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GEOLAC 2015

THE GEOTHERMAL CONGRESS FOR LATIN AMERICA AND THE CARIBBEAN

CONFERENCE REPORT

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INTERCONTINENTAL MANAGUA
NICARAGUA

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CONFERENCE OVERVIEW

The 2015 Geothermal Congress for Latin America and the Caribbean took place from November 18-19 in Managua, Nicaragua. Co-hosted by The World Bank in association with CAF, CABEI, CARICOM, GIZ, IDB, KfW and other leading regional development partners, the conference gathered 133 senior stakeholders from over 30 countries.

Since we gathered in Costa Rica for GEOLAC 2014 we have witnessed significant changes in the global energy markets. Today, the price of oil is substantially – nearly 50% – off where it was this time last year. Factor in a regional priority to expand the role of natural gas in national energy matrices and some would argue that we should be concerned about prospects for geothermal development in Latin America and the Caribbean.

Others, however, would argue that – to use the mantra we introduced at GEOLAC last year – "the time is now". The long-term need to improve and optimize power generation mixes remain, so that future bouts of international fuel price volatility will not result in similar high costs and shocks of the past. There is also an opportunity to seize with potentially lower drilling costs, which make up as much as half of a geothermal investment. With less demand in oil markets, drilling companies are eager for business in other sectors, and the geothermal industry could be the beneficiary. Then consider the increasing awareness and sophistication of governments across the LAC region as a whole, where they are working with development partners to mobilize substantial risk capital towards early stage development of key projects where preparation is advanced, which should be cause for considerable optimism. As good projects come to the fore and risk capital is increasingly available, one of the key questions we addressed at GEOLAC this year is whether businesses will partner with governments to seize this opportunity to scale-up geothermal across the LAC region.

We were particularly excited to be in Nicaragua for GEOLAC 2015, a market where the Government recently announced its intention to attract investment totaling more than US3bn into its renewable sector. Geothermal is a priority. Drilling has already commenced on the first of three new production wells slated for the 77 MW San Jacinto-Tizate plant, while the Government has secured funding from the Climate Investment Funds (CIFs) to help advance the readiness of several additional fields for investments. This includes enlisting the support of the World Bank Group to help speed up the development of the Casita-San Cristobal project through a public-private partnership. Funds are also being mobilized for advancing other fields in its Geothermal Master Plan.

Progress in Nicaragua has been defined by collaboration and by a coordinated effort combining the public sector, the multilaterals, and the international private sector. It is precisely that type of collaboration we sought to foster at GEOLAC 2015 where, gathered under one roof, were the vast majority of stakeholders whose alignment and commitment we need to catalyze the development of geothermal across the region. At this time we would like to extend our particular thanks to our hosts, the Government of Nicaragua, for their support of GEOLAC. We would also like to thank the many regional and international development organizations – amongst them CABEI, CAF, Caricom, CDB, GIZ, IDB, JICA and KfW – who lent their support to this initiative as part of their broader commitment to developing geothermal across Latin America and the Caribbean.

WELCOME REMARKS

Charles Feinstein, Director, Energy & Extractives Global Practice, The World Bank

Feinstein contextualized the discussion with the current economic and energy sector landscape, suggesting that the "time is now" to seize the opportunity to scale-up geothermal in Latin America and the Caribbean, especially as economic growth in the region has slowed down. Globally, oil markets have become sluggish. Seemingly a threat to the future of geothermal investment, it provides some opportunities. With prices low, there is an excess stock of drilling rigs that could ease exploration efforts. Further, with the volatility of oil prices, prices could rise unexpectedly, and the diversification of energy generation sources reduces instability and shock potential.

A clean domestic resource in the form of geothermal energy could also reduce and stabilize electricity costs in a region, complementing other clean energy resources. Increasing support for climate-friendly investment in light of Paris talks, SE4ALL initiative, UN Sustainable development goals, there will be more resources available in the form of financing.

Efforts will require the cooperation of various stakeholders, including government, the private sector, institutions like the World Bank. The World Bank Group (WBG) is motivated to aid in this effort based on its twin goals of reducing poverty and boosting equity. Affordable energy is essential for achieving the twin goals.

LAC has tremendous geothermal potential which represents about 15% of total global geothermal capacity. Mexico leads the way with the world's 4th largest geothermal capacity in the world. Approaches to development across the region differ sharply. Costa Rica and El Salvador want to increase capacity primarily through public sector. Nicaragua and Guatemala want more private sector development, and are eager to develop and pursue models of public-private partnerships.

In the Caribbean, geothermal represents only 15MW of capacity, but significant efforts are in play to develop geothermal to stabilize some of the highest energy costs in the world. South America is at an earlier stage of geothermal development but making advances in Chile, Colombia and Bolivia.

An additional 2 GW could be added in the LAC region in the next 20 years, but in the last decade, Mexico and Central America have only invested in 200MW. Further investment will require a concerted effort by all involved.

There are three major challenges for geothermal development:
First: Resource Risk. Mechanisms to mitigate the exploratory risks of development are needed. This requires public support through state-investment or cost-sharing grants, including exploration support. One size does not fit all, but requires involvement of public institutions to fit within their own unique conditions. Initially government-led efforts have been most successful. To assist, WBG has developed ESMAP, which is an effort to mobilize financing to reduce high-risk initial stages of exploration, providing $250 million to countries.

Second: Improving the investment climate. States must work to streamline legal policy frameworks, ensure access to sufficient financing to reduce risk.

Third: Improving the procurement of experienced and reputable developers. Countries need to attract and select developers with the financial and technical skills that makes them qualified to carry out projects from exploration to generation. Criteria should vet for candidates that can be accountable under international standards.

Geothermal energy could play a critical role in a diversified, lower cost, and environmentally sound power sector matrix in Latin America and the Caribbean.

KEYNOTE ADDRESS

Ernesto Martínez Tiffer, Presidente Ejecutivo, Empresa Nicaragüense De Electricidad (ENEL)

Nicaragua, under President Ortega, has been committed to modernizing the energy matrix since 2007. At that time, 80% of power generation came from fossil fuels, and 20% from renewable resources, a mix of geothermal, biomass, hydro, and solar. Currently, 54% of energy is developed from renewable sources. Nicaragua is planning to continue investment and aims to have 90% of power generated from renewable sources by the year 2020.

The Nicaraguan government requires 10% public participation in projects in order to mandate regulations on developers in order to ensure a balance between public and private benefits from investment in renewable energy projects. Public participation is important, since the end goal is to provide low-cost energy access for the people.

Nicaragua has only developed 10% of its renewable energy potential, and there is substantial potential for future investment.

SPOTLIGHT MARKET: NICARAGUA

Hector Baldivieso, Project Team Leader, InterAmerican Development Bank (IDB)
Carolina Cárdenas, Investment Officer, International Finance Corporation (IFC)
Migara Jayawardena, Senior Energy Specialist, The World Bank
Marc Murnaghan, CEO, Polaris Infrastructure Inc.
Ernesto Martínez Tiffer, Presidente Ejecutivo, Empresa Nicaragüense de Electricidad (ENEL)

Ernesto Martinez Tiffer: Strong potential for geothermal in Nicaragua. The Pacific region of Nicaragua has 18 volcanos and the most potential for future geothermal development. Nicaragua has the 9th largest geothermal production in the world, and 4th largest in the Americas behind US, Mexico, and El Salvador.

Nicaragua currently has 35MW of generation from geothermal, which represents only 12% of potential installed capacity of 1570 MW.

Momotombo was the first site developed in Latin America, and the government is currently doing studies with IDB to explore more potential for development. San Jacinto is one site that has been identified for development since 1995, but began exploration and studies in 2005. It is the largest site in the country at the volcano Casita. The government partnered with Colorado Power (Polaris Infrastructure) to develop San Jacinto and hopes to have the next phase of development from that site online within five years.

Geothermal is a priority, but will the country will diversify the matrix with wind, solar, and biomass as a short term method for generating power.

Nicaragua hopes that investors and banks will not view the country as being a risky investment proposition. "The risk is not as high as perceived by investors." The government is also committed to working closely with developers to mitigate risk as much as possible.

Hector Baldivieso: Migara Jayawardena asks how can stakeholders mobilize investment funds and prioritize investments. Baldivieso identifies two key issues: the mitigation of risk, and building alliances to get support for development. In 2010 the government launched an integration program for the transmission of energy and to increase coverage in isolated areas. Geothermal has been a component of a broader energy investment program.

Investment is supported through eight cofinancers of "ENACEL" program that help evaluate risk for specific geothermal fields through studies and testing reports. The Nordic Development Fund has been a key partner in the process, along with other institutional partners such as JICA from Japan, who helped with exploration of fields. Together they have developed five fields that will be critical for energy production.

The country has also partnered with IDB and WB who have provided funding for early-stage costs of exploration. A September 2015 study by the National University of Nicaragua projected that by 2030, geothermal will represent 30% of the energy generation matrix. Currently geothermal represents 15%.

Marc Murnaghan: Polaris has taken over the San Jacinto site development. Nicaragua's geothermal resources are plentiful, and the government is willing to support investment.

The availability of debt capital is the limiting factor to the development of the resources in the country.

Equity for the Polaris project has come from Canada, which has a history of financing mining projects. Investors take the risk of drilling, but mining and drilling is perceived to have a high upside. Investors will take high risk if there is a high upside. International carbon pricing systems can get that high risk down.

The renewables market is limited by fixed energy prices though, and more investment capital is going towards low risk, low return investments in solar and wind.

Risk is the big hurdle for geothermal. Public private partnership to lower risk in geothermal is essential for development of geothermal in Nicaragua. Political risk is also a challenge, but Nicaragua is relatively stable politically.

What kind of governmental support is needed? In San Jacinto, there were problems with the initial contract and development program before Polaris came in, but the government made concessions to allow the projects to proceed. Additionally, investors need to buy surface land to get into potential fields. The government has been helpful in facilitating land purchases when the owners are not otherwise interested in selling.

Ernesto Martinez Tiffer: It would be very complicated and difficult to negotiate field acquisition without the intervention of the government. Geothermal development is an important collective goal and is worth making a push for. This is similar to when there was development of hydroelectric dams where artificial lakes are created. Since Nicaragua has at least 10% involvement in each project, they have to provide some assistance to developers.

Hector Baldivieso: At the volcano Cosiguina, Phase I of surface studies has been completed and in 2016 there will be drilling of slim wells to determine the possible development of the field. JICA will assist with this stage, and are in a similar process in Costa Rica. There are three fields in development. The next stage is commercial exploration. In the next five years the country will have gotten closer to generating more geothermal power.

Ernesto Martinez Tiffer: Additional fields between Masaya and Granada have the potential for 1000-2000 MW, according to experts. These are now in the initial study phase. In the shorter term wind will be the renewable resource of choice.

RISK MITIGATION: ONE SIZE DOESN'T FIT ALL

Mario Cerna, Senior Energy Specialist, Central American Bank For Economic Integration (CABEI)
Mauricio Garron, Director of Strategy and Energy Studies, CAF
Christiaan Gischler, Lead Energy Specialist, Inter-American Development Bank (IDB)
Migara Jayawardena, Senior Energy Specialist, The World Bank
Jens Wirth, Senior Project Manager, KfW

Christiaan Gischler: Reducing investment risks reduces the cost of investment. Based on lessons learned from previous geothermal projects, risk decreases significantly after the initial study and exploration phases I and II. To address this, IDB provides contingent recovery grants and there is also the risk mitigation fund through the Geothermal Development Facility for Latin America (GDF)

Jens Wirth: The cost-sharing approach has shown to be more successful. Up to 40% of the costs were covered for projects in East Africa through a GDF risk mitigation fund.

One large challenge to geothermal projects is the speed of development. In Latin America and the Caribbean, not only does there need to be risk management in the exploration stage, but projects need to move quickly to provide energy as quickly as possible.

Also, disbursement of the grant funding can be delayed if countries cannot meet the requirements on time.
Migara Jayawardena: The backstopping process of risk is necessary for upstream investment. The government has to assume this risk to make projects possible.

Mario Cerna: The development of geothermal with Latin America has been since the 1990s, but started to advance significantly since 2008 with the financing for San Jacinto. CABEI works closely with governments to facilitate project development.

Mauricio Garron: How can CAF help develop plans to meet growing demand for energy infrastructure? How can they join forces with other institutions to bring this about as quickly as possible? Interest in geothermal is growing worldwide, and there is also an effort to develop best practices that future projects can be developed and draw more support from stakeholders. Effective partnerships will be critical.

Migara Jayawardena: What are the top key things to do to lead to success?

Mario Cerna: Governments should find areas that optimize resources, and work closely with institutional partners.
Jens Wirth: Governments should take on the projects with the best potential (based on experience). This involves A) having experience and financial background with developers, B) evaluating the quality and state of the project through testing, and c) determining whether there is a viable business case for the project. Will this be commercially viable to develop? Must demonstrate that in the rigor of the market you have a viable case for development.


Christiaan Gischler: The ability to develop Public Private Partnerships (PPP) is important. State participation is vital to private sector success in many markets.

Garron: When evaluating projects, to determine their viability, you have to determine what criteria to use to determine what each stakeholder considers to be a marketable project.

PROJECT SHOWCASE: EL CEIBILLO, GUATEMALA

Silvia Alvarado, Director, National Commission Of Electric Energy – Guatemala
Otto L. García, Field Manager, El Ceibillo, Us Geothermal Guatemala

Silvia Alvarado: Renewable energy makes up a large share of current energy generation: especially hydro and biomass, but solar and wind also growing market share. Geothermal represents a small portion at 2.35%.

The regulatory framework in the country has paved the way for energy investment, and the energy market is now open to private investors. New geothermal investments will be driven by private sector capital. New laws create incentives for renewable energy development. Projections for potential is between 300-1000 MW.

Two projects are currently in operation generating 50MW, while five areas in particular have been studied with a potential for nearly 300MW.

An early energy plan was put in place in 1995, and will expire in 2017. Not much has been accomplished in the way of developing geothermal energy, but the new incoming administration has plans to open up new geothermal fields for development.

There is a national fund for geothermal that is in place until 2020. The government is working with various stakeholders to develop and diversify the energy production matrix. There are plans for these stakeholders to meet in 2016 to increase capacity and seek strategies for risk mitigation.

Otto Garcia: U.S. geothermal has two projects under development in El Ceibillo, Amatitlan, with capacity of 50 MW.

Estimated geothermal output potential near 520 MW. Geothermal resources in Guatemala are concentrated mainly in Southern Pacific regions.

Despite the business-friendly environment, investors would still like to operate in more areas that the government currently won't allow. New PPP partnerships might open new regions for exploration. However, Guatemala needs more political "willingness" to get these structures off the ground.

Further complicating the issue, domestic technical capacity is weak, as there are few skilled workers to evaluate projects; need to develop an educational training program. Guatemala should establish links with El Salvador that already has university training programs in geothermal.

Overall, total potential for geothermal in Guatemala is unknown, as much remains unexplored. However, the costs of development of geothermal are still too high, and there needs to be improved technology for it to be a more viable option.

BREAKTHROUGH MARKETS: BOLIVIA, HONDURAS & PERU

Marco Antonio Escobar Seleme, Project Director, Laguna Colorada, ENDE - Bolivia
Mauricio Garron, Director of Strategy and Energy Studies, CAF
Ing. Rene Soto, Director General of Energy, Secretariat of Energy, Natural Resources, Environment and Mines - Honduras
Luis Alberto Vega Alva, Funcionario de la Dirección General de Electricidad, Ministry of Energy And Mines - Peru

Marco Escobar Seleme, Bolivia: Bolivia's 2025 electricity plan is to develop alternative energy projects, and geothermal projects to 100MW.

Bolivia is in the final stages of negotiation with the financier on the Laguna Colorada project, and are signing an agreement with JICA to begin exploration through well drilling.

The Laguna Colorada site is in the extreme southwest of the country. Development in the site Began in 1990 with 6 wells drilled, and others tested in subsequent years. Tests on wells in 2012-2013 yielded good results, and the project is promising.

The Initial pilot phase involved developing the existing wells, producing just 5MW of output. Exploration allowed for evaluation of the production potential. Later stages include opening of additional wells followed by installation of pipes, then building the plant, and the last stage is to build transmission lines.

Broadly the development of geothermal is complicated by the fact that some areas for exploration exist in national park reserves. Development in these areas requires negotiation with the government.

Luis Vega Alva, Peru: Since 1997 Peru has been exploring geothermal energy. Master plan projects nearly 3000 MW of energy potential from geothermal.

Laws determine whether explorations is permissible, depending on whether purposes are for electricity. Potential developers must apply for authorization, which would allow them to study and explore a site for three years. After studies, in order to develop the resource, the developers need government concessions that lasts 30 years. If the purpose is to develop electricity from the resource, the developer needs a concession for geothermal production, and a concession for electricity production.

Explorations and studies have been done in 2007, 2012, 2013, and 2015 with Cooperation of the Japanese through Japan International Cooperation Agency (JICA)

Since 2010 or 2011, the government of Peru has begun to grant concessions for drilling and developing. Total projects in progress since 2011: 15 in phase I (exploration), and 2 in phase II (drilling wells). However, government authorizations for exploration dropped between 2011 and 2013 because of environmental concerns.

In September, the government created a center for geothermal studies that will try to identify possible projects.
One limitation is that geothermal is not currently competitive in prices, which makes it difficult for Investors who are not willing to invest in geothermal because no guarantee of returns. The government is studying ways to make investments attractive through auctioning utility contracts for 20 year periods.

Other limitation is that some of the potential geothermal fields are in national parks and protected areas. Interested developers will need to get permission from the authorities to proceed with exploration projects.

The development of other renewable energies is low, and the combined output from wind, solar, and biomass amounts to about 2.5%. The hopes is that geothermal can be developed to amount for 5% of the energy matrix, and more in the long term.

Rene Soto, Honduras: By 2022, the country plans to have 80% of energy generation through renewable sources, and 20% through carbon-based energy.

The legal framework has been developed to encourage investors and developers to start projects in the country. In 2007 a law promoting renewable energy generation was passed. A subsequent 2014 law consolidated these efforts, which reduced tariffs on biocombustibles and streamlined the licensing process to just two weeks for approval for energy projects. One such measure is to allow the purchase of all materials and equipment to be exempt from taxes. Private investment will be the principal source of development of energy projects.

To date, Honduras has not developed geothermal energy. Studies have identified over 200 areas of geothermal activity, but only one area has a developed project of 35MW. Rather, the country sees solar as a more attractive energy generation source for the short term, since there has not been much interest in geothermal on the part of investors and developers.

There remains much room for development of geothermal energy in Honduras. The country is committed to developing renewable energies, and is open for development, with few legal, and social obstacles.





PROJECT SHOWCASE: CASITA-SAN CRISTOBAL, NICARAGUA

Migara Jayawardena, Senior Energy Specialist, The World Bank
Marc Murnaghan, CEO, Polaris Infrastructure Inc.
Ernesto Martínez Tiffer, Presidente Ejecutivo, Empresa Nicaragüense De Electricidad (ENEL)

Ernesto Martinez Tiffer: Cerro Colorado Power (CCP, a subsidiary of Polaris Infrastructure), a government partner, has the concession for development at Casita, which has the largest potential energy output at 225MW, compared to San Jacinto's 167MW.

There are currently three sub areas of exploration and studies: Ometepe, Masaya, Mombacho with a potential for 30 MW production expected from each site.

While Polaris continues to develop San Jacinto, they are also exploring the Casita site. The project with Casita is near final approval, and there is confidence that there will be a viable geothermal field discovered.

Marc Murnaghan: The length of time for developing projects makes investments difficult for private companies. The faster you can carry out studies, the faster investment decisions can be made.

Costs are not reduced in a linear process, but rather, a project has to reach a certain stage of development before costs can come down. Investors would like to have drilled at least test 3 wells before deciding on a project's viability, but possibly 4 or 5 would be better. Along the process the company needs access to capital resources to continue to reach project milestones.

Migara Jayawardena: This requires investment commitment to develop wells, since a piecemeal approach is not efficient.
After phase I and II (surface testing and exploration drilling), investors need to identify further funding sources to proceed to the next stage of development which includes production drilling and power plant building. This comes in the form of cost-sharing arrangements. These arrangements depend on the risks being shared between public and private stakeholders.

When arriving at the production stage, commercial financing is difficult to acquire. Developers need to generate equity. Some funding can come from World Bank sources. The financing approach ideally takes project from drilling to power plant production. Still, financing has to be flexible enough to adjust based on progress.

Ernesto Martinez Tiffer: Not all countries have the same potential for development, nor have all approached development in the same way. As a small country with limited money for development, Nicaragua has chosen to turn to the private sector.

Marc Murnaghan: Another point is that developing projects requires a lot of coordination – Nicaragua is lacking in terms of supply chain, so materials and equipment like drilling rigs are sourced from outside countries and it can be a challenge to get everything moving smoothly.

SPOTLIGHT MARKET: MEXICO

Salvador Espíndola, Technical Director, Grupo Enal
Noel González, Project Manager, Grupo Dragon
Maria Isabel Haro, Consultant, Capital Markets and Financial Institutions Division, Inter-American Development Bank
Michelle Alejandra Ramirez Bueno, Director of Geothermal, Ministry Of Energy (SENER) – Mexico
Chris McCormick, Director of Strategy and Project Finance, Reykjavik Geothermal

Michelle Alejandra Ramirez Bueno: In 2013, Mexico underwent a process of constitutional reform, which includes an overhaul of the energy sector. In 2014 a geothermal energy law was passed to regulate geothermal exploration, complementing the national waters law. The laws requires the registration of general areas of interest, where exploration is not exclusive. Permits are given for 3 years of exploration activities to prove viability of sites. If the site is viable, a concession can be issued to grant access to the field for 30 years. Regulations require that steam is reused to ensure sustainability.

After energy reform law was passed, explorations and permits to explore increased rapidly.

Prospective growth in industry to double, with total potential of 13.4 GW

Price setting the market is still young and the system infrastructure is developing. But projects are moving forward and investors will come.

Maria Isabel Haro: The Mexican Government has sought to provide investment financing for risk mitigation. There is $57 million available in the form of contingency grants and donations through the Clean Technology Fund. The fund is necessary because banks aren't lending to the sector, and there isn't sufficient insurance available to support exploration for early stage explorati on drilling.

The CTF provides a backstop for exploration projects – if a project fails, CTF funds will cover losses, and the investor does not have to pay back the grant.

Many projects are cut short because of a lack of funding. The efforts of the Mexican government through the CTF are to bring consistent financing sources and reduce risk with the intent to foster the growth of a sustainable market. The hope for Mexico is that in the next 10 years there is a market developed to a point where there are more banks and insurers, and that public and private support for more geothermal projects increases.

Noel González: Grupo Dragon (GEODESA) is the first private company in Mexico to have a geothermal field online. They are currently working on the San Pedro project. San Pedro is 100% financed through domestic funding sources. Development at this site started with a 5MW project, with potential capacity of 52MW. Grupo Dragon has drilled several wells and is currently constructing an additional 25MW plant.

A problem for further development is that the price of geothermal energy is not more attractive than other energy

sources. Further investment requires that the prices of energy are competitive compared to alternatives. This situation makes it difficult to attract more commercial partners.

Salvador Espíndola: Mexico is eager to look for new projects in the country, and the legal framework has been streamlined to support growth in the industry. The question is if the new framework can keep up with movement of the industry.

Chris McCormick: Geothermal development is not only a technical problem, but also legal and political problem. If these are not addressed, in 5 years you won't see any progress.

If Mexico is to meet its aggressive renewable energy targets, refo This requires energy reforms that include: A) privatization of oil and gas b) CCGT (Combined Cycle Gas Turbine) power from natural gas, and c) geothermal power. The perfect scenario for development of the sector is to gather finance (from both domestic and international sources) with complementary institutional and legal reforms.

The best financing programs address the first $20-30 million of a project. This reduces risk and makes for attractive environment for investors.

Not unreasonable to suppose that – if Mexico succeeds in putting the pieces in place - Mexico could potentially generate 10GW of energy.

Other countries should make a strong commitment to reforms like Mexico because otherwise the money will go somewhere else.










PROJECT SHOWCASE: PAILAS II AND BORINQUEN I & II, COSTA RICA

Miguel Ángel Hernández Alfaro, Coordinator of Financial Management, Business Engineering and Construction, ICE
Enrique Rodriguez, Senior Energy Specialist, Inter-American Development Bank (IDB)

Hernandez Alfaro: Production of energy in Costa Rica is mostly derived from renewable sources, of which the majority is from hydro power. In 2014, geothermal power represented 15% of the energy matrix. According to a study conducted in the 1990s, the country has a total geothermal potential of 875MW, and there is 195MW of geothermal energy in operation. There are currently three projects under construction (Pailas II, and Borinquen I & Borinquen II) that will generate 165MW, which should be in the final stages of development by 2018, 2022 and 2024 respectively.

Two fields in Miravalles and Pailas were opened in 1994. The long-term development plan at these sites involved integrated studies, specialized designs, and operational expertise with the goal of maximizing development. JICA has provided the operational expertise for geothermal projects, and cooperation with investors ensured that the project was being carried out according to plan.

For Pailas II and Borinquen I and II, the first step has been to determine if the project is "bankable," which depends on the potential output of the site. If the project is feasible, the project will receive institutional approval within one year. By the second year, the Secretary of the Environment will assess environmental impact before granting an environmental license. This licensing process takes between six months to a year. At the same time, licenses for land use are granted. By the third year, the financing process begins. This requires due diligence in determining budgets, scheduling, licensing, financial scheduling requirements (milestones). This transparent process reassures investors. The next step is to acquire state approval from Congress. With this a contract is signed specifically for the project in question and concessions for development are granted. Developers must meet milestones in order for subsequent disbursements of money to follow.

Much of the best sites are in national parks. Hernandez suggests that these be opened up for development of geothermal resources.

GEOTHERMAL DEVELOPMENT FACILITY (GDF) LATIN AMERICA | JOINT LAUNCH OF THE BCIE/KFW – MUNICH RE & CAF/KFW – MUNICH RE BRIDGE AND INVESTMENT FINANCING PROGRAMS

Mario Cerna, Especialista en Energía, BCIE
Mauricio Garron, Director Análisis y Estrategias de Energía, CAF
Matthias Tönnis, Senior Underwriter and Geologist, Munich Re
Jens Wirth, Senior Project Manager, KfW Development Bank

The Central American Bank for Economic Integration (BCIE) and CAF, Development Bank of Latin America, announced their new Geothermal Bridge and Investment Financing Programs. In close cooperation with Munich Re the Programs will provide tailored debt financing for both the capacity drilling as well as plant construction phases of the project development cycle. The Programs were jointly developed between BCIE, CAF, MunichRe and KfW under the framework of the Geothermal Development Facility (GDF). The GDF constitutes the first multi-donor initiative to promote geothermal energy on a continental scale.

GEOLAC KEYNOTE ADDRESS

H.E. Dr. Vince Henderson, Permanent Representative & Ambassador of the Commonwealth of Dominica, United Nations

Dominica & St. Lucia have pursued geothermal energy since 1950s, prior to independence.

In early 2000s development of the resource began in earnest, and the countries received support from OAS. Dominica has invested over $20 million dollars in geothermal. More than 50% of this funding came from grants from institutional partners such as the World Bank.

Some of the major challenges faced by the region:

- Caribbean has some of the highest energy rates in the world
- High up-front costs are a challenge for Caribbean governments, who must rely on grants to mitigate risks and costs.
- Relatively small markets limit the scale of geothermal production and create local monopolies for energy provision.
- Managing the integration of geothermal energy within existing power systems
- Currently, Caribbean nations are dependent on fossil fuel for energy.

Despite these challenges, there is still much potential for solar, wind, and geothermal energy in the region. How can countries harness these technologies for the development of a viable energy sector?

Countries need to invest in R&D studies to determine the suitability of different energy sources for Caribbean countries, using lessons learned and best practices gleaned from projects in bigger markets. They also need to be sure that investments in technology are fully utilized, and not that investments are made just for the sake of buying new technology.

Two challenging features of geothermal are the high up-front costs and the long time it takes to develop the resource. Overall costs are now comparable to diesel imports, but investors will want at least 20% return. Moreover, once installed, it is not efficient to scale geothermal plants up or down, as with other technologies.

Geothermal energy will compete with other power sources. If investing in solar, wind, and hydro, geothermal investments cannot be installed to a scale that undermines other technologies.

Main points to focus on for the Caribbean region are: 1) to work to minimize risk from geothermal; 2) important that in the enthusiasm to develop geothermal, governments choose the right partners; 3). Need to rely on expertise and best practices gained from projects in other countries.

INTERNATIONAL SESSION

Thrainn Fridriksson, Energy Specialist, World Bank Energy Sector Management Assistance Program (ESMAP)
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Clotilde Rossi di Schio, Manager for Sales and Business Development, Americas, Turboden
Stephen A. Morel, Climate Finance Specialist, Structured Finance, Overseas Private Investment Corporation (OPIC)

Thrainn Fridriksson: Turkey's geothermal market is one of the fastest growing in the world, and is an example of successful development of the resource. Investment was opened to private companies that were granted concessions, and developed 500MW in just over 10 years. Funding support is provided for early exploration. Developers can apply for funding to drill 3 exploratory wells through a Clean Technology Fund as well as ESMAP, and this will cover 40-60% of drilling costs.

Roger Henneberger: GeothermEx has worked on project assessments for more than 40 years. One lesson learned is that when problems arise, it is important for governments to not to add complexity to projects because this inevitably drives away investors. Investors want to see a clear path for project development. It is also important to be realistic about expectations based on resource assessments and not try to push projects past what the assessment determines.

Anthony Hinde: Based on the successful development experience in Turkey, the mitigation of drilling risk is one of the clear lessons learned. The government has worked to mitigate risk, and then auctioned concessions which are attractive for investors. Selling the concessions is extremely valuable for governments, and developers paid for them because Turkey offered a 10-year fixed-rate feed-in tariff of $105 per MW.

While Turkey is the fastest growing market in the world for geothermal, Indonesia's progress has been very slow because of lack of transparency and clarity about procedures.

Another good example is Kenya. Kenya drills the resource and provides the steam, and then sells the concession to develop the resource into electricity, at which point the government purchases the converted resource. This way the developer has a very clear idea of what their income is going to be over the next 20 years.

An additional way to develop the resource is through new turbine technology. This can be retrofitted to existing projects that are not developing at their full capacity, or if sites have not been developed, countries can revisit sites to see if projects would now be feasible given the new technology.

Clotilde Rossi di Schio: It is important to work with good providers for long-term solutions. There is a huge potential for retrofitting systems or better use of brine to improve existing infrastructure.

PROJECT SHOWCASE: CHINAMECA & SAN VICENTE, EL SALVADOR

José Estévez, Commercial Director, Grupo Cel
Mariano González Serrano, Senior Energy Specialist, The World Bank

El Salvador has made a priority of developing green energy, especially geothermal. Grupo Cel is leading the development of geothermal projects in El Salvador.

There are two new fields - Chinameca and San Vicente - which are part of an accelerated development process. El Salvador has 207 MW installed capacity in country, and, in light of new technology, there is a total potential of 500MW.

There are at least four key elements to realize this goal:

1) Competent management from an entity or organization that will work towards the national interest of El Salvador, where geothermal development is a priority.
2) Identify a company with sufficient prior experience with geothermal development.
3) Have government authorities that will remained focused on projects and facilitate process of development.
4) Have a good structure for financing projects that can meet the challenges that arise and make use of lessons learned from other geothermal projects.

By 2018 share of energy from geothermal will fall relative to other sources, as investment in wind and solar energies moves forward. As a country with ample geothermal resource potential, El Salvador must develop these resources further in the coming 15-20 years. Wind and solar have high costs and are subject to intermittent generation, which can lead to lags in energy provision for the country. Geothermal is more durable and reliable.

The lack of local materials is a limitation, and can slow down the process. To maintain an accelerated track towards geothermal development, this challenge will have to be overcome. From the government's end, the process will have to be revised streamlined and bureaucratic steps should be minimized. A model for fast-tracking development and modernizing technology with modular plants can reduce the time needed to bring a project to generating power. Initial development phases and approvals can be completed within one year.

The target is to have 50 MW of generation from Chinameca and 30MW from San Vicente by 2019.

WHY REGIONAL CAPACITY BUILDING IN GEOTHERMAL MATTERS

Juan José García, Project Manager, Regional Geothermal Training Program, National Council Of Energy, El Salvador
Manfred Haebig, Regional Program Director (4E Program for Central America), GIZ

Juan Jose Garcia: Central America has huge potential for geothermal development, but progress is limited. There is a need for more skilled people, stronger institutions, and increased cooperation between industry and academia. Since 2009 El Salvador has worked in cooperation with universities in El Salvador and partners from Italian organizations as well as the IDB to develop a regional geothermal training program. The aim, broadly, is to create a center to increase the number of trained professionals in the region. The program has been developed in a systematic manner, beginning with an initial baseline phase, which will provide a foundation for the greater long-term plan.

There are diverse stakeholders in the program, starting with United Nations University and the government of Iceland who are involved in carrying out the diagnostic component of the baseline phase. They have continued assessments of the academic aspects of the program and will conduct an audit to evaluate progress thus far. Results are promising, as the baseline levels have been improving. The International Geothermal Association, the International Geothermal Center and the government of El Salvador have been in charge of the long-term planning for the training center and program. The University of El Salvador, along with LaGeo and CNE (Consejo Nacional de El Salvador), are in charge of running the training programs. The program brings together three important dimensions – the academic side on the part of the University of El Salvador, the technical side from industry partners, and the political side from CNE. In 2014 JICA joined the effort to complement the program. Funding for the training program comes from the IDB, NDF (Nordic Development Fund) and CNE.

Next steps for the training program involve a pilot program of e-learning modules in 2016, and organizers hope to continue sharing in knowledge and developing networks in Central America for better knowledge and capacity.

DRILLING COSTS: MANAGING THE KNOWN UNKNOWN

Paolo Bona, Geothermal Consultant, The World Bank
Bill Rickard, President, Geothermal Resource Group

Bill Rickard: Costs are highest in the early exploration phase of projects, and decline steadily as the site is developed. In order to reduce costs and change the way the risk curve looks, more attention should be paid to planning and studies can translate into major cost savings.

There have been no significant advances in drilling practices for many decades, but planning is a key component of saving costs in drilling. The planning is the stage where many projects run into problems. Gathering all geological data beforehand provides a baseline for understanding project viability and drilling strategy, which in turn reduces costs. To develop a more efficient plan, you need to know what you are facing first. Preliminary sampling of sites provides valuable information for drilling, such as the size of test wells, what depth to drill, what kind of equipment to use, and where the wells have the best temperature. One should ideally follow an iterative process to drilling. Plan, drill, test, plan.

Drilling represents half of the cost of a project, so studies up-front can save money down the road, reduce risk, and reduce cost.

CARIBBEAN: DEFINING THE SUCCESS CRITERIA FOR GEOTHERMAL DEVELOPMENT

Alastair Brookes, Clean Energy Advisor, JACOBS
Sylvester Clauzel, Permanent Secretary, Ministry of Sustainable Development and Energy - St. Lucia
Ellsworth Dacon, Director, Energy Unit, Ministry of National Security, Air & Seaport Development - St. Vincent & The Grenadines
Hon. Ian "Patches" Liburd, Minister, Ministry of Public Infrastructure, Post, Urban Development and Transport - St. Kitts and Nevis
Hon. Troy Liburd, Minister, Ministry of Communications, Public Works, Public Utilities, Posts, Physical Planning, Natural Resources, and Environment – Nevis
Migara Jayawardena, Senior Energy Specialist, The World Bank
Mark Lambrides, Senior Energy Specialist, The World Bank

Geothermal energy production is not new to the Caribbean region, but in the past projects – with the exception of the Guadeloupe plant – have not been successfully developed.

Alastair Brookes: Recently, New Zealand has supported efforts to developing geothermal through technical sharing and expertise based on the development approach used in the Pacific. They have provided a combination of technical studies and advisory services.

Grenada had earlier studies done with assistance from the Italians in 1980s, and in 1990 by the United States.

However, development fell through due to political reasons.

Recently the New Zealand government signed a Memorandum Of Understanding (MOU) with Grenada, and JICA has been undertaking surveys and studies with assessments due to be completed by the next year.

A challenge in the process is posed by small size of markets. In Grenada, 10 MW of energy provides 50% of all demand. Once the resource is developed, the utility contracted will have responsibility for a long-term project of 25 years. This is a large commitment for both sides of the agreement.

Further, the capacity of government is strained – a relatively small number of public sector workers are given much responsibility for broad issues, and devoting government resources in the form of personnel to a project is difficult.

Sylvester Clauzel, St. Lucia: The island has had a long history of exploration since 1950s, and has drilled several exploratory wells over the years. However, problems arose, and the chemical content of the steam made further generation prohibited. Since then, the site of the wells was determined to be a world heritage site by the UN, so government had to reassess its efforts.

In 2004, the government signed an agreement to develop a plant, but the technical organization hired was unable to complete requirements and the project was abandoned. A new agreement was signed in 2011 with more stringent requirements. Key partners – specifically the World Bank and the Government of New Zealand - have committed to help support the process.

The objective for developing geothermal is to achieve energy security first, and second to reduce energy costs. The high energy costs put a strain on citizens and raise tourism costs. Natural gas was not a solution to ensure energy security goals.

The first step was negotiating a financial development plan before proceeding to ensure that the geothermal resource is a viable option for reducing energy costs, and not an opportunity to provide runaway profits for a private developer.

A national regulatory commission will facilitate operation of utilities and improve reliability of services. Investors to be offered a fixed rate of return.

Ellsworth Dacon, St. Vincent & The Grenadines: The history of geothermal on the island spans over 20 years, starting in 1991 when an Italian company conducted exploratory studies. These studies determined that St. Vincent and the Grenadines was not the most ideal location for geothermal development. Subsequent studies came with mixed results. Challenges with the island terrain suggests that geothermal operations would be difficult, so the government changed their strategy. There would be no further studies, but they invited a company to explore production viability and pursue a PPP. A geothermal bill was drafted to pursue the project further.

The advantage of having a private partner is speed. Private investors are motivated to develop and produce results. With this, the government hopes to have a plant in operation by 2018-2019.

Hon. Ian "Patches" Liburd, St. Kitts: A failure to invest in the countries geothermal resource would amount to a failure for the country both socially and economically.

On Sept 4th 2015 the government signed an MOU with a French company, and the first project is proposed to be completed in 5 years. The government wants to determine the viability for geothermal energy on the islands. In 2016, developers will start the process of slim-hole drilling, and a workshop will be held to bring grants, subsidies, and funds. By 2017, commercial sized drilling will be carried out, by 2018 final authorization can be given, and developers should finalize the installation process by 2020.

In this process, there will be no problems stemming from "legacy issues" from earlier geothermal exploration; rather the government has learned from this experience. The current project represents a 50/50 PPP with St. Kitts and the private company in question.

One misperception about investing in the Caribbean is that the population is too small, but based on the expected expansion of tourism, energy demand will increase greatly. The process has to be done cooperatively while managed under a regulatory framework for licensing and distribution.

Ambassador Vince Henderson: In Dominica, testing, exploring and drilling has been completed, and projects on the island have arrived at a stage where turbines can be installed and power can begin to flow.

One concern is that the region needs a permanent platform to share information based on lessons learned, and best practices. Dominica has the only independent regulatory commission in the region to negotiate a PPP.

A World Bank study found Guadeloupe, Dominica, Martinique have the best potential for geothermal development and inter-island transmission networks. The World Bank has been a key partner in terms of providing technical expertise and financing, as well as the government of France (ADF).

APPENDIX 1 - LIST OF CONFERENCE PARTICIPANTS

First Name	Last Name	Title	Company	Work Country
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Sylvain	Brogle			France
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