

**Joel Renner**  
**Comments on IPCC Geothermal Paper**  
**(via e-mail; received: 8 June 2008)**

Comments from J. L. Renner

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General comments:

It is difficult for me to decipher when EGS resources are included in resource estimates and when not (see additional comments below). Many of my comments are somewhat nit picking to some extent and are probably a result of English as second language for many of the authors.

The tone and the actual writing confuse me in regard to EGS. I never quite know whether they are referring to improved “conventional” hydrothermal technology or EGS when they make their projections of future production. In general I believe that they were just somewhat careless in differentiating. Or, perhaps they don’t really include EGS in the numbers although it is mentioned in the text. This is a group of authors who don’t seem to include binary production within the realm of conventional geothermal technology so they may not believe in including EGS as a potential resource

It think that regardless of whether or not you believe that the hot dry rock end of the EGS spectrum will be developed you should at least say that there could be some huge amount of possible resource out there if technology is developed. They should have been much more careful in delineating just what is hydrothermal; i.e. that which can be developed without stimulation.

I think that it will be more difficult to develop EGS, particularly the closer we get to the HDR end of the spectrum, than the MIT team may think it will be. But having said that, the authors of the current article should have used a much larger potential resource number and then provided any caveats they desired.

P 1 Abstract

They state that up to 140 GWe is available with advanced technology and then go on in next sentence to mention EGS. They should have clarified that the 140 refers to conventional hydrothermal – at least that’s what I think they meant. Or did they mean conventional plus EGS?

P 5 Paragraph just before section “Geothermal Resources”

“...only in areas where thermal water is concentrated...” This is confusing they really mean where sufficiently hot fluids were found with sufficient rates of production since the point they seem to be making is that lower temperatures are now economic in certain areas. Also this is a

matter of economics not technology. Binary plants have always been workable at these lower temperatures they just weren't economic. And heat pumps! They are only "emerging" in the sense that their use is increasing rapidly. They have been used for decades, particularly in commercial applications.

P 6 top of page

They are a bit careless with the temperature at depth calculations. 90 to 100 should be 90 to 105 and for 1 km I would have said 40 to 45. I'm not sure average gradient is quite as high as they state. I also don't like the use of "dry" rock at bottom of page 5, but that's picky for the assumed audience for the paper. To be correct technically they should differentiate between convective and conductive heat transfer.

P 6 paragraph starting Bertani

As written I believe that they imply the MIT report includes an estimate of German EGS potential. I don't think that Tester's group did that. Presumably the German number comes from Paschen et al.

P 6 figure 4 and discussion of the numbers

They don't really make the distinction between hydrothermal (presumably that's where the 140 GWe comes from) and what might be available from EGS. Confusing.

P 8

The discussion of low temperature systems is a bit confusing

P 10 last paragraph

Refer to most temperature of resources used for electricity as greater than 150. Earlier they used 180

Page 11

They seem to consider that dry steam and flash plants are "conventional" and binary is thus not conventional. That may be their perspective but I would hardly say that it is true! They also simplify the general difference between conventional binary and Kalina. It's not just ammonia-water. Kalina also includes recuperative heating.

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