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GEOTHERMAL TRAINING PROGRAMME



REGIONAL GEOTHERMAL OFFICE FOR CENTRAL AMERICA

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ABSTRACT

Due to the increasing geothermal interest and activities in Central America, five partners joined efforts in 2013, and established a Regional Geothermal Office in El Salvador (RGO) with the aim of promoting geothermal projects, enhancing the development of geothermal energy potentials and strengthening the scientific and technological capabilities of governmental entities, scientific institutions and private sector companies. Achieving these objectives involves the creation of expertise, technological development, knowledge transfer, networking and communication, policy development as well as private and public investment into corresponding technologies and human capital, being the link between the region and partnerships worldwide, dedicated to promoting geothermal.

1. INTRODUCTION

The use of geothermal energy has a long history in several countries in Central America. It is currently operating in 8 regional plants connected to the power grid, generating up to 625 MW of electricity. El Salvador, for example, covers up to 24 % of the electricity demand from geothermal sources.

According to estimates, the total potential for generating electricity with geothermal energy in Central America is between 3,000 MW and 13,000 MW. Experience in Central America through this technology is mostly in high enthalpy, i.e. the use of geothermal resources of high temperatures (over 200°C). Additionally, there are opportunities to use geothermal energy for direct use in this region. There is also a lot of potential in low enthalpy geothermal energy, which corresponds to the generation of electrical energy on a smaller scale and for thermal power generation in industrial processes, air conditioning, balneology, agriculture, etc.

In order to strengthen the development of the geothermal energy potential and enhance scientific and technological capabilities of government institutions and the private sectors dedicated to this technology in the region, five entities of great importance in this matter joined together to create a Regional Geothermal Office for Central America (RGO).

2. ORGANIZATION

The Operation Manual of the Regional Geothermal Office for Central America (RGO) was signed between February and April 2013 by the following institutions: International Center for Geothermal

Energy at the University of Bochum (GZB), the German Cooperation in El Salvador (GIZ), the International Geothermal Association (IGA), the National Energy Board of El Salvador (CNE) and the Salvadoran geothermal company, LaGeo. Figure 1 shows the institutions and personnel involved in the organization of the RGO. The RGO will have its base in El Salvador and will work together with an internationally established network of institutions and experts in the field of geothermal energy.

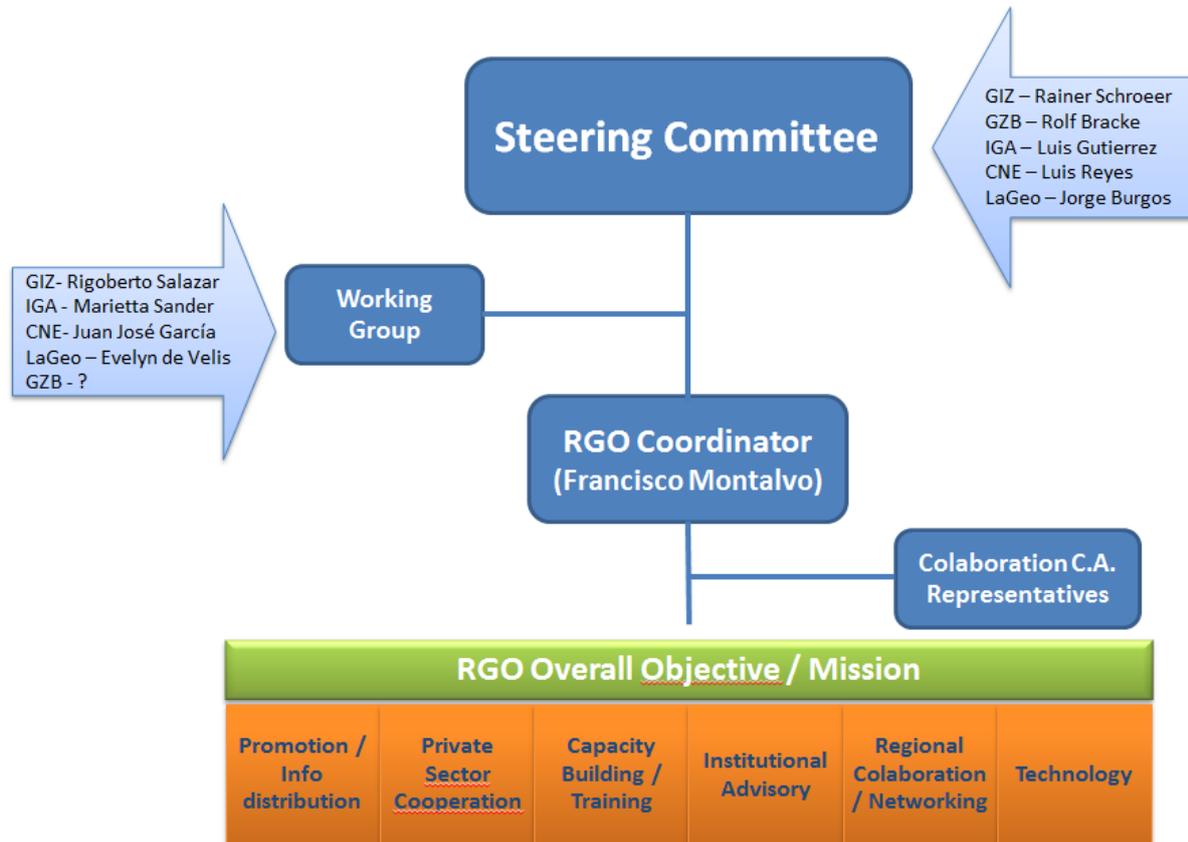


FIGURE 1: Regional Geothermal Office for Central American Organization

Within the organization considered in the Manual Instructions, the main coordinator of communications and activities of the RGO is the Secretary of the RGO, who in turn is headed by an Executive Officer or Coordinator, who is part of the staff of LaGeo (RGO, 2013). The RGO intends to cover in the next future, the entire Latin American region and the Caribbean, after its initial formation in Central America.

A brief description of the mentioned institutions supporting RGO is described below:

The **German Cooperation in El Salvador (GIZ)** has carried out the Program “4E Renewable Energies and Energy Efficiency in Central America”, working mainly in the implementation of strategies for the dissemination of renewable energy (RE) and energy efficiency measures (EE), and increase in investments in RE and EE. The creation of the RGO is another effort driven by the German government through the 4E-GIZ program, which aims to increase and strengthen together with its donors, the local capacity and investment technologies of renewable energy in Central America (GIZ, 2014). GIZ works hand in hand with the energy department of the General Secretariat of SICA (Central American Integration System). Within the program, the geothermal energy plays an important role as GIZ is an active participant in the establishment, organization and operation of the RGO.

The **International Geothermal Center at the University of Bochum (GZB)** is a joint research establishment of science and economics, involving administration and politics. The GZB provides a

competence and information center to the public with regards to all queries concerning the utilization and extraction of geothermal energy (GZB, 2014). Among other objectives, the GZB works in transfer technology, know-how and information between universities, the economy and the public sector as well as to conduct and to foster application-oriented geo-research between various universities, to supply education and advanced training and the establishment of a scientific network of associated universities and research bodies on the national and international scale.

The RGO is supported also by the **International Geothermal Association (IGA)**. The IGA is a scientific and educational organization established to operate worldwide (IGA, 2014). It has more than 5,200 members in over 65 countries. Its mission is to encourage research, development and utilization of geothermal resources worldwide through the publication of scientific and technical information among the geothermal specialists, business community, governmental representatives, UN organizations and civil society. The International Geothermal Association (IGA) has operated its Secretariat since January 1st, 2011 in Bochum, Germany. Furthermore, the IGA Secretariat currently is part of the RGO's Technical Committee. On the 14th of November 2013, the IGA announced the foundation of the geothermal learning centre, the IGA Academy. The IGA Academy offers training courses with different focus and depth at existing international geothermal training institutes and universities. The RGO is planning to organize a geothermal specialized course with experts from the IGA Academy by the end of 2014 in Costa Rica.

The National Energy Council of El Salvador (CNE) is an autonomous non-profit state institution of public service that provides normative and regulatory national energy policy, with the aim of encouraging the rational use of energy sources in the country (CNE, 2014a; CNE, 2014b). It is also part of the RGO's Steering and Technical Committee and the management of the Regional Geothermal Training Programme (RGTP).

The geothermal Salvadoran company **LaGeo**, a company of excellence in this area currently operates two geothermal fields in the country with 38 years of experience in development and management the geothermal resources. Besides the exploitation of the geothermal resources, LaGeo, as an additional merit, is supporting the promotion and capacity building through the RGO and the RGTP.

The **RGO**, as mentioned above, will have its headquarters for the region in El Salvador and will work with an international network of institutions and experts in the field of geothermal energy and coordination of scientific research and capacity building, to help reduce the gap in this technology, in terms of technological development and all its potential application in the region, and encouraging the use of geothermal energy in the region.

The vision to create this office is to strengthen the networks between the countries of the Central American Integration System (SICA) and its entities; encourage cooperation within the academic and technological sector among member countries of SICA. A fundamental part of its action is to harness the geothermal resource present in Central America to further develop projects in this area in order to make it a viable market to attract local and international investors to the region.

3. OBJECTIVES

The Regional Geothermal Office for Central America (RGO) was established to promote and strengthen the development of the geothermal potential in Central America, as well as scientific and technological capabilities of the government entities, academic and scientific institutions and industries.

One of the main activities carried out by the new entity's documentation of information is the promotion of education and training for public and private entities in order to increase human capital in the regional geothermal industry, and implementation of new projects in cooperation with other institutions.

In addition to establishing guidelines for collaboration, reporting results and distribution of best practices in technical, social, environmental and regulatory issues, conducting seminars, workshops and conferences on such topics are carried out.

The main goals involve the transfer of knowledge, experience and technology, suitable for the development of geothermal resources policies, public and private investment in the corresponding technological and human capital.

The main strategic objectives can be described as follows:

- Promotion / distribution of technical and general information:
 - Establish guidelines for collaboration, reporting experiences and distributing documents on best technical, social and environmental practices.
 - Disseminate best practices of geothermal development and lessons learned, including policies, financing and investment guarantees.
- Cooperation with the Private Sector / Institutional Advisory:
 - Promote the facilitation and implementation of development projects and research.
 - Promote the implementation of financial support schemes in geothermal projects.
- Human Resources and Training / Institutional Advisory:
 - Promote education and training programs to increase the human capital in the regional geothermal industry.
 - Initiate and conduct seminars, workshops and conferences.
 - Promote the creation of a Centre of Excellence Geothermal in Central America.
- Regional Collaboration / Networking Groups:
 - Increase communication activities and develop networks between the countries of Latin America and the Caribbean and their respective institutions.
 - Provide the link between the region of Latin America and other global partnerships to promote geothermal energy.
- Technology / Cooperation with the Academic and Private Sector:
 - Sign academic cooperation between countries and technological sectors in the region.
 - Promote attendance of the Central America countries in research, development and implementation of projects for low and medium enthalpies.

The RGO will work to facilitate technological development and policy, strengthening skills and knowledge transfer of this energy resource. In addition, it will encourage private and public investment in this sector.

In summary, the strategic objectives are presented in Figure 2.

4. OPERATIONAL PROGRAMME

According to the Operational Programme, the main activities carried out for the RGO in 2013 and in the future are focused on:

- Organization and planning:
 - Visit to GZB at Bochum University, working in the organization and planning programme with GZB, IGA and CNE.
 - Technical Coordination Group meetings providing progress of activities.
 - Meetings of Directors – Steering Committee.

- Review / validation of Organizational Structure of the RGO 2013.
- Presentation of Periodic Progress Reports / Results.
- Strategic Development Plan 2013-2017, which intends to hire a consultant to develop the plan where the sustainability of the RGO is included.

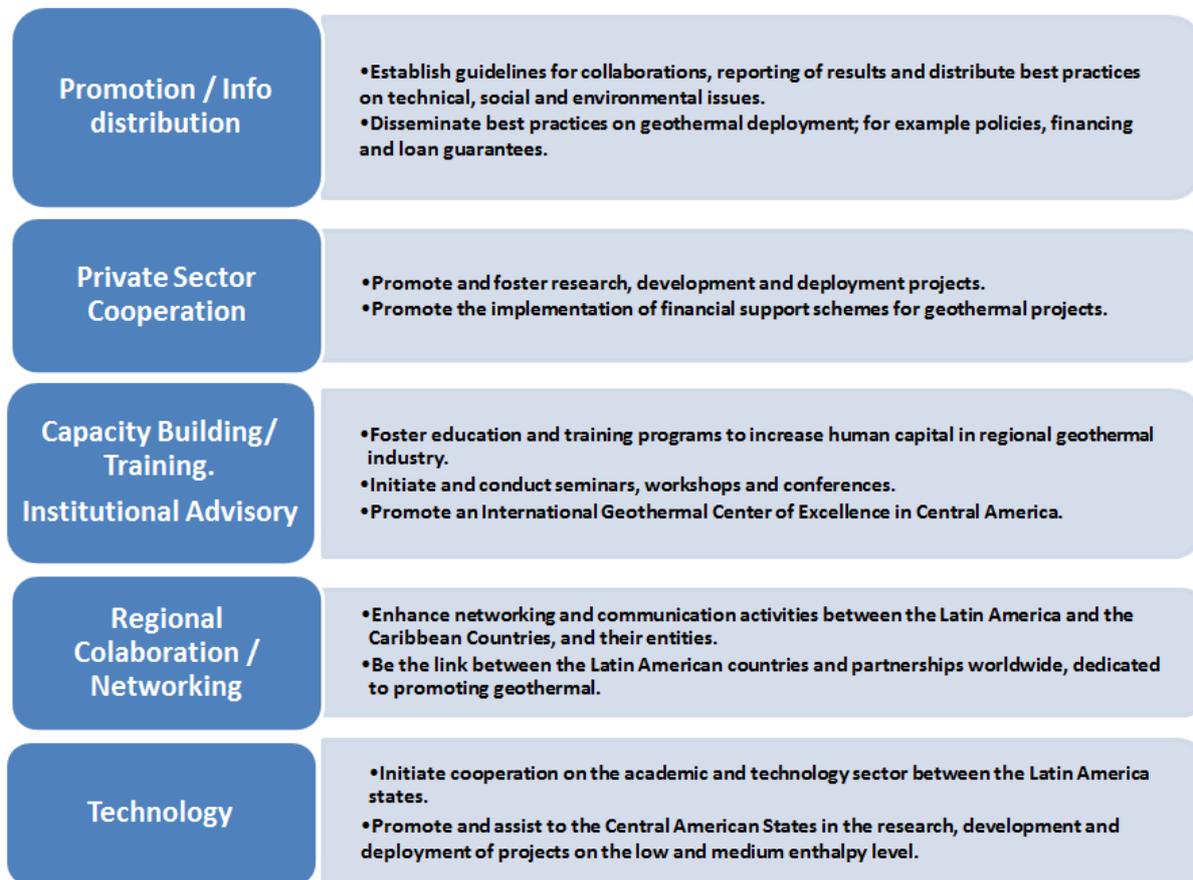


FIGURE 2: Regional Geothermal Office strategic objectives

Note: Possible further Members / Partners: Stakeholders from Central America, IRENA, IDB, BCIE, etc.

- **Promotion / Release:**
 - Prepare activities for the participation of representatives of C.A. in Geo-T Expo Fair in Essen, Germany 2013 (Figure 3).
 - Advertise through internet websites (Figure 4) and magazines (IGA News, Piensa en geotermia, GIZ, LaGeo, CNE, GEOLAC, etc.), preparing articles and news on a regular basis.
 - Participate in the World Geothermal Congress 2015, in Melbourne Australia.
- **Networking:**
 - Develop a list of experts and specialized companies in the geothermal industry in Central America, Latin America and the Caribbean.
 - Develop a list of experts and specialized companies in the geothermal industry in Germany. Preliminary list presented in Report related to the visit GZB, Bochum.
 - GEOLAC website (Figure 5), by establishing network of experts, academic and research institutions and companies in the geothermal industry in C.A., L.A. and the Caribbean.



FIGURE 3: Promotion of the Regional Geothermal Office (GIZ, 2013a)

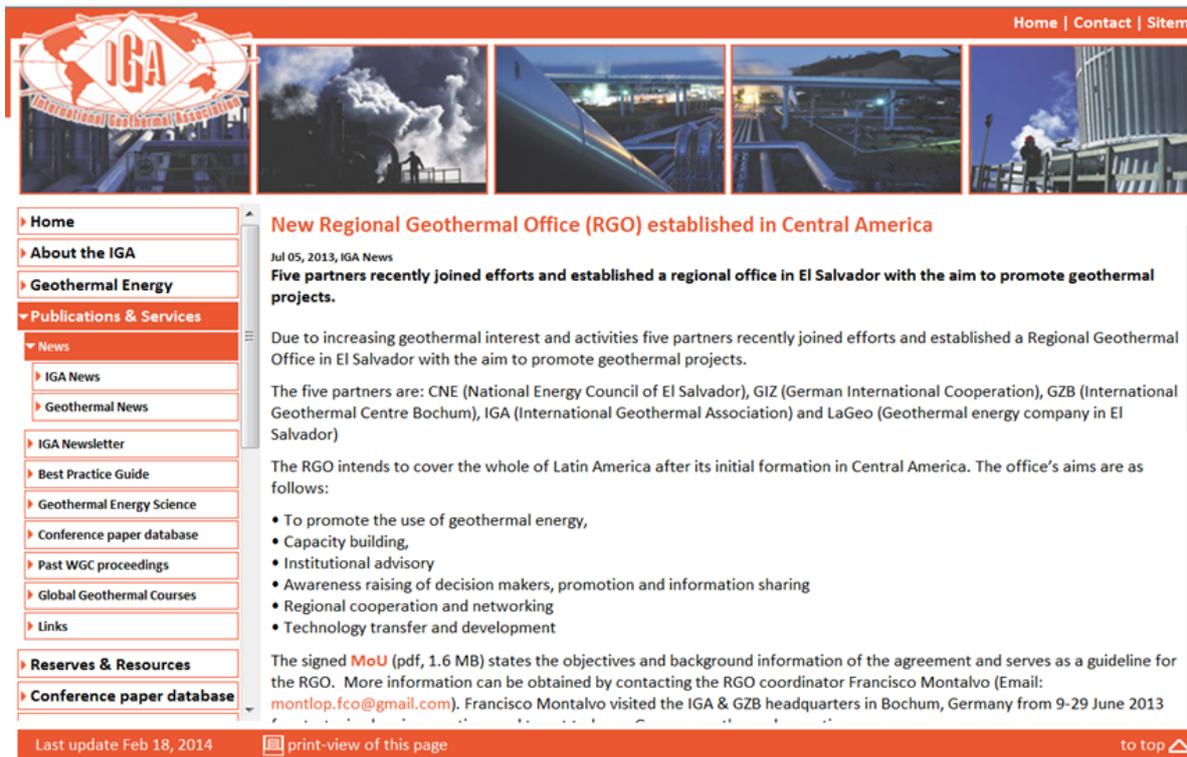


FIGURE 4: News about the Regional Geothermal Office (IGA, 2013)

RedGEOLAC

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Que es un acuífero?
Un acuífero es cualquier formación litológica con la permeabilidad suficiente para alojar agua meteórica percolada desde la superficie (un lago subterráneo de agua proveniente desde la superficie, por ejemplo).

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Geotermia en Centroamérica

La geotermia es el calor del interior de la tierra que se ha concentrado en ciertos sitios del subsuelo, conocidos como yacimientos geotérmicos. Un yacimiento geotérmico típico se compone de una fuente de calor, un acuífero y la llamada capa sello. La fuente de calor es generalmente una cámara magmática en proceso de enfriamiento (las entrañas de un volcán, por ejemplo). El acuífero es cualquier formación litológica con la permeabilidad suficiente para alojar agua meteórica percolada desde la superficie (un lago subterráneo de agua proveniente desde la superficie, por ejemplo). La capa sello es otra formación, o parte de ella, con una menor permeabilidad, cuya función es impedir que los fluidos geotérmicos se dispersen totalmente en la superficie.

El desarrollo de los recursos geotérmicos dentro del área Centroamericana debe contribuir considerablemente a alcanzar los Objetivos de Desarrollo del Milenio, generando la electricidad con base al aprovechamiento de los recursos renovables (fluidos geotérmicos) fuente de energía autóctona y limpia. Esto permitirá amortiguar los precios de la electricidad favoreciendo a los sectores más grandes de la población, contribuyendo a una menor contaminación del ambiente en la región, creando oportunidades de empleo sobre todo en áreas rurales donde se desarrollan los proyectos geotérmicos y protegiendo a los países de Centroamérica contra futuras alzas en el mercado del petróleo.

En países como El Salvador, Nicaragua, Costa Rica y Guatemala, la exploración geotérmica propiamente dicha se inicia a finales de los años

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FIGURE 5: Web site GEOLAC, networking tool. Source: IDB-LaGeo

- **Training:**
 - Support and participate in the implementation / development of the Regional Training Center of the National University of El Salvador (Figure 6). Coordination of the Working Group (Technical) of the RGO has active participation in the Diploma in Geothermal Energy, Regional Geothermal Training Programme (CNE-UES-LaGeo-IDB-NDF).
 - Promote the creation of a Geothermal Centre of Excellence. Similarly it is participating in the establishment of the Regional Centre for Geothermal Energy, which will set the foundation to make it in the future a Geothermal Centre of Excellence in C.A.
 - Participate in the UNU-GTP & LaGeo Short Courses.
 - Organize an Advanced Seminar - 2014 IGA Academy. Define issues and a seminar for advanced geothermal technology in the second quarter of 2014 in Costa Rica.
- **Technology:**
 - GIZ Consulting Report prepared on Medium and Low Enthalpy Geothermal Projects barriers.
 - Development of a national plan for the promotion of geothermal energy of low and medium enthalpy in El Salvador (see map in Figure 7). Starting the project in El Salvador and later expand to other countries.
 - Investigate and support the creation, implementation and development of a new project for hedging risk activities for Geothermal Drilling. Project presented to the German Development Bank (KfW).
 - Implementation of a Comprehensive Regional Geothermal Development Master Plan.



Programa Energías Renovables y Eficiencia Energética en Centroamérica



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El Salvador gradúa a 26 en geotermia.

26 alumnos se graduaron del primer diplomado en geotermia. El curso busca posicionar al país como líder en capacitación técnica y científica de recurso humano para el aprovechamiento de los recursos geotérmicos.

13 Dec 2013 | Geotermia

Unos 26 alumnos nacionales e internacionales se graduaron del primer diplomado en geotermia impartido en El Salvador.

Con la certificación de los 26 profesionales nacionales y extranjeros, las autoridades del Consejo Nacional de Energía (CNE), Universidad de El Salvador (UES) y LaGeo, dieron por concluido el Diplomado de Especialización en Geotermia, Edición 2013, el cual busca posicionar a El Salvador como un país líder en la capacitación técnica y científica de recurso humano para el aprovechamiento de los recursos geotérmicos; y representa los primeros pasos para constituirse en un Centro Regional de Investigación y Entrenamiento Geotérmico.

Este diplomado forma parte del componente de formación profesional de la cooperación técnica brindada por el BID y el Fondo Nórdico de Desarrollo (FND) para la consolidación de un Centro Regional de Capacitación.

Durante los cinco meses del diplomado, los estudiantes se formaron en temas como: la exploración geológica, geoquímica y geofísica, además se capacitaron en el campo por medio de visitas a las instalaciones de LaGeo (única empresa en el país que genera electricidad a partir de la geotermia o lo que es lo mismo, el calor del subsuelo) y el estudio de las técnicas de perforación de pozos



FIGURE 6: Diploma in Geothermal Energy, Regional Geothermal Training Programme (CNE-UES-LaGeo- IDB-NDF) (GIZ, 2013b)

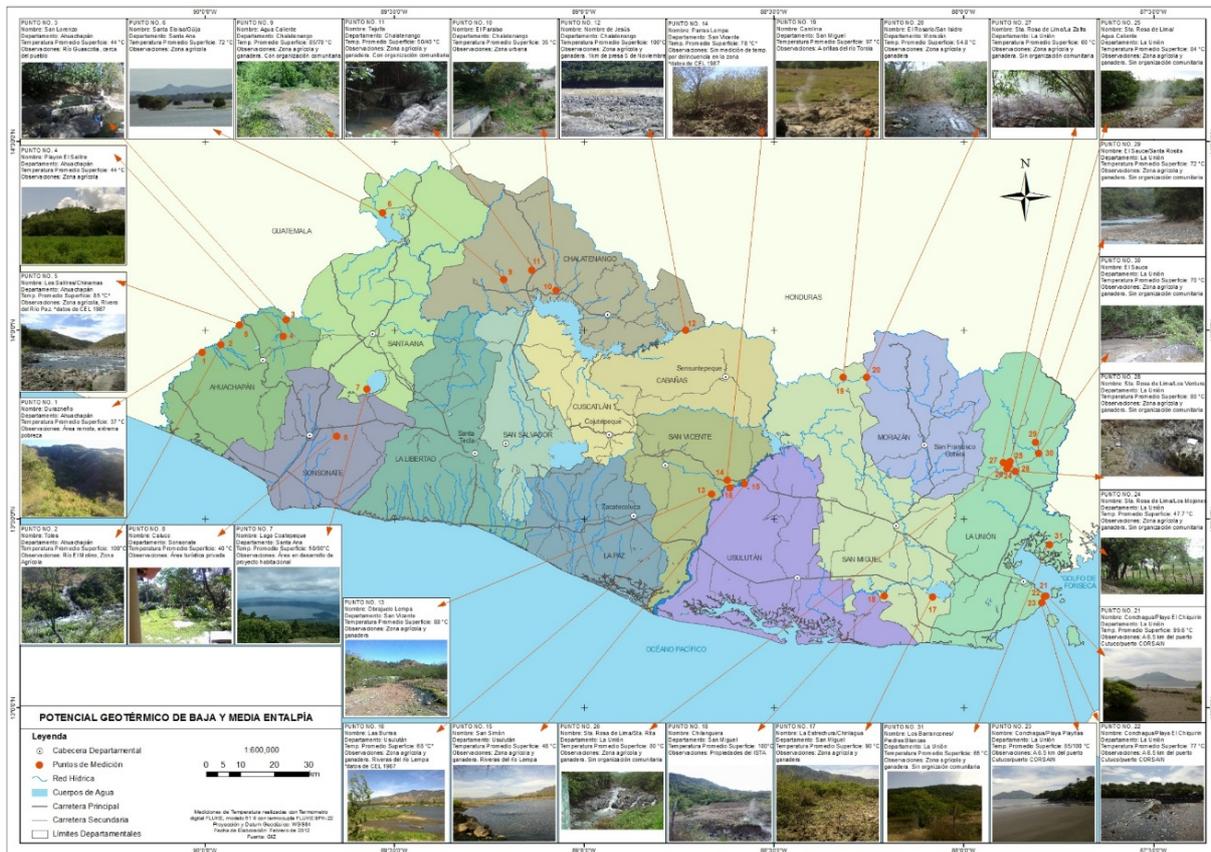


FIGURE 7: Map of Medium and Low enthalpy resources in El Salvador. Source: GIZ

- Development of the RGO
 - Evaluation of the RGO's future to be considered in structuring the Strategic Plan (Vision, Mission, Values , structure, resources, etc .).
 - Affiliation and Memberships RGO (Strategic Plan and sustainability mechanisms). In the future through the institutions affiliated to it, for instance Geothermal National Associations may be represented at IGA, through a Central American Branch.
- Regional collaboration
 - Activities relating to the IGA
 - Divulge information in Central America to incorporate new members for the IGA. Recently incorporated new members such as Nicaragua and other countries in L.A. (Honduras, Chile, Ecuador and Peru).
 - Facilitate / act as a leader in the Central American region to exchange information / queries to the IGA and disseminate information of the Association between all actors and others interested in the topic. The RGO, which leads to closely mention the IGA, due it participates as a support for the Office, thus having the same goals.
 - Support the establishment / formalization of a Regional Geothermal Association. Currently already has the Geothermal Association of El Salvador, the Geothermal Association of Costa Rica, both recognized by the IGA and recently has begun the process for the formation of the Geothermal Association of Nicaragua. This is one of the medium-term objectives, forming the first "Branch" of the IGA in L.A.
 - Assistance to IGA to publicize the progress of RGO and regional collaboration.
- Institutional advisory
 - Promote the establishment of financial support schemes in geothermal projects.
 - Promote the implementation of rules or laws of geothermal through contacts between entities in different countries. Some countries already have regulations or laws, so it is necessary to know the institutional and industrial landscape of each country, and to establish the roles and responsibilities of different institutions.
- Private sector cooperation
 - Promote the facilitation and implementation of development projects and geothermal geoscience research or technology between companies and research institutions or academic.
 - To promote contacts between people / institutions interested in geothermal generating companies with products or services to the geothermal industry.
 - Identify synergy of business networks and other institutions: education, research etc.

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