Organisation of Eastern Caribbean States
Sustainable Energy Unit

REPORT
OECS GEOTHERMAL ENERGY ROUNDTABLE

Harbor Club Hotel, Saint Lucia,

5th December 2018

Organisation of Eastern Caribbean States

CARIBBEAN DEVELOPMENT BANK

IRENA
International Renewable Energy Agency

OECS Geothermal Energy Roundtable
&
UNFC Geothermal Resource Classification and Training

5th – 7th December 2018, Saint Lucia

"Advancing Geothermal Energy for Economic Development and Resilience"

ECS

CARIBBEAN DEVELOPMENT BANK

IRENA
International Renewable Energy Agency

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Global Atlas
FOR RENEWABLE ENERGY

ESMAP
Energy Sector Management Assistance Program

INTERNATIONAL GEOTHERMAL ASSOCIATION
IGA

GLOBAL GEOTHERMAL ALLIANCE


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Background

Geothermal energy has emerged as a priority for the OECS region as the scientific evidence suggests a strong potential to transform the regional energy landscape. Currently seven OECS Member States are pursuing geothermal energy as part of their renewable energy mix. During an OECS Energy Policy Implementation Dialogue in March 2018 recommendations from the Member States were given to increase the support for geothermal energy development in the region.

The Organisation of Eastern Caribbean States Commission together with International Renewable Energy Agency (IRENA), The Caribbean Development Bank (CDB), the International Geothermal Association (IGA) and the World Bank organized the Geothermal Energy Roundtable and United Nations Framework Classification (UNFC) Training Course for Geothermal Energy on 5th -7th December 2018, in Saint Lucia.

The geothermal energy dialogue brought together key experts and decision-makers in geothermal energy from the region to help advance and initiate a regional cooperation for geothermal energy. The discussions focused on the status of the OECS geothermal projects and the opportunities, challenges and underlying risks with a view to highlighting the risk mitigation and financing options. The dialogue was followed by a training workshop that introduced the UNFC classification and training work currently being undertaken by the IRENA, the IGA and the World Bank's Energy Sector Mapping and Assessment Program (ESMAP), under the partnership umbrella of the Global Geothermal Alliance (GGA) coordinated by IRENA.

The UNFC Geothermal Specifications provided an insight in the harmonized framework to qualify estimates of geothermal energy extractable by a project based on key elements of economic viability, technical feasibility and confidence, in a globally consistent and informative manner for prospective users of the information. Promoting standardization in this context is critical for investors, regulators, governments and consumers as a foundation for informed prospecting and evaluation of development opportunities at project, company, and national level. The training workshop presented the UNFC geothermal specifications, and application examples (i.e., case studies) and made participants more familiar with UNFC principles and classification methodology and their benefits to the future geothermal market. The workshop provided valuable feedback, comments, and suggestions on the Geothermal Specifications, especially in the Caribbean context.

OECS Geothermal Energy Roundtable

Advancing Geothermal Energy in the OECS for Economic Development and Resilience

Opening Ceremony

The opening ceremony was chaired by the Mistress of Ceremony, Ms. Judith Ephraim, Programme Coordinator for Sustainable Energy at the OECS Commission. In her welcome remarks she thanked the organisers, host country and participants for their support of the Roundtable and Training workshop. A brief overview of the genesis of the collaboration that facilitated the hosting of the meeting was provided and the main objectives were outlined.

Mr. Chamberlain Emmanuel, Head of the Environmental Cluster addressed the meeting on behalf of the Commission. He emphasized the importance of Energy and Resilience in the context of Small island Developing States (SIDS). Recognizing that the delivery of reliable and affordable energy remains a challenge for the region he posited that geothermal energy could help address this need through the provision of clean and renewable energy. He further highlighted that the relative complex nature of geothermal energy required regional collaboration at all levels for success. In this regard, he expressed his appreciation for the wide cross-section of participants especially those from utilities, regulators and academia. He also indicated his appreciation for the participation of the Regional Council of Guadeloupe, given that Guadeloupe has the only geothermal energy power plant in the region and is in the process of obtaining OECS membership.

Mr. Joseph Williams, Head (Ag), Renewable Energy/Energy Efficiency Unit of the Caribbean Development Bank (CDB) in his address, indicated that the bank was pleased to be co-sponsoring the roundtable. He further emphasized the commitment of the CDB to work with the OECS Commission, IRENA, the IGA and the World Bank on the development of Geothermal Energy in the region. He announced that the co-sponsorship was made possible through the European Union Caribbean Investment Facility (CIF) to support geothermal energy in the region through the Caribbean Geothermal Risk Mechanism. He indicated that in recent years some progress had been made but the region needed to advance the pace and to “get it right” in geothermal energy. Mr. Joseph further shared that the bank was providing opportunities to finance geothermal energy through grants available to support early-stage, exploratory drilling which will help determine the country’s true geothermal energy potential. He made the call for more attention to be placed on the environmental and social aspects of geothermal energy development, capacity building and the supportive regulatory framework. In this regard, he confirmed the CDB’s commitment to securing resources to address these identified needs for the region.

Mr. Abdulmalik Ali in addressing the meeting on behalf of the International Renewable Energy Agency (IRENA) shared some of the work the organization was doing to advance renewable energy, particularly in support of (SIDS). In this regard, he highlighted the SIDS Lighthouse Initiative, the Global Geothermal Alliance and Global Atlas for Renewable Energy. The latter will provide resource data covering all renewable resources through a single easy-to-use platform that will support investors and developers in decision-making. Mr. Ali spoke to the importance of risk mitigation for geothermal energy and the

availability of an anchor investor for success in geothermal energy. He reiterated the commitment of IRENA to work with partners on the classification of geothermal resources in helping to de-risk geothermal energy.

Ms. Marit Brommer, Executive Director of International Geothermal Association (IGA), in her address expressed her thanks to the OECS Commission and other partners for organizing the Geothermal Energy Roundtable and Training Course. She introduced the IGA as an international voice committed to advancing geothermal energy with a particular emphasis on technology transfer and capacity building. These, she cited, were critical to unlocking the true global potential for geothermal energy. She also shared that the IGA together with the United Nations, the World Bank and IRENA, had been working on building capacity for the development of a common language to classify the resources and reserves of geothermal energy globally. This classification process is expected to help provide a better appreciation of the value of geothermal energy globally. Ms. Brommer announced plans for the World Geothermal Congress in April 2020 in Reykjavik, Iceland and invited the Caribbean region to participate and share their experiences at the event.

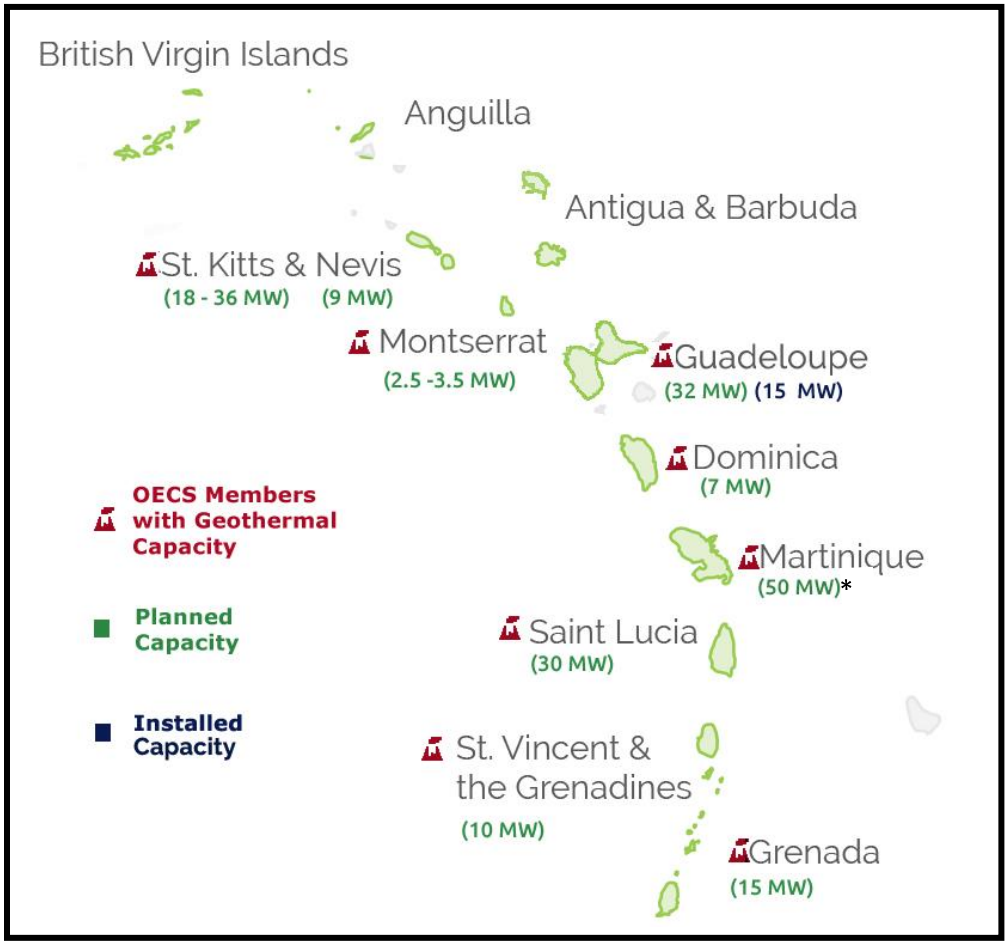
The World Bank's remarks were delivered by Ms. Brommer on behalf of Mr. Thrainn Fridrikson and emphasized his strong support for geothermal energy. Special mention was made of the World Bank's recent report on Geothermal Energy for the Latin America and Caribbean countries which assesses the key challenges and opportunities in the region. Ms. Brommer indicated that the World Bank was keen on supporting capacity building and legislation for geothermal energy. She highlighted the Bank's work on "Gender and Geothermal" and shared plans on an upcoming workshop on the topic planned for March 2019 in Guadeloupe.

Honourable Minister Stephenson King, Minister for Infrastructure, Ports and Energy of Saint Lucia in delivering the feature address welcomed participants and expressed his gratitude to the organisers for the Geothermal Energy Roundtable and Training Course. He confirmed Saint Lucia's pleasure in hosting the event and shared some of Saint Lucia's latest geothermal energy developments and plans. He noted the progress of the neighbouring islands and thanked the international community for their support for geothermal energy to the region, which he recognized as vital given the intrinsic challenges of geothermal energy.

He recognized the meeting as a significant opportunity to explore more ways to act collectively on geothermal energy in the region. He called for a strategic and collaborative approach to geothermal resource development and challenged the region to speak with one cohesive voice to establish a regional geothermal industry vision. He underscored the benefits of pooling resources together and proposed the development of a regional strategy on geothermal energy which would support functional cooperation.

Geothermal Energy in the Eastern Caribbean

A key objective of the roundtable was to obtain a status report on the achievements with respect to geothermal energy in the region that could inform plans for collaboration on advancing progress. The first technical session of the meeting addressed this by presenting a snapshot of geothermal energy in the region. The presentation was led by Ms. Judith Ephraim of the OECS Commission who underscored the importance and benefits of geothermal energy to the region. The challenges to geothermal energy were highlighted drawing reference to a 2016 report produced by the Commission based on a survey undertaken. The survey results identified Finance and Government Policy as the main challenges to geothermal energy in the region. Some key needs and gaps were discussed including the alignment of other national policies to support geothermal and capacity building. Support for transaction negotiations and business models was recognised as critical to geothermal energy development efforts in the region. The presentation also underscored the repeated calls for closer regional collaboration on geothermal energy given shared circumstances and challenges.



Eastern Caribbean Countries with geothermal potential

**Estimated capacity (potential) for geothermal development, information statutorily validated by French law and provided by The Martinique Territorial Authority*

During the session updates on geothermal energy pursuits on each island were provided by relevant country representatives. The following is a summary of the discussions:

Commonwealth of Dominica - Rawlins Bruney

The geothermal resource on Dominica is estimated at 65 MW. The country is pursuing a 7 MW geothermal plant, comprising two 3.5 MW units, to supply the domestic market in the first instance. Financing has been provided by IDA, DFID and SIDS DOCK. Technical Assistance including the services of a project manager is being provided by the Government of New Zealand. The Dominica Geothermal Development Company established in 2016, is facilitating this development. The plans for the project development have been delayed due to the passage of Hurricane Maria. However, the delay presented an opportunity to reassess the project design and incorporate some considerations for resilience. The new design has rerouted the reinjection pipelines which are now designed for natural hazards. The Interconnection Agreement has been signed and the Sales Agreement is awaiting signature. The government plans to approach the international market with tenders once approval from World Bank is received. Construction is expected to begin by the third quarter of 2019 and will last for 18 months. Once this construction phase is completed the intention is to have a second phase of construction for a larger plant which will provide geothermal energy for export.

Drilling Site – Dominica

Grenada - Hubert Samuel

The Grenada Geothermal Energy Project contemplates the installation of 15MW of geothermal capacity in a market with an existing peak demand of approximately 33 MW, based on the progress of a prudent project development approach that ensures the de-risking of the project as it proceeds through its development phases. This is facilitated by the conduct of the necessary exploratory drilling, as well as Environmental and Social Impact Assessments (ESIA) at the various drilling stages.

Preliminary, surface-based exploratory investigations have been completed and current plans are to drill two slim-hole wells to further characterize the geothermal source that is indicated by the preliminary work. The overall cost of the project is estimated at US$132M with the exploratory drilling phase projected at US$15.5M. The ESIA to inform the exploratory drilling will be performed in 2019 and the exploratory drilling campaign is planned for 2020 (with the infrastructure to support drilling having to be designed and built prior to drilling commencement). The project's early stages are grant-financed and the business model envisages the incorporation of private sector investment for financing once technical and economic feasibility of the source has been established and the existence of a bankable project is confirmed. The current plan is to have geothermal energy incorporated to the national grid post-2026.

Martinique - Benoit Vittecoq

Martinique have 3 prospective fields: Les Anses d'Arlet, Lamentin's plain and Mount Pelée. The last round of exploration was undertaken between 2012-2017 and additional exploration is needed to assess the productivity of each prospect. Financing is being sought to evaluate the permeability and recharge of each field which will allow an estimate of the productivity of the fields.

Montserrat - Felix Persaud

In 2014 Montserrat successfully drilled 2 production wells, each projected to be capable of delivering 2 MW of electricity. The actual capacity will depend on the technology used and the reinjection management facility. A third well was drilled based on the well completion report to ascertain a suitable

Long term testing at MON-01 Site - Montserrat

configuration amongst the first two wells. This may result in the use of two wells as production and one as reinjection but this depends on results of the third well. Montserrat has moved into an early market engagement survey to better understand the market players for the surface plant. The government is currently in discussion with their funding agent with a view to a surface plant producing by 2020.

Saint Kitts - Yvan McPhail

Saint Kitts has done some site surveys and there is an estimated potential of 36 MW. There is a current non-disclosure agreement which limits what can publicized and negotiations are ongoing.

Nevis - Jervan Swanston

In 2007 exploration rights were given to the West Indies Power company for the production of 40 MW. This capacity would be sufficient to cover the baseload of Nevis and Saint Kitts. This agreement is no longer valid and the current geothermal energy development is being pursued with Nevis Renewable Energy International Company with a focus on satisfying the electricity needs on Nevis which has a peak demand of 9 MW. The proposed plant will initially comprise two 5 MW units and can be expanded as demand grows. Construction plans are advanced and the required financing for the plant is in place.

Exploration well (N-4) drilled March 2018, Hamilton Nevis.

Saint Lucia - Terrence Gillard

In 2014 under the World Bank administered Geothermal Resource Development Project (GRDP), additional surface exploratory work was undertaken to help inform the government's decision of moving forward with geothermal energy. Under this new round of work, a Light Detection and Ranging (LiDAR) study and additional geoscientific studies were completed. A prefeasibility study undertaken indicated that it was highly unlikely that additional surface studies would add more value. The recommendation was therefore to proceed with exploratory drilling. The ESIA was conducted for the proposed drilling at the three sites in the southwestern part of the country identified in the prefeasibility study. The project also provided transaction advisory support, the hiring of a transaction advisor and the hiring of a public information and communication consultant for outreach and consultation. An additional component supported geothermal energy development legislation and regulation for ESIA and for the Piton Management Area (PMA)[1]. The results of the surface studies indicate that the potential resource locations are close to the PMA.

Proposed Drilling Areas – Saint Lucia

The GRDP project is expected to end in January 2019 and based on the recommendations of the prefeasibility study Saint Lucia geothermal exploration drilling is planned under the umbrella of the Renewable Energy Sector Development Project. The drilling will be financed through a blend of grant and loans from various sources. The project preparation grant has been accessed under Clean Technology Fund and the project will go to World Bank board in May 2019. The project is a US$ 22.5 M package and the aim is to drill 3-4 slim holes. The Government is currently working on establishing the Project Implementation Unit comprising a project manager and other professional staff. The hiring of the Exploration Management Consultant who will advise government on the contracting of the drilling services and civil works is also underway.

[1] Name of protected area in Saint Lucia

Saint Vincent and the Grenadines - Ellsworth Dacon

In 2014 discussions began on the Geothermal Act which was passed in 2015. The government engaged with a private entity under a public private partnership arrangement and the business case was presented in 2015. The ESIA has been completed and a number of legal agreements were finalized including the concession agreement, generation license, power purchase agreement, interconnection agreement, project management services agreement.

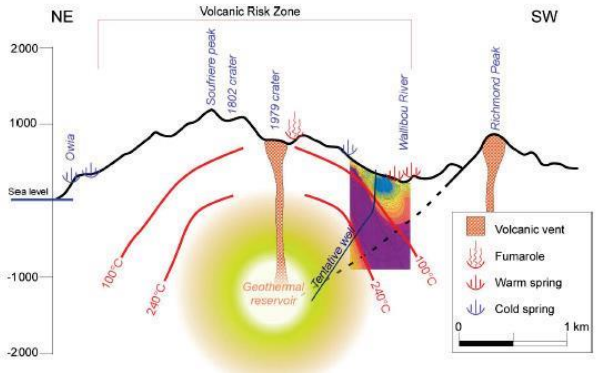


Figure 1: A Conceptual model of the Possible Geothermal Reservoir within the La Soufriere Mountain[2] (Saint Vincent and the Grenadines)

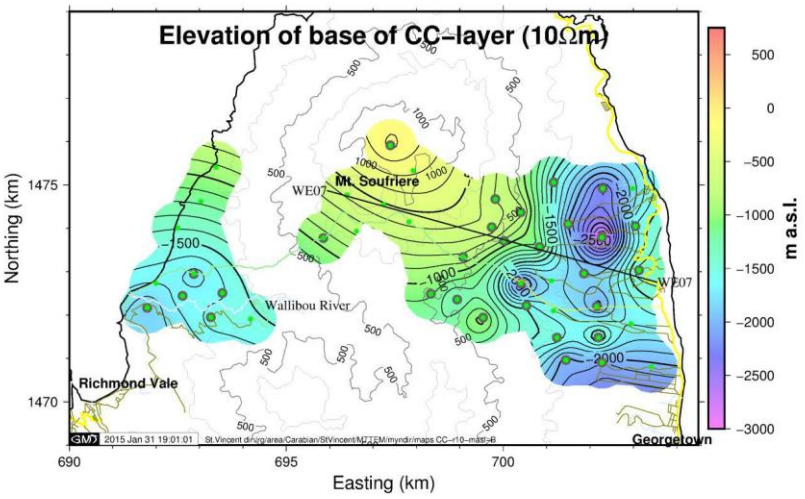


Figure 2: Elevation of the Clay Cap Layer[3] (Saint Vincent and the Grenadines)

The financial model has been presented and agreed upon. He indicated that the civil works would be completed in December 2018. The drilling contract was signed in late November 2018 and drilling is expected to commence in April 2019. With the current schedule the EPC contract is expected to be issued by Jan 2020 with plant completion in 2021.

[2] Volcanic Risk zone Identifying Structures to the North East of the Wallibou River, have to face volcanic risk in design whereas structures to the South West of the river are shielded from pyroclastic and surge flow

[3] Elevation of the base of the Clay Cap layer, interpreted to be the 240 degrees Celsius, the Green points show location of MT soundings, which observe the depth to base of the Clay Cap layer

Guadeloupe - Osmar Ludovic

Currently there is a geothermal plant of 15 MW of geothermal energy installed on Guadeloupe. In 2017 over 100 GWh was produced by the Bouillante Plant which ranked geothermal energy as number one for renewable energy on Guadeloupe. The plan is to expand geothermal energy on Guadeloupe by developing other projects which should deliver an estimated 27 MW from geothermal energy by 2023 and a second expansion phase.

Bouillante Geothermal Power Plant in Guadeloupe (aerial picture, BRGM)

Thematic Presentations

The Roundtable allowed for some critical issues for geothermal energy to be discussed within the Caribbean context. A feature presenter initiated the discussion with a short presentation on ideas and developments and participants further developed the points and recommendations in a plenary session. A summary of the presentations is provided below.

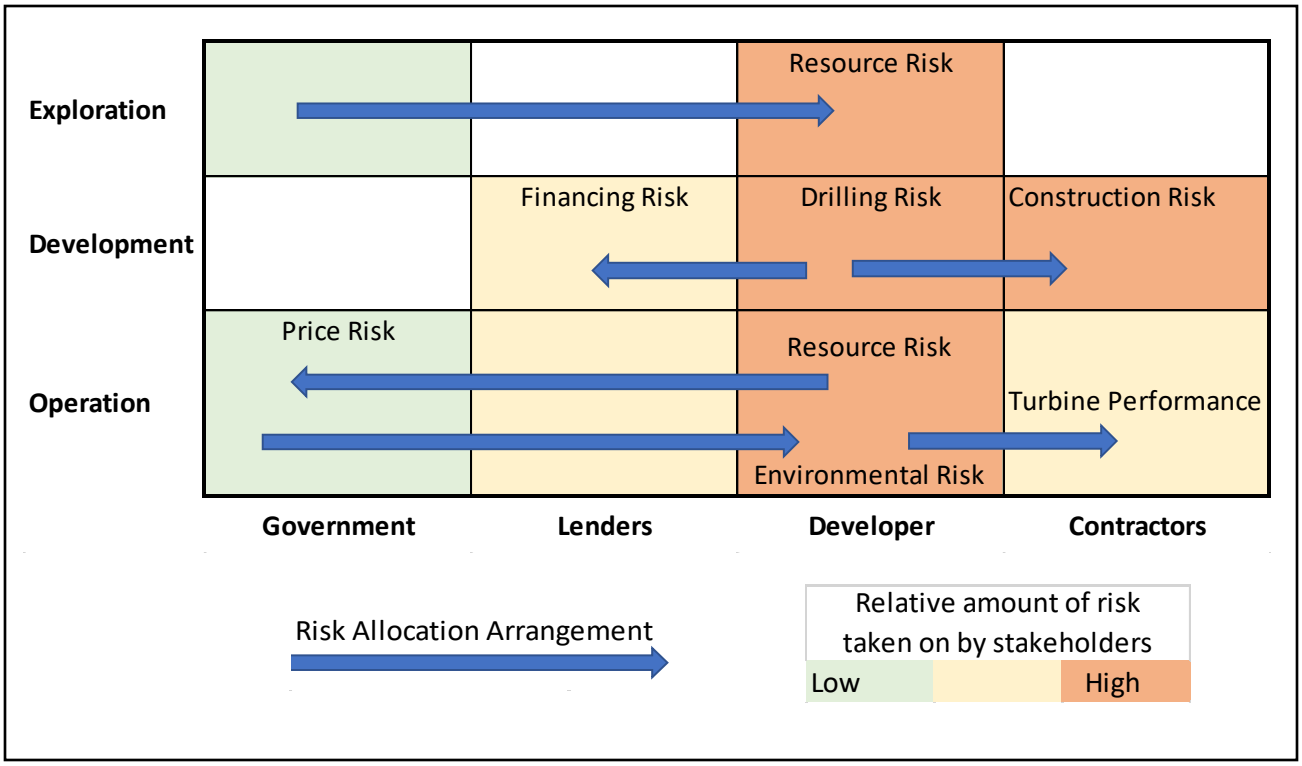
Risk Management for Geothermal Projects in the Caribbean - Charlin Bodley

The first thematic presentation provided an overview of the key risks resource and non-resource risks posed to geothermal energy projects. The non-resource risks identified included, financial risks, market guarantee and price, project management and organisation, resource sustainability and opposition from local communities. Some examples of effective risks responses to resource risks were highlighted including those centered on identification of the appropriate contract type, the use of sub-contracting services, documentation and experience transfer. The factors which contribute to financial risks of geothermal energy development were examined and this led to a brief discussion on the true cost of delays. It was recognized that the effective use of Project Management principles and institutional organization which allowed for dedicated resources and explicitly defined responsibilities significantly improve the success of geothermal projects. The appropriate business model was also seen as an important factor in addressing risks surrounding market guarantee and price. The importance of reservoir management and potential development conflicts were also discussed within the context of risk management.

Conflict between two visions of legitimacy (presentation)

Financing Geothermal Energy in the Caribbean - Joseph Williams, CDB

This presentation elaborated on the financial challenges to geothermal energy in the Caribbean region and highlighted the available support from the Caribbean Development Bank for geothermal energy development. The presenter noted that the region is experiencing challenges with the requisite skills for geothermal energy including within the categories of technical/engineering, financial, legal, transaction advisor and ESIA. The importance of the legal framework for geothermal energy was underscored and some of the challenges identified in this regard included geothermal energy ordinances and legislation, the existing capacity of the regulatory body and establishment of the appropriate legal instruments. Information was shared on the financing facilities for geothermal energy at the Caribbean Development Bank including the GeoSmart Initiative and the EU Caribbean Investment Facility (CIF). Mr. Williams drew attention to the component of Investment Grants for Government to support exploratory drilling and a smaller component for technical assistance under the EU CIF. He explained Capacity Building is a priority area for support for the CDB and highlighted several related initiatives are currently planned in this regard.



Risk Allocation among Stakeholders (presentation)

Geothermal Energy Island Interconnection - Titlon Rhonda Douglas

Ms. Douglas opened the discussion on the potential for export of geothermal energy through submarine cables in the region with a presentation examining the requirements and citing similar energy interconnection case studies across the world. Export of geothermal energy between islands has become an area of interest for the OECS given that some islands have estimates of geothermal energy potential that exceed their national demand. She noted that the close proximity of islands of the Eastern Caribbean makes it possible for submarine cables to be used and interconnect to the grid but the cost had to be a major consideration. The presentation highlighted some of the results of a research project she undertook during her recently completed course of studies with the University of the United Nations Geothermal Training Programme. This explored some specific possibilities for the Caribbean including the case of Nevis providing geothermal energy generated electricity to Puerto Rico which is located about 440 km away. She also presented the results of a SWOT analysis for subsea interconnection of the Eastern Caribbean which provided a more comprehensive assessment of this potential. It was recognized that more research was needed in this area with particular reference to feasibility studies on cross border interconnection and legislation.

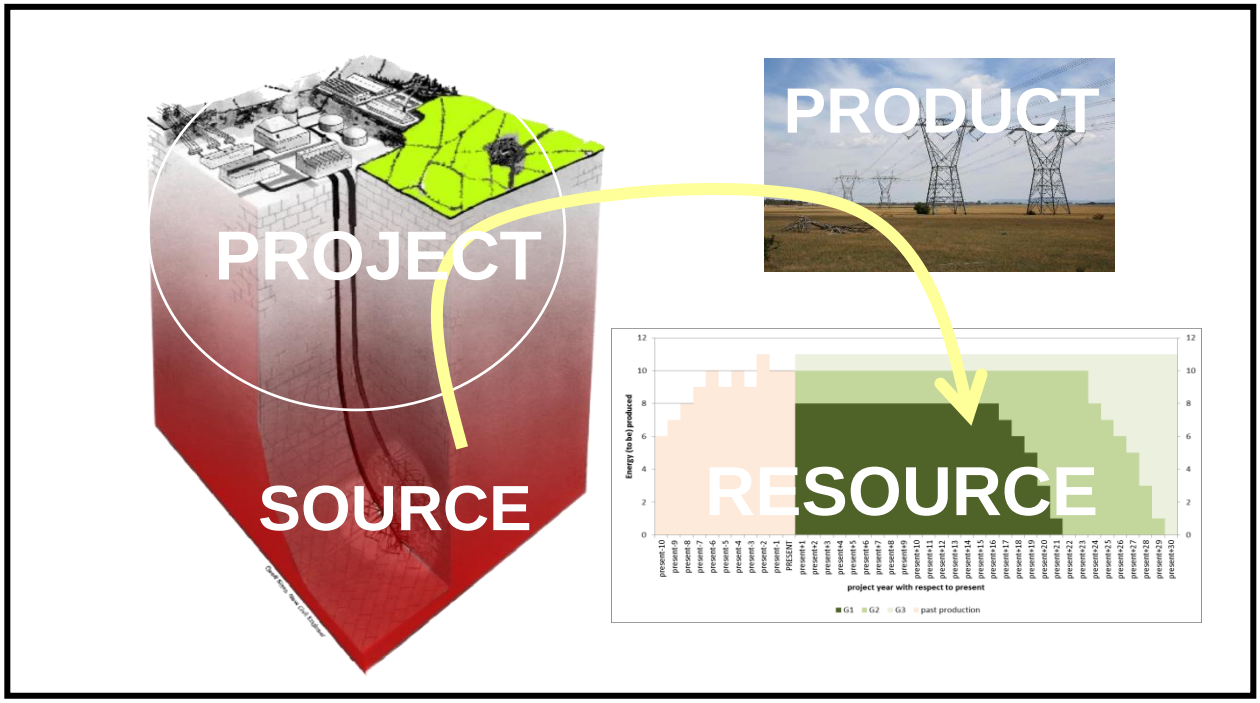
ISLAND INTERCONNECTION		**DISTANCE (KM)**
Nevis	St.Kitts	3.29
Nevis	Monsterrat	93
Montserrat	Antigua	53.9
St. Lucia	Bardados	174
St. Vincent	St. Lucia	76
Dominica	Martinique	93
Dominica	Guadeloupe	96.4

Possible Subsea Interconnection in the Eastern Caribbean (presentation)

Application of UNFC to Geothermal Energy Resources - Greg Ussher

(on behalf of the Task Force on the Application of the UNFC to Renewable Energy and the IGA Resources and Reserves Committee)

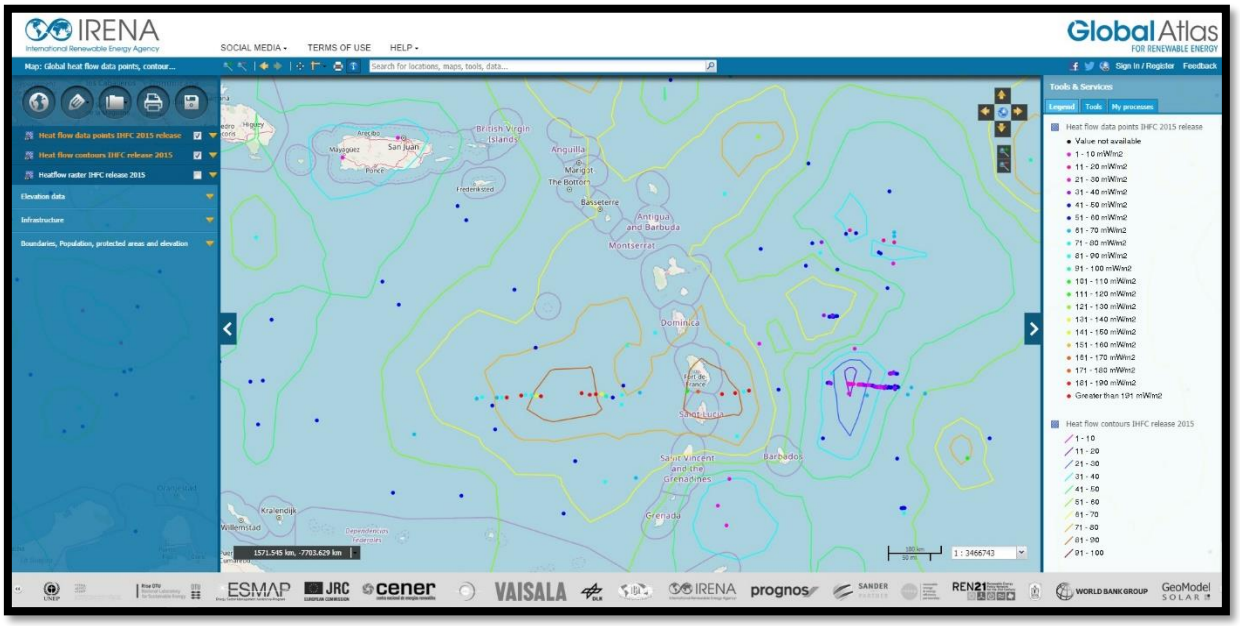
This presentation provided an introduction of the United Nations Framework Classification UNFC and its application to geothermal energy resources. The UNFC was originally developed for fossil energy and mineral reserves and resources but was extended to renewable energies. Geothermal energy is the latest renewable energy sources to which the UNFC has been applied. The classification system is based on three criteria, 1) the degree of favorability of social and economic conditions for establishing commercial viability of the project 2) the maturity of studies and commitments necessary to implement projects and 3) level of confidence in the estimate of potentially recoverable quantities. Each criterion in turn, has different categories that represents different developmental stages or conditions. The classification process is supported by a decision tree that assist with the classification of the geothermal resource.



UNFC Geothermal Definitions (presentation)

The IRENA´s Global Atlas for Renewable Energy - Huyi Chen

Ms. Chen introduced the IRENA's renewable energy mapping tool[4] in her presentation. This tool is a resource data and support service tool, which facilitates access to spatial data[5] and key parameters like resource quality information of renewable energy sources across the world. It is designed to assist policy makers and developers in planning as well as to support investors in assessing the quality of their investments in renewable energy projects. It aims to provide free resource data for all, optimize development and reduce costs. The Global Atlas geothermal energy mapping is in the pilot stage and provides heat flow profiles from different parts of the world. The Geothermal Resource Classification Initiative introduced at the workshop following the Geothermal Roundtable was conducted in partnership with the IGA and the World Bank (ESMAP). Following the pilot training in Indonesia in March 2018 and the Caribbean, similar resource classification training is scheduled for Ethiopia and El Salvador in 2019.



Global Atlas example map: Global heat flow data points, contours and map

[4] Global Atlas for Renewable Energy, https://irena.masdar.ac.ae/gallery/#gallery

[5] Geographic Information System (GIS)

Selected Case Studies from the OECS

The approaches to geothermal energy development in the OECS differ based on the national circumstances and decisions taken on each island. The meeting recognized that while there may not be any clear wrong or right approach to development particularly with respect to the business models, valuable lessons can be learned from each strategy employed. Two advanced case studies were presented highlighting their approach to de-risking geothermal energy development, particularly for the business model used and the results achieved thus far.

Saint Vincent and the Grenadines

Mr. Ellsworth Dacon, indicated that the key features of the approach by St. Vincent and the Grenadines was the creation of a Public Private Partnership for geothermal energy and the use of the Open Book approach to negotiations. The Government utilized available grants and technical assistance to develop a legal framework which offered concessions, permits and environmental regulations for geothermal energy. Based on several reports which indicated a good potential for geothermal energy, the government began the search for ideal partners that were willing to conduct feasibility studies at their own costs, develop a project and operate it for 25 years. The early involvement and commitment of resources by the private sector partners was an important component of the government's strategy to ensure vested interest in the success of the project by the private sector partner. The strategy was also hinged on the thinking that engagement of the right partners would help attract funding agencies.

Signing of Drilling Contract, 29 Nov. 2018 (source: Reykjavik Geothermal)

St. Vincent Geothermal Company Limited (SVGCL) and Icelandic Drilling Company have signed a drilling contract for drilling four wells

An important part of the strategy involved government setting of a ceiling price for the electricity to be produced from geothermal energy and inviting a partner to present a business case showing how they

could meet the ceiling price. The meeting of the ceiling price was a pre-condition for partnership. An Open Book approach was used where the components of the electricity were analysed and all key requirements were brought to the table. The aim was to have frank negotiations towards meeting the goals of the government, utility and consumers for an acceptable energy price. Working together the partners were able to seek grant and concessional financing together as a Public-Private Partnership. The project has received both grant and concessional funding for completion from the Interamerican Bank (IDB), CDB, Abu Dhabi Fund for Development (ADFD), the United Kingdom Department for International Development (DFID), Global Environment Facility (GEF), New Zealand and the Japan International Cooperation Agency (JICA).

Commonwealth of Dominica

Drilling Rig Tower - Dominica

Geothermal Energy development in Dominica is being undertaken by a project company, the Dominica Geothermal Development Company, which was formed as a private company in 2017 with 100% shareholding held by the Government of the Commonwealth of Dominica (GoCD). The company has been established to deliver a 7 MW_e (nominal) geothermal power plant. The company is owned by government but operates as a private company. This current structure is an adaptation form an earlier structure which involved government partnering with a private developer to firstly build a small domestic plant followed by a larger plant for export of energy. The initial deal was complex and ambitious which resulted in negotiations that were quite long and involved. Government eventually changed plans to focus on construction of the small plant for domestic use. Whilst negotiating the government used grant financing to drill exploratory wells and subsequently production wells with sovereign loans.

The unique structure and organization allow the company to access funding for both governments and the private sector. The company is privately run and functions independently. The company retains technical expertise and the services of legal and commercial advisors to supplement its full-time staff. This approach afforded some unique benefits. The company was able to take advantage of some attractive financing from the World Bank including grants from New Zealand and the SIDS dock that were only available to public entities, as well as some low-cost loans. The company was able to access the public window of International Development Assistance (IDA) as well as private sector financing.

Drilling Truck - Dominica

The establishment of the new company structure with a single owner and an organization of dedicated individuals separate to government, whose purpose is to drive the geothermal project, served to simplify the development process. During the past 18 months, progress was accelerated with the hiring of staff for the company. The important role of the regulator was also underscored as part of the Dominica Case study.

Dominica plans to issue an EPC contact in 2019 and plant commissioning is scheduled for the end of 2020. Although not all documents have been signed, the needed elements for geothermal energy in Dominica are in place. This includes proof of the resources, drilling for the power plant, the legal framework for permitting the development, the structure and organization for the company, the power purchase agreement, the financing and the bid document.

Approach of Working Group Session

The first sessions on derisking and the country status updates identified some main thematic areas for designing a collaborative mechanism to support geothermal energy development in the OECS. The agenda provided a working group session to allow for deeper analysis and discussions of the issues and to provide recommendations for addressing them within a regional context.

The meeting agreed on 7 Thematic Areas for derisking geothermal development:

1. Negotiations/Transactions
2. Legal/regulatory and Policy Environment
3. Capacity Building
4. Financing
5. Business Development Approach/Entrepreneurship
6. Environment and Social Considerations
7. Champions for Geothermal

The following questions guided the working group discussion:

1) What are the main challenges/needs/gaps in this thematic area?

2) What measures/interventions can be undertaken to address (1) in the next 2-3 years?

3) What agencies/stakeholders could contribute to (2)?

Negotiations/Transactions

Background:

An OECS stakeholder analysis in 2016 identified the negotiation of Power Purchase Agreements (PPAs) as one of the main challenges to geothermal energy development in the OECS. The OECS Energy Policy Implementation Dialogue Workshop in March 2018 again reiterated these concerns. Currently the Member States have no or limited experience in negotiating the complex and wide-reaching contracts needed for geothermal projects. In addition, OECS Member States with geothermal potential have different business or ownership models. Furthermore, the investors, whether public and/or private, have different expectations for return of their investments. Each negotiating partner need to do calculations of tradeoffs between possible benefits and risks.

The working group tried to identify main challenges in their context to help better understand the constraints, find ways to support the negotiations and transactions and share experiences.

Key Results of the Working Group:

- The group benefitted largely from Dominica´s experiences, since they are already advanced in negotiating PPAs and grand concessions for developers
- One crucial pre-step for the negotiations and transactions is the need to identify relevant current and expected future stakeholders to ensure the interests of all are represented
- Based on the experience of negotiations in Nevis it is recommended to have all relevant information including specialized analysis before starting the negotiations
- There are limited financial resources and human resource capacity to develop appropriate PPAs and concessions

- Future measures and interventions should include targeted and tailor-made training and courses for building regional expertise in negotiations and transactions

- The capacity building could be provided by relevant energy partners including the World Bank and CCREEE

- Guidelines for the development of PPAs were seen as useful, however it was recognized for the specific case of geothermal energy each PPA would have its distinct and individual conditions

- A curated list of advisory resources including companies, experts and consultants was recommended

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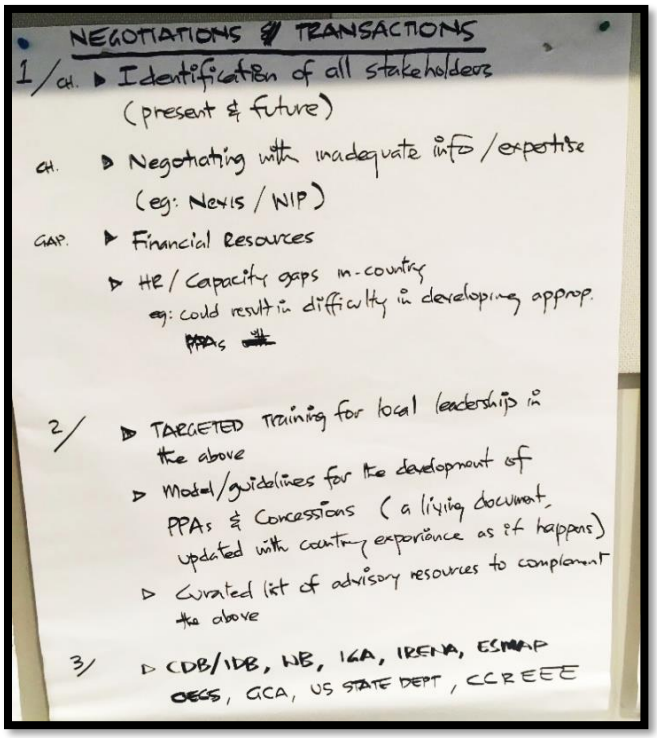


Legal/Regulatory and Policy Environment

Background:

Each OECS Member State pursuing geothermal development is at a different development stage and has a different enabling environment with regard to legal, regulatory and policy frameworks. The enabling environment was identified as a key element to leverage geothermal development at the OECS Policy Dialogue in March 2018 in Saint Lucia. The appropriate policy and regulatory environment will allow for, ***inter alia***, attracting investments and developing clear guidelines, best practice and protocols for geothermal energy development. There is also the need to establish regulatory agencies in countries that do not have and to build the capacity of the existing regulatory commissions to undertake geothermal energy.

Key Results of the Working Group:

Challenges

There are energy policies in the region however the associated legislation and regulations are inadequate or absent. Inadequate penalties also make it difficult for the regulator to enforce regulations for the market and the utility.

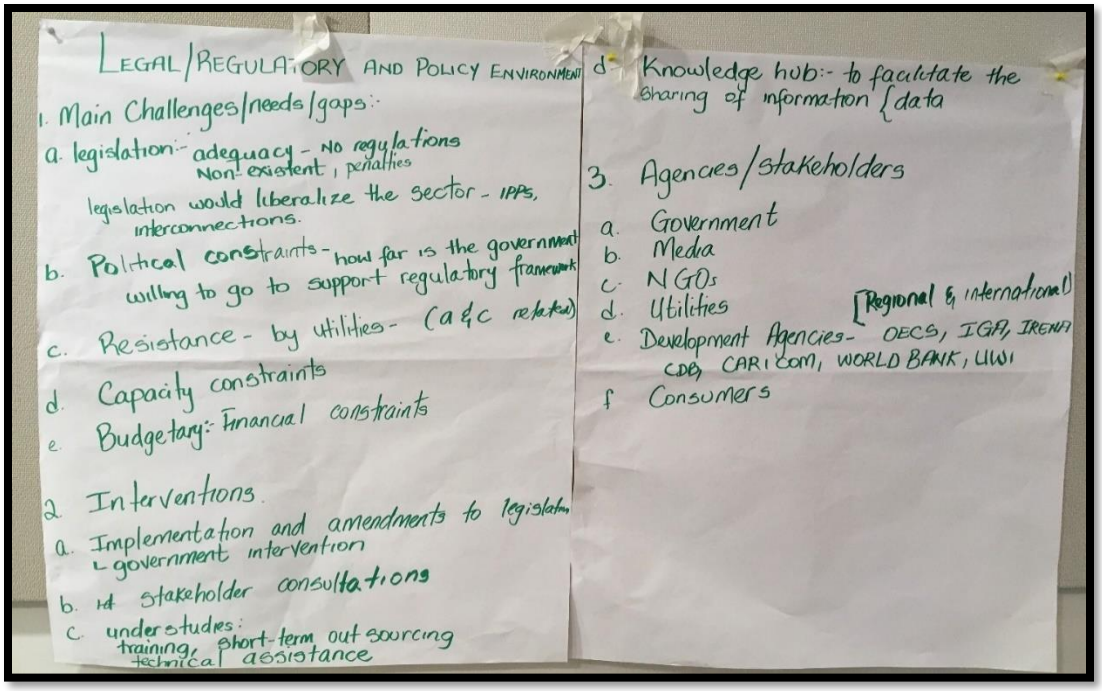
There is need for enactment of the appropriate legislation to allow for some level of liberalization and encourage the entry of Independent Power Producers (IPPs) and interconnection agreements.

The regulators may face the challenge of obtaining political support for enforcement of the regulations as well as resistance from utilities.

Existing regulators also experience human capacity and financial constraints which hinder their ability to be truly independent as they rely on government for funding.

Proposed solutions for the challenges include:

- The implementation and amendments to legislation
- Government stakeholder consultations
- Training and understudy opportunities
- Short-term out-sourcing
- Technical assistance
- Establish a knowledge hub to facilitate the sharing of information and data



Identified agencies and stakeholders in the legal, regulatory and policy environment are the governments, media, NGO´s, utilities, development agencies. Regional and international organizations or entities like OECS, IGA, IRENA, CDB, CARICOM, World Bank, UWI are important stakeholders as well as consumers.

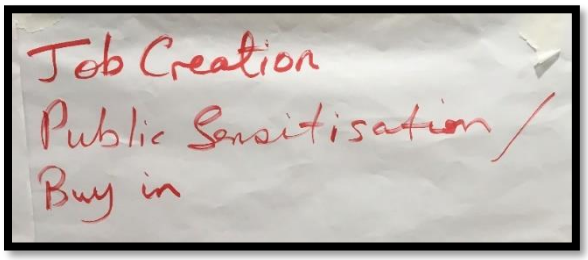
Capacity Building

Background:

Geothermal energy exploration and development creates new jobs that must be filled by persons with the requisite skills and expertise. In addition, decision makers and other involved stakeholders must be well-informed and have a good appreciation of geothermal energy development issues. Given the limited experience with geothermal energy in the region, there is need to develop local specialists and knowledge in this field at different levels to support the proposed new developments. Capacity building is therefore seen as a critical component to the region's geothermal energy strategy. A working group discussed the main issues for capacity and suggested concrete actions for enhancement.

Key Results of the Working Group:

The group agreed that geothermal development was expected to enhance the economic development of the region in general. In this regard, the group underscored the importance of that the local community benefitting from the geothermal development. They emphasized the importance of public sensitization and including local people as part of the development. This would help foster "buy in" and help guarantee sustainable development.

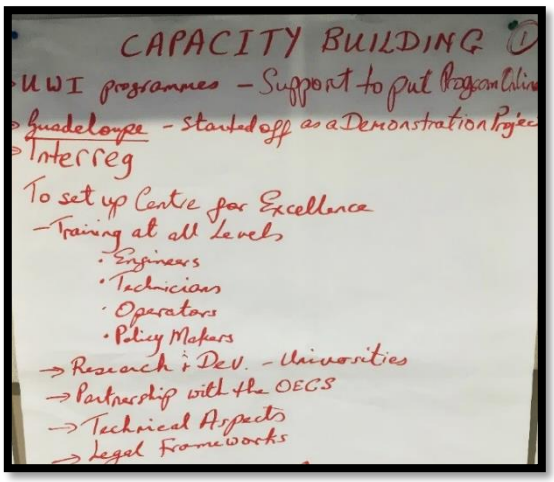


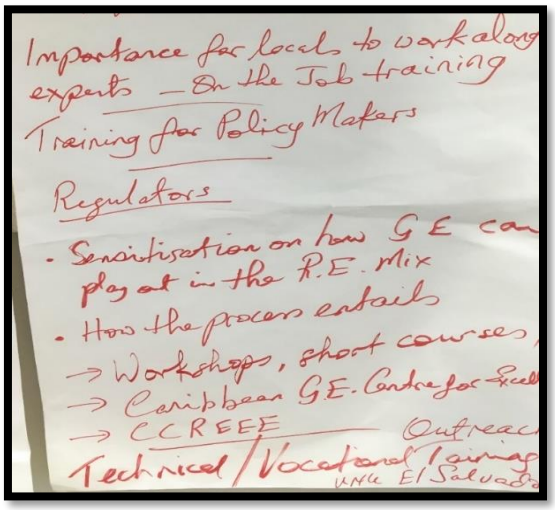
Challenges identified by the working group:

- Limited technical geothermal training opportunities
- Existing renewable energy programmes at the University level are expensive and not affordable for many students
- There is a lack of baseline studies to identify the actual capacity needs for geothermal energy in the region

Proposed solutions for the challenges include:

- Setting up less expensive energy online courses to reach the entire region (UWI and University of Guadeloupe already started to establish internet-based online courses)
- Create scholarship and apprentice programs
- Establish the Center of Excellence (CoE) in Guadeloupe which could provide comprehensive training at all levels (for engineers, technicians, operators, policy makers etc.)
- Create a specialized geothermal curriculum at the Université des Antilles in Guadeloupe and foster close collaboration with CoE to align its activities to regional initiatives as well as to enhance research and development
- Sharing of knowledge and best practice examples from existing projects in the Caribbean
- Promotion of "on the job-training" with international experts who can advise and coach the local persons (Saint Vincent and the Grenadines is already using this approach)
- Sensitize and develop tailored geothermal training for policy makers and regulators
- Conduct a baseline study to identify and map the capacity needs and "critical" skills
- Develop geothermal capacity building roadmaps and programmes on a local and regional level (based on the needs assessment)





Financing

Background:

The peculiar characteristics of islands such as the small size, remote locations and absence of economies of scale lead to higher developmental costs for renewable energy projects including geothermal. Despite the high interest in geothermal development because of its environmental and economic benefits, the OECS Member States are not well positioned to take on additional debt to finance the high upfront investments of geothermal projects. Innovative ways are therefore needed to address the financing of geothermal energy and in particular the high-risk exploratory phase.

The working group discussed the financing obstacles and presented the following points from the working session.

Key Results of the Working Group:

Three main challenges were identified by the working group:

1) Access to finance

2) Accountability of financial support, especially grants

3) Availability of government and counterparty guarantees.

Proposed Interventions

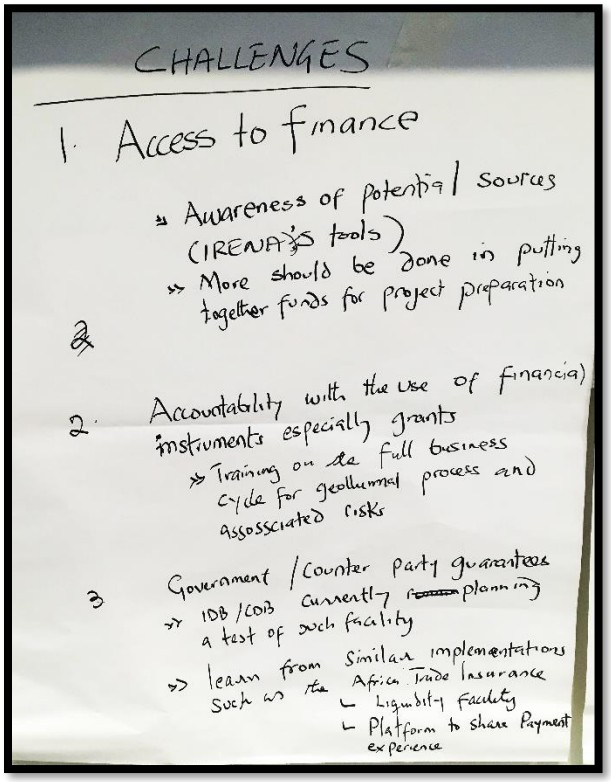
1. A key requirement to access finance is knowledge about the funding institution landscape, their funding requirements and processes. Understanding the requirements of the respective financing institution is a pre-requisite to preparing a tailored proposal. The capacity to access financing is enhanced through awareness about available tools and research into publicly available information.

Agencies such as IRENA have produced a number of tools such as the *Project Navigator*[6] and *Sustainable Energy Market Place*[7] that provide guidance in developing bankable projects and preparing project documents. In addition, these tools can be used to catalyze investments by connecting project owners, financiers/investors, host governments, service providers and technology suppliers.

The Abu Dhabi Fund for Development (ADFD) was identified as one example of a funding facility providing concessional loans for renewable energy projects including geothermal development.

2. Requesting entities which apply for financial support like grants require specific quality standards in their accountability system to be eligible for these funds. Capacity building was identified as a needed intervention to address these gaps in accounting knowledge and procedures required by the donors.

3. The absence of government guarantees and the counterparty guarantees can be a reason why projects fail to qualify for financing. To address this, some regional Banks (IDB and CDB) are planning to pilot a liquidity guarantee facility in case of late payments from the utilities. The Caribbean Region could learn from an example from Africa, where the Africa Trade Insurance Agency [8] is already established and functioning.



[6] https://navigator.irena.org/index.html
[7] https://www.irena.org/marketplace
[8] http://www.ati-aca.org, It offers insurance products to protect against political risks, currency inconvertibility or transfer restrictions, and trade embargoes as well as non-payment risks, like damage to property or loss of revenue from business interruption due to politically motivated violence or terrorism and sabotage events.

Business Development Approach / Entrepreneurship

Background:

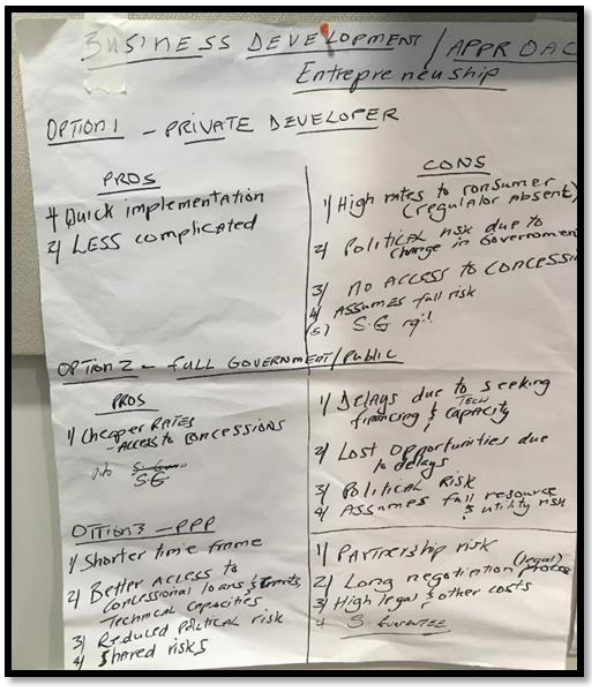
The geothermal business development approach or business models employed for a project will have an influence on the ownership structure, financing and derisking strategy. There is no one-size-fits-all solution and each business model has its distinct pros and cons. The appropriate model will depend on the national circumstances including technical capacity, ability to access financing and the amount of data available. It is generally recognized that the government plays an important role in the development of geothermal energy whether as a facilitator of developers or as an active participant in the business structure. Whilst some OECS Member States have already decided on their business approach others have not articulated the approach to be adopted. The working group elaborated on different business approaches for geothermal energy and their advantages and disadvantages.

Key Results of the Working Group:

The working group identified three geothermal business development options:

1. Private business development
2. Full government/public
3. Public-private-partnership

The private business approach could be a private utility or private developer. The likely advantages include quick implementation and a less complicated structure. The anticipated disadvantages within the OECS context include higher rates for the consumer, increased vulnerability to political risk due to change in governments and limited access to concessions. In this approach it is expected that the private developer assumes full risk and requires sovereign guarantees. It was noted at the meeting that countries could face challenges in providing sovereign guarantees.



The second option is the public approach to development where development is completely government-led. This approach has been successful in some cases. However, inadequate technical capacity or financing may pose risks which result in delays. These delays can lead to further lost opportunities. Hence, for such an approach to be successful, measures that address these challenges have to be implemented. Such an

approach is also expected to have an increased political risk due to government changes which might lead to abandonment of the project. A challenge might be that the government or the public assumes the full resource and utility risk creating pressures on public resources. The anticipated advantages are that the rates will be cheaper and the government has access to grants and concessions and the development will not require sovereign guarantees.

The third option is the Public-Private-Partnership (PPP) which is a combination of the two other approaches. In this approach there are several shared responsibilities between the government and the private sector partner which can be adjusted over time. The example of Saint Vincent and the Grenadines recommends that the private developer is part of the development process from the beginning. Challenges to this approach might include partnership risk and longer negotiation processes resulting in higher legal and other costs. Additionally, a sovereign guarantee is required for this approach. Generally, the advantages anticipated include a shorter timeframe to develop the resource and access to concessional loans or grants is better. With this approach technical capacity is also guaranteed. There are also benefits to be derived from sharing the resource and utility risks.

Environment and Social Considerations

Background:

Although geothermal is a clean source of energy, the development, including the exploration of the resource must be conducted in an environmentally and socially responsible way to minimize adverse impacts on the communities. The local populations in the Eastern Caribbean have little or no experience with the effects of large-scale development activities like the construction of a geothermal energy plant.

A comprehensive assessment of the environmental and social implications of the proposed development will provide governments, developers, local communities and other stakeholders with the right information for decision-making. Land issues are of particular interest to geothermal energy in the region. While the land footprint of geothermal power plants is less in comparison with that of conventional power plants, the location of the resource on the islands may present issues for development. The working group discussed the challenges for the region this regard and proposed some interventions.

Key Results of the Working Group:

The working group identified two main challenges, namely: 1) Land access and acquisition and 2) Effects on Environment and Population

Land Access and Acquisition

Issues identified include**:**

- Geothermal projects located in protected areas such as near heritage sites can present a unique challenge for development.
- Access to geothermal resources in mountainous areas or where roads are inadequate is also problematic.
- Inadequate land use policies can also present challenges for geothermal projects in the region.

Proposed Measures

- To mitigate the land access and acquisition challenge a proper and sustainable resettlement and safeguards program needs to be in place before starting geothermal development.
- Land use policies and physical planning which consider geothermal development from the early beginning reduce the land access and acquisition difficulties.

Effects on Environment and Population:

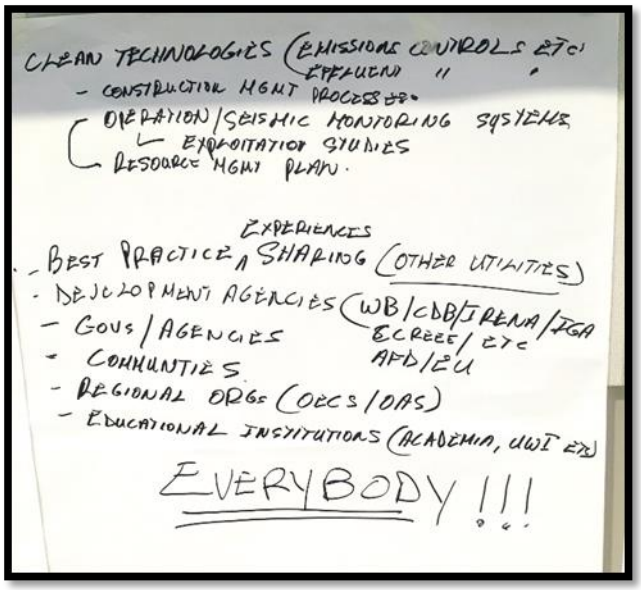
Issues identified include:

- Relocation and resettlement of nearby communities due to gas emissions, smells, traffic and noise.
- The risks of groundwater contamination due to effluent discharge.
- Concerns for seismic activities from the geothermal development.
- The livelihood of the surrounding communities may be negatively impacted.
- Potential conflict with existing land uses in close proximity to the development such as tourism and other industries and businesses.
- The lack of social acceptance or resistance to a geothermal project by some members of the communities due to the Not in My Backyard, NIMBY, phenomenon or limited education on such projects.

Proposed Measures

- To mitigate the above-mentioned challenges key assessments plans and regulations are needed. These include ESIAs, environment management plan and land use policies and plans. Resettlement safeguard programmes should also be developed at the initial stages of development.
- A combination of education, communication and awareness plans will address the issues social acceptance of the population. These should include sharing positive examples through benchmarking of utility experiences, case studies and best practices in geothermal development.
- The risk of these improbable but possible seismic reaction can be assessed and minimized with early due-diligent geophysical studies.
- The concerns on building resilience for geothermal energy projects can be addressed through the construction design, use of adequate building codes and consideration for undergrounding relevant infrastructure.
- Improving accessibility to appropriate commercial insurance for the energy assets was identified as an important mitigation measure.
- Building redundancy in the design and proper maintenance of systems was also recommended as a means to also improve resilience for geothermal projects.

- A comprehensive resource management plan that includes the use of clean technologies (any process, product, or service that reduces negative environmental impacts) should be developed and implemented to address issues like emissions. The plan should also include construction management processes, approved operations and seismic monitoring.
- A wide cross-section of actors was identified as important to mitigating the potential environmental and social issues and so collaboration was seen as critical. Some of the key actors included, Utilities, CCREEE and UWI.



Champions for Geothermal

Background:

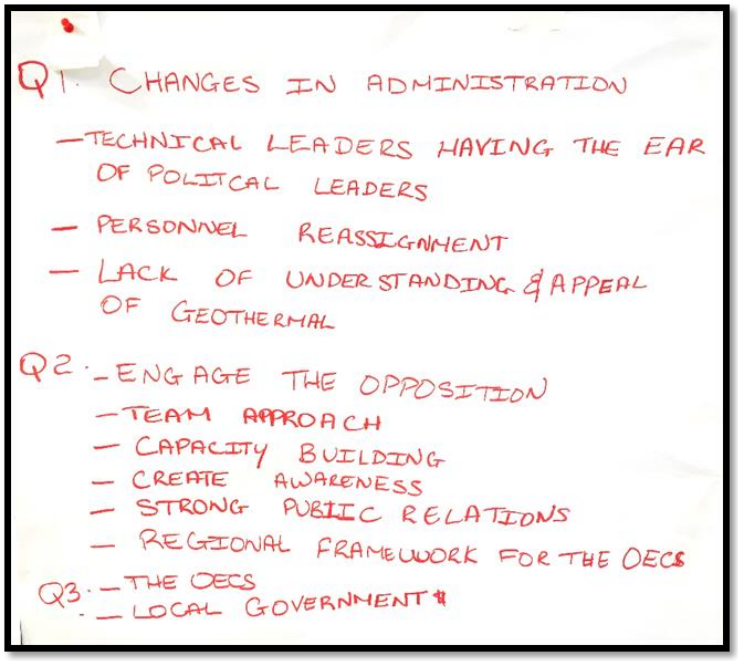
The meeting recognized that the success of geothermal projects in the region could be greatly assisted by the existence of a national champion for geothermal. This figure could serve as a visionary advocate who spurs action and sustains efforts towards advancing geothermal energy development success. A key role for the champion is to assist with publicizing the project and garnering support for it. However, the role of the champion extends beyond promotion and could include facilitation of a common understanding between developers and financiers. A geothermal champion may also be a company/individual who has made notable achievements for geothermal energy.

Key Results of the Working Group:

Saint Vincent and the Grenadines and Dominica were highlighted as cases where there is a recognizable champion for geothermal energy who had been able to help move the geothermal projects forward.

Key Challenges include:

- An effective national champion for geothermal could be lost due to changes in political administration or reassignment of technical personnel.
- The lack of technical understanding of geothermal energy by the wider community creating misconceptions and reducing its appeal.



Proposed solutions:

Sufficient engagement of the political opposition in the development process could help mitigate the impacts of the loss of champion due changes in political administration or personnel reassignment.

Developing champions in technical leaders that have the "ear" of the political leaders and can influence them, could also ensure the longevity of champions across political changes.

Development of a team approach to champion the geothermal cause could be an effective and more sustainable approach to individual champions.

Capacity building, public awareness and strong public relations can address the issues surrounding misconceptions on geothermal energy.

The OECS is well-placed to serve as a regional champion for geothermal energy at a higher decision-making level helping to mitigate delays and loss of momentum caused by changes in political administrations. The OECS acting through its Commissioners could support and promote a better understanding of the benefits to be derived for geothermal energy in the region.

Regional Collaboration for Geothermal Energy

The last session of the day focused on a discussion on a regional approach for collaboration on geothermal energy. Several references were made throughout the day on the need for greater regional collaboration on geothermal energy. Two major initiatives to support a regional geothermal energy that were highlighted were:

1) The OECS Commission's plan to establish a "Geothermal Development Mechanism" (GDM).
2) The establishment of a Geothermal Energy Centre of Excellence

Drawing on these discussions Ambassador Vince Henderson led a plenary session on recommendations for a regional approach for geothermal energy that would support enhanced cooperation. The following are the salient points highlighted in the context of a regional approach:

a) There is need for more of a regional approach to utilize learning based on the experiences from the region.

b) The geothermal experiences of the region could be captured in a decision-maker's guide for geothermal energy which would assess both lessons in success and failure.

c) Recognizing that there were now more financing opportunities for geothermal energy, the focus should be on getting the right solutions within our context to ensure success.

d) It was recommended that the OECS Commission coordinate the regional effort for geothermal energy within the wider CARICOM framework and serve as a possible hub for geothermal energy within the knowledge management hub.

e) UWI was identified as a key institution to support the interventions on capacity building for geothermal energy.

f) It was recommended that the OECS Commission coordinate a Meeting of Energy Ministers recognizing that ministers are decision makers and need to be empowered.

g) It was recommended that efforts to develop geothermal energy should focus on supporting the creation of new industries and economic opportunities as well as adding value to traditional existing industries.

h) It was recommended that the region should seek to foster geothermal to reduce the electricity tariff.

Annex A - Participants List

(5th of Dec. 2018 – Geothermal Round Table Dialogue)

OECS Member States Representatives and Stakeholders

COUNTRY	NAME	OFFICIAL DESIGNATION	MINISTRY/ORGANISATION
ANGUILLA	Dallen Connor (Mr.)	Energy Officer	Energy Unit Department of Environment, Ministry of Home Affairs
DOMINICA	Rawlins Bruney (Mr.)	Project Support Engineer – Electrical	Dominica Geothermal Development Company Ltd.
	Dave Stamp (Mr.)	Generation Manager	Dominica Electricity Services Ltd.
	Michael Fadelle (Mr.)	Coordinator, Renewable Energy Programme	Ministry of Trade, Energy and Employment
	Justinn Kase (Mr.)	Executive Director	IRC, Independent Regulatory Commission Dominica
	Michael Savarin (Mr.)	GCF National Programme Coordinator	Ministry of Planning and Economic Development
	Amb. Vince Henderson (Mr.)	Ambassador, Permanent Representative	Permanent Mission to the Commonwealth of Dominica to the OAS.
	David Wenstrup (Mr.)	Managing Director, Advisor for Governments	Clean Infra Partners
GRENADA	Dwayne Cenac (Mr.)	Planning and Engineering Manager	Grenada Electricity Services Ltd. (Grenlec)
	Fitzroy James (Mr.)	Commissioner	PURC, Public Utilities Regulatory Commission Grenada
	Patricia Clarke (Ms.)	Permanent Secretary	Ministry of Infrastructure, Development, Public Utilities, Energy, Transport and Implementation
	Lawrence Samuel (Mr.)	Commissioner, Coordinator	NTRC / Public Utilities Regulatory Commission (PURC)

	Herbert Ainsley Samuel (Mr.)	Project Coordinator Geothermal Energy	Ministry of Infrastructure Development, Public Utilities, Energy, Transport & Implementation
GUADELOUPE	Nicolas Pouget (Mr.)	Directeur de Missions et du Développement / Project and Development Manager	Suez Consulting
	Osmar Ludovic (Mr.)	Energy Engineer	Regional Council of Guadeloupe
	Chouraki Jacques (Mr.)	President	Teranov
MARTINIQUE	Benoit VITTECOQ (Mr.)	Director of BRGM Martinique	French Geological Survey Martinique Office
	Murielle Lesales (Ms.)	OECS Commissioner for Martinique	Territorial Authority of Martinique
MONTSERRAT	Kenaud Ryan (Mr.)	Renewable Energy & Special Projects Advisor	Montserrat Utilities Ltd.
	Felix Persaud (Mr.)	Assistant Engineer	Ministry of Communication, Works & Labour
	Beverly Mendes (Ms.)	Permanent Secretary	Ministry of Communication, Works & Labour
	Raymond Tyson (Mr.)		Private Sector Representative
ST. LUCIA	Augustine Dominique (Mr.)	Manager, Protected Areas	Department of Sustainable Department
	Abigail Pascal (Ms.)	Engineer	St. Lucia Electricity Services Ltd. (LUCELEC)
	Terrence Gillard (Mr.)	Chief Energy, Science and Technology Officer	Department of Infrastructure, Ports and Energy
	Barbara Jacobs-Small (Ms.)	Managing Director	Right Angle Imaging
	Charlin Bodley (Ms.)	Energy Officer	Department of Infrastructure, Ports and Energy
	Benise Joseph (Ms.)	Energy Officer III	Department of Infrastructure, Ports and Energy
	Ivor M. Daniel (Mr.)	Permanent Secretary	Department of Infrastructure, Ports and Energy
	Estelle George (Ms.)	General Counsel/Corporate Secretary/CEO (Ag.)	NURC, National Utilities Regulatory Commission

	Maria Jean-Baptiste (Ms.)	Representative: OECS Commissioner Amb. Elma Gene Isaac	Ministry of Finance, Economic Growth, Job Creation, External Affairs & Public Service
	Jenna Flavien (Ms.)		Project Co-ordinating Unit, Ministry of Economic Affairs
	Dean Nicholas (Mr.)	Developer/Investor/ Stakeholder	Construction Development International (CDI) Ltd
	Kerne Antoine-Gabriel (Ms.)	Energy Specialist	National Utilities Regulatory Commission (NURC)
ST. KITTS AND NEVIS	C. Jomo Williams (Mr.)	General Manager (Ag.)	SKELEC, St. Kitts Electricity Company
	Yvan McPhail (Mr.)	Energy Officer	Energy Unit, Ministry of Public Infrastructure, Post, Urban Development and Transport
	Nicole T-Shari Agard (Ms.)	Accounts Manager	Ministry of Public Infrastructure, Post, Urban Development and Transport
	Jervan Bernel Swanston (Mr.)	General Manager	Nevis Electricity Company Ltd (NEVLEC)
	Titlon Rhonda Douglas (Ms.)	Senior Physical Planning Officer	Nevis Island Administration, Department of Physical Planning
ST. VINCENT	Melissa Defraitas (Ms.)	Energy Officer	Energy Unit, Ministry of National Security, Air and Sea Port Development
	Ellsworth St.Clair Dacon (Mr.)	Director of Energy	National Security

International & Regional Organisations

	NAME	OFFICIAL DESIGNATION
INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA)	Huiyi Chen (Ms.)	Associate Programme Officer
	Abdulmalik Oricha Ali (Mr.)	Programme Officer
ORGANIZATION OF CARIBBEAN UTILITY REGULATORS (OCCUR), C/O PUBLIC UTILITIES COMMISSION	Kathleen Riviere-Smith (Ms.)	Executive Director
CARIBBEAN DEVELOPMENT BANK (CDB)	Joseph Williams (Mr.)	Head (Acting), Renewable Energy/Energy Efficiency Unit
INTERNATIONAL GEOTHERMAL ASSOCIATION (IGA)	Robert Hogarth (Mr.)	IGA Expert
	Paolo Conti (Dr.)	IGA Expert
	Marit Brommer (Ms.)	IGA Executive Director
	Greg Ussher (Mr.)	IGA Expert
	Harmen Mijnlieff (Mr.)	IGA Expert
THE UNIVERSITY OF THE WEST INDIES (UWI)	Elizabeth Bullock (Dr.)	UWI Student
	Indra Haraksingh (Dr.)	UWI Lecturer
	Marisa Singh (Dr.)	UWI Instructor
ORGANISATION OF EASTERN CARIBBEAN STATES (OECS)	Judith Ephraim (Ms.)	Programme Coordinator
	Chamberlain Emmanuel (Mr.)	Head, Environmental Sustainability
	Martin Rufenach (Mr.)	Programme Officer
	Beverly Best (Ms.)	Head, Resource Mobilization
	Patricia Lewis (Ms.)	Administrative Assistant
	Natasha Augustin (Ms.)	Administrative Assistant

Annex B – Agenda

OECS Geothermal Energy Roundtable

Saint Lucia, 5th December 2018

Opening Ceremony	Welcome remarks: **Master of Ceremony** Remarks**:** **OECS Commission – Chamberlain Emmanuel** Remarks**:** **CDB – Joseph Williams** Remarks: **IRENA - Abdulmalik Oricha Ali** Remarks**:** **IGA - Marit Brommer** Opening address**:** **Government of Saint Lucia –** **Hon. Minister Stephenson King**
Presentation	Geothermal Energy in the Eastern Caribbean **Judith Ephraim, OECS Commission**
Presentation	Risk Management for Geothermal Projects in the Caribbean **Charlin Bodley, Government of Saint Lucia**
Presentation	Financing Geothermal Energy in the Caribbean **Joseph Willams, CDB**
	Coffee break
Presentations	Selected Case Studies from the OECS
Breakout Sessions	Geothermal Energy Development: Challenges and Opportunities
Plenary Discussion	Derisking Geothermal Energy in the Caribbean
	Lunch break
Presentation	Direct use of Geothermal Energy Prospects **Paolo Conti, IGA** *(was actually not presented due to time constrains)
Presentation	Overview of the Global Atlas for Renewable Energy (geothermal component) **Huiyi Chen, IRENA**
Presentation	The United Nations Framework Classification for Resources and Reserves (UNFC), application to renewable energy
	Coffee break
Presentation	Application of UNFC to Geothermal Energy Resources **Greg Usher, IGA**
Presentation	Geothermal Energy Island Interconnection: A viable option for the Eastern Caribbean, **Titlon Rhonda Douglas**
Presentation	Recommendations for a Regional Collaborative Framework for Geothermal Energy in the Caribbean