



GEOTHERMAL PROJECT MANAGEMENT THE ICELANDIC APPROACH

Gestur Gíslason

Reykjavik Geothermal
Köllunarklettsvegi 1, 104 Reykjavik
ICELAND
gestur@reykjavikgeothermal.is

ABSTRACT

The road from the initial exploration of a potential geothermal resource, to an operational geothermal power plant is complex and expensive, and its success depends heavily on a sound project management strategy, based on wide-ranged expertise. The challenge of the management team is to harmonize the work of the geoscientific group dealing with the resource itself, the geothermal industry (drillers, designers, suppliers, environmental requirements etc.) and the political environment.

1. INTRODUCTION

A geothermal project, from the early exploration stage to the operation of a geothermal power plant may take years to develop, and requires a large specialized work force as well as considerable finances. To complete a large geothermal development programme the developer or owner of the project must secure a strong and focused management team, well experienced in the various specialized geothermal matters as well as in finances, energy sales, contracting etc. To harness the resource a vast geothermal knowhow is needed, but in order to reach the end of the road and complete an economical viable geothermal installation there is additional need for considerable co-operation with the geothermal industry and the political environment where the project is being implemented, including legal framework, permits and power purchase agreements etc.

2. GEOTHERMAL GREEN ENERGY

Geothermal energy is one of the most cost-competitive of all renewable energy sources (Figure 1). The average generation costs of geothermal energy are significantly lower than those of other green energy sources. Average generating costs are comparable to those of natural gas, and bettered only by those of coal. Geothermal energy and hydro energy are comparable in prices. Geothermal generating costs are mostly affected by the quality of the resource, the financing terms of initial capital expenditure, and the experience and quality of the management team.

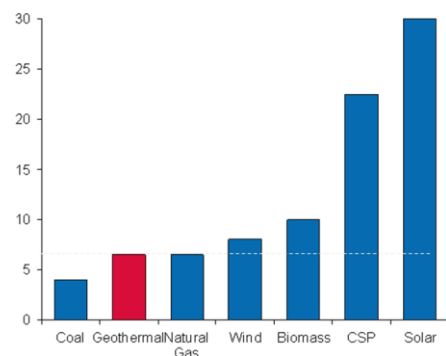


FIGURE 1: Generating Cost of Various Energy Sources. (USD cents/kWh)

In addition to the competitive cost, the capacity factor makes geothermal power production unusual among green energy sources, as it can supply base load power. The capacity factor is a measure of the stability and reliability of each energy source and the suitability of each energy source to generating base-load power (Figure 2). Among renewable energy sources, only hydro-electric, biomass and nuclear power plants are comparable to geothermal.

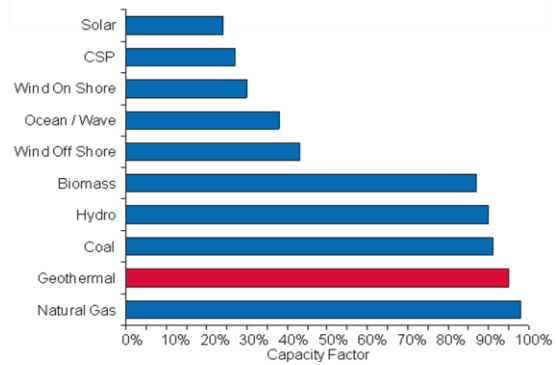


FIGURE 2: Capacity Factor of Various Energy Sources

3. THE STAGES OF THE PROJECT

A geothermal project can be described in a number of ways, concentrating on the geoscientific work, the civil work timeline etc. Commonly a geoscientist would describe a geothermal master plan as shown in Figure 3. All stated work in the graph concentrate on the geoscientific and drilling operations of the project, and it is useful to carry out these subjects to satisfy the project needs. This approach is not sufficient for the project owner or the developer of the resource. In order to complete a geothermal project in a satisfactory manner various necessary administrative, legal matters and contractual matters must be carried out parallel to the scientific work. In Figure 2, a project is described from the viewpoint of the developer/investor, turning a potential resource into an operating power plant by following a highlighted seven stage value chain. The work at hand under each stage can be summarized as follows:

1. Acquire concession rights
 - Fact finding
 - Site visit/exploration
 - Concession rights bidding
2. Resource assessment
 - Surface exploration
 - initial resource modelling
3. Framework contracts
 - Establish head of terms
 - Project agreement
 - Power purchasing agreement
 - Tax concessions
4. Exploration Drilling
 - Drill 3-5 exploration well
5. Financial closing/tendering
 - Finalize PA and PPA
 - Secure financing
 - Design power plant
6. Production Drilling/Power Plant Construction
 - Drill multiple production wells
 - Construct power plant
7. Commissioning/Operation
 - Steady state operation

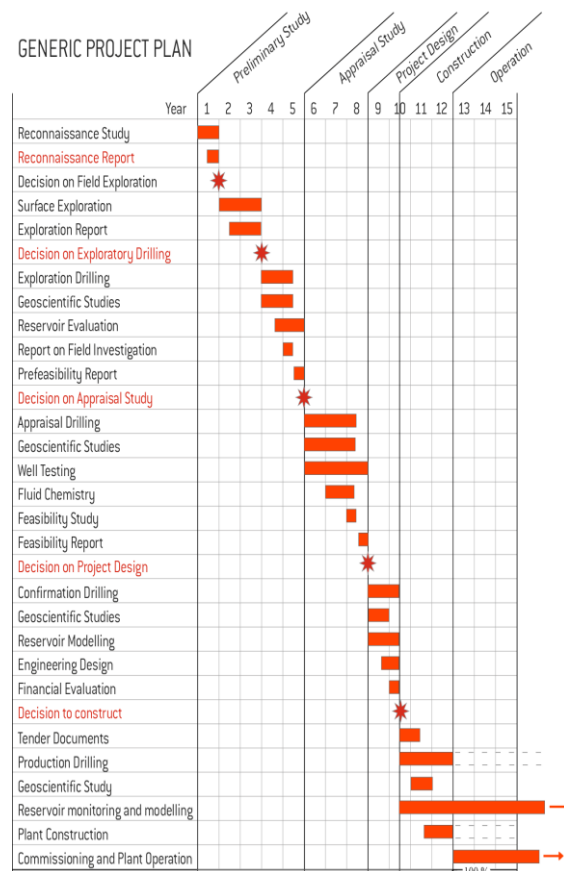


FIGURE 3: General project plan



FIGURE 4: A geothermal value chain

4. RISK MANAGEMENT

Risk management is one of the greatest challenges of a geothermal management team. The initial steps to verify the existence of an economic geothermal resource, i.e. the first deep drillholes, are expensive enterprises and the risk factor is high. This risk is one of the main barriers when it comes to attracting private investors to develop a geothermal greenfield. But the management team also has to deal with other risk factors, such as political risks, financial risk and operational risks. It can be stated that the main challenge of a geothermal management team is risk management. The management team has several tools at its hand to reduce the various risk factors that a geothermal project is faced with. Several multi-lateral organizations offer risk mitigation tools for geothermal investment in developing countries. Downside insurances are available to cover:

- Political/Country risk
- Resource risk

Political risk guaranty (insurance) is available from the Multilateral Guaranty Investment Agency (MIGA; a member of the World Bank Group) for investment projects in developing countries, covering:

- Breach of contract (e.g. non-payment)
- Transfer restriction and inconvertibility
- Expropriation
- War and civil disturbance (including terrorism)

The ARGeo Mitigation Fund offers drilling insurance for exploratory drilling:

- Covers 80% of the cost of drilling if results are below par
- Cost is equal to 2% of drilling cost



FIGURE 5: A world class geothermal management team

Figure 5 shows the role of a properly oriented geothermal management team (here shown as the experienced management of Reykjavik Geothermal). The team has to have high level insight in all aspects of a geothermal project, i.e. the resource, the political environment and the geothermal industry.

5. CONCLUSIONS

The success of a geothermal project depends on the experience of the team which manages the project on behalf of the owner/developer. The role of the management team is to ensure that each phase of the project is properly carried out to fulfil the needs of the project. A qualified management team is a

guarantee to the owner that risks will be kept at minimum, and that a project objectives will be met on schedule at a minimum cost.

REFERENCES

Bertani, R., 2005: World geothermal power generation in the period 2001-2005. *Geothermics*, 34, 651-690.

Fridleifsson, I.B., 2002: Energy requirements for the new millennium. In: *Human development and the environment: Challenges for the United Nations in the new millennium*. United Nations University Press, Tokyo, 220-233.

Lund, J.W., Freeston, D.H., and Boyd, T.L., 2005. Direct application of geothermal energy: 2005 Worldwide review. *Geothermic,s* 34, 691-727.

Stefansson, V., 1999: No success for renewables without geothermal energy. *Paper presented at the European Geothermal Energy Council Seminar EGENC 1999, April 29-30, Ferrara, Italy*, 15 pp.