LIST OF ANNEXES

A. INCREMENTAL COST ANNEX

A.1 INCREMENTAL COST TABLE

Project Component/ Activity	Benefits/ Costs	Baseline Scenario	Alternative (GEF -) scenario	Increment
Resource Characterization				
	Global Environmental Benefits	Viable, geothermal resources exist, but are not currently exploited. Several studies have been undertaken, but no follow up. Electricity generation remains mainly based on diesel generation sets.	Resource characterization is completed. Exploratory drilling commences on the three islands (staggered).	Exploratory drilling permits geothermal development activities to advance significantly.
	Domestic Benefits	Several independent studies indicate that geothermal resources are available. but there is insufficient data for exploitation.	Resource characterization is completed. Exploratory drilling commences on the three islands (staggered). Local experts and authorities are involved and trained.	Development of data regarding geothermal resources that allows for the characterisation of the resources, attraction of developers, and proper environmental monitoring.
	Costs	**1,320,000**	**8,270,000**	**6,950,000**

Project Component/ Activity	Benefits/ Costs	Baseline Scenario	Alternative (GEF -) scenario	Increment
Risk Reduction Financial Tool				
	Global Environmental Benefits	No risk mitigation fund exists for the exploration of geothermal sites. Private investors reluctant to invest up front sums.	Identified geothermal projects are evaluated and structured to share risks between public and private participants.	Risk Mitigation Fund established, private investors feel more confident in sharing risks of geothermal exploratory work.
	Domestic Benefits	Geothermal resources remain largely untapped. Potential projects are unprepared.	Specific, geothermal, renewable energy resources are evaluated and prepared to be exploited.	Given successful exploration results, geothermal resources are exploited, generating less CO_2 than fossil fuel sources.
	Costs	**0**	**5,200,000**	**5,200,000**

Project Component/ Activity	Benefits/ Costs	Baseline Scenario	Alternative (GEF -) scenario	Increment
Institutional Strengthening and Capacity Building				
	Global Environmental Benefits	Physical, human, policy and data resources are developed independently in the different African Rift valley countries.	Databases, forums, training and evaluation of policies, legal and regulatory frameworks concerning geothermal energy are coordinated.	Legal and regulatory framework is evaluated and modified to encourage private investment in geothermal development in the three project countries.
	Domestic Benefits	Insufficient regional integration + knowledge base concerning development and exploitation of geothermal energy resources	Local experts are involved and trained. New information, know-how and expertise is gained from regional and international interaction	Legal, regulatory and policy frameworks are coordinated and improved to facilitate commercial geothermal development.
	Costs	**0**	**700,000**	**700,000**

B. LOGFRAME ANNEX

Objectives and Outcomes	Objectively Verifiable Indicators	Means of Verification	Important assumptions
Global Objective: To reduce diesel-based electricity production in the Project countries via the introduction of commercially based geothermal electricity production.	GHG emissions reduced through geothermal energy production	Environmental monitoring and evaluation reports on avoided GHG emissions; scientific measurements,	Countries willing to implement environmental management and monitoring systems. Utilities are cooperative and provide data.
Development Objective: To overcome the barriers to the development of geothermal power and implement a regional strategy that will create the conditions for successful deployment of one or more commercially viable geothermal power plants in the region.	Reduced dependency on fossil fuels for electricity production, reduced cost of electricity, entry of IPPs based on geothermal production.	Reduced fuel costs by local utilities, verification of production costs via financial statements, number of permits/licenses issued for IPPs (geothermal)	Political and economic stability in the region. Private sector needs for investment security are met by Governments. Governments are willing to implement policies and measures needed for geothermal development.
Project Objective: To facilitate investments in geothermal power production in the Project countries by addressing financial, institutional, information, and resource confirmation-related barriers currently facing geothermal resource development in the region.	Resources are adequately confirmed by surface studies and drilling. Adoption of relevant legislation by respective states concerning geothermal exploitation. Implementation of regulation to facilitate commercial production and sale of renewable energies (geothermal) Introduction of Risk Reduction Financial Tool to attract geothermal developers. Implementation of adequate environmental monitoring instrument(s) to track direct and indirect pollution reduction activities of the project. Existence of international geothermal	Confirmation study and drilling reports. Megawatts of geothermal energy installed by the completion of the Projects. Existence of appropriate legislation and regulatory framework concerning renewable energy production in general and geothermal production in particular. Existence of operating Existence of environmental	Political and economic stability in the region. Government support and willingness to implement necessary measures. Alternative energies (including gasline development) remain unfeasible on technical and/or economic grounds prior to official signing of adequate PPA's for geothermal production.

	developers interested in GEF project opportunities. Existence of interested electricity buyers. Existence of local trained and knowledgeable staff on technical issues concerning geothermal energy and development and electrical networks.	monitoring systems and trained staff to implement them. Number of geothermal developers responding to international expression of interest for geothermal development. MOU(s) between potential buyers and sellers. Number and responsabilities of local, trained staff in geothermal development. Number of geothermal energy investments in the region. Monitoring and evaluation reports on geothermal energy investments made; official publications	

Immediate objectives/outcomes			
Objectives and Outcomes	**Objectively Verifiable Indicators**	**Means of Verification**	**Important assumptions**
1. Priority prospects are confirmed through surface exploration and selected exploration drilling takes place.	Corresponding scientific reports.	Resource characterization reports.	The results of the surface exploration recommend drilling.
2. The financial risk is mitigated through the existence of an appropriate financial tool which attracts potential private developers.	Number of official expressions of interest received by Project countries with properly defined geothermal projects. Confirmation that financial tool is suitable for potential developers.	Official expressions of interest. Effective use of financial tool.	The financial tool is defined and implemented. For private sector entry at this stage: government guarantees, incentives, and policies/regulations provide sufficient security to investors.
3.Necessary institutional, legal and regulatory framework introduced and adequate capacity building takes place.	Approved legislative and regulatory documents, necessary structures and staff is trained.	Legal and regulatory documents, number of staff trained,	Project countries remain committed to private sector participation in geothermal development National legislatures are favourable to passing suggested laws and regulations.

Outputs			
Objectives and Outcomes	**Objectively Verifiable Indicators**	**Means of Verification**	**Important assumptions**
Output 1.1: Documented technical results and recommendations.	Technical reports summarizing geo-scientific activites and recommendations.	Technical studies	Studies continue to be implemented. Reliable data is produced from studies.
Output 1.2: Design and implementation of further exploration phase	Documents, plans, budgets, indicating further exploration phases	Documents, plans, budgets	Studies indicate that further exploration is warranted.
Output 1.3: Compilation of prospectus	Prospectus containing technical data on geothermal development of interest to private developers.	Prospectus	Necessary required by private developers can be produced within givin projects/budgets.
Output 1.4 : Advice to Government	Memos, meetings with officials	Memos, minutes of meetings.	Geothermal prospects are develped sufficiently to be commercialiazed. Government support for tendering.
Output 1.5: Periodic Review	Periodic Reports concerning activities	Report	Existence of monitoring program.
Output 2.1: Preparation of Risk Reduction Financial Tool Implementation	Description of RRFT mechanism.	Minutes of Steering Committee.	Steering committee agrees on appropriate tool and its implementation.
Output 2.2: Choice of Financial Tool Manager	Tender documents for Financial Tool Manager. Tender evaluation report selecting Financial Tool Manager.	Tender documents, Tender evaluation report.	Tender is arranged, publicized and carried out. Multiple bidders that meet evaluation criteria.reply Evaluation committee makes an unbiased choice.
Output 2.3: Guideline Procedures	Guidelines are produced	Guideline documents	Specific guidelines are required to operate the Financial Tool.
Output 2.4: Support for Exploration Drilling / Use of Financial Mechanism	Contracts are prepared between commercial developers including the Financial Tool. Debt write off in the case of exploratory drilling failure.	Contracts. Financial report of RRFT activities. Claim from developer Affidavit from Geothermal Panel indicating exploratory drilling failure. Decision from Steering Committee.	The Financial Tool is managed by an entity that has the authority to make contracts. Procedures are followed and proper documents provided by the developer, Geothermal Panel and Steering Committee.

Output 2.5: Monitoring of Drilling Projects	Monitoring activities	Periodic monitoring reports	Monitoring and Evaluation system is established and operates on a regular basis. Information is freely available.
Output 3.1: Project Selection	Geothermal projects are selected.	Number of projects, Ranking.	Project selection criteria established. Data related to criteria is available.
Output 3.2 :Preliminary Institutional Review	Report reviewing institutional aspects	Report, laws, regulations, acts governing geothermal/ energy development in Project countries	Legal, institutional and regulatory information exists and is available. Cooperation of Project country Governments.
Output 3.3: Commercial/investment advice	Advice provided to government officials concerning general commercial/investment climate.	Presentation to Government officicals (slides, tables, etc) Minutes of meetings with Government officials	Documents, law, regulations, acts, etc which govern investment in the Project countries exists and is available.
Output 3.4: Contractual advice	Advice to governments on structuring the contracts.	Presentations to Govenerment officials. Contracts	Government officials are reactive and have the ability to sign contracts.
Output 3.5: Tender process support	Tender process organized, publicized, according to international standards	Tender documents, Bidder's responses.	Tender is carried out on time according to internatinal standards. Bidders respond to the tender.
Output 3.6: Sound contractual framework for private developers	Contracts developed for geothermal development in the Project countries.	Contracts	Government officials are reactive and have the ability to carryout tenders.

C. STAP Roster Technical Review

C.1 Responses to STAP/ Council/IA comments

D. SUMMARY OF PDF-B ACTIVITIES, FINDINGS & RECOMMENDATIONS

Annex D
Origins and development - Geo-Caraïbes Project Background
PDF-B Results

Pre-Project geothermal development. Multiple studies of the geothermal potential in many of the OECS countries date back over 40 years; however, with the exception of the 15 MW geothermal power project "Bouillante" in Guadeloupe, there has been no successful development of this resource in the region.

PDF Block B grant objective. With the objective of addressing the challenges that have heretofore limited the commercial development of geothermal power production in the Eastern Caribbean, the concept for the Geo-Caraïbes Project was launched. The PDF Block B grant activities concerning the design of the Project began with the execution of a PDF-A Grant in August 2003. At that time, three Project Countries – Dominica, St. Kitts & Nevis, and St. Lucia – confirmed their commitment to participate the regional geothermal development Project.

PDF-B Project fieldwork. The PDF-B Project fieldwork began in January 2004, and continued over seventeen months through May 2005. Table 1, below, lists the key events and meetings that comprised the PDF-B. The results from these activities are described in later sections of this document and serve as the foundation for the Full Project request

TABLE 1: KEY GEO-CARAÏBES EVENTS AND MEETINGS.

Date	Event	Location	Stakeholders
August 2003	PDF-A Stakeholder Consultation.	Roseau, Dominica	Project focal points from each Project Country.
January 2004	PDF-B Awarded to UNEP.		
January 2004	Dominica Geothermal Law Investigation. Stakeholder Meetings.	Roseau, Dominica	Dominica Project focal points & Geo-Caraïbes Legal & Policy Advisor; OAS.
February 2004	UNEP – OAS Project Negotiations.	Paris, France	UNEP Project Manager & OAS Executing Agency Manager; AFD.
March – April 2004	Project Countries - Reconnaissance Mission. Stakeholder Meetings.	Dominica, St. Lucia, & St. Kitts & Nevis	Project focal points; Utility representatives; Local media; Commercial representatives.
April 2004	Project Launch Meeting.	Pointe de la Verdure, Guadeloupe	Regional Geothermal Advisory Task Force; French Project partners (EDF, AFD, Guadeloupe Regional government, Interreg, ADEME, ICFC).
July 2004	Project Countries –	Basseterre, St. Kitts	Policy & Legal Team from

	Geothermal Policy Consultation. Stakeholder Meetings.		each of the Project Countries; & the Geo-Caraïbes Geothermal Advisory Task Force.
August 2004	St. Kitts & Nevis geothermal resource investigation.	Nevis	Geo-Caraïbes resource consultants (GeothermEx and MIT), & Nevis Island Administration technical representatives.
October 2004	UNEP Project Consultations.	Guadeloupe & Dominica	Project Country Geothermal Consultative Groups in Dominica; French Project partners (EDF, AFD, Guadeloupe Regional government, Interreg, ADEME).
November 2004	St. Lucia Stakeholders Consultation.	Castries, St. Lucia	St. Lucia Geothermal Consultative Group & Geo-Caraïbes Policy & Legal Team.
December 2004	French partners consultation.	Basseterre, Guadeloupe	French Project partners; Minister Austrie, Dominica; Mark Lambrides, OAS.
December 2004	Geothermal Financing Alternatives – Mission.	Paris, France & Washington, DC	Financing component consultants (ICE) & Geo-Caraïbes Advisory Team.
December 2004	St. Lucia Energy Week. Stakeholder Meetings.	Castries, St. Lucia	Presentation to energy stakeholders during nation energy week.
January 2005	Dominica geothermal resource investigation.	Roseau, Dominica	Geo-Caraïbes resource consultants (CFG), Geo-Caraïbes Technical Advisory Team & Dominica representatives.
February 2005	Geothermal electricity inter-island transmission consultation.	Dominica, Guadeloupe, & Martinique	Geo-Caraïbes/AFD interconnections consultants AETS; EDF; DOMLEC; Project focal points.
March 2005	St. Kitts & Nevis & Dominica Stakeholders consultation.	St. Kitts & Dominica	Host country Consultative Groups (including representatives from Attorney General's office, Focal points, electric utilities) and Geo-Caraïbes Policy & Legal Team.

PDF-B Project Activities. During the PDF-B stage, taking global geothermal development experience as precedent, the Project determined that three principal elements are conditions precedent for successful geothermal development.

- Component One: Technical - Determining Resource availability and enabling market access.

- Component Two: Policy - Reforming the energy sector framework.
- Component Three: Financial - Improving financial viability.

The Geo-Caraïbes Project is designed to address each of these key elements on a systematic basis. The sections below detail the barriers determined in PDF and the conclusions and recommendations for overcoming these barriers.

Component One: Determining Resource Availability and Enabling Market Access.

Front-end loaded costs of geothermal projects create a threshold entry barrier. By arming the Project Countries with reliable, verifiable technical data, the Countries will be positioned knowledgeably to attract a broader range of investor-developers. Geothermal development requires very significant capital investment prior to commercial viability being established. Potential geothermal resources must be identified and assessed, and reserves estimated. Geological, geochemical and geophysical investigations, including drilling of boreholes, is required to establish the economic reserves of a geothermal prospect, at a cost of many millions of US$. The high-risk/high-cost capital required to establish the economic viability of a geothermal prospect becomes a very significant barrier to commercial resource development, especially for projects with modest power output (10s of MW). Even where commercial interest is high, economic benefits to the host nation maybe greatly eroded by the high initial exploratory and drilling costs with their concomitant high interest and ROI rates.

1. *Build capacity by providing Project Countries with geo-scientific knowledge base*. Compilation, analysis and refinement of geo-scientific data are essential preconditions to commercial development and to Project Country management of that development. The objective is to design a data base that provides the Project Countries with commercially useable geo-scientific data that will attract the most highly qualified developers. Possession of data developed to world standards positions a country with the bargaining power to award geothermal resource concessions to those financially and technically qualified developers that can establish the best commercial development Project.

2. *Ensure sustainability by establishing a technically qualified geo-scientific cadre in the Project Countries.* Sustainability in a country depends on building a technical cadre in that country that is competent to manage technical matters concerning exploration of resources, establishment of reserves, licensing and the geo-scientific aspects of commercial development.

3. *Maximize environmental benefits.* In order to enable maximum environmental benefits from geothermal development, PDF-B established requirements for collection of baseline environmental data. The Full Project will further assist each Project Country in establishing datasets and monitoring capabilities such that environmental impacts of geothermal development can be effectively managed.

4. Enable economies of scale. Geothermal power plants are most economical where installed capacity is sizable. By aggregating demand and addressing growing needs for electricity on several islands, geothermal energy is well suited to respond to both the incremental increases in demand in the three Project Countries and the large demand in the French Antilles. The demand in Dominica, St. Kitts & Nevis, and St. Lucia may be met through a progressive exploitation in modules. Significant rationale exists for aggregating demand. Also, addressing growing needs for electricity on several islands with geothermal energy will have multiple benefits to the generation facility host country, including the significant reduction of electricity prices (achieved through economies of scale) and the generation of revenue through electricity export charges and royalties.

5. *Establish achievable interventions.* The Geo-Caraïbes Technical Advisory Team ("TAT"), in collaboration with other Project teams and the Project Countries, have utilized the various findings of PDF-B to establish a number of achievable Full Project interventions to reach the stated full project improving technical knowledge and capacity objective.

6. *Identify subcomponents.* Achieving the full project improving technical knowledge and capacity objective will occur through interventions in four subcomponents. These Full Project interventions are discussed below, within the four identified subcomponents:

    - *Subcomponent One:* Geo-scientific Data Collection and Analysis;
    - *Subcomponent Two:* Technical Capacity Building and Outreach;
    - *Subcomponent Three:* Environmental Stewardship; and
    - *Subcomponent Four:* Establish the Technical Feasibility for Inter-island Electricity Connections.

Subcomponent One: **Geo-scientific Data Collection and Analysis**. *Identify barriers to establishing a full understanding of resource availability that may prevent private-sector development of geothermal energy and create solutions to overcoming these barriers in the Full Project stage.*

7. *PDF-B Activities* (Geo-scientific Data Collection and Analysis). *Compile all existing geo-scientific data and collect additional data necessary to provide a basic framework for analysis of baseline geothermal prospectivity.* The Technical Advisory Team, with the assistance of Project Country officials, established a digital archive of geo-scientific data relevant to geothermal exploration in each Project Country. The TAT compiled data from personal holdings, scientific literature and national archives during Project missions. Prior to the launch of the Project, the three Geo-Caraïbes Project Countries had archived a range of scientific resource information available – from minimal (St. Kitts & Nevis) to significant (St. Lucia). The PDF-B phase of the Geo-Caraïbes Project included compilation and archiving of previously collected geo-scientific data and identification of the best prospects for commercially viable exploitation in each country. Collection of new geo-scientific

data in two of these prospects enabled development of rudimentary geothermal resource models that will serve as the foundation of more detailed exploration of resources and establishment of quantitative reserve estimates planned for the Full Project. Collection and some re-interpretation of previous geo-scientific work undertaken in the region enabled the establishment during PDF-B of a digital database comprising documents, maps in Geographical Information System ("GIS") format, and raw scientific data will be enhanced during the Full Project and will become the basis of Prospectivity Reports for each Project Country.

8. *PDF-B Findings* (Geo-scientific Data Collection and Analysis). During the PDF-B, the Project identified the following geo-scientific data collection and analysis barriers that may prevent private private-sector development of geothermal energy and developed the following solutions to overcoming these barriers in the Full Project stage:

9. *Barrier:* No complete archive or appropriate cataloguing of information pertaining to geothermal exploration or to baseline geo-scientific data exists in any of the of the Project Countries. This lacuna meant the effective loss of a very significant body of work which, under other circumstances, could be extremely valuable to incoming commercial developers.

10. *PDF-B Intervention: Collect and digitize relevant documents from national archives, scientific literature and other sources.* The Project Support Team, guided by the Technical Advisory Team, digitized a large array of documents and maps from national archives, from personal data holdings of public-domain information (which was often absent from the national archive) and from the scientific literature. Both typed manuscripts and maps were converted to electronic format and distributed via CD-ROM. Key maps were also digitized and added to the Geographical Information System (GIS) database for each Project Country.

11. *PDF-B Intervention: Identify best prospects in each Project Country and collect and analyze new scientific data relevant to geothermal exploration in those prospects*. The Technical Advisory Team, via subcontracting arrangements, facilitated the collection of a broad range of new scientific data in the identified best prospect in St. Kitts & Nevis and Dominica. New data collection has been undertaken by a commercial developer in St. Lucia.

12. *Proposed Full Project Intervention: Develop comprehensive Prospectivity Reports including complete data archives as a main "marketing" tool to attract best commercial developers.* The archive and databases established in PDF-B will be supplemented as new data is collected and analyzed, and will be presented in a user-friendly format to the Project Countries as well as to prospective commercial developers once sufficient information is collected to adequately reduce exploration risk.

13. *Barrier:* The baseline scientific data is insufficient to enable a satisfactory pre-feasibility study of geothermal prospectivity in Dominica and St. Kitts & Nevis.

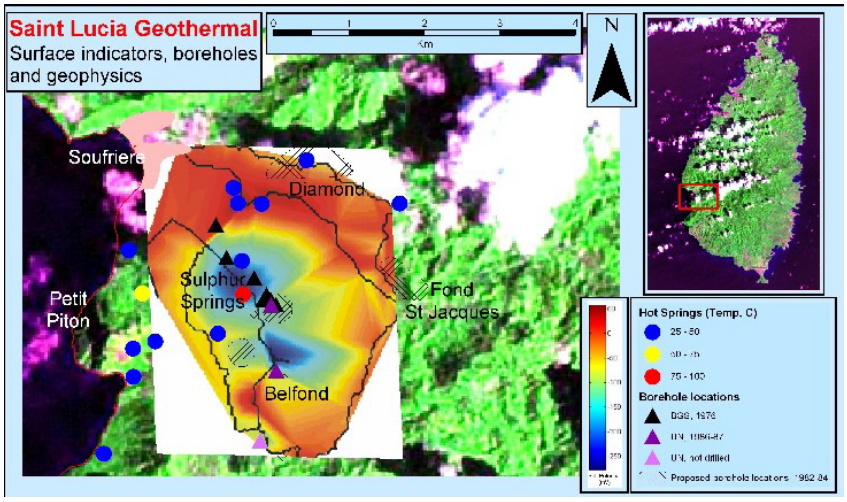
14. *PDF-B Intervention: Commission detailed studies comprising a broad range of geo-scientific disciplines to establish pre-feasibility level understanding of geothermal prospectivity for primary prospects in Nevis and Dominica.* The completion of detailed scientific investigations in two prospects established the viability of scientific exploration activities and supported previous assertions regarding the good prospectivity of both areas.

15. *PDF-B Intervention The Project found a large volume of relevant literature from a variety of sources, and added significantly to the scientific knowledge of geothermal prospectivity through analysis of existing and new data collected by the Project.*

16. *PDF-B Intervention St. Lucia*. PDF-B technical activities in St. Lucia were limited to a reconnaissance mission in March 2004, by the Technical Advisory Team. During that visit, the TAT undertook a substantial search and analysis of existing documentation and data relating to geothermal exploration and development. St. Lucia has been the main focus of geothermal exploration in the Anglophone Eastern Caribbean. Seven shallow and two deep exploration wells were sunk between 1977 and 1987, all but one in the immediate vicinity of the main surface thermal emanations at Sulphur Springs (Map 1). Of the two deep wells sunk as part of a UNDP Project in 1986 and 1987, the one at Sulphur Springs produced hot water, but the water chemistry was acidic and production was associated with substantial dissolved gases. The other deep well, at Belmont, was hot but dry. Despite much interest, commercial exploitation of the resource has not yet been undertaken. Some recent geophysical surveys and reprocessing of old surveys undertaken by Dr. Dale Morgan of MIT (member of Geo-Caraïbes TAT) add significantly to the data collected during the main phase of geothermal activity on St. Lucia in the 1970s and 1980s. Those conclusions maybe summarized as follows:

    (a) *Sulphur Springs.* With modern technology, the resource proven in the Sulphur Springs deep borehole may be commercially exploitable, depending on the market conditions for generated electricity. The acidic water conditions are treatable, and there appears to be sufficient temperature and flow rate to operate any one of a number of generating options.

    (b) *Qualibou Depression.* Other areas in the Qualibou depression appear to have good up flow of hot fluids based on recent geophysical data. The Belmont deep well probably just missed such a zone, and others exist in several areas.



MAP 1: St. Lucia PDF-B Resource Locations

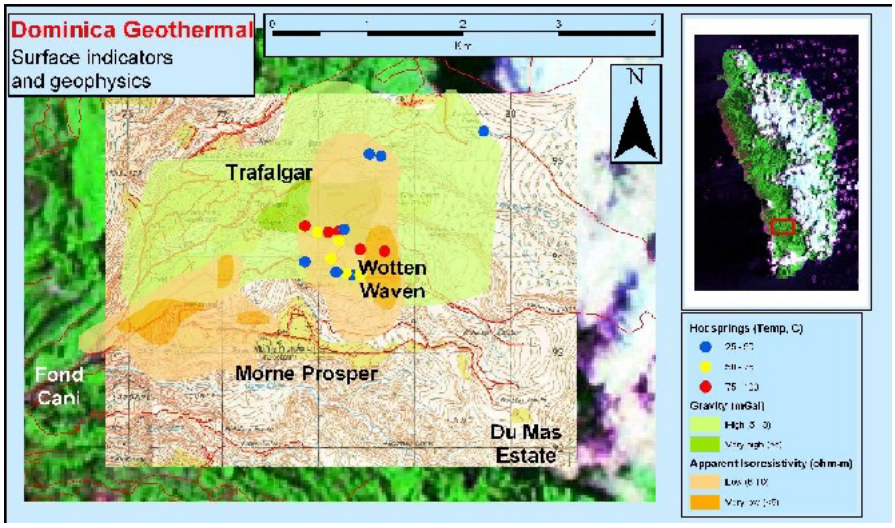
17. *PDF-B Intervention Dominica* (Geo-scientific Data Collection and Analysis). Previous regional studies of Eastern Caribbean geothermal potential have consistently cited Dominica near the top of the list of commercially interesting resources. However, various factors have combined to preclude any major exploration work for geothermal resources apart from that undertaken by the French Geological Survey ("BRGM") in the early 1980s. During a field mission in March 2004, the Geo-Caraïbes TAT evaluated the surface thermal manifestations in southern Dominica and reviewed available information pertaining to past geothermal exploration. The TAT concluded that the Wotten Waven area, a few miles to the east of the capital Roseau, provided the best opportunity for early commercial development. In December 2004, the Geo-Caraïbes Project commissioned CFG Services Ltd., to undertake a review of previous work in Dominica and to collect additional geological and geochemical data. The broad aim of the CFG study was to verify and build upon the geothermal model for the Wotten Waven area presented after the BRGM work in the 1980s. This model is highly encouraging for commercial geothermal development, but there remains a strong need to update the model and re-affirm its conclusions using modern exploration and analytical techniques. In particular, the CFG study was to collect additional structural data for the Wotten Waven area, especially in the River Blanc where there are numerous surface hot springs and fumaroles, and also try to include the Boiling Lake/Valley of Desolation area in the geothermal model. The main conclusions from the exploration work, which was completed in January are summarized as follows and in Map 2, below:

    (a) W*otten Waven.* A substantial geothermal reservoir exists beneath the Wotten Waven area, likely stretching from Boiling Lake in the east to Fond Cani in the west. The heat source(s) for this reservoir may be one or more major magma bodies at a depth of 5 to 10 km which, in the past 50,000 years or so, have fed numerous eruptions including that of the Roseau Tuff (the highest volume eruptive event in the Eastern Caribbean).

(b) *Thermal Features.* Leaks to the surface from the primary geothermal reservoir are rare; however, the TAT has concluded that the many warm and hot springs, soufrières and other thermal features covering a broad area represent small perched aquifers heated by conduction and/or mixing from the deep reservoir.

(c) *Structural control.* There appears to be some structural control on surface emanations and, possibly, on the upward passage of primary geothermal fluids towards the surface. These structural controls likely include both tectonic and volcanic features of local as well as regional significance.

(d) *Seismicity.* The occurrence of seismicity beneath the Wotten Waven area and throughout southern Dominica suggests an active hydrothermal system and that fracture permeability at depth may enhance geothermal exploitation potential. Thus, gaining an understanding of structural control on geothermal manifestations is critical to successful exploitation.



MAP 2: DOMINICA PDF-B RESOURCE LOCATIONS

PDF-B Intervention St. Kitts & Nevis. The twin island nation of St. Kitts & Nevis had previously been identified as having good geothermal potential. Both islands have dormant volcanoes, although eruptive activity involving magma has not been recorded since colonization in the early 16th Century. On St. Kitts, the potentially active volcanic centre of Mt. Liamuiga dominates the northern third of the island; while on Nevis, Nevis Peak lies in the center of and dominates the entire island. The Technical Advisory Team determined the following considerations significant:

(a) *Thermal features.* Geothermal indicators, in the form of surface thermal features, occur on both islands. The TAT review of these features and their value as geothermal indicators was undertaken during an initial Geo-Caraïbes field mission to St. Kitts & Nevis in April 2004. The TAT found substantial evidence to support the conclusion that the western side of Nevis island provided the best opportunity for future commercial geothermal development and recommended that an exploration mission comprising geological, geochemical and geophysical work should concentrate in this area. As a prelude to the exploration work, Dr. Simon Young, another member of the TAT, undertook a review of previous work on Nevis relevant to geothermal prospectivity This review document formed the foundation to the commissioning and completion of the multi-disciplinary exploration program completed in August 2004.

(b) *Geological and geochemical exploration.* Previous geothermal exploration on Nevis had been limited to geological and some geochemical work. While useful, some of that work proved to be inconsistent, especially with regard to the temperatures and chemistry of waters sampled from the numerous water wells drilled in western Nevis. The geological and geochemical work commissioned by Geo-Caraïbes and undertaken by GeothermEx Inc. concentrated on rationalizing the existing data through a comprehensive re-sampling and reanalysis of surface thermal features and accessible water wells, sampling and analysis of new water wells, offshore vents and previously unsampled surface features, and a comprehensive geological appraisal of western Nevis with special emphasis on defining surface structural features.

(c) *Geophysical investigation.* The geological and geochemical work was supported by geophysical investigations undertaken by SP International Inc. These investigations, undertaken at the same time as the geology/geochemistry, comprised both high-resolution gravity and Self Potential (SP) techniques. Gravity is often used as a "regional", *i.e.,* an investigative, tool for geothermal exploration, and new instrumentation and processing techniques make it increasingly useful. SP techniques, especially as developed and interpreted by SP International and their associates at the Massachusetts Institute of Technology (MIT) have demonstrated their usefulness to identify movement of geothermal fluids in the subsurface. The geophysical investigations concentrated on an area centering on Farm Estate, just to the south of Charlestown, the capital of Nevis, and the site of the most long-lived and consistently hottest of the surface thermal

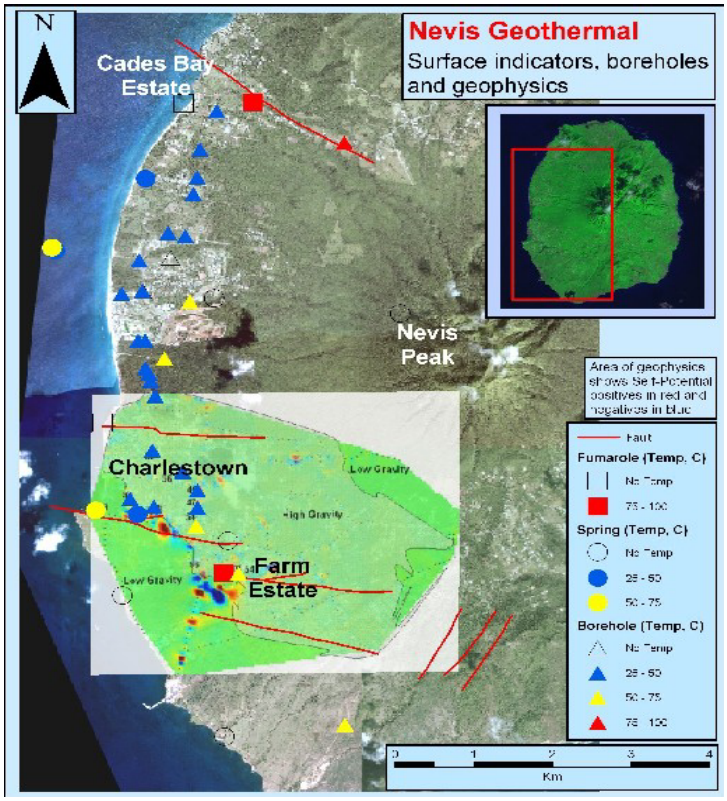
features on the island. The main conclusions of the geothermal exploration work undertaken to date are summarized as follows and in Map 3, below:

i. *Thermal features.* Nevis has a substantial surface heat anomaly which covers much of the western side of the island. Several lines of evidence suggest that there is a warm surface aquifer which is being heated via conduction and minor mixing by a substantial, deeper primary geothermal reservoir. The two are separated by an aquitard.

ii. *Farm and Cades Estate.* Leakage to the surface and leakage upward of the primary geothermal reservoir are both concentrated along zones of structural weakness, primarily located just south of Charlestown (Farm Estate/Bath Spring area) and further north at Cades Estate.

iii. *Offshore sites.* At all sites onshore, the primary geothermal fluids are mixed with water from the shallow warm aquifer and/or sea water or are not present at all. In all cases, the proportion of primary fluid is too small to enable meaningful modeling of the chemistry or geothermometric temperature of those fluids. However, several springs located offshore do appear to source from primary geothermal fluids. Although sampling was not particularly successful at these sites, an approximate geothermometric temperature of 170°C was obtained for a modeled primary fluid.

iv. *Geophysical data.* Geophysical data, supported by geology and geochemistry, successfully located zones of anomalous geothermal fluid flow at a resolution sufficiently fine to assist in siting of exploratory wells. The gravity data are consistent with a dense aquitard (likely comprising old lava flows) at a depth of ~200m and with a thickness of ~300m in an area adjacent to the Farm Estate/Bath Spring target zone.



MAP 3: NEVIS PDF-B RESOURCE LOCATIONS

Subcomponent Two: **Technical Capacity Building and Outreach**. *Support development of national technical capacity to improve marketability of local geothermal resources and oversight of commercial exploration and production projects. Develop national technical capacity relevant to geothermal exploration and production*.

18. *PDF-B Activities* (Technical Capacity Building and Outreach). *Identify and assess local technical capacity in each Project Country and initiate education and outreach activities to foster national appreciation of geothermal energy development and development of regional technical capacity.* The Project, with the assistance of Project Country officials, identified at least one government technical official to act as the lead Technical Officer (Geothermal) in each Project Country. That technical official then attended Project Mission meetings and worked with the TAT and subcontractors during exploration missions.

19. *PDF-B Findings* (Technical Capacity Building and Outreach). *During the PDF-B, the Project identified the following technical capacity barriers that may prevent private private-sector development of geothermal energy and developed the following solutions to overcoming these barriers in the Full Project stage:*

20. *Barrier:* In none of the Project Countries was there a level of technical expertise, either within or outside of the Government, sufficient to enable satisfactory oversight of geothermal exploration and production projects.

21. *PDF-B Intervention: Identify suitable technical personnel and initiate technical capacity development.* In conjunction with other areas of work within the Geo-Caraïbes Project, technical outreach and capacity building has been undertaken in PDF-B, setting the groundwork for the establishment, during the Full Project, of a Technical Officer (Geothermal) in each participating nation. The TAT identified suitable technical persons in each Project Country and these Technical Officers (Geothermal) identified in Table 2, below, took part in local and regional Project Missions. The Technical Officer (Geothermal) is envisioned to be the national focal point for all technical matters concerning exploration of resources, establishment of reserves, licensing and geo-scientific aspects of commercial development. In addition to enabling further formal and practical training for each identified individual, the Full Project will also foster development of a regional pool of expertise in geothermal energy and will promote the addition of geothermal education modules to regional curricula for most undergraduate levels.

TABLE 2: PROJECT COUNTRY TECHNICAL TEAM REPRESENTATIVES.

Project Country/Organization	***GTRO***	***Missions***
St. Kitts/Nevis	Rene Walters	Exploration Mission, Nevis
	Charles Harris	Exploration Mission, Nevis
St. Lucia	Judith Ephraim	Exploration Mission, Nevis
Dominica	Arlington James	Exploration Mission, Nevis
		Exploration Mission, Dominica
St Vincent (SRU)	Aisha Samuel	Exploration Mission, Nevis

22. *Proposed Full Project Intervention: Continue capacity building through formal and informal training of Geothermal Technical Resource Officers.* The Resource Officers in each Project Country will continue to be involved in technical aspects of all Project Missions and also with tasks assigned to the Technical Advisory Team. Formal training opportunities will be identified and placements made as appropriate.

23. *Barrier:* The lack of awareness of geothermal energy potential and the poor understanding of technical aspects of geothermal energy, combined with an inherent distrust of high cost technical development Projects, combine to form a major barrier to acceptance of geothermal development by the population of the region.

24. *PDF-B Intervention: Outreach activities accompanied all missions to the Project Countries.* In order to heighten awareness of the Project and the benefits of Geothermal Energy development, education and outreach activities were highlighted as an important aspect of reducing barriers to geothermal development. Educational packages were distributed to local schools. Both technical exploration missions were accompanied by written press releases and presentations and/or press briefings broadcast on national radio. Other Project missions were accompanied by written

press releases. The Project encouraged public access to Project members and Project Country officials during all missions to foster trust and develop understanding of geothermal development.

25. *Proposed Full Project Intervention: Develop detailed education and outreach strategies for each Project Country and for the region as a whole.* The Project will establish links with educational institutions and bodies in Project Countries from primary school to post-graduate level and, in partnership with those institutions and bodies, develop educational materials to support the development of increased knowledge of geothermal energy across the region. The Project will continue to develop outreach opportunities as part of in-country activities, including use of TV, radio and printed media as appropriate.

26. *Barrier*: The Project found a generally low level of in-country technical capacity, and a lack of regional capacity to develop technical expertise and heightened public awareness. However, the TAT did identify a strong desire amongst Project Country officials and the general public to learn more about and develop better technical capacity to deal with geothermal development.

27. *PDF-B intervention St. Lucia:* Previous geothermal exploration in St. Lucia has led to a heightened awareness of geothermal potential in general and geothermal resource exploitation in particular. This heightened awareness is especially developed in the sphere of public-sector decision makers and technocrats, and was most recently evidenced by the prominence of geothermal energy development in the country's sustainable energy plan and the associated outreach activities by the Prime Minister and others. Unfortunately, the time interval since activities took place as part of the previous development efforts (which ended in 1987) and the lack of commercial development following that previous effort has led to a decline in awareness of and support for geothermal development among the general population. There has also been no sustained effort to put in place educational mechanisms to foster awareness among those too young to remember the previous geothermal development projects. These factors all lead to a lack of technical capacity to effectively manage a sustained commercial geothermal exploration and development program and a low level of awareness among the general population of the environmental and economic benefits of developing geothermal energy on St. Lucia.

28. *PDF-B intervention Dominica:* Awareness of geothermal energy potential is present in Dominica, but only at a low level, and it is tinged with considerable concern. Three particular concerns were identified: a skepticism regarding the viability of renewable energy Projects following the disappointing results from a major hydro-electric power generation Project; concern regarding the potential impact of geothermal and related development in environmentally sensitive areas also rich in tourist potential; and deep-felt fears of geothermal development triggering volcanic activity. Dominica's small size and lack of job opportunities in technical areas means that there is a very limited pool of technical expertise relevant to geothermal development. The major exploration mission in Dominica, along with other Project

missions during PDF-B, was accompanied by press releases to the print media and live or recorded TV and radio broadcasts. The OAS office in Dominica has also played a significant role over the past several years in raising awareness of geothermal energy potential, especially amongst senior decision-makers in the public sector. Public support for geothermal is also bolstered by the high and increasing cost of electricity in Dominica, which is clearly associated with high world oil prices in the eyes of the general public.

29. *PDF-B intervention St. Kitts & Nevis:* Awareness of geothermal energy potential in St. Kitts & Nevis was generally low, except in a limited sphere of decision-makers in the Nevis Island Authority, who had previously been approached by a private developer. Also, the small size of the two islands has led to a lack of technical capacity relevant to geothermal development. Both of these issues were addressed within the PDF-B work program, especially during the exploration mission in Nevis, when several press releases were issued and a "town hall meeting" (which was also broadcast live on national radio) was held. Development of technical capacity within St. Kitts & Nevis was initiated with exposure of several officials within the Nevis Island Administration to geothermal exploration techniques; and has began a geothermal familiarization process with candidates who may be nominated to be the St. Kitts & Nevis Technical Officer (Geothermal). In general, public support for geothermal development in Nevis appears solid, with existing knowledge of the thermal features at The Baths and of the warm aquifer underlying Charlestown making awareness of "hot water" high. The high cost of electricity, the identification of the need for more power in Nevis (especially for desalination) and the potential to sell electricity to St. Kitts all lead to a positive feeling towards geothermal development.

30. *PDF-B Intervention Regional*: During the various missions in the region and through other Project contacts, some evaluation of regional technical capacity for geothermal development was made. It was found that regional educational institutions, most notably the University of the West Indies, has very limited capacity for the development of graduate level technical expertise in geothermal energy exploration and production. One autonomous unit within the UWI system, the Seismic Research Unit based in Trinidad, does have expertise in important aspects of geothermal exploration, and were utilised as a sub-contractor during the exploration mission in Nevis. During the PDF-B, the Project also initiated contact with other UWI Departments related both to technical and educational collaboration during the Full Project.

Subcomponent Three: **Environmental Stewardship**. *Ensure that geothermal development is undertaken in an environmentally sensitive way, to ensure maximum benefits of a long-term, sustainable indigenous energy source allied with a reduction in the local, regional and global environmental impacts of energy production and consumption.*

31. PDF-B Activities (Environmental Stewardship). Assess institutional and technical capacity to monitor and manage environmental impacts of geothermal development.

32. PDF-B Findings (Environmental Stewardship). During the PDF-B, the Project identified national capacity relevant to monitoring and management of environmental aspects of geothermal development and the relevant stakeholders in environmental aspects of geothermal development and assessed current baseline datasets. In addition, the Project identified the following technical capacity barriers that may prevent private private-sector development of geothermal energy and developed the following solutions to overcoming these barriers in the Full Project stage:

33. *Barrier:* Each of the Project Countries lack baseline environmental information relevant to the monitoring of geothermal development and lack of knowledge regarding the environmental impacts and benefits of geothermal, although each of the Project Countries has some level of environmental expertise and an institutional framework for monitoring and management of the environment.

34. *PDF-B Intervention: Identify stakeholders and begin development of frameworks for baseline environmental data collection.* The Project held an environmental stakeholder consultation meeting in Nevis during the exploration mission and began the process of identifying stakeholders and baseline datasets in the other Project Countries.

35. *Proposed Full Project Intervention: Strengthen institutional capacity and baseline environmental monitoring for geothermal development. Facilitate stakeholder capacity building nationally and regionally to enable effective environmental stewardship throughout the geothermal development process.* The Project has identified Stakeholders in each Project Country and will continue to develop institutional systems and environmental monitoring operations in order to establish a baseline of environmental data which can be used to monitor environmental impacts of geothermal exploration and production. As commercial opportunities develop, the Project will continue to assist Project Countries in monitoring and management of environmental impacts to ensure regulatory compliance.

36. *Barrier:* Although the Project found abundant institutional experience in environment and climate-change related issues, but little capacity to operate monitoring systems and a low level of knowledge regarding specific environmental issues relating to geothermal development. *In particular:*

37. *Barrier St. Lucia:* Geothermal energy production and the World Heritage Site will need to co-exist. One particular issue identified in St. Lucia is the juxtaposition of the main geothermal resource area and the newly designated Pitons World Heritage Site. Geothermal development within the designated area, which is also a major tourism site, must be undertaken within strict environmental guidelines. At present, there is little baseline data against which to identify environmental impacts, and there is concern amongst both the general public and government officials about the co-existence of geothermal energy production and the World Heritage Site.

38. *Barrier Dominica:* Geothermal energy production and the Trois Pitons World Heritage Site will need to co-exist. Environmental monitoring capacity is generally poor. Environmental stewardship is a major concern to all in Dominica, with tourism and agriculture both hugely reliant on the continued protection and preservation of the environment. The primary geothermal resource area is close to the Trois Pitons World Heritage Site and is in an area of outstanding natural beauty and tourism activities.

39. *Barrier Dominica:* Environmental monitoring capacity is generally poor. Environmental monitoring capacity is generally poor in Dominica, although there is some institutional experience in monitoring operations and the identified Technical Officer (Geothermal), Arlington James, has been the leading official in previous environmental monitoring projects.

40. *Barrier St. Kitts & Nevis:* There is a lack of relevant baseline data and little public-sector capacity to monitor and manage environmental impacts. The stakeholder meeting held in Nevis revealed a high level of interest in environmental aspects of geothermal development, but also identified a lack of relevant baseline data and little public-sector capacity to monitor and manage environmental impacts. Private sector groups, however, were identified as having the capacity to assist the Government in environmental monitoring. The nature of Nevis' tourism product and the small size of the island combine to ensure a high level of appreciation of environmental stewardship as critical to successful geothermal development.

Subcomponent Four: **Establish the Technical Feasibility for Inter-island Electricity Connections.** *In order to maximize the economies of scale for geothermal power production in the Project Countries through replication to neighboring islands, establish the technical feasibility for inter-island electricity connections.*

41. *PDF-B Activities (Technical Feasibility for Inter-Island Transmission).* Assess the institutional, technical and financial issues associated with the development and operation of an inter-island electricity transmission line between one or more Project Countries and the French Antilles, Guadeloupe and Martinique. [Note: the French Government through AfD provided funding for the Inter-Island Transmission studies. No GEF funds were utilized in the execution of this PDF-B Subcomponent].

42. *PDF-B Findings (Technical Feasibility for Inter-island Electricity Connections).* During the PDF-B the Project ascertained the demand for electricity for Guadeloupe and Martinique; gauged the likely interest of the electric utility – EDF – to purchase electricity via imported geothermal power; and identified the following technical capacity barriers that may prevent private-sector development of geothermal energy and developed the following solutions to overcoming these barriers in the Full Project stage:

43. *Barrier:* The development of a geothermal power plant(s) for the export of electricity to the French Antilles and laying of an inter-island electricity transmission line, will require a long-term commitment from the purchasing utility (EDF) and would be unlikely in the event that increased demand for power on the islands was not adequate.

44. *PDF-B Intervention:* The inter-island electricity transmission study team (AETS Energy and Infrastructure) conducted an electricity demand study, with the assistance of Project Country government and electric utility officials, and relevant stakeholders in the French Antilles

45. *Proposed Full Project Intervention:* Execute detailed electricity demand analysis and supply Projections for inter-island electricity trade. Further, secure expression of interest from EDF for its participation in the Project.

46. *PDF-B Findings* (Technical Feasibility for Inter-island Electricity Connections). *The Project found, based on its preliminary analysis, that the proposed inter-island connection Project appears to be technically feasible, the study having revealed no major technical obstacle.* The following conclusions and recommendations pertain:

    (a) *Export Load.* Considering the requirement of network stability and the greater capacity of power generators in Guadeloupe and Martinique, the Project Consultant has recommended a maximum export load of 40 MW for each of the two islands.

    (b) *AC/DC recommendations.* For this power range, and considering interconnection distances, the Project consultant has recommended an AC inter-island connection of 63 or 90 kV. The DC inter-island connection hypothesis was discarded due to cost factors. It should be noted that because of the distance between islands, direct energy exchange between Martinique and Guadeloupe will not be possible, thus excluding any benefits in terms of integrated network management.

    (c) *Routes.* Possible routes for the interconnection have been identified, taking into account geographic and environmental constraints. Map 4, below, illustrates the possible interconnections.

(d) *Dominica-Guadeloupe cost.* The Dominica-Guadeloupe link runs 99 km long, including 43 km of aerial landlines in Dominica and 56 km of underwater cable at a maximum depth of 700 m, with a land hook-up to the Guadeloupean network close to the Capesterre station. Estimated cost: 30 Million Euros.

(e) *Dominica-Martinique costs.* The Dominica-Martinique link runs 90 km long, including 18 km of aerial landlines in Dominica and 72 km of underwater cable at a maximum depth of 1000 m, with a land hook-up to the Martinican network close to the Marigot station. Estimated cost: 30 Million Euros.

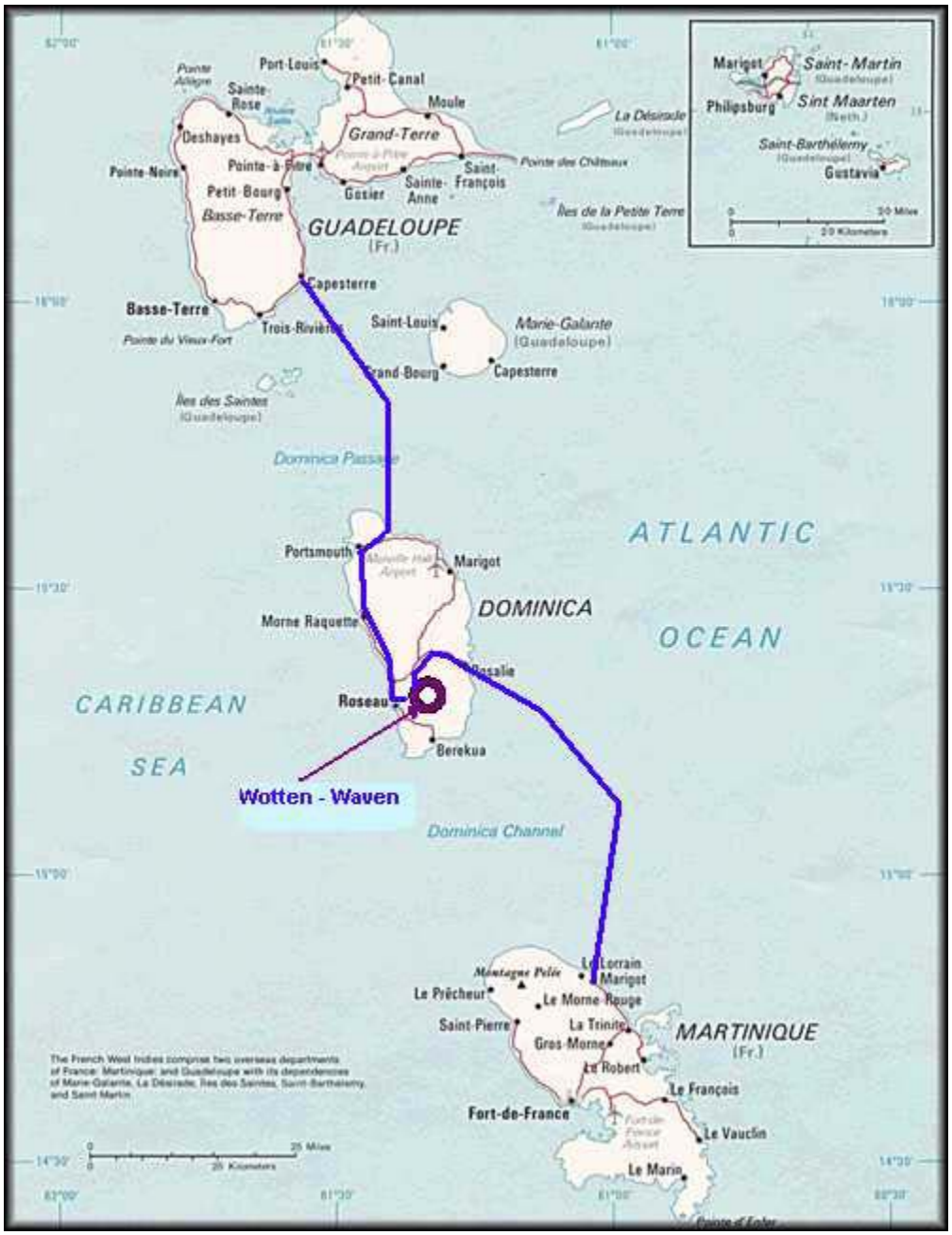
47. *Project Findings (Technical Feasibility for Inter-island Electricity Connections).* The Project found that the projected demand for power in the French Antilles is significant and would warrant electricity imports if the price of power is appropriate and the reliability of its supply is high. Subject to the ongoing process of investments planning under the responsibility of the French Ministry of Industry (PPI – Programmation pluriannuelle des investissements), the increase in power requirements together with the possible declassification of some aging oil power plants provides ample justification for new production tools in these three islands. The following figures seem realistic:

    i. for Guadeloupe and Martinique, the need for new production units in short – medium term (2010 – 2015) could reach 40 to 80 MW, and the aging oil power plants that need to be replaced represent more than 100 MW of power on each island; and

    ii. for Dominica, 5 MW must be provided by 2010, in order to replace the small oil units with high production costs.

48. The scale of these requirements and the relative lack of alternatives for local power providers speak in favor of the geothermal Project and its integration into the power production toolbox of the three islands. It is complementary to existing production units and provides system stability thanks to the diversification of power sources.

MAP 4: POSSIBLE ELECTRICITY TRANSMISSION INTER-CONNECTIONS.



Component Two: Reforming the Energy-Sector Framework.

49. *Overcome existing institutional and policy barriers that discourage private-sector development.* The three Geo-Caraïbes Project Countries have requested assistance in creating conditions that spur private-sector investment in geothermal power development. Drawing on experience with multiple private-sector investors, developers and lending institutions, during the PDF-B the Project determined that legal predictability and stability – meaning a stable political environment, a reliable legal framework, an effective regulatory environment, and clear and reliable take-off rules stipulated in Power Purchase/Sales Agreements ("PPAs") – are prerequisite to private-sector investment in geothermal development and share equal weight with resource availability, finance, and market accessibility. The barriers to legal predictability and stability that were identified during the PDF-B are discussed in the following sections.

50. *Ensure sustainability.* The Project Countries, mindful that the sustainability of geothermal resource development in the region is dependent on the appropriate structuring of their executive and regulatory institutions, have requested assistance in building their institutional framework. Sustainability is further ensured if the stakeholders – the utilities, the private-sector opinion makers and prospective developers – share common goals with the Project governments. Moreover, long-term sustainability requires education and training of both a technical and a regulatory cadre in the Project Countries. During the PDF-B, the Project laid the groundwork for sustainability in the institutional, stakeholder and educational areas.

51. *Strengthen on-going capacity of regional and national policy and legal bodies established to implement Full Project Energy-Sector reforms.* Stakeholder participation and consultation is a fundamental principle of the Geo-Caraïbes Project. The operating strategy of the PDF-B, as well of as of the Full Project, is to integrate key stakeholders in the decision-making process. Consistent with the Project objective of capacity building in each of the Geo-Caraïbes countries, the Project established, and or worked with three geothermal advisory groups:

    (1) Regional Geothermal Advisory Task Force;
    (2) Policy and Legal Team; and
    (3) Project Country Geothermal Consultative Groups, one in each of the three Project Countries.

52. The interface between the Policy and Legal Team and the Project Country decision-makers from the outset of the PDF-B ensured engagement of a broad spectrum of stakeholders at each pivotal decision point, thereby helping ensure that barriers were recognized by the Project Country policymakers at the outset; that the solutions selected from various alternatives were crafted by competent legal draftsmen, guided by the region's policymakers; and that the detailed process built each country's knowledge base.

53. *Establish achievable interventions.* With sustainability, capacity building, legal predictability and stability as their charter, the Policy and Legal Team analyzed the barriers that the Full Project can overcome by policy reform and/or by providing additional capacity. During this process, the Team undertook to balance the private-sector investment prerequisites of private-sector investors and developers vis-à-vis the public responsibilities of the Project Countries, and to temper capacity-building *possibilities* with a realistic assessment of the *desirability* of interventions that the Project can/should appropriately influence on island nations.

54. *Ensure Replicability.* By addressing the barriers that thus far have prevented geothermal production in the Geo-Caraïbes area, first on a regional basis, and then tailoring solutions on a country-specific basis, the Full Project has initiated the process of transfer and replication of successful experiences. This process will continue in the Full Project stage.

55. *Identify Energy-Sector Framework reform subcomponents.* The Project can achieve the Full Project energy-sector framework objective and enable the Project Countries to meet the conditions precedent to legal predictability and sustainability by undertaking interventions in four areas. These Project interventions are discussed, below, as four subcomponents of Energy-Sector Framework reform under the headings of:

- *Subcomponent One:* Policy Reforms;
- *Subcomponent Two:* Institution Building;
- *Subcomponent Three:* Capacity Building; and
- *Subcomponent Four:* Legislative and Regulatory Counsel.

Subcomponent One: **Policy Reforms**. *Identify policy barriers that may prevent private-sector development of geothermal energy and create politically acceptable solutions to overcoming these barriers in the Full Project stage.*

56. *PDF-B Activities* (Policy Reforms*). Establish the viability of the current legal regimes in the region to promote and govern geothermal development*. The Policy and Legal Team proceeded with the threshold objective of determining whether the current legal regimes can viably promote and regulate commercial development of the region's geothermal resources. The Team identified and analyzed the published legislation from the three Project Countries and worldwide legislation from sovereign jurisdictions that promote private-sector development of geothermal power. The Team also undertook a series of fact-finding missions to the three Project Countries during the winter and spring of 2004 to ensure that its members had a clear understanding of the objectives and goals of the public and private stakeholders in each of the three Project Countries.

57. *PDF-B Findings* (Policy Reforms). *During the PDF-B, the Project identified the following policy barriers that may prevent private-sector development of geothermal*

energy and developed the following politically acceptable solutions to overcoming these barriers in the Full Project stage:

58. *Barrier:* The Project Countries shared no common vision that would form the basis of a concerted regional approach that would enjoy a high probability of success in geothermal resource development. The Policy and Legal Team concluded that, although the governments of each of the Project Countries had articulated a clear desire to develop their geothermal resources, it would first be necessary for them to reach a common regional goal in order for the Project to proceed.

59. *PDF-B Intervention: Assist the region's policy-makers (i) in developing, articulating and establishing a shared goal with respect to geothermal resources development, and (ii) in crafting a regional policy declaration to guide policy reform.* Following the series of preparatory, fact-finding country missions, the Policy and Legal Team met during the April 2004 Project Launch Meeting in Guadeloupe, to work with the Regional Geothermal Advisory Council to develop a shared vision that could be expressed as unified, regional goal. Representatives from the Guadeloupe and Martinique Departments – themselves important stakeholders – also participated, thus broadening the regional perspective. The regional policy declaration forms the heart of model legislation addressing geothermal development. For example, as formulated for the Commonwealth of Dominica in the Draft Geothermal Resources Development Bill, the declaration reads:

> "It is hereby declared that all the Geothermal Resources in, or under any Land of whatsoever ownership or tenure are vested in and are subject to the control of the State. It is the duty of the State to promote the exploration for, and development of, its Geothermal Resources in such a manner as to assure the supply of energy necessary for the economic growth and general welfare of the people of the Commonwealth of Dominica and to decrease the dependency of the Commonwealth of Dominica on non-renewable resources. It is hereby declared to be in the public interest to foster, encourage and promote the discovery, development, production and disposal of Geothermal Resources in the Commonwealth of Dominica in such manner as will safeguard the natural environment and the public welfare and at the same time will encourage private enterprise to provide the necessary services, financing and technology." *Article 2, section (1), Geothermal Resources Bill, CoD (2005).*

60. *Proposed Full Project Intervention: Re-evaluate and refine starting goal.* As recognized from inception, any goal or policy declaration needs to be re-visited and refined in context of new information as well as evolving socio-economic realities. The Full Project will continue to course-correct in consultation with the Country Geothermal Consultative Groups and with the leadership of governments of the Project Countries.

61. *Barrier:* Independent Power Producers ("IPPs") lack legal authority to generate electricity. Project Country laws establish a monopoly for electricity generation to the grid. This generation monopoly will have to be altered to encompass the geothermal IPP niche, unless and until the economics of these nations allow Build-Own-Operate ("BOT") projects to be considered.

62. *PDF-B Intervention: Coordinate with World Bank consultants drafting reform of electricity sector legislation in the Commonwealth of Dominica.* In conjunction with consultants who have been retained by the World Bank to work with Dominica to reform the Commonwealth's electricity act, the Project reviewed the proposed geothermal resource development-sector proposals in context of proposed electricity-sector reforms to the Dominican legislation.

63. *Proposed Full Project Intervention: Reconcile new electricity act in the Commonwealth of Dominica with the proposed geothermal resource development legislation.*

64. *Barrier:* Historically, regional utilities have resisted long-term purchases of IPP electricity. In Dominica and St. Lucia, electricity generation, transmission, and distribution are in the hands of private sector monopolies. Given the exclusive rights owned by these companies (DOMLEC and LUCELEC), it will be necessary to establish a sound legal arrangement that enables the development and implementation of the strategy outlined by this Project. DOMLEC and LUCELEC have historically opposed dealing with IPPs. The regional utilities – the government-run utilities of St. Kitts & Nevis as well as DOMLEC and LUCELEC – have expressed concern about the predictability of when geothermal resources will come on line. Moreover, the utilities are under pressure to predict and buy adequate generation capacity years in advance. In order for the Project replication component – generation for export and transmission to the French Antilles – the French utilities will also need to be engaged during the Full Project if undersea transmission proves feasible. EDF officials have underscored that energy-security issues are inherent when transmission of electricity between the island nations is at issue.

65. *PDF-B Intervention: Consult with the utilities to determine the conditions precedent that need to be in place for them to revise their IPP policies*. After multiple sessions with the utilities, in particular DOMLEC and LUCELEC, the utilities indicated their receptivity to carving out a niche for electricity produced by IPPs from geothermal resources.

66. *Proposed Full Project Intervention: Establish the authority for IPPs to generate electricity*.

67. *Barrier:* The utilities and the Project governments have no effective mechanisms to enable geothermal power sales.

68. *PDF-B Intervention: DOMLEC & LUCELEC consultations*. Since there is more than a shade of difference among the government-owned utilities, government-regulated utilities and private utilities that populate the Eastern Caribbean, the Project determined that if the Project objective is to be achieved, all of these utility forms must be receptive to entering into power purchase/power sales agreement with an independent power producer. In anticipation of working with those regional utilities that are the potential buyers of geothermal power production, with the goal of developing a regional PPA during the Full Project Phase, the Team met with each of the utilities during the PDF-B, briefed them on each occasion of a country visit, and included them as active participants in all stakeholder meetings. After a series of meetings between the Policy and Legal Team and DOMLEC and LUCELEC, these utilities requested a regional meeting (with relevant members of the Team and the Regional Geothermal Advisory Group participating) to craft a model PPA.

69. *Proposed Full Project Intervention: Streamline and standardize the legal and regulatory procedures for PPAs between a utility and private, geothermal power producers.* As noted above, Project success depends on the receptivity of the Geo-Caraïbes utilities to entering into PPAs with independent power producers, and on whether these PPAs have clear and reliable take-off rules. Model contracts minimize costly delays and complications in contract negotiations. During the Full Project, however, the Project will have to resolve the open question of whether a model PPA should be government-issued, or left up exclusively to negotiations between each purchasing utility and the private-sector developers. The Project anticipate convening the utilities that service the three Eastern Caribbean countries, plus inviting representatives of the French utilities, to work toward developing a regional PPA during the Full Project Phase. During the Full Project, the Policy and Legal Team will continue to refine its understanding of the legal and business conditions precedent in each country that will enable and encourage each utility to enter into such a PPA.

70. *Subcomponent Two:* Institution Building. Identify *institutional barriers that may prevent private-sector development of geothermal energy and create politically acceptable solutions to overcoming these barriers in the Full Project stage.*

71. *PDF-B Activities* (Institution Building). *Establish the viability of the current legal regimes in the region to promote and govern geothermal development.*

72. *Research, collect, and review existing regional legislative and regulatory documentation and underlying structures.* As background for institution-building analysis, the Policy and Legal Team compiled the legislation and regulations that impact the development of geothermal power for each of the Project Countries in the region. The Team then undertook a detailed review of 100-plus Project Country laws that address aspects of natural resource development in the context of private-sector development of those resources for the production of electricity. This compilation of relevant legal materials is a unique collection that may be utilized by commercial Project developers in their review of market conditions. (Compilation of Laws

Relating to Geothermal Resource Development in the Geo-Caraïbes Countries is currently held by the Project Management Team at the OAS.)

73. *Compare the resource development strategies that are proposed to be established in the region with successful geothermal-resource development policies that have been implemented elsewhere in the world*. As follow-on to the legal review of the legislation of the Geo-Caraïbes countries, the Policy and Legal Team identified and analyzed the published legislation from more than 70 other sovereign jurisdictions that promote private-sector development of geothermal power. The policy declaration and goals established by the regional policy makers served as the touchstones used to gauge the need for legal reform. The Team then compared regional policies with the policies that have been established by countries that have successfully developed geothermal resources in order to establish precedent for regional policy and legal reform options.

74. *Develop a regional geothermal resources law based on the unified, regional goal*. At the April 2004 Project Launch Meeting, the Regional Geothermal Advisory Group, comprising representatives from the governments and utilities of the three Project Countries, developed the modus operandi for the formulation of policies. The Group concluded that a regional approach to establishing an energy-sector framework – encapsulated in regional legislation and regulation – had been successfully achieved in the Geo-Caraïbes area in recent years (*e.g.*, in the telecommunications sector), and that a regional approach would encourage more predictable judicial interpretation as well as enable the marshalling of technical and regulatory assets on a regional basis.

75. *PDF-B Findings* (Institution Building). *During the PDF-B, the Project identified the following institutional barriers that may prevent private-sector development of geothermal energy and developed the following politically acceptable solutions to overcoming these barriers in the Full Project stage.*

76. *Barrier: The legal framework is inadequate for successful geothermal development.* The Project Countries have no ready mechanism for memorializing regional policy reform consensus. The Project observed that no on-going regional mechanism exists for vetting identified policy barriers, evaluating the merits of alternative policy reforms, and memorializing regional agreement on the preferred reforms. Since most of the world's countries that have successfully developed geothermal resources commercially, have enacted discrete geothermal resource development legislation, the Policy and Legal Team determined that a focused regional law could serve as an appropriate vehicle for organizing and memorializing policy reform decisions in a holistic context, and, when enacted, could implement those policy reforms in a single stroke. The alternative – tinkering individually with scores of laws already on the books – could prove a time-consuming, if not insurmountable, task. Furthermore, the Team concluded that, were the Project Countries to rely on the common law system in Dominica and St. Kitts & Nevis or the code/common law system in place in St. Lucia, resolution of geothermal resource issues would not be predictable. In St. Kitts & Nevis, for one example, mineral laws are administered federally; water laws are

administered separately by each island administration. The legal definition of "geothermal resources" determines jurisdictional power over the resource. Consequently, it is important to be able to predict whether "geothermal resources" would be treated, in local jurisprudence, as "minerals" or as "water". Importantly, international precedent indicates that geothermal resources have not been successfully developed by the private sector under existing water, hydrocarbon or mining laws, nor even under laws specific to geothermal development, if those laws are not development friendly. Moreover, the region lacks a consistent policy approach in the laws relating to investment in the resource sector. As a result, the Project Countries may be less competitive for scarce investment dollars than other areas within the hemisphere that have geothermal potential and that are also vying for private-sector investments.

77. *PDF-B Intervention: The Project proceeded to develop a comprehensive regional Geothermal Resources Development Bill, and then adapt that regional bill for each participating country.* The Policy and Legal Team determined to pursue development of a discrete law that directly dealt with the unique qualities of geothermal resources in a privately funded development climate. In crafting this geothermal legal regime, the Team proceeded to identify existing barriers to managing the resources, promoting development, providing for power sales/purchase, ensuring transmission, and ensuring environmental integrity, and then crafted optional legislative tools designed both to provide legal predictability and executive branch governance and regulatory capacity. The Team, determined to adopt the prevailing international approach, i.e., defining "geothermal resources" in a sui generis manner – meaning treating geothermal resources, as a resource unique in itself. Consequently, in the Full Project, jurisdiction over the resource will be determined by a deliberative policy decision. Drawing on the precedents established in legislation elsewhere in the world, the Team set forth the baseline undertakings that most of the competitive, pro-private-sector geothermal development legal regimes have followed. During this process, the Project began initial investigations of the receptivity of the region's finance ministries to carving out incentives for geothermal resource investment that will make the area more competitive in terms of tax treatment and judicial stability. In July 2004, after legal review of the body of individual country laws and related country-level policy discussions, the Team drafted a regional Geothermal Resources Development Bill. After individual country, internal discussions, the Team re-crafted the regional draft legislation into each country's preferred format and incorporated country-specific policy options. The Team then presented the draft bills to the Country Geothermal Consultative Groups (St. Lucia November, 2004, St. Kitts & Nevis, March 2005). In the interval between the PDF-B and the Full Project, the draft Geothermal Resources Development Bill is undergoing public review in all three Project Countries. The draft bill for each country will continue to be modified, as stakeholder input is collected.

78. *Proposed Full Project Intervention: Provide regulations.* The Geothermal Resources Development Bill contemplates the establishment of a detailed regulatory regime. This regulatory regime will be based on the final draft of the geothermal

resources development legislation. It will be written and put into effect during the Full Project.

79. *Proposed Full Project Intervention: Identify and overcome any legal transmission hurdles.* It is critical that when generation is available that transmission facilities be ready for use. Land transmission may be governed by a transmission line agreement. Undersea cables between the Project Countries and the French islands may be governed by bi-lateral international agreements.

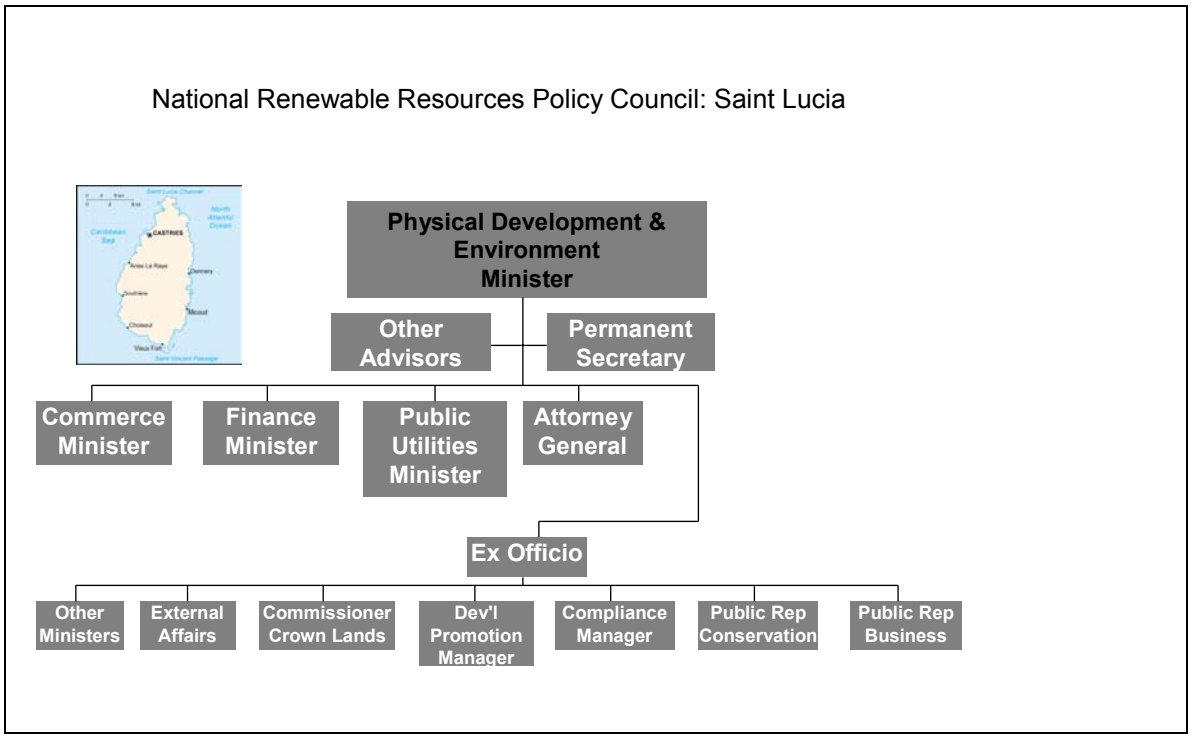
80. *Proposed Full Project Intervention: Design and implement legislation instituting competitive advantages.* These initiatives include, but are not limited to, providing for a grandfathered tax regime, granting express freedom from expropriation, creating conditions for remittance of interest, principal and earnings, and addressing tax incentives in the developmental stages of geothermal development.

81. *Barrier:* Institutional organizations are inadequate for managing resources. The Project Countries have neither personnel with the capacity to undertake the requisite analyses of development proposals, nor a mechanism to mobilize the responsible administration for quick response, nor guidelines requisite for geothermal resource development. The governments in power at the time of a geothermal development opportunity have historically and consistently taken an *ad hoc* approach to new development – embodying relationships in contracts that have invariably been prepared by promoters with minimal government input. Consequently, successor governments have had little access to institutional memory, less ability to monitor a developer's progress, and almost no stake in assuring the long-term success of a previous government's initiatives.

82. *PDF-B Intervention: Determine capacity to govern a geothermal regulatory regime.* In consultation with the Regional Geothermal Advisory Group, the Project determined that the existing institutions in the region do not have the depth or breadth of capacity to formulate informed judgments about geothermal resource development. The Project Countries have limited personnel resources. No one, either from the Project Management, or from the Project Countries themselves could see any advantage to institutionalizing a standing regulatory body in this context; however, both the St. Lucia and the Dominica Project Country Consultative Groups determined that there was great utility in designing a standing policy body that has the institutional capability to advise executive decision-makers at the Cabinet level. Both of these Project Country Groups concluded that by broadening the mandates of such an advisory body from geothermal resources to all the renewable energies, the institutionalization of a multi-task national renewable resources policy council would be justified. St. Kitts & Nevis, in contrast, determined that an institutionalized natural resources advisory council, would be beyond the human resource capacity of their country, and elected to institute a more *ad hoc* advisory council, limited to geothermal development. See Table 3 (St. Lucia NRRPC) for an example Council make-up.

83. *Proposed Full Project Intervention: Correlate institutional reform in conjunction with the evolution of the Geothermal Resources Development legislation and the promulgation of regulations.* As the draft Geothermal Resource Development Bill for each country will continue to be modified, as stakeholder input is collected, so will the institutional framework.

TABLE 3: ST. LUCIA NRRP COUNCIL



84. *Barrier*: The current legal and institutional framework is inadequate to create the conditions for successful commercial geothermal power plants, since Project Country governments lack mechanisms either for promoting commercial-sector development or for selecting from among commercial developers. Past experience indicates that no effective mechanism is in place for a developer to use, other than going directly to a Prime Minister.

85. *PDF-B Intervention: Determine how to restructure existing government departments to govern geothermal development.* In consultation with the Regional Geothermal Advisory Groups, the Project determined the need for mechanisms and capacity to promote geothermal development, to negotiate concessions, and to issue requests for proposals.

86. *Proposed Full Project Intervention: Design and institute a critical path for private-sector entry into each country's geothermal development market.* The Full Project will institutionalize a "one-stop shop" designed to facilitate the entry of geothermal resource developers; establish a critical path for negotiated licenses (with due

diligence criteria); and establish a critical path for public bidding (with mechanisms for qualifying prospective developers).

87. *Proposed Full Project Intervention: Design and institute, within an existing ministry, mechanisms allowing the potentially conflicting goals of geothermal development promotion and geothermal resources compliance to co-function transparently without creating an inherent conflict of interest.*

88. *Barrier:* The region lacks the institutional capacity to regulate the technical aspects of geothermal development, including safety and environmental impact mitigation.

89. *PDF-B Intervention: Determine how to provide a meaningful regulatory structure.* Acknowledging that the region has limited human capacity resources, the Project determined that necessity dictated balancing governmental regulation and private-sector self-regulation. In conjunction with the Regional Geothermal Advisory Group, the Policy and Legal Team determined to identify the public interest being fostered or protected and then to identify the concomitant tools available to accomplish the regulatory task with the least disruption to the market and the least cost to the public. The Team concluded that regional regulatory bodies should avoid micro-management and focus on safety and the environment. By requiring private-sector bonding and other significant consequences for non-compliance, safety and environmental regulation could approach self-regulation. By providing guideline documents and training to inspectors, and by limiting them to a reactive – as distinguished from proactive – role, the Project Countries could initiate an affordable and workable regulatory system that could be expanded into a more robust proactive regulatory role as the growth of geothermal development so mandates.

90. *Proposed Full Project Intervention: Identify and draft the requisite field rules, model contracts, and schedules.* Assist the governments in developing relationships with qualified bonding companies.

91. *Proposed Full Project Intervention: Establish the means for restructuring a schedule of fees, royalties and taxes that balance the government's interest in receiving a return with enabling the development of the resource.* Establish a schedule structure that balances the government's interest in charging fees sufficient to cover government's administrative and inspection cost in issuing permits, licenses, concessions and regulating for the public welfare, with enabling Projects to succeed. Establish a royalty structure that balances the government's interest in assuring that resources belonging to the State return their value to the State, with the government's interest in facilitating private-sector development with its front-end-loaded financing. Establish a tax structure that balances the taxes due by a corporate citizen receiving State services, with "greenfield" tax incentives developed by other sovereign States in an effort to promote private-sector investment in geothermal resources.

92. *Barrier:* No due diligence mechanisms in place. None of the Project Countries have mechanisms in place that adequately provide due diligence guidance for testing either

the economic viability or the technical capacity of a prospective developer. The issue of due diligence mechanisms arose in all three countries during the PDF-B.

93. *PDF-B Intervention: Provided advice and counsel to Project Country governments.* At the request of the Crown Counsel of St. Lucia, the Project provided an overview of due diligence guidelines. Further, the Project provided the Commonwealth of Dominica and St. Kitts & Nevis a similar overview of due diligence measures and an analysis of the legal requirements for due diligence pursuant to current legislation.

94. *Subcomponent Three:* Capacity Building. *Identify* capacity barriers *that may prevent private-sector development of geothermal energy and create politically acceptable solutions to overcoming these barriers in the Full Project stage.*

95. *PDF-B Activities* (Capacity Building). *Lay the groundwork for stakeholder incorporation in the Full Project decisional processes.* During the PDF-B, the Project undertook a series of fact-finding missions to the Project Countries to identify and meet with stakeholders. As further discussed below, in any independent power Project there will be five major stakeholders:

    (1) the government,
    (2) the buying institution (usually a utility in a base power situation),
    (3) the selling institution (the developer – usually a coalition of private companies),
    (4) the opinion makers, and
    (5) the lending institutions.

96. *Develop mechanisms for shareholder incorporation during PDF-B.* As indicated above, and consistent with the Project objective of capacity building in each of the Geo-Caraïbes countries, the Project established three policy groups: (i) a Regional Policy Group, (ii) a Policy and Legal Team, and (iii) three Project Country Geothermal Consultative Groups, one in each of the three Project Countries.

97. *Utilize PDF-B stakeholder mechanisms for Full Project initiatives*. Through these three PDF-B entities, the Project engaged a broad spectrum of stakeholders at each pivotal decision point, thereby (i) integrating key stakeholders in the decision-making process at the outset, (ii) providing them with genuine opportunities to influence the execution of the Project from inception to completion, and (iii) ensuring stakeholder "ownership" of the Project and its related activities. Concomitantly, stakeholder input has provided Project Management with immediate and useful feedback, plus a greater degree of certainty that the new Full Project initiatives and reforms will be able to be put into place without creating unnecessary friction within the existing institutional framework.

98. *Establish public awareness of the benefits of sustainable geothermal energy, overcome misinformation, and lay the groundwork for a public outreach plan.* During the PDF-B, the Project initiated public outreach through media interviews,

including television, radio and print media, on both a regional as well as on an international basis. Radio talk shows, in particular, were determined to have an important role in promoting public discussion in the Project Countries.

99. *Lay the groundwork for establishing a trained cadre of Project Country professionals*. During the PDF-B, the Project undertook a multidisciplinary educational approach in briefing the Regional Geothermal Advisory Council and the Country Geothermal Consultative Groups – utilizing the PDF-B consultant experts to introduce the scientific, commercial, policy and legal aspects of geothermal resources development and reinforcing lecture presentations with field trips. During the PDF-B, both the Policy and Legal Team and the Technical Advisory Team met and had discussions with those professionals within the Project Countries who were the prime candidates to assume leadership of the governance and regulation of geothermal resources development – including government officials, attorneys, engineers, and renewable resource experts.

100. *PDF-B Findings* (Capacity Building). *During the PDF-B, the Project identified the following capacity barriers that may prevent private-sector development of geothermal energy and developed the following politically acceptable solutions to overcoming these barriers in the Full Project stage:*

101. *Barrier:* The Project Country governments lack mechanisms for promoting commercial-sector development.

102. *Proposed Full Project Intervention: Obtain input on proposed legislation and regulations from the international private-sector developer community.* During the Full Project Phase, the Policy and Legal Team will test the proposed laws and regulations within the private-sector investment/development community – particularly through national and international geothermal associations – with the objective of identifying and addressing actual or perceived impediments before putting the draft legal regime into the final legislative stages. Incorporating private-sector input prior to enactment of legislation also serves the function of dissemination of the opportunity and should encourage a wider-spread knowledge of the opportunity and the concomitant interest in undertaking development.

103. *Proposed Full Project Intervention: Identify major institutions potentially capable of lending to private-sector developers in the Caribbean and obtain input on proposed legislation and regulations from that international lending community*. In the Full Project Phase the Policy and Legal Team, in conjunction with our financial consultants, will consider the generation, transmission and distribution issues in context of optimizing the conditions for lending to a commercial Project as well as the role of government guarantees and country risk insurance. Similar to the approach that the Team envisions taking with the geothermal commercial community, the Team will test the proposed laws and regulations within the international lending community before recommending implementation of the draft legal regime to ensure that the legislative, regulatory and institutional framework optimizes the conditions

for lending to a Project Country commercial Project, and in particular that the PPA reflects the current requirements of the lending institutions.

104. *Barrier*: Government institutions lack capacity – both information and mechanisms – for promulgating reliable, accurate or timely information about geothermal resources development. Feedback from the Regional Geothermal Advisory Council as well as from spot surveys, indicated that surprisingly little concrete information about the nature of geothermal resources had permeated the general public, particularly in Dominica and in St. Kitts & Nevis. The early geothermal drilling experiments in St. Lucia and the museum/tourist facility at Soufriere in St. Lucia has created greater public awareness in that country. In all three countries, however, misinformation has created some public misapprehension about geothermal development. For example, questions – even from more sophisticated stakeholders – continue to arise about whether geothermal drilling can cause earthquakes or volcanic eruptions. Project Management is aware that misinformation and superstition in the Hawaiian Islands (where quite serious opposition was raised over the fact that geothermal drilling would anger the volcano gods) resulted in long-term interruption of geothermal drilling in Hawaii. The Project has concluded that the technical training needs to be broad-based, so that, for example, the training of a regulator will be multidisciplinary. Similarly, public outreach will not only be technical, but shall also include policy, legal and economic issues.

105. *Proposed Full Project Intervention: Establish a Regional public outreach geothermal resources educational program, develop related shareable materials, and tailor the Regional program to meet country-specific circumstances to those ends.*

(a) *Provide expert educational teams to create and present replicable training programs*. Such educational teams can be taken from island to island, thereby maximizing attendees on each island.

(b) *Initiate teacher education.* Teacher education allows geothermal courses to be taught at the lower grade levels. Bottom-up education of the population has proven an extremely effective approach in the Caribbean.

(c) *Enable the utilization of published teaching materials.* The various national and international geothermal associations have published educational material pitched at different grade levels that can be disseminated on an on-going basis to the Project Country school systems.

106. *Barrier*: The Region lacks the trained human resources to participate in, govern, or regulate geothermal resource development. Although the human potential is available, capacity building is required. Virtually no one has received an education or practical training that would enable efficient regulation of a geothermal resources regime. Moreover, there is no skilled workforce. For example, in countries in which

there is a history of petroleum exploration and exploitation, cross-training is possible. In the Project Countries, even skilled workers will have to be retrained.

107. *Proposed Full Project Intervention: Formulate local and regional educational programs to assist the governments with in-house development of the people to staff the prerequisite regulatory institutions.* Design and execute training programs and workshops covering: (i) the general economic issues involved in efficiently awarding geothermal concessions or other contractual arrangements given the expected market and policy environment; (ii) the financial/risk-sharing characteristics of these contractual arrangements; (iii) the legal aspects of the contractual arrangements for geothermal development; (iv) relevant contract negotiation skills; (v) the administration of concessions/contracts, including associated accounting and management information systems; (vi) a management-level overview of the technical aspects of geothermal development; and (vii) environmental impact and safety management. To these ends:

(a) *Initiate a multi-disciplinary training program in conjunction with the regional universities*. Such university training has potential support from regional agencies, *e.g.*, the University of West Indies and the Organization of Eastern Caribbean States.

(b) *Establish repository libraries at regional and Project Country locations.* Build up the resources at regional repositories (*e.g.,* CARICOM), as well as on each island. Interconnect them as feasible.

(c) *Establish a regional geothermal web site and provide web site training.* Providing access to that information on the worldwide web. Develop mechanisms that will allow governments to protect proprietary information.

(d) *Enable prospective administrators and regulators from the Project Countries to tour geothermal facilities in the Western Hemisphere.* Such meetings will allow prospective administrators and regulators to meet with their administration and regulatory counterparts, enabling on-site cross-training.

(e) *Provide short-course, technical training to government technicians.*

Subcomponent Four: **Legislative and Regulatory Counsel**. *Identify* **country-specific barriers** *that may prevent private-sector development of geothermal energy and create politically acceptable solutions to overcoming these barriers in the Full Project stage and, where appropriate, expand local solutions regionally.*

108. *PDF-B Activities* (Legislative and Regulatory Counsel). *Provide assistance to the Commonwealth of Dominica in regulating existing licenses.* In 1995, the Commonwealth of Dominica entered into a license agreement with a private geothermal developer to develop Dominica's geothermal potential. Although the licensee was inactive for five years, after which time the government, pursuant to the

terms of the license was within its right to have cancelled the license, the government took no action. The government was unable to determine the most appropriate course of action from its own internal resources and requested Project assistance.

109. *PDF-B Findings* (Legislative and Regulatory Counsel). *During the PDF-B, the Project identified the following country-specific barriers that may prevent private-sector development of geothermal energy and developed the following politically acceptable solutions to overcoming these barriers in the Full Project stage:*

110. *Barrier:* The regional governments lack internal capacity to monitor or regulate licenses.

111. *PDF-B Intervention: Provide the Commonwealth the requested assistance.* The Project provided a legal assistance to Dominica and a small stipend to enable it to retain local counsel to in resolving the matter. On counsel's recommendation the government issued a notice to DGPC that the license had been considered abandoned since its fifth year (2000), and this significant barrier has been removed.

112. *PDF-B Intervention: Establish permit, license and concession criteria.* The Policy and Legal Team identified permitting and licensing criteria as well as the criteria on which resource concessions are granted in other sovereign jurisdictions.

113. *Proposed Full Project Intervention: Develop for each Project Country (i) limited-term, use-or-lose, extendable permits convertible to licenses; (ii) medium term use-or-lose licenses convertible to concessions; and (iii) long-term, time-extendable concessions.*

Component Three: Improving Financial Viability

114. *Overcome existing financial barriers that discourage private-sector development.* The high-risk nature of geothermal development matched with high up-front costs for exploration as well as capital costs implies that a large proportion of the cost of a Project must be expended before the probability of failure declines to a level similar to that of other power development projects. The high risks and capital intensity discourage public and private developers from investing in small high enthalpy geothermal Projects even though acceptable rates of return can be demonstrated.

115. *Enable access to financial instruments to assist in mitigating the exploration and appraisal risk.* It will thus improve access to finance for public and private developers and play a catalytic role in establishing geothermal energy as a strategic option in the power expansion planning of the countries in the region. It will provide support for exploration and appraisal drilling to both public and private developers at equal conditions. As a result, reduced risks and costs at early stage geothermal development can be expected to encourage the pursuit of Projects up to the final stage of an operational power plant.

116. *Correct mistakes evidenced in failed local attempts to exploit the resource.* These failed efforts mirror the general barriers described in the Project Concept Document. There have been several initiatives to develop geothermal energy among the Project Countries. In each case the local experiences that have led to failed attempts to exploit the resource largely mirror the general barriers described in the Project Concept Document. For example, in the case of Dominica, the previous geothermal resource license (to a private developer; originally in partnership with the government) did not result in any drilling or significant progress toward resource exploration and/or exploitation during the seven years of this concession. Several factors led to the failure of this effort to proceed to financial closure. In general, the small island developing states represent a significant financial risk, versus the potential benefits of a successful Project such that the region has not been able to attract the large, world class project developers that are able to commit their own resources for Project evaluation and investment.

117. *Transform the market conditions (including policy reform and preliminary resource evaluation) while making available financial resources for drilling exploration – the key to geothermal development in the region*. Several private developers and utilities based in the region have expressed interest in the development of geothermal Projects in Dominica, St. Lucia, and St. Kitts & Nevis. However, senior energy decision makers have made clear their concerns regarding the need (i) to guide the development process and (ii) ensure that a rational sequence of Project preparation for the optimised exploitation of national resources is followed. Thus, transforming the market conditions (including policy reform and preliminary resource evaluation), while making available financial resources for drilling exploration, is a precondition for providing the framework that will entice proven geothermal project developers to compete for geothermal development opportunities in the region.

118. *Provide a risk mitigation fund to assist in mitigating the exploration and appraisal risk.* It will thus improve access to finance for public and private developers and play a catalytic role in establishing geothermal energy as a strategic option in the power expansion planning of the countries in the region. It will provide support for exploration and appraisal drilling to both public and private developers. As a result, reduced risks and costs at early stage geothermal development can be expected to encourage the pursuit of projects up to the final stage of an operational power plant.

119. *Establish achievable interventions.* The Geo-Caraïbes Project engaged the services of a specialized renewable energy financing consulting team to evaluate the potential financial risk mitigation tools that could be deployed by the Project. During this process the Financial Advisory Team in conjunction with the Technical Advisory Team prepared the principal conclusions with regard to financial risk mitigation.

120. *Identify financing subcomponents.* The Project can achieve the Full Project financial viability objective and enable the Project Countries to meet the conditions precedent to legal predictability and sustainability by undertaking interventions in three areas. These Project interventions are discussed, below, as three subcomponents of financial viability reform under the headings of:

- *Subcomponent One:* Identify key financial requirements for sustainable Project development;
- *Subcomponent Two:* Assess possible financial tools that may be deployed to mitigate the financial barriers; and
- *Subcomponent Three:* Preliminary design of a Risk Mitigation Fund.

Subcomponent One: **Identify Key Financial Requirements for Sustainable Project Development.** Identify the key financial requirements for commercial development of geothermal energy in the Eastern Caribbean.

121. *PDF-B Activities* (Identify Key Financial Requirements for Sustainable Project Development). Determine principal financial requirements to transition potential Projects from preliminary exploration phase to commercially viable Project opportunities. Further, characterize the commercial viability of the geothermal resources in each of the Project Countries.

122. *Barrier:* Most geothermal power development around the world has been launched following significant financial investments by the public sector in the evaluation, characterization, and proving of geothermal resources. Due to the high-risk nature of the development, particularly the drilling stage, this implies that it is seen as "too risky" to invest limited funds, compared with conventional power generation options. This major barrier must be removed in order to encourage the region to pursue geothermal development as a strategic option for power generation.

123. *PDF-B Intervention: Undertake preliminary surface studies of geothermal reservoirs with the intention of providing the foundation of knowledge regarding the geothermal resources.* By conducting critical geology, geochemistry, and geophysics, the Geo-Caraïbes Project took the first step in mitigating financial risks by investing directly in these essential studies. The information collected, including that which was assembled from previous analyses and newly developed data will be made available to potential private developers according to criteria developed during the Full Project. The conduct of surface studies enabled the Geo-Caraïbes Technical Advisory Team and the Financial Advisory Team to suggest what analytical steps would be required in order to develop a comprehensive geothermal model such that the host governments could commercialize each of the Project opportunities. Similarly, potential private developers might have a better understanding of the required studies remaining in the development cycle.

124. *Proposed Full Project Interventions. Prepare comprehensive investor packages for each Project opportunity.* The packages will summarize the technical findings, market conditions, and describe the expected financial requirements. These packages

will be targeted to potential commercial developers with a goal of encouraging reputable companies to compete for the development opportunities that will be forthcoming.

125. *PDF-B Findings* (Identify Key Financial Requirements for Sustainable Project Development). Based on the studies collected and initiated during the PDF-B, there is considerable rational for continuation of the geothermal development process in each of the Project Countries. Below is a summary of the technical findings and recommendations regarding the next activities that may be undertaken in the resource evaluation, proof, and testing phase. The technical findings are described in greater detail in Component One above, but are summarized here in an effort to highlight the potential financial investments that may be required vis-à-vis the proposed fund.

Subcomponent Two: **Assess Financial Tools to Mitigate Financial Barriers.** *Identify the possible financial tools that may be utilized to adequately mitigate the exploration and drilling risks of the Project, while contributing to the goals of the Project.*

126. *PDF-B Activities* (Assess Financial Tools to Mitigate Financial Barriers). Review potential financial tools and/or resource exploration strategies that have been used around the world. Evaluate the potential applicability of the various approaches to the geothermal development environment in the Eastern Caribbean.

127. *ICE review of financial mitigation tools.* During the PDF-B, the Financial Advisory Team (International Conseil Energie ["ICE"]) reviewed more than 70 technical and Project documents, and conducted more than 15 interviews to assess the potential geothermal financial mitigation tools that may be deployed for drilling and other exploratory activities. Following is a summary of the basic funding mechanisms that were determined relevant for the Geo-Caraïbes Project:

(a) *Direct total grants.* Direct grants cover the entire cost of (an) initial well(s). This mechanism would be the most attractive to a developer. However, this kind of grant is better adapted to research or innovative programs, *e.g.,* the European Hot Dry Rock Geothermal Programme located in the East of France. This program involves several European Member States and benefits from European Union grants associated with other national funds.

(b) *Cost-shared grants.* In cost-shared grants, the developer is required to contribute to a part of the resources required for drilling. In-kind contributions (manpower, materials, equipment, etc.) may be permitted to count toward the cost-share portion. Several current or recent funding programs use this structure. The cost-sharing mechanism helps to ensure that the developer is serious and substantial and leverages the available funding, potentially extending it to more Projects. However, there are also several potential drawbacks:

i. The developer may be resistant to reasonable oversight of the work by the funding entity, by virtue of its cost-sharing contribution.

ii. The developer may insist on retaining either confidentiality or a proprietary interest in the results of the drilling, again based on the cost-share contribution.

iii. The cost-share contribution is subject to abuse, for instance by exaggerating or inflating the value of labor, materials or other components. This can occur whether or not in-kind contributions are specifically allowed. A cost-share structure therefore does not necessarily reduce the funding agency's burden of investigation and oversight, though, as noted above, adequate oversight may be more difficult to enforce.

(c) *Contingency grants.* With contingency grants, funds disbursed are required to be paid back to the funding agency under specified terms if the project is commercially successful, but do not need to be repaid if the project does not proceed. This type of funding has been used successfully in the past for initial geothermal exploration wells. Spread over a sufficient number of projects (and time), the soft-loan mechanism leverages the use of the funds through loan repayments. In addition, it may encourage developers to make efficient use of funds once a project is underway. A full-funding and soft-money approach allows for a high degree of oversight by the funding agency. Potential drawbacks include:

i. The absence of developer risk creates a potential for abuse if the developer is not serious in pursuing a successful project.

ii. The initial funding requirement may be high (if several projects are funded simultaneously), and a high failure rate could lead to fewer Projects being funded.

(d) *Guarantees.* Guarantees aim to reduce the risk of a loan and therefore ease access to commercial financing and reduce the interest rate required by the financing structure. Instead of providing direct funding, a guarantor takes on a contingent liability that is called only in the event of non-performance. Most guarantors are either public or multilateral entities.

i. Even if the amount of financing available were sufficient to finance all the planned drilling works, full cost financing would be dangerous, since it minimizes the developer's involvement in the project.

ii. For the same reason, a guarantee is an interesting instrument since it lets the developer secure the commercial financing of his project himself.

(e) *Insurance Guarantees.* To insure potential geothermal generation resource developers against the exploration and appraisal drilling risks, a private insurance mechanism cannot be considered. Private insurance companies are not ready to cover such high-risk exploration drillings.

Subcomponent Three: **Preliminary Design of Risk Mitigation Fund.**

128. *PDF-B Activities* (Preliminary Design of Risk Mitigation Fund). In consultation with project developers, the Technical Advisory Team, Project Managers and others, the Financial Advisory Team developed the initial recommendations for the structure of the Risk Mitigation Fund.

129. *Design of Financial Tool.* Design a financial tool for the three Caribbean Project Countries that would achieve the following objectives:

(a) Easy to implement and flexible mechanism;
(b) Adapted to the relatively high geothermal potential of the islands; and
(c) Attractive for private developers in such conditions that they would not have to commit their personal guarantee for mobilizing funds.

130. Furthermore, the Project also takes into consideration the fact that the concerned islands are small developing countries. As is the case with the East African Rift Countries involved in the ARGeo Project, the Project Countries lack sufficient experienced technical and managing teams to bring to success such risky and costly geothermal Projects.

131. *Geo-Caraïbes Risk Mitigation Fund overview.* Given the characteristics of the Project Countries and the modalities of funding alternatives, the preliminary recommendation is that the Geo-Caraïbes Project prepare a Risk Mitigation Fund that is structured as a contingency grant. The Risk Mitigation fund will address the essential geothermal risk parameters (reservoir temperature and enthalpy of fluids), together with:

(a) Geothermal resource size;
(b) Geothermal reservoir permeability;
(c) Gas content of geothermal fluids;
(d) Scaling and surface formation of scales; and
(e) Acidity of geothermal fluids.

132. *Geo-Caraïbes Risk Mitigation Fund characteristics.* The principal objective of the Risk Mitigation Fund is to cover the risks of the exploration and appraisal phases. The types of activities considered are the deep commercial size wells. The nature of this objective excludes preliminary investigations (such activities will largely be covered by the Geo-Caraïbes Project during the Full Project phase). The nature of this objective also excludes the cost of production drilling and the cost of power plant implementation.

133. *The Project proposes to provide a contingency grant covering 80% of the eligible costs.* This proposed contingency grant is designed:

i. to provide money directly and quickly for lowering the level of financing sources needed from developers' equity and loans from commercial banks;
ii. to prevent a quick depletion of the fund; and
iii. to create commitment from the developer.

134. *The Risk Mitigation Fund will constitute a facility in which funds disbursed are required to be paid back under specified terms if the Project is commercially successful, but do not need to be repaid if the Project does not proceed.* It may encourage developers to make efficient use of funds once a Project is underway. A soft-money approach allows for a high degree of oversight by the fund management.

135. *The associated contingency-grant program would maintain a high degree of oversight and maximize the use of funds over time.* The monitoring process maximizes the probability of success, in which case the funds will be reimbursed and will be available for complementary drilling works in the region.

136. *In case of failure, the Fund Manager and the other organizations involved in the program having rights over the results of the works financed will be able to use them for further investigation.* Failure is defined as the event in which an economically exploitable resource is not identified. As in the case of Bouillante II in Guadeloupe, it is recommended to define a practical measurement of failure and success. Three cases could be considered: total failure / partial failure / total success, corresponding to three different levels of expected profitability and three different levels of grant reimbursement.

137. *Grace period.* A grace period for the repayment period would be necessary to avoid a heavy debt charge for Project sponsors. A two years time lapse between application approval and repayment could be considered.

138. *Risk Mitigation Fund size.* The Fund size depends on the number of potential projects and the amount of expenditures to be covered. The definitive size of the Fund will be based on the amount of drilling and appraisal phase investments considered, and the funds made available by the donors.

139. *PDF-B Activities* (Preliminary Design of Risk Mitigation Fund). *Consistent with the recommended structure of the Risk Mitigation Fund and the institutional arrangements for the Geo-Caraïbes Project, the Financial Advisory Team outlined the application arrangements and management structure of the Risk Mitigation Fund.*

140. *Applications.* Applications will be procured through a Project Management Unit ("PMU") of the Geo Caraïbes facility, to be established. The applications would contain comprehensive and detailed analysis of the Project status, including all

preliminary data collected that would justify the proposed drilling phases. A non recoverable application fee would be charged in order to finance the Fund's operation and the scientific / technical and economic study of applications by experts.

141. *Role of the Project Management Unit.* The Project Management Unit would serve as an entry point for Project applications to Geo-Caraïbes. It would thus evaluate applications against criteria to be established by the PMU and to be approved by the Geo-Caraïbes Board of Directors. It may provide technical support to public applicants during Project preparation to assist them in meeting Geo-Caraïbes eligibility criteria. It would provide an evaluation report on the overall Project application, including a possible drilling component for scrutiny by the Scientific and Technical Advisory Panel.

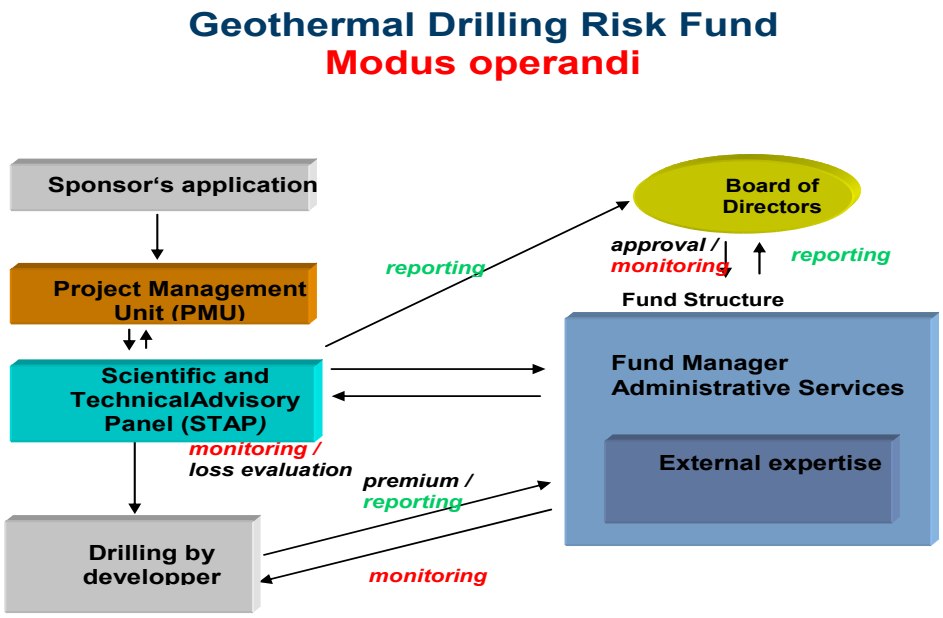
142. *Role of the Fund Manager.* The Fund would be established at a Financial Institution, which will open a fiduciary account for this purpose. It will provide in-house Project management staff and administrative services and make use of external advisors. Fees paid by applying developers and revenues from cash flow management shall cover these management services. As a preliminary task, the Fund Manager will have to organize the Fund structure. It will:

i. Assess all legal and fiscal implications of the agreements to be signed with potential developers;
ii. Elaborate a template for Project applications to the Fund; and
iii. Appoint external advisors as needed.

143. *Modalities of the Risk Mitigation Fund.* The developer shall prepare his application according to a template to be elaborated by the Fund Manager. Basically, it shall comprise:

i. Details of the applicant and its major partners in the Project: corporate details, legal standing, financial standing, directors and advisors;
ii. Experience and track record: references in particular in regard to geothermal developments;
iii. Financial and technical feasibility studies or equivalent;
iv. Detailed drilling plan (decision tree, expected outcomes…);
v. Funding scheme (sources, mitigation, financing structure…);
vi. Other items to be defined by Fund Manager.

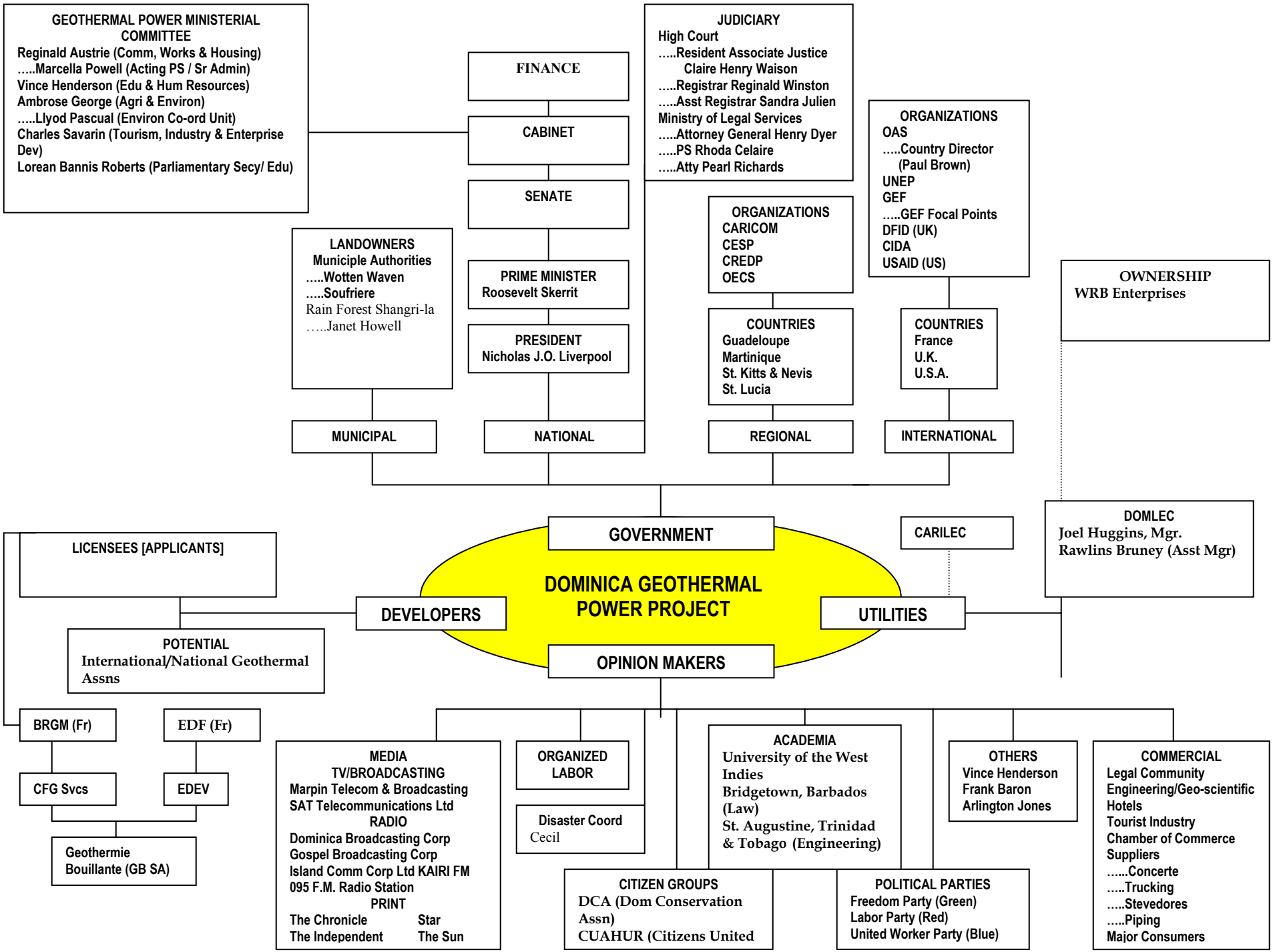
144. *Organizational Structure.* The organizational structure for the proposed Risk Mitigation Fund is illustrated below.

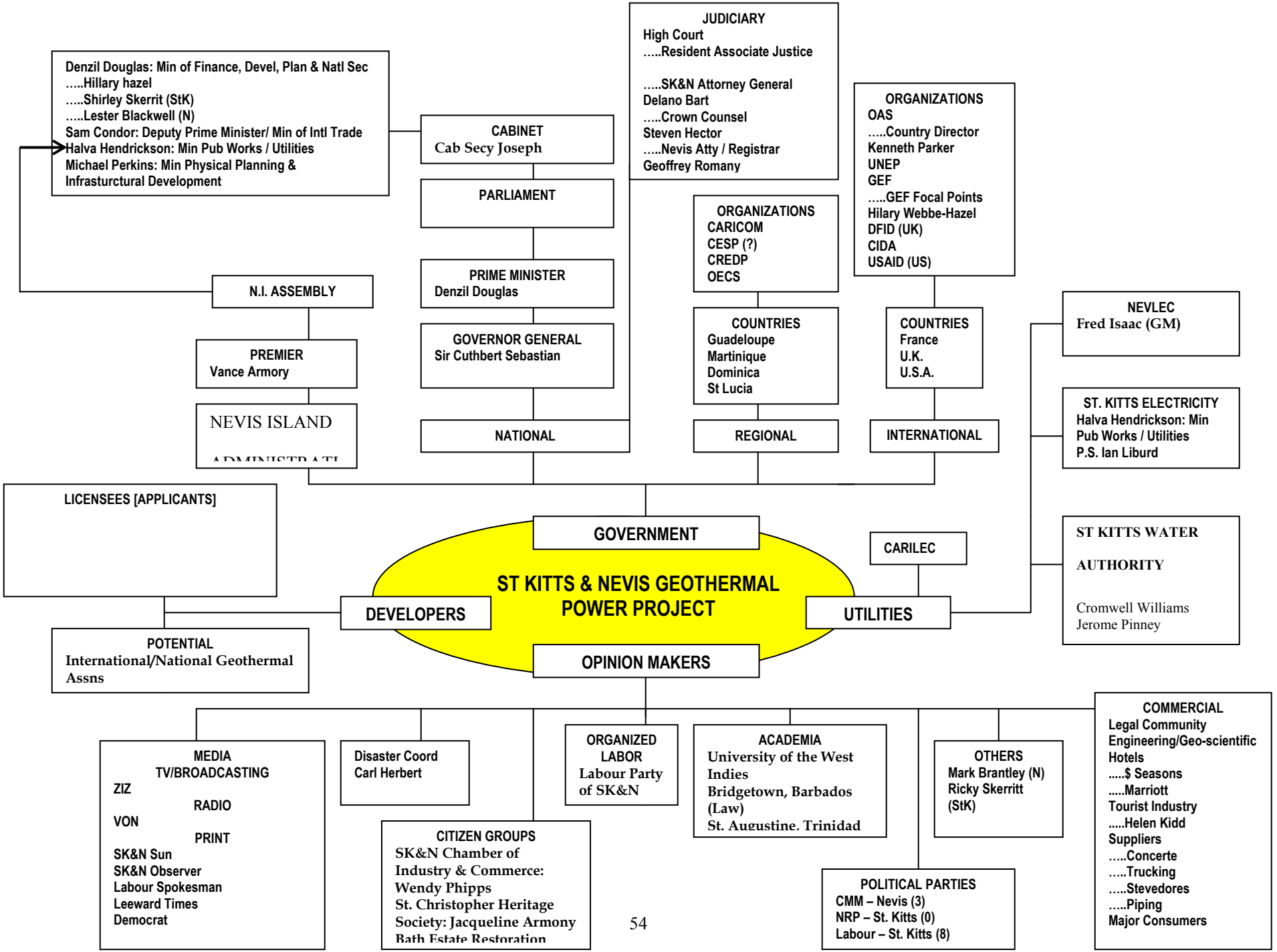


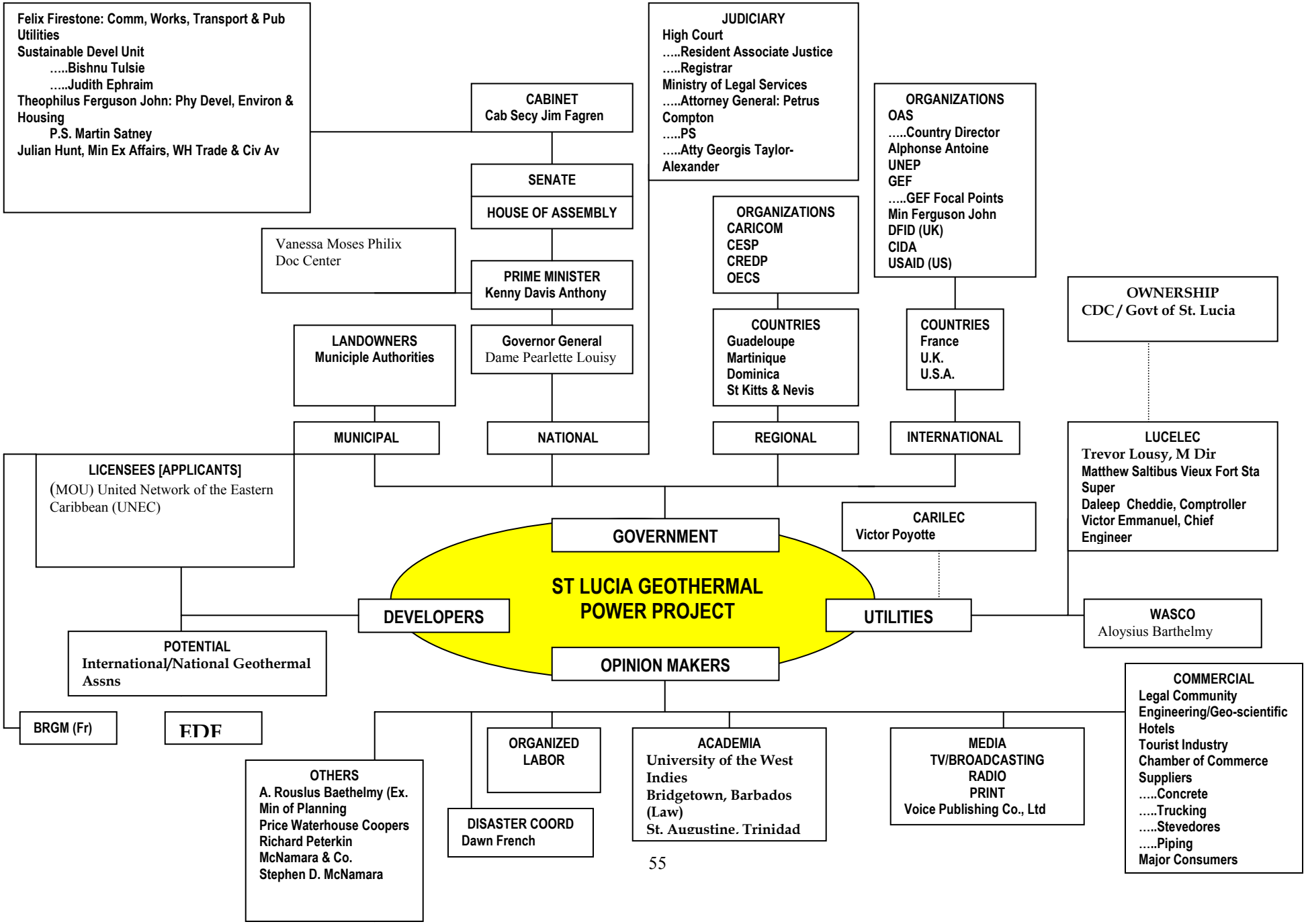
PDF-B Stakeholder Relationships

145. *Lay the groundwork for stakeholder incorporation in the Full Project decisional processes.* During the PDF-B, the Project Team undertook a series of fact-finding missions to the Project Countries to identify and meet with stakeholders – principally those stakeholders in the governmental, utility and "opinion maker" sectors. During the course of the PDF-B, however, a number of prospective developers identified themselves and were incorporated into the process. A diagrammatic representation of the stakeholders (as of 2005) in the Commonwealth of Dominica, St. Kitts & Nevis, and St. Lucia are set forth in Tables 4, 5 and 6, below.

TABLES 4, 5 & 6: PDF-B STAKEHOLDERS IN DOMINICA, ST. KITTS & NEVIS, AND ST. LUCIA




Denzil Douglas: Min of Finance, Devel, Plan & Natl Sec
…..Hillary hazel
…..Shirley Skerrit (StK)
…..Lester Blackwell (N)
Sam Condor: Deputy Prime Minister/ Min of Intl Trade
Halva Hendrickson: Min Pub Works / Utilities
Michael Perkins: Min Physical Planning & Infrasturctural Development
CABINET
Cab Secy Joseph
PARLIAMENT
PRIME MINISTER
Denzil Douglas
GOVERNOR GENERAL
Sir Cuthbert Sebastian
NATIONAL
JUDICIARY
High Court
…..Resident Associate Justice
…..SK&N Attorney General
Delano Bart
…..Crown Counsel
Steven Hector
…..Nevis Atty / Registrar
Geoffrey Romany
ORGANIZATIONS
CARICOM
CESP (?)
CREDP
OECS
COUNTRIES
Guadeloupe
Martinique
Dominica
St Lucia
REGIONAL
ORGANIZATIONS
OAS
…..Country Director
Kenneth Parker
UNEP
GEF
…..GEF Focal Points
Hilary Webbe-Hazel
DFID (UK)
CIDA
USAID (US)
COUNTRIES
France
U.K.
U.S.A.
INTERNATIONAL
N.I. ASSEMBLY
PREMIER
Vance Armory
NEVIS ISLAND
NEVLEC
Fred Isaac (GM)
ST. KITTS ELECTRICITY
Halva Hendrickson: Min Pub Works / Utilities
P.S. Ian Liburd
ST KITTS WATER AUTHORITY
Cromwell Williams
Jerome Pinney
LICENSEES [APPLICANTS]
GOVERNMENT
CARILEC
ST KITTS & NEVIS GEOTHERMAL POWER PROJECT
DEVELOPERS
UTILITIES
OPINION MAKERS
POTENTIAL
International/National Geothermal Assns
MEDIA
TV/BROADCASTING
ZIZ
RADIO
VON
PRINT
SK&N Sun
SK&N Observer
Labour Spokesman
Leeward Times
Democrat
Disaster Coord
Carl Herbert
CITIZEN GROUPS
SK&N Chamber of Industry & Commerce: Wendy Phipps
St. Christopher Heritage Society: Jacqueline Armony
Bath Estate Restoration
ORGANIZED LABOR
Labour Party of SK&N
ACADEMIA
University of the West Indies
Bridgetown, Barbados
(Law)
St. Augustine, Trinidad
POLITICAL PARTIES
CMM – Nevis (3)
NRP – St. Kitts (0)
Labour – St. Kitts (8)
OTHERS
Mark Brantley (N)
Ricky Skerritt (StK)
COMMERCIAL
Legal Community
Engineering/Geo-scientific
Hotels
…..$ Seasons
…..Marriott
Tourist Industry
…..Helen Kidd
Suppliers
…..Concerte
…..Trucking
…..Stevedores
…..Piping
Major Consumers


Felix Firestone: Comm, Works, Transport & Pub Utilities
Sustainable Devel Unit
.....Bishnu Tulsie
.....Judith Ephraim
Theophilus Ferguson John: Phy Devel, Environ & Housing
P.S. Martin Satney
Julian Hunt, Min Ex Affairs, WH Trade & Civ Av
CABINET
Cab Secy Jim Fagren
SENATE
HOUSE OF ASSEMBLY
Vanessa Moses Philix
Doc Center
PRIME MINISTER
Kenny Davis Anthony
LANDOWNERS
Municiple Authorities
Governor General
Dame Pearlette Louisy
MUNICIPAL
NATIONAL
JUDICIARY
High Court
.....Resident Associate Justice
.....Registrar
Ministry of Legal Services
.....Attorney General: Petrus Compton
.....PS
.....Atty Georgis Taylor-Alexander
ORGANIZATIONS
CARICOM
CESP
CREDP
OECS
COUNTRIES
Guadeloupe
Martinique
Dominica
St Kitts & Nevis
REGIONAL
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UNEP
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DFID (UK)
CIDA
USAID (US)
COUNTRIES
France
U.K.
U.S.A.
INTERNATIONAL
OWNERSHIP
CDC / Govt of St. Lucia
LUCELEC
Trevor Lousy, M Dir
Matthew Saltibus Vieux Fort Sta Super
Daleep Cheddie, Comptroller
Victor Emmanuel, Chief Engineer
LICENSEES [APPLICANTS]
(MOU) United Network of the Eastern Caribbean (UNEC)
GOVERNMENT
CARILEC
Victor Poyotte
ST LUCIA GEOTHERMAL POWER PROJECT
DEVELOPERS
UTILITIES
OPINION MAKERS
WASCO
Aloysius Barthelmy
POTENTIAL
International/National Geothermal Assns
BRGM (Fr)
EDF
OTHERS
A. Rouslus Baethelmy (Ex. Min of Planning
Price Waterhouse Coopers
Richard Peterkin
McNamara & Co.
Stephen D. McNamara
ORGANIZED LABOR
DISASTER COORD
Dawn French
ACADEMIA
University of the West Indies
Bridgetown, Barbados
(Law)
St. Augustine. Trinidad
MEDIA
TV/BROADCASTING
RADIO
PRINT
Voice Publishing Co., Ltd
COMMERCIAL
Legal Community
Engineering/Geo-scientific
Hotels
Tourist Industry
Chamber of Commerce
Suppliers
.....Concrete
.....Trucking
.....Stevedores
.....Piping
Major Consumers

146. *Regional Geothermal Advisory Group*. In conjunction with the launch of the PDF-B, the Project Manager requested that each of the Project Countries select five key decision makers, who could represent the interests of critical elements of the energy sector. These decision makers were drawn from the ministries with principal responsibility for each country's energy and infrastructure, the major national utilities, environmental and renewable energy offices, and the offices of the attorneys general of the three countries. The interaction between Project Management and the Group facilitated course-corrections to policy initiatives in response to country input at every major step throughout the PDF-B. Simultaneously, influential decision-makers were sensitized to both the subtleties and realities of geothermal development issues.

TABLE 7: COMPOSITION OF REGIONAL GEOTHERMAL ADVISORY TASK FORCE.

Member	Position	Country
Reginald Austrie	Minister of Communications, Works and Housing	Commonwealth of Dominica
Dr. Colmore Christian	Permanent Secretary, Ministry of Communications, Works and Housing	Commonwealth of Dominica
Rawlins Bruney	Manager, Dominica Electricity Services Ltd. (DOMLEC)	Commonwealth of Dominica
Sylvester Vital	Senior Engineer, Ministry of Communications, Works and Housing	Commonwealth of Dominica
Alick C. Lawrence, Esq.	Legal Consultant to Office of Prime Minister Commonwealth of Dominica	Commonwealth of Dominica
Ferguson John	Minister of Physical Development, Housing and Environment	St. Lucia
Martin Satney	Permanent Secretary, Ministry of Physical Development, Environment and Housing	St. Lucia
Judith Ephraim	Officer, Unit of Sustainable Development and Environment, Ministry of Physical Development, Housing and Environment	St. Lucia
Trevor Louisy	Managing Director, St. Lucia Electricity Services Ltd. (LUCELEC)	St. Lucia
Georgis Taylor-Alexander, Esq.	Crown Counsel	St. Lucia
Michael A. Perkins	Minister of Physical Planning and Infrastructural Development, Natural Resources and Environment	St. Kitts & Nevis
John Channor	Chief Engineer/Manager, St. Kitts Electricity Department	St. Kitts & Nevis
Shirley Skerrit Andrew	Senior Project Analyst, Planning Unit, Ministry of Sustainable Development (subsequently Ministry of Finance)	St. Kitts & Nevis
Stephen Hector, Esq.	Office of Attorney General	St. Kitts & Nevis
Israel Mukasa	Office of Attorney General	St. Kitts & Nevis

147. *Policy and Legal Team.* The Minister of Justice in St. Lucia, the Prime Minister in the Commonwealth of Dominica, the Attorney General in St. Kitts & Nevis, and the Minister of Physical Planning in the Nevis Island Administration, each appointed attorneys to represent their country's legal interests in the Regional Policy Group. The attorneys appointed to the Regional Policy Group also constituted the major working group of PDF-B, serving as a panel of legal and drafting experts to work with Project consultants and staff. Named the "Legal and Policy Team," the country legal advisors were led by the Project counsel, and worked in tandem to establish the viability of the current legal

regime's enabling commercial development of the region's geothermal resources in context of world-wide standards.

TABLE 8: COMPOSITION OF POLICY & LEGAL TEAM

Member	Position	Affiliation
A. John Armstrong, Esq.	Policy & Legal Team Leader	OAS Legal Consultant McLean, VA, USA
Mark Lambrides	OAS Advisory Team	Project Coordinator, OAS Washington, DC, USA
Sasha Gottleib	OAS Advisory Team	Project Deputy Coordinator, OAS Washington, DC, USA
Jan C. Vermeiren	OAS Advisory Team.	Deputy Director, OAS Washington, DC, USA
Georgis Taylor-Alexander, Esq.	St. Lucia Representative to Policy & Legal Team	Crown Counsel St. Lucia
Stephen Hector, Esq.	St. Kitts & Nevis Representative to Policy & Legal Team	Office of Attorney General St. Kitts & Nevis
Israel Mukasa	St. Kitts & Nevis Representative to Policy & Legal Team	Office of Attorney General St. Kitts & Nevis
Mark Brantley, Esq.	Nevis Island Administration Representative to Policy & Legal Team	Legal Consultant to Office of Minister of Physical Planning and Infrastructural Development, Natural Resources and Environment Nevis Island Administration
Alick Lawrence, Esq.	Commonwealth of Dominica Representative to Policy & Legal Team	Legal Consultant to Office of Prime Minister Commonwealth of Dominica

148. *Project Country Geothermal Consultative Groups.* Working through the core policymakers in the Regional Policy Group, the PDF-B Project Management caused the establishment of a broader group of stakeholders within each country. These expanded Project Country stakeholder groups are known as the "Dominica, St. Kitts & Nevis, or St. Lucia Geothermal Consultant Group", as appropriate. These Consultant Groups have acted as a sounding board for proposed policy initiatives and served as the first step in the public review of proposed policy reforms in PDF-B, and shall continue in that function during the Full Project. Moreover, since the membership of the Project Country, Geothermal Consultant Groups has been drawn not only from the governments in power, but also from the bureaucracy and minority political parties, these Consultative Groups have the potential of promoting non-partisan support for the Full Project reforms and of retaining the corporate memory – conditions prerequisite for policy initiatives to flourish during succeeding governments.

TABLE 9: COMPOSITION OF PROJECT COUNTRY GEOTHERMAL CONSULTANT GROUPS

Commonwealth of Dominica		
Name	***Title***	***Organization***
Hon. Reginald Austrie	Minister	Ministry of Communications, Works & Housing
Hon. Ambrose George	Minister	Ministry of Agriculture and Environment
Hon. Osborne Riviere	Minister	Ministry of Foreign Affairs, Trade & Marketing
Hon. Charles Savarin	Minister	Ministry of Tourism
Amb. Crispin Gregoire	Ambassador	Mission to the United Nations

Paul Brown	Director	Organization of American States
Rawlins Bruney	Production Manager	DOMLEC
Brian Bynoe	Director	Ministry of Agriculture & the Environment, Lands and Survey Department
Ellise Darwton	Legal Officer	DOMLEC
Hon. Henry Dyer	Attorney General	Ministry of Legal Affairs, Immigration & Labour
Amb. Crispin Gregoire	Ambassador	Permanent Mission of the Commonwealth of Dominica to the United Nations
Sen. Jacinta Bannis	Parliamentary Secretary	Ministry of Community Development, Gender Affairs & Information
Irwin LaRocque	Parliamentary Secretary	Ministry of Tourism
Allen Paul	Director of Trade	Ministry of Trade
Joel Huggins	Managing Director	DOMLEC
Alick Lawrence	Project Attorney	Alick Lawrence, PC.
Hon. Prime Minister Roosevelt Skerritt	Prime Minister	Prime Minister's Office
Marcella Powell	Permanent Secretary	Ministry of Communications, Works & Housing
Hon. Osborne Riviere	Minister	Ministry of Foreign Affairs, Trade & Marketing
Ambrose Sylvester	Financial Secretary	Ministry of Finance & Planning
Sylvester Vital	Senior Engineer	Ministry of Communications, Works & Housing
St. Kitts & Nevis		
Name	***Title***	***Organization***
Delano Bart	Attorney General	Government of St. Kitts
Bertill Browne	Project Engineer	Electricity Department
Stephen Hector	Staff Attorney	Government of St. Kitts
Karen Hughes	Staff Attorney	Government of St. Kitts
Israel Mukasa	Attorney	Legal Department
Amicia Mussenden	Legal Adviser	Ministry of Sustainable Development
Kenneth Parker	OAS Director	Organization of American States
A. Michael Perkins	Minister	Ministry of Physical Planning & Infrastructural Development, Natural Resources and Environment
Shirley Skerritt	Senior Project Analyst	Ministry of Sustainable Development
St. Lucia		
Name	***Title***	***Organization***
Georgis Taylor-Alexander	Senior Crown Counsel	Attorney General's Chambers
Adrian Augier	Development Consultant	Landmark Ltd.
Truscott Augustin	Chief Public Utilities Officer	Ministry of Communications, Works, Transport & Public Utilities
Gregory Blanchard		CARILEC
Crispin D'Auvergne	Sustainable Development and Environment Officer	Ministry of Physical Development, Environment & Housing
Judith Ephraim	Sustainable Development and Environment Officer	Ministry of Physical Development, Environment & Housing
Cornelius Fevrier	Sustainable Development and Environment Officer	Ministry of Planning, Sustainable Development & Environment Unit
George James	Deputy Permanent Secretary (Ag)	Ministry of Physical Development, Housing & Environment
Theophilus Ferguson-John	Minister	Ministry of Physical Development, Housing & Environment
Kentigen Louis	Commissioner of	Ministry of Physical Development, Environment

	Crown Lands	& Housing
Trevor Louisy	Managing Director	LUCELEC
Keith Nichols		Organization of Eastern Caribbean States
Cynthia Hinkson-Ouhla	Legal Officer	Ministry of Physical Development, Environment & Housing
Bishnu Tulsie	Director	St. Lucia National Trust

E. COST BENEFIT ANALYSIS OF THE GEO CARAÏBES PROJECT

A. Overview.

This section will deal with the economical justification of the Geo-Caraïbes Project. The financial viability of this Project depends on environmental grants to achieve an adequate financial rate of return.

The basic idea is to compare future alternative electricity production systems based on their Life Cycle Cost (LCC) for electricity production and the CO2 emission abatement cost. Also the payback period or break-even point is important to know.

The possible generation capacity of the geothermal system considered for this analysis is estimated for 90 MW on the island of Dominica, 10 MW on St. Kitts & Nevis and 10 MW on St. Lucia (earlier studies pointed out the need for 7.5 MW, but according to this type of small geothermal units, it has been assumed that 2 production units of 5 MW would be more suitable).

The current total primary energy (TJp) used in 2004 by the Project Countries is 4767 TJp, of which 4632 TJp is based on fossil fuel combustion. The CO2 emission in 2004 amounts a total of 139,494 metric tons of CO2.

TABLE 20: ENERGY DATA OF THE GEO-CARAÏBES (2004)

Island	Fuel type	Installed capacity (MWe)	Primary Energy (TJp)[1]	Metric ton CO2[2]
Dominica	Diesel Oil	14.4	429	12,133
	Hydro	7.6	135	.
St. Kitts	Diesel Oil	34.5	1082	32,417
Nevis	Gas Oil	12.8	509	12,716
St. Lucia	Diesel Oil	56.8	2612	82,228
Geo-Caraïbes		126.1	4767	139,494

B. Proposed Geothermal Project.

Since we are dealing with three different Project countries with different utilities and geothermal potentials the project will analyze the geothermal development per each Project country based on the study completed in Dominica and in a later stage summarize the results for the Geo-Caraïbes area.

Several possible geothermal developments have been studied at preliminary levels in the three Project countries. In the case of Dominica, the most interesting option (90 MW in two production units of 45 MW each) shall be evaluated over the full Project period. On St. Kitts & Nevis a 2 x 5 MW option will be evaluated and on St. Lucia (2 x 5 MW) will be analyzed. For the economic analysis in the Project countries, we have assumed that five years are necessary for the drilling process and the construction period and that the lifetime of the equipment is 20 years.

[1] Calculated using an energy conversion efficiency of 40% and load factor of 0.8

[2] Calculated using the total consumed fuel in 2004 by each utility and the Low Heating Value (LHV) of Diesel Oil (36 MJ/L).

Table 21 shows an overview of the proposed geothermal Project in 2012 for the first year of operation.

TABLE 21: PROPOSED GEOTHERMAL PROJECT.

Geothermal (1st Operational year)			
Island	Possible capacity (MWe)	TJ (2012)	Metric ton offset (2012)
Dominica	90[3]	5046	168,022
St. Kitts	.	.	.
Nevis	10	561	18,669
St. Lucia	10	561	18,669
Geo-Caraïbes	**110**	**6168**	**205,360**

E.1 DOMINICA.

1.1 Baseline or Business-as-Usual.

1.1.1. Load Forecasts

Existing and future power demand of Dominica and the neighbouring French Islands has been reviewed in 2005 on the basis of recent utilities forecasts:

	Guadeloupe	Peak Load (MW)	Martinique	Peak Load (MW)	Dominica	Peak Load (MW)
2004	**1430 GWh**	221	1380 GWh	218	70 GWh	13
2010	**1781 GWh**	280	1560 GWh	253	80 GWh	15
2000-10 Growth	**3,5 to 4%**		3 to 4%		1%	
2020	**2300 GWh**	360	2000 GWh	330	100 GWh	20
2010-20 Growth	**2,5 %**		2,5 %		3%	

The considered load growths in each island have to be considered as pessimistic, since they are based on moderate economic activity growth and on the intensification of on-going energy efficiency improvement programmes.

1.1.2. Existing Generation

Overall, the existing generation means in the 3 islands can be characterized as follows:

(end 2005)	Guadeloupe	Martinique	Dominica
Effective Capacity	**440 MW**	**420 MW**	**20 MW**
Generation	**74% HFO/Gas-oil 15% Bagasse/Coal 3% Hydro 3,5% Geothermal (GB1, GB2) 4,5% Wind**	**100% HFO/Gas-oil**	**40 % Hydro 60 % Diesel (Gas-oil)**

[3] This potential with the interconnection to Guadeloupe and Martinique

The existing generation analysis show that more than 90% of the overall capacity is thermal, and based on imported fuels: Heavy Fuel Oil, Gas-Oil and Coal. In terms of generated energy, it is estimated that 95% is based on imported fuels and only 5% on renewable and indigenous resources.

1.1.3. Future Generation Possibilities

Based on information provided by DOMLEC and EDF (not official) the different possible medium-term minimal needs and corresponding options for future generation development without the Project were assessed as follows:

Dates / Options	Guadeloupe	Martinique	Dominica
2010 2012 2014	40 MW - 40 MW	- 40 MW -	5 MW - -
Diesel Bagasse / Coal Renewable (other than project)	Upgrading existing HFO Units / New Units One site only GB3 mostly	Upgrading existing HFO Units / New Units One site only Limited	New Plant Under evaluation

After 2014, the use of the existing Diesel units will have to be reduced. Most of the units will have to be de-commissioned afterwards; although EDF declined to state about any de-commissioning schedule, it is estimated that at least 200 MW of base load Diesel plants (out of 380) will have to be closed by 2020.

So by counting the minimal incremental needs due to load growth, plus new requirements due to de-commissioning, it is expected that at least 450 MW of new base load installed capacities will be necessary in the 3 islands by 2020, which means 30 MW per annum or 120 MW (3 units of 40 MW) every 4 years. Of these 450 MW, the only options (without the Dominica Geothermal Project) other than new Diesel plants are:

- 2 suitable sites for Bagasse / Coal thermal plants for a total of 80 MW;
- A third development of Bouillante Geothermal Plant (GB3, aprox. 40 MW)
- Small hydro, small geothermal, wind and photovoltaic potential: not officially stated, but it is estimated that a maximum of 45 MW (20 in each French Island, 5 in Dominica) could be realistically and economically installed by 2020.

If all these options are effectively developed (which is highly unlikely), there would still be a very minimal need of more than 280 MW of new power stations before 2020, roughly 130 to 140 in each one of the French islands, 10 in Dominica.

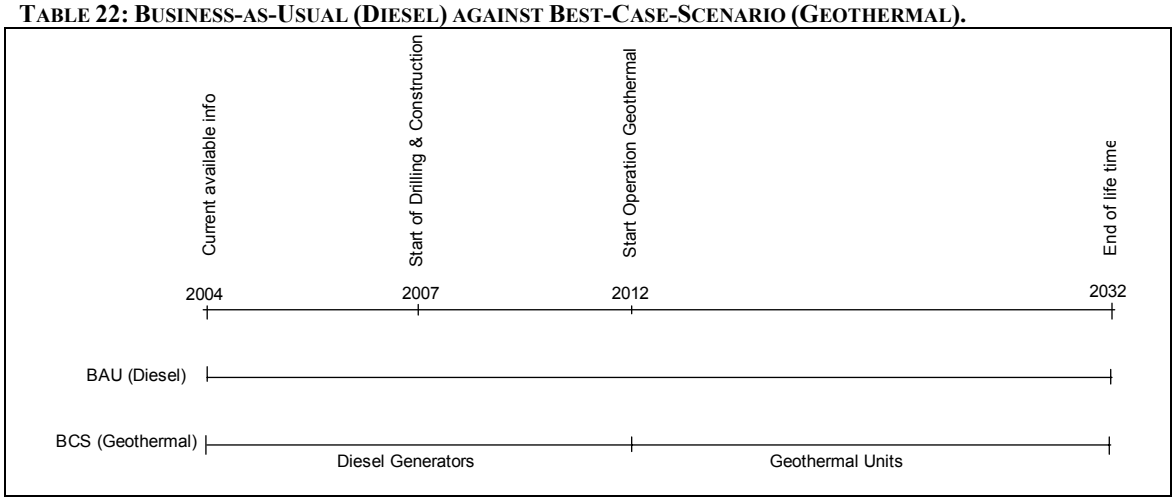
For this reason, it is possible to state that in case of no initiative for the geothermal energy project in Dominica, with interconnection to the French islands, the highest probable development for these new plants would be diesel fuel based generators. To compare the two alternatives, diesel or geothermal, the Project have to quantify the possible required capacity between 2004-2032 for the island of Dominica in the baseline or Business-as-Usual (BaU).

1.2 Best Case Scenario.

For the geothermal development or Best Case Scenario (BCS) a diesel expansion in the intermediate period before the start of real geothermal operation has to be taken into account. And then evaluate the performance of the geothermal system form 2007-2032.

To make it more understandable the Project will visualize the situation, see Table 22 below.

TABLE 22: BUSINESS-AS-USUAL (DIESEL) AGAINST BEST-CASE-SCENARIO (GEOTHERMAL).



The geothermal projected capacity is set on 2*45 MWe (based on available data4) of which Dominica will use about 10 MWe of it for its own energy demand and the difference can be sold to the French islands.

The CBA will be performed for the period 2012-2032 since this is the period of the operation of the geothermal power plant with a lifetime of 20 years. All the years before that, in both scenarios investment will have to be made in diesel generators.

Since only 10 MW will be used by Dominica and the difference sold to the French islands, it means that if there was no investment in geothermal, 10 MW diesel would have been required on Dominica and at the same time the difference of 80 MW would have been required by the French islands, that otherwise would have invested in Diesel generators.

The total investment cost for 4 x 20 MW and 2 x 5 MW Diesel generators (Low-Speed and/or Medium-Speed) is about US$ 115.6 million5. It is assumed that these systems have a lifetime of 20 years. The annual operation and maintenance costs will be about US$ 4.66 million (4% of investment).

On Table 23 an overview is shown of the parameters that where taken in account for the Diesel System in the Cost-Benefit Analysis (CBA).

[4] AETS-Energie et infrastructure
[5] AETS-Energie et Infrastructures

TABLE 23: GENERAL INPUT DATA FOR THE DIESEL SETS (DOMINICA).

Parameters	Value	Unit
Investment cost	115,600,000	US$
Operation & Maintenance	4,660,000	US$
Miscellaneous	2,330,000	US$
Fuel Costs	72,150,000	US$
Discount Rate	0.11	
Unit capacity	90	MWe
Unit type	4x20MW, 2x5MW	
Lifetime	20	Years
Conversion efficiency	40%	
Load factor	0.8	
Electricity production	630	GWh
Primary Energy	5676	GJp
Diesel Oil price	2.08	US$/imp. Gallon
	12.71	US$/GJ
Emission factor (Diesel Oil)	74.1	kg CO2/GJ

The efficiency of new diesel generators is assumed at 40 %, this means that for 90 MWe an amount of 5676 TJ of primary energy is needed.

A discount rate of 11% was assumed since this is the acceptable range for World Bank Projects6.

1.3 Proposal (Geothermal on Dominica).

In the case of the island of Dominica there are several options for geothermal development. They differ in the amount and capacity of generations units. In this section only the most promising scenario is discussed, based on 2 x 45 MW units.

For this option, the main parameters for the CBA are shown in Table 24. The total geothermal investment (drilling exploration included) is estimated to be US$ 240.4 million7, while the interconnection links would total US$ 68.2 million. And an annual operation and maintenance (O&M) costs of US$ 10.3 million (4% of plant and steam field investment, plus 1% of interconnection investment).

TABLE 24: INPUT DATA FOR THE CBA OF THE GEOTHERMAL OPTION

Parameters	Value	Unit
Investment cost	308,600,000	US$
Operation & Maintenance	10,300,000	US$
Miscellaneous	5,100,000	US$
Discount Rate	0.11	
Unit capacity	90	MWe
Unit type	2x45MW	

6 Polish GEF geothermal Project (Zakopane)
7 AETS-Energie et Infrastructure

Lifetime	20	Years
Conversion efficiency[8]	45%	
Load factor	0.8	
Electricity production	630	GWh
Primary Energy	5046	GJp

Since in this scenario there is no use of fossil fuels there is no direct CO2 emission related to the electricity production.

The Life Cycle Cost of electricity production is the best indicator to evaluate the two alternatives. Based on the highest life cycle cost one can calculate an adequate electricity price by adding an acceptable percentage of earnings to the price.

Another option is to take the current electricity price of the concerned islands into account. In Dominica, it is US$ 0.32/kWh for the final consumer; no indications are available on the generation cost; however, based on current crude oil prices of 60 US$/bbl, and on international power plant costs applied to the local conditions, the current and expected mid-term cost of electricity generation should be between 0.17 and 0.20 US$/kWh. In the French islands, the current generation cost is estimated at 0.11 US$ / kWh under the same conditions.

The following Table 26 shows the overview of the results of the cumulative LCC of the electricity production (US$/kWh) for the Project period. Note that the initial geothermal investment cost has been increased by a factor of 1.25, in order to take into account the effect of the study, drilling and construction periods which amount to a total of 5 years.

TABLE 26: RESULTS OF LCC ANALYSIS FOR DOMINICA.

		Geothermal Dominica (Proposed)	Diesel Generator (Base)	Increment
Type of Power Plant	Unit			
Power plant		Geothermal	Diesel Fueled	
Future dev.	MWe	90	90	
Units		2 x 45 MW	4x20 + 2x5 MW	
Tot. Investment cost	Million US$	385.8	115.6	**270.2**
Annual O&M costs	Million US$	10.3	4.66	5.64
Annual Misc costs	Million US$	5.1	2.33	2.77
Annual Fuel costs			72.45	-72.45
Tot. Costs (year 1)	Million US$	**401.2**	**122.59**	**278.61**
Discount rate		0.11	0.11	
Lifetime		20	20	
Cum. PV of Total costs (PV LCC Costs)	Million US$	**458.0**	**674.1**	**-216.1**
Annual Electr. Prod	GWh	630	630	
Cum. Electr. Prod	GWh	12614	12614	

[8] Geothermal Management Company Inc.

annual CO2 emission*	kton CO2	0.00	420.6	-420.6
Cum. CO2 emissions	**kton CO2**	**0.00**	**8412**[9]	**-8412**
Electr. Prod. Cost	US$/kWh	**0.091**	**0.134**	**-0.043**

*All CO2 emission reductions are direct, and all will occur after the GEF Project contribution ends (7 years)

Based on the life cycle cost (LCC), this is in this case from the import of fuel till the physical production of electricity (production cost), the Project can set an electricity price where the IRR is set to the acceptance of the investors. The rate influences after how many years the Project will pay itself off (break even point). It is also possible to use a weighted average of the current electricity price of Dominica and the French islands and find the payback time based on the earnings.

Cost-Benefit calculations show that the LCC Electricity price for geothermal is on average 0.091 US$/kWh and of diesel 0.134 US$/kWh. The total cumulative costs for the Project lifetime will be on average US$ 458 million for geothermal compared to US$ 674 million for diesel. This means that it is more attractive to invest in geothermal than in diesel, the electricity price can be reduced (social perspective) and still creating enough profit to have an acceptable payback period (private perspective).

With the current mixed generation costs of DOMLEC and EDF, estimated at US$0.12/kWh while the final consumer price in Dominica is 0.30/kWh10**, the payback period for the geothermal will be 6 years.** But since the aim is to lower the electricity prices by introducing geothermal energy production we have to look specifically to the LCC of the geothermal Project. This LCC was US$0.091/kWh for geothermal during the Project lifetime. This means that the price can be considerably reduced to a level where still profit can be made.

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If you reduce the price to US$0.10/kWh11, which means a profit of US$0.009/kWh (US$0.10/kWh – US$0.091/kWh) the payback period will become 13 years.

Internal rates of return will typically be 15% to 25%. A rule-of-thumb: for Projects with a lifetime of more than 15 years the internal-rate-of-return is a little bit higher than the inverse of the pay-back period. In this case the inverse of 13 years is 0.077, so a discount rate of 11% is good.

[9] The CO2 price within the Carbon Credit market is now about 10-20 US$/ton CO2. See http://www.corpwatch.org/article.php?id=11883

[10] This price is the current average electricity price asked from the consumers on Dominica (including distribution, administrative costs etc.)

[11] This price relates only to the production of electricity, thus excluding distribution and other costs.

E.1.1 Sensitivity analysis

- Fuel costs

A sensitivity analysis has been used to calculate the fuel price influence on the life cycle cost (LCC) of the electricity production by diesel fuelled systems. Also it is interesting to know what the change in LCC will be because of changes in discount rate, when comparing diesel with geothermal systems.
The main results of the sensitivity analysis done for the fuel price for the diesel system and discount rate for the diesel and geothermal system can be summarised as follows:

As starting point (100%), the current diesel price of US$2.08/Imp. Gallon was used. The calculations of the LCC have been made with changes up to 60% reduction or 60% increase in diesel price. **It results that the diesel system can only be competitive when the diesel fuel price decreases up to 60% of its current value (with 100% for the geothermal). This corresponds to a crude oil cost of 36 US$/bbl instead of 60.**

- Discount rate

If we focus on the development of the LCC by changing the discount rate (**from 8% to 14%, or the basic value of 11% plus or minus 3%),** for the diesel system the LCC is practically constant at US$0.135 per kWh. **And the LCC development by changes in the discount rate for the geothermal system range between US$0.080-0.105 per kWh**. The slope of the discount rate-geothermal curve is bigger than the discount rate-diesel curve and indicates that by changing the discount rate for both systems, the geothermal system will be more sensitive to it.

- Geothermal resource quality

Quality of the geothermal resource is of particular concern for these power plants. Since it is not known at this point of the Project, sensitivity analysis has been done assuming either an investment and O&M cost increase of 20%, or a decrease of 20% in annual energy generated. The results are as follows:

In case of a 20% cost increase, the LCC of the geothermal system increases from 0.091 to 0.110 US$/kWh and the IRR decreases from 23% to 17%

In case of a 20% decrease in producible energy, the LCC of the geothermal system increases to 0.114 US$/kWh, while it climbs to 0.142 US$/kWh for the Diesel option. The IRR decreases to 18%.

E.2 ST. KITTS & NEVIS AND ST. LUCIA.

Table 27 shows the results for a 2x5 MW geothermal development; St.Kitts & Nevis are assumed to be interconnected since the demand in Nevis is not sufficient to absorb the chosen capacity, while it is assumed that additional transmission costs within St. Lucia are negligible.

TABLE 27: RESULTS OF THE LCC ANALYSIS FOR ST. KITTS & NEVIS AND ST. LUCIA.

St. Kitts & Nevis / St. Lucia						
		Geothermal (Nevis)	Geothermal (St. Lucia)	Diesel Generator (Base)	Increment Nevis	Increment St. Lucia
Type of plant		Geothermal	Geothermal	Diesel Fueled		
Future dev.	MWe	10	10	10		
Units		2 x 5MW	2 x 5MW	2x5MW		
Tot. Investment cost	Million US$	49.8	44.8	12.6	37.2	32.2
Annual O&M costs	Million US$	1.85	1.8	0.5	1.35	1.3
Annual Misc costs	Million US$	0.95	0.9	0.25	0.7	0.65
Annual Fuel costs	Million US$			8.5		
Tot. Costs (year 1)	Million US$	52.6	47.5	21.85	30.75	25.65
Discount rate		0.11	0.11	0.11		
Lifetime		20	20	20		
Cum. PV of Total costs	**Million US$**	**65,0**	**59.7**	**77.9**	**-12.9**	**-18.2**
Annual Electr. Prod	GWh	71	71	71		
Cum.Electr. Prod	**GWh**	1402	1402	1402		
annual CO2 emission*	kton CO2			93.6	-93.6	-93.6
Cum. CO2 emissions	**kton CO2**			1869.6	-1869.6	-1869.6
LCC Electr. Prod. Cost	**US$/kWh**	**0.12**	**0.11**	**0.14**	**-0.02**	**-0.03**

*All CO2 emission reductions are direct, and all will occur after the GEF Project contribution ends (7 years)

The electricity production costs for the diesel is 2 to 3 cent higher than geothermal, US$0.14/kWh compared to US$0.11 and 0.12/kWh. This is interesting, because the investment cost in diesel units is about 28% of the investment on geothermal units. This means that initially the geothermal might seem to be too costly, but on the Project lifetime it will still cost less, see the total cumulative costs. In this case it's the socio-environmental considerations as CO2 emission reduction and possible job creation that comes along with geothermal development that should be the main decision criteria.

E.2.2 Sensitivity Analysis

Sensitivity analyses have shown that the diesel and geothermal variants are equivalent when the fuel costs are respectively set at 80% of the present cost (for St. Kitts and Nevis) and 70% of the same (for St. Lucia). The corresponding crude oil values would be of 48 and 42 US$/bbl respectively.

F. DETAILED PRESENTATION OF RISK REDUCTION FINANCIAL TOOL

This document presents an analysis of one of the most suitable financial mechanisms appropriate to the specific conditions in the Project countries.

The Risk Reduction Financial Tool would constitute a facility in which funds disbursed are required to be paid back under specified terms if the Project is commercially successful, but do not need to be repaid if the Project does not proceed. It may encourage developers to make efficient use of funds once a Project is underway. A soft-money approach allows for a high degree of oversight by the fund management.

The associated contingency-grant program would maintain a high degree of oversight and maximize the use of funds over time. The monitoring process maximizes the probability of success, in which case the funds will be reimbursed and will be available for complementary drilling works in the region.

In case of failure, the Fund Manager and the other organizations involved in the program having rights over the results of the works financed would be able to use them for further investigation. Failure is defined as the event in which an economically exploitable resource is not identified. As in the case of Bouillante II in Guadeloupe, it is recommended to define a practical measurement of failure and success. Three cases could be considered: total failure / partial failure / total success, corresponding to three different levels of expected profitability and three different levels of grant reimbursement.

The Bouillante II project consisted in the development of the geothermal site of Bouillante located in Guadeloupe. by drilling 3 new production holes to provide heat to a new power generation plant.

3 variants were considered according to the number of actually productive drillings:

- 10 MWe if the drillings produced the expected flows;
- 6 MWe if only 2 wells were successful;
- 3 MWe if only one well produced the requisite geothermal flow.

The second drilling would be realized only if the first was successful and the third only if the first and second produced the expected results.

The total amount was financed through a project-financing scheme except for the drilling costs, which were covered by subsidy, of which 75% constituted a contingency grant.

The contingency grant part was reimbursable totally/partially/not at all, depending on pre-established absolute pressure and temperature conditions.

The grant had to be reimbursed in the form of a unique payment calculated as described hereafter:

- if the flow was ≥ 78.8 t/h, at 6 bars of absolute pressure, the reimbursement was total;
- between 54 t/h and 78.8 t/h flow, at 6 bars of absolute pressure, the reimbursement was partial, calculated with the formula:

$$R = \text{Grant sum} \times \frac{[\text{flow (t/h)} \times 1.834] - 85.036}{(78.8\text{-}19.3)}$$

- between 33.3 t/h and 54 t/h flow, at 6 bars of absolute pressure, the reimbursement was a lump sum;

- between 19.3 t/h and 33.3 t/h flow, at 6 bars of absolute pressure, the reimbursement was partial, calculated with the formula:

$$R = \text{Grant sum} \times \frac{[\text{flow (t/h)} - 19.3}{(78.8\text{-}19.3)}$$

The grant reimbursement had to be made at least 34 months after the beginning of the first drill, which means after the commissioning of the plant. It was calculated as described hereafter:

- 20% upon submission of a copy of the main equipment or service orders corresponding to a minimum of 20 % of the drilling costs,

- 30% upon submission of the statement of at least 50% of the expenditures,

- 30 % upon submission of the statement of at least 80% of the expenditures,

- 15% upon submission of the 1st drilling execution report and the statement of at least 95% of the expenditures,

- the balance upon completion of a report on cashed out expenditures.

For the Geo-Caraïbes Project, a similar instrument can be used which takes into account the specific parameters of each geothermal field.

Grace period. A grace period for the repayment period would be necessary to avoid a heavy debt charge for Project sponsors. A two years time lapse between application approval and repayment could be considered.

Risk Reduction Financial Tool size. The Tool size depends on the number of potential projects and the amount of expenditures to be covered. The definitive size of the Tool would be based on the amount of drilling and appraisal phase investments considered, and the funds made available by the donors.

PDF-B Activities (Preliminary Design of Risk Reduction Financial Tool). *Consistent with the recommended structure of the Risk Reduction Financial Tool and the institutional arrangements for the Geo-Caraïbes Project, the Financial Advisory Team outlined the application arrangements and management structure of the Risk Reduction Financial Tool.*

Applications. Applications would be procured through the Coordination Task force as the Project Management Unit ("PMU")of the Geo Caraïbes facility, to be established The applications would contain comprehensive and detailed analysis of the Project status, including all preliminary data collected that would justify the proposed drilling phases.

Role of the Project Management Unit (CTF). The Project Management Unit would serve as an entry point for Project applications to Geo-Caraïbes. It would thus evaluate applications against criteria to be established by the CTF. It may provide technical support to public applicants during Project preparation to assist them in meeting Geo-Caraïbes eligibility criteria. It would provide an evaluation report on the overall Project application, including a possible drilling component for scrutiny by the Geothermal Advisory Panel.

(a) *Analytical factors.* The CTF would analyse the commercial and economic prospects with respect to a future geothermal power plant – assuming that the exploratory and/or appraisal phases are successful. This analysis would include the following aspects, on the basis of information provided in the application and/or improved through assistance of the CTF:

i. Electricity-sector analysis (sector policy, institutional set up, geothermal development strategy, power expansion planning, tariff policy and structure) investment and production cost analysis,
ii. Grid access: requirement and cost of additional transmission lines; institutional responsibility for such an investment and its subsequent operation;
iii. Financial and economic analysis; and
iv. Sensitivity analysis.

(b) *Funds.* The CTF would further establish whether or not the Project should be supported by the Tool from a sector political perspective and would perform a financial, economic and risk evaluation on the basis of corresponding reports of the Geothermal Advisory Panel. The CTF should closely coordinate the execution of these tasks with the Tool Manager and seek its approval regarding individual Terms of Reference, the selection of advisors, and all substantial reports. Eventually, the CTF would pass on its comprehensive Project assessment report including the Geothermal Advisory Panel's recommendation to the Tool Manager. The CTF should prepare a corresponding evaluation report on each individual Project, and the drilling component in particular, for approval by the Tool Management.

Role of the Geothermal Advisory Panel. The Geothermal Advisory Panel ("GAP")would be developed as a unit of the Geo-Caraïbes Facility. Among its roles would be the provision of a scientific and technical opinion to the CTF on whether a drilling program is worth undertaking considering the probability that the drilling will identify an exploitable geothermal resource. Its opinion will be a crucial element to be considered by the Tool management when deciding upon an application for the Financial Tool's support. The GAP should then monitor drilling execution by the sponsor and correspondingly provide appropriate scientific and technical advice to the Tool management. Finally, the GAP should provide technical judgment on possible default cases, with regard to the justification of the reimbursement claim and the appropriate amount thereof.

Role of the Tool Manager. The RRFT would be established at a Financial Institution, which would open a fiduciary account for this purpose. It would provide in-house Project management staff and administrative services and make use of external advisors. Fees paid by applying developers and revenues from cash flow management should cover these management services. As a preliminary task, the RRFT Manager would have to organize the Fund structure. It would:

i. Assess all legal and fiscal implications of the agreements to be signed with potential developers;
ii. Elaborate a template for Project applications to the RRFT; and
iii. Appoint external advisors as needed.

The financial conditions for managing such a Financial Tool would be defined by the Geo-Caraïbes Steering Committee in the framework of the Geo-Caraïbes Project. The RRFT Manager (advised by the Geothermal Advisory Panel) would approve, reject or request modifications to the funded work based on:

i. The extent to which the work proposed for funding is suitable to meet its immediate objectives; and
ii. The extent to which the broader program and the funded drilling component constitute a reasonable approach to exploration and development.

Modalities of the Risk Reduction Financial Tool. The developer should prepare his application according to a template to be elaborated by the RRFT Manager. Basically, it should comprise:

i. Details of the applicant and its major partners in the Project: corporate details, legal standing, financial standing, directors and advisors;
ii. Experience and track record: references in particular in regard to geothermal developments;
iii. Financial and technical feasibility studies or equivalent;
iv. Detailed drilling plan (decision tree, expected outcomes…);
v. Funding scheme (sources, mitigation, financing structure…);
vi. Other items to be defined by RRFT Manager.

G. LETTERS OF ENDORSEMENT

GOVERNMENT OF THE COMMONWEALTH OF DOMINICA

MINISTRY OF COMMUNICATIONS, WORKS AND HOUSING

Tel. (1-767) 448-2401 Ext. 3204
Fax. (1-767) 448-4807

Government Headquarters
Kennedy Avenue
Roseau
Commonwealth of Dominica
West Indies

16th June, 2003

Mr. Tom Hamlin
GEF Climate Change Task Manager
Division of Technology, Industry and Economics
United Nations Environmental Programme
39-43 Quai Andre Citroen
74739 Paris
FRANCE

Dear Mr. Hamlin,

Endorsement of the Eastern Caribbean Geothermal Development Project by Dominica

The Government of Dominica is firmly committed to achieving sustainability of the energy sector and to the promotion and development of renewable forms of energy. The objectives of this project are consistent with the aims and objectives of the National Sustainable Energy Plan and the energy policy currently being developed in Dominica.

To this end, the Government of Dominica is pleased to endorse the Eastern Caribbean Geothermal Development Project and looks forward to its successful implementation.

Sincerely,

.....
ELIUD T. WILLIAMS
PERMANENT SECRETARY

cc. Mr. Paul Brown, Director
Office of the OAS in Dominica

Mr. Lloyd Pascal
GEF Focal Point, Dominica

Permanent Secretary
Ministry of Agriculture & the Environment

ST CHRISTOPHER AND NEVIS
THE PLANNING UNIT
MINISTRY OF FINANCE, AND DEVELOPMENT AND PLANNING
P. O. BOX 186 • CHURCH STREET • BASSETERRE • ST KITTS
TELEPHONE: (869)465-2521 • FAX: (869)466-7398
E-mail: planningstk@caribsurf.com

To: Ms. Jan C. Vermeiren
Principal Specialist
Unit for Sustainable Development
E-mail: jvermeiren@oas.org
Tel: 202-458-3006

From: Mrs. Hilary Hazel
St. Kitts and Nevis GEF Operational Focal Point

Date: May 26, 2003

Subject: Eastern Caribbean Geothermal Development Project

With reference to the above mentioned project proposal, I am writing in my capacity of GEF Operational Focal Point for the Government of St. Kitts and Nevis.

The Government of St. Kitts and Nevis has reviewed the Eastern Caribbean Geothermal Development project draft concept proposal. We fully endorse this project and express our desire to cooperate with UNEP in the execution of the proposed project.

Sincerely,

Hilary Hazel
GEF Operational Focal Point for the Government of St. Kitts and Nevis

cc. Mr. Kenneth Parker
Director
OAS in St. Kitts and Nevis
E-mail: oassknkp@caribsurf.com
Tel: 869-465-2636

GOVERNMENT OF SAINT LUCIA

MINISTRY OF PHYSICAL DEVELOPMENT, ENVIRONMENT AND HOUSING

Graham Louisy
Administrative Building
P. O. Box 709
Waterfront
Castries, Saint Lucia
West Indies

7th May 2003

Tom Hamlin
GEF Climate Change Task Manager
Division of Technology Industry and Economics
United Nations Environmental Programme
39-43 Quai Andre Citroen
74739 Paris
FRANCE

Dear Mr. Hamlin

RE: SAINT LUCIA'S ENDORSEMENT OF THE EASTERN CARIBBEAN GEOTHERMAL DEVELOPMENT PROJECT

The Government of Saint Lucia is firmly committed to achieving sustainability of the energy sector and to the promotion and development of renewable forms of energy. To this end, the Government of Saint Lucia is pleased to give its endorsement of the Eastern Caribbean Geothermal Development Project. The objectives of this project are consistent with the aims and objectives of the National Sustainable Energy Plan and the energy policy currently being developed in Saint Lucia. The project will build upon the work currently being undertaken under the sustainable energy plan and should produce significant benefits for Saint Lucia.

The Government of Saint Lucia looks forward to the successful implementation of this project and to participating in the initiative.

Sincerely

MARTIN SAINEY
Permanent Secretary

cc: Richard Meganck, *Organisation of American States*