# THE CHALLENGE OF FINANCING GEOTHERMAL DEVELOPMENT

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## ABSTRACT

A major financial commitment has been made for geothermal exploration and development by both the private and public sectors in the United States. Oil, gas and mineral companies have research and development programs for geothermal and the recent mandate on alternate energy by the administration can only accelerate them. The recent passage of the energy bill with its provisions for intangible drilling write-offs and depletion for geothermal resources has also encouraged this trend. Unlike oil and gas however, geothermal is a site-specific resource and must be developed on a prospect by prospect basis. The major customers for this energy are the electric utilities. Since their capital bases have vastly different risk and rate of return criteria from the producer companies, an impasse appears to have developed as to how to bring about commercial resource development. This paper suggests a financing tool by which this dilemma can be resolved and operating experience - the key to successful commercialization - can be accumulated as early as possible in the exploration and development process.

Since 1960, the growth and prosperity of the geothermal industry has been severely limited by its narrow development base. One reservoir alone - The Geysers - is currently operated on a commercial, cash-flow-producing basis. Only recently has it finally become apparent that other reservoirs discovered during the last few years have been realistically targeted for startup dates for commercial production and cash flow generation. Under the present approach to commercialization, it appears that an elapsed time of eight to ten years, with continuing in-ground investments during that period, is required from the date of initial discovery of a producing reservoir to the beginning of cash flow - the same lead time as may be expected for a nuclear facility. One of the major factors causing this long lead time and startup delay is the absence of an accepted methodology and business approach to the financing of the initial commercial power generation facilities on a given reservoir. Such long lead time and unnecessary delays add significantly to the gross investment, and therefore cash flow required from the project.

The financing approaches to geothermal development projects must take into account the different risk and return requirements of the resource producer and energy end-user. In addition, risk to invested capital must be minimized and the economics of the overall project should be enhanced rather than diminished by the financing package utilized. Clearly, the traditional borrower/lender relationship outlook will not serve in such an environment. What is needed here is the adaptation of proven project financing techniques into a specifically geothermal mold utilizing to best advantage all of the basic elements present in a geothermal development and utilization program.

Project financing can be defined as a project in which the lenders look solely to the economics, i.e., cash flow, of the project for the repayment of their loans. I should like to develop this theme by addressing some relevant questions:

<u>What comprises a geothermal power plant financing project?</u> The question here is one of definition. Before the developer of a given resource can realize any cash flow return on his in-ground investment, a buyer must be found who will not only commit contractually for the long-term purchase of the resource produced but also will finance the construction of the power plant conversion facilities. Without a buyer willing to do both of these things - no commercial cash-flow-producing project can exist. Both the production and utilization phases of a geothermal development project are inextricably tied together on a site-specific basis.

Given this underlying unity of resource discovery and utilization phases, one may ask why more reservoirs have not been developed on a cooperative basis between resource company and local utility. The answer to this question lies in the risk and return differential requirements of the two kinds of capital bases represented.

By its charter and public mandate, a utility cannot afford to expose its capital to risks such as proving out a previously unutilized geothermal reservoir or the drilling of dry holes. For such a highly-regulated type of company to commit its own funds for the construction of a geothermal power plant, the resource company in question would have to guarantee a reliable supply of steam of uniform quality over the useful life of the plant. After all, in financial terms, such a guarantee would accomplish nothing more than putting the long-term purchase of geothermal steam on a par with long-term purchase contracts for fossil fuels where no uncertainty exists with plant performance. If the reservoir failed, the utility would still be faced with the problem of obtaining replacement power. Such financial assurances on the part of a resource company would, however, treble or quadruple its exposure in any given project. In the case of a 55 MW plant, an in-ground investment of $15 to $20 million would be accompanied by a $50 to $60 million contingent liability. Even for the largest of companies, that represents a lot of eggs to put in one basket, not to mention putting geothermal way beyond the reach of smaller companies. Even if a resource company were willing to finance the construction of a power plant, however, it is doubtful that the company would be willing to accept the regulated rate of return authorized for the project by the presiding Public Utilities Commission (PUC). Conversely, a PUC is highly unlikely to authorize privately-owned projects to generate power priced to incorporate a rate of return higher than that allowed the local utility. Furthermore, it is unlikely to find a resource company willing to expose itself to PUC regulation.

The situation has also been complicated in recent years by the advocacy of 55 MW units as the ideal size for the initial power plant on a newly discovered resource. This point of view persists in spite of the fact that the only successful commercialization of a resource to date in the United States has taken place at the Geysers and that project started with a 12 MW unit. Although it may well prove true that a 55 MW facility will eventually provide optimum performance efficiencies and capital cost economies of scale, it appears difficult to design such a plant the first time around on a new reservoir without an accumulation of actual operating experience on a commercial basis. After all, each reservoir is essentially unique even though a number of basic traits may be shared in common with others. The structure of a commercialization scenario should not automatically include a 55 MW plant as its initial development objective. Other factors such as the time value of money, length of construction periods for units of different sizes, accelerated cash flows, and risk minimization play fully as important a role in determining the optimal size of an initial plant as theoretical economies and efficiencies. The determination of which is to be the appropriate first step in the commercialization of a given resource should be custom-tailored to the size, objectives and capabilities of the resource developer and the utility involved.

The issues relating to initial unit sizes will be dealt with in the section on "Business Development Strategy" below. For the moment, I would like to introduce a third factor - a common denominator - into the equation of resource company and utility. To mitigate the utility's risk concerns and to eliminate the need for a resource company to enter the utility business, a special adaptation of project financing called the Interim Risk-Assuming Company ("IRAC") should be applied to the project as an integral partner. In simplest terms, the IRAC would satisfy the resource company's objectives by purchasing the geothermal resource at the wellhead. It would then convert the steam into electricity for sale to the utility at the busbar on a mills/kwh generated, take-or-pay basis. In having only to buy the electricity produced, or available for production, the utility would remain with a load planning problem alone and, as a result of not having an investment in the plant itself, no risk in the reservoir. The IRAC would finance, own, construct and operate the power plant. Having defined the scope of and the partners in the project, let me now address some of the financing aspects.

Financing Options. The DOE Geothermal Loan Guarantee Program (GLGP) is the major government-supported source of financing to the geothermal industry outside of the tax-benefits recently (finally) enacted. This program allows for the financing of a variety of project structures with different timings - being in essence both a flexible and constructive format for private sector and government cooperation. In spite of the benefits it provides in reducing the reservoir risk component in financing projects and the opportunity for borrowers and lenders to establish normal industry working relationships, this program has its drawbacks for publicly-held companies, especially utilities. Default is triggered only by the failure of a specific geothermal project presumably for either reservoir or performance reasons, but such a default could have an adverse impact on the stock or bond ratings of the Borrower. This is a major consideration for incorporating the IRAC vehicle into the project financing and for that vehicle to be privately-owned by a third party. In this manner, the 75% guarantee feature can be incorporated into the financing plan. Since most prospects for commercialization in the geothermal industry concern previously unutilized reservoirs where an insurance against reservoir risk is vital to the financing of the project, I shall restrict myself to discussing those financial approaches making use of the GLGP.

We have so far defined a geothermal power plant financing project as including both the in-ground investment as well as the utilization facilities (gathering system, power plant, reinjection facilities, and transmission). In order for the project to be viably operated over its life, a significant amount of working capital and stand-by sources of financing will be required.

The 25% at-risk portion required within the framework of the loan-guarantee program, may be provided in part by some of the inground investment sunk costs consisting of the wells drilled, etc. Both the working capital as well as the balance of the unguaranteed 25% portion will have to be provided by some form of equity. A careful balance must be drawn in order to minimize the overall cost of the financing because risk capital is the most expensive type of money available. A number of successful project financing users, both in the utility and iron ore industries for instance, have made effective use of project financing to bring down the overall financial cost of the project by, among other considerations, being able to reduce the equity required to an absolute minimum. The same results are possible in the geothermal industry although the sources of the risk capital themselves will be different. Inasmuch as geothermally-produced electricity must compete in some service areas with apparently less expensive fossil-fired units, it is imperative that interest charges and return on investment outlays be minimized in order to permit the flowing through of tax benefits to effect the lowest possible net output energy cost.

The goals of an IRAC-based project financing may therefore be stated as follows:

1. Minimize the financing cost component of geothermal power generation to help provide a fully-competitive total energy cost.

2. By minimizing financing costs, provide an opportunity for the project to satisfy the rate of return criteria of the resource holder.

3. Provide a vehicle for implementing an optimal development/commercialization strategy.

In approaching these goals, the IRAC will act as a combination banker and project manager. As banker, the IRAC would hold title to the plant instead of debt instruments from the borrower; as project manager, it is responsible for making the plant available on a cost effective basis conforming to the contracts it holds with both the utility and the resource company.

Commercialization/Development Strategy. With regard to the optimization aspect mentioned above, a successful geothermal commercialization plan must proceed in prudent stages with adequate safeguards taken to ensure the protection of invested capital and long-term operational viability. A vital safeguard is the need for an adequate working capital supply to avoid collapse of the project due to temporary cash shortfalls. Three other factors should be addressed in this context: technological risk, bonding capacity (associated with cost-overrun protection), and the need for accumulating operating experience.

In the case of technological risk, a significant number of discovered reservoirs might be produced using either the flash or the binary cycle. These technologies differ with respect to cost and engineering efficiency. Use of a flash plant under such conditions will result in the application of a proven technology to an uncertain resource whereas use of the binary unit will apply an emerging technology to an uncertain resource. In order to minimize technological risk, it is obviously advisable to build the initial generating facilities on new reservoirs employing established technology.

Construction of the initial plant is itself fraught with dangers if a contractor does not have sufficient bonding capacity or is unable to provide some form of cost overrun protection. If that consideration is not addressed, the possibility of a contractor's inability to handle the job without attendant ruinous delays and wildly escalating costs will quickly doom the economic future of a project. A 2 mill/kwh price advantage over, let us say, coal, will quickly vanish if poor construction practices result in plant costs 110% of those anticipated. Selection of a major contractor attuned to the financial aspects of construction and also willing to share some of the burden of escalating costs must be the objective of the project financing. Construction audit and cost control routines will help identify and contain potential problems in a timely fashion.

Operating experience is the last of the non-financial considerations of prime importance to the successful financing and commercialization of a geothermal development program. Without reservoir production monitoring and analysis, it will be hard to assess what the actual operating and production characteristics of the field will be. Production rates, pressure, chemical composition, and temperature must all be observed with respect through time. The utilization of the resource is site-limited. Accordingly, the plant investment, once made, is irrevocable. It thus makes sense to determine what it takes to work with the resource under commercial extractive conditions as early as possible in a given development program. For the above reasons, power generation with relatively small units should be undertaken at the earliest opportunity following the discovery of a resource. Portable wellhead units (1-5 MW) can be installed on a successful discovery site within as little as six months. Semi-portable plants (10-20 MW) can be installed twelve to fifteen months after receipt of permit. By contrast, the lead time for a 55 MW plant, exclusive of the mandatory EIS review (12-24 or maybe more months), is on the order of thirty-six months. The eventual objective of a commercialization program will probably be one or a series of 55 MW plants. The interim objective of the wellhead units is to provide assurance that the 55 MW objective is being approached in an optimal and risk-free manner. An added advantage is the optimal take-down related to field development investment. The 10-20 MW interim units will provide further resource confidence while generating revenues far sooner than the 55 MW plant.

In some cases, however, substantial front-end testing and development will have taken place. Then it may be appropriate to target a 55 MW plant as the starting point for commercial power generation. Given the long lead time for such plants, one or several well-head units can be installed to generate long-term data on reservoir performance parameters. Continued success in operating such units will provide an assurance of success for the larger plant. Environmental data-gathering and assessment objectives will also be furthered by the operation of these units. In some instances, comparison tests between small flash and binary units will determine their actual comparative economic and performance advantages.

## SUMMARY

As herein established, implementing geothermal power plant financing involves treating every aspect of the geothermal process. Although the IRAC project financing concept provides the basic financial vehicle for the initial facilities on a given reservoir, its self-contained objective is planned self-obsolescence. With enough information and operating experience gathered on a specific reservoir, the point will be reached when the follow on units can be conventionally financed by the utilities themselves. Ideally, an individual IRAC will be created for each reservoir exploration and development program, and will phase out progressively as the long-term viability of the resource is proven.