic from wastewater, has also been achieved. Dissemination of results has been very successful through participation at workshops and seminars in Iceland, Japan, New Zealand, the Philippines and the United States.

There was significant participation by the GIA in the WGC 2000, in Japan, with major Annex I contributions in two IEA special sessions on geothermal environmental issues and a Plenary Session on international scientific collaboration programmes developed and held. A special issue of *Geothermics* on "Environmental Aspects of Geothermal Development" (Hunt, 2000) was produced in 2000 and a second is currently in preparation. Geothermal environmental short courses have also been held at Auckland University (New Zealand) to provide specialized training in environmental management of geothermal projects.

3.2 Annex III: Enhanced Geothermal Systems (formerly Hot Dry Rock)

Annex III research results have been actively circulated. The development of high temperature logging instrumentation, and the collection and assessment of information relating to the application of geophysical methods for fracture mapping have been published; and there was major participation at the WGC 2000.

A significant contribution was made with the completion of the EGS Economic Model in 2001. It allows the user to define the geothermal resources and specify the engineering and financial characteristics of a proposed project to determine the resulting economics and to optimize the plant configuration. Extensive applications at Fenton Hill (USA), Soultz-sous-Forêts (Alsace, France), and a site at Hunter Valley (Australia) have demonstrated the usefulness of the model. The model operates on a PC in the Windows environment and is freely available on the web (MIT Webpage).

In 2003, a new down-hole motor was successfully tested for drilling a highly deviated well at the Geysers geothermal field. The use of shear-wave splitting as a fracture characterization tool was further developed and will be applied in conjunction with the future Coso geothermal field massive hydraulic fracture test. Development of new methods for interpreting tracer tests to estimate fluid flow paths and velocities and temperature flow in fractured geothermal reservoirs continued with the goal of producing a simple set of tools for test interpretation in single- and two-phase, fractured geothermal reservoirs. Work was begun on the design and production of the first version of the Project Management Decisional Assistant (PMDA) for helping guide work through the various development stages of EGS projects. Drilling, acoustic emission, hydraulic fracturing and modelling/simulation data were compiled for the "Overall Compilation and Review of Hijiori HDR Experiments" as part of the EGS reservoir evaluation project.

Excellent progress continued in 2003 on the major European EGS Project at Soultz-sous-Forêts, with successful hydraulic stimulation of a 3-km^3 volume around the 5,000 m deep injection and production wells; and drilling of the second production well began. France, Germany, Italy and Switzerland, with technical support from Japan and the USA, are expecting to produce 6 MW of electricity from this project by 2005 (Soultz Webpage). Further significant EGS success has been had by an Australian GIA participant, who became the worlds first publicly listed company concerned solely with EGS energy, with its successful public offering on the Australian Stock Exchange in 2002. Venture capital amounting to several million Australian dollars was raised in 2002 with additional funding of A$5 M awarded by the Government. Further significant venture capital was raised in 2003. The first well in this Australian Cooper Basin project, was successfully completed to >4,300 m depth and had very successful hydraulic stimulation results.

Many of the 2003 results from Annex III were presented at international workshops and conferences in the USA and Mexico.

3.3 Annex IV: Deep Geothermal Resources

A special session on deep geothermal resources was organized for the WGC 2000, at which results for the general modelling and strategy for development of deep geothermal resources were presented.

Important databases pertaining to the drilling and logging of deep geothermal wells, techniques for the exploration of deep geothermal resources and the characterization of their reservoirs, and of references related to materials performance in aggressive geothermal chemical environments have been created and are available on CD-ROM. Much of this information has also been published.

Corrosion models, which include the effects of fluid chemistry, phase stability and fluid velocity, have been developed for down-hole and wellhead environments under flow conditions and used to identify corrosion control options.

As stated above, the first deep geothermal well to be drilled in Australia was successfully completed in 2003 as part of the Cooper Basin EGS project. Encouraging results were obtained with the encounter of systems of fractures and joints at depths >4,000 m and temperatures in excess of 250 °C reached. As part of the European EGS Soultz project, a third well was successfully drilled to ~5,000 m in 2003 and very successful hydraulic tests performed. In addition, the first well was drilled at the German deep geothermal project in Bad Urach to about 4,200 m. Subsequent stimulation tests created a deep reservoir at 3,300-4,200 m depth where temperatures of about 170 °C were attained.

In 2003, the conceptual models of several Mexican geothermal fields with deep reservoirs were updated and a new computer code for the rigorous simulation of heat and mass transport in high temperature reservoirs, including effects of high non-condensable gas, was developed and successfully tested.

Several of the annex participants presented results at a geothermal conference in Iceland and several reports and six scientific papers were published.

3.4 Annex VII: Advanced Geothermal Drilling Techniques

The working group for this annex held meetings in March and November 2002, March and September 2003, and March 2004, to refine the subtask objectives and define the specific task activities. Finger and Hoover (2003) have described the role of this annex in advanced geothermal drilling.

The format for the presentation of well cost/performance data was defined and the first group of well-cost data sets was placed into the database. Agreement was reached on the outline for the high-temperature part of *Geothermal Drilling Best Practices Handbook*. Preliminary discussions for collaborative testing at Cerro Prieto, Mexico, were also held.

3.5 Annex VIII: Direct Use of Geothermal Resources

The Direct Use of Geothermal Energy annex is the most recent annex to be initiated by the GIA. It officially commenced operations on 19 September 2003, and work in the annex is expected to begin in late 2004.

4. FUTURE DIRECTIONS

The GIA has actively advanced into its second 5-year term guided by a new Strategic Plan. The studies in several of the active annexes are being revised, reorganized and extended. As examples, planning is proceeding for new work to begin in Annex I on induced seismicity and in Annex III, new work is being proposed on field experiments on enhanced geothermal systems. The programme is also expanding through the addition of completely new areas of cooperative research, e.g. Annex VIII: Direct Use of Geothermal Energy commenced activities in September 2003, and preparation is well advanced on Annex V: Sustainability of Geothermal Energy Utilization and Annex VI: Geothermal Power Generation Cycles. The tasks associated with Annex IX: Geothermal Market Acceleration, are recognized as very important, and are being developed in association with the IEA's own market acceleration annex. Options are also open for new collaborative activities to be added to the programme under new subtasks and annexes, and new proposals are encouraged.

The GIA recognizes the importance of expanding its membership to help achieve its goal of supporting and advancing worldwide geothermal energy use. Therefore, the GIA extends an invitation to national organizations, universities, multilateral organizations, international inter-governmental organizations and industry to seriously consider joining. Membership is open to both IEA Member and non-Member countries. Interested parties should contact the IEA-GIA Secretariat (IEA-GIASec@gns.cri.nz) for information on joining. Membership is formalized through the IEA Secretariat, which has been instrumental in assisting with the growth of the GIA.

The GIA website (IEA-GIA Webpage) also provides contact information and easy access to its major documents including: the Implementing Agreement, annex descriptions, strategic plan, GIA membership details and annual reports. The site also provides a major resource for the dissemination of the programme's results.

5. CONCLUSIONS

As global energy demand accelerates in the coming decades, especially in the rapidly growing developing countries, more effort must be directed at increasing the contribution of sustainable energy systems. Geothermal energy can play a significant role, especially with its vast untapped worldwide potential. However, to do so, it is essential to overcome market and technical barriers.

The GIA programme, now well into its second 5-year term, provides a mechanism for the extensive international cooperation in geothermal R&D necessary to overcome these barriers and advance the use of geothermal energy worldwide. At present, the EC and nine Member countries from Europe, Asia, the Americas and Oceania are collaborating to help meet the challenge. Considerable effort is needed, and the GIA extends an invitation to those national organizations, universities, industry and other groups who are able to contribute to join us.

ACKNOWLEDGEMENTS

The authors would like to thank Clifton Carwile, David Nieva, Ladislaus Rybach, Allan Jelacic and Peter Tulej for their helpful comments on earlier versions of this paper.

REFERENCES

Finger, J.T. and Hoover, E.R.: The IEA's role in advanced geothermal drilling. *Transactions*, GRC 2003 Annual Meeting, Morelia, Mexico (2003).

Hunt, T.M. (Ed.): 2000. Special Issue on Environmental Aspects of Geothermal Development. *Geothermics*, 29, 4/5, 175 p (2000).

IEA Webpage: www.iea.org.

IEA-GIA Webpage:

http://www.gns.cri.nz/GIA/index2.html.

MIT Webpage: http://web.mit.edu/hjherzog/www/.

Mongillo, M.A. and Nieva, David: The IEA Geothermal Implementing Agreement- Its Status, Achievements and Prospects. *Budapest Forum*, the IEA-GIA Webpage or the IEA Budapest Forum webpage: http://library.iea.org/dbtw-wpd/textbase/work/2003/budapest/geother.pdf (2003a).

Mongillo, M.A. and Nieva, David: The IEA Geothermal Implementing Agreement- Its Status, Achievements and Prospects. *Transactions*, GRC 2003 Annual Meeting, Morelia, Mexico (2003b).

Rybach, L.: The IEA Geothermal Implementing Agreement – Status and Prospects. *Geothermal Resources Council Transactions*, Vol 22, 55-59 (1998).

Soultz Webpage: www.soultz.net.

WEO 2002: *World Energy Outlook 2002*. International Energy Agency, 530 p (2002).

Table 1. List of GIA Annex titles, operating agents, task leaders and contact e-mail addresses, participating countries and operating status.

Annex Number	Title Operating Agent (OA) Task Leader (TL); Affiliation; Contact E-mail Participants	Status
I	Environmental Impacts of Geothermal Development OA: Institute of Geological and Nuclear Sciences Limited (IGNS), New Zealand TL: Chris Bromley; IGNS, New Zealand; c.bromley@gns.cri.nz Participants: Iceland, Italy, Japan, Mexico, New Zealand, USA	Active, Continuing through 2005
II	Shallow Geothermal Resources	Closed
III	Enhanced Geothermal Systems OA: New Energy & Industrial Technology Development Organization (NEDO), Japan TL: I. Matsunaga; AIST, Japan; matsunaga-isao@aist.go.jp Participants: Australia, EC, Germany, Italy, Japan, Switzerland, USA	Active, Continuing through 2005
IV	Deep Geothermal Resources OA: Forschungszentrum Jülich (F-J), Germany TL: Dieter Rathjen; F-J, Germany; d.rathjen@fz-juelich.de Participants: Australia, Germany, Italy, Mexico, New Zealand, USA	Active, Continuing through 2006
V	Sustainability of Geothermal Energy Utilization	Draft
VI	Geothermal Power Generation Cycles	Draft
VII	Advanced Geothermal Drilling Techniques OA: Sandia National Laboratories, United States TL: Jack Wise; Sandia National Laboratories, USA; jlwise@sandia.gov Participants: EC, Iceland, Japan, Mexico, New Zealand, USA	Active, Continuing through 2005
VIII	Direct Use of Geothermal Energy OA: The Federation of Icelandic Energy and Waterworks, Iceland TL: Einar Gunnlaugsson; The Federation of Icelandic Energy and Waterworks, Iceland; einar.gunnlaugsson@or.is Participants: Iceland, New Zealand, Switzerland, USA	Active, Continuing through 2007
IX	Geothermal Market Acceleration	Draft

Beilage 4

BEILAGE 4

Präsentation/Diskussionsgrundlage für weiteres Vorgehen Subtask C, Pisa

IGEA-IGA Annex III Meeting

ENEL Auditorium
Pisa, Italy

12 October 2004

0900 Opening remarks and participant/observer introductions

0910 Brief recent activities in Annex III from participants
Subtask B: Allan Jelacic
Subtask C: Thomas Mégel
Subtask D: Isao Matsunaga

0940 Discussion of new subtask
Proposal by Allan Jelacic and Roy Baria
Discussion future collaboration

1040 Other items for discussion
Presentations at WGC2005
Next meeting at Tsukuba/Sendai

1100 Adjourn

Isao Matsunaga, Task Leader Annex III
AIST

Subtask C: Data Acquisition and Processing
Status and Activities 2004

Th. Mégel

2003 → 2004 → 2005 →

Completion 1. Version
EGS-PMDA
(Handbook for Starting new EGS Projects)

Swiss workgroup GIA

Review
Annex III – Participants

Dissemination

Extension
of the EGS-PMDA

IEA-GIA Annex III Meeting, Pisa, 12. October 2004

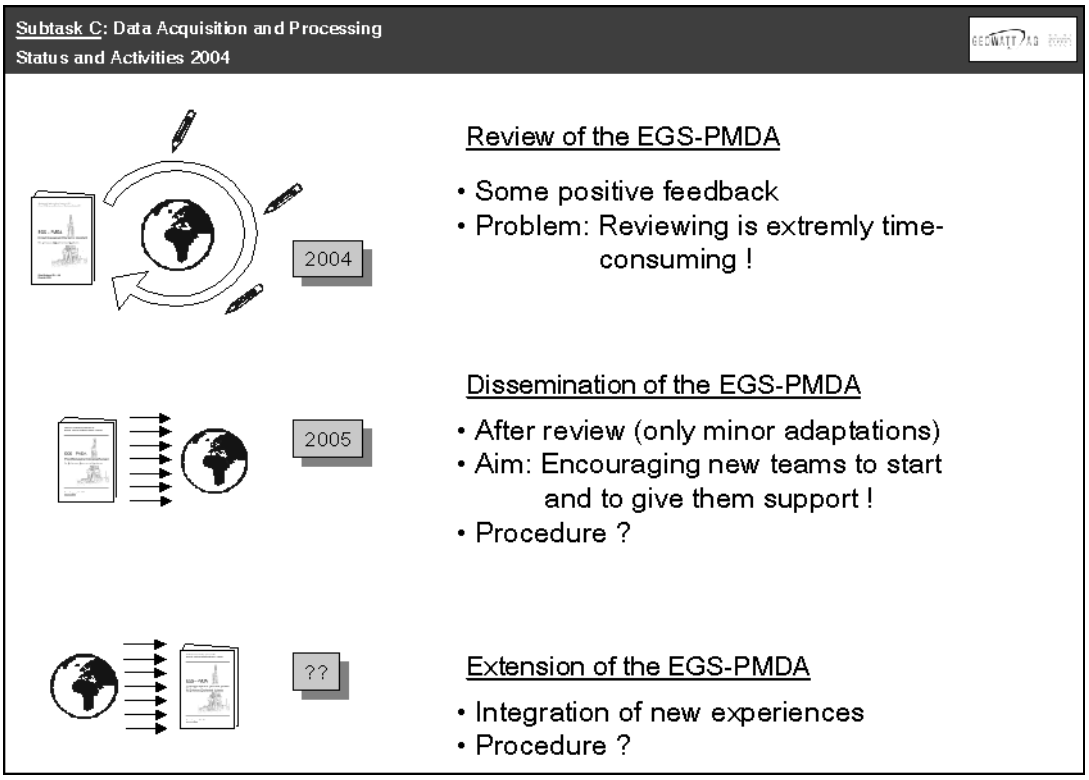
Subtask C: Data Acquisition and Processing
Status and Activities 2004

2003

EGS-PMDA: Handbook for starting new EGS Projects

Chapters

	Introduction	Tasks and targets and general status EGS-PMDA
Project planning	Generic project	• Principal **milestones** within the whole life cycle of a EGS plant • **Data Matrix (XCEL)**: Data requirement for each project phase • **Task Matrix**: First point of need of a specific data set • Information to the data sets
	Index of Suppliers	Register of suppliers (XCEL)
Sources of Know-how	Collected Experiences	Databases (ACCESS) • Fenton Hill : Literature • Rosenmanowes : Literature, Information to data • Soultz-sous-Forêts: Literature, Information to data
	Bibliography	EGS literature database (EndNote)



Resultat der Diskussion (Pisa):

- Der EGS-PMDA soll so bekannt gemacht werden, dass neue, auch bislang ausserhalb der bestehenden geothermischen Gemeinschaft stehende Teams Zugriff darauf haben.

- Die Publikation soll über das Internet erfolgen. Die geeignete Webseite(n) muss/müssen noch evaluiert werden.

- Der EGS-PMDA soll am World Geothermal Congress 2005 am Stand der IEA-GIA publik gemacht werden.

- Da der EGS-PMDA vor allem auch als Unterstützung für den Neustart von neuen Projekten vorgesehen ist, sollen generische ökonomische Informationen zu einem nächstmöglichen Zeitpunkt darin integriert werden.

BEILAGE 4

Präsentation am Annex III-Meeting am National Institute of Advanced Industrial Science and Technology AIST in Tsukuba/Japan

IEA Annex Task III meeting at Tsukuba 2004

Tsukuba AIST West, number 1 conference room, 2F

9:30-9:45 Introduction
Isao MATSUNAGA

Subtask B - Application of Technology of Conventional Geothermal Energy to Hot Dry Rock Technology

9:45-10:15 US DOE Research, Joel RENNER
10:15-10:45 The Coso/EGS Project—Recent Developments, Peter ROSE

10:45-11:00 **-Break-**

Subtask C - Data Acquisition and Processing
11:00-11:30 EGS-PDGM, Thomas MEGEL

Subtask D - Reservoir Evaluation
11:30-12:00 Review of The HDR Development at Hijiori Site. Tsutomu YAMAGUCHI

12:00-12:15 Preparation for the annual report, WGC2005, closing remarks, Isao Matsunaga

Status EGS-PMDA

IEA - GIA, Annex III, Subtask C (Data Acquisition and Processing)

1. EGS-PMDA: What is it?
2. Status/Plan 2004
3. Outlook 2005 - ...

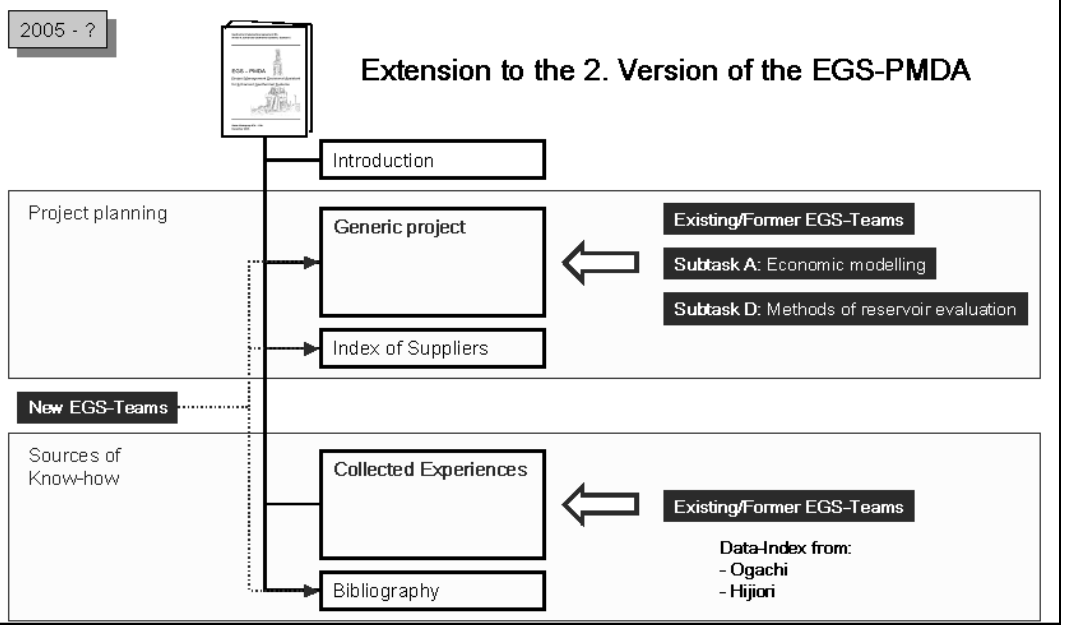
Th. Mégel, GEOWATT AG, CH-Zürich
Leader Subtask C (2003 -)

AIST, 18. November 2004

•••

1. EGS-PMDA: What is it?
2. Status/Plan 2004

3. Outlook 2005 - ...

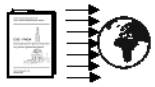


BEILAGE 4

1. EGS-PMDA: What is it?
2. Status/Plan 2004
3. Outlook 2005 - ...TODO

GEOWATT AG

Now TODO: Dissemination of the EGS-PMDA



1. To define/do the **advertising** for the dissemination process
2. To define the **reproduction**, costs and payment

Now to decide: 2. Version of the EGS-PMDA

1. To decide whether an adapted extraction of the **Subtasks A+D** should be integrated, by who and how
2. To decide whether to form an **Int. Workgroup** EGS-PMDA