The Environmental Impact Evaluation for Geothermal Projects in Costa Rica

Hartman Guido-Sequeira

Instituto Costarricense de Electricidad, Centro de Servicio Recursos Geotérmicos, Guayabo de Bagaces, Guanacaste, Costa Rica

hguido@ice.go.cr

Keywords: Miravalles Geothermal Field, Sustainable Development, EIA.

ABSTRACT

The evaluation of the impacts is one of the most important aspects in any Environmental Impact Assessment (EIA), because it states the most relevant impacts that need to be controlled in order to ensure the protection of the natural resources. The procedure used to evaluate the impacts need to be specific for the project under study and need to be as clear and accurate as possible. The procedure presented in this paper is used at the geothermal electrical sector in Costa Rica and can be used in any project.

1. INTRODUCTION

The Miravalles Geothermal Field is located at the Miravalles Volcano in Bagaces, Guanacaste, between the Blanco and Cuipilapa rivers basins. The Miravalles I and Miravalles II power plants are located at the coordinates 298 000 N-405 700 E at 610 m a.s.l and the Miravalles III power plant at the coordinates 300 150 N-407 050. (Vallejos, 1996)

The Miravalles Environmental Assessment was done in 1988. Since it was the first EIA ever done in Costa Rica it changed the way of creating models for future large projects. However, this study includes all the environmental aspects considered in the modern methodology for the EIA, even the social aspects. (ICE 1988)

In Costa Rica the laws clearly protect the environment but also the right of the inhabitants to well-being.

• The national constitution indicates that "All the people have the right to enjoy a healthy and ecologically balanced environment" and also the government has the responsibility to ensure this right.

The most important environmental Law (1995) indicates:

• The environment is national heritage for all of its inhabitants. This implies the obligation to protect it but also the right to use it to provide well-being.

• The government has to ensure the sustainable use of the natural resources.

• The damage to the environment is a social, economic and cultural offense.

All the projects in Costa Rica need to obtain permission from the Ministry of Environment (environmental authority). The methodology to evaluate the impacts are established in the legislation DE-31849 "Reglamento General sobre los Procedimientos de Evaluación de Impacto Ambiental". Before any development the organization needs to present a preliminary environmental study that is a detailed description of the project and the environment where the project will be inserted. Based on this information the authority decides the environmental impact significance of the project and then if the EIA is necessary.

There are three significance categories:

- Low environmental impact significance
- Moderate environmental impact significance
- High environmental impact

If the impacts are considered as low significance the developer only needs to present an environmental declaration. If the significance are moderated the developer need to present a environmental management program, and if the significance is high, depending on the importance of the impacts the authority could require a partial or full EIA, and it is necessary to make a money deposit as a guarantee in case of nonconformance. If any noncompliance occurs the company can lose its money. And if the impacts are considered to be extensive, the project can be stopped.

2. THE ENVIRONMENTAL MANAGEMENT IN GEOTHERMAL PROJECTS IN COSTA RICA

The environmental geothermal management is focused in the EIA requirements. One important tool to ensure a systematic way to accomplish the EIA requirements is using an Environmental Management System. The ISO 14001 Environmental Management System implementation at geothermal projects in Cost Rica began in 2002, due to the new ICE environmental policies. Before 2002 Miravalles has an environmental monitoring system, it was mainly focused in the monitoring of different environmental parameters established at the Environmental Impact Assessment, and does not include the management system of the ISO 14001.

In March 2002, the ICE directive council established the environmental policy for the organization and ten principles to define it. The ICE policy is as follows: The Instituto Costarricense de Electricidad (ICE) plans and develops its activities with the principle of sustainable development; the management is done according with the attitude of conservation, protection, recovering and adequate use of the environment. In order to implement the policy and principles the directive council selected five projects to implement the Environmental Management System, one of them Miravalles.

The implementation was planned in different steps as follows:

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- a. Initial Environmental Management System planning: In this step the revision of the resources was done. As a result environmental collaborator groups were formed. The members of these groups have to coordinate the people on their working areas to help in the identification of environmental aspects, the impacts evaluation and the implementation of the actions described in the environmental plan. Also, they have to assemble a supporting environmental group with workers that know as well as possible the different process.
- b. Initial system's evaluation: This step consists in the evaluations of the actual system in order to determinate the necessary changes to comply with the ISO 14001 demands. Based on this information the initial Environmental Management System planning was established. The most important changes were related with the documentations of the system, because most of the actions were done but not in a documented way.
- c. Identifying environmental aspects: This step is maybe the most important because it allows identifying the origin of the environmental problems and is after that when the organization can plan the action to control the impacts. In Miravalles the supporting environmental groups together with the environmental manager identify these aspects. It is done by checking the different process step by step, identifying the specific potential point of impact. Once the aspects were identified the group evaluated their impacts by using a value scale that contains the different ranges, considering the frequency of the action, the temporality of the potential impact, the extension, the effects over the people, over the natural flora and fauna and over the public relation with communities and environmental or social organizations. The figure 5 shows the matrix of the different environmental parameters evaluated.
- d. Identifying legal and other requirements: This is not an easy work, because there are a lot of laws and regulations related with the environment.
- e. Establishing objectives and targets: When the significant impacts are identified it is necessary to establish objectives and targets. In Miravalles more than ten objectives were established, all of them related with negative and positive impacts.
- f. Environmental Management Program: There is a management program focused in to get the proposed objectives. Now the different departments in Miravalles are working in specific actions to find out ways to control their impacts.
- g. Procedures: At this time most of the procedures are already documented or in the revision stage. There is an advantage because the existence of a quality system under the standard ISO 9000 that allows the use of this platform to help the Environmental Management System procedures and documentation. The figure 1 shows the procedures used at the geothermal projects.

h. Environmental education: The relationship with the communities and other actors related with the environmental issues is maybe the most important thing in the environmental management. It is very important to ensure that the communities clearly know what exactly is the project, what are the negative and positive impacts over the natural, economical and social aspects, what the organization is doing to control these impacts, what are the social and economical benefits of the project and also the importance of the natural resources protection.

In Miravalles, the Environmental Management System is used as a tool of continual improvement to administrate environmental issues and can be used successfully to ensure the EIA requirements. The Environmental Management System improves the EIA programs because ensure the continual actions' reviewing, and allow the detection of new impacts. The Environmental Management System that has been used in Miravalles (Figure 1) has 8 environmental procedures to ensure adequate environmental management and additional procedures to control the system.



Figure 1: Environmental management system.

With the Environmental Management System it is possible to systemize and improve the control of impacts in a continuous way (continuous improvement). Figure 2 shows the model of continuous improvement in the geothermal environmental management. It is necessary because the process changes as well as the organization, the environmental conditions and legal requirements change. And this means that the environmental programs and the actions also need to change continually. Public relations are very important because the people may be against the organization and can complain. For this reason the Environmental Management System has to ensure public participation and a fast response to all complaints. The organization and the people have to ensure compliance with the law. The Environmental Management System has to allow a fast identification of any law's change to take it into account

The main objective of any Environmental Management System is to improve the environmental performance of the organizations to protect the environment, improve their public image and reduce costs.



Figure 2: Environmental Management System and continual improvement.

The main idea of the Environmental Management System is first to prevent all kind of negative impacts. If it is not possible it will try to reduce the negative impacts and if any of these solutions are possible, then it will focus on to mitigate the impacts. But as is shown in figure 3, there are other aspects associated with the implementation of the Environmental Management System. The organization can reduce the costs if it teaches the people about the importance of reduce the unnecessary use of material, electricity, water, paper, etc. It will represent a high efficiency and less production costs.

The actual laws in Costa Rica and in most of the other countries penalize environmental pollution, in most of the cases it means high quantities of money to pay and use of time and resources reversing the damage. All this problems can be prevented if the organization implements an adequate Environmental Management System. Finally, it has to be taken into account that the communities have a lot of power. If they are against the project it will mean a lot of problems that can be prevented and solved by a correct Environmental Management System implementation.



Figure 3: Environmental Management System helps to improve the environment's protection.

The Environmental Management System also increases the sense of responsibility with nature and thereby improves the personal satisfaction among all of the members of the organizations.

The environmental management in the geothermal projects in Costa Rica is focused on six main aspects, air and water quality, evolution of the rainwater pH, environmental education, field management and communities' relationships.

The monitoring is done using a system of control stations located around all the influenced area. The figure 4 shows the location of the stations (air, water and rain). Also the meteorological conditions have been monitored.



Figure 4: Environmental monitoring system.

Environmental Due to the Management System requirements it is necessary to analyze all the project activities to determinate possible changes in the environmental conditions that can produce new environmental impacts. As was mentioned the processes of the development and commercial exploitation changes in a continual way and then new impacts can appear. To monitor the changes the matrix shown in figure 5 is used. The matrix considers different environmental parameters, the legal aspects and the frequency of the activities.

These continuous studies are quite important because they involve the persons working directly at the project activities. It means that the analyses will considerer all the small details, potential problems probably not detected during the EIA process. This detailed analysis allows reviewing and valorized the process and then classify the impacts by relevance as is shown in Figure 6 and also what environmental parameters are the most affected by the different process as is shown in Figure 7. In this way it is quite easy to determine how to use the resources of the organization in an efficient way.

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Figure 6: Environmental impacts



Figure 7: Impacts at the productive process

This information allows attending first to the impacts with more significance and then reduces the negative impacts of the projects.

The information obtained using this Environmental Management System tool can be used as input information at the EIA for new geothermal development ensuring more accuracy in the impacts identification and increasing the enterprise credibility against the environmental authority and the communities.

3. CONCLUSIONS

The EIA is an important tool to establish the project's environmental impacts, but due to the authority problems to control all the projects, this tool does not ensure the correct management of the identified impacts.

With the Environmental Management System is possible to systemize and improve the control of impacts in a continual way improving the EIA programs because it ensures the continual reviewing and allow the detection of new impacts.

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