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EXPANSION POSSIBILITIES OF THE LOS AZUFRES GEOTHERMAL FIELD

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ABSTRACT

The Los Azufres Geothermal Field has an installed capacity of 98 MW. CFE has decided to install 40 additional MW in the next 2 years.

The evaluation of the resources and the experience of 12 years of commercial operation supports an additional expansion of 80 MW in the northern sector. CFE is at present, evaluating different operational and financial schemes to bring private investment to these projects.

Introduction

At present, the Los Azufres Geothermal Field has a total installed capacity of 98 MW. Electricity production started in 1982, with five backpressure turbogenerators — 5 MW each. In the southern sector of the field (Tejamaniles), there are four backpressure turbines — 5 MW each, a condensing unit — 50 MW, and two binary cycle units — 1.5 MW each, making a total of 73 MW. On the other hand, there are five backpressure turbines in the northern sector (Maritaro), making a total of 25 MW.

Production History and Experiences

The backpressure units were installed with the purpose of obtaining information about the behaviour of the reservoir and wells and, at the same time, producing inexpensive electricity since the early stages of the development of the field. The condensing unit began commercial operation in 1988, after 6 years of experience with backpressure turbines.

Some of the most relevant information that has been obtained is described:

- The average production of wells is in the order of 45 T/h of steam. Corrosion and scaling are not significant, and well decline rates are less than 4% per year.
- There is a shallow production zone (500 to 1000 m) characterized by dry steam wells with variable gas content (1 to 10% by weight). Deeper wells produce steam and brine with qualities of about 0.4 to 0.6. The pressure profile of the reservoir shows a steam dominated zone in the upper

part, followed by a hydrostatic profile, in correspondence with the production characteristics of the wells.

- Pressure decline in the reservoir is in the order of 1 to 2 bars per year. The chemical characteristics of the fluids have been rather stable during all these years of extraction, except for the influence of injected water in the western part of the Tejamaniles Sector. This behaviour indicates that the rate of mass extraction is rather conservative.

Resource Assessment

Volumetric assessments of the resources indicate that the Tejamaniles Sector can sustain a capacity factor of 165 MWe — and the Maritaro Sector, a capacity of 180 MWe. It means that it might be possible to increase the installed capacity with 100 MWe in Maritaro and with 90 MWe in Tejamaniles.

A more detailed evaluation using a numerical simulator has been done for the Tejamaniles Sector proving that another 20 to 30 MW can be installed. Injection is beneficial because it reduces the rate of pressure drawdown and, therefore, the number of required wells to sustain steam production during the commercial operation of the plants.

In the northern Maritaro Sector, a detailed numerical simulation is in progress. Nevertheless, we can assume that this sector has at least the same capacity as the Tejamaniles Sector, which means that 80 additional MW can be installed. The results of the simulation may increase this figure significantly.

Furthermore, the northern and west-northern limits of the reservoir, are not well established. Future exploratory work in that area may increase the reservoir capacity even more.

Development Strategies

At present, CFE is considering different technical, economical, and financial schemes to increase the installed capacity in Los Azufres with few basic rules that must be kept into consideration.

These rules are as follows:

- CFE will maintain the management of the steam field. That means that CFE might use contractors to drill or to produce steam, but will not relinquish to private contractors a lease to exploit the field.
- CFE will be responsible for supplying the necessary steam to the power plants.
- The power plants will be built as "turn key" projects — with 100% of private financing, as a BOT or BLT project.
- CFE will favor smaller plants (10 to 30 MW). These plants are modular, and require almost no redundancy, and are best adaptable to an environment with complex topography as in Los Azufres.

The projects to increase the capacity of the field take into account the use of production wells that are at present shut in, the repairing of other wells to make them productive, the convenience of moving some of the portable backpressure units to other areas within the field, or to other geothermal fields, the feasibility of repowering these backpressure units and, of course, the construction of new units and drilling of new wells.

The size of the units will depend on the availability of steam in different parts of the field, environmental considerations, type of technology to be used and economics.