

ASSESSING THE FINANCIAL RISKS OF GEOTHERMAL ENERGY: A MODELING APPROACH

Kamal Golabi

Graduate School of Business
University of Pittsburgh
Pittsburgh, PA, 15260, USA

ABSTRACT

I discuss suggested alternatives for reducing the financial risks of geothermal development and propose a modeling approach to the prediction of the busbar cost, and to the evaluation of the financial options.

In recent years, geothermal energy has emerged as a promising energy source and has received serious attention from developers and potential users. Still, despite apparent environmental advantages of this resource, including its potential cost competitiveness and public acceptance, the commercial development and use of geothermal energy has been rather slow. Main impediments to the development of this resource have been financial, environmental, technical and in some cases, regulatory uncertainties. Since geothermal power is unique in that the user facility is tied to a single fuel at a single site, these uncertainties are of particular concern to potential users.

The areas of uncertainty are well known. During the last few years, several workshops and various studies have addressed potential risks and in particular, the financial risks of geothermal energy. From these discussions several viewpoints regarding the adequacy of available measures for reducing the financial risks of developing and using geothermal energy have emerged. These measures range from contractual agreements between developers and users that would place the risk of reservoir loss on the supplier, to government-sponsored insurance programs that would basically ask the taxpayers to shoulder the financial risks of developing geothermal energy. I will discuss these options and their advantages and disadvantages.

Each of these options covers risks to certain users with the possible exclusion of others, resulting in different groups having widely divergent views on the relative attractiveness and feasibility of one scheme versus another. In addition, each scheme is accompanied by either direct or indirect costs to

the potential end user whose views would be represented either by public interest groups or regulatory agencies mandated with protecting the interest of the public.

In order to evaluate the different alternatives and achieve a consensus regarding the effectiveness of these options, two central issues need to be resolved. The first issue is to arrive at a procedure that would define specific short-term and long-term goals and which would quantify the outcomes of the different alternatives. Developing a rational criterion for evaluation is essential for measuring how well any of these options meets the specified goals. I submit a procedure for arriving at such measures, and propose a modeling approach to the quantification of the most important criterion: the levelized busbar cost and its probability distribution.

I discuss how different kinds of uncertainties associated with geothermal energy development can be aggregated into a risk model. The model would consist of various submodels that relate the endogenous and exogenous uncertainties of major cost components, including the cost of plant shutdown due to unforeseen environmental and seismic hazards. It will function both as a means for integrating the various probabilistic cost components, and a method to account for the financial and economic uncertainties that affect these costs. Therefore, the modeling approach to risk aggregation is more than a tool for evaluating the different programs; it proposes that all uncertainties, whether due to seismic hazards, changes in regulations, or reservoir-induced factors, can be combined into a single measure. The effectiveness of each of the proposed programs can be measured against this model, or at least against those submodels that are affected by the particular program under consideration.

A second central question is that of developing a procedure when the values of a number of individuals, often with

Golabi

conflicting interests, are incorporated into the risk model. While there are practical problems associated with encoding the values of a single decision maker in a format required for the application of the model, conceptually, this case does not present a problem. The unresolved problem arises when either a decision maker wishes to take the values of the interested parties into account, or when the decision-making entity consists of a group of individuals with differing values. I present some thoughts on how this problem can be addressed in a systematic way.