COST OF GEOTHERMAL POWER AND FACTORS THAT AFFECT IT

Subir K. Sanyal
GeothermEx, Inc., 5221 Central Avenue, Suite 201, Richmond, California 94804-5829 USA

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ABSTRACT

This paper presents an analysis of the sensitivity of the cost of geothermal power to: (a) capital cost; (b) operations-and-maintenance (O&M) cost; (c) make-up well drilling cost; (d) resource characteristics (well productivity and its rate of decline); (e) development and operational options (installed plant capacity, number of years of make-up well drilling, and project life); and (f) macro-economic climate (interest and inflation rates). The power cost here represents levelized cost (in cents per kilowatt-hour) over the project life, the capital cost being amortized over 30 years; any royalties, tax burden, or tax credit are ignored. A range of development sizes, from 5 to 150 MW, is considered. The economy of scale in both capital cost and O&M cost, as well as the higher productivity decline rate due to increased installed capacity, are taken into account.

Power cost is sharply reduced by maintaining full generation capacity, by drilling make-up wells, for at least the first 10 years or so following plant start-up; however, continuing make-up well drilling beyond about 20 years does not reduce power cost any further. The minimum achievable power cost is insensitive to plant capacity; it is on the order of 3.4¢ / kWh. There are significant opportunities to reduce power cost as site-specific experience is gained in resource management and power plant operation throughout the project life. Power cost is most sensitive to unit O&M cost followed by unit capital cost, interest rate and inflation rate in the decreasing order of sensitivity; it is relatively insensitive to well productivity, drilling cost per well or well productivity decline rate. The macro-economic climate has relatively minor impact on power cost. Operating small power plants beyond their typical amortization period of 30 years can substantially reduce power cost; this reduction is insignificant for plants of 50 MW or larger capacity. Power cost does not decline significantly with increasing plant capacity except in the unlikely situation of well productivity decline being insensitive to plant capacity, when it may be as low as 3.2¢ / kWh. In the unusual situation of an absence of economy of scale, power cost increases with plant capacity, the minimum achievable level being 3.4¢ / kWh. In the very unlikely situation of both well productivity decline as well as unit capital and O&M costs being insensitive to plant capacity, power cost would be on the order of 3.6¢ / kWh.

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