

What is geothermal Potential?

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1. GEOTHERMAL POTENTIAL

Different authors have performed different estimation of the geothermal potential, both for electricity generation and the direct uses. The IGA is making a compilation of all the existing data, in order to establish a “confidence interval” of the minimum-maximum expected potential for the geothermal exploitation.

The published data are the following:

- [A] Fridleifsson, 1999, quoting Bjornsson, 1998
- [B] Gawell, 1999
- [C] Stefansson, 2000 (2)
- [D] Stefansson, 2002, quoting WEA, 2000
- [E] Cataldi, 1999

Reference [A]:

Useful Accessible Resource Base for electricity production: 12,000 TWh/y. This value should be compared with present annual production of 44 TWh/y in 1997, and with the forecasting to year 2020 with the present growth rate: 318 TWh/y (with a capacity of 58 GWe)

Useful Accessible Resource Base for direct uses: 600,000 EJ/y. Present value 38 TWh/y in 1997, forecasting for 2020: 141 TWh/y (thermal capacity 37 GWth).

Reference [B]:

With the present technology the world potential should be between 35 and 72 GW of electric generation capacity. With enhanced technology (permeability enhancement, drilling improvements) this range could be 66 and 138 GW.

The present installed value (1998) is around 8 GW. Taking into account the effective availability factor, the geothermal electricity could reach the 1,089 TWh/y value with the maximum quoted capacity.

Reference [C]:

The world geothermal potential for electricity generation is about 22,400 TWh/y; the direct uses are split into two categories: low and high temperature. The first one is >1,400 EJ/y (>392,000 TWh/y), while the second is four time less: 400 EJ/y (112,000 TWh/y). The present (1996) world electricity generation is 12,500 TWh/y and the total world energy use is 396 EJ/y (109,880 TWh/y).

Reference [D]:

Present (from WGC2000 data) value for the geothermal energy is 49 TWh/y for electricity (from 8 GW of installed capacity) and 53 TWh/y for direct uses (from 15 GWth of installed capacity).

The geothermal resources suitable for electricity and direct uses are 5,000 EJ/y. If 10% of these reserves can be economical exploited, this value of 500 EJ/y could be utilized 1/3 for electricity generation and the remaining for direct uses.

In 1999 the total world energy consumption was 407 EJ/y.

Reference [E]:

The Accessible Resource Base is $140 \cdot 10^{24}$ J; the resources are 5,000 EJ; the reserves are reduced to 500 EJ. Finally the “reserve on land = RoL”, which can be economically exploited for all the geothermal energy utilization are 370 EJ: it is twice the total production of oil in 1996. Of this RoL 2/3 can be accounted for low temperature (<150°C), 1/3 for high temperature, suitable for electricity production.

With 100 years of industrial exploitation the rate per year can be calculated at 1.2 EJ/y for electricity and 2.5 EJ/y for direct uses.

These values are sensibly smaller than the other authors, and should be considered as referred to a refined extrapolation of 2020 capacity.

2. Conclusion

All the references (rounded values) are collected together in the following table.

	Electricity			Direct uses		
	GW	TWh/y	EJ/y	GWth	TWh/y	EJ/y
World Energy Consumption (estimated 1996)		12,000	43		112,000	400
WGC2000	8	49	0.18	15	53	0.19
Extrapolation to 2020	42	300	1.1	40	140	0.50
Potential [A]	1,700	12,000	43	48,000,000	170,000,000	600,000
Potential [B]	140	1,000	3.6			
Potential [C]	3,100	22,000	79	160,000	>560,000	>2,000
Potential [D]	5,900	42,000	150	28,000	98,000	350
Potential [E]	46	330	1.2	190	670	2.4

The range of electrical and direct uses potential can be from the following table (rounded values):

Electricity				
	today	Extrapolation to year 2020	Minimum	Maximum
TWh/y	50	300	1,000	40,000
GW	8	40	140	6,000
Direct Uses				
	today	Extrapolation to year 2020	Minimum	Maximum
TWh/y	50	140/700	100,000	170,000,000
GWth	15	40/200	30,000	50,000,000

3. REFERENCES

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