

WELL PRODUCTIVITY ENHANCEMENT BY DRILLING MULTI-LEGGED WELLS - A QUANTITATIVE ASSESSMENT

Sanyal, S.K., Morrow, J.W., Henneberger, R.H., and Granados, E.E.
GeothermEx, Inc., 5221 Central Avenue, Suite 201, Richmond, California 94804 USA

Keywords:

Forked well, multi-legged well, multilateral well, geothermal well productivity, well productivity enhancement

ABSTRACT

This paper presents an analysis of the well productivity enhancement possible by drilling multi-legged (or “forked” or “multilateral”) wells in geothermal fields at temperatures in the 100 to 250°C range. A parameter, Productivity Enhancement Factor (“PEF”), is introduced to quantify productivity enhancement; it is defined as the ratio of the downhole productivity index of the multi-legged well to that of the original hole before the forked leg was added. Assuming the original hole to be vertical, it is shown that PEF rises sharply with deviation angle of the forked leg up to about 5 degrees; beyond this, PEF continues to increase with deviation angle albeit at a slower rate. A deviation angle of 25 to 30 degrees gives the highest percent increase in PEF per meter drilling of the forked leg (for a two-legged well) or legs (for a three-legged well). PEF is not significantly affected by reservoir temperature and declines rapidly with flow time for a few weeks before the decline rate stabilizes; PEF becomes nearly constant after a year or two of flow. The tighter the reservoir rock the more effective it is, in general, to enhance well productivity by drilling multi-legged wells. PEF of a two-legged well does not exceed a value of 2 unless the skin factor in the forked leg is less than in the original hole, in which case it can reach a value perhaps as high as 2.5. A three-legged well can provide up to 50% more PEF than a two-legged well, everything else being equal. Not only does a three-legged well pose a higher drilling risk, it is less effective in enhancing well productivity per unit drilling cost. Only where the original hole and the first forked leg both prove disappointing in productivity, drilling a second forked leg may be worthwhile.

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