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Barrier and Opportunity Identification in Geothermal Direct Use: A Task of Collaborative Research under IEA-GIA

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Background

- **Renewable energy technologies** generally face barriers to technology uptake, for example, immature technology, high initial cost and other obstacles such as environmental and legal constraints and lack of public acceptance, information and education (IEA, 2006).
- **For geothermal power generation** like other renewable electricity, these barriers are rather well identified and information is shared to some extent.
- **For geothermal direct use**, on the other hand, cost and other barriers are quite different from country to country and sometimes poorly identified. This is also true for opportunities and supportive measures, if any.



History of the Annex VIII Task C Questionnaire

- **September, 2005 (14th ExCo meeting)**
agreed on formulating and circulating a questionnaire
- **June, 2006**
The first circulation has been completed
- **March, 2007 (17th ExCo meeting)**
Compiled and analyzed results of answers from six participating countries was reported
- **October, 2008 (20th ExCo meeting)**
agreed on circulating revised questionnaire
- **September, 2009**
Answers from twelve countries has been received and subsequent compilation & analysis have been made



Contents of the Revised Questionnaire

Part I. General Questions on Present Status:

1. Present status
2. Development trends
3. Energy policy

Part II. Barrier and Opportunity Identification:

4. Social and political issues
5. Information channels for public awareness
6. Environmental constraints
7. Legal matters
8. Financial capacities
9. Technical and other barriers
10. Supportive measures
11. Future concerns

Part III. Other Relevant Issues:

12. International cooperation
13. Other relevant issues to be added (something like suggestions)



Countries and correspondents to the questionnaire

Country	Correpondent	Organization	Abbr.
Australia	Barry Goldstein	PIRSA	Au
Canada	Alison Thompson	CanGEA	Ca
France	Fabrice Boissier	BRGM	Fr
Hungary	Janos Szanyi	University of Szege	Hu
Iceland	Jonas Ketilsson	Orkustofnun	Is
Japan	Hirofumi Muraoka	AIST	Jp
Korea	Yoonho Song	KIGAM	Kr
New Zealand	Chris Bromely	GNS Science	NZ
Spain	Laura Calla do Brunete	APPA	Es
Switzerland	Ladislaus Rybach	Geowatt AG	Ch
Sweden	Leif Bjelm	Lund University	Se
USA	John Lund	Geo-Heat Center	US



Question 1. Present status

1.a. Summarize the present status

- twelve countries amount up to about 50 % of world geothermal direct use

1.b. Does a resource assessment about the geothermal direct use exist?

- Yes: Hu (not dynamic), Es(?), Se (more or less), US
- No: Au, Ca, Jp, Kr, NZ
- Yes and No: Is, Fr, Ch
- Note:
 - Potential values are based on quite different temperature ranges & assessment methods
 - Most countries do not single out direct use, and standard methodology (for example, geothermal heat pump) is better to be defined first



Question 2. Development trends:

What development trends are foreseeable within the next 5 years?

2.a. Other than geothermal heat pumps

- Not significant when comparing GHP
- But, Fr, Hu and Se (new district heating) and NZ (industrial use as well) expect some notable increases
- In Is, snow melting and fish farming will increase

2.b. Geothermal heat pumps and their main application

- Most of countries expect remarkable growth: for example, national targets; 340 ktoe by 2012 in Fr and 190 MWt new installation in Hu (1,400 TJ/year); 10-30% of annual increase



Question 3. Energy policy

3.a. What is a national energy master plan?:

- **Six countries (Au, Fr, Hu, Kr, NZ, Ch):** mentioned national target, although different from each other (11 to 20% of renewable by 2020 or 2030)

3.b. Is CO₂ tax already issued?

- **Yes:** Fr, Ch, Ca (only in BC for fuel sale; \$15/CO₂ tonnes)
- **Being prepared:** Au (Carbon Pollution Reduction Scheme in 2010)

3.c. Priority to indigenous & renewable options?

- **All yes except Se** (no by government)

3.d. Is geothermal explicitly mentioned?

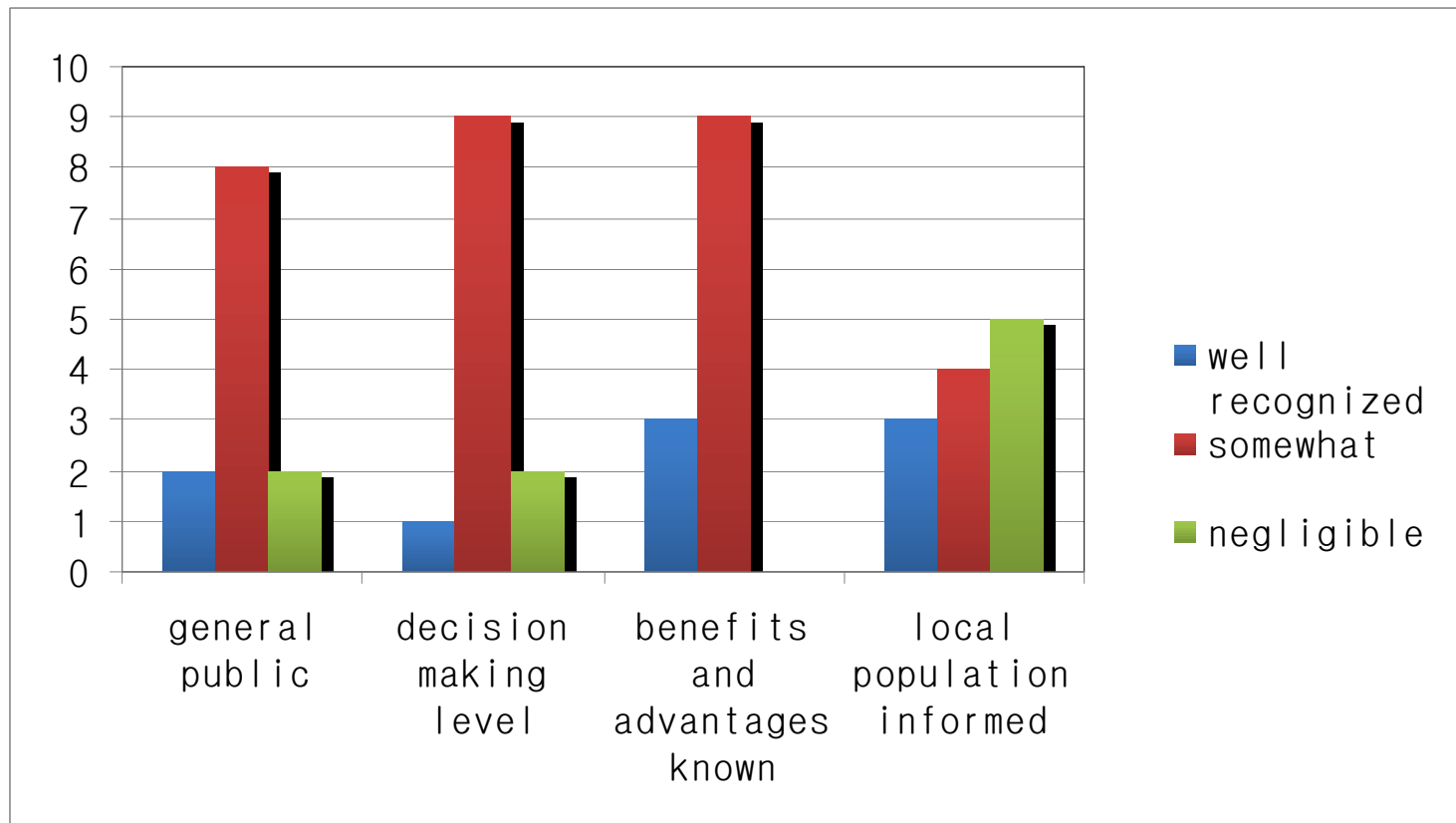
- **Explicitly mentioned:** Is, Fr, NZ, Es, Ch, US
- **One of renewables:** Au, Ca, Hu, Jp, Kr, Se (very vaguely)



Question 4. Social and political issues

4.a-4.d. Is geothermal energy recognized, and ,,,?

- **Note:** Lack of lobbying (Fr) or other renewables' powerful lobbying (Kr, NZ) is a possible or substantial threatening factor





Question 5. Information channels for public awareness

- Is there information available through the followings?
 - 5.a. In academia (public schools or university level)?
 - Yes from all (but different schemes each other)
 - 5.b. In professional societies, special conference & workshops?
 - Yes from all
 - 5.c. Through media or special events?
 - Yes to some extent: various levels including TV, Newspapers and articles
 - 5.d. Any other channels (e.g. special campaigns or demonstration centers)?
 - Public websites: Fr, Is, NZ, Ch, US
 - Demonstration centers: Hu, Is, NZ, Es



Question 6. Environmental constraints

6.a. What environmental protection legislation exists (e.g. water, landscape, noise protection)?:

- Quite different from country to country and even from state to state: but most countries include water and air quality, landscape, noise

6.b. Are environmental impact statements / reports required? (is there lower limit in MWt for this?):

- No: Au, Jp, Se
- Lower limit: Fr (>100 m; 230 kW), Is (>50 MW), Es (deep geothermal), Ch (>5 MW)
- Depending on project size: Ca, NZ, US
- Other: Hu (depend on depth and water body condition), Kr (for groundwater use, no lower limit)

6.c. Others:

- Hu: should be reinjected into the same aquifer
- NZ: Waste water disposal, H₂S emissions, subsidence and hot spring interference



Question 7. Legal matters

- Does a specific geothermal legislation exist? /7.a. part of mining?:
 - **Yes:** Ca (BC, separate, >80°C), Fr (mining), Hu (more than 20 including mining), Is (separate), US (separate; varies state by state)
 - **No:** Jp, Kr, NZ, Es, Se, Ch
 - **Yes and No:** Au (only for drilling to depths beyond 1 km)
- 7.b. What licenses are required?/7.c. Licensing Authority?:
 - **Drilling permit only:** NZ (Regional Council), US (state departments on energy or resources related)
 - **Utilization, Development and other permits:** Ca (BC Ministry of Energy, Mines and Petroleum Resources), Fr (state), Hu (Environmental and Mining Bureau), Is (three steps depending on licenses), Es (Mining, Hydro, Environmental)
- 7.d. Is direct use taxable?:
 - **Yes:** Ca (>80°C), Hu, Is (VAT 14%), NZ (royalty), Es (permitting tax), US (royalty)
 - **No:** Au, Fr, Jp, Kr, Se, Ch



Question 8. Financial capacities

8.a. Does a drilling risk guarantee exist?:

- **Yes:** Fr, Se (in some cases)
- **No:** Au, Ca, Hu, Is, Jp, Kr, NZ (tax write-off for failed well), Ch (only for power generation; used to be), Es, US (used to be)

8.b. Are there companies specialized in direct use?:

- **Yes:** Au (3 GHP Co.), Ca (for GHP), Fr (not many), Hu (more than 30), Is, Jp (for GHP), Kr (only for GHP), NZ (several small), Es (limited), Se (many), Ch (for GHP), US (only a few)

8.c. Are there financial institutions providing R&D grants or banks for loans/guarantees?:

- **Yes:** Fr, Hu, Is, Kr, NZ, Se
- **Other countries:** Government funds directly

8.d. Are there any private investors?:

- **yes from all except Ca,** but not many and mainly for larger project or for district heating, only Ch for shallow geothermal



Question 9. Technical and other barriers

9.a. Technical and scientific?

- **No:** Is, Fr, Jp, Se
- **Lack of subsurface information such as hydrogeologic and thermal properties:** Ca, Kr, NZ, Es, Us
- **Others:** Hu (reservoir usage, lack of long term security), Es (high investment cost), Ch (location problem in some cantons)

9.b. Competition by other energy supplier?

- **Natural gas:** Au, Ca, Fr, Hu, Kr, NZ, Ch (low oil price as well), US
- **Others:** lobbying from other renewables (Kr, NZ), cheap electricity, LPG and other heating fuels such as fire wood (NZ), electrical or oil heating subsidized in 'cold areas' (Is)



Question 10. Supportive measures

10.a. Are there governmental supportive measures? (pilot and demonstration objects, subsidies)?:

- **Yes:** from all except USA through subsidies for GHP (Au, Ca, Jp, Kr, Se) or for R&D, feasibility study or investigation (Fr, Hu, Is, NZ, Ch)

10.b. Are there electricity rebate (e.g. for heat pumps) by utilities?:

- **Yes:** Hu (2009 for GHP), Ch (some cantons)
- **No:** Au (to be added), Ca, Fr, Is, Jp, Kr, Nz, Es, Se, Us (used to be)

10.c. Any other supports (tax incentives, royalty exemptions, guaranteed take over)?:

- **Yes:** Fr (lower VAT), Es, Se (direct financial support, but not on regular basis), US (tax credit for GHP)
- **No:** Au, Ca, Hu, Is, Jp, Kr, NZ, Ch (used to be)



Question 11. Future concerns?:

(difficult to summarize)

- What should be done to further develop geothermal direct use in your country?
- 11.a. Political and governmental support (e.g. tax or subsidy)
- **Subsidy, tax write-off, electricity rebate, and risk guarantees:** Au, Ca, Fr, Kr, NZ, Es, US
 - **Others:** 'Green heat' label (Ch), simplified permit process (Es), new Act specific for geothermal (Hu), pilot project (Ca)
- 11.b. Point of view of Technical and/or instrument
- **Establishing Engineering standard or qualification:** Kr, Ch, Es
 - **Resource assessment / new development:** Ca, Fr, Is, Kr, NZ, US
 - **Using abandoned oil/gas well:** Hu, NZ
 - **Others:** GHP(Is), cascade utilization of hot spring water (Jp)
- 11.c. Social/economic point of view?
- **Better public relation, education and promotion:** Ca, Kr, NZ, Es, Ch, Us
 - **Others:** environmental concern (Fr, NZ, Se), industry nurture (Au), cost reduction (Hu, Kr), snow melting, greenhouses and for fish farming (Is)



Question 12. International cooperation

- In what R&D framework is your country active?
 - Most of countries: IEA-GIA
 - European Countries: EU Framework
 - Others: Geo-Heat Center



Question 13. Any other relevant issue to be added?

- **Hungary:** Communities are open to apply geothermal resources for district heating. Consequently, there are some municipalities where the system is currently in planning or realization phase.
- **USA:** We need to do a better job of publicizing geothermal energy - its benefits, it's used 24/7, as a domestic resources and its benefit to greenhouse gas emissions. Too often, only solar, wind and biomass are listed as renewables. With the increased in GHP, that can be installed anywhere in the world - geothermal direct use is now possible worldwide - and we should make that known.



Discussion, Conclusions and Suggestions

- **Direct use prospect:**
 - Geothermal heat pump installation is expected to increase more than 10% every year
 - Other types of direct use will also increase but with much lower rate

- **Technological problems to be solved:**
 - Method of direct-use resource assessment should be designed (including potential for GHP?)
 - It should include subsurface information as various as possible to remove technical barrier, if any
 - Engineering standard and qualification scheme are better to be devised with help of various available sources (subject of Task E) ⇒ important for nurturing small business



Discussion, Conclusions and Suggestions (continued)

- **Supportive measures:**
 - Government support types (e.g. subsidy, tax credit, electricity rebate, and so on) should depend on each countries' development stage and legal system as currently those are
 - But, nevertheless, we may need to categorize those and better to prepare a best suited proposal and corresponding outcome or prospect ⇒ **especially important to decision makers**

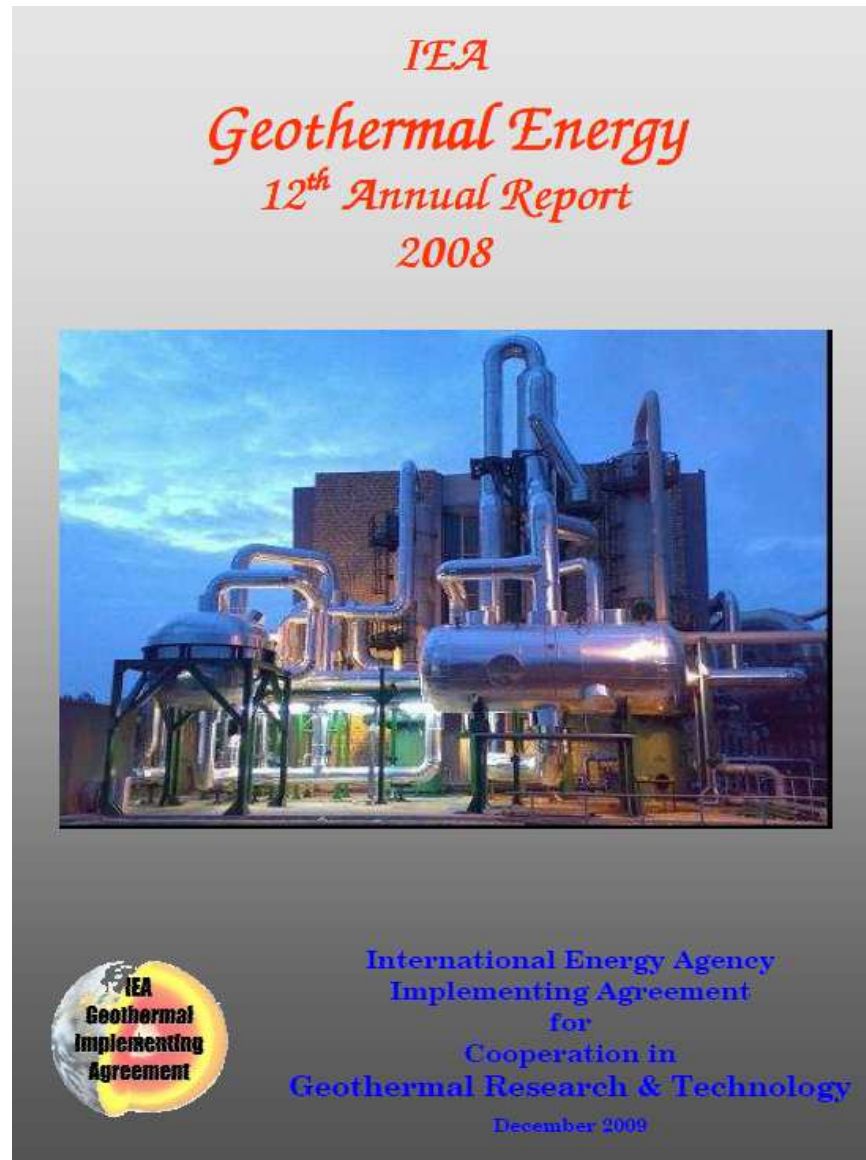


Discussion, Conclusions and Suggestions (continued)

- **Public relations and information to decision making level:**
 - Although it is getting better, geothermal is still less known to public than other RES such as wind, PV, bio, and so on
 - On the decision making level, furthermore, lack of lobbying or powerful lobbying from other RES may be a threatening factor against making geothermal wide spread
 - So, we need to do better job of publicizing the geothermal energy with emphasis on its indigenous and ubiquitous nature ⇒ should devise effective tools such as demonstration center or media program
- Of course, further survey on other countries those are active in direct use such as China, Germany, Poland and Turkey will definitely widen and deepen our understanding and perspective



Thank you for attention!



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