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- **Hon. Rayburn Blackmoore**, Minister of Public Works, Energy & Ports, Government of Dominica
- **Dr. Moisés Dávila**, Carbon Capture Usage & Storage Initiative Leader & Advisor on Renewable Energies, Ministry of Energy – Mexico
- **Honorable Dr. Edgar Gutiérrez Espeleta**, Minister of Environment, Energy, Sea, Coasts & Wetlands, Government of Costa Rica
- **Hon. U. Troy Liburd**, Junior Minister, Ministry of Communications, Works, Public Utilities, Posts, Physical Planning, Natural Resources and Environment, Government of Nevis
- **Hon. Edwin Ramon Rodas Solares**, Vice Minister of Energy & Mines, Government of Guatemala
- **Pierre Audinet**, Clean Energy Program Leader, Energy Sector Management Assistance Program, The World Bank – USA
- **Paolo Bona**, Geothermal Consultant, CAF, Development Bank of Latin America – Venezuela
- **John Borgersen**, Vice President of Strategic Planning, Tetra Tech – USA
- **Diane Brown**, Senior Environmental Analyst, Overseas Private Investment Corporation – USA
- **Mario Cerna**, Energy Specialist, Central American Bank for Economic Integration – Honduras
- **Jacques Chouraki**, President, Teranov – France
- **Sylvester Clauzel**, Permanent Secretary, Ministry of Sustainable Development, Energy, Science & Technology, Government of St. Lucia
- **Malcolm Cosgrove-Davies**, Manager, Energy Sector – Latin America & Caribbean, The World Bank – USA
- **Eduardo Cuevas**, Senior Investment Officer, International Finance Corporation – Guatemala
- **Carlos Jose Echevarria**, Senior Energy Specialist, Inter-American Development Bank
- **Marco Antonio Escobar**, Project Director: Laguna Colorada, Empresa Nacional de Electricidad
- **Hon. Elvis Rodas Flores**, Under-Secretary of Energy, Ministry of Energy, Natural Resources, Environment & Mines, Honduras
- **Juan Jose Garcia**, Regional Geothermal Training Program Coordinator, Consejo Nacional de Energía – El Salvador
- **Anita George**, Senior Director – Global Practice on Energy and Extractive Industries, The World Bank
- **Dr. Gerardo Hiriart**, CEO, ENAL – Mexico
- **Vilhjálmur Gudmundsson**, Director of Business Development, Green Energy Group
- **Migara Jayawardena**, Senior Energy Specialist, The World Bank – USA
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- **Ariel Arman Lapus**, Managing Director for Latin America, Energy Development Corporation – Philippines
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- **Ariel Sacerdoti**, Vice President of International Business Development, Ormat – USA
- **Christian Santana**, Director of the Renewable Energy Division, Ministry of Energy
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- **Shohei Tada**, Energy Expert, Inter-American Development Bank – USA
- **Toshitaka Takeuchi,** South America Division Chief, Japan International Cooperation Agency – Japan
- **Mark Taylor**, Head of Geothermal Research, Bloomberg New Energy Finance – USA
- **Manuel Torres**, Sectors & Countries Department Manager, Central American Bank for Economic Integration – Honduras
- **Wesly Ureña Vargas**, Senior Geothermal Engineer, KfW Development Bank – Germany
- **Joseph Williams**, Energy Consultant, Caribbean Development Bank – Barbados
- **Jens Wirth**, Project Manager, KfW Development Bank – Germany

CONFERENCE OVERVIEW

The launch of **GEOLAC** in 2012 reflected the emergence of geothermal as a long-term source of baseload power for Latin America and the Caribbean.

Two years on, and the prospects for the development of LAC geothermal are stronger than ever. The prevailing economic climate is markedly more confident, multilaterals are moving aggressively to mobilize resources, and well-capitalized developers are targeting proven resources region-wide.

Co-Hosted by The World Bank, **GEOLAC 2014** gathered key stakeholders — governments, utilities, multilaterals, developers, capital providers, and other providers of expertise — to explore opportunities for increased geothermal output, tackle obstacles to development, promote the exchange of knowledge and expertise, and facilitate vital new meetings and relationships.

OVERVIEW OF GEOLAC 2014: SESSIONS AND UNDERLYING THEMES

1. Mitigating Risk: New Tools, New Partnerships, for the LAC Region
Drilling risk is geothermal's historic show-stopper, and it is a major hurdle for most green-field development in the LAC region. The private sector is particularly challenged to mobilize risk capital in today's environment. We are seeing, however, the emergence of new mechanisms, which may change the landscape for early-stage risk mitigation such as cost sharing funds, public sector exploration, and insurance. What has worked globally? And what holds promise for LAC?

2. Mobilizing the Private Sector: Policy, Regulation, Risk Mitigation
A panel of developers holding concessions across the region discussed what can be done to catalyze the development of geothermal in the LAC region. What are the priority policies and regulatory and risk considerations that are critical to mobilizing financing? Developers also detailed the risks they face and the legal and regulatory measures that would enhance the investment climate, power off-take considerations, taxes and other incentives.

3. The Central American Leaders Session: Contrasting National Approaches & Exploring Emerging Opportunities for Geothermal Development
As a region, Central America has led the way in terms of the development of their geothermal resources. Institutionally and politically, however, the approach to geothermal has varied tremendously from country to country. This session compared and contrasted approaches with a view to establishing best practice at a national level. The session provided developers with a clear sense of where new opportunities are emerging across the region.

The World Bank's Migara Jayawardena leading the Risk Mitigation Session

4. A Masterclass in Geothermal Financing
Which geothermal "business models" have most successfully mobilized financing? What successful examples of publicly and privately financed geothermal projects can we point to and what were the success criteria? What can we learn from the multilateral/bilateral experience of financing geothermal (IFC, IDB, JICA, et al.)? What multilateral programs are coming online and with what implications? As countries & developers map out geothermal projects, how can the right technical approach impact the financing process?

5. Social & Environmental Standards: Implications for Financing and Project Success
Increasingly, meeting the Equator Principles criteria for environmental safeguards is essential for a project's bankability. What are key considerations for meeting international safeguard standards in geothermal development and what are some recent experiences?

6. Latin America & Caribbean Country Roadshows
GEOLAC Country Roadshows are designed to profile countries on the cusp of making the geothermal breakthrough. Each session comprised country presentations followed by an interactive question and answer session.

DESCRIPTION OF GEOLAC 2014 MAJOR THEMES/SESSIONS

1. Mitigating Risk: New Tools, New Partnerships for the LAC Region

In this discussion, panelists delved into geothermal's historic show stopper – drilling risk and the new mechanisms that have emerged to address early-stage risk mitigation such as cost sharing funds, public sector exploration, and insurance. The challenges that the geothermal industry faces are not typical of other forms of renewable energy and are thus more difficult to overcome.

The World Bank (WB) has identified four strategies that have been used globally to mitigate the risk associated with geothermal development. In each of these cases, the government, the private sector or a combination of both takes on the development risk of the project. The WB determined that government cost-shared drilling is the best method to reduce risk and collaborate with the private sector. The debate continues over the best ways to implement the model.

Additionally, the WB found that the majority of investments made in geothermal projects were in the construction of power plants while more funding was needed at earlier stages. As a result, the WB began a global initiative to scale geothermal energy in developing countries in 2013. $235 million in funding has been raised in a period of 16 months, most of which has been channeled through the Clean Tech Fund.

The KfW Development Bank in Germany developed a Risk Mitigation fund that will be operational by 2015. The fund will allow developers to buy down risk at the start of the project but also access financing and risk mitigation tools that are tailored to each stage of geothermal development. Grants for early surface level work are critical because spending here will impact the risk profile of the project during exploration.

Another risk mitigation tool is being developed by the French government, which is currently adapting tools from the oil and gas industry to make them available to geothermal developers. These tools could increase assurance during exploration by 40 – 60%, which will allow developers to better attract funding.

Mitigating risk also involves addressing the issues that contribute to finance gaps, such as differences in procedures from country to country, weak regulatory framing, social and environmental issues, and energy markets that do not encourage risk investments.

Other important risk factors raised by conference delegates include institutional building for the public sector, proper communication between the developer and government, financial and technical capacity building, and reputational risks for the industry that occur when an ill-equipt developer misdrills.

"The thing with risk is this — we keep talking about reducing risk but the only way to do that is to drill because it's the only way to know what's down there. This is really about allocating the risk. We know that we need a combination of stakeholders to do this." — **Migara Jayawardena**, Senior Energy Specialist, The World Bank

2. Mobilizing the Private Sector: Policy, Regulation, Risk Mitigation

New sources of capital in this industry are entering through the WB Latin American Geothermal Fund and other sources. Is this enough to catalyze the market?

Before drilling exploratory wells, developers submit a proposal outlining where and how they want to drill. Even in the best cases, changes will have to be made – the developer may want to go deeper, or drill in a different direction, or decide to drill the third well before the second. In these cases, the developer has to work against a wall that says that they need to follow what was in the initial proposal. Developers need to be able to adapt and make changes quickly during the exploratory process.

Additionally, developers have to be able to ensure that wells produce stable steam through testing by installing small pressure thermic systems. The ability to generate energy during the exploratory stage in order to test the wells and the pumps would very much attract more developers.

When entering a market, the Energy Development Corporation (EDC) looks at whether or not geothermal energy could play an important role in the energy matrix and the level of government commitment. In the Philippines, for example, EDC found a high level of government support for geothermal and an openness to partner with people who knew the business.

Once commercial operation of a plant has been achieved, risk decreases but it does not disappear. The maintenance of a geothermal field isn't something to take lightly. Ormat has two plants in Guatemala that are running very well. In 2014, one of the wells stopped running and needed to be re-drilled. Fortunately it came back online and is doing better than before.

The resources must be there; prices must be sustainable. Prices might look great in one market, but they might not work well in another and you have to look at that. Players on an international scale have to be very careful to analyze on a local basis. It's also necessary to make sure that the development of a well works for the environment. There are consequences to depleting a reservoir.

"Developing a geothermal project is very complex. It's a big orchestra with many, many, many instruments. If one of them is out of tune then the whole thing might not work." — **Ariel Sacerdoti**, Vice President of International Business Development, Ormat, USA

3. The Central American Leaders Session: Contrasting National Approaches & Exploring Emerging Opportunities for Geothermal Development

Throughout the Central and South American region, different countries have different power potential and models. What are the barriers to tapping the resources in the region?

Nicaragua installed 70 MW of geothermal power in the 1980s and has since added 140 MW. Government and World Bank support was critical in the development of these projects. Despite the fact that the wells functioned well, operating a plant is not always straightforward and requires patience in order to diminish the risk of the initial phase, not only on the offset, but also through the initial studies. To engage the private sector, Nicaragua offers tax exemptions for investors for 10 years.

Last year, **Guatemala** created a sustainable energy policy that extends to 2027 and integrates renewables into the energy matrix. Guatemala currently has two operating geothermal plants and seeks to have 6% of installed energy capacity come from other identified geothermal sites. As of 1998, however, Guatemala transitioned to an open market and the government decreased its investments in geothermal projects. Though a leader in geothermal energy in terms of making the transition from publicly to privately led projects, the decreased presence of the government has impacted the pace of geothermal development.

With the assistance of Germany, **Honduras** has awarded 500 MW in renewable concessions, 15% of which went to geothermal. A public, private partnership (PPP) was approved to develop three different sites, and feasibility study contracts have been approved. These sites have estimated capacities for 20, 28 and 35 MW. There are 15 additional geothermal sites that the government is considering.

Costa Rica started operation of its first plant at Miravalles in 1994. The Costa Rican government financed the project with help from banks and participation from the private sector. Costa Rica is aiming to achieve 90% renewable energy by 2020 and needs 1350 MW installed capacity to do this. To achieve this, Costa Rica will develop 17 additional geothermal plants. One of the biggest success factors will be the environmental and cultural issues associated with developing geothermal in Costa Rica's national parks.

El Salvador has an installed geothermal capacity of 104.4 MW, which provides 24% of its energy. The government is working to develop extensive incentive programs to diversify its energy matrix. In terms of geothermal, there are no taxes on machinery used for generation or drilling. El Salvador offers other, non-financial incentives. The government will establish the first center of research and training for geothermal in the region. The center will offer short courses specializing in different topics. The curriculum will be tailored to each country. Additionally, El Salvador and Germany partnered to open a regional geothermal office to support governments and the private sector and to develop capacity.

4. A Masterclass in Geothermal Financing

When it comes to geothermal financing, the challenge is risk – and not just resources. Additional funding is needed at every project stage, but the kind of money that is needed changes because the nature of risk changes. In the production drilling stage, there is much lower resource risk but in many cases, the equity needed could be $70 or $100 million. This is the missing middle for geothermal financing.

Once the steam starts gathering, the plant operates more or less like a conventional power plant and commercial financiers might be more open to providing funding. But the question remains - are there many commercial entities or banks that are in the business of financing geothermal at any stage?

The role of a multilateral is limited once commercial banks, bond markets or any other type of financing that's based on a corporate finance structure is tapped. The second type of financing option is when someone else provides steam resource. This is less risky because the project doesn't carry resource risk.

Do we have enough financiers who understand geothermal? This in itself is a risk — if five large projects materialized at the same time in the Latin American and Caribbean for 1000 MW, are there enough financiers who have a grounding in geothermal to assess the risk and "process" the funding requirement? Financing is limited but one of the reasons is the size of the global market. Banks have to make an investment to get into a business line because they have to train employees to assess risk. So if you have 200 solar power projects, there's critical mass. If you have a geothermal project here and then two years later another one there, there's no critical mass to train bank staff. If you had five or six projects emerge simultaneously, you might get people excited.

How do you compress the timeframe from the start of a project to the closing of financing? The more aspects of the project that are bundled and done in parallel, the riskier the project. In the traditional model, you'd do the steam, then do the financial arrangements and then do the plant construction. If you want to save time, you could do steam and construction at the same time, but if you do that then you assume additional risk if things don't go according to plan.

Exploring risk is the stage in the development process that poses the greatest risk because of how long it takes to develop models and all of the different components needed. Most drilling projects are financed by equity, which is expensive. With many wells at different locations, it takes time to examine the steam before a plant becomes operational.

One suggested approach is to build a small power plant on each well to generate electricity. With each additional well, an additional power plant would be installed. In this way, revenues are developed early and the developer creates cash flow for further investment in the project. Additionally, the geothermal wells are tested. Steam field development requires piping and a high capital investment. This model was successfully rolled out in Kenya.

By installing these wellhead plants, it's possible to create an economical and financial resource. Or, if it's not possible to sell to the grid, the energy can be utilized to power the drilling rigs. It's beneficial if developers, banks and governments can see green power added to the grid as soon as possible.

Another form of bridge financing is through securitization, i.e. securitizing cashflows from online geothermal assets to make funds available to develop additional wells. This isn't without risk, but it's less risky for developers and the model has been successful with other energy sources.

The Japan International Cooperation Agency (JICA) is one of the most active donors in the region. The market is immature and as a result there are huge risks that the private sector can't assume. Recently, JICA helped the government of Peru to create a nation-wide master plan to create resource maps and conduct a nationwide geothermal study. Preparing a concrete master energy plan is key to mitigating resource risk. JICA is actively engaged in promoting this service throughout Latin America.

The IDB is also very active in the sector and offers offers financial products and risk mitigation instruments to help with the development of projects — from grants to consolidation of loans and lines of credit.

Public sectoring financing through the multilaterals and bilaterals is not directly available to the private sector, though it can be made available to developers at certain times. Loan guarantee programs to encourage commercial entities to lend to the private sector are another tool in the multilateral arsenal.

5. Social and Environmental Standards: Implications for Financing and Project Success

Integrating the triple bottom line into the development of geothermal projects to alleviate risk can be done in many different ways. In New Zealand, Tetra Tech used local principals to evaluate risk by examining the "living vitality of all things". All stakeholders rated how resources would be diminished, stay the same, or improve. In another project, Tetra Tech involved the local population in the monitoring of biodiversity by creating a cell phone app.

Whether there's a model or not, stakeholders must be involved early. If done correctly, early involvement is a way to grow a geothermal program, not something that stresses it. Often times, environmental and social factors are considered at the mid-stage, but doing so means that projects will be exposed to risks and stumbling blocks that can become very expensive. A model that constantly informs and adapts is much stronger than one that just does an initial assessment.

CABEI and KfW created a tool to measure social and environmental risk. This involves controls for legislation to identify social and environmental risk and to verify those risks before granting the loan to the client. Environmental analysts look at projects before a loan is granted.

The Overseas Private Investment Corporation (OPIC) is the US government's finance institution which provides loans and risk insurance. OPIC worked on five geothermal projects between 1971 and 1988, primarily in the Philippines and Indonesia. In 2010, OPIC revised and expanded its self-imposed environmental and social policy. Changes were made at the urging of NGOs who wanted to make national parks more sustainable. OPIC's policy is that national parks may not be developed unless the project will not damage the park and will actually improve it.

OPIC supported a geothermal project in Kenya in a national park. There were a number of different components about this sensitive project that allowed OPIC to support it. This included minimal land clearance, existing roadways, natural features that blocked noise and visual impact, low hydrogen sulfite concentrations, the reinjection of fluids so as not to impact the water table, two phase heat extraction to reduce steam plume, pipes clad in green to reduce the view, transmission lines routed around the outside of the park, monitoring done over the years to show that the impact upon the park was low, and monetary contributions from the plant to upkeep the park.

6. Latin America & Caribbean Country Roadshows

LATIN AMERICA

Chile has an estimated potential for 16,000 MW in geothermal power. The industry faces, however, many challenges. Though there is interest in developing geothermal fields due to the very high cost of energy, government funding is limited to develop these projects. That said, all development will be private and there are currently no subsidies or preferential conditions available. Geothermal has a high structural cost in Chile due to the fact that there is no drilling industry in the country and therefore a very high cost to bringing in drilling equipment. Additionally, the areas in which the potential sites are located don't have network coverage or roads. Despite these barriers, Chile has reviewed 50 applications for different concessions and has granted environmental approval for two projects. Moving forward, the government of Chile seeks to cooperate with the industry to find solutions to these challenges and create tools to support the industry.

Bolivia has partnered with JICA to develop a geothermal site that was initially started in the 1970s. This site has the potential to produce between 100 and 300 MW. JICA did the technical operation and trained the workers. Because the site is remote, the cost of interconnection alone would be $50 million. In July 2014, however, Bolivia signed a contract with JICA for concessional funding. The bidding for the design and supervision of the drilling is currently underway. By 2016, Bolivia anticipates having nine active wells in addition to tenders for other sites. All of this will be completed by 2020.

An additional challenge in Bolivia is the need for a social license for projects. This must be completed before any work is done. Indigenous communities and other offices, such as the Ministry of Tourism, are involved in the project from the outset.

There are a couple of mining companies that have applied to work as link companies on geothermal concessions. There is interest amongst them, but this does not constitute a boom. First, some projects have to be concrete for them to see that there's potential and demand. Second, the mining industry has to learn the ins and outs of a new industry.

CARIBBEAN

Many Caribbean islands are volcanic and therefore have the potential for geothermal energy development. A number of islands have conducted exploration since the 1950s, but without much success. The populations, power demand and projects are small, and so the question is how can these islands attract high-quality developers and compete with high electricity costs?

Caribbean Ministers explored opportunities for regional collaboration on geothermal at GEOLAC 2014

The development of geothermal energy in **Nevis** is an ongoing saga. The country has been seriously trying to delve into geothermal for about 10 years now.

Nevis and St. Kitts has a population of 52,000 and both islands take up 104 square miles. There is an installed capacity of 56.4 MW and the average cost of electricity is 37 cents. 70% of profits from electricity sales go to purchase fuel for power generation. There are two government-owned utilities, both of which are monopolies. Other project stakeholders include the government, bankers, lenders and the citizens.

The Nevis administration hopes to construct a 10 MW geothermal plant. Though the average base load in Nevis is only 6 MW, there is anticipated growth because of development and increased use as rates decrease. A second phase would see the development of a 20 MW plant on St. Kitts. Thus far, geological surveys have been conducted and three slim wells drilled on the Western side of Nevis. Successful development of this project would put the country close to being 100% renewables.

The island of **Dominica** has 71,000 people and a peak demand of 17MW. 64% of energy is generated from fossil fuels and 46% from hydro. The cost per KWh is 46 cents and as a result, it's difficult to attract any energy intensive companies to the island. A conversation on geothermal began in 1969 but it wasn't until recently that resources were mobilized.

In 2011 and 2012, several slim wells were drilled and the resource was proved. In March of 2014, two full-sized wells were drilled, one for production and one for reinjection. This one well has a capacity of 11.4 MW and a small plant should be operational by 2015 or 2016. By 2017/8, Dominica will construct a large export plan to send energy to Martinique. Dominica aims to be 100% renewable by 2015.

St. Lucia has an estimated 75 MW geothermal capacity. Exploratory work for geothermal began in the 1950s. A challenge is that 90% of tourists that come to the island visit the region in which the potential sites are located. It is also a UNESCO World Heritage Site. This status does not permit geothermal exploration and so the country must determine the value of that status vs. the value of energy security.

St. Lucia commissioned a study last year that found that drilling would not interfere with the area and got the green light to move forward with the project. The project is currently in the first stage of development – geomapping, testing and pre-feasibility work. A social and environmental impact assessment will also be conducted within the next few months.