

GEOHERMAL WELL PRODUCTIVITY: WHY HOTTER IS NOT ALWAYS BETTER

Subir K. Sanyal, James W. Morrow, and Steven J. Butler
GeothermEx, Inc., 5221 Central Avenue, Suite 201, Richmond, California 94804

Keywords:

Well productivity, power capacity, pumped well, geothermal well, EGS well, well capacity

ABSTRACT

This paper investigates the practical range of net power capacity available from conventional and Enhanced Geothermal System (“EGS”) wells as a function of temperature. For a geothermal resource temperature up to about 190°C, which is the operating temperature limit of presently available downhole pumps, wells are typically pumped and power is usually generated in a binary-cycle plant, and in rare cases in a flash-cycle or hybrid-cycle plant. In this temperature range under the current state of downhole pump technology, the net MW capacity of a well has a practical upper limit of about 7.3 MW, irrespective of how high the well’s productivity index is. This capacity limit cannot be improved unless technology can be improved to allow pumping at a higher rate than the present practical limit of about 160 l/s (2,500 gallons per minute); improving the temperature tolerance of pumps, by itself, will not increase this capacity limit. For resource temperatures greater than 190°C, wells must be self-flowed, and power is generated from such wells in a flash-cycle or hybrid-cycle plant. In the temperature range of 190°C to nearly 220°C a self-flowing well’s net power capacity (irrespective of its productivity index) is less than the maximum of 7.3 MW available from a pumped well. Above 220°C, the net power capacity of a well increases rapidly with increasing temperature and productivity index, and the practical upper limit is determined only by well design; the larger the well diameter the higher is the upper limit. The maximum net power capacity available from an EGS well depends on reservoir depth and local temperature gradient, the optimum depth being increasingly shallower for higher temperature gradients. The trend of decrease in the optimum depth with temperature gradient applies whether this optimum is defined in terms of the maximum net MW capacity of a well or the minimum drilling cost per net MW capacity.

[For a copy of this paper please e-mail us at mw@geothermex.com](mailto:mw@geothermex.com)