



## Synthesis of the restitution seminar

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Writing and credit photo:  
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## Summary

Organised by the Regional Council of Guadeloupe, ADEME and their partners, in the frame of the INTERREG IV Caribbean Space of the European Union, the international seminar of the Geothermal in the Caribbean Phase 2 project took place in Guadeloupe on September 9<sup>th</sup> and 10<sup>th</sup> 2015. It was attended by around 150 people from the Caribbean area (Ministries, local authorities' representatives, industrials, services companies, financial institutions).

This technical seminar was in the wake of the "Renewable energy conference" organised in the same place, on September 7<sup>th</sup> and 8<sup>th</sup>, by the CARILEC (Caribbean Electricity Utility Service Corporation), the electric energy producers association for the Caribbean.

Its aim was to report the led work for the INTERREG project, the Geothermal in the Caribbean Phase 2, of which the purpose was to prepare the necessary conditions to develop geothermic electricity production projects in the Antilles.

Within all the renewable energy sources, geothermal energy seems to be, because of its qualities, the energy source of a particular interest for all the volcanic islands of the West Indian arc, of which it constitutes a common wealth. That is why it is necessary to highlight it as best as possible, by taking in count the particularities of its territories, fundamentally constrained by their insularity, the very rich biodiversity and attached to their touristic development.

Throughout different testimonies and study results, this seminar allowed us to show why geothermal energy had not been more able to develop itself, up until now, in these territories, even though it is perfectly capable of covering the basic demand because of its insensibility to the climatic hazards and its particularly low cost of each MWh delivered. Among the given answers, there is especially the geological risk caused by the geothermic resource that can only be known of precisely after preliminary studies and explorative drilling. Moreover, in these island territories, such projects have to ease into a sensible environment, with conflict risks with the natural environment, which has to be protected, or areas with a strong touristic potential. We can also notice that up until now the West Indian arc has a political will to achieve a joint development allowing to pool needs and resources. As a consequence, the private sector, investors and industrials, is not necessarily interested for eventual projects of which the size would be too reduces to allow their profitability if the initiatives had to be restricted to each island.

Having realised this, the Geothermal in the Caribbean Phase 2, launched in 2012, and ending end 2015, has several aims. The first one is to be able to attract industrials and investors with the will to reduce the risk associated to the assessment of the available geothermal resource, whilst reinforcing the level of social acceptability by the communities living on the future production sites. The second one is to accumulate experience and develop good habits in the management of geothermic projects. The third aim consists in drawing up a statement on the methodological way of developing such projects in the Caribbean.



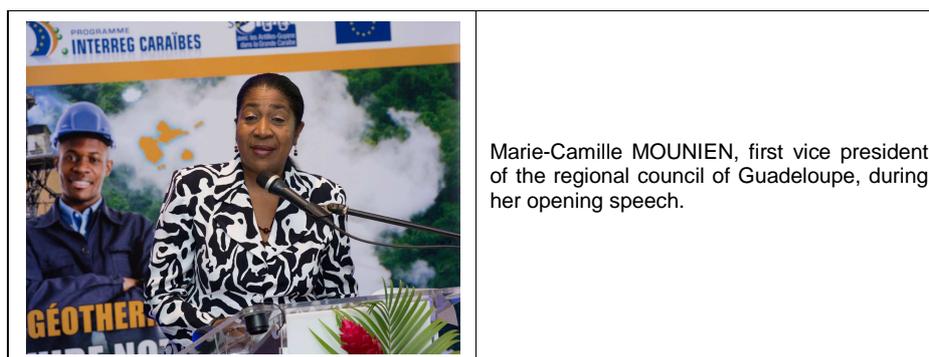
During the entire technical restitution seminar, all the aspects linked to the development of geothermic projects in the Caribbean islands were spoken of throughout several big themes. For each of them, speakers talked about their experience or, for some of them, reported studies that they had already led in the frame of the Geothermal in the Caribbean Phase 2 project. Thus, all the participants to the seminar were able to talk with these people. Beyond the know-how of the industrials of the sector and the financing questions, the seminar was centred on the environmental and social know-how of the actors implied in the management of geothermic projects. Therefore, it was a lot about the initial environmental state, impact studies, acceptability of the projects from the populations, opinion surveys, pieces of information and dialog. Even though the available and accessible geothermic potential allows us to consider with optimism the energetic future of these insular territories, all the speakers and participants insisted on the fact that the main priority was to associate to the development of geothermal energy the strong actions on the control of the energetic demand and efficiency. A report about the politics of the demand controlled in the area have, thus, been carried out in the frame of the Geothermal in the Caribbean Phase 2 project and many other actions were suggested.

The following points are the main conclusions of the different themes handled during this seminar:

- It is necessary to have a willing public action, with a true public-private partnership to develop projects
- The use of dedicated tools and the practical application of a common methodology is required to develop a project answering to demanding criteria of environmental excellence, token of a good acceptability
- During all the phases of the project, it is necessary to manage both environmental studies and societal studies
- At each step of the project, dialog with the stakeholders has to be led and regular information has to be brought to the populations
- Because of the reduced individual size of the market that represents each island of the Caribbean, it is necessary to share the efforts for all the islands
- Sharing needs and resources reflects the issue of the network between the islands and the technical potential of networking
- For some territories, it is necessary to put a legal and regulation frame into place
- So that a true branch can be organized, it is important to be able to train qualified staff at all responsibility levels following the example of the initiatives of the University of the French Antilles
- Finally, it is important to instore a Caribbean governance so that these projects fit in sustainably whilst taking in count the needs of these territories.



## 1) Political opening



Marie-Camille MOUNIEN, first vice president of the regional council of Guadeloupe, during her opening speech.

The Geothermal in the Caribbean Phase 2 project seminar was organised by the Guadeloupe region, ADEME and their partners, in the frame of the INTERREG IV Caribbean Space of the European Union. It was a technical seminar to re-establish the progress and the first results of the studies led in favour of the development of the volcanic geothermal energy on the Antilles arc to produce electricity. The Dominica's government is a partner of this project. Unfortunately, after the Erika storm severely hit Dominica end of August, the country is going through tough moments that have prevented its representatives to take part in this event. As Mrs Marie-Camille MOUNIEN, first vice-president of the regional council of Guadeloupe, leader of the project reminded it: *“This dramatic event is likely to happen again in our region because of the climate imbalance. This justifies, if needed, that the sustainable development and the engagement against the climate changes constitute priorities in our action. That is why we have fully engaged ourselves in promoting renewable energies and mastering energy consumption.”*

If to this date, the geothermal power plant of Bouillante in Guadeloupe is the only unit to work in all the insular Caribbean region, a report done in the frame of the Geothermal in the Caribbean Phase 2 project has shown that the development potential of the geothermal electricity production in all this zone is important. Thus, geothermal energy seems to be, because of its qualities, the energy source of a particular interest for all the volcanic islands of the West Indian arc, of which it constitutes a common wealth. Therefore it is necessary to highlight it as best as possible, by taking in count the particularities of its territories, fundamentally constrained by their insularity, the very rich biodiversity and attached to their touristic development. In that respect, a country close to the zone, like Costa Rica, represents a reference and an example to follow, because it managed to combine the development of geothermic with integrated environmental and social approaches.

Even though Caribbean people are not very concerned by the climate changes due to their greenhouse gas emissions, they are a part of those populations who will pay the heaviest tribute. Considering this, Daniel CHOMET, regional adviser, president of the sustainable development, transport and energy commission of Martinique, declared : *“Of this situation it seems necessary to be able to build, beyond the notions of position and sovereignty, from what makes us territories both exposed and who share a same community destiny, a coherent response so that our voice of Caribbean, our voice of islands, can truly organise, structure itself at an extremely important time for the planet's life.”*



Daniel CHOMET, regional adviser, president of the sustainable development, transport and energy commission of Martinique.

After having long been abandoned and despite its attractive features for the West Indian arc, geothermal energy enjoys today an interest from the interregional institutions, of which it is important to make the most of. Geothermal energy is the typical example showing the necessity of having first a voluntary public action. Indeed if the public actors are not mobilised, the offered orientations will have difficulty in emerging. Moreover, dedicated tools to structure the actions have to be put into place, because of the complexity of the project. Added to this the necessity of a Caribbean governance that allows projects to continue in the long run and answers the needs of the concerned territories.

Strongly convinced of the importance of geothermal energy for Guadeloupe and for all the islands of the West Indian arc, Mrs Marie-Camille MOUNIEN concluded with these words: “I have good hope that the tools developed and the way of proceeding will also be used with benefit by the governments, by their services, by the consulting offices, by the associations, for other projects of geothermic centrals in different islands. It is only in that case that the Geothermal in the Caribbean Phase 2 project will reach its aim and will be able to illustrate the aims of our regional cooperation, that is to say a cooperation on concrete subjects with added value for the reciprocal development of our territories.”

## 2) Overview of the situation: Geothermic Caribbean 2 project.

The Geothermic Caribbean project started in 2008 with a phase 1, with 5 partners and was led in the frame of the INTERREG III-b Caribbean space program: Guadeloupe, as the leader, Dominica’s government, the regional council of Martinique, the ADEME and the BRGM. This project went on for two years and its aim was to specify the knowledge about the geothermic potential of Dominica and study how this country could cover 100% of its needs in electricity, and at the same time the capacity to export a part of its production towards Guadeloupe and Martinique. The done work should have allowed to prepare an exploration drilling campaign in the Roseau valley which finally was carried out with success in 2011 and 2012. The learned lessons of this phase 1 have shown that because of the similarity of the existing geological context and the common issues met (insular territories, fundamentally constrained to the very rich biodiversity and attached to their touristic development), a common strategy of geothermic development in the West Indian arc should be applied. It has also been showed that it was necessary, from the start of a project, to take in count the environmental and social sides, by including populations, to ensure their good accessibility. It is with these aims that the phase 2 of the project was launched. It is called Geothermic Caribbean 2 (or GC2). Managed by the regional council of Guadeloupe, this phase 2 falls within the frame of the INTERREG IV Caribbean Space program. It brings together in addition to the previous partners, the French



Development Agency (FDA), the Deposits and Consignments Fund (DCF), and Strasbourg Electricity Geothermic. Launched in 2012 and finishing end 2015, the Geothermal in the Caribbean Phase 2 project had several aims, with the Lesser Antilles arc as geographic perimeter, from St-Kitts and Nevis up north to Grenade down south:

- 1) Prepare the necessary conditions to create over time, in this perimeter, geothermic projects and allow thus a lasting electricity supply, to a stable cost and very inferior to the current production cost, with a low environmental impact.
- 2) Promote an exemplary approach of geothermic development in a tropical and insular context, taking in count the particularities of the concerned territories, from the rich biodiversity and fundamentally constrained by their insularity.
- 3) Develop and reinforce the regional cooperation by creating a dynamic around geothermic and the demand control.

The Geothermal in the Caribbean Phase 2 project has 5 parts, with several tasks in each part: one part about the environmental approach of the projects, one part on the demand control and the energetic efficiency, one specific part on geothermal energy and two transversal parts, one about the actions of communication/ information and the other one dedicated to the training, with in particular the achievement of an excellent prefiguration study Caribbean centre about geothermal energy.

The finality of the project is to develop tools and methodologies that can, then, be deployed.



### 3) Potential energy demand management (EDM) and geothermic in the Caribbean.

Two studies led in the frame of the Geothermal in the Caribbean Phase 2 project – one about the evaluation of the potential of the EDM, and the other on the development potential of geothermic – have allowed to draw up an overview of the energetic situation of the West Indian arc. They were respectively done by the study office Equinoxe and Robert Célaire Consultants, and by the engineering and service structure, Teranov. The studied zone covers 8 islands from the little Caribbean, with up north the Saint-Kitts & Nevis islands and down south the Grenade Island.

The small study on the demand control was only about the energetic consumption in the buildings. The electricity demand is around 4300GWh/ year, with an 11% penetration rate of renewable energies. Leading a voluntary politic could lower this consumption to 3700GWh/year in 2030, whereas, if nothing is done, it will approach 4500GWh/year. To this date, the electricity production is essentially based on diesel. This dependency on fossil energies is constant on the 8 studied territories, except from Guadeloupe where the part of renewable energies reaches 20% with a diversified mix, and Dominica that uses hydraulic energy for 36% of its electricity production. Since 2010, we can observe an electricity consumption stabilisation on all these territories. This can be explained partially by the economic crisis, but also by the effects of the led actions in favour of the EDM since a few years. The average production cost of electricity is 250€/MWh, whereas it is only 180€/MWh for photovoltaic and 160€/MWh for geothermic for example. The issue now is continuing to develop EDM and working on the thermic quality of buildings.

Concerning geothermic, the study has shown that a potential in all the one existed with different situations, knowing that only today Guadeloupe has, with the Bouillante geothermal Unit, a 15 MW geothermal power plant. Thus, by 2030, the geothermal potential of the West Indian arc could reach 270 MW. It could cover 45% of the electricity needs if the voluntarist scenario for the demand control is applied. Some islands have a bigger potential than their needs like Saint-Kitts & Nevis and Dominica, for example. One of the main obstacles to the development of the energetic branch is the cost of exploratory drilling, with the financial risk that is associated to it, that is to say the risk of not finding any exploitable geothermic resource even though money has been spent to drill. This obstacle is even more important in insular territories, because the individual size of each market is small. The main advantage of geothermal energy is that it constitutes a base energy that can be used to substitute all the other carbon-based energies, unlike other renewable energies of which we know the variable character. The volcanic geothermic is a controlled technology since many years, among others in the Caribbean, thanks to 20 years of experience with Bouillante central. The expertise exists and is available for all these islands of the Caribbean to accelerate their economic and social development in the respect of the environment. Remains, now, to have a strong political support, to benefit from public finance for the exploratory drilling, to create a specific regulations for geothermic and to provide adapted tools and methodologies. In 2030, Dominica will be the first island to reach 100% of its electricity production with renewable energies, thanks to the hydraulic supply and the geothermic with an electricity potential of geothermic origin 690GWh/year. To this date, Guadeloupe will not yet reach its energetic autonomy. For the 8 concerned islands by the perimeter of the study, by combining a strong renewable energy development and a reinforcement of the EDM, the part of the renewable energies could reach 70% in 2030.



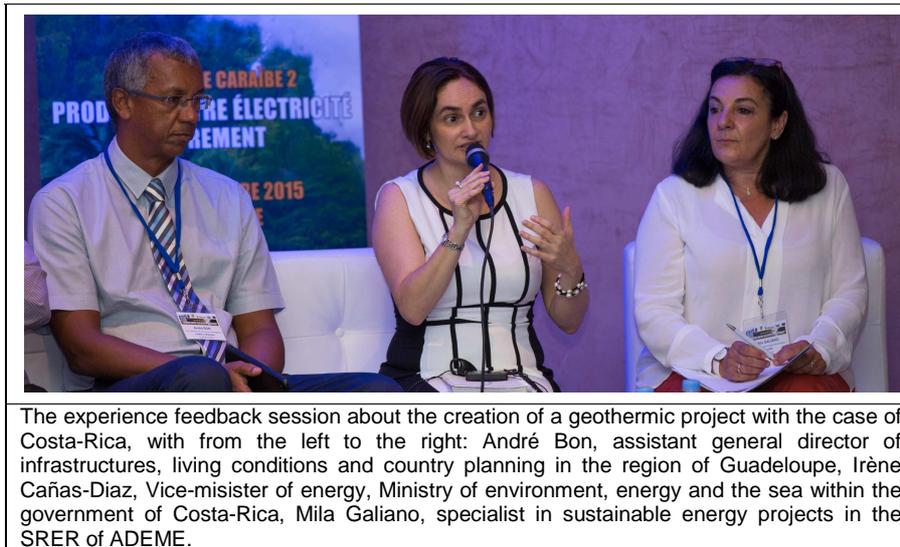
Both studies confirm that geothermic is truly at heart of the development strategy of renewable energies in this region because of the advantages it offers. But it should be developed with other renewable energies, without exclusive, and combining it with the actions of EDM.

#### 4) The Costa Rica case



In 2014, a French delegation, constituted around ADEME, went to Costa Rica to meet the main Costa Rican actors concerned by the development of geothermal energy, to talk about their experience, their point of views, their positioning. Indeed Costa Rica launched, since the beginning of 2000s, an exemplary approach concerning the environmental integration of its geothermic central projects (geothermic represents almost 13% of the electricity mix knowing that the first installation was put in service in 1994) and a debate is in progress since a few years to authorize or not the access of geothermal energy to national parks. For the French delegation, those meetings aimed at integrating the teachings of the Costa Rican experience in the writing of a guide dedicated to the environmental integration of geothermic projects in a tropical and/or insular context (one of the goals of the Geothermal in the Caribbean Phase 2 project). Irène Cañas-Dias, the Costa Rican vice minister of energy within the ministry of environment, energy and sea-side, explained that in 1949, an electricity institute was created in Costa Rica in order to develop the use of sustainable energies. Most fossil energies are used in the transport sector. Sustainable energies represent 21% of the energy mix, plus 11% of biomass. In 2015, geothermic energy represents 13% of the electric mix, while hydroelectricity's share is 73%. Thus geothermic energy is the second source of sustainable electricity. Irène Cañas-Diaz wants to put forward the fact that on top of the virtues mentioned for geothermic energy, another one is very important for Costa-Rica: unlike photovoltaic, wind-powered and hydroelectricity, geothermic energy isn't affected by climactic changes. If the situation in the country is an exemplary one, one must keep in mind that this is not the only solution. Every country has resources of its own and whose availability can vary according to the time of the year. The interesting thing is that in Costa-Rica, the country started to consider geothermic energy as soon as the 60's. The first studies started in 1975 and the first geothermic power plant was built in the 80's at Miravalles. The project started in 1994 with a 55MW capacity, and to this day 6 geothermic power plants are operational for a total capacity of 195MW. Furthermore, 3 other power plants are beign constructed, which will bring the geothermic electricity capacity to over 300 MW. Costa-Rica evaluates their geothermic potential over 875 MW.





The actual government launched a plan to define its energy policy from 2015 to 2031, following a participative approach in which the whole energy sector meets and has 2 angles. The first one is about the electricity production and the second one is about the transport sector which relies heavily on fossil energies. In the first angle, the effectiveness of the energy, the production of decentralized electricity and the optimisation of the electric mix are in the heart of the debates. Costa-Rica wants to move forward in developing geothermic energy for its electricity production, but it has to face the problem of its national parks. More than 20% of its territory is indeed covered by a national park, most of which are located near a volcano, and this is where we find the greatest part of exploitable geothermic resources for electricity. In the Pailas II power plant, located on the edge of a national park listed as UNESCO World Heritage, people are considering to us directional drilling to get to the geothermic resources located in the park area so the park stays listed since it is a huge source of income through tourism. All the sustainable energy development projects include a dialog with the population in order to discuss all the social and environmental aspects. From the start, the electricity national company, which leads the projects, always considered those not just like an electricity-producing power plant, but like a long-term project which will re-shape a territory and with the will to obtain in return a socio-economical feedback for the populations, while keeping in mind the preservation of the biodiversity and the environment. For Irène Cañas-Díaz, on top of those two most important missions, one of the challenges faced by Costa-Rica regarding the populations is the question of compensation. In her opinion, a compensation which would answer an immediate need is not enough; the populations need to be given tools so they can themselves develop new activities to allow them to improve their way of life. The Costa-Rica example had the advantage of highlighting a problem that is yet to be solved and which also concerns domestic laws.

According to Daniel Chomet, we must ask ourselves “Are we the actors of the promotion of sustainable energies, or the actors of the promotion of the environment?” In his opinion, the solution is not to be found in the political field in the time of a term, but in the time of a generation.

## 5) The regional political and normative framework

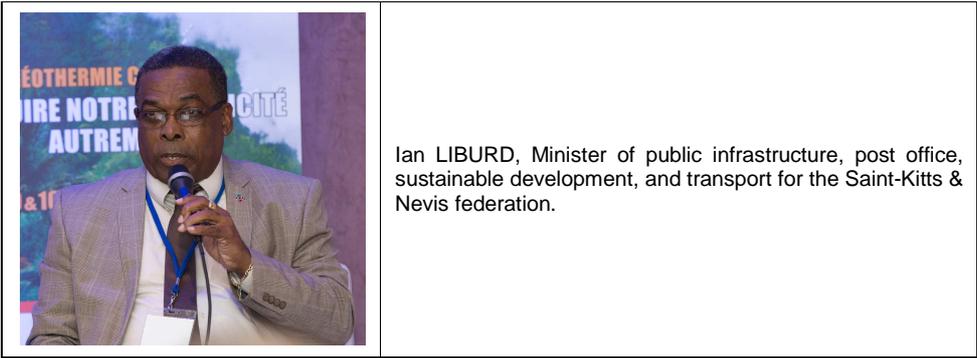
Beyond the geothermal potential in the Caribbean, the political and normative framework which will allow those projects to actually become a reality must be determined. What are the national political structures in those islands with a geothermic potential and do they need to evolve? If they do, how so?



The first elements of response were brought in by Devon Gardner, responsible of the Energie program and director of the energy unit within the CARICOM administration. The Caribbean community is made of 15 member states. This is a very cosmopolitan set of countries, with a whole set of energy systems, various socio-economic situations and several political landscapes. The total electricity production capacity is of 5GW for an annual production of 19.7TWh. The actual share of sustainable energies stands between 9 and 10%, and the goal is to increase it up to 47% by 2027. The total production of sustainable energies is around 4.3GW with a share of geothermic energies of up to 1.07GW, i.e 25%. Geothermic energies will thus play an essential role, but the problem is that certain countries don't have any geothermic potential whereas others have a potential that exceeds their needs; so the possibilities of interconnections must be evaluated. In order to reach the objective of 47%, the CARICOM set up a roadmap and a strategy on a regional level, the C-SERMS, which should serve as a framework for political structuration regarding sustainable energies and energetic effectiveness. This roadmap must be re-worked in order to make sure the potentials and objectives can be reached, and they will then need to be declined for every member state of the CARICOM. This way, those strategic decisions will allow to determine strategies and actions on a national level to create projects both visible and replicable in the whole region.

Ian Liburd is the minister of public infrastructures, post office, urban development and transports in the Saint-Kitts & Nevis federation. He just signed an understanding with a services and engineering company called Teranov in order to develop a partnership to develop geothermic energies on both islands. For Ian Liburd, the development of sustainable energies is essential if this territory is willing to face both economic and environmental challenges. In the political area, the country aims at making everyone equal regarding energy. Every citizen must have access to affordable energy whatever his social status. This policy must make sure that all the questions regarding climatic changes are taken into account during the process. This territory has a good potential for solar, wind-powered and geothermic energies with its two

volcanos in Saint-Kitts and one in Nevis. In Nevis, the first step of exploratory drilling has already started. The energy policy has been put up to date and must be ratified by the administration. A unit dedicated to those three types of sustainable energies will be created within the government. A modification of the legislation is in progress to set up fees, a billing system and the creation of permits for the production, transport, distribution and supply of electricity. This process will allow to clearly define the role of every step within the energy sector. The government must yet define its energy policy. The operators must put services available to the users. Independent agencies must regulate the sector, and finally the legislation must make sure there is a balance between the needs of the customer and the needs of the producers so the investors know they can trust this sector.



Ian LIBURD, Minister of public infrastructure, post office, sustainable development, and transport for the Saint-Kitts & Nevis federation.

For Hugo HODGE – executive director of CARILEC – the first problem met by geothermal in this area is an economy of scale problem. When looking at the dimensioning of systems island by island, the answer was brought until this day with small oil power plants. Scale economies shall be through interconnection between islands, as very few of them have the same resources, especially in geothermal. The development of those interconnections require precise studies. Indeed, the depth from one island to another can change widely and make the installation of a submarine cable impossible. Therefore, according to CARILEC, setting up a big inter-Caribbean network of cable is not the point. The solution presupposes the development of small plates finding each time the best way regarding the nature and the depth of the seabed between islands. The best way economically could also include a detour. According to Hugo HODGE, the question that remains is whether those connections will be in alternating current or in HVDC direct current (High Voltage Direct Current). The advantages of the HVDC would be to allow extending the electrical network in the Caribbean zone. Indeed, the first interconnected systems would be connected thanks to this. Those interconnections shall permit those who have a geothermal capacity to share it with neighbouring islands that have not. The partnership are important from an economical point of view so that the projects mean something.

**6) Methodology of assembly geothermal projects**

The Geothermal in the Caribbean Phase 2 project aimed at defining methodology and tools to build up geothermal projects in the best conditions of acceptability and of insertion in the environment as possible. This part of the seminar identified the points to watch to avoid a false start of the project. It also illustrated the need of an environmental study at the same time as the launch of a study on the geothermal resources. As an expert of projects on sustainable energy in the SRER (Renewable Energy Division) of ADEME, the work led by Mila GALIANO



consisted in an analysis of both the ecological approach and the technical approach of the projects.

To look at the environmental and societal effects of a geothermal project requires a complete knowledge of the local sensitivities. It is even truer in an insular context of the Lesser Antilles. A vigilance in biodiversity, restricted property, the water problem, the natural risks exposure in the area and the economical development of this area based on agriculture and tourism will be done. Each time, it is needed to make an evaluation of the sensitivity, the nature and the potential effects of the project, and the stakes. Driving a project can be divided in 4 parts: the preliminary analysis, the development, the project setting and finally, the operation. Those four steps are extended on a long period of time. The prescribed method is based on three tools. The first one is an integration of all the preoccupations when project is built. The second one aims at following and manage all the environmental aspects of the project while the project setting and the operation parts are done. During all the processes, there is a possibility of changing a situation. The third tool is about the governance of the project and the dialogue with the populations and the actors of the project all along the project life. This work has to be done from the first technical step of the project with a preliminary environmental and societal analysis. Therefore, a detailed environmental original state must be reported. Each big step has to be done with an environmental and a dialogue approach. Indeed, at any time, the project can be stopped for geological or technical reasons, or because of environmental and socio-economic situations that would not be positive anymore. Mila GALIANO also offers a last tool developed for Dominica. It is an environmental management plan with recommendations so that the government and the manager of the project can have proposed solutions as soon as the original state and the analysis of the economical and societal sensitivities have been done.

All those elements are ascertained in a methodological of environmental excellence guide currently being written thanks to the Geothermal in the Caribbean Phase 2 project



Roundtable on the steps of a geothermal project setting, with speakers from left to right: Benoît IMBS, in charge of license and environment in ES Géothermie, Bernard SANJUAN, geochemist and in charge of the Geothermal Resources unit in BRGM, Mila GALIANO, expert of projects on sustainable energy in the SRER of ADEME, Sylvester CLAUZEL, permanent secretary in the Ministry of Sustainable development, Energy, Science and Technology in the Saint Lucia government.

It is mandatory to know for fundamental information before starting the conception of geothermal plant to verify if the project is feasible. The temperature of the geothermal reservoir as well as its capacity, its depth, and the fluid flows that can be used must be known with a high



precision. Those data will be found through one of the first steps of the project, the preliminary analysis and the development. Bernard SANJUAN, geochemist and in charge of the Geothermal Resources unit in BRGM, has presented the details of the operations. Geological, geochemical, and geophysical studies (the 3G), as well as a hydrogeological study have to prove the existence of a resource. This step has to be done after a preliminary recognition identifying the favourable areas. The studies will reduce the uncertainty before the expensive exploratory drilling. Bernard SANJUAN state that, for now, those exploratory drilling are not giving all the information they could. He says that the information would be very useful as very few scientist works are done in addition of the drilling (those works are often disregarded). Usually, surface studies are just confirmed when it would be possible to have a better view of the geometry of the reservoir, of the drains that serve it, in order to have a better understanding.

Benoît IMBS, in charge of license and environment in ES Géothermie, bring an interesting testimony on how to drive the different parts of a geothermal project in Alsace. His speech was about the lifecycle of a project, from the time of its born until the end. He says that a geothermal project is the meeting between an investor and a territory, including its population, being able to be exploited. The legislation is a fundamental element. Indeed, even if it can appear constraining, it is proven by experience that it secures the environment. It forces the manager of the project to be perfect, and permit him to have more competences. All the activities and all the projects can cause nuisances and impact on the environment that shall be minimize as much as it is possible. Facing those considerations, the dialogue with DREAL (the regional administrative authority in charge, in France, of the control of the respect of the regulation) is essential. Nevertheless, the experience has shown that a constant dialogue with the population is important as much as to cooperate entirely with the elected representatives.

After the testimony of Alsace, Sylvester CLAUZEL, permanent secretary in the Ministry of Sustainable development, Energy, Science and Technology in the Saint Lucia government illustrated the specific problems of the Caribbean area and showed how to handle a geothermal project. An exploratory drilling has been made in the 80s in Saint Lucia, without being continued. Since then, three geothermal interesting areas has been identified, but like in Costa Rica, there are listed as UNESCO World Heritage and the research works have to take into account this criterion. For now, there are only surfaces studies. To be able to make some exploratory drilling, it is important to choose the right places, without endanger this UNESCO ranking, as well as making environmental and societal studies. A geothermal bill is discussed, and so is a regulatory framework with the implementation of an independent regulatory authority. After a feasibility study, Sylvester CLAUZEL is aware of the fact that his government might facing a dilemma between the ranking in the UNESCO World Heritage and the option that would secure energy for the future. According to him, the energy security is the most important for the country. It reveals another problem on development of sustainable energy. This development can be way quicker than the one of geothermal energies, as the island have questionable robustness of network and interconnection between islands. However, a research has shown that the injection rate in variable renewable energies rate of injection in Renewable Energy should not exceed 23 %.



## 7) Needs and financing tools linked to the project assembly

Following the best practices for mounting and driving a geothermal project, it was important to know what are the needs and financing tools associated with mounting geothermal projects in the Caribbean. Hervé BOUGAULT is the French Development Agency's (FDA) in Fort-de-France in Martinique. The FDA is a partner to the Geothermal Caribbean 2 project and as such, it has funded the exploration drillings in Dominica. The FDA motivation, as a development agency, is to assist countries to develop and therefore know the growth. In order to do so, technical capital and investment are needed. However, for the FDA, capital does not worth much without energy. It is the energy's quantity and quality that will make the competitiveness of an economy. Of course, energy efficiency is taken into account. In the Caribbean states, the FDA faces a barrier which is the external debt sustainability. Working on an endogenous energy source, such as geothermal, is significantly reducing oil imports and consequently is improving the external debt sustainability. For the FDA, the other important issue is to be in front of projects for which the plants will be sized to allow export and generate foreign exchange inflows. This is typically the case of Dominica. Geothermal energy can bring out a sustainable resource. That being so, funding can only be set up if all the technical and environmental safety are implemented. We saw during different presentations that the preparatory and exploratory phases were those which represented the central risk with an uncertain return on investment. Therefore, we must provide adapted tools for this type of funding. Generally, the speaker, in this case, is the state itself and not a private investor. Thus, the FDA has the right tools for this. It can also bring subsidy. However, due to a decrease in resources, it is becoming difficult. That said, as the French Global Environment Fund (FGEF) manager, the FDA can also bring the grant thanks to this fund. In the case of Dominica, the FDA has made available for preparatory and exploratory phases sovereign subsidized loans and direct subsidies to which were added grants from the FGEF. In case of failure of the exploratory phase, the FDA can also lean back its loans to a guarantee fund. To fund the project itself, where we enter an industrial phase, the FDA has a fairly wide range of tools with sovereign and non-sovereign loans. Generally speaking, on this kind of operation, the FDA is never the sole. Moreover, these loans are usually non-recourse and deconsolidated. In this case, the guarantees are taken on the electricity sale agreements, hence the importance of these contracts' strength.



Roundtable discussion on the needs and financing tools associated with the installation of geothermal projects. The participants from left to right : Joseph Williams, renewable energy consultant at the Caribbean Development Bank (CDB) , Hervé BOUGAULT , director of the French Development Agency (FDA ) in Fort-de-France in Martinique , Paul MONDESIR , project manager of the European Union delegation in Barbados and the Eastern Caribbean , CURNIER Richard , Regional Director of the Caisse des Dépôts & Consignations ( CDC).

The AFD provides loans, never on equity. In such circumstances, what is the role and what are the Caisse des Dépôts et Consignations' (CDC) objectives at the Caribbean scale? Richard Curnier, Regional Director of the CDC, brings some answers. The role of the CDC is to assist the public and European policies, enabling amongst others, the economic development of territories, for instance by accompanying transitions such as the one related to energy and green growth. These accompaniments must create value on the territory through employment and taxation. The CDC has set itself the mission to help create its own renewable energies industry. From the development to the construction phase, it intervenes as a stake that will always remain a minority and this on experienced technology. This procedure is only set up if the project is supported by local authorities. It may also intervene in either the current account or in the form of convertible bonds or SPV in the companies' capital (Special Purpose Vehicle: special purpose entities). The CDC has already invested in the region on several renewable energy projects: wind, photovoltaic, biomass and micro-hydro power plant. In the field of geothermal energy, the CDC has invested in the geothermal plant project ECOGI, based in Alsace. But other geothermal projects are being considered because the CDC wants to diversify its investment mix in the field of renewable energy.

Paul Mondesir is the project manager of the European Union delegation to Barbados and the Eastern Caribbean. He shares his views on the extent of the needs and financing offers available to Caribbean countries to carry out their projects in the field of renewable energy and MDE. For him, it is important for the islands in the area, which have a geothermal potential, to measure the complexity of such projects in terms of size, means at their disposal, and their expertise level. The conclusion he draws is that these islands are not able to control such projects by themselves. The European Union, as honorary broker, is initially assisting them to act in this complex space in order to avoid the existing pitfalls. The experience of Dominica has already helped us learn many things about financing solutions of a geothermal project. It emerges from this that it is important for all the project phases to have a strategy and a funding plan in advance that will allow to get the funds exactly when they are needed. It is also necessary for this area to establish a genuine expertise in the energy field. If some countries have already set up renewable energy development policies and laws, including geothermal energy, it is important to quickly define regulations to show project developers and investors how to operate. He noted that while some countries have already defined a renewable energy developing policy and passed laws, including geothermal, there is not always a regulation. In this context, the European Union offers two types of solutions. The first is an initiative to accelerate the access to energy in developing countries by funding the electrification. These are convertible grants from the European Union as part of public-private sector mixed funding. The aim is to stimulate private investment through a leverage effect which will fill the financial gap at the very beginning of a project in the form of risk capital. This funding method is related to a project sustainability with a profitability objective. These grants are convertible into redeemable debt once the project is successful. The second solution is the Caribbean Investment Facility (CIF). It is a mechanism that aims to blend subsidies from the European Development with loans from financial institutions development fund, such as the EIB, the CBD or the IDB in order to help Caribbean countries to fund their infrastructures, including those in the energy field. These funds can be used for technical studies and feasibility studies.

Joseph Williams is a renewable energy consultant in the Caribbean Development Bank (CDB) and his wish is to see an acceleration of renewable energy projects and MDE in the Caribbean. This financial institution has 19 borrowing countries mainly belonging to CARICOM. It is the first bank in the region to intervene more often on the intermediate financing in order to enable



applicants to access other sources of funding in a context of project financing in favour of climate. Among various tools, the CBD has established GeoSmart, which is a financing tool dedicated to geothermal and is able to support a project in all its phases as they were presented in the previous session. Each phase requires a very specific type of funding. For the pre-feasibility study, the funding is grant type. For the feasibility study with exploratory drilling, we have a combination of CGR and concessional loans. For the development and implementation part, concessional loans are used.

## 8) Detailed presentation of the export of French geothermal offer

Ségolène ROYAL, the French Minister of Ecology, has announced in a statement in March 2015 the creation of a guarantee fund to ensure the project leaders against the risk of finding insufficient geothermal resources. The effective implementation of this guarantee fund is underway and it is due to the French cluster initiative GEODEEP geothermal. This fund will be separated into two parts: a fund for the volcanic geothermal and another one for the EGS (Engineered Geothermal Systems) geothermal.



Sylvain Brogle, Director of International Development for Clemessy and vice president of marketing GEODEEP and Eric LASNE, CEO of CFG Services, came to present the advantages and the supply of this cluster. In response to the strong national and international commitment to developing geothermal, all the French professionals in this field came together in a cluster after finding out that France had a long experience in this sector and thanks to these companies, an expertise answering all the fields of the value chain. With this combination of skills, GEODEEP is able to work anywhere in the world on turnkey geothermal plants, and possibly bring financing solutions. While geothermal high energy capacity worldwide is only 12 GW and 16 MW in France, the ambition of GEODEEP, which wants to take significant market share internationally, is a challenge. In response, the French cluster argued several additional advantages that could make a difference. The first is innovation with the leverage effect brought by this gathering of skills and experience, particularly in the field of complex geothermal

fractured reservoirs. But what highlights GEODEEP is its ambition in ecology and sustainable development with a high quality level in compliance with health and safety standards. This adds an approach to the environmental and social acceptability of projects with the establishment of an acceptable mechanism adapted to each country and each situation. In addition, these projects should contribute to local development in the long term socio-economic environment in which they operate. In addition, these projects should contribute to long term local development of the socio-economic environment in which they operate. In the volcanic geothermal generator's section, the global market is estimated at 3 to 4 billion dollars a year for an annual capacity of 800 MW of new projects. The objective of GEODEEP is to capture a part of this market, the figure of 5 % is considered as the most realistic, the 10 % is considered much more ambitious. This cluster is now, a tool in running order ready to offer its expertise in the Caribbean. For Sylvain Brogle, we now need investors to gather around GEODEEP order to develop projects, and for him, it is important that major French energy operators are mobilizing around these projects.

### 9) Presentation of Dominica's project

The geothermal project on the Dominica Island, in the Geothermal in the Caribbean Phase 2 project, made it possible to have a concrete case to help define a methodology for the conduct of a geothermal project on a tropical and insular context. The Guadeloupe region is the leader of the Geothermal in the Caribbean Phase 2 project and its deputy general manager came to explain what the important project link between Dominica and Guadeloupe was and the contribution of INTERREG IV program space Caribbean for the development of the geothermal resource in the area of the West Indies were. Knowing the cooperation with Dominica, on geothermal topic, started in 2008, with preliminary discussions which were initiated in 2005. For André Bon, the project Geothermal Caribbean 2, beyond its central concern on geothermal energy and technical issues, has profoundly changed the nature of the existing relations between Guadeloupe, regional political organization, and the government of a neighbour state. A long-term common approach focusing on energy and sustainable development is thus installed. The actual use of European funds for the INTERREG joint projects management is the second point that emerges from this experience. The funds INTERREG IV Caribbean Space demonstrated flexibility to adapt to all study phases of a project, such as the Geothermal in the Caribbean Phase 2 project.

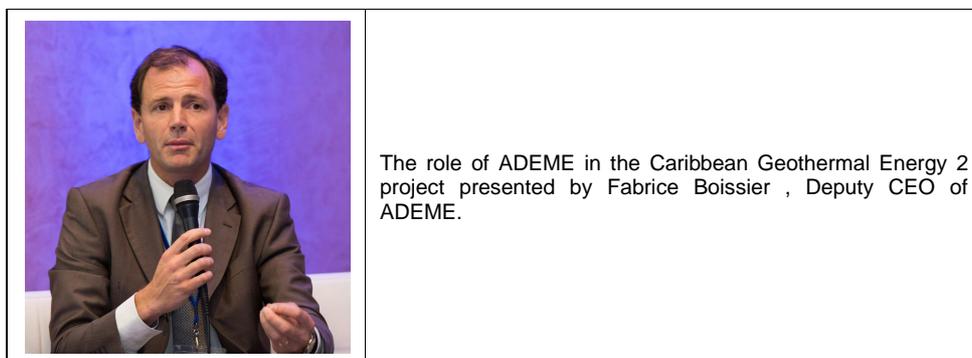


Preliminary presentation of Dominica's project by the leader André Bon, deputy general manager of infrastructure, living environment and spatial planning for the region.



Fabrice Boissier - Deputy CEO of ADEME - has clarified what the role of ADEME in the Geothermal in the Caribbean Phase 2 project is.

ADEME's mission is to increase and contribute to ensuring energy and ecological transition. Above all, it is primarily a partner to support the entire society in its efforts to make this transition a success. That is reason why it intervened in the Caribbean Geothermal Energy 2 project. In addition, the French overseas territories are vital territories for this transition. Facing the challenge of such an objective, geothermal appears as an important future component in the new energy mix of these territories. ADEME has always supported geothermal, whether in France or in its overseas territories. It supports R&D in this area and assists for the establishment of the geological risk insurance mechanism with GEODEEP. If until now the volcanic geothermal has not been developed much in these territories, ADEME sees an explanation that the Caribbean Geothermal Energy 2 project highlighted: the lack of an integrated and systemic vision geothermal. Now, thanks to this cooperation based on a concrete work at the field level, particularly Dominica, this integrated approach provides the solution to deal with such complex problems. For this work, ADEME brought a vision of national expert with the guarantee of an institutional actor's neutrality. It also brought all its assets to associate them with those of Guadeloupe region which on its side, brought its dynamism, its political vision and its relationship with other Caribbean territories.



## 10) Environmental approach of the project and work conducted in Dominica

The Geothermal in the Caribbean Phase 2 project made it possible to lead an environmental study on the Dominican field, particularly with the completion of an initial state which will subsequently assess the actual impact of a future geothermal project. At that level, the role of ADEME was crucial, and it is Mila Galiano, specializing in renewable energy projects at the SRER (Renewable Energy Division) of ADEME who came to explain what this initial state of the environment is and what definition could be given.

Initially, ADEME found out that environmental data were missing on the study area during the Caribbean Geothermal 1 project in which Caribbean Environment Development (CED) had conducted an environmental pre-feasibility study of the Roseau Valley in Dominica,



To make an impact study on a project, it is needed to assume it starts from a reference point. During the mission conducted in Costa Rica, if the delegation observed beneficial effects of geothermal energy on the environment, the absence of an initial state of the environment made it difficult to quantify the extent. That is why in the Geothermal in the Caribbean Phase 2 project, a zero point has been achieved on the Roseau Valley in Dominica; area having been identified as a high geothermal potential zone. In the conduct of the project, the main issue is to be able at any time to measure any kind of impact which, if it turned negative, contrary to expectations, could be subject to corrective action; the objective being to have permanently the most exemplary project as possible towards the environment.

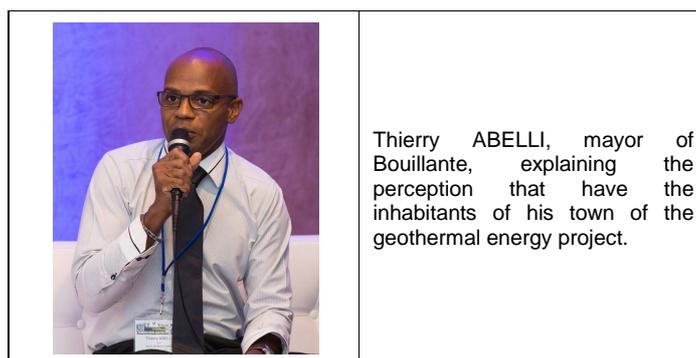
Olivier Felicite is a project manager at Caraïbe Environnement Développement (CED). With a group of 10 companies and more than 50 specialised engineers, he lead studies and surveys to establish the initial state of the Roseau Valley's environment. Eight thematic were treated: hydrobiology and hydrography, wildlife, water and land flora, socio-economic, acoustics, air quality, landscape and quality of life, natural risks, climatology and aerology. The goal was to get quantitative data carried according to International Standards in order to establish comparisons in time, but also in other places of the region or elsewhere in the world. The CED assured the entire study coordination with an important dimension of communication and consultation. Most of the realised studies were technical enough and necessitate many field investigations. To do so, a consultation and explication work with the population on the different methods used and their utility was needed. At this level, the aim was to develop a better acceptability of the project, to identify the different actors on the field and understand their role and expectations. To this was added a will to share the knowledge acquired on this environment with the populations, the government and the actors of the project, in order to achieve a true cooperation process. During these meetings conducted with the population, a representative of the government was always present. The conducted studies reveal that most of the population of the Valley of Reed is mostly favourable to the project. It is ready to accept in its valley a geothermal central, but to certain conditions: that its expectations will be respected elements such as the tranquillity of the site, the landscape and the living conditions are taken into account. The economic actors were also able to express their expectations, and of course, for them, this project of geothermal energy has not to impact on their activity; the one of the tourism being firstly concerned. Globally, the people consulted have been satisfied of

these studies which have permit to deepen the knowledge that these people had of their environmental living conditions. In return, their expectations are strong regarding the final restitution of the results. Because of the cyclone Erika which has hit Dominica, this final restitution of the works had to be rescheduled. By the way, the realisation of the initial state of the environment of the Reed's Valley has permit to draft a requirements specification of the impact study, taking into account the particularities of the Valley for a future project of geothermal electricity production. This requirements specification also integrates a environmental management plan of the future geothermal plant.

Among all the issues identified, some are directly transferable to other islands in the Caribbean. Thus, most of the requirements specification drafted for Dominica will also be used for other islands.

### 11) Dialogue of the communities and tools of communication

The work conducted in Dominica on the initial state has shown the population had expectations. About that, it appeared interesting to also look at the expectations of the population of Bouillante in Guadeloupe where operate since 1986 the only geothermal plant in service in the Caribbean island. In order to better apprehend what could be these expectation, Thierry ABELLI, mayor of Bouillante, came to bring his testimony regarding the perceptions that his administered have regarding the plant. At the very beginning of the project Bouillante 1, “one has let believe the population that they will have free electricity”. This never occurred and certain environmental inconveniences such as noise and the odours due to the emanations of H<sub>2</sub>S have led to a lots of dissatisfactions among the population, and this more than that the jobs induced have stayed marginal. With the creation of Bouillante 2, some real ameliorations have appeared to reduce the nuisances of this central located midtown. The company Géothermie Bouillante, which had taken up this facility after withdrawal of EDF, initiator of the project Bouillante 1, implicated itself in the associative life to achieve “a kind of peace”, according to the mayor. What now expects the population of Bouillante is that this central brings some real economic benefits for their town. Thierry ABELLI wishes that – aside from the question of fees – to skills and qualifications equivalent, local employment to be privileged. For the future project Bouillante 3, it is certain that the population has questions and will have some expectations to demand.



Therefore, the perception of the projects by the residents is an important aspect. In addition to these works on the environmental initial state in Dominica, it has been decided to conduct a large opinion survey to the populations of Guadeloupe, of Dominica and of Martinique. Patrice GROUZARD, responsible of the national communication on the Renewable Energies and Building of ADEME, has presented the results of this opinion survey, in which the quantitative

stage was a telephonic interview of 1 411 people, with 15 minutes per interview. The main intel of this opinion survey are that the populations interviewed have an ecologic sensibility very strong toward their environment. First of all, they are conscious of the richness of the biodiversity of their territory and they are strongly attached to it. The second point is about their strong economic preoccupations. They expect benefits, and against a form of diffidence for the decision-takers and the politics, they want transparency during the stage of dialogue. A third important point is underlined from this survey: the inhabitants concerned by these projects have a strong awareness of the necessity to conduct their territories toward energetic self-sufficiency. If this survey has permit to learn that the acceptability of the geothermal energy, as a local energy source, was high, regardless of the territory, it has raised that the state of knowledge about geothermal energy was not bad at all, but still not enough. For ADEME, the conclusion of this study is that beyond the Geothermal in the Caribbean Phase 2 project, it will be imperative to pursue the dialogue and the communication with the populations for several years, by measuring regularly the effects of this action in the same time. The observation is that it is not the geothermal energy itself which can create hindrances, but a lack of skills in the exploitation of the instalments and a lack of information about the projects.

Yoann LEGENDRE, regional geologist in the administration board of BRGM in Guadeloupe, has worked on the establishment of tools destined to improve the state of the population's knowledge regarding the projects. The Geothermal in the Caribbean Phase 2 project has therefore permit to achieve the documents of communication and information to destination of this public, in order to bring it scientific and practical aspects on the geothermal energy, for that it could make its own opinion. The will was to make available information of reference, the most neutral possible, on the base of updated documents. This communication has to ensure the promotion of the geothermal energy as source of local electricity production for these territories. Three types of publics have been selected: the opinion's leaders, the general public and the scholars. Different tools of communication are used, with, every time, a differentiated speech depending on the type of public targeted



The dialogue of the communities and the tools of communication during the conduct of a geothermal project, with from left to right: Mila GALIANO, from the SRER of ADEME, Thierry ABELLI, mayor of Bouillante, Yoann LEGENDRE, geologist in the regional administration board of BRGM in Guadeloupe, Patrice GROUZARD, responsible of the national communiacion EnR and Building of ADEME, Olivier FÉLICITÉ, project manager in Caraïbe Environnement Développement (CED).

Some generic information's paper documents approaching the geothermal energy in the Caribbean on a dozens of major axis are in progress of finalisation. In complement, 4 films of



around 10 min, promoting the high energy geothermal science in the Caribbean have been realised as part of this project. These different films tackle the themes of the geothermal project in Dominica (Dominica, the 100%-green island), of the operation and exploitation of the geothermal energy in the Caribbean (Bouillante, Capital of geothermal science), of the opportunity of development of the geothermal energy for the Caribbean (Geothermal energy, the blow of the Caribbean) and of the importance of geothermal energy in the energetic transition (Geothermal science, pillar of the transition). Furthermore, a website valorising the Geothermal in the Caribbean Phase 2 project and the development of the geothermal energy in the Caribbean have been created: [www.geothermie-caraibes.org](http://www.geothermie-caraibes.org). The last part of this strategy of communication is to put in place a House of the Geothermal energy on the site of the Reed's Valley in Dominica and on the one of Bouillante in Guadeloupe. This project is in the review process through the form of a requirements specification to write, stating what could be a house of the geothermal energy. It is currently under dialogue with the communities and the different local actors.

## 12) Creation of value, jobs, formation, and excellence centre

The creation of local jobs thanks to the projects of geothermal energy pass by the development of actions of formation to the geothermal's jobs. Certain formations are being put in place with the University of Antilles, and a Caribbean centre of excellence dedicated to the production of geothermal electricity in a volcanic context is being studied as part of the Geothermal in the Caribbean Phase 2 project. Philippe LAPLAIGE, engineer responsible of the program on geothermal energy in ADEME, has presented the outlines of this study. The centre, of national scale, would be based in Guadeloupe with mission: the support to the project of R&D, the establishment of formation's curriculum, the conduct of the communication and information actions, the establishment of shares of international scale. It would mobilize the French actors of the sector, of the industry and of the research, and by associating strongly to it the interested Caribbean actors. Two level of formation would be proposed, superior formation and professional formation, with some professional acting on all the chain of value of the sector. The analysis of the chain of value of the project of production of geothermal electricity has thus permit to identify 16 big segments of activities to sum a number of 46 distinct skills. The ongoing study of prefiguration includes an analysis of what is already done in France in matter of centre of excellence for the reduced carbon energies, and an analysis of similar structures abroad. The report of this study, forecast for end 2015, will be discussed with the sponsors of the Geothermal in the Caribbean Phase 2 project, but others sponsors are invited, for example the university of the French Antilles.





About the creation of value, jobs, formation and centre of excellence, from left to right: Philippe ROCHER, deputy director, responsible of the geothermal energy division in BRGM, Devon GARDNER, responsible of the energy program and director of the energy unit in the secrétariat of CARICOM, Ruddy BLONBOU, university lecturer in the university of the French Antilles, responsible of the formation of engineer in energetic system, Philippe LAPLAIGE, expert engineer in charge of the geothermal program in ADEME.

In 2013, the SIDS DOCK (Small Island Developing States), the UNIDO (United Nation Industrial Development Organisation) and the Austrian government, decided to join their efforts to develop on the Caribbean a centre dedicated to the renewable energies: the CCREEE (Caribbean Centre for Renewable Energy and Energy Efficiency). The coordination of this project have been entrusted to the secretariat of CARICOM. The main objective of this centre was to promote the development of the EnR and of the energetic efficiency in the countries of the Caribbean, in order to support the development of a low-carbon-emission economy. Therefore, it must provide a technical support and an expertise in order to answer to all of the issues linked to this energetic transition in the region. All the actions of this centre will have to generate incomes in order to become economically independent. For Devon GARDNER, responsible for the energies and director of the energy unit in the secretariat of CARICOM, this centre is going to play an important role in the Caribbean. It is forecast that it appeals to associate members of exterior lands than CARICOM. By saying this, he naturally thinks of the French territories, and to this regard, to the Caribbean centre of excellence on the geothermal energy which could be created in Guadeloupe.

The geothermal energy relies on the numerous scientific disciplines. The rise in skills of this sector and its competitiveness go through the R&D and the innovation. Therefore, it is legitimate to want to structure in France a pole of excellence leader in the R&D in the underground technologies relying on the scientific and industrial skills. This is the objective of the consortium of scientific interest (CSI) Géodénergies which Philippe ROCHER, responsible of the geothermal energy division in the BRGM, has roughly sketched out. This consortium has for ambition to become a national and international reference in R&D on all that concerns the utilisation of the underground in favour of the reduced carbon energies. This rely on three main sectors which are the geological storage CO<sub>2</sub>, the storage of energies under the form of heat or cold, or under the form of compressed air, and lastly the geothermal energy. The approach is multidisciplinary by taking into account the economical and societal aspects. This CSI also wants to be a force of recommendation regarding the superior education. Among the sponsors



of Géodénergies, one can find 7 institutions of research, a pole of competitiveness, and the University of the French Antilles. The adhesion of Géothermie Bouillante as a sponsor is currently in progress. In the end, the reason of being of this CSI is the development of partnership research projects. These projects must systematically associate at least one industrial.

Ruddy BLONBOU is a university lecturer in the University of the French Antilles. He supervises the formation of engineer energetic systems. The first promotion of this formation just started its third year. There is an option geothermal energy to his program which has 120 hours. This specific formation includes two modules, both of them credited by the CIT (Commission of the engineer titles – independent structure dependant of the minister of research, which has in France for missions to inspect the demands of empowerment to deliver the titles of graduated engineer or to periodically evaluate the engineer formations). The objective of this formation is to answer of the local needs in matter of engineer capable to supervise the projects, in particular during the stage of implementation. This mean that for the moment this option is essentially centred on the industrial technologies linked to the exploitation of the geothermal resources.

### **13) Closing of the seminar: transversal regards between Costa Rica, Saint-Kitts, Nevis and Guadeloupe**

Irène CAÑAS-DIAS, Vice-Minister of the energy in the ministry of the environment, of the energy and of the sea of the government of Costa-Rica, makes the observation that lastly the Caribbean islands and the territories of Central America, in particular his country, share a lot of things in common in the domain of the renewable energies in general, and in the one of the geothermal energy in particular. The notion of energetic independence is the targeted objective by all, but, for her, it is important to work on the ideal combination and to mutualise the projects between counties and islands in the region to achieve a better cost and a better profitability of the instalments. For the environmental and societal aspects, there again, all of the countries in this area share the same challenge, and it is important to develop the communication and the dialogue ahead in order to succeed these projects. After these two days, it becomes clear that the cooperation within this community of interest and of challenges is also a success factor. The share of the know-how will permit to achieve this energetic independence thanks to the renewable energies.

To succeed this transition to an energetic independence based on the renewable energies represent for all an enormous challenge and for which Ian LIBURD, Minister of public infrastructures, of the post, of the urban development and of the transports of the federation of Saint-Kitts and Nevis, has given a interesting vision in his conclusion. For him, it is not the electric network which has to say according to its state what we have to do or not do in matter of energy. It is to the government to define in their policies what they want. One can't demand from the companies of electricity that they undergo the constraints linked to the variability of the renewable energies, and in the same time demanding of them an implication on the safety of the energetic supply. In front of this, the geothermal energy become the first priority. It is this reasoning that has lead his government to elect the geothermal energy as the primary energy. If the interconnection between the islands has been a lot discussed, the minister Ian LIBURD wanted to underline that the cost and the profitability of these interconnections have not been tackled in the dialogue and that this factor won't have to be neglected in the continuation of these works.





The seminar of the restitution conclude itself on the transeversal regards between Saint-Kitts and Nevis, the Costa Rica and the Guadeloupe with from left to right: Ian LIBURD, minister of the public infrastructures, of the poste, of the urban development and of the trasports of the federation of Saint-Kitts and Nevis, Marie-Camille MOUNIEN, first vice-director of the regional council of Guadeloupe, and Irène CAÑAS-DIAZ, vice-minister of the energy, of the ministry of the environment, of the energy and of the sea, of the government of Costa Rica.

To conclude these two days, the last word was for Marie-Camille MOUNIEN, first vice-president of the regional council of Guadeloupe. This seminar of restitution of the studies conducted as part of the INTERREG IV Geothermal in the Caribbean Phase 2 project has put forward the great geothermal potential of the region, but also the difficulties and the barriers of which are confronted the territories to develop the exploitation of the resources. Her conviction is simple: *“Against these barriers, it looks like that only the cooperation will permit us to find the new ways and means to create the conditions of development of this renewable energy. As such, the program INTERREG Espace Caraïbe is an adapted tool to put in place the cooperation in the Caribbean.”*

If the pursuit of the efforts to promote the renewable energies is obvious, she reminds that the necessity to accentuate the actions in the area of the mastering of the energetic consumptions. This area certainly constitutes a second way of cooperation. The regional council of Guadeloupe reaffirms its will to pursuit its implication in the development of the geothermal energy and, more broadly, of the renewable energies and of the energetic proficiency in the Caribbean through the program of cooperation INTERREG Espace Caraïbe. To complement this seminar, the dialogues with the OECS and the CARICOM appeared promising. The elaboration of a roadmap defining the content of a future project INTERREG V is in pursuit. Therefore, the regional community of Guadeloupe invites all the interested sponsors in the continuation of this cooperation to join it.



To complement the conferences, this seminar will have been marked by the signature of an agreement protocol (MOU) between the minister of the public infrastructures, of the poste, of the urban development and of the transports of the federation of Saint-Kitts and Navis, Ian LIBURD, and the president of Terannov, Jacques CHOURAKI, symbolised here by a handshake. This protocol include a roadmap which forecast a possible production of geothermal energy in 2020 in Saint-Kitts.

Visit of the geothermic plant of Bouillante, organised the 10<sup>th</sup> september 2015 afternoon



Puits BO-6		
<b>FORAGE</b>		
DEBUT DU FORAGE		03/02/2001
FIN DU FORAGE		14/03/2001
LONGUEUR FOREE		1248m
PROFONDEUR ATTEINTE		1034m
INCLINAISON MOYENNE DU PUIS		30° vers le N-O
<b>MESURES</b>		
TEMPERATURE MAXIMALE MESUREE		252°C
<b>ESSAIS DE PRODUCTION</b>		
DEBIT DE FLUIDE MESUREE		320 tonnes/heure
DEBIT VAPEUR CALCULE (à 6 bars-a)		80 tonnes/heure



