International Collaboration involving New Zealand through the IEA Geothermal Technology Collaboration Programme

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ABSTRACT

New Zealand was a founding participant in the International Energy Agency Geothermal Technology Collaboration Programme (IEA Geothermal TCP) when it was established back in 1997. The 16 participants in IEA Geothermal meet regularly to share and discuss technology and policy advances, and to facilitate information dissemination fostering the uptake of geothermal energy across the globe. Since 1997, GNS Science has represented New Zealand on the Executive Committee (ExCo). New Zealand members and alternates have been active in many leading roles within Tasks and Working Groups. In a separate contracted role GNS Science also operates the Secretariat for IEA Geothermal, with the current contract expiring at the end of June 2028.

The Geothermal TCP puts in significant effort to advance technologies and appropriate policy that will enable greater utilisation of geothermal energy in nations across the globe. This is particularly relevant as nations transition to low carbon energy as part of their net zero 2050 energy transitions. The paper will summarise pertinent aspects of the work undertaken.

Three Tasks currently underway that are particularly relevant for New Zealand are a:

- Geothermal Gas Management Task
- Wider System Benefits of Geothermal Energy Task, and
- Superhot Rock Geothermal Task.

The paper canvasses aspects of these Tasks and identifies the Task leaders. This provides a connection point should there be an interest in actively becoming involved in any of them.

1. INTRODUCTION

The paper canvasses some of the 28-year history of IEA Geothermal, the history of New Zealand's involvement, with the Institute of Geological and Nuclear Sciences (IGNS, re-branded GNS Science in 2006) playing a significant role in the operation of the organisation, and current Task activity which is open to New Zealand organisations or individuals to join.

2. IEA GEOTHERMAL

The International Energy Agency Geothermal Technology Collaboration Programme (TCP), referred to as IEA Geothermal or the Geothermal TCP, promotes international cooperation in the geothermal sector linking agencies, organisations, industries and geothermal experts in research and technology, producing authoritative information on geothermal energy and documenting best practices. Activities focus on shared Task activity, and sharing results and information gained from participant members' government and industry geothermal programmes.

The organisation was established on 19th June 1996 as a TCP by the Governing Board of the International Energy Agency Paris (IEA). The founding Implementing Agreement (IA) document was signed by the European Commission, Japan, New Zealand, Switzerland, the UK and the USA on 7th March 1997.

At the time of NZGW 2025 the programme will be well into its 28th year of operation under Implementing Agreements formally mandated by IEA Paris. IEA Paris periodically reviews and renews a TCP's mandate for a specific time period (terms). IEA Geothermal is into its sixth term with Table 1 below identifying the mandated term periods.

Table 1: IEA Geothermal mandated terms with start and end dates.

Term	Start	End	Years
1	7 March 1997	6 March 2002	5
2	6 March 2002	31 March 2007	5.1
3	1 April 2007	28 February 2013	5.9
4	1 March 2013	28 February 2018	5
5	1 March 2018	28 February 2023	5
6	1 March 2023	29 February 2028	5

TCP membership is as a Contracting Party, a Sponsor or Limited Sponsor. Contracting Parties include the European Commission, governments, and parties designated by their government. Sponsor members are organisations such as an industry organisation or a national association that chooses to belong in their own right, without requiring government designation.

IEA Geothermal is managed by an Executive Committee (ExCo) comprising a member and alternate from each participant organisation. The 16 current participants are identified in Figure 1.

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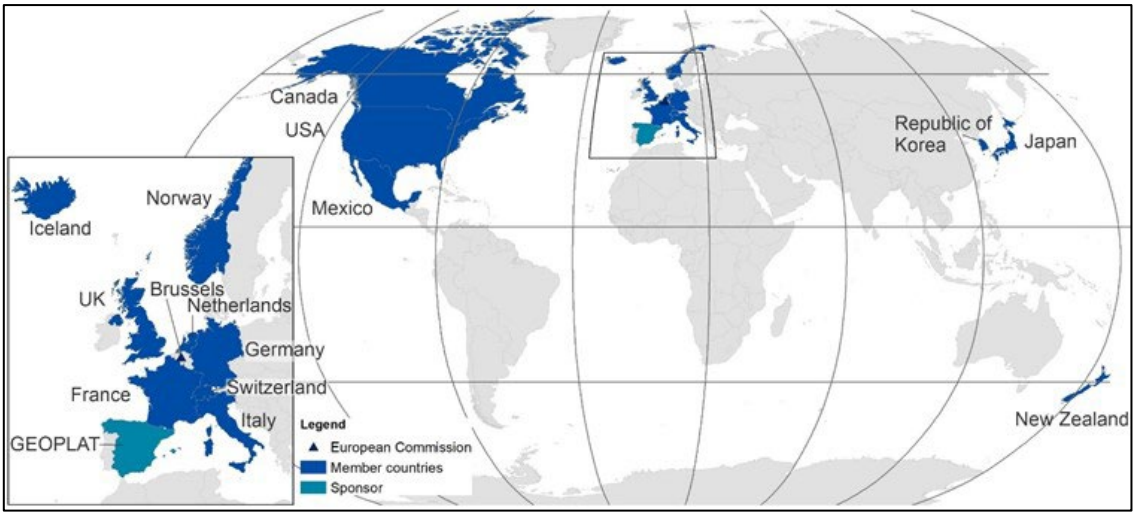

Figure 1: IEA Geothermal participant member countries in blue, the European Commission in Brussels, and GEOPLAT, Spain, the sponsor organisation, shown in turquoise.

Participants pay their own expenses associated with participation in the ExCo and Task activities. They also contribute to the common fund that funds operation of the TCP secretariat.

The Executive Committee meets twice yearly and often holds symposia, workshops or other meetings in conjunction with the committee meetings.

2.1 TCP Background

TCPs are mandated to share knowledge and information, accelerating energy technology innovation, assisting nations to meet energy and climate goals, enhancing energy security, and supporting economic growth. The multilateral technology collaborations are established through the IEA Implementing Agreement framework where networks of professionals work together. There are about 40 active TCPs, involving more than 6000 experts across 50 countries, where stakeholders from the public and private sectors share knowledge and work collaboratively to deliver effective outcomes to energy and climate challenges. The breadth of expertise which can be accessed for relatively modest cost by nations and organisations is a significant asset for the global community. More information on the various TCPs is available from the individual TCP websites accessible through the IEA TCP webpages.

2.2 IEA Geothermal History

IEA Geothermal has documented its history through papers prepared for the World Geothermal Congresses; 2005 (Mongillo et al 2005), 2010 (Mongillo et al, 2010), 2015 (Mongillo and Bromley, 2015), 2020 (Carey and Wissing, 2020) and 2023 (Carey and Yasukawa, 2023).

In 2025, an historical compilation was jointly prepared by Samantha Alcaraz, Chris Bromley and Brian Carey (Alcaraz et al, 2025a) to record highlights through to the end of the TCP's 25th year of operation. This document is accessible through the IEA Geothermal website (URL Link).

2.3 Web Presence

2.3.1 Website

An important part of the IEA Geothermal contribution to the international geothermal sector and the uptake of geothermal energy globally is the provision of information available from the IEA Geothermal website. The website contains information on TCP activities, provides access to geothermal data, publications, IEA Geothermal workshops and symposium presentations and details of upcoming events.

2.3.2 Social Media

The IEA Geothermal LinkedIn channel is used to disseminate information and opportunities that members of the geothermal sector may be interested in participating in. Readers can follow the channel to receive regular updates directly to their LinkedIn account.

2.3.3 YouTube channel

The IEA Geothermal YouTube channel is used to post videos from online webinars and videos of presentations from some of our workshops and symposia.

3. NEW ZEAND'S INVOLVEMENT

As noted above, New Zealand was a signatory to the 7th March 1997 founding IA document. The Institute of Geological and Nuclear Sciences (IGNS) was designated by the New Zealand Government to represent New Zealand's interests on the TCP. Sandra MacFarlane signed the IA document for New Zealand.

Activity commenced at the first Executive Committee meeting held on the 10th March 1997 in Sendai, Japan, where New Zealand was represented by Trevor Hunt from IGNS, Wairakei Research Centre.

Annex 1 (later Working Group 1) on Environmental Aspects was established at the Sendai meeting with Trevor Hunt as the Task leader. Chris Bromley took over leadership of the Annex at the 8th ExCo when he became the NZ member.

3.1 Official New Zealand Members and Alternates

Table 2 records the members and alternates for New Zealand and the Executive Officer positions held by New Zealanders through the years.

Table 2: NZ Members and Alternates, and Executive Officers

Member		
Trevor Hunt	10/3/1997	8/3/2002
Chris Bromley	6/11/ 2002	ongoing as at November 2025
Alternate		
Craig Finch	2002	
Colin Harvey	1/3/2003	1/5/2012
Brian Carey	1/3/2014	17/8/2015
Anya Seward	26/2/2025	ongoing as at November 2025
Geothermal TCP Executive Officers		
Chair		
Chris Bromley	23/3/2007	31/12/2015
Vice Chair		
Chris Bromley	1/1/2016	31/12/2021

Details of the New Zealand attendance at the Executive Committee meetings has been assembled into an historical record from the meeting minutes and these, along with some other notes are included in tabular form (URL Link to Table).

3.2 Administrative Support

During the 1st Term the administrative work of the TCP was performed on a voluntary basis by the ExCo participants. As the activities grew the ExCo established a Secretariat to provide administrative support for the group with the expenses funded from member contributions.

3.2.1 Executive Secretary

At the 9th ExCo, March 2003, the IGNS bid to provide Secretariat services based at the Wairakei Research Centre, New Zealand, was accepted, with Mike Mongillo leading the secretariat as the Executive Secretary. He fulfilled this role for 12 years from 14th March 2003 to 17th August 2015.

Sophie Pearson-Grant provided support for the Secretariat commencing August 2014 through to November 2021, including website support, annual report editorial functions and work associated with conference booths.

Brian Carey commenced as Executive Secretary on the 18th August 2015 and, as at the time of this paper, is providing on-going support for the secretariat in that role.

Jan Carey provided secretariat support for ExCo meetings, taking minutes at the 34th to 48th Executive Committee meetings.

Since 1st March 2023 the Executive Secretary role has been co-shared by Brian Carey and Samantha Alcaraz.

The Executive Secretary can be contacted by email iea-giasec@gns.cri.nz.

4. Common Fund Management

A common fund was created in 2002 to support secretariat services, including the Executive Secretary role established in March 2003. It was initially set up during the 7th ExCo meeting on the 8th March 2002 with a US-DOE contribution of USD 25,000, managed by the National Renewable Energy Laboratory (NREL) in Colorado, USA. On the 20th September 2012, at the 28th ExCo, the US-DOE announced it could no longer support NREL as the fund custodian.

GNS Science took over the common fund account custodian role in March 2013. By that time, the common fund account held over USD 240,000. GNS Science has acted as the account custodian for the TCP since then.

4.1 Funding for NZ membership in IEA Geothermal

Funding New Zealand's common fund contributions has changed through time.

From 2003 to 2011 there was a shared funding arrangement with Ministry for Economic Development (now MBIE) contributing 50%, MB Century and IGNS/GNS Science contributing the balance.

From 2012 to 2024 MBIE paid 100% of the NZ common fund contribution. GNS Science has paid the full 2025 contribution.

5. TCP ACTIVITIES

The TCP's activities are guided by core principles of collaboration, data and knowledge sharing, fostering innovation and technology development. Collaboration within IEA Geothermal provides members with valuable opportunities to engage with, benefit from, and contribute to the international geothermal community.

Over the past 28 years, IEA Geothermal activities and tasks have varied in response to the interests and needs of participants.

5.1 Data and Information

Sound and timely statistics are important to inform decisions, policies and expenditure. IEA Geothermal holds a repository for Geothermal Data that is regularly updated with trends analysed and outputs reported through the IEA Geothermal website (link to reports). Josef Weber from Georg-August-Universität Göttingen University manages this work for IEA Geothermal.

5.2 Symposia and Workshops

IEA Geothermal is active in partnering with other organisations in running symposia and workshops. More detail on recent symposia and workshops can be found in

Alcaraz et al (2025a) and Alcaraz et al (2025b). The events are open, usually free of charge to participants and once completed presentations from the events can be downloaded from the Workshop Presentation webpage seeking to enable widespread dissemination of the information.

5.3 Annual Reports and Other Publications

Participating members and IEA Geothermal produce Annual Reports which cover activity that has occurred on a calendar year basis. These publicly available reports can be downloaded from the Annual Report page or the individual Member's page on the IEA Geothermal website.

On the 1st April 2025 the TCP presented its mid 6th term report to the IEA Renewable Energy Working Party that canvassed TCP activities since the 1st March 2023 (IEA Geothermal, 2025; link).

In late 2024, IEA Paris published The Future of Geothermal Energy Report (IEA, 2024), which highlights the significant potential of enhanced geothermal systems (EGS) and closed loop advanced technologies. Brent Wanner, an author of the IEA report, presented a keynote address to the 10th April 2025 Deep Geothermal Energy Workshop in Paris organised by IEA Geothermal and AFPG. His presentation and video recording can be found on the workshop webpage.

5.4 Working Group 1: Environmental Impacts

New Zealand has taken the leadership role in Annex 1 / Working Group 1 since this workstream was accepted at the 1st ExCo meeting in March 1997.

The objective was to determine the environmental effects of geothermal development and provide methods to avoid or minimise their impacts. Progress with collaborative research outputs on a variety of environmental and social aspects were summarised in World Geothermal Congress proceedings of 2010, 2015 and 2020 (e.g. Bromley et al, 2020), and four Special Issues of 'Geothermics' (2005, 2010, 2014 and 2021). These Special Issues, dedicated to articles on environmental topics, were proposed and edited by Working Group 1 members.

Collaboration tasks included studying the impacts of development on natural features, the problems associated with discharge and reinjection of geothermal fluids and gas emissions, methods of impact mitigation, and how to develop sustainable utilisation strategies. Progress can be tracked through the IEA Geothermal Working Group 1 webpage and references.

One of the subtasks addressed 'Resource Sustainability'. Summaries of the joint work undertaken in this subtask were presented in conference papers by co-leaders Gudni Axelsson and Chris Bromley between 2006 and 2020. The outcomes from assessments of resource sustainability and capacity, were also incorporated into international efforts to address climate change mitigation for the IPCC (Bromley et al, 2010). Development progress challenges and forward projections also helped inform a geothermal road-map prepared for the IEA in 2011 (Bromley and Beereport, 2011; IEA, 2011).

Another environmental subtask originally addressed the effects of 'Induced Seismicity' as an environmental and social concern. A series of three international workshops were organised between 2005 and 2009 to discuss the issues related to fracture creation for EGS. A protocol for managing EGS induced seismicity was prepared by this group of participants (Majer et al, 2008). As a result of growing interest, the subtask was upgraded to a full Working Group (WG11) in 2010. Collaboration activities and meetings with participants of IPGT (International Partnership in Geothermal Technology, involving USA, Switzerland, Australia and New Zealand) led to joint working group activity between 2010 and 2014 which resulted in a 2014 draft 'White Paper' on the topic. Ongoing activity was latterly incorporated into WG13 Emerging Geothermal Technologies as a subtask in 2020. Efforts were focussed on mitigating the adverse effects of induced seismicity while enhancing its benefits by optimising production and injection permeability. A summary of these efforts, with respect to induced seismicity in conventional geothermal operations, is provided in Bromley (2020).

5.5 Working Group 12: Deep Roots of Volcanic Geothermal Systems

This Working Group / Task has been co-led by Chris Bromley (NZ) and Gudni Axelsson (Iceland) since its inception in April 2014. The focus has been on discovery and delineation of superhot geothermal resources ('deep roots') that are prospective and accessible by drilling. By advancing technology, particularly in deep drilling and well completion, the task seeks to enable reliable energy production from these superhot prospects. Tasks include assessing the potential thermal energy, the likely permeability, and the geochemical and physical conditions to be expected in these settings, through experiments in fluid-rock interactions, and advanced simulation models. More details on the accomplishments of the Working Group can be found in Bromley et al, (2025) and on this webpage.

Aspects of the collaboration efforts have recently transitioned into a new "Superhot" Task led by CATF (USA) that is described in Section 6.

5.6 Working Group 8: Direct Use

New Zealand joined Iceland, Japan, USA, the Republic of Korea, Switzerland and other countries as participants in a 'Direct Use' working group (WG8) led by Iceland in 2003. This included sharing information on ground-source heat-pump deployment, equipment performance validation and cost, barriers and opportunities, resource characterisation and data presentation through online maps. New Zealand's main contribution at this stage came through supporting an international comparison of hydrothermal chemistry and temperature from shallow bores and hot springs (Muraoka et al, 2010).

WG8 tasks were restructured in 2013 under Swiss leadership with an emphasis on innovation, communication, statistics, designs, standards and costs. New Zealand (Brian Carey) helped with the innovation and communication tasks. This resulted in Direct Use IEA-Geothermal outreach workshops in Mexico,

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Thailand, Vietnam, Germany, Austria, South Korea, Canary Islands and Costa Rica. These events are described in a summary paper of Geothermal Direct Use by Link and Carey (2020).

6. ACTIVE TASKS IN 2025

Examples of Tasks currently active include:

- **Mine Water Geothermal Energy**

  An international mine water energy expert group coordinated by the British Geological Survey was established in 2022 and the group meets to leverage global collaborations and knowledge sharing. More information can be found on the webpage. To join the group email Alison Monaghan, minewaterthermal_iea@bgs.ac.uk.

- **Underground Thermal Energy Storage**

  IEA Geothermal commenced working in this area of underground thermal energy storage in April 2023. The most recent workshop was held in Zurich on the 6th October 2025. The output from this workshop can be accessed through this link (URL Link) To become involved please connect with Stephan Bolay, Stephan.Bolay@geotest.ch.

- **Advancements in Innovative Geothermal Drilling for the Heat Transition.**

  This work, underway since 2023, and recently completed, provides an overview of novel hole-making systems and drilling automation solutions and discusses their potential impact on the geothermal industry. The work is summarised in a paper in the proceedings of the European Geothermal Congress by Reinicke et al (2025).

- **Gas Management in the Geothermal Sector**

  An international group led by Iceland is looking at geothermal gas emissions and carbon capture and utilisation from geothermal resources and power plants. This Task seeks to provide a geothermal context into the IPCC Synthesis Reporting cycle (AR7) which has activity to be reported in the period 2027 to 2029.
  To join this group email Jonas.Ketilsson@landsvirkjun.is.

- **The Wider Systems Benefits of Geothermal**

  This work stream is researching the wider systems benefits from the adoption of geothermal energy at a national level. The work is led by the UK, and various nations are developing workstreams as might be applicable to them. To connect up with this workstream, contact Sarah Robinson from the Department of Energy Security and Net Zero by emailing sarah.robinson@energysecurity.gov.uk.

- **Superhot Rock Geothermal**

  There is an international group working on moving superhot rock geothermal from a potential technology to a commercial technology. It is looking at projects that are accessing geothermal energy at temperatures above 300ºC such as the Icelandic IDDP work, Mazama at Newberry (USA) and deep drilling in the Taupō Volcanic Zone to be funded by the New Zealand government. The Task is led by the Clean Air Task Force, USA. More information is available on the IEA Geothermal superhot rock webpage. To connect up with the workstream email jhill@catf.us.

Various people from New Zealand are involved in a number of these Tasks. If you have an interest and wish to join, email the Task leader.

7. CONCLUSIONS

IEA Geothermal continues its activity around the globe, fostering the uptake of geothermal energy using the organisation's powerful collaborative networks.

New Zealand has been a key contributor to the TCP since the Implementing Agreement was established in 1997 both as a participant and through GNS Science who have operated the TCP Secretariat since 2003.

There are opportunities for any New Zealand organisation or individual to connect into Task activity that is being undertaken. More information and updates on activities can be found on the IEA Geothermal website (www.iea-gia.org) and through the linkedin channel. The Task leader should be contacted to become involved with the Task.

ACKNOWLEDGEMENTS

It is timely to acknowledge the extraordinary contribution that Chris Bromley has made to IEA Geothermal as the member for NZ for over 23 years, as an Annex / Working Group and Task leader for all of this period of time, and in the roles of Chair and Vice Chair of the TCP through the years 2007 through until the end of 2021.

Disclaimer

Views, findings and publications of the IEA Geothermal TCP do not represent the views or policies of the International Energy Agency Secretariat (Paris) or of its member countries.

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