Cover Page for CTF Project/Program Approval Request[a]

1. **Country/Region**	Eastern Caribbean (Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines)		2. **CIF Project ID#**	(CIF AU will assign ID.)	
3. **Investment Plan (IP) or Dedicated Private Sector Program (DPSP)**	IP		4. **Public or Private**	Public	✓
	DPSP	✓		Private	
5. **Project/Program Title**	Sustainable Energy Facility (SEF) for the Eastern Caribbean				
6. **Is this a private sector program composed of sub-projects?**	Yes				
	No	✓[1]			

7. **Financial Products, Terms and Amounts**

Financial Product		**USD** (million)	**EUR** (million)[b]
Grant			
Fee on grant		0.95	
MPIS (for private sector only)			
Public sector loan	Harder terms		
	Softer terms		
Senior loan			
Senior loans in local currency hedged			
Subordinated debt / mezzanine instruments with income participation			
Second loss guarantees			
Equity			
Subordinated debt/mezzanine instruments with convertible features			
Convertible grants and contingent recovery grants		19.05	
Contingent recovery loans			
First loss guarantees			
Other (please specify)			
Total		20.00	

8. **Implementing MDB(s)**	Inter-American Development Bank (IDB)
9. **National Implementing Agency**	Caribbean Development Bank (CDB)
10. **MDB Focal Point**	Claudio Alatorre (calatorre@iadb.org)

[1] The Program will be composed of sub-projects. However, since there will be a single IDB approval, for the purposes of this cover page, it is considered as a single project.

11. **Brief Description of Project/Program (including objectives and expected outcomes)**[c]

Antigua and Barbuda (A&B), Dominica (DOM), Grenada (GRE), Saint Kitts and Nevis (SKN), Saint Lucia (SL), and Saint Vincent and the Grenadines (SVG), are 6 Small Island Developing States (SIDS) with small and isolated electricity markets located in the Eastern Caribbean. Between 75 to 100% of their electricity production is based on imported liquid fossil fuels and the average electricity tariff in 2013 was very high, at US$0.39 per kWh. Geothermal Energy (GE) is the largest locally available renewable energy (RE) resource and could provide the lowest electricity generation cost in addition to being the most reliable. To date there is however no operating GE plant in any of these six Eastern Caribbean countries (ECCs).

IDB has set up the Sustainable Energy Facility (SEF) for the Eastern Caribbean, which includes all six ECC. The objective of the SEF is to contribute to the diversification of the energy matrix in an effort to reduce the cost of power generation, as well as greenhouse gas (GHG) emissions and electricity tariffs. This should be achieved through the following components: (1) energy efficiency; (2) regulatory framework, institutional strengthening and capacity building; and (3) renewable energy. This third component includes support for Geothermal Energy (GE) projects through the GeoSmart Facility, a facility proposed by the Caribbean Development Bank (CDB) to catalyze the development of GE projects at different stages with grant and concessional funding. *CTF funding is only requested to provide contingent grants for full-scale geothermal exploration drilling for the GE projects* (the "Program").

The CTF Trust-Fund Committee approved in June 2014 the DPSP Phase II program concepts and requested the MDBs to proceed to develop sub-programs and projects within CIF countries. Out of the six countries included in SEF, four (DOM, GRE, SL, and SDV) are CIF (PPCR) pilot countries, while two (A&B and SKN) are not. SKN will be included in the Program (the country is now on track to develop a 10 to 15 MW power plant, and is exploring a 25 MW second phase). A&B does not have geothermal potential and therefore will not receive CTF funding.

The rationale for including SKN in the proposal is as follows: The SEF has been set up on a regional basis in order achieve economies of scale, foster regional cooperation, and minimize transactional costs. The IDB has been working with the CDB to promote social and economic development in the Eastern Caribbean since 1978 (and since 2009 in several energy initiatives), and in every one of these initiatives, all six ECCs have been included as beneficiaries.

The program is classified as public as it will be implemented by the public sector arm of the IDB. However the program targets Public Private Partnership (PPP) projects.

The expected outcome of the Program are:

1. 60MW of geothermal power generation capacity installed;
2. GHG emission reductions of 338,421 tCO_2e/year and 10,152,000 tCO_2e during the lifetime of the Program;
3. Reduction of 722 thousand barrels of oil imported for electricity generation;
4. USD 50.5 million reduced spending on oil imports;
5. Average decrease in tariffs from USD 0.33/kWh in 2015 (at a fuel price of USD 70 per barrel) to USD 0.27/kWh

The IDB is requesting a grant of USD 950,000, which will be used mainly to support the CDB in the implementation of the Program through highly specialized consultants and other technical assistance activities. For procedural reasons, this amount is requested as *fee* (equal to 5% of the contingent grant amount) instead of *grant*.	
12. **Consistency with CTF investment criteria**[c]	
(1) Potential GHG emissions savings	338,421 tons CO_2e/year and 10,152,000 tons CO_2e during the lifetime of the Program
(2) Cost-effectiveness	The cost effectiveness of CTF investments is 0.51 tons CO_2e/USD. This corresponds to abatement costs of 2.0 USD/ton CO_2e of CTF resources.
(3) Demonstration potential at scale	In addition to the GE development that will be supported by the Program in GRE, SKN and SVG (10 MW each), the ECCs have the potential to develop an additional capacity of 30 MW (10 MW in DOM and 20 MW in SLU). Depending on the results of exploration in SVG, if successful, more GE could be developed to export electricity to Barbados. In SKN the Program also has the potential to scale up to a second phase, to add additional 25MW in order to supply St Kitts from Nevis through a subsea cable. SKN could also develop more GE to export to the neighboring islands (Saba and Montserrat). The successful implementation of the GeoSmart Facility will generate a wealth of experience that can be shared through south-south cooperation between SIDS from the Caribbean and the Pacific. Facing similar conditions and barriers, the Pacific islands have an important untapped geothermal resource potential, in particular Papua New Guinea, Vanuatu, Samoa, Tonga, N. Marianas Islands. Fiji, Solomon Islands and New Caledonia.
(4) Development impact	The Program will have the following impact: - Reduction of 722 thousand barrels of oil imported for electricity generation; - USD 50.5million reduced spending on oil imports (at a fuel price of USD 70 per barrel); - Average decrease in electricity tariffs from USD 0.33/kWh in 2015 (at a fuel price of USD 70 per barrel) to USD 0.27/kWh - 120 construction, 51 operation and maintenance jobs created - 30% of women employed in construction and plant O&M - 35% of women who participate in consultations
(5) Implementation potential	The implementation potential for the Program is good due to several reasons: (a) Surface studies have already been completed and show good potential for plant development; (b) funding is available from several donors covering most of the project development stages; and c) Public Private Partnership structures for project development have already been set up with local governments.

	PPP are relatively new in the Caribbean and both the CDB and country governments have a limited track record structuring and financing this type of projects and sub loans. In order to ensure an effective execution of the SEF, the program will provide through Component 2 the transfer of technical expertise to develop local competencies, as well as the availability of specific training and advisory services as required by the CDB and the governments. Resources from Component 2 will be used for the financing of non-reimbursable technical assistance to the CDB, and to the ECC governments, including the ministries responsible for energy and the power utilities. Support to the CDB will focus on strengthening its capacity as required to implement the program, including: (i) consulting services to provide specific skills and advisory services when required for sub-project preparation; (ii) drafting of legal documents (i.e. loan contracts for GE sub-loans); and (iii) further developing staff capacity to evaluate and execute sub-loans. Support to the ECC governments will include: (i) supporting an effective legal, policy and regulatory framework for the implementation of SE projects; (ii) strengthening their technical, institutional, environmental and regulatory capacity; (iii) providing transaction advisory support to structure projects and negotiate with private partners; and (iv) offering opportunities for training to acquire the necessary skills to enable SE development and execute SE projects. In fact, the CDB will retain an expert consulting firm that will support the CDB to assess, appraise, design and develop at least the first of the GE PPP sub-loans through the entire CDB's project cycle. The firm will also advise in terms of sourcing of the required staff as needed, and identifying training requirements, with emphasis on PPP contracts for GE developers. In addition to this, the CDB, in cooperation with its development partners, including the IDB and its Multilateral Investment Fund, has established a US$1.2 million regional PPP support program designed to assist its borrowing member countries in the development and implementation of PPP. In accordance with Directive B.13 of the IDB's Environment and Safeguards Compliance Policy (OP-703), the program is classified as a Financial Intermediary (FI) and as such this operation is not categorized according to its potential environmental and social impacts and risks. However, GE sub projects present the potential for significant E&S risks. Due to the high risk nature of these sub-projects, the Bank will engage the CDB in a "hand-in-hand" E&S due diligence process on each Category A project, and on all geothermal sub-projects, providing final sign off and closely monitoring project implementation with the support of an external consultant.

(6) Additional costs and risk premium	Geothermal resource risks are perceived as significant by lenders during the exploratory and production drilling stages, significantly limiting debt financing to a) corporate lending backed by a strong balance sheet, or b) concessional financing by public sector development banks or bi/multilateral donors. When project debt financing is not available, and sponsors need to finance this stage with equity, the cost of capital is often times prohibitive (especially in small markets like the ECCs). CTF resources would provide the missing financing; this financing is not available from other lenders and is critically needed to a) allow sponsors to achieve a certain measure of risk-sharing, and reduce the amount of additional capital at risk required before commercial debt is available, and b) leverage sponsors equity and enhance the economics of projects, in order to achieve a competitive LCOE.
Additional CTF investment criteria for private sector projects/ programs	
(7) Financial sustainability	
(8) Effective utilization of concessional finance	
(9) Mitigation of market distortions	
(10) Risks	

13. **For DPSP projects/programs in non-CTF countries, explain consistency with FIP, PPCR, or SREP Investment Criteria and/or national energy policy and strategy**

In 2012, the representative of the Alliance of Small Island States (AOSIS), issued the Barbados Declaration on Achieving Sustainable Energy for All, in which among others the countries expressed their concern that "[…] most SIDS are highly dependent on imported oil and other fossil fuels for transport and electricity generation and this is a major source of economic vulnerability for SIDS. This leaves SIDS highly exposed to oil-price volatility. The increasing cost of imported fossil fuels represent a major impediment to the achievement of sustainable development and poverty eradication in SIDS as scarce financial resources are diverted from efforts to promote social and economic development and ensure environmental protection. Furthermore, many remote and rural SIDS communities have little or no access to modern and affordable energy services." It also underscored that "while SIDS contribute the least to global emissions and have limited human, financial and technical resources, our nations continue to take significant actions towards the reduction of our own emissions including through regional and inter-regional energy initiatives as our contribution to resolving global climate change and as a demonstration of our moral leadership in the fight against climate change."

In the framework of this declaration the SIDS adopted voluntary commitment to transform their energy matrix, in particular GRE and SVG:

- GRE: "Grenada is committed to a transition to a low carbon development path through increasing the efficiency of energy usage and the further deployment of indigenous sources of renewable energy. Grenada voluntarily commits to a minimum target of reducing its total GHG emissions by 20% below Business As Usual by 2020."
- SVG: "(i) Reduce projected increase in peak demand by 5% by 2015 and 10% by 2010 an strive to reduce power losses down to a total of 7% by 2015 and 5% by 2020; (ii) Deliver 30% of projected total electricity output from Renewable Energy Sources (RES) by 2015 and 60% by 2020; (iii) Increase energy security and diversify the energy portfolio; (iv) Reduce projected consumption of fossil fuels in the transport sector by 10% by 2015 and 15 % by 2020; and (v) Reduce projected electricity generation by 5% by 2012 and 15% by 2020."

This Program will contribute to the achievement of these objectives. It is also in line with Caribbean Community Secretariat (CARICOM's) Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS) framework, which is part of the Regional Energy Policy establishing targets for the contribution of RE to total electricity generation. The ministers of Energy of CARICOMs member states approved it in March 2013.

Moreover, the Program will contribute to the implementation of the national energy policy of GRE, SKN and SVG and the development of geothermal resource bills. SKN is the only country in the ECCs which has already adopted the Geothermal Resource Development ordinance.

14. **Stakeholder Engagement**[c]

IDB and CDB will require that all beneficiary countries will need to develop multistakeholder engagement plans and consultations. Nevis and Dominica already performed mulitstakeholder engagements. Saint Vincent and the Grenadines implemented multistakeholder meetings on July 15-July 19 2015. All other countries will need to comply at the relevant project development stage.

15. **Gender Considerations**[c]

The Program will incorporate in its components elements which will contribute to the achievement of the first strategic gender objective in the Implementation Guidelines for the Operational Policy on Gender Equality in Development that is empowering women economically by facilitating women's access to economic opportunities and promoting women's entrepreneurship.

The Program will promote gender equality in hiring. The companies will be encouraged to adopt practices such as hiring under equal conditions, review of hiring requirements to detect criteria that potentially exclude women, and the possibility of setting targets related to women participation. Besides, the project will promote the inclusion of local women in training activities for the construction, operation and maintenance work that does not require specific qualifications.

When possible the project will support a shift from the informal to the formal sector for women's businesses that provide services such as cleaning, food services, textile production for uniforms, etc. to the geothermal facility. To secure the working environment of women employed in the plant there will be exclusive bathrooms for women, and appropriate uniforms for females. The companies will promote an environment free form sexual harassment in which this type of attitude and behavior is prevented, and where conflict reporting and resolution are facilitated (please see also Annex 5).

16. **Indicators and Targets**		
Project/Program Timeline		
Expected start date of implementation[d]		June 2016
Expected end date of implementation[d]		June 2024
Expected investment lifetime in years (for estimating lifetime targets)		30
Core Indicators		**Targets**[e]
GHG emissions reduced or avoided over lifetime (tons of CO_2-eq)		10,152,000
Annual GHG emissions reduced or avoided (tons of CO_2-eq/year) (specify: upon completion of the project/program / on the maximum year / on a representative year)	Once projects are in operation	338,421
Installed capacity of renewable energy (MW)		60
Number of additional passengers using low-carbon transport per day		
Energy savings cumulative over lifetime of investment (MWh)		
Annual energy savings (MWh/year) (specify: upon completion of the project/program / on the maximum year / on a representative year)		
Identify relevant development impact indicator(s)		**Targets**
Decrease in electricity tariffs		USD 0.06/kWh
Reduction in oil imports		USD 50.5 million
Jobs		171 (30% women)
Number of wells drilled with CTF funding		2

17. **Co-financing**		
	Please specify as appropriate	Amount (in million USD)
MDB 1	IDB	20
MDB 2 (if any)		
Government		
Private Sector		407
Bilateral	JICA	41
Others	GEF	3
	CDB	39.2
Total		510.2

18. **Expected Date of MDB Approval**
November 2015

NOTES:

[a] This cover page is to be completed and submitted together with the MDB project/program proposal when requesting CTF funding approval by the Trust Fund Committee.

[b] For products denominated in EUR, please also provide USD equivalent in the column to the left

[c] Please provide the information in the cover page or indicate page/section numbers in the accompanying project/program proposal where such information can be found.

[d] Insert "not applicable" (N/A) if dates cannot be determined at the time of submission (e.g. private sector programs)

[e] Insert value N/A if indicator is not applicable to the project/program.

Version December 9, 2014

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

REGIONAL

SUSTAINABLE ENERGY FACILITY (SEF) FOR THE EASTERN CARIBBEAN

(RG-L1071)

AND

CLEAN TECHNOLOGY FUND (CTF) INVESTMENT GRANT FOR THE SUSTAINABLE ENERGY FACILITY (SEF) FOR THE EASTERN CARIBBEAN

(RG-G1009)

AND

GLOBAL ENVIRONMENT FACILITY (GEF) INVESTMENT GRANT FOR THE SUSTAINABLE ENERGY FACILITY (SEF) FOR THE EASTERN CARIBBEAN

(RG-G1004)

PROPOSAL FOR OPERATION DEVELOPMENT

This document was prepared by the project team consisting of: Christiaan Gischler (INE/ENE), Project Team Leader; Jaiwattie Anganu (CMF/CJA), Alternate Team Leader; Emilio Sawada (INE/CUR); Adriana Valencia, Shohei Tada, Camila Gonzalez, Stephanie Suber, and Wilkferg Vanegas (INE/ENE); Maria Florencia Attademo (IFD/CMF); Maria Isabel Haro (IFD/CMF); Claudio Alatorre, Mateo Salomon and Christoph Tagwerker (INE/CCS); Betina Hennig (LEG/SGO); Colin McKee and Genevieve Beaulac (VPS/ESG); Jacob Veverka (INE/TSP); Seth Stevens Colby (VPP/VPP); Paloma Marcos (SCL/GDI); Lesley Cassar (CCB/CCB); Christel Saab (CCB/CBA); Denise Salabie (FMP/CBA); Roy Parahoo (FMP/CBA); Maria Camila Padilla (FMP/CBA); Camilo Osorio (CCB/CBA); and Rochelle Franklin (CCB/CBA).

CONTENTS

LIST OF ANNEXES

ABBREVIATIONS

A&B	Antigua and Barbuda
AFS	Audited Financial Statements
CDB	Caribbean Development Bank
CORE	Co-financing Mechanism for Renewable Energy and Energy Efficiency
CTF	Clean Technology Fund
DOM	Dominica
DPSP	Dedicated Private Sector Program
EA	Executing Agency
ECC	Eastern Caribbean Countries
ECERA	Eastern Caribbean Energy Regulatory Authority
EE	Energy Efficiency
EIA	U.S. Energy Information Administration
EIRR	Economic Internal Rate of Return
ENPV	Economic Net Present Value
ESA	Electricity Supply Acts
E&S	Environmental and Social
ESIA	Environmental and Social Impact Assessment
ESMR	Environmental and Social Management Report
FI	Financial Intermediary
GCI-9	Ninth General Increase in the Resources of the Inter-American Development Bank
GCF	Green Climate Fund
GCL	Global Credit Loan
GDP	Gross Domestic Product
GE	Geothermal Energy
GEF	Global Environment Facility
GRE	Grenada
IFC	International Finance Corporation
IPP	Independent Power Producers
IRENA	International Renewable Energy Agency
JICA	Japan International Cooperation Agency
LCOE	Levelized Cost of Energy
OECS	Organization of Eastern Caribbean States
OC	Ordinary Capital
OCR	Ordinary Capital Resources
OM	Operating Manual
OSF	Other Special Funds
PBL	Policy-Based Loans
PCR	Project Completion Report
PPA	Power Purchase Agreement
PPP	Public Private Partnerships
PV	Photovoltaics
RE	Renewable Energy
SEF	Sustainable Energy Facility
SE	Sustainable Energy
SFR	Special Funds Resources
SKN	Saint Kitts and Nevis
SL	Saint Lucia
SSF	Safeguard and Screening Form for Screening and Classification of Projects
SVG	Saint Vincent and the Grenadines
SWH	Solar Water Heaters
USA	United States of America
US	United States
WB	World Bank

PROJECT SUMMARY
REGIONAL
SUSTAINABLE ENERGY FACILITY (SEF) FOR THE EASTERN CARIBBEAN
(RG-L1071, RG-G1009, RG-G1004)

<table>
<tr><th colspan="5">Financial Terms and Conditions</th></tr>
<tr><td colspan="5">Borrower and Executing Agency: Caribbean Development Bank (CDB)</td></tr>
<tr><th>Source</th><th>Amount (US$)</th><th>%</th><th colspan="2">Terms and conditions</th></tr>
<tr><td rowspan="8">IDB Ordinary Capital (OC) (RG-L1071)</td><td rowspan="8">20,000,000</td><td rowspan="8">28</td><td colspan="2">Flexible Financing Facility[a]</td></tr>
<tr><td>Amortization Period:</td><td>22 years</td></tr>
<tr><td>Original WAL:</td><td>15.25 years</td></tr>
<tr><td>Disbursement Period:</td><td>8 years</td></tr>
<tr><td>Grace Period:</td><td>8.5 years</td></tr>
<tr><td>Supervision and Inspection Fee:</td><td>[b]</td></tr>
<tr><td>Interest rate:</td><td>Libor-BASED</td></tr>
<tr><td>Credit Fee:</td><td>[b]</td></tr>
<tr><td>Currency of Approval:</td><td>United States dollars (US$) chargeable to the OC</td></tr>
<tr><td rowspan="2">CTF (Grant)[1] (RG-G1009)</td><td rowspan="2">20,000,000</td><td rowspan="2">28</td><td colspan="2">CTF Investment Grant</td></tr>
<tr><td>Currency of Approval:</td><td>United States dollars (US$)</td></tr>
<tr><td rowspan="2">GEF (Grant)[2] (RG-G1004)</td><td rowspan="2">3,013,698</td><td rowspan="2">4</td><td colspan="2">GEF Grant</td></tr>
<tr><td>Currency of Approval:</td><td>United States dollars (US$)</td></tr>
<tr><td>CDB counterpart:</td><td>29,200,000</td><td>40</td><td colspan="2"></td></tr>
<tr><td>Total:</td><td>71,263,698</td><td>100</td><td colspan="2"></td></tr>
<tr><td colspan="5">Parallel financing:</td></tr>
<tr><td>JICA (loan)</td><td colspan="2">40,000,000</td><td>JICA (grant)</td><td>1,000,000</td></tr>
<tr><td colspan="3">Total Parallel financing:</td><td colspan="2">41,000,000</td></tr>
<tr><th colspan="5">Project at a Glance</th></tr>
<tr><td colspan="5">Project objective/description: The objective of the Sustainable Energy Facility (SEF) for the Eastern Caribbean (the Program) is to contribute to the diversification of the energy matrix in the Eastern Caribbean Countries (ECC) in an effort to reduce the cost of power generation and electricity tariffs by promoting the implementation of Energy Efficiency (EE) and Renewable Energy (RE) technologies to reduce the region's dependency on liquid fossil fuels (¶1.22). To that end, the program contemplates the financing of the following components: (i) Energy Efficiency (EE); (ii) Regulatory framework, institutional strengthening and capacity building; and (iii) Renewable Energy.</td></tr>
<tr><td colspan="5">Special contractual condition prior to the first disbursement: that the Borrower presents evidence that (i) the Operating Manual (OM), including the Credit Regulations of the program and the sub-loan/grant model agreements, has been approved, in accordance with the terms and conditions previously agreed upon between the CDB and the Bank (¶3.5).

Special conditions prior to execution: (i) that the Program Manager and Technical Specialist, whose functions and responsibilities will be defined in the OM, have been appointed to the Project Management Unit (PMU) within the CDB (¶3.2); and (ii) that the Borrower presents evidence, before starting the execution of the activities of Component 3, that an expert consulting firm has been contracted to support the Borrower to assess, appraise, design and develop at least the first one of the GE PPP sub-projects (¶2.11).</td></tr>
</table>

[1] The availability of these resources will be subject to its approval by the CTF Trust Fund Committee (TFC).
[2] The availability of these resources will be subject to its approval by the GEF Secretariat.

Exceptions to Bank policies: An exception to Bank's current procurement policies set forth in documents GN-2349-9 and GN-2350-9 is requested for approval by the Board of Executive Directors so that works, goods and services providers from CDB member countries, which are not members of the IDB, may participate in the procurement processes for activities to be financed with resources of or administered by the Bank (¶3.6).									
The project qualifies for[(c)]:	SV	☑	PE	☐	CC	☑	CI	☑	

(a) Under the Flexible Financing Facility (FN-655-1), the borrower has the option to request modifications to the amortization schedule as well as currency and interest rate conversions. In considering such requests, the Bank will take into account operational and risk management considerations.

(b) The credit fee and inspection and supervision fee will be established periodically by the Board of Executive Directors during its review of the Bank's lending charges, in accordance with the relevant policies.

(c) SV (Small and Vulnerable Countries), PE (Poverty Reduction and Equity Enhancement), CC (Climate Change, Sustainable Energy and Environmental Sustainability), CI (Regional Cooperation and Integration).

I. DESCRIPTION AND RESULTS MONITORING

A. Background, Problem Addressed, Justification

1.1 The independent Eastern Caribbean countries (ECC), Antigua and Barbuda (A&B), Dominica (DOM), Grenada (GRE), Saint Kitts and Nevis (SKN), Saint Lucia (SL), and Saint Vincent and the Grenadines (SVG), are 6 island states with small and isolated electricity markets. The fact that these countries have small and isolated grids, lack the scale necessary to import cheaper fossil fuels, such as natural gas, and have not yet fully developed their Renewable Energy (RE) endowments, makes them dependent on costly imported liquid fossil fuels for electricity generation and results in high electricity costs.

1.2 Electricity tariffs in the ECC are indexed to fuel prices, or include a fuel surcharge with a direct pass through to end consumers. Hence, customers often see high electricity tariffs and high volatility in their monthly bills. In 2013, the average electricity tariff was US$0.39/kWh (with lower oil prices of US$70/barrel the tariff is estimated at US$0.33/kWh). By comparison, in the State of Florida in the United States of America (USA), the average tariff was US$0.11/kWh.[1] On average, in 2014 the fuel cost represented 53% of the total cost to end users.

1.3 **Fiscal implications of liquid fossil fuel dependency**. Ever since the first oil shock of 1973, oil dependence has become a heavy burden on the ECC economies. High electricity prices both hinder economic growth, and a high public sector energy bill drains public resources that could be used to provide more social services. Governments in the region face fiscal constraints partly due to their fossil fuel import bills. As presented in Table 1, oil imports as a percentage of Gross Domestic Product (GDP) exceed 7% for all ECC. Limited borrowing capacity as implied by the Debt-to-GDP ratios averaging 86% limits the governments' ability to invest in Sustainable Energy (SE) technologies thus perpetuating dependency on imported fossil fuels and its tightening effect on fiscal space.

Table 1. Key Information on the Energy Sector in the Eastern Caribbean

Country /island	Average Tariff (US$/kWh)		Oil Imports as a % of GDP	Fossil Fuel Imports (US$ Million)	Debt to GDP ratio
	2013	2014			
A&B	0.44	0.42	12% (2012)	150 (2012)	98.7% (2015)
DOM	0.41	0.36	7% (2012)	41.5 (2012)	73.7% (2013)
GRE	0.40	0.37	10% (2012)	101.1 (2012)	105.5% (2014)
SL	0.37	0.32	9% (2011)	116 (2011)	84.8% (2013)
St. Kitts	0.35	0.32	9% (2010)	22.6 (2010)	80.0% (2015)
Nevis	0.37	0.32			
SVG	0.36	0.34	11% (2011)	91 (2011)	74.7% (2013)

1.4 **Eastern Caribbean power sector overview**. All countries[2] except for SKN have one vertically integrated electricity utility, responsible for generation,

[1] Castalia (2014). Caribbean Regional Energy Integration Assessment: Scenarios and Opportunities.
[2] In the case of A&B, the utility also manages the production and distribution of potable water and wastewater treatment. Water pumping and production is the highest consumption of energy in A&B.

transmission, and distribution of electricity. In SKN, two vertically integrated electricity utilities are responsible for generation, transmission, and distribution of electricity, one on St Kitts and another on the island of Nevis. DOM, GRE, and SL have privately owned utilities while utilities in SVG, A&B, and SKN are entirely state-owned (see Table 2).

1.5 Fossil fuel based power generation units in the ECC have been in operation on average for over 13 years, power service is reliable, the ECC have almost reached universal electricity access,[3] and in general, electricity tariffs reflect the full cost of service.[4] There are no fossil fuel sources available domestically in any of the 6 ECC. Although Independent Power Producers (IPP) are allowed to generate electricity to sell to the utility, the only RE IPP in operation is the Nevis wind farm with 2.2MW of installed capacity. Utilities have relatively small customer bases, which do not allow for larger and more cost-effective power generation plants that use other fuels.

Table 2. Key Information on the Energy Sector in the ECC

Country /Island	Utility	Government Ownership (%)	Peak/ Baseload Demand[5] (MW)	Installed Generation Capacity (MW)	Genera-tion Capacity from RE (%)	Average Fuel Cost (US$/kWh sold) (2013)
A&B	APUA	100%	49.2/25	83	0%	NA
DOM	DOMLEC	21%	16.8/8	26.7	25%	0.18
GRE	GRENLEC	21.6%	29.2/15	48.6	1%	0.22
SL	LUCELEC	45.4%	59.7/30	86.2	0%	0.22
St. Kitts	SKELEC	100%	24.0/12	43.0	0.05%	NA
Nevis	NEVLEC	100%	9.3/4.5	13.9	20%	NA
SVG	VINLEC	100%	25.7/13	51.4	10%	0.20

1.6 **Legal and regulatory framework**. The electricity sectors of all ECC are governed by the Electricity Supply Acts (ESA).[6] The ESA establish the structure of the electricity sector, regulate the sector, and either grant licenses to the vertically integrated utility or create the legal framework necessary for the ministry responsible for energy to do so. The ESA also establish the price setting mechanism that is used to determine electricity tariffs.

1.7 **Regulation of the electricity sectors varies between countries**. DOM, GRE and SKN have legislation that mandates creating an independent regulator for the electricity sector. Despite this, only DOM has appointed an independent regulator as yet. GRE and SKN have assigned regulatory functions among different government agencies. In SL and SVG regulation is established by statute in the ESA and regulatory functions are spread among various government agencies. The World Bank (WB) sponsored the Eastern Caribbean

[3] The ECC's coverage rates are the following: SL 96% (2013), Saint Kitts 95% (2012), Nevis 95% (2012), GRE 99.5% (2013), SVG 99% (2011), Dominica 91.2% (2011), and A&B 88.2% (2010).
[4] Except in the case of SKN.
[5] Baseload demand is assumed to be approximately half of the peak load.
[6] The only exception to this is SKN, where the electricity sectors in each island are governed by separate laws and tariffs are set by the Governor General in Saint Kitts and by NEVLEC in Nevis.

Energy Regulatory Authority (ECERA) project was planning to have one regional regulator for the Eastern Caribbean region. Currently, the ECERA fulfills the function of an advisory agency housed at the headquarters of the Organization of Eastern Caribbean States (OECS) Commission in SL.

1.8 In some countries, there is one ministry that is responsible for policymaking and oversight in the electricity sector. An example of this is in GRE where the Ministry of Finance, Planning, Economic Development, Trade, Energy and Cooperatives oversees the electric utility and also develops policies for expanding RE use. In the case of SVG, the Ministry of Transport and Works is the main body responsible for overseeing the electricity sector, but regulatory functions are spread across five other governmental bodies.

1.9 The ECC have taken steps to improve their governance frameworks to promote the adoption of RE for power generation. However, significant work and changes are required for the successful implementation of RE in general and Geothermal Energy (GE) in particular. Most of the countries lack laws and regulations governing the exploration and development of geothermal resources. Only Nevis has passed legislation that defines what a geothermal resource is and who owns it, and sets out the process for assigning rights to explore and exploit it. The rest of the countries are working to prepare geothermal resource development bills which are currently at different stages of seeking parliamentary approval.

1.10 **SE potential**. All of the ECC have available SE resources that could offset liquid fossil fuel generation and hence create financial savings. SE means economically viable RE and Energy Efficiency (EE) projects that displace fossil fuel-based electricity. Adoption of EE technologies[7] and measures could not only reduce consumption through demand-side management but also optimize power generation at the supply side. EE can generate financial savings for end consumers and reduce electricity bills for governments while improving countries' fiscal situation due to reduced oil imports for power generation. Increasing EE is part of the ECC government's strategies for the energy sector and small scale projects have been implemented (i.e. replacement of 280,000 incandescent light bulbs with compact fluorescent light bulbs in Dominica). However, data on the rate of adoption of EE technologies in the region is scarce. Additional investments are required to roll-out EE measures across all ECC and to further develop laws and regulation that promote EE adoption. RE can provide alternative sources of power generation that are both more cost-effective and less harmful for the environment than diesel and heavy fuel oil power generation.

1.11 Figure 1 shows the technologies that can be developed to seize the region's SE potential. The figure shows the amount of barrels of oil that each technology would displace (vertical axis) and their all-in cost or Levelized Cost of Energy (LCOE)[8] (horizontal axis). The size of the bubbles shows the potential of the technology in terms of Megawatts (MW) of potential installed capacity and the

[7] The key EE technologies for the ECC can be divided into the following groups: (i) lighting; (ii) air conditioning; (iii) refrigeration; (iv) mechanical applications; (v) solar water heating; and (vi) other efficient appliances.

[8] The LCOE is a way to compare the all in cost of any energy technology, including capital cost, operation, maintenance, and decommissioning during its lifetime.

color indicates whether it is baseload,[9] intermittent energy or EE. The graph shows that GE, a baseload energy with more than 90% capacity factor, the lowest LCOE (around US$0.10/kWh), the largest potential displacement of oil barrels (more than 2 million barrels) and the largest estimated installed capacity potential (over 160MW), is the largest available RE resource for the ECC (except A&B) with the possibility in some cases of exporting[10] power to neighboring islands via undersea cables.

1.12 Also in Figure 1, EE appears to be the second technology/measure that has similar LCOE than GE, but with lower oil displacement and installed capacity potential (equivalent to 35MW). The main EE technologies with highest potential in this region are: (i) Solar Water Heaters (SWH)[11] which would replace electric water heaters; (ii) light-emitting diode (LED) technology, and other efficient lighting for replacing high pressure sodium streetlights (and other standard technologies); and (iii) EE appliances, like efficient air conditioning. Table 3 shows the estimated investment requirements for EE and RE in the ECC and Table 4 presents the estimated investment requirements for GE by stage of development.

Table 3: Estimated Investment requirements for EE and RE in the ECC (in US$ Million)

Country	EE			RE				
	Solar water heating	Streetlights and building retrofits	Total EE	Solar PV	Wind	Hydro	GE	Total RE
SL	8.0	7.7	**15.7**	26.0	20.0	-	168.3	**214.3**
SVG	5.0	4.8	**9.8**	15.6	10.0	18.0	96.3	**139.9**
GRE	5.9	5.7	**11.6**	13.0	7.5	-	102.3	**122.8**
SKN	2.8	2.7	**5.4**	10.4	10.0	-	92.1	**112.5**
DOM	4.2	4.0	**8.3**	7.8	-	-	67.0	**74.8**
A&B	3.9	3.7	**7.6**	26.0	12.5	-	-	**38.5**
Total	**29.8**	**28.6**	**58.4**	**98.8**	**60.0**	**18.00**	**526.0**	**702.8**

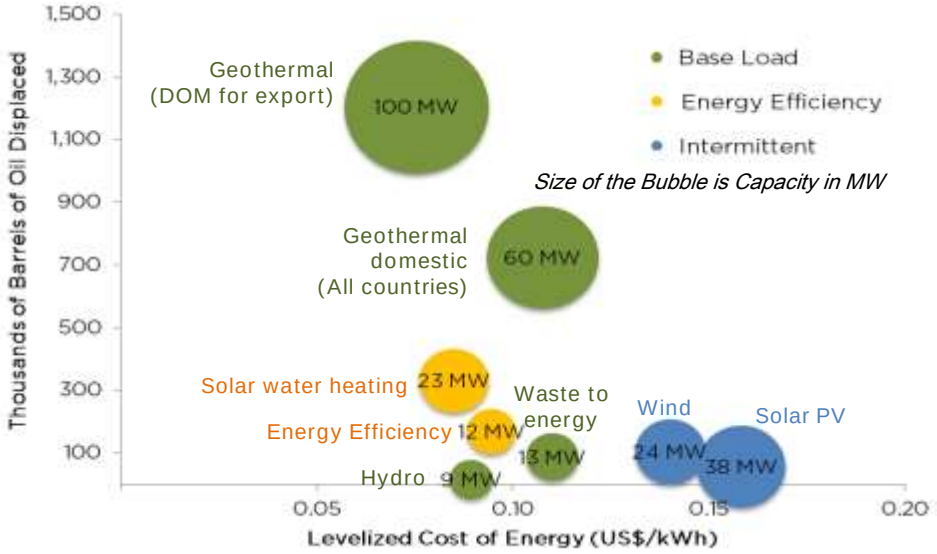
Table 4: Estimated total investment required for GE in the ECC by stage of project development (in US$ Million)

Country	Stage 1a: Pre-Invest-ment	Stage 1b: Pre-investment	Stage 2: Exploration	Stage 3: Field Development		T&D and Access Roads	Total
	(Studies)	(Slim hole drillings)	(Full scale drillings)	(Production /re-injection wells)	(Plant)		
SL	(done)	6	14	42	90	16.3	**168.3**
SVG	(done)	(skip)	14	21	45	16.3	**96.3**
GRE	(done)	6	14	21	45	16.3	**102.3**
SKN	(done)	(done)	14	21	45	12.1	**92.1**
DOM	(done)	(done)	(done)	7	45	15.0	**67.0**

[9] Baseload energy is the power that can be produced 24 hours per day and 7 days a week without interruption.
[10] Nevis could be connected to St Kitts, Dominica to Guadeloupe, and Dominica to Martinique with a 5km, 70km and 100km undersea cable respectively.
[11] Barbados, also located in the Eastern Caribbean, has over 35% penetration of SWH, saving more than 50MW equivalent over 20 years.

Total	**0**	**12**	**56**	**112**	**270**	**80.2**	**526.0**

Figure 1. SE Alternatives for the ECC[12]



1.13 The potential for RE, however, remains largely unrealized in the ECC. Apart from some hydro power (25% of installed in DOM and 16-20% of gross generation in SVG in 2013), electric utilities in these countries use diesel or fuel oil generators. The main barriers to SE in the ECC are: (i) high capital costs; (ii) lack of access to capital at appropriate terms; (iii) inadequate legislative, regulatory and policy frameworks; (iv) limited fiscal space for governments to acquire new public debt; (v) insufficient specialized technical skills; (vi) lack of economies of scale given the relative small size and isolation of electricity markets in the ECC; and (vii) RE resource risk (especially in GE).

1.14 **Lessons learned from international experience**. A shift towards SE through increased use of RE and increased EE has demonstrated potential for meeting energy challenges such as high electricity cost and overdependence on imported fossil fuels. Lessons learned from current and previous EE initiatives supported by IDB (i.e. 2485/OC-BA and 2748/OC-BA) point to the potential of leveraging more private sector capital in support of EE through performance based contracts. Performance based contract models for EE and RE retrofits will be included in the OM making this knowledge available to SEF sub-projects. To date, 164 countries have set targets related to RE penetration in their energy systems,[13] and countries, cities and corporations globally have committed to double the rate of global EE by 2030.[14] International experience indicates that the existence of an enabling legal and regulatory framework for SE, private investment, international cooperation and the availability of sources of appropriate financing are essential for global investment in RE and EE. Among

[12] The information to prepare Figure 1 was obtained from the report Strategy for Developing Geothermal Potential through Public-Private Partnerships in the Eastern Caribbean, prepared by Castalia Advisors Inc. (Annex 13).
[13] United Nations Climate Change Newsroom.
[14] At the UN Secretary General's Climate Summit in 2014.

RE solutions, GE development in particular necessitates significant public sector support to move forward. The factors that enabled GE development in countries such as El Salvador, Costa Rica, Nicaragua, Kenya, US,[15] Iceland[16] and Guadaloupe[17] were analyzed and lessons were extracted to as part of the design of the SEF. The main factors are: (i) the existence of high quality GE resources; (ii) availability of grant support and risk mitigation mechanisms for exploratory activities; (iii) strong government commitment to develop GE; (iv) an enabling legal and regulatory framework that sets incentives to develop RE technologies and provides clear rules for the development of geothermal resources; and (v) development of early geothermal projects by government-owned agencies with support of international donors.

1.15 **Proposed Intervention**. The proposed Sustainable Energy Facility (SEF) for the Eastern Caribbean (the "program" or "SEF") will be financed through a Global Credit Loan to the CDB chargeable to the Bank´s ordinary capital (OC) resources. In addition, resources from the Clean Technology Fund (CTF) and the Global Environment Facility (GEF) will be available for the financing of non-reimbursable investment and technical assistance. CDB will make use of different financial instruments as appropriate for meeting each ECC's needs to develop their SE potential. For instance, CTF resources are appropriate for mitigating the exploratory risk during earlier stages while IDB's OC resources can adequately address financing needs at later stages of GE development. The program will support the ECC (¶1.1) to overcome the barriers mentioned above (¶1.13) to finance (through loans and grants) commercially and economically viable SE projects to support the strengthening of legal and regulatory frameworks and capacity for developing SE potential. This program will provide financing mechanisms to unlock investments in SE and mobilize private sector capital and expertise required for developing SE projects in the region. GE development, which has the largest potential for the displacement of oil consumption, suffers from special challenges that require participation of both the governments and the private sector through Public-Private Partnerships (PPP) arrangements. This is due to the limited borrowing capacity of the region's governments to undertake infrastructure investments, the scale of investments required to develop GE, high uncertainty during early development stages that the private sector is unable to bear, and the limited capacity in ECC to develop their GE potential. Therefore, the program will provide concessional financing that will crowd in private sector capital to develop and implement GE initiatives.[18]

1.16 **Eligibility of the CDB as a borrower of Bank's resources**. The proposed financing to the CDB complies with all 3 criteria (compatibility, complementarity,

[15] US is the country with the highest installed capacity for geothermal generation (3,442MW in 2013) of which California hosts (78%).

[16] Iceland has successfully developed its geothermal resources and has an installed capacity of 665MW for geothermal generation.

[17] Guadeloupe, an Overseas Department of France, is the only island in the Eastern Caribbean that has successfully developed its geothermal resources and demonstrates the feasibility of developing GE potential in the context of a small island. Guadeloupe has an installed capacity of 15MW consisting of a 4.7MW plant (Bouillante 1) and a 10MW plant (Bouillante 2).

[18] Despite of the relatively small scale of the GE plant per country (10-15 MW), GE projects are expected to contribute significantly to reduce power generation costs in the ECC countries. Other SE technologies will receive SEF funding as described in paragraph 2.6

and additionality) as set forth in the Bank's Operational Policies and Strategies Manual (OP-601: Relationship with Subregional Financial Institutions - General Policy). Regarding compatibility, a review of CDB policies and operational practices shows that CDB policies and strategies are consistent with those of the Bank's, predicated on consistent principles with no rules in conflict with each other. Regarding complementarity, since the Bank cannot lend directly to the ECC (not member countries of the Bank), the CDB provides the channel for Bank assistance to support the social and economic development of these countries. Finally, regarding additionality, this loan has a multiplier effect with regard to financial resource flows to the sub-region and will increase the level of resources that the CDB could provide to the beneficiary countries. In accordance to OP-601, having determined that the CDB's policies are consistent with those of the IDB, the CDB will apply its own policies and procedures for granting sub-loans with resources from the program.

1.17 **Strategic alignment**. All operations financed by CDB through this loan will comply with strategic alignment metrics homologous to the Bank's. All operations will be mapped to the specific CDB's country strategy with each of their ECC borrowers and to IDB's institutional priorities as outlined in the Report on the Ninth General Increase in the Resources of the IDB (GCI-9) (AB-2764) as each sub-loan contributes to the goals of: (i) supporting development in small and vulnerable countries; (ii) assisting borrowers in dealing with mitigation and adaptation to climate change, sustainable energy and environmental sustainability; and (iii) increasing regional cooperation and integration. In accordance with the Bank´s guidelines for the classification and validation of operations eligible for the GCI-9 regional cooperation and integration[19] lending priority (GN-2733).

1.18 **IDB lending to the CDB**. On January 27, 1977, the Bank Charter was amended to allow the Bank to provide financial resources to the CDB to support the development of its ECC members. On September 28, 1977, the Bank and the CDB entered into an agreement setting forth the general standards applicable to operating relations between both institutions. Since then, the Bank has financed 5 Global Credit Loan (GCL) programs[20] to the CDB, using sovereign guarantee lending terms, for a total of US$114 million.

1.19 **Lessons learned from previous work with CDB**. The Project Completion Report (PCR) of the two most recently completed global loans to the CDB (926/OC-RG; 975/SF-RG, and 1108/SF-RG) and the lessons learned from the execution of 2798/BL-RG, highlight the following aspects that contributed to effective program implementation: (i) sound project design process as reflected in the high quality of CDB project appraisal documents; (ii) project consistency

[19] This operation is automatically classified as regional integration under the sub-sector Energy Integration (EN-INT). The program meets 1 of the 4 criteria of the Bank´s Sector Strategy to Support Competitive Global and Regional Integration (GN-2565-4): (i) regional additionality due to the operation being a regional project that has a direct effect on improving the integration of the ECC independent energy systems, helping them reduce their electricity prices and become more economically competitive (See Annex 11, Regional Integration Technical Annex)

[20] The global loan currently under execution (RG-L1018; 2798/BL-RG) reached eligibility in December 2013 and has disbursed 41% of total funds as of July 31, 2015.

with country strategies; (iii) CDB's responsive approach to clients, as reflected by flexibility in the use of sub-loans to address changing priorities in the borrowing countries; and (iv) high quality supervision by CDB in terms of ensuring that project outputs were achieved. The GCL (2798/BL-RG) currently in implementation offers the following lessons for consideration in the preparation and implementation of this operation: (i) ensure that the financial conditions as well as Environmental and Social (E&S) requirements applicable to sub-loans are fully agreed by all parties; and (ii) given that CDB's non-resident Board of Directors meets 5 times a year,[21] the CDB had difficulty meeting the 30 day publication requirement of the E&S appraisal under the previous loan and requested a waiver in each instance. As such, under this loan the requirement to publicly disclose the E&S Appraisal on CDB's webpage has been modified to ensure that it is done simultaneously with other Board documentation but not less than 10 days prior to the Board meeting. Specific to the publication of the Environmental and Social Impact Assessment (ESIA), the requirement that this be made available at a minimum of 30 days prior to the Board meeting, or in line with local country legislation, whichever is greater, has been maintained. The ESMR addresses these points in more detail.

1.20 **CDB's experience in the energy sector**. In its 45 years of existence, the CDB has been continuously involved in the development of the power sector, leading on the transformation (through technical assistance and advice) of several government departments, with responsibility for electricity, into electric utility corporations. Lending over the period has largely supported investments in generation and transmission and distribution by public and private utilities. CDB's involvement with the SE sub-sector began in the 1980s when, with development partners, a regional energy project was executed by CDB. For the last 4 years, small-scale solar Photovoltaics (PV) installations are routinely included in social infrastructure projects in off-grid rural and hinterland locations, such as schools, clinics and for water pumps. SE considerations have been mainstreamed in CDB's operations, so that routine screening for opportunities for the inclusion of SE components across sectors is now normal. Loans to the private sector supported generation from bio-mass by an IPP and more recently a utility-scale solar PV plant. The Sustainable Energy Technical Assistance Project was implemented through a grant to the OECS Commission in 2011 for the development of appropriate frameworks and strategies for 9 OECS countries along with programs to build awareness in the sub-region. Since 2014, the CDB has renewed its focus on the energy sector, with particular emphasis on SE, through the establishment of appropriate internal structures and staffing, policy and strategy, partnerships and appropriate resource mobilization.

1.21 **CDB's experience lending to the private sector**. In the ten-year period since 2005, CDB has approved over US160 million in direct private sector loans, indirect loans to financial intermediaries for the benefit of the private sector without a government guarantee, and equity investment funds. Direct lending, other than to financial intermediaries and electric utilities included loan co-financing with other senior lenders for a biomass co-generation plant in Belize.

[21] CDB's Board of Directors meets 5 times a year in March, May, July, October and December.

B. Program Objective and Components

1.22 The objective of the program is to contribute to the diversification of the energy matrix in the ECC) in an effort to reduce the cost of power generation and electricity tariffs by promoting the implementation of EE and RE technologies to reduce the region's dependency on liquid fossil fuels.

1.23 The Bank will provide a GCL to the CDB, which will be complemented with resources from other donors to finance eligible sub-loans and grants (investment and technical assistance) in all eligible beneficiary countries (A&B, DOM, GRE, SKN, SL, and SVG). The program proposes the financing of the following components:

1.24 **Component 1: EE** – Resources from this component will be used for the financing of sub-loans and grants to ECC governments to promote EE measures such as: (i) retrofitting government buildings; (ii) installing new or replacing existing streetlights with more efficient ones; and (iii) increasing power generation efficiency, including transmission and distribution loss reduction programs. EE opportunities identified during program preparation would require investments estimated at US$58.4 million as shown in Table 3.

1.25 **Component 2: Regulatory framework, institutional strengthening and capacity building –** Resources from this component will be used for the financing of non-reimbursable technical assistance to the CDB,[22] [23] and to the ECC governments, including their ministries responsible for energy and electric utilities. Support to the CDB will focus on strengthening its capacity as required to implement the program including: (i) consulting services to provide specific skills and advisory services and when required for sub-project preparation; (ii) drafting of legal documents (i.e. loan contracts for GE sub-loans); and (iii) further developing staff capacity to evaluate and execute sub-loans. Support to the ECC governments will include: (i) supporting an effective legal, policy and regulatory framework[24] for the implementation of SE projects; (ii) strengthening their technical, institutional, environmental and regulatory capacity; (iii) transaction advisory support to structure projects and negotiate with private partners; and (iv) providing opportunities for training to acquire the necessary skills to enable SE development and execute SE projects.

1.26 **Component 3: RE** – Resources from this component will be used for the financing to both ECC governments and PPP under the following sub-components: Subcomponent 1: Intermittent RE: includes the financing of projects such as wind power and solar PV; and Subcomponent 2: includes the financing of projects such as GE, hydro and waste to energy projects. Since the risk levels involved in GE projects are inherent to each of the development stages, the program will offer financial instruments tailored for each stage to enable projects to advance to subsequent stages through to plant construction. Funds for GE

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22 Complementary to CDB's Caribbean Regional PPP Support Mechanism http://www.iadb.org/en/news/news-releases.

23 IDB's private sector windows will collaborate with the CDB to facilitate knowledge transfer and capacity building regarding investment strategies.

24 Including a framework for establishing PPP arrangements.

projects will be made available through a facility proposed by the CDB, called the GeoSmart Facility to address the specific challenges that GE development faces given its risk profile. Under this sub-component, the GeoSmart Facility will provide a range of financial support to public sector actors and/or PPP,[25] customized for each stage of geothermal development to support development of GE projects in each of the ECC with geothermal potential[26]. The activities to be financed are: (i) pre-investment activities for which a mix of grants and/or loans [27] are best suited to unlock investments will include: (a) surface studies (geology, geophysics and geochemistry- 3Gs) and ESIA, and studies on the feasibility of power interconnections between neighboring islands; and (b) drilling of early exploration wells (slim holes); (ii) exploration activities, for which risk mitigation instruments such as contingent recovery grants are essential, will include: (a) exploration drilling program (full size wells); and (b) feasibility studies for targeted reservoirs, including ESIA for this phase; and (iii) field and power plant development activities for which loans will be provided for: (a) production drilling (production and reinjection wells); (b) engineering and construction of power plants; and (c) access roads, substations and transmission lines. As shown in Table 3, RE opportunities identified during program preparation would require investments of approximately US$703 million of which US$526 million are required for GE.

1.27 **Donor coordination**. There are other donors supporting the region's energy development. The SEF will provide financing, according to demand by beneficiaries, that is complementary to efforts currently undertaken by other donors. In terms of GE interventions, the following are some of the main actors engaged and the way the SEF is and will be coordinating with them (See Annex 4, Donor Coordination). Mechanisms for donor coordination in the ECC are already in place[28] and CDB will leverage those in order to coordinate SEF activities with other donors as required to avoid duplication of efforts and foster collaboration and synergies.

a. The WB is currently providing technical cooperation support to DOM and SL and considering further support in the form of concessional lending using Clean Technology Fund (CTF) resources and their own concessional lending. Thus, the possibility that the SEF could finance elements that are complementary to those the WB would finance in these two countries will be explored (i.e. the

[25] Including in the form of Special Purpose Vehicles that may be led by a government or by the private sector. During the Analysis Mission held from June 1 – 10, 2015 the project team engaged with several potential GE private developers that are interested in obtaining funds for the SEF to mitigate risk during early stages of GE development.

[26] In 2010 the study called "Caribbean Regional Electricity Generation, Interconnection, and Fuels Supply Strategy", prepared by Nexant and financed by the World Bank concluded that undersea cables were not necessarily viable for long distances. The only feasible electrical interconnections between islands in the Eastern Caribbean would be Nevis-St. Kitts, the DOM – Martinique and the DOM – Guadeloupe links. Thus it would be more cost-effective for each of the ECC to develop their individual GE capacity.

[27] Preliminary studies indicate projects require concessional terms and grant funding in order for GE projects to be feasible and for expected results to be materialized.

[28] The Eastern Caribbean Donor Partner Group (ECDPG), of which CDB is a member, is coordinated by the Delegation of the EU to Barbados, the Eastern Caribbean and OECS. It holds periodic meetings to coordinate donor efforts and identify opportunities to collaborate among donors. The Caribbean Renewable Energy Forum (CREF) is also a venue used by the IDB, CDB and other donors to promote SE.

transmission line from the GE Plant to the main center of consumption in DOM and regulatory framework and capacity building in SL).

b. The International Renewable Energy Agency (IRENA) and the Abu Dhabi Fund for Development have approved a loan to SVG for US$15 million for GE development. The SEF could provide financing to SVG for exploration as it is well suited to mitigate exploration risk in coordination with the IRENA funding.

C. Cost of the Program

1.28 The cost of the program is estimated at US$72,213,698 of which US$20 million will be financed by the Bank´s ordinary capital (OC) resources, US$20 million by the CTF[29] (US$19.05 million to fund GE projects and US$0.95 million for technical assistance), US$3,013,698 by the GEF,[30] and US$29,200,000 by the CDB as local counterpart resources. A funding proposal for US$40 million was submitted by IDB to the Green Climate Fund (GCF)[31] on July 31, 2015 to complement the SEF. However, Bank approval of these resources will be processed independent of this operation.

1.29 In addition, the program will be complemented by parallel financing (US$41 million) to be provided by the Japan International Cooperation Agency (JICA) (US$40 million loan and US$1 million grant) through the Cofinancing of Renewable Energy and Energy Efficiency (CORE)[32] mechanism with the IDB. Availability of these resources will not affect the timely and effective execution of the IDB loan or the achievement of its objectives[33]. The disbursement of the IDB loan will not to be conditioned on the approval of the parallel resources.

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29 The CTF Trust Fund Committee endorsed in June 26, 2014 the scaling up of the Dedicated Private Sector Program (DPSP) I, utility-scale RE with a focus on GE. US$20 million DPSP funds will be available for the SEF subject to CTF approval to be approved in tandem with the IDB loan; the modality for the use of CTF resources will be described in the Operating Manual (OM).

30 The GEF Secretariat has endorsed the Project Information Form for supporting RE and EE in the ECC and final approval is pending so that US$3,013,698 will be available for the SEF (US$1,095,890 for A&B, US$1,004,566 for SVG, and US$913,242 for GRE).

31 The GCF is a fund within the framework of the UNFCCC which its purpose is to make a significant and ambitious contribution to the global efforts towards attaining the goals set by the international community to combat climate change. The IDB was accredited in July 2015 to act as channel through which GCF will deploy its resources to developing countries and is in the process of submitting a full proposal for GCF resources to be used for the SEF. GCF resources comprising US$25 million in loans would be used for GE investments, US$12 million in contingent recovery grants would support GE exploratory drilling, and US$3 million in grants would support regulatory frameworks as required to develop GE in the region. Resources from the GCF will be subject to the approval of the GTF by the Board of Executive Directors.

32 CORE is a co-financing mechanism established in March 2012 and amended in March 2014 whereby JICA commits to provide Central America and the Caribbean region with highly concessional loans of up to US$1,000 million as a co-financing resource with the Bank to support RE and EE projects/programs. The Memorandum of Cooperation signed among the Bank, JICA and CDB in July 2014 at Trinidad and Tobago, formalizes a framework of cooperation among the three parties to consider the possibility of co-financing under CORE for RE and EE in the EC, with special focus on GE development.

33 Disbursement of Components 1 and 2 can proceed while JICA's contribution is being processed for approval during the early stages of the loan. Disbursement of Component 3, for which JICA's resources are expected to be used, can proceed with CTF resources first which are needed to mitigate exploratory risk so that GE projects can move forward to a stage where IDB OC resources as well as JICA's loan resources can be used.

Table 5. Cost of the Program by Source and Component (US$ Millions)

Component	Financing						Parallel Financing		
	IDB (OC loan)	CTF (contingent grant)	CTF (grant)	GEF (grant)	CDB (loan)	CDB (grant)	JICA (loan)	JICA (grant)	Total
Component 1: Energy Efficiency	-	-	-	1.10	8.00	-	-	-	**9.10**
Component 2: Reg. framework, inst. strengthening and capacity building	-	-	0.95	1.92	10.00	1.20	-	1.00	**15.07**
Component 3: Intermittent RE and GE	20.00	19.05	-	-	10.00	-	40.00	-	**89.05**
Total	**20.00**	**19.05**	**0.95**	**3.01**	**28.00**	**1.20**	**40.00**	**1.00**	**113.21**
					72.21			**41.00**	

D. Key Results Indicators

1.30 **Expected results**. The development of approximately 60MW[34] of RE in the ECC and the implementation of EE measures (street lighting and public buildings retrofitting) saving 31GWh/year will displace liquid fossil fuel based electricity generation which is costlier than generation with SE technologies. This could result in a 20% reduction of the average electricity generation cost and, if generation cost reductions are passed on to customers, this should lead to an average decrease in tariffs from US$0.33/kWh in 2015 (at a fuel price of US$70 per barrel) to US$0.27/kWh. The reduction in generation cost could result in significant reductions in electricity bills[35] and cost savings for customers[36] as well as in a reduction in CO2 emissions of 375,930 metric tons per year.[37]

1.31 Introducing EE measures and technologies and replacing liquid fossil fuel based generation with RE generation, particularly GE, will reduce the importation of fuel oil. This will benefit the countries' by improving their current accounts and their foreign exchange reserves. The annual importation of oil products is expected to fall by an average of 802,000 barrels with respect to current oil imports in the ECC estimated at 1.8 million barrels/year (a 44% reduction). This would reduce the average amount of international reserves used to pay for fuel imports by US$56 million (or US$40 million with fuel price of US$50 per barrel) per year.

[34] 20MW GE in SL, and 10MW GE in each country in DOM, SKN, SVG, and GRE.

[35] Electricity bills would reduce as an effect in power generation cost reduction through the use of more affordable technologies like GE and through energy savings at the household level using EE measures and technologies.

[36] The agreement between the government and/or regulator with the PPP should aim to reflect the concessionality of the funding provided by the SEF in the Power Purchase Agreement and in the final tariff to customers.

[37] Estimated multiplying yearly GE electricity generation times an emission factor of 0.76 tons CO2/MWh obtained from http://www.eia.gov.

Reducing government expenditure on electricity (for example street lighting and in government facilities) would free up fiscal space for governments to pay down debt or provide other needed services. The savings due to EE measures and technologies would be US$3.9 million per year in the 6 ECC.

1.32 **Results indicators**. The expected results and outputs, which include CTF and GCF core outcome indicators,[38] are detailed in the Results Matrix (See Annex 1). The project will incorporate in its components elements which will contribute to the achievement of the first strategic gender objective in the Implementation Guidelines for the IDB's Operational Policy on Gender Equality in Development: empowering women economically by facilitating women's access to economic opportunities and promoting women's entrepreneurship. The Results Matrix includes the corresponding gender indicators (See Annex 5, Gender Aspects).

1.33 **Economic viability**. A Cost Benefit Analysis (Annex 3) was developed for each of the sub-projects identified in the Indicative Project Pipeline for the program. The projects have an aggregate Economic Net Present Value (ENPV) of approximately US$163 million and all of them are financially and economically viable; the Economic Internal Rate of Return (EIRR) is greater than 12% for all projects.[39] A sensitivity analysis was conducted and indicates that the program's economic viability is maintained despite changes in the values of some key variables.[40]

II. FINANCING STRUCTURE AND MAIN RISKS

A. Financing Instruments

2.1 The program will be financed through a Global Credit Loan to the CDB from the Bank´s ordinary capital resources and through non-reimbursable investment and technical assistance financing. Resources from the CTF through its Dedicated Private Sector Programs (DPSP) will be used by the CDB to finance GE projects under the following two modalities: (i) loan guarantees, where CDB will provide a loan, using IDB funding, to the GE developer (PPP) for exploratory drilling and in case the drilling is unsuccessful, CTF resources will be used to repay the loan; and (ii) as a contingent recovery grant where the CDB can offer a grant to the GE developer for exploratory drilling which will be converted into a loan in case the

[38] In addition to project success indicators that track validation of the resource base, the leverage achieved by the donor funds, and the ability of the project to achieve financial closure, core indicators relevant to CTF include: volumes of GHG avoided and MWh generated.

[39] The lowest EIRR among the sub-projects analyzed is 14.4%.

[40] For GE projects the ENPV falls from US$160 million in the base case to US$66 million when the price for monetizing carbon emissions decreases by 40% and the capital expenditures increase by 20%. ENPV falls from US$160 million in the base case to US$62 million when there is a 20% reduction in oil prices with respect to the U.S. Energy Information Administration (EIA) 2015 reference projection. For EE projects the ENPV falls from US$3 million in the base case to US$830,000 when the efficiency of the retrofitted lamps decreases by 10%, and the street lighting tariff (avoided cost) decreases by 12% due to a decrease in the oil price.

exploration is successful[41]. The Credit Regulations of the program, included in the OM, will define the applicable terms and conditions.

2.2 **Resource allocation**. Resources will be used for the financing of sub-projects by the CDB in the eligible countries that meet the eligibility criteria for the program established in the loan contract and agreements to be entered into between the Bank and the CDB, and those set forth in the OM (¶3.5). ECC countries will have equitable opportunity of access to program resources which will be available on a first-come first-served basis, provided that: (i) a minimum of 3 countries receives funding; and (ii) no single country receives more than 50% of program resources.[42]

2.3 Sub-projects may be financed by the CDB either from one source of funding or a combination of them. This will be determined by the CDB in the context of each sub-project based on the criteria and guidelines set in the OM of the program. The all-in financing cost to each final beneficiary that receives resources from the program should not exceed 2.6% per *annum*[43] in the case of loans granted to GE projects under PPP arrangements. Financing instruments will be structured in a way to incentive private sector participation.

2.4 The CDB, with input from the IDB (¶3.6), will determine which projects will receive funding from the program based, among other factors, on the countries' development priorities and on the CDB's internal programming processes. Nevertheless, an Indicative Project Pipeline has been developed by the CDB that includes a set of projects preliminarily identified, which could be require funding from the program.

2.5 **Eligibility of loans that support policy reforms.** Up to 30% of the total amount of IDB loan resources (OC) may be used by the CDB for the financing of individual Policy-Based Loan (PBL) operations to ECC countries to support energy policy reforms, with an emphasis on SE. PBL operations will be financed when there is a sound macroeconomic policy framework in the corresponding country. To this end, the CDB will carry out an independent analysis of the country´s macroeconomic policy framework.[44]

2.6 **Project eligibility criteria.** EE and RE eligible project projects financed through Components 1 and 3 respectively must be public sector operations[45], except for GE projects which will have to be structured as legally established PPP (bringing

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41 The Operating Manual (OM) of the program will define the criteria for determining successful and unsuccessful drilling as well as the percentage of investment required from the private sector sponsors.

42 This amount is based on the cumulative expenditure needed to complete at least one geothermal investment starting from exploratory drilling.

43 This rate was estimated based on a blended loan including IDB OC and CTF loan resources in a 1:1 ratio. The OM will explain in detail how this rate was estimated as well as the on-lending mechanism for CDB to make sub-loans to its ECC borrowers.

44 Currently, CDB makes PBL only to countries directly, and limits its PBL lending to 20% of its total lending. Based on CDB's current policies and guidelines applicable for PBLs CDB PBLs must be based on a sound macroeconomic framework, requiring a determination that the country's macroeconomic policy framework is appropriate at the moment of approval of the PBL and the maintenance of such macroeconomic policy framework for each disbursement under the PBL.

45 CDB's CALC can finance private sector EE and RE projects

together the public and private sectors with the common goal of developing GE). Project eligibility criteria will be further developed in the OM; however, the minimum requirements projects have to comply with to access program funding are: (i) having a results matrix that includes project impact, outcome and output indicators, with baseline data and targets; and (ii) having an ESIA and meeting the social safeguards criteria, as noted in ¶2.8. In addition to this GE eligible projects should have a contractual[46] and/or regulatory mechanism in place that allows concessionality granted to them to be reflected in the Power Purchase Agreement (PPA) to be signed with an off-taker, in order to reflect as much as possible the concessionality granted in the electricity tariffs to final users.

B. Environmental and Social Safeguard Risks

2.7 In accordance with Directive B.13 of the Bank's Environment and Safeguards Compliance Policy (OP-703), the program is classified as a Financial Intermediary (FI) and as such this operation is not categorized according to its potential E&S impacts and risks. The Facility's target investments include EE and RE. The RE component of the Facility is most dominant and comprised largely of GE sub-projects, presenting the potential for significant E&S risks. As such, this project is classified as a high risk FI (FI-1). The construction impacts for GE projects represent the more significant risks, which can include: (i) potential contamination of soil and ground water by drilling mud; (ii) increased water demand from wells drilling and testing and for the cooling system; (iii) potential land contamination due to the disposal of drilling mud and solid wastes; (iv) noise and vibrations generated during drilling; (v) effects of drilling on groundwater aquifers, nearby hot springs, natural thermal features, and induced micro-seismicity and/ground subsidence; (vi) increased heavy traffic and potential traffic accidents in the vicinity of the project site; (vii) noise and dust emissions; (viii) soil erosion and loss of vegetation; and (ix) potential impacts to thermal features; and potential impacts to marine habitat and fauna. Most of these construction impacts and risks can be adequately mitigated through the implementation of appropriate environmental, health and safety management plans and standard operating procedures.

2.8 Due to the high risk nature of these sub-projects, the Bank will engage the CDB in a "hand-in-hand" E&S due diligence process on each Category A project, and all geothermal sub-projects, providing final sign off and closely monitoring project implementation with the support of an external consultant.[47] In addition to this agreed due diligence process requirement, the Bank will require as part of the loan agreement that the CDB comply with all applicable local environmental, social, health and safety, and labor regulatory requirements, and in relation to the financing of sub-projects with IDB's proceeds ensure that each sub-project complies with: (i) CDB´s E&S policies and review procedures; (ii) in-country regulations; (iii) IDB's list of excluded activities; (iv) fundamental principles of the rights at work; and (v) the International Finance Corporation (IFC) performance standards and applicable WB environmental, health and safety guidelines.

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[46] If the regulation for GE exploration and exploitation are not in place, then the contracts between CDB and GE PPP should include the necessary provisions to compensate for the lack of regulations.

[47] Budget for this has been included in the monitoring budget (see Monitoring & Evaluation Plan, Annex 5).

C. Fiduciary Risk

2.9 The fiduciary risk of the project has been assessed as low mainly due to the adequacy of the CDB's organization structure and procedures for fiduciary management, its demonstrated capacity in the fiduciary management of projects, and the overall low risk of the CDB's operational performance.[48]

2.10 The CDB is an AA rated financial institution that, according to recent reports[49] is based on (i) its strong business profile which is reflected in its role as "the cornerstone lender" to Caribbean governments and its "extremely strong financial profile", reflected through its strengthening capital adequacy, its less diversified funding profile, and its solid liquidity. It should also be noted that the CDB has also continued to strengthen its governance structure through the consolidation of its risk management and monitoring framework, as well as through the introduction of new institutional checks and balances".[50]

D. Other Key Issues and Risks

2.11 **Institutional capabilities of executing sub-projects through PPP**. PPP are relatively new in the Caribbean and both the CDB and country governments have a limited track record structuring and financing this type of projects and sub-loans. For this not to affect the execution and effectiveness of the SEF, the program will ensure through Component 2 the transfer of technical expertise to develop local competencies as well as the availability of specific training and advisory services as required by the CDB and the governments. **As condition prior to the first disbursement for activities under Component 3 the CDB will retain an expert consulting firm[51] that will support the CDB to assess, appraise, design and develop at least the first of the GE PPP sub-loans through the entire CDB's project cycle.** The firm will also advise in terms of sourcing required staff as needed, training requirements, with emphasis in PPP contracts for GE developers. In addition to this, the CDB, in cooperation with its development partners, including the IDB and its Multilateral Investment Fund, has established a US$1.2 million regional PPP support program designed to assist its borrowing member countries in the development and implementation of PPP (¶1.26).

2.12 **Enabling legal and regulatory frameworks.** The successful implementation of EE and RE projects financed by the SEF requires regulations for RE generation and institutional arrangements for implementing and overseeing RE and EE projects. There is a risk that because not all countries have developed specific RE and GE legislation and regulation (¶1.9), it will be harder to establish PPP and move forward with GE projects in the region. To mitigate this risk the OM will define a requirement for GE sub-projects to include, in the absence of supporting

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48 A financial due diligence of CDB was undertaken for the preparation of the SEF confirming the conclusions reached by the Standard & Poor's assessment.

49 Standard & Poor's Ratings Services provides high-quality market intelligence in the form of credit ratings and in its May 7, 2015 report on the CDB confirmed its "Stable" outlook and affirmed CDB's "AA/A-1+" status on long and short term foreign currency ratings.

50 See Caricom Today. Standard and Poor's affirms CDB's AA/ A-1+ ratings.

51 The funding for the firm will be financed by the TCs currently in execution RG-T2480 and/or RG-T2260

legislation and regulation, provisions in the PPP contracts defining: (i) the process for granting a license to develop geothermal resources and assigning responsibility for monitoring geothermal resources to a government body; and (i) the tariff setting mechanism that will allow the electric utility to recover the cost of service regardless of the technology or fuel used to generate power, while reflecting any reductions in the costs of electricity generation. For other RE projects, Component 2 will help mitigate this risk by providing support to governments to make the necessary changes to the legal and regulatory frameworks.

2.13 **Feasibility of GE projects and materialization of expected results.** The exploratory risk might deter private investments or increase the cost of capital to levels that don't allow for the reduction of power generation costs. The program addresses this by: (i) providing through Component 3: (a) grants to support governments in the pre-investment phase ensuring that there is enough technical and scientific information for governments and private investors to make sound investment decisions; (b) risk mitigation instruments to fund exploratory drilling reducing the risk for project developers; and (c) concessional funding to reduce the overall cost of capital for GE projects; and (ii) requiring that GE projects have a contractual and/or regulatory mechanism that reflects the concessionality granted through this program in PPAs.

III. IMPLEMENTATION AND MANAGEMENT PLAN

A. Summary of Implementation Arrangements

3.1 **Executing Agency (EA).** The CDB will be the borrower and the EA of the program and will work in close collaboration with IDB and other donors. Individual sub-projects will be implemented by ECC government agencies in case of public sector projects and by legally established PPPs, in accordance with the criteria set forth in the OM for GE projects.

3.2 **Project Management Unit (PMU).** The CDB's Projects Department will serve as the PMU of the SEF. **As condition prior to the first disbursement for activities under Component 3 the CDB will appoint a Program Manager and a Technical Specialist whose functions and responsibilities are defined in the OM.**

3.3 **Financial structure**. The CDB has two sources of funding for its borrowing members: (i) OCR financed from equity contributions, market borrowings and income; and (ii) Special Funds Resources (SFR). The SFR comprises a number of funds, the largest of which is the Unified Special Development Fund, while all others funds together are referred to as the Other Special Funds (OSF). The Ordinary Capital (OC) resources of the IDB will be treated and on-lent by CDB as its OCR resources, having its callable capital automatically available as guarantee and the CTF resources will be managed and accounted for as part of the OSF. The GEF resources will be administered as non-reimbursable grants.

3.4 **Disbursements and commitment period**. It is expected that the loan will have an 8 year disbursement and a 7 year commitment period. The latter is the period

for the sub-loan agreements to be signed. As sub-loans financed by the CDB are implemented, the CDB will present disbursement requests to the Bank based mainly on the reimbursement of payments made and the advance of funds mechanisms. Advances will be disbursed based on the liquidity needs of the project within a 6 month period. With the exception of the first advance of funds, the CDB will have to present a justification for the use of at least 70% of the total cumulative balances pending justification, and the Bank approve such justification.

3.5 **Execution and administration**. The provisions governing program execution, including the use of program resources and eligibility of each financial instrument to be used on a sub-project by sub-project basis, will be established in the OM agreed by the IDB and CDB. **It is a special contractual condition prior to the first disbursement that: the Borrower presents evidence that the Operating Manual (OM), including the Credit Regulations of the program and the sub-loan/grant model agreements, has been approved and entered into effect, in accordance with the terms and conditions previously agreed upon between the CDB and the Bank.**

3.6 **Project cycle.** The executing mechanism which is summarized here will be fully described in the OM. To begin the project cycle, every sub project would require a 2 page concept note and a non-objection from the IDB to move forward. A final non-objection will be requested prior to CDB's board approval. It is expected that as part of the execution, the project team will be continuously monitoring the development of the sub projects and providing the required support to the CDB to facilitate the execution of the sub-projects.

3.7 **Procurement of goods and services**. Given the consistency of CDB procurement policies with those of the IDB (GN-2349-9 and GN-2350-9), it is recommended that the CDB uses its own procurement policies for operations receiving financing from this global loan. IDB policies require that funds from Bank loans be used only for procurement of activities contracted with firms or individuals of IDB member countries. Therefore, as with previous global loans to the CDB, an exception will be requested for approval by the Board of Executive Directors so that goods, works and services providers from CDB member countries, which are not members of the IDB, may participate in the procurement processes for activities to be financed with resources of the program. Since the program is mainly demand-driven, and sub-projects will be identified during execution, the proposal does not include a Plan of Activities, a Pluriannual Execution Plan, or a Procurement Plan.

3.8 **External control and reporting**. Given the consistency of the CDB financial management policies and procedures with those of the IDB and in accordance with the Bank's Financial Management Guidelines OP-273-6, external audit requirements will be met through: (i) submission of the Annual Audited Financial Statements (AFS) of the CDB. These reports are to be presented to the Bank within 180 days following the end of CDB's fiscal year end.[1] It should be noted that in accordance with OP-273-6, a longer due date, as compared to the Bank

[1] CDB's fiscal year end is December 31st.

norm of 120 days, is being requested since the project will utilize the financial management system of the CDB;[2] (ii) submission of an assurance report on the process of preparation and submission of disbursement requests. These reports will be conducted by an independent audit firm that is eligible to the Bank, and the report submitted within 180 days following the end of CDB's fiscal year end. The CDB may utilize the services of its auditors, once they are eligible to the Bank; and (iii) submission of semi-annual unaudited financial reports of the SEF including financial status reports on sub-loans. These statements should be submitted within 60 days after the close of each semester. These statements are intended to supplement the information in CDB's AFS since the AFS do not include project specific information.

B. Summary of Arrangements for Monitoring Results

3.9 The CDB will monitor and supervise operations based on their policies and procedures and provide IDB with the necessary information for IDB to monitor and evaluate the program as well as to comply with its reporting obligations to the CTF and GCF (See Monitoring & Evaluation Plan, Annex 2).

3.10 **Progress reports**. The results of CDB's monitoring and supervision will be reported to the Bank through semi-annual progress reports submitted no later than 60 days after the end of each semester. These reports will indicate the degree of fulfillment of the output indicators and progress toward the outcomes of the Results Matrix, making it possible for the Bank to monitor these indicators using the Bank's Project Monitoring Report They will also include for each individual operation: (i) a report on its consistency with the sub-loans eligibility criteria, environmental and social safeguards criteria as detailed in the OM, and the IDB´s GCI-9 priority lending targets; (ii) CDB financial statements of the individual operation and summary updates on its situation, the problems encountered and measures taken to address them; and (iii) data on the outcome and outputs of the results matrix of the individual operation. The latter will be based on information in the CDB's Project Supervision Reports, copies of which will be annexed to the reports.

3.11 **Midterm review**. Once 50% of loan resources are disbursed, or after 4 years from the eligibility of disbursements, whichever is earlier, a midterm review will be jointly conducted by the CDB and the IDB. The mid-term evaluation will consider the following indicators: (i) savings in oil imports; (ii) avoided CO_2 emissions; (iii) jobs created; (iv) effects in tariff; (v) installed capacity of RE projects and energy savings from EE projects; and (vi) institutional capacity and/or capacity building implemented for the execution of the program and its sub-projects.

3.12 **Project Completion Report (PCR).** In addition, a PCR will be prepared evaluating the impact and results obtained by the program and each sub-project completed. As part of the PCR an ex-post Cost Benefit analysis of the program will be developed. It is recommended that the PCR be conducted up to 2 years

[2] CDB's financial rules dictate that its AFS may not be released until approved by the Board of Governors at its annual meeting held in May of each year. This means that CDB will be unable to submit AFS within the 120 day deadline from the end of the fiscal year as per IDB norms.

after the final disbursement of SEF resources to the individual projects, instead of 90 days after disbursement conclusion as mandated by IDB's Manual CO-309. The PCR will include the progress in meeting the project results as defined in the results matrix, information on the execution of the program and lessons learned.

ANNEX 1. RESULTS MATRIX

Project Objective	The objective of the Sustainable Energy Facility (SEF) for the Eastern Caribbean is to contribute to the diversification of the energy matrix in the Eastern Caribbean Countries (ECC) in an effort to reduce the cost of power generation and electricity tariffs by promoting the implementation of Energy Efficiency (EE) and Renewable Energy (RE) technologies to reduce the region's dependency on liquid fossil fuels. The SEF is a financial facility funded by loans and grants, including a Global Credit Loan (GCL) from the IDB to the Caribbean Development Bank (CDB), which would on-lend the resources to finance eligible sub-loans in Antigua and Barbuda, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines.

Impact Indicators	Units	Base Level (2015)	Target Level	Source of Verification	Comments
Average electricity tariff for customers in ECC.	US$/ KWh	0.33	0.30	CARILEC Average Tariffs for ECC.	Measures the average electricity tariff in the 6 ECC covered by the program.

Component 1	Indicator	Units	Base (2015)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Target	Source of Verification/ Comments
Results													
Reduction in electricity consumption from public lighting sectors with EE projects financed by the program.	Electricity saved by EE applications, measures & programs.	GWh/year	0	0	0	0	9.3	28.0	31.1	31.1	31.1	130.6	Source: Report from CDB based on utility sales reports.

Component 1	Indicator	Units	Base (2015)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Target	Source of Verification/ Comments
Reduction in imports of fossil fuels for electricity generation in EC countries due to EE projects financed at any stage by the program.	Reduction in imports of fossil fuels for electricity generation.	Thousand barrels of oil	0	0	0	0	15	30	45	50	80	220	Source: Estimation based on efficiency levels and number of retrofitted lamps; to be provided by the Executing Agency (EA) based on information from governments and utilities in ECC. Final calculations to be checked with the utilities and the governments in the ECC (ex-post CBA).
Greenhouse Gas (GHG) emissions avoided by EE projects financed at any stage by the program.	GHG emissions avoided.	$ktCO_2e/yr$	0	0	0	0	1.6	4.0	15.0	20.0	37.5	496.3	Source: IDB estimations made following IDB methodology, based on number of lamps installed, efficiency levels of lamps, and an average conversion factor. (ex-post CBA) KtCO2e = thousands of tons of CO2 equivalent.
EE projects appraised by the CDB	EE projects appraised	Number of EE projects	0	1	1	0	0	0	0	0	0	2	Source: Report from CDB.

Component 1	Indicator	Units	Base (2015)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Target	Source of Verification/ Comments
Outputs													
Loans provided to energy efficiency projects with resources from the program.	Loans provided for EE projects.	Number of EE loans	0	0	0	1	0	0	0	0	0	1	Source: Report from CDB.
Component 2	**Indicator**	**Units**	**Base**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Target**	**Source of Verification/ Comments**
Results													
ECC with legal and regulatory frameworks that enable Geothermal Energy (GE) development.	# countries that have GE legal and regulatory frameworks.	# countries	1	0	0	1	1	0	0	0	0	3	Source: Report from CDB.
Women trained in construction, operation and/or maintenance of RE and EE infrastructure and projects.	% of women trained, out of the total trainees, in construction, management and/or maintenance of SE infrastructure/ projects.	%	0	0	0	0	0	0	0	0	0	30	Source: Reports from the CDB based on information from governments and private project sponsors. Measured as an average of individual GE sub-projects at the end of the program.
Outputs													
Energy policy reforms or recommendations for energy policy reform provided to and implemented by governments in ECC.	Number of ECC.	Number of countries	0	0	0	1	1	0	0	0	0	2	Source: Report from CDB.

Trainings provided to the EA and/or government employees with resources from the program	Number of trainings provided.	Number of trainings	0	0	2	3	2	3	3	2	0	15	Source: Report from CDB.
Grants provided for technical assistance to governments in ECC with resources from the program.	Number of EC countries receiving grants.	Number of countries	0	0	1	1	1	1	0	0	0	4	Source: Report from CDB.
Component 3	**Indicator**	**Units**	**Base**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Target**	**Source of Verification/ Comments**
Results													
GHG emissions avoided by geothermal projects financed at any stage by the program.	GHG emissions avoided.	$ktCO_2e/yr$	0	0	0	0	0	338.4	338.4	338.4	338.4	1,353.7	Source: IDB estimations made following IDB methodology, based on installed capacity, electricity generation, and an average conversion factor (ex-post CBA). KtCO2e = Thousands of tons of CO2 equivalent.

Component 3	Indicator	Units	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Target	Source of Verification/ Comments
Reduction in imports of fossil fuels for electricity generation in ECC with geothermal projects financed at any stage by the program.	Reduction in imports of fossil fuels for electricity generation.	Thousand barrels of oil	-	-	-	-	-	722	722	722	722	2,889	Source: IDB estimations based on estimated installed capacity and electricity generation to be provided in EA reports based on information from governments and utilities in ECC. Final calculations to be checked with the utilities and the governments in the ECC (ex-post CBA).
Geothermal power generation capacity installed in projects facilitated or financed at some stage by the program.	MW of geothermal capacity.	MW	0	0	0	0	0	0	0	0	60	60	Source: Report from CDB. Estimations of expected installed capacity based on quality of resource confirmed once exploration wells are drilled.

Component 3	Indicator	Units	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Target	Source of Verification/ Comments
Geothermal projects financed at any stage by the program that moved on from early exploration to production drilling or from early exploration or production drilling to construction of plants and/or electricity generation.	Number of GE projects financed that moved to the following stage of development.	Number of GE projects	0	0	0	1	1	1	1	0	0	4	Source: Report from CDB with information from ECC and private project sponsors.
Women participate in consultation processes related to GE projects.	% of women who participate in consultations.	%	0	0	0	0	0	0	0	0	0	35	Source: Reports from the CDB based on information from governments and private project sponsors (Measured as an average of individual GE sub-projects at the end of the program).
RE projects appraised by the CDB	RE projects appraised	Number of RE projects	0	0	1	1	1	0	0	0	0	3	Source: Report from CDB.

Component 3	Indicator	Units	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Target	Source of Verification/ Comments
Outputs													
Loans provided to geothermal projects at any stage of development with resources from the program.	Number of loans to GE projects.	Number of loans	0	0	0	1	1	1	0	0	0	3	Source: Report from CDB.
Loans provided to finance transmission lines required for connecting GE plants to the power grid.	Number of loans for transmission and distribution projects.	Number of loans	0	0	0	0	1	0	0	0	0	1	Source: program report from EA with information from the projects, the utilities, and the governments in the ECC.

NOTES:

(1) Further details on how to calculate each of the indicators are provided in Appendix A of the Monitoring and Evaluation Plan, see IDB docs 39683427.

(2) The targets in the results matrix are targets for each year, as opposed to cumulative targets up to the year. All targets are set taking into account the projects in the indicative pipeline of the SEF (including five geothermal projects). If the projects financed by the SEF change over time, then the targets would need to be adjusted to reflect the expected results of the actual projects funded.

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

REGIONAL

SUSTAINABILITY ENERGY FACILITY FOR THE EASTERN CARIBBEAN

(RG-L1071)

ANNEX 2. MONITORING AND EVALUATION PLAN

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Abbreviations

CBA	COST BENEFIT ANALYSIS
CDB	CARIBBEAN DEVELOPMENT BANK
CTF	CLEAN TECHNOLOGY FUND
EA	EXECUTING AGENCY
EC	EASTERN CARIBBEAN
EE	ENERGY EFFICIENCY
IDB	INTER-AMERICAN DEVELOPMENT BANK
JICA	JAPANESE INTERNATIONAL COOPERATION AGENCY
MW	MEGAWATT
MWH	MEGAWATT HOUR
PCR	PROJECT COMPLETION REPORT
PBL	POLICY-BASED LOAN
POD	PROPOSAL FOR OPERATION DEVELOPMENT
RE	RENEWABLE ENERGY
SEF	SUSTAINABLE ENERGY FACILITY

1 Introduction

This document presents the Monitoring and Evaluation Plan for the Sustainable Energy Facility Program ('the Program'). The purpose of this document is to establish the framework, processes, and institutional arrangements that will be used to monitor and evaluate the Program.

The Program's general objective is to reduce the Eastern Caribbean's ('EC') dependency on fossil fuels and the cost of power generation and electricity tariffs. The Program seeks to achieve these objective by: (i) reducing the demand of and expenditures in electricity for street lighting; ii) implementing a regulatory framework and developing the institutional capacity necessary for sustainable energy development; and iii) diversifying the energy matrix.

The specific objectives of the Program are to: (i) promote energy efficiency interventions such as installing efficient streetlights or retrofitting government buildings, ii) develop the institutional and regulatory framework necessary to enable sustainable energy development, and iii) push forward the development of geothermal and other renewable energies.

The Program consists of the following components:

- **Component I. Energy Efficiency.** Component I will provide loans to public sector actors to promote EE measures such as: (i) retrofitting government buildings; (ii) installing new or replacing existing streetlights with more efficient ones; (iii) increasing power generation efficiency; and (iv) implementing EE programs for small and medium enterprises (SMEs) and housing projects.
- **Component II. Regulatory Framework, Institutional Strengthening, and Capacity Building.** Component II will provide technical assistance to the Executing Agency ('the EA') to strengthen its capacity to implement the Sustainable Energy Fund ('the SEF'), particularly for lending to private sponsors, and to EC countries for: (i) developing an effective legal, policy, and regulatory framework for the implementation of sustainable energy ('SE') projects in the region; (ii) strengthen their technical, institutional, environmental, and regulatory capacity; and (iii) acquiring the skills to enable SE development
- **Component III. Renewable Energy.** Component III will provide loans to implement RE projects. **Sub-component 3A** will finance intermittent RE public sector projects such as wind power and solar PV. **Sub-component 3B** will finance base-load projects such as GE, hydro and waste to energy projects. Funds for geothermal projects will be made available through a facility called the **GeoSmart Facility** to address the specific challenges that GE development faces given its risk profile.[1] The GeoSmart Facility will provide a range of financial products to public sector actors and/or public-private partnerships (PPP)[2], customized for each stage of geothermal development: **(i) Pre-investment activities** for which a mix of grants and concessional lending are best suited to unlock investments will include: (a) surface studies (3Gs), including social and

[1] Concessional financing terms are required to reduce the exploration risk and therefore attract private sponsors who are expected to be the sub-borrowers.

[2] Including in the form of Special Purpose Vehicles (SPVs) that may be led by a government or by the private sector

environmental impact assessment, and their integration; and (b) drilling of early exploration wells (slim holes); **(ii) exploration activities** for which risk mitigation instruments such as contingent recovery grants are essential will include: (a) exploration drilling program (full size wells); and (b) feasibility studies for targeted reservoirs, including social and environmental impact assessment; and **(iii) field and power plant development activities** for which concessional lending is called for will include: (a) production drilling (production and reinjection wells); (b) engineering and construction of power plants; and (c) substations and transmission lines.

This Monitoring and Evaluation (M&E) Plan is organized in two main sections:

- the **Monitoring Plan** (Section 2)—presents the indicators used to monitor the Program's outputs, assigns the responsibility for collecting data, defines the instruments used to monitor the Program, and establishes the work plan and budget for monitoring the Program
- the **Evaluation Plan** (Section 3)—presents the main questions the Evaluation Plan addresses, mentions the studies that the Evaluation Plan builds upon, identifies the indicators used to evaluate the Program, and describes the methodology and instruments used to evaluate the results of the Program.

2 Monitoring

The Program will be monitored by tracking a set of indicators that measure performance. The monitoring plan defines these indicators and establishes the process and institutional arrangements to monitor these indicators. Specifically, the monitoring plan describes the instruments used to track these indicators, defines the tasks, assigns responsibilities, and defines budget necessary for preparing these instruments.

2.1 Output Indicators

Table 2.1 presents the indicators that will be used to measure whether the Program's outputs are fulfilled. The Program's outputs are not fixed in advance as they will depend on the actual demand of SEF resources from the Governments and private sponsors from EC countries. For example, the exact number of streetlights installed will depend on the street lighting projects defined and resources requested by the Governments in EC countries. As such, the indicators are designed to be flexible enough to allow for this variability in quantity of outputs. The CDB will be the Executing Agency ('EA) of the Program and therefore the main party responsible for providing inputs to monitor the Program.

Table 2.1: Output Indicators

Indicator	Description	Frequency of Measurement	Source of Verification
Component I: Energy Efficiency			
Loans provided to energy efficiency projects with resources form the Program.	Measures the number of loans provided for energy efficiency projects	At the start of the Program (Yrs 2 and 3) and at completion of the execution period	Reports from CDB
Component II: Regulatory Framework, Institutional Strengthening, and Capacity Building			
Policy Based Loans (PBL) provided to Governments in EC countries	Measures the number of PBLs provided to Governments in EC countries	At the beginning of the execution period (Yr 3) and at completion of the execution period	Reports from CDB
Trainings provided to the EA and/or government employees with resources from the Program	Measures the number of trainings provided to the EA and/or government employees	Each semester and at the completion of the execution period	Reports from CDB
Grants provided for technical assistance to Governments in EC countries with resources from the Program	Measures the number of EC countries receiving grants	Semi-annually during the first three years of the Program and at the completion of the execution period	Reports from CDB

Indicator	Description	Frequency of Measurement	Source of Verification
Component III – Renewable Energy			
Loans provided to geothermal projects at any stage of development with resources from the Program	Measures the number of loans granted for geothermal projects	Semi-annually during years three, four, and five of the Program and at the completion of the execution period	Reports from CDB
Loans provided to finance transmission lines required for connecting geothermal plants to the power grid	Number of loans for transmission and distribution projects	Semi-annually during the fourth year of the Program and at the completion of the execution period	Program report from EA with information from the projects, the utilities, and the Governments in the EC countries
Grants (in the form of loan guarantees or grants convertible to loans) provided to geothermal projects with resources from the Program	Measures the number of grants provided to geothermal projects	Semi-annually during the third year of the Program and at the completion of the execution period	Reports from CDB with information from the Governments, private sponsors, and utilities in EC countries

Table 2.2 presents the planned annual disbursements from the Program for each of the outputs. The disbursements are based on the indicative pipeline of projects to be financed by the Program and the indicative allocations of Program resources between projects.[3] The table shows that the Program's largest disbursements are estimated to occur in the first two years of Program operation. The IDB and the EA will refine these planned financial disbursements at the start of the Program when the project pipeline has been advanced. The IDB will include these planned disbursements as targets in the Project Monitoring Report (PMR) and will track actual disbursements against these targets to monitor the progress of financial disbursements during implementation.

Table 2.2: Annual Costs by Output (US$ millions)

Outputs/year	1	2	3	4	5	6	7	8	Total costs
Component I: Energy Efficiency									
Loans provided to energy efficiency projects with resources form the Program.		8.0	0	1.1					9.1

[3] The projects in the indicative pipeline were identified in the mission to the six EC countries in June 2015 based on conversations with government officials and utilities. The indicative pipeline is included in a separate document.

Component II: Regulatory Framework, Institutional Strengthening, and Capacity Building									
Policy Based Loans (PBL) provided to Governments in EC countries			15.0						15.0
Trainings provided to the EA and/or government employees with resources from the Program	0.2	0.3	0.1	0.1	0.1				0.8
Grants provided for technical assistance to Governments in EC countries with resources from the Program	0.6	1.4	0.5	0.4	0.4				3.3
Sub-total Component II	**2.3**	**2.2**	**16.9**	**1.8**	**1.8**				**19.1**
Component III: Renewable Energy									
Loans provided to geothermal projects at any stage of development with resources from the Program			24.8	24.8	5.2	5.2			60.0
Loans provided to finance transmission lines required for connecting geothermal plants to the power grid				15.0					15.0
Grants (in the form of loan guarantees or grants convertible to loans) provided to geothermal projects with resources from the Program		13.3		6.7					20
Sub-total Component III	**0**	**13.3**	**24.8**	**46.5**	**5.2**	**5.2**	**0**	**0**	**95.0**
Total SEF	**0.8**	**23.0**	**40.4**	**48.1**	**5.7**	**5.2**	**0**	**0**	**123.2**

Notes: The US$20 million in grants to geothermal projects are contingent grants provided with CTF resources.
Additional grant resources from other donors might be added to the SEF and disbursed to projects.

2.2 Data Collection and Instruments

The EA (the CDB) will be responsible for reporting on the results of the Program, based on information collected from the EC Governments and private sponsors and on information from its own systems. The EA will be responsible for reporting progress and results to the IDB. The EA will collect, store, and retain all information to assist the IDB in monitoring performance of the Program.

The INE/ENE Division of the IDB will be responsible for overseeing the execution of the Monitoring and Evaluation Plan for the complete Program, including the funds provided by other donors. As such, they must report annually to the Clean Technology Fund Trust Fund Committee (CTF TFC) and the Japan International Cooperation Agency ('JICA') on

progress towards achieving the results of the Program and estimations of results (in case of plants in state of construction and non-operational as of reporting date).

The project team composed by specialists from INE/ENE and IFD/CMF, with support from the country office in Barbados, will be in charge of following up the execution, monitoring and evaluation of the program. The EA and the IDB have committed to carry out field visits according to a regular schedule to be agreed upon between the two parts (see Table 2.2 Monitoring Work Plan for an indicative schedule).

Sources of information for monitoring the Program include EA semi-annual reports, IDB's field inspections, and EA administrative records and financial statements. The EA will be responsible for providing administrative records, financial statements, and reports, and will participate in the IDB's field inspections.

2.3 Reporting Monitoring Results

The IDB will use three instruments to monitor the Program's progress in completing the expected outputs:

- Semi-annual Reports
- Due Diligence and Annual Supervision Missions
- Field Inspections
- Audited Financial Statements.

For each instrument, the remainder of this section describes the instrument, and explains who is responsible for preparing it, when it should be submitted or carried out, its purpose, and its content.

2.3.1 Semi-Annual Reports

Semi-Annual Reports are designed to monitor the progress in implementing the energy efficiency ('EE') and renewable energy ('RE') projects and the technical assistances funded, and measure their impact through various indicators. The EA is responsible for preparing them, with input from the Governments, private sponsors, utilities, and projects in EC countries. The IDB is responsible for reviewing the Semi-Annual Reports and giving its non-objection. As their name suggests, these reports are due every six months. The EA will deliver the reports within 60 calendar days after the end of each semester.

Purpose

The purpose of the Semi-Annual Reports is to track the Program's progress towards the targets established for the output indicator described in Section 2.1 and the results indicators included Section 3.3. The Semiannual reports will serve as inputs to completing the Project Monitoring Report (PMR), which is the IDB's main tool for monitoring progress towards meeting the indicator targets.

Content

Semi-Annual Reports contain four components:

- **Execution Plans**—present Gantt charts that show the Program's progress towards completing the tasks for fulfilling outputs. The Gantt charts present updated timelines that show any planned changes in carrying out the tasks within each Component. Two execution plans are presented: the Pluri-annual Execution

Plan (PEP) which covers the complete execution period and the Annual Operation Plan (POA) which covers the following twelve-month period. The execution plans should assign costs to each task to track the financial progress of the Program. In addition, the EA should attach a bank statement with the execution plans, which the IDB will use to validate the progress reported in the execution plans against actual disbursements

- **Financial and Procurement Plans**—show the planned disbursements and procurement activities for the following twelve-month period. The Financial Plan presents a financial projection of the planned disbursements that should coincide with the planned tasks included in the execution plans. The Procurement Plan shows procurement activities the EA will carry out directly. Generally, the EA's procurement activities will take place at the beginning and towards the end of the Program's execution period. The EA would only need to submit Procurement Plans when there are procurement activities planned for the following year
- **Updated Risk Matrix**—shows the status of risks identified in the Risk Matrix of the Program, as well as proposed actions or mitigation measures. It also identifies any new issues, risks, and events that affect or may potentially affect the future implementation of the Project
- **Updated Results Matrix**—shows the progress towards the targets listed for each indicator in the Results Matrix of the Program.
- **Lessons Learned**—presents the lessons learned and any other information required to ensure the successful implementation of the Project.

2.3.2 Due Diligence and Annual Supervision Missions

There will be due diligence for each Category A proposed renewable energy project. There will be one due diligence mission at the beginning of the projects. Following that, there will be annual supervision missions for the following five years, ending in year six of the Program.

The IDB will be responsible for hiring external consultants to carry out the due diligence and supervisions missions for the renewable energy projects financed through the Program. The due diligence missions should occur during year 1 of the Program, prior to the first disbursements made to the projects. The supervision missions will occur on an annual basis, starting in year two and ending in year six.

Purpose

The purpose of the due diligence missions is to provide an independent opinion about the viability of the projects and their progress. Specifically, the due diligence will verify the financial and technical information included in the loan applications and inform the IDB and other donors of the risks. The supervision missions will provide an unbiased technical opinion about the projects' progress.

Content

The IDB will develop the TOR of the due diligence and supervision missions and will hire the consultants that will carry out the due diligence. Once completed, the IDB must review and approve the consultant's reports.

2.3.3 Field Inspections

Field Inspections are designed to monitor the progress in implementing the EE and RE projects and the technical assistances funded. Field Inspections provide an opportunity for the IDB to validate in the field the progress reported in the Semi-Annual Reports. The IDB is responsible for coordinating them with support from the EA, EC Governments and private sponsors. Other donors of the SEF that may want to participate in the field inspections will coordinate it with the IDB. Field inspections are to be carried out semiannually, within a 60 day period after the Semi-Annual Reports are submitted.

Purpose

The purpose of the Field Inspections is to track and confirm the Program's progress towards targets listed for each indicator included in the Results Matrix.

Content

Field Inspections include field visits and meetings between the IDB, the EA, and the EC Governments and/or private sponsors that signed project agreements with the EA.

2.3.4 Audited Financial Statements

The EA will submit to the IDB:

(a) Annual Audited Financial Statements (AFS) of the CDB. These reports are to be presented to the Bank within 180 days following the end of CDB's fiscal year end, December 31st;

(b) Assurance Reports on the Process of Preparation and Submission of Disbursement Requests (Assurance Reports) to be conducted by an independent audit firm that is eligible to the Bank, and the report submitted within 180 days following the end of CDB's fiscal year end, December 31st and should be audited by a firm of independent public accountants.

(c) Semi-annual Unaudited Financial Reports of the project, including financial status reports on sub-loans. These statements should be submitted within 60 days after the close of each semester. These statements are intended to supplement the information in CDB's AFS since the AFS does not include project specific information.

Purpose

The purpose of the Audited Financial Statements, Assurance Reports on the Process of Preparation and Submission of Disbursement Requests and Semi-annual Unaudited Financial Reports of the project is to assess the financial performance of the Program.

2.4 Monitoring Coordination, Work Plan, and Budget

The IDB will be responsible for overseeing the execution of the Monitoring and Evaluation Plan for the complete Program, including the funds provided by other donors. The IDB will also be responsible for reporting to the other Donors on the execution and results of the Program. The project team at the IDB responsible for carrying out these tasks will be composed by specialists from the INE/ENE and IFD/CMF divisions, with support from the country office in Barbados.

The EA (the CDB) will be responsible for executing the SEF and reporting on the results of the Program. The EA will create a Project Management Unit that will be responsible for carrying out these tasks (see Operating Manual). The Project Management Unit will be

responsible for reporting the Program's progress and results to the IDB and the other donors (CTF and JICA).

Table 2.3 shows the timing of the tasks for monitoring the Program, including the cost and entity responsible for carrying out each task.

Table 2.3: Monitoring Work Plan

Activity	2016		2017		2018		2019		2020		2021		2022		2023		2024		Resp.	Fund.	US$
	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2			
Semi-Annual Reports																			EA	Prog.	0
Field Inspections																			IDB & EA	Prog.	120,000
Audited Financial Statements																			EA	Prog.	140,000
Assurance Reports																			EA	Prog.	195,000
E&S Due Diligence and Annual Supervision Missions by External Consultant																			IDB	Prog.	150,000
Total																					**605,000**

3 Evaluation

The Program will be evaluated by measuring compliance with targets for a set of indicators. The Evaluation Plan first defines what questions the indicators address. Then it mentions the studies that the Evaluation Plan builds upon and describes the indicators that will be used to evaluate the results of the Program. It also explains the before and after evaluation methodology and the instruments that will be used to evaluate the Program. Lastly, it describes the institutional arrangements, work plan, and budget to carry out the Evaluation Plan. In addition to this, an impact evaluation of the SEF will be conducted using synthetic control method. This method will be used to compare units (ECC) exposed to the intervention of interest (the SEF) to one or more unexposed units.

3.1 Main Evaluation Questions

The purpose of the evaluation is to assess the outcomes of the Project. The main evaluation questions are as follows:

- Did electricity demand from streetlights decrease where energy efficiency projects were financed by the Program?
- How many geothermal projects financed by the program moved or are projected to move from the current to the next stage of development?
- What is the electricity generation from geothermal projects financed at some stage by the Program?
- What was the impact of the Program towards decreasing the amount of greenhouse gas emissions, the cost of electricity service, and the amount of fuel oil imports?
- How much additional public and private resources was the Program able to leverage in the development of energy efficiency and renewable projects financed at some stage by the program?

3.2 Existing Knowledge

An ex ante Cost Benefit Analysis (CBA) and financial analysis of the geothermal projects that may be funded by the Program have been prepared. The CBA is an economic analysis that presents the net economic benefits to the EC region and to each country from implementing the Components I and III of the Program. The financial analysis estimates the rate that the geothermal projects would charge to utilities and its impact on the tariff in the countries, as well as the cost of debt of the projects. The financial analysis includes projected financial statements for each of the geothermal projects.

The CBA, financial analysis, and a description of the methodology used in their preparation and their main conclusions are explained in further detail in the Cost Benefit Analysis Report (Annex 3). A summary of the methodology, assumptions, and main results of the ex-ante CBA are discussed below.

Cost Benefit Analysis

The objective of the CBA methodology is to determine whether or not Component I and Component III of the Program are economically viable. To do so, a CBA is carried out for the street light retrofitting and geothermal power projects included in the indicative project

pipeline. The IDB and Castalia identified the indicative project pipeline in meetings with local Governments, the Caribbean Development Bank, and potential private project sponsors during a mission to the EC in June 2015. As such, the indicative project pipeline is the current forecast of the potential demand for Program funds from the EC countries.

The results of the CBA indicate that the projects are economically viable when a 12 percent discount rate is used. Specifically, the results of the CBA show that the present value (PV) of the net economic benefits of each project is positive and their internal rates of return exceed the cost of capital (12 percent). Similarly, the PV of the aggregate net economic benefit of all projects combined is also positive and exceeds the cost of capital. This means that implementing the projects will result in a net economic gain for the Governments in each of the countries and for the region as a whole, and so, the Governments, multilateral institutions, and private sponsors should proceed with implementing them.

To carry out the CBA, a methodology that complies with the IDB Guidelines for Economic Analysis was used. Specifically, the PVs of the projects' net benefits were estimated. To do so the PV of the projects' benefits and costs were estimated. For calculating the projects' benefits, the savings in electricity expenditures and the monetary value of greenhouse gas emissions displaced by the projects were estimated. For calculating the projects' costs, the full economic costs of implementing the projects were included, including the costs not financed by the Program. Then the difference between these two values was calculated and the present value of that difference was found. That PV is the result of the CBA. If the PV is positive, the project is economically viable.

To determine the projects' net benefits, the annual economic costs and benefits were estimated for a period of 40 years and a period of 15 years for geothermal projects and energy efficiency projects, respectively. Table 3.1 presents the assumptions used to calculate the economic costs and benefits of the projects.

Table 3.1: Assumptions Used to Determine the Indicative Projects' Economic Costs and Benefits

Variable	All Projects	Dom.	Gren.	Nevis	SL	SVG
General Assumptions						
Social Cost of one ton of CO_2 emissions (US$/t$CO_2$)	10[4]					
Pounds of CO_2 emissions per kWh of electricity produced from fuel oil (No.2) (tCO_2/MWh)	0.84[5]					
Discount rate (%)	0.12					
Assumptions for Geothermal Projects						
Plant size (MW)	60	10	10	10	20	10
Plant availability (%)	85					
Total Capex (US$ million)	531.5	68.3	102.3	96.3	168.3	96.3
Pre-investment	12	0	6	0	6	0
Exploration	56	0	14	14	14	14
Production Drilling	112	7	21	21	42	21
Power Plant Construction	270	45	45	45	90	45
T&D and Access Roads	81.5	16.3	16.3	16.3	16.3	16.3
Operating cost of electricity from geothermal generation (US$/kWh)	0.02[6]					
Avoided cost of fuel oil generation (US$)		0.174	0.205	0.192	0.20	0.189
Assumptions for Energy Efficiency Projects						

[4] The Department of Energy assigns a range for the social cost of CO_2 from $0 to $20 per ton of CO_2. We use the median value of this range. See following source:
Department of Energy. Chapter 9: Emissions Monetization. Pg. 2
https://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/ch_9_ashrae_nopr_tsd.pdf. (accessed on 4 December 2014)

[5] U.S. Energy Information Administration. "Frequently Asked Questions: How much carbon dioxide is produced per kilowatt-hour when generating electricity with fossil fuels?" http://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11. Accessed on 4 December 2014.

[6] Office of Energy Efficiency & Renewable Energy. U.S. Department of Energy. "Geothermal FAQS." http://www1.eere.energy.gov/geothermal/faqs.html (accessed on 9 December 2014).

Variable	All Projects	Dom.	Gren.	Nevis	SL	SVG
Lamps retrofitted per technology (Number) : ▪ HPS Lamp, 400W ▪ HPS Lamp, 250 W ▪ HPS Lamp, 100 W ▪ HPS Lamp, 50 W	 ▪ 2900 ▪ 2400 ▪ 2200 ▪ 0	 ▪ 1400 ▪ 700 ▪ 0 ▪ 0			 ▪ 1500 ▪ 1700 ▪ 2200 ▪ 0	
Capex per technology (US$/unit): ▪ HPS Lamp, 400W ▪ HPS Lamp, 250 W ▪ HPS Lamp, 100 W ▪ HPS Lamp, 50 W	 ▪ 1000 ▪ 900 ▪ 500 ▪ 300					
Yearly O&M cost equipment cost (US$/unit/year): ▪ HPS Lamp, 400W ▪ HPS Lamp, 250 W ▪ HPS Lamp, 100 W ▪ HPS Lamp, 50 W	 ▪ 20 ▪ 18 ▪ 10 ▪ 6					
Baseline Consumption per year (kWh/year/unit): ▪ HPS Lamp, 400W ▪ HPS Lamp, 250 W ▪ HPS Lamp, 100 W ▪ HPS Lamp, 50 W	 ▪ 2032 ▪ 1314 ▪ 517 ▪ 263					
Project Consumption per year per technology (kWh/year/unit): ▪ HPS Lamp, 400W ▪ HPS Lamp, 250 W ▪ HPS Lamp, 100 W ▪ HPS Lamp, 50 W	 ▪ 1016 ▪ 657 ▪ 258 ▪ 131					
Life time of lamps (years)	11.42					
Avoided cost of electricity expenditures (US$)		0.26[7]			0.39[8]	

[7] 2014 Dominica Street Lighting Tariff (71 cents per unit converted to US dollars). Source: DOMLEC. "DOMLEC Tariff Sheet effective as of September 2007" http://www.domlec.dm/index.php/our-company/news/24-domlec-tariff-sheet. Accessed on 28 June 2015.

[8] 2014 St. Lucia Basic Energy Rate for Street Lighting converted to US Dollar. Source: LUCELEC "Basic Energy Rates" https://www.lucelec.com/content/energy-rates. Accessed on 28 June 2015.

The results of the CBA and the financial analysis were used to establish the targets for measuring the results of the Program. This ensures the targets set in the Evaluation Plan coincide with the goals established during the design and approval of the Program. Specifically, the targets for percentage decrease in CO2 emissions and savings in electricity consumption and expenditure are based on the estimates used to calculate the CBA. The targets for the percentage decrease in cost of electricity service will be based on the projected cost of electricity service calculated in the financial model.

3.3 Outcome Indicators

Table 3.2 presents the indicators that will be used to measure whether the Program achieved its intended outcomes. Due to the long maturities associated to these projects, projects financed from early exploration may not be fully operational until past the timeframe of evaluation. Therefore, for those cases, some indicators will be estimated based on expected future outcomes A note is included signaling the indicators for which this is the case. The basis for estimating indicator values is included in the source description.

Table 3.2: Key Results Indictors

Results Indicator	Unit /Description	Frequency of Measurement	Source of Verification
Reduction in electricity consumption from Public Lighting sectors with EE projects financed by the Program	GWh/year Electricity saved by EE applications, measures and programs	Semiannually starting in the fourth and fifth year of the execution period and at the end of the execution period	EA report based on utility sales reports
Reduction in imports of fossil fuels for electricity generation in EC countries due to EE projects financed at any stage by the Program	Thousand barrels of oil Reduction in imports of fossil fuels for electricity generation	Annually, starting in the fourth year of the execution period until the end of the execution period	IDB estimations made based on number and efficiency levels of installed lamps. Figures to be checked with the utilities and the Governments in the EC countries (ex-post CBA)
Greenhouse gas (GHG) emissions avoided by EE projects financed at any stage by the Program	$ktCO_2e/yr$ Greenhouse gas (GHG) emissions avoided	Annually, starting in the fourth year of the execution period until the end of the execution period	IDB estimations made following IDB methodology, based on number and efficiency levels of installed lamps and an average conversion factor of 0.84 (ex-post CBA)

EC countries with legal and regulatory frameworks that enable GE development	Number of countries that have GE legal and regulatory frameworks	Annually, starting in the third year until the end of the seventh year of the execution period and at completion of the execution period	EA report based on information from Governments
Women trained in construction, operation and/or maintenance of RE and EE infrastructure and projects	% Measures the percentage of women trained, out of the total trainees, in construction, management and/or maintenance of SE infrastructure/projects	At the completion of the execution period	EA report based on information from Governments and private project sponsors
Greenhouse gas (GHG) emissions avoided by geothermal projects financed at any stage by the Program	ktCO2e/yr Greenhouse gas (GHG) emissions avoided	Annually, starting in the fifth year of the execution period until the end of the execution period	IDB estimations made following IDB methodology, based on installed capacity, electricity generation, and an average conversion factor of 0.84 (ex-post CBA)
Reduction in imports of fossil fuels for electricity generation in EC countries with geothermal projects financed at any stage by the Program	Thousand barrels of oil Measures the reduction in imports of fossil fuels for electricity generation	Annually, starting in the fifth year of the execution period until the end of the execution period	IDB estimations made based on estimated installed capacity and electricity generation. Figures to be checked with the utilities and the Governments in the EC countries (ex-post CBA)
Geothermal power generation capacity installed in projects facilitated or financed at some stage by the Program	MW Measures the MW of geothermal capacity that is ready to be generating electricity in the year	Once, at the end of the SEF execution period (Yr 8).	EA report with info from the projects in the EC countries

GE resource potential proven through exploratory drilling financed at some stage by the Program	MW Measures the MW of geothermal capacity	Annually, starting in the third year until the fifth year of the execution period and at the end of the execution period	EA report with info from the projects in the EC countries
Geothermal projects financed at any stage by the Program that moved on from early exploration to production drilling or from early exploration or production drilling to construction of plants and/or electricity generation	Number of geothermal projects Measures the number of geothermal projects financed that moved to the following stage of development	Annually, starting in the fifth year until the end of the execution period	
Women participate in consultation processes related to the projects.	% Measures the percentage of women who participate in consultations	At the completion of the execution period	EA report based on information from Governments and private project sponsors
Geothermal projects facilitated or financed at any stage by the Program that moved on from early exploration to production drilling or from early exploration or production drilling to construction of plants and/or electricity generation	Number Measures the number of geothermal projects facilitated or financed by the Program that moved from early exploration to production drilling, or from early exploration or production drilling to construction of plants and/or electricity generation	Once at the completion of the execution period	EA report with information from the projects and the Governments in the EC countries

3.4 Evaluation Methodology

The IDB will follow a before-completion and after-completion methodology to evaluate the results of the Program. Specifically, for a group of indicators, the IDB will compare baseline values against the values after the Program is completed. This is the same methodology that

is used for monitoring the Program. The only difference is the point in time when the methodology is applied. For monitoring the Program, the methodology is applied while the Program is being executed. For evaluating the Program, the methodology is used after the Program is completed.

By measuring baseline values in year 0 (2015), the IDB will simulate a counterfactual of what the performance for these indicators would be if the Program would not be implemented. This methodology assumes that if the Program were not implemented, indicator values would remain at their baseline values.

The main instrument the IDB will use to evaluate the Program will be the Project Completion Report ('PCR'), which compares the Program results against baseline values. The IDB will base the PCR on mid-term and final evaluations and an ex-post CBA. These instruments are described in more detail in the following section.

Also, in addition to the evaluation described in this section, the IDB Oversight Evaluation Office (OVE) may also separately evaluate the impact of the Program.

3.5 Reporting Results

The EA will be responsible for reporting on the results of the Program, based on information collected from the EC Governments and private sponsors and on information from its own systems. The EA will be responsible for reporting progress and results to the IDB. The EA will collect, store, and retain all information to assist the IDB in monitoring performance of the Program.

The INE/ENE Division of the IDB will be responsible for overseeing the execution of the Monitoring and Evaluation Plan for the complete Program, including the funds provided by other donors. As such, they must report annually to the Clean Technology Fund Trust Fund Committee (CTF TFC) and the Japan International Cooperation Agency ('JICA') on progress towards achieving the results of the Program and estimations of results (in case of plants in state of construction and non-operational as of reporting date).

The project team composed by specialists from INE/ENE and IFD/CMF, with support from the country office in Barbados, will be in charge of following up the execution, monitoring and evaluation of the program.

There are four instruments that the IDB will use to evaluate the Program's results. The instruments are as follows:

- Baseline Values Study
- Mid-Term Evaluation and Final Evaluation
- Ex-post Cost Benefit Analysis ('CBA')
- Ex-post Financial Analysis
- Project Completion Report for the Program and for individual projects

For each instrument, the remainder of this section describes its purpose, the entities responsible for preparing it, and, when applicable, the methodology used in its preparation.

Baseline Values Study

The Baseline Values Study will establish the baseline values of the indicators that will be used to evaluate the Program. This study is a key input of the Evaluation Plan and so must be measured at the start of the Program. The IDB is responsible for carrying out the Baseline Values Study with support from the EA, and the Governments, utilities, private sponsors, and projects in EC countries.

Mid Term Evaluation

The Mid-term Evaluation is designed to assess the performance of the Program, by reviewing whether the Program has met the targets set for the evaluation indicators. Specifically, the evaluation will verify the reported progress of the Program, assess Program's performance against the planned results, and assess the EA's performance in coordinating and executing the Program. These evaluation will also identify ways that the Program's operations could be improved and will identify lessons learned. A Final Evaluation will be completed as part of the Project Completion Report discussed in further detail below and presented in Paragraph 3.12 of the Proposal for Development.

The EA is responsible for hiring the independent consultant that will prepare the Mid Term Evaluation. In addition, the EA is responsible for providing the independent consultant the information needed to complete it. Once completed, the EA must submit the Mid-term Evaluation to the IDB for its review and non-objection. The Mid-term Evaluation is due once 50% of loan resources are disbursed, or after 4 years from the eligibility of disbursements, whichever is earlier.

Expost Cost Benefit Analysis

The ex-post Cost Benefit Analysis ('ex-post CBA') is designed to measure the economic impact of the Program. The ex-post CBA will measure whether the actual economic benefits of the Program exceeded its actual economic costs and how these compared to estimations made when the Program was designed. It will also assess the financial costs and benefits of the geothermal projects to private investors or PPP. Comparing the ex-post CBA with the ex-ante CBA will identify what factors led to discrepancies between the estimated costs and benefits included in the ex-ante CBA and the actual costs and benefits observed at the Program's completion. For this reason, the ex-post CBA will follow the same methodology used for preparing the ex-ante CBA presented in Section 3.2 and in the Cost Benefit Analysis Report (Annex 3).

In assessing the financial costs and benefits of the geothermal projects to the investors, the ex-post CBA will determine the cost of electricity service with the new geothermal capacity. Due to the long maturities associated to these projects, projects financed from early exploration may not be fully operational until past the timeframe of evaluation. As such, indicator values that depend on when power plants are commissioned will be estimated. The ex-post CBA will be the instrument to estimate the estimated decrease in cost of service based on up to date information about resource quality, estimated installed capacity, and the estimated timelines for the geothermal power plants to come on line.

To carry out the ex-post CBA, a methodology that complies with the IDB Guidelines for Economic Analysis will be used. Specifically, the PVs of the projects' net benefits will be estimated based on current information for the EA, Governments, and private project sponsors. To do so the PV of the projects' benefits and costs will be estimated. For

calculating the projects' benefits, the savings in electricity expenditures and the monetary value of greenhouse gas emissions displaced by the projects will be estimated. For calculating the projects' costs, the full economic costs incurred during the implementation of the projects will be included, including the costs that were not financed by the Program. Then the difference between these two values will be calculated and the present value of that difference will be found. That PV is the result of the ex-post CBA. If the PV is positive, the projects will have been economically viable. To determine the projects' net benefits, we estimate the annual economic costs and benefits for a period of 40 years and a period of 15 years for geothermal projects and energy efficiency projects, respectively. Section 3.2 contains the main assumptions used.

The IDB is responsible for hiring the independent consultant that will prepare the ex-post CBA, and reviewing and approving the final draft of the ex-post CBA. The EA is responsible for providing the independent consultant with the information needed to complete the ex-post CBA. In addition, the EA will coordinate with local authorities in EC countries to obtain any information that the external consultant may require to complete the ex-post CBA.

The ex-post CBA will be developed as part of the Project Completion Report completed for the Program.

Project Completion Report for the Program

The Project Completion Report (PCR) is designed to assess and document the performance of the Program. A PCR will be completed for the Program as a whole including the results of each sub-project financed through the Program. The PCR evaluates three main areas: whether the Program and sub-projects met their targets for results indicators, whether the results are sustainable, and the issues that affected how successful the Program and sub-projects were in achieving their intended results.

In evaluating whether the Program and sub-projects met the targets for results indicators, the PCR uses a before and after methodology that compares the baseline values of the results indicators against the indicator values after the Program and/or Project is completed. As part of the PCR completed for the Program, an ex-post Cost Benefit Analysis (CBA) will be developed.

The evaluation of the sustainability of the results and the issues that affected the Program's and/or projects' implementation is focused on evaluating risks. In evaluating whether the results are sustainable, the PCR identifies the risks that could affect the sustainability of the Program's and/or projects' results, and their likelihood and severity. The four main kinds of risks that should be considered include: financial risks, sociopolitical risks, institutional framework and governance risks, and environmental risks. In evaluating issues, the PCR considers the risks that were not properly mitigated against and turned into issues that affected the implementation of the Program and sub-projects. Examples can include poor local implementation capacities and delays and effects thereof on the Program's and/or projects' results.

3.6 Evaluation Coordination, Work Plan, and Budget

The budget for completing the Evaluation Plan is US$90,000 and will be financed with funds from the Program. The tasks of the Evaluation Plan will be carried out at the start, at the halfway point, and at the completion of the Program. For each evaluation instrument, the remainder of this section describes when it should be prepared, who prepares it, and how it will be funded.

- **Baseline Values Study**—will be the responsibility of the IDB and will potentially be procured to an external consultant. The Baseline Values Study will be prepared within the last quarter before the Program starts. The study will be financed with Program funds for a value of US$10,000
- **Midterm Evaluation**—will be procured by the EA and prepared by an external consultant. The Mid-term Evaluation will be financed with Program funds and will cost an estimated value of US$40,000.
- **Ex post Cost Benefit Analysis**—will be procured by the IDB and prepared by an external consultant. The Ex-post CBA will be financed with funds from the Program and will cost approximately US$40,000. The Ex-post CBA will be prepared within the first semester after the Program has closed.
- **Project Completion Report**—will be prepared by the EA and conducted up to 2 years after the final disbursement of SEF resources to the individual projects.

Table 3.3: Evaluation Work Plan

Activity	2015	2016		2017		2018		2019		2020		2021		2022		2023		2024		Res.	Fund	US$
	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2			
Baseline Values Study																				IDB	IDB	10,000
Mid-term Eval.																				CDB	IDB	40,000
Ex-post CBA																				IDB	EA	40,000
PCR																				EA	IDB	0
Total																						90,000

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SUSTAINABLE ENERGY FACILITY FOR THE EASTERN CARIBBEAN

(RG-L1071)

Annex 3
Cost Benefit Analysis of the Pipeline of Projects Potentially Funded by the Sustainable Energy Facility for the Eastern Caribbean

August 2015

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1 Introduction

Electricity tariffs in the six independent Eastern Caribbean Countries ('ECC') are among the highest in the world. The small and isolated systems that comprise the energy sectors in the ECC do not have the scale necessary to import lower cost fossil fuels. As a result, the energy matrices in the ECC are mainly dependent on diesel-based generation, which result in high cost and volatile electricity prices for consumers. All the ECC have available sustainable energy (SE) resources that could largely offset fossil fuel generation and generate significant savings.

The IDB and other donors seek to contribute to reducing electricity prices in the ECC. They plan to do so by supporting the diversification of energy matrices and the installation of energy efficiency ('EE') measures. The Sustainable Energy Facility (SEF) for the Eastern Caribbean ('the Program') will be a Global Credit Loan that will fund SE in the ECC. The Program will provide loans to fund EE measures, institutional strengthening, and renewable energy projects, with an emphasis in geothermal power.

This document presents the Cost Benefit Analysis ('CBA') of the pipeline of EE and renewable energy (RE) projects that the Program could potentially finance. The CBA is carried out for the street light retrofitting and geothermal power projects included in the Indicative Project Pipeline. The IDB has identified the indicative project pipeline in meetings with local Governments, the Caribbean Development Bank, and potential private project sponsors during a mission to the six ECC in June 1-10, 2015. As such, the indicative project pipeline is the current forecast of the potential demand for Program funds from the ECC.

To carry out the CBA, we use a methodology that complies with the IDB Guidelines for Economic Analysis. Specifically, we find the present values (PV) of the projects' net benefits. To do so we estimate the PV of the projects' benefits and costs. For calculating the projects' benefits, we estimate the savings in electricity expenditures and the monetary value of greenhouse gas emissions displaced by the projects. For calculating the projects' costs, we estimate the full economic costs of implementing the projects, including the costs not financed by the Program. We then find the difference between these two values and find the present value of that difference. That PV is the result of the CBA. If the PV is positive, the project is economically viable.

This CBA suggests that the Program generates an aggregate Present Value of **US$170 million**[1] and an **internal rate of return of 18 percent** over a forty year period for the geothermal projects and twenty year period for the energy efficiency projects. This is the PV of the projects compared to a business-as-usual (BAU) scenario that involves no changes in the generation matrices of the ECC, nor additional investments in retrofitting street lights. The aggregate PV is composed of US$167 million from five geothermal projects and US$3 million from two street lighting projects. The benefits of the Program will stem from savings on electricity bills from street lighting, the monetary value of avoided greenhouse gas emissions related to the displaced electricity from diesel based generation, and the reduced cost of electricity generated from geothermal power.

In this document we present our analysis in detail as follows:

[1] Assuming a discount rate of 12 percent.

- **Pipeline of Projects Potentially Funded by the Sustainable Energy Facility—**presents the projects included in the indicative project pipeline, upon which this CBA is based (Section 2)
- **Cost Benefit Analysis of the Geothermal Projects—**shows that the geothermal projects financed through the Program are economically viable. It does so by showing that the net economic benefits of the potential geothermal projects are positive and the internal rate of returns exceed the discount rate. The section also presents the assumptions and methodology used to calculate these results (Section 0)
- **Cost Benefit Analysis of the Street Lighting Projects—**shows that the energy efficiency projects financed through the Program are economically viable. It does so by showing that the net economic benefits of the potential energy efficiency projects are positive and the internal rate of returns exceed the discount rate. The section also presents the assumptions and methodology used to calculate these results (Section 4)
- **Cost Benefit Analysis of all Projects in the Pipeline—**aggregates the results presented in the two previous sections to show the economic viability of the Program as a whole (Section 5).

2 Pipeline of Projects Potentially Funded by the Sustainable Energy Facility

This section presents the projects that are included in the Cost Benefit Analysis ('CBA'). The projects included in the CBA are those that were identified in the indicative project pipeline. The IDB developed the indicative project pipeline based on information from local Governments, the Caribbean Development Bank, and potential private project sponsors during a mission to the six ECC in June 2015. As such, the indicative project pipeline is a current forecast of the potential demand for Program funds from the ECC Governments and private sponsors.

The projects included in the indicative project pipeline consist of five geothermal projects [2]and two energy efficiency projects. The energy efficiency projects are in Saint Lucia and Dominica and consist of retrofitting public streetlights for energy efficient ones.

Table 2.1 presents the details of the five geothermal projects that could potentially be funded by the SEF. The five geothermal projects consist of 60MW of installed capacity and a total capital investment of about US$517 million. The three geothermal projects that are included in the indicative project pipeline are the projects in Grenada, Nevis and Saint Vincent and the Grenadines. Total capital investment for these three projects has been estimated at US$290 million. The countries in the five ECC with geothermal potential have advanced at different rates in developing their geothermal resources. As such the estimated date for the power plants to come on line and the stages still to be developed varies by country. The earliest and latest are Dominica (Phase 1) in 2017 and Grenada and Saint Lucia in 2019.

Table 2.1: Pipeline of Potential Geothermal Projects

Project	Plant size (MW)	Total Capex (US$ Million)	Estimated Generation Start Year	Stages Done	Stages to be Done
Dominica Phase 1	10	67.0	2017	▪ Pre-investment ▪ Exploration ▪ Production Drilling	▪ Power plant construction ▪ T&D and Access Roads
Grenada	10	102.3	2019	▪ Pre-investment (studies) underway	▪ Pre-investment (slim holes) ▪ Exploration ▪ Production Drilling ▪ Power plant construction ▪ T&D and Access Roads
Nevis	10	92.1	2018	▪ Pre-investment	▪ Exploration ▪ Production Drilling ▪ Power plant construction

[2] The projects in Saint Vincent and Nevis were identified as the two geothermal projects that the SEF would likely fund among the total five projects.

Project	Plant size (MW)	Total Capex (US$ Million)	Estimated Generation Start Year	Stages Done	Stages to be Done
					▪ T&D and Access Roads
Saint Lucia	20	159.3	2019	▪ Pre-investment (studies) underway	▪ Pre-investment (slim holes) ▪ Exploration ▪ Production Drilling ▪ Power plant construction ▪ T&D and Access Roads
Saint Vincent and the Grenadines	10	96.3	2018	▪ Pre-investment (studies) underway	▪ Exploration ▪ Production Drilling ▪ Power plant construction ▪ T&D and Access Roads
Total	**60**	**517.0**			

(1) SVG will skip the pre-investment stage and will start directly with Exploration.

Table 2.2 presents the two street lighting projects included in the project pipeline. The specific projects have not been defined yet. Therefore, the projects for which the CBA is done are only indicative at this stage. The projects consist of retrofitting about 7,800 street lights for a total capital investment of US$6.45 million. Both projects would be fully operational (lamps retrofitted) by 2017.

Table 2.2: Pipeline of Potential Energy Efficiency Projects

Project	Lamps Retrofitted	Total CAPEX (US$ Million)	Estimated Operating Date
Saint Lucia	5,400	4.13	2017
Dominica	2,400	2.32	2017
Total	**7,800**	**6.45**	

3 Cost Benefit Analysis of the Geothermal Projects

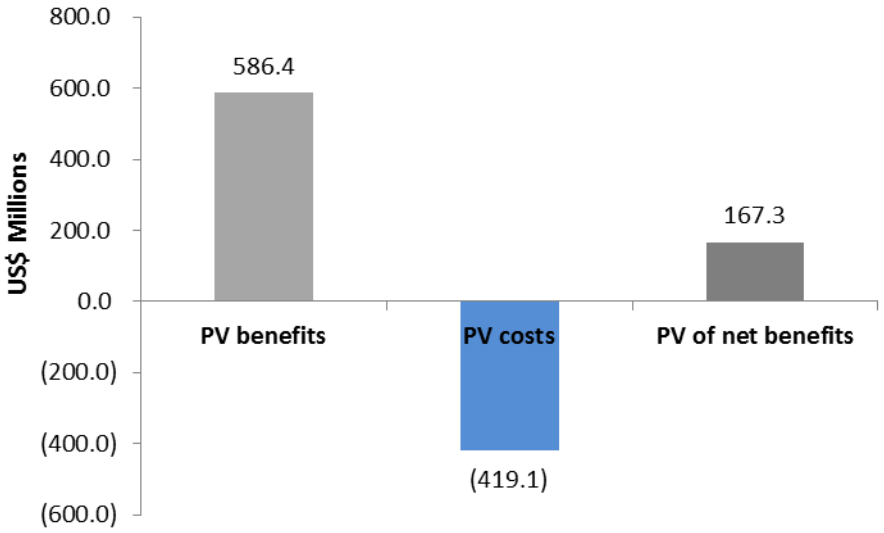
The purpose of this section is to determine whether the Renewable Energy Component ('Component III') of the Sustainable Energy Facility ('the Program') is economically viable. Component III of the Program will fund renewable energy power projects, with an emphasis in geothermal power. To determine Component III's economic viability, we perform a Cost Benefit Analysis ('CBA') of the geothermal projects that it will potentially fund. We find that that the geothermal projects have an aggregate net present value of

approximately US$167.3 million and internal rate of return of 16% percent. That is, the projects are economically viable. Therefore, the Governments and the donors should proceed with implementing the geothermal projects.

In this section we present the results of the five geothermal projects financed in the first phase. Our analysis excludes the second phases of the geothermal projects in Saint Kitts and Dominica because they will not be funded by the SEF. We present our analysis as follows:

- Methodology and Assumptions (Section 3.1)
- Economic Costs, Economic Benefits, and Net Economic Benefits of the Geothermal Projects (Section 3.2)
- Sensitivity Analysis of Geothermal Projects (Section 3.3)

Figure 3.1: Net Economic Benefits of the Geothermal Projects in the five Eastern Caribbean Countries



3.1 Methodology and Assumptions

The objective of the CBA methodology is to determine whether or not Component III of the Sustainable Energy Facility ('the Program') is economically viable. We do so by estimating the net benefits of the indicative geothermal projects that will be financed by the Program.

To determine the projects' economic viability, the present values (PV) of the projects' net benefits are calculated. We calculate the projects' benefits by finding the difference in the electricity costs incurred and greenhouse gas emissions (GHG) emitted between the Program scenario and the counterfactual scenario. The counterfactual scenario is when no geothermal projects are implemented and the electricity sectors in the ECC remain predominantly based on diesel and heavy fuel oil.

The steps to calculate the net benefits of the Program are:

- Estimate the economic costs of geothermal projects (Section 3.1.1)

- Estimate the economic benefits of geothermal projects (Section 3.1.2)
- Estimate the present value of the geothermal projects net economic benefits (Section 3.1.3).

We discuss each of these steps and the assumptions used in their calculation (Section 3.1.4) in more detail below:

3.1.1 Economic Costs of Geothermal Projects

The economic costs of the geothermal projects are composed by:

- **Capital Expenditures (Capex)**—these are the capital investments needed to complete the project stages that are pending. Specifically, we include the costs for completing the pre-investment stages (first slim hole drillings), the exploration stage (test drilling), and the field development stage (production drilling and power plant construction). The costs for developing access roads and/or transmission lines connecting GE projects to the local grid were also considered. The IDB provided estimation of Capex per stage of development.

3.1.2 Economic Benefits of Geothermal Projects

The economic benefits of the geothermal projects are composed by:

- **Savings in generation costs**—generating electricity from geothermal resources potentially cost less than generating electricity from fuel oil. Therefore, the country will save in generation costs by replacing fuel oil generation with geothermal generation. We estimate the savings to the country as the difference between the Total Avoided Cost ('TAC') of fuel oil generation and the Total Operating Costs ('TOC') of geothermal generation. The TAC is the long run marginal cost of diesel generation. We use the following formulas to calculation the savings in generations costs:

$$TAC\ (US\$) = Avoided\ Cost\ of\ Fuel\ Oil\ Generation\left(\frac{US\$}{kWh}\right) \times Generation\ from\ Geothermal\ (kWh)$$

$$Avoided\ Cost\ of\ Fuel\ Oil\ Generation\left(\frac{US\$}{kWh}\right) = \frac{Total\ Fuel\ Cost\ (US\$)}{Total\ Energy\ Sold\ (kWh)}$$

$$TOC(US\$) = Operating\ Costs\ from\ Geothermal\left(\frac{US\$}{kWh}\right) \times Generation\ from\ Geothermal\ (kWh)$$

- **Reduction in CO_2 emissions**—generating electricity from geothermal resources produces less CO_2 emissions than generating electricity with fuel oil. We calculate the economic benefit of the reduction in CO_2 emissions as the product of the expected reduction in CO_2 emissions and the social cost of CO_2 emissions. The expected reduction in CO_2 emissions is the product of the CO_2 emissions per unit of electricity produced from fuel oil and the units of electricity produced from geothermal generation.

3.1.3 Net Economic Benefits of Geothermal Projects

After we estimate the project's economic costs and benefits, the next step is to calculate the PV of the project's net benefits. To do so, we subtract the PV of the project's costs from the PV of the project's benefits. To determine the PV of the projects costs and

benefits, we use a social discount rate of 12 percent (in real terms). If the PV of the project's net benefits is greater than zero, the PV of economic benefits is greater than the PV of economic costs. That means that the geothermal project is economically viable and, therefore, the Government and the donors should proceed with implementing it.

3.1.4 Assumptions for Geothermal Projects

To determine the geothermal project's net benefits, we estimate the annual economic costs and benefits of the geothermal project, for a period of 40 years. Table 3.1 presents the assumptions used to calculate the economic costs and benefits of the geothermal projects.

Table 3.1: Assumptions Used to Determine the Economic Costs and Benefits of the Geothermal Projects

Variable	All Projects	Dom.	Gren.	Nevis	SL	SVG
Plant size (MW)	60	10	10	10	20	10
Plant availability (%)	85					
Total Capex (US$ million)	517.0	67.0	102.3	92.1	159.3	96.3
Pre-investment	12	0	6	0	6	0
Exploration	56	0	14	14	14	14
Production Drilling	112	7	21	21	42	21
Power Plant Construction	261	45	45	45	81	45
T&D and Access Roads	76.0	15.0	16.3	16.3	16.3	16.3
Operating cost of electricity from geothermal generation (US$/kWh)	0.02[3]					
Social Cost of one ton of CO_2 emissions (US$/t$CO_2$)	10[4]					
Tons of CO_2 emissions per kWh of electricity produced from fuel oil (No.2) (tCO_2/MWh)	0.76[5]					
Avoided cost of fuel oil generation (US$)		0.174	0.205	0.192	0.20	0.189
Discount rate (%)	12					

[3] Office of Energy Efficiency & Renewable Energy. U.S. Department of Energy. "Geothermal FAQS." http://www1.eere.energy.gov/geothermal/faqs.html (accessed on 9 December 2014).

[4] The Department of Energy assigns a range for the social cost of CO_2 from $0 to $20 per ton of CO_2. We use the median value of this range. See following source:

Department of Energy. Chapter 9: Emissions Monetization. Pg. 2 https://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/ch_9_ashrae_nopr_tsd.pdf. (accessed on 4 December 2014)

[5] U.S. Energy Information Administration. "Frequently Asked Questions: How much carbon dioxide is produced per kilowatt-hour when generating electricity with fossil fuels?" http://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11. Accessed on 4 December 2014.

The assumptions are based on studies from reliable sources and estimations based on the indicative project pipeline. For example, our assumptions on plant sizes are based on the proposed geothermal projects included in the indicative project pipeline. The indicative project pipeline was developed by the IDB and Castalia based on information from Governments and project sponsors in the EC. Our assumptions for capital expenditures are based on each country's stage of geothermal development, and the estimated average costs for developing each geothermal stage from the IDB and the Energy Sector Management Assistance Program (ESMAP).[6] Our assumptions for avoided cost of fuel oil generation are based on the capital, operating, and maintenance costs of diesel-based generation in the Eastern Caribbean.[7] The avoided cost of fuel generation is based on the information of the Financial Statements of the utilities of each country. The 12 percent discount rate is in line with the discount rates used in ESMAP's 2012 Geothermal Handbook.

3.2 Economic Costs, Economic Benefits, and Net Economic Benefits of the Geothermal Projects

This section presents the results of the CBA. When aggregating the economic cost and benefits of the geothermal projects, we find that the aggregated net benefits are positive. Also, each project individually has positive net benefits. That means that the implementation of the Program will allow the development of geothermal projects that generate net economic benefits for each of the countries and the region as a whole.

Table 3.2 presents the economic costs and benefits of the each of the five projects and the net aggregated economic benefits for the region. Each of the geothermal projects has positive net economic benefits and an internal rate of return ('IRR') that exceeds the 12 percent cost of capital. Therefore all of the geothermal projects are economically viable.

Table 3.2: Economic Costs and Benefits of the Geothermal Projects

Project	PV Benefits (US$M)	PV Costs (US$M)	PV of net benefits (US$M)	IRR (%)
Dominica Phase 1	110.6	60.6	50.0	20.4%
Grenada	100.7	78.9	21.8	14.7%
Nevis	97.4	78.3	19.2	14.47%
Saint Lucia	178.6	121.2	57.4	16.7%
Saint Vincent and the Grenadines	99.1	80.1	19.0	14.4%
Total	586.4	419.1	167.3	16.0%

[6] The Energy Sector Management Assistance Program (ESMAP). "Geothermal Handbook: Planning and Financing Power Generation." June 2012 and West Japan Engineering Consultants, Inc., "Study on Current Status of Geothermal Development in the Eastern Caribbean Islands." March 2014.

[7] Our assumption for avoided cost of fuel oil generation is based on the capital, operational, and maintenance expenses for generating one kWh of electricity from diesel based technology in Barbados (included in the Barbados Integrated Resource Plan).

A detailed schedule of the annual benefits and costs for each project is included in Appendix A.

3.3 Sensitivity Analysis of Geothermal Projects

We conducted a sensitivity analysis to estimate the impact that changes in the values of some key variables used in the CBA would have on the expected economic viability of the projects. The independent variables we included in our sensitivity analysis are the price for monetizing CO2 emissions, the capital expenditures, and the avoided cost (price of oil). We selected these variables based on the likelihood that these variables could change and the size of the impact that the variables would have if they did change.

These projects have smaller net benefit margins and so have less room to absorb increases in costs and decreases in benefits. For the remainder of this section we discuss in more detail the effects of:

- Changing the Price of CO_2 Emissions
- Changing CAPEX
- Changing the price of oil.

Table 3.3 presents the results of changing the price of CO2 emissions. We present the PV of the costs, benefits, and net benefits of the geothermal projects for a high case (increasing the price to US$15 per ton of Co2) and low case (decreasing the price to US$6 per ton of Co2) as well as the base case (US$10 per ton of Co2). The table shows that even after lowering the price of CO2 emissions, all of the geothermal projects remain economically viable, with an aggregate NPV of US$158 million. In the high price scenario, the aggregate NPV increases to US$180 million.

Table 3.3: CBA Sensitivity to Changes in Price of CO_2 Emissions

(US$000)	**Scenario** US$/t$CO_2$ emissions	**Dominica Phase 1**	**Grenada**	**Nevis**	**Saint Lucia**	**SVG**	**All 5 projects**
PV benefits	Base: 10	110,585	100,676	97,437	178,620	99,071	586,389
	15	112,659	104,795	99,285	181,915	100,919	599,573
	6	108,927	98,567	95,958	175,984	97,592	577,029
PV costs	Base: 10	60,571	78,873	78,270	121,238	80,118	419,071
	15						
	6						
PV of net benefits	**Base: 10**	**50,014**	**21,803**	**19,167**	**57,382**	**18,953**	**167,319**
	15	**52,087**	**25,922**	**21,015**	**60,677**	**20,801**	**180,502**
	6	**48,356**	**19,694**	**17,688**	**54,746**	**17,474**	**157,958**
IRR	Base: 10	20.4%	14.7%	14.5%	16.7%	14.4%	16.0%
	15	20.8%	15.3%	14.7%	16.9%	14.7%	16.3%
	6	20.2%	14.5%	14.3%	16.5%	14.3%	15.8%

Table 3.4 presents the results of increasing capital expenditures ('CAPEX'). We present the PV of the costs, benefits, and net benefits of the geothermal projects for a high case where CAPEX increases by 20 percent and a medium case where CAPEX increases by 10 percent. The results show that for the high case the aggregate PV of net benefits remains positive at US$83.5 million.

Table 3.4: CBA Sensitivity to Changes in Capex

(US$000)	**Scenario** Capex Overrun	**Dominica Phase 1**	**Grenada**	**Nevis**	**Saint Lucia**	**SVG**	**All 5 projects**
PV benefits	Base: No	110,585	100,676	97,437	178,620	99,071	586,389
	10%						
	20%						
PV costs	Base: No	60,571	78,873	78,270	121,238	80,118	419,071
	10%	66,629	86,761	86,097	133,362	88,130	460,978
	20%	72,686	94,648	93,924	145,486	96,142	502,885
PV of net benefits	**Base: No**	**50,014**	**21,803**	**19,167**	**57,382**	**18,953**	**167,319**
	10%	**43,957**	**13,916**	**11,340**	**45,258**	**10,941**	**125,411**
	20%	**37,900**	**6,028**	**3,513**	**33,134**	**2,929**	**83,504**
IRR	Base: No	20.4%	14.7%	14.5%	16.7%	14.4%	16.0%
	10%	18.8%	13.6%	13.4%	15.4%	13.3%	14.8%
	20%	17.4%	12.7%	12.4%	14.3%	12.3%	13.7%

Table 3.5 presents the results of changes in the avoided cost of generation due to changes in the price of oil to a high and a low price scenario based on U.S. Energy Information Administration (EIA) projections. A lower oil price means that the avoided cost of diesel-based generation is lower, and so the benefits from geothermal power are lower, and vice versa. The table shows that in most cases the projects remain economically viable when there are changes in the price of oil. Only when the price of oil is reduced to the low scenario, the projects in Grenada, Nevis, and Saint Vincent and the Grenadines are no longer economically viable. However, their IRRs are greater than 10%. The reason why these projects are not economically viable under this scenario is that these projects are smaller and farther behind in developing their geothermal resource, and so have a smaller net benefit margins. At an aggregate level the projects are no longer economically viable at the low oil price scenario, with a negative US$4 million PV and an 11.9 percent internal rate of return.

Table 3.5: CBA Sensitivity to Changes in Avoided Cost Due to Changes in Oil Price

(US$000)	Avoided Cost with Oil Price @US$/barrel	**Dominica Phase 1**	**Grenada**	**Nevis**	**Saint Lucia**	**SVG**	**All 5 projects**
PV benefits	Base: EIA Reference	110,585	100,676	97,437	178,620	99,071	586,389
	High	194,092	178,115	170,804	313,099	173,913	1,030,023
	Low	78,564	70,553	69,232	126,308	70,299	414,956
PV costs	Base: EIA Reference	60,571	78,873	78,270	121,238	80,118	419,071
	High						
	Low						
PV of net benefits	**Base: EIA Reference**	**50,014**	**21,803**	**19,167**	**57,382**	**18,953**	**167,319**
	High	**133,521**	**99,241**	**92,535**	**191,861**	**93,795**	**610,953**
	Low	**17,992**	**-8,321**	**-9,038**	**5,070**	**-9,819**	**-4,115**
IRR	Base: EIA Reference	20.4%	14.7%	14.5%	16.7%	14.4%	16.0%
	High	33.9%	23.4%	23.1%	26.4%	23.4%	25.7%
	Low	15.3%	10.8%	10.7%	12.5%	10.6%	11.9%

4 Cost Benefit Analysis of the Street Lighting Projects

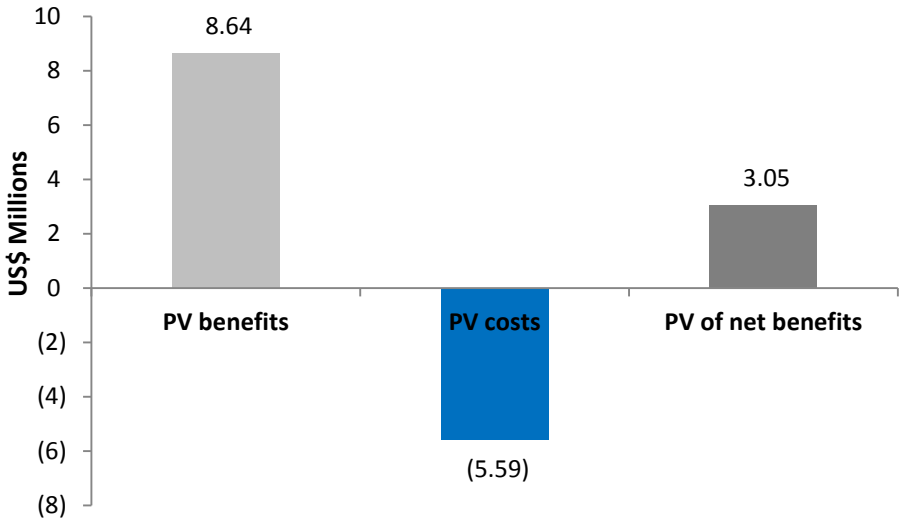
The purpose of this section is to show whether the Energy Efficiency ('EE') Component ('Component I') of the Sustainable Energy Facility ('the Program') is economically viable. Component I of the Program will provide loans to public sector actors to promote EE measures such as: (i) retrofitting government buildings; (ii) installing new or replacing existing streetlights with more efficient ones; (iii) increasing power generation efficiency; and (iv) implementing EE programs for small and medium enterprises (SMEs) and housing projects.

To determine Component I's economic viability, we perform a Cost Benefit Analysis ('CBA') of the EE projects that it will potentially fund. We find that that the EE projects have an aggregate net economic benefits of approximately US$3.1 million in PV and an internal rate of return of 24 percent. Therefore, the Governments and the donors should proceed with implementing the EE projects.

In this section we present the aggregate results of the two EE projects financed through the Program. We present our analysis as follows:

- Methodology and Assumptions (Section 4.1)
- Economic Costs, Economic Benefits, and Net Economic Benefits of the Geothermal Projects (Section 4.2)
- Sensitivity Analysis of Geothermal Projects (Section 4.3).

Figure 4.1: Net Economic Benefits of the Street Lighting Projects in the five Eastern Caribbean Countries



4.1 Methodology and Assumptions

The objective of the CBA methodology is to determine whether or not Component I of the Program is economically viable. We do so by estimating the net benefits of the indicative EE projects that will be financed by the Program. The indicative EE projects potentially financed by the Program include installing energy efficient street lamps in Saint Lucia and Dominica. For the remainder of this section, to facilitate discussion we will refer to the EE projects financed through the Program as street lighting projects.

To determine the projects' economic viability, the present values (PV) of the projects' net benefits are calculated. We calculate the projects' benefits by finding the difference in the electricity costs incurred and monetary impact of the greenhouse gas emissions (GHG) emitted between the Program scenario and the counterfactual scenario. The counterfactual scenario is that the Governments do not invest in EE retrofits for street lights, and maintains the current technology. Therefore, electricity consumption for public buildings and public lights is assumed to remain constant.

The steps to calculate the net benefits of the Program are:

- Estimate the economic costs of geothermal projects (Section 4.1.1)
- Estimate the economic benefits of geothermal projects (Section 4.1.2)
- Estimate the present value of the geothermal projects net economic benefits (Section 4.1.3).

We discuss each of these steps and the assumptions used in their calculation (Section 4.1.4) in more detail below:

4.1.1 Economic Costs of Street Lighting Projects

The economic costs of the street lighting projects are composed by:

- **Capital Expenditures (Capex)**—these are the capital investments needed to install the EE streetlamps. Specifically, we include equipment and travel costs for the specialized suppliers who will install the streetlights. Travel costs are included for each year in which the streetlights are installed
- **Operations and Maintenance (O&M)**—these are the equipment and labor costs for replacing the streetlights that malfunction and fail every year during the life of the project
- **Other costs**—these are the other costs needed to install and operate the EE streetlights. Within this category we include the costs for the studies, training, and monitoring and verification needed to install and maintain the streetlights. Specifically, for each country we include a baseline and optimization study to determine the number of streetlights to replace and the type of technology to adopt. We also include the training needed to build local technical capacity needed to operate and maintain the streetlights. Finally, we also include annual monitoring and verification costs for ensuring that the streetlights are operating optimally and identifying those that need to be replaced.

4.1.2 Economic Benefits of Street Lighting Projects

The economic benefits of the street lighting projects are composed by:

- **Savings in avoided electricity expenditures**—EE streetlights consume less electricity than the lamps currently in use. Therefore, the country will save in electricity expenditures by replacing streetlights currently in use with EE ones. We estimate the savings to the country as the difference in electricity expenditures incurred under the baseline scenario and those incurred with the street lighting projects. For the baseline scenario we assume that the streetlights replaced under the street lighting projects are not replaced. We use the following formulas to calculate annual electricity savings:

$$Electricity\ savings\ (kWh) = Baseline\ consumption\ (kWh) - Project\ consumption\ (kWh)$$

$$Baseline\ Consumption\ (kWh) = \#\ of\ Streetlights\ Retrofitted * Annual\ Baseline\ Consumption\ (\frac{kWh}{streetlight})$$

$$Project\ Consumption(kWh) = \#\ of\ Streetlights\ Retrofitted * Annual\ Project\ Consumption\ (\frac{kWh}{streetlight})$$

- **Reduction in CO_2 emissions**—EE streetlights consume less electricity resulting in electricity savings. These electricity savings result in avoided GHG emissions from the displaced electricity generation. We calculate the economic benefit of the reduction in CO_2 emissions as the product of the expected reduction in CO_2 emissions and the social cost of CO_2 emissions. The expected reduction in CO_2 emissions is product of the CO_2 emissions per unit of electricity produced based on fuel oil generation[8] and the number of units of electricity savings.

4.1.3 Net Economic Benefits of Street Lighting Projects

After we estimate the street lighting projects' economic costs and benefits, the next step is to calculate the PV of the street lighting projects' net benefits. To do so, we subtract the PV of the projects' costs from the PV of the projects' benefits. To determine the PV of the projects' costs and benefits, we use a social discount rate of 12 percent (in real terms). If the PV of the project's net benefits is greater than zero, it means that the PV of economic benefits is greater than the PV of economic costs. This means that the streetlights projects are economically viable and, therefore, the Government and the donors should proceed with implementing them.

4.1.4 Assumptions for Street Lighting Projects

To determine the geothermal project's net benefits, we estimate the annual economic costs and benefits of the street lighting projects, for a period of 15 years. We assume that the EE streetlights are installed once and maintained until they reach the end their lifetime. Table 4.1 presents the assumptions used to calculate the street lighting projects' economic costs and benefits.

[8] This calculation assumes that the predominant generation technology in the EC countries that install EE streetlights will remain diesel based. This might change if the geothermal projects presented in Section 0 are implemented before the streetlight projects.

Table 4.1: Assumptions Used to Determine the EE Project's Economic Costs and Benefits

Variable	All Projects	Dominica	Saint Lucia
Lamps retrofitted per technology (Number) : ▪ HPS Lamp, 400W ▪ HPS Lamp, 250 W ▪ HPS Lamp, 100 W ▪ HPS Lamp, 50 W	 ▪ 3100 ▪ 2500 ▪ 2200 ▪ 0	 ▪ 1600 ▪ 800 ▪ 0 ▪ 0	 ▪ 1500 ▪ 1700 ▪ 2200 ▪ 0
Capex per technology (US$/unit): ▪ HPS Lamp, 400W ▪ HPS Lamp, 250 W ▪ HPS Lamp, 100 W ▪ HPS Lamp, 50 W	 ▪ 1000 ▪ 900 ▪ 500 ▪ 300		
Yearly O&M cost equipment cost (US$/unit/year): ▪ HPS Lamp, 400W ▪ HPS Lamp, 250 W ▪ HPS Lamp, 100 W ▪ HPS Lamp, 50 W	 ▪ 20 ▪ 18 ▪ 10 ▪ 6		
Baseline Consumption per year (kWh/year/unit): ▪ HPS Lamp, 400W ▪ HPS Lamp, 250 W ▪ HPS Lamp, 100 W ▪ HPS Lamp, 50 W	 ▪ 2032 ▪ 1314 ▪ 517 ▪ 263		
Project Consumption per year per technology (kWh/year/unit): ▪ HPS Lamp, 400W ▪ HPS Lamp, 250 W ▪ HPS Lamp, 100 W ▪ HPS Lamp, 50 W	 ▪ 1016 ▪ 657 ▪ 258 ▪ 131		
Life time of lamps (years)	11.42		
Social Cost of one ton of CO_2 emissions (US$/t$CO_2$)	10[9]		

[9] The Department of Energy assigns a range for the social cost of CO_2 from \$0 to \$20 per ton of CO_2. We use the median value of this range. See following source:

Department of Energy. Chapter 9: Emissions Monetization. Pg. 2 https://www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/ch_9_ashrae_nopr_tsd.pdf. (accessed on 4 December 2014)

Tons of CO_2 emissions per kWh of electricity produced from fuel oil (No.2) (tCO_2/MWh)	0.75[10]		
Avoided cost of electricity expenditures (US$)		0.26[11]	0.39[12]
Discount Rate (percent)	12		

4.2 Economic Costs, Economic Benefits, and Net Economic Benefits of the Street Lighting Projects

This section presents the results of the CBA. When aggregating the economic costs and benefits of the street lighting projects, we find that the PV of the net benefits is positive. Also, each individual project has positive PV of net benefits. This means that the implementation of the Program will allow the development of street lighting projects that generate net economic benefits for each of the countries and the region as a whole.

Table 4.2 presents the economic costs and benefits of the each of the two projects included in the indicative project pipeline and the net aggregated economic benefits for the region. Each of the street lighting projects has positive net economic benefits and an internal rate of return ('IRR') that exceeds the 12 percent cost of capital. Therefore all of the street lighting projects are economically viable.

Table 4.2: Economic Costs and Benefits of the Street lighting Projects

Project	PV Benefits (US$ million)	PV Costs (US$ million)	PV of net benefits (US$)	IRR (%)
Dominica	2.7	2.0	0.7	19.9
Saint Lucia	5.9	3.6	2.3	26.4
Total	8.6	5.6	3.1	24.1

A detailed schedule of the annual benefits and costs for each project is included in Appendix B.

4.3 Sensitivity Analysis of Street Lighting Projects

We conducted a sensitivity analysis to estimate the impact that changes in the values of some key variables used in the CBA would have on the expected economic viability of the projects. The independent variables we included in our sensitivity analysis are the

[10] U.S. Energy Information Administration. "Frequently Asked Questions: How much carbon dioxide is produced per kilowatt-hour when generating electricity with fossil fuels?" http://www.eia.gov/tools/faqs/faq.cfm?id=74&t=11. Accessed on 4 December 2014.

[11] 2014 Dominica Street Lighting Tariff (71 cents per unit converted to US dollars). Source: DOMLEC. "DOMLEC Tariff Sheet effective as of September 2007" http://www.domlec.dm/index.php/our-company/news/24-domlec-tariff-sheet. Accessed on 28 June 2015.

[12] 2014 St. Lucia Basic Energy Rate for Street Lighting converted to US Dollar. Source: LUCELEC "Basic Energy Rates" https://www.lucelec.com/content/energy-rates. Accessed on 28 June 2015.

efficiency of the retrofitted lamps and the price of oil. We chose these variables based on the estimated likelihood that these variables could change and the size of the impact that the variables would have if they did change.

Overall, we find that the projects remain economically viable when the key variables change to extreme values. The project in Saint Lucia performs better than the project in Dominica. The project in Saint Lucia has a larger net benefit margin and so has more room to absorb decreases in benefits. Tariffs in Saint Lucia are higher than they are in Dominica. Therefore the net electricity savings from the project in Saint Lucia are higher, creating a greater cushion to absorb decreases in benefits. For the remainder of this section we discuss in more detail the effects of:

- Changing the efficiency levels (electricity consumption) of the street lamps
- Changing the avoided cost (due to changes in the price of oil).

Table 4.2 presents the results of changing the efficiency of retrofitting streetlights. We present the PV of the costs, benefits, and net benefits of the projects for a low efficiency case (a 10 percent decrease in the efficiency) and a high efficiency case (a 10 percent increase in the efficiency). The table shows that even after decreasing the efficiency levels of the retrofitted street lamps, the projects in both countries remain economically viable, with PVs of US$1.76 million and US$0.43 million in Saint Lucia and Dominica, respectively. Similarly, IRRs of both projects remain above the discount rate of 12 percent.

Table 4.3: CBA Sensitivity to Changes in Efficiency of Street Light Lamps

(US$)	Saint Lucia			Dominica		
	Base	Lower efficiency (+10% consumption)	Higher efficiency (-10% consumption)	Base	Lower efficiency (+10% consumption)	Higher efficiency (-10% consumption)
PV benefits	5,909,572	5,318,615	6,500,529	2,728,552	2,455,697	3,001,407
PV costs	(3,561,177)			(2,026,372)		
PV of net benefits	**2,348,396**	**1,757,438**	**2,939,353**	**702,181**	**429,326**	**975,036**
IRR	26.39%	22.99%	29.71%	19.86%	16.91%	22.71%

Table 4.4 presents the results of changing the price of oil to a high of 70 and a low of 52. A lower oil price means that electricity tariffs are lower and so the savings in electricity expenditures of the projects are lower, and vice versa. We assume that the non-fuel costs remain constant. The table shows that even when the price of oil is reduced to 52 per barrel, the projects in both countries remain economically viable, with PV of US$0.74 million and US$0.16 million in Saint Lucia and Dominica, respectively. Similarly, IRRs of both projects remain above the discount rate of 12 percent.

Table 4.4: CBA Sensitivity to Changes in Avoided Cost due to Changes in Oil Price

	Saint Lucia			Dominica		
(US$)	Base (Current Tariff)	Oil Price @70 per barrel	Oil Price @52 per barrel	Base (Current Tariff)	Oil Price @70 per barrel	Oil Price @52 per barrel
PV benefits	5,909,572	4,732,570	4,300,200	2,728,552	2,397,993	2,190,459
PV costs	3,561,177			2,026,372		
PV of net benefits	**2,348,396**	**1,171,394**	**739,023**	**702,181**	**371,621**	**164,087**
IRR	26.39%	19.49%	16.82%	19.86%	16.28%	13.93%

5 Cost Benefit Analysis of All Projects in the Pipeline

The purpose of this section is to show the aggregate economic viability of the Sustainable Energy Facility ('the Program'). Among other investments, the Program will fund renewable energy projects, with an emphasis on geothermal energy, and energy efficiency projects.

To determine Program's economic viability, we perform a Cost Benefit Analysis ('CBA') of the projects that it will fund. We find that that the projects have an aggregate net present value of approximately US$170 million and internal rate of return of 18 percent. Therefore, the Governments and the donors should proceed with implementing the projects.

Figure 5.1: Net Economic Benefits and Internal Rate of Return of the Program

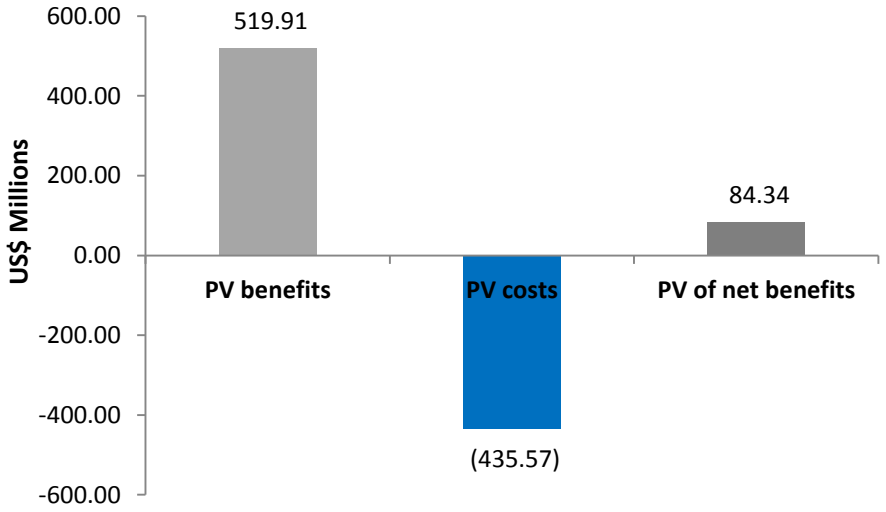


Table 5.1 presents the economic costs and benefits of the each of the seven projects included in the indicative project pipeline, and the net aggregated economic benefits for the region. Each of the projects has positive net economic benefits and an internal rate of return ('IRR') that exceeds the 12 percent cost of capital. Therefore all of the individual projects are economically viable.

Table 5.1: Economic Costs and Benefits of the Geothermal Projects

Project	PV Benefits (US$)	PV Costs (US$)	PV of net benefits (US$)	IRR (%)
Geothermal Projects				
Dominica Phase 1	110.6	60.6	50.0	20.4%
Grenada	100.7	78.9	21.8	14.7%
Nevis	97.4	78.3	19.2	14.47%
Saint Lucia	178.6	121.2	57.4	16.7%
Saint Vincent and the Grenadines	99.1	80.1	19.0	14.4%

Project	PV Benefits (US$)	PV Costs (US$)	PV of net benefits (US$)	IRR (%)
Subtotal	**586.4**	**419.1**	**167.3**	**16.0%**
Street Lighting Projects				
Dominica	2.7	2.0	0.70	19.9
Saint Lucia	5.9	3.6	2.3	26.4
Subtotal	**8.6**	**5.6**	**3.0**	**24.1**
Total	**519.9**	**435.6**	**84.3**	**18.0**

As mentioned above, all projects are economically viable and net economic benefits range from a high of US$57 million for the geothermal project in Saint Lucia to a low of US$700,000 for the street lighting project in Dominica. The geothermal projects have higher net economic benefits than the street lighting projects due to their high potential in terms if installed capacity measured in MW and the high displacement of fossil fuels they represent. On the other hand, the street lighting projects present higher internal rates of returns. This relationship is explained by the larger scale of the geothermal projects, which provide larger size PV of benefits but require much larger investments compared to the street lighting projects. This relationship is also explained by the fact that the street lighting projects generated benefits sooner in time than the geothermal projects.

Appendix A: Annual Economic Costs and Benefits of the Geothermal Projects

This Appendix presents the schedule of the annual economic costs and benefits of the geothermal projects in each country. The schedules show the annual net cash flows from the geothermal projects and the net present value and internal rates of return. We find that each of the geothermal projects has positive net economic benefits and an internal rate of return ('IRR') that exceeds the 12 percent discount rate. Therefore all of the geothermal projects are economically viable.

Table A.1: Schedule of Annual Economic Costs and Benefits of Geothermal Project in Dominica (Phase 1)

Dominica Phase 1		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Geothermal Monetary Savings													
Geothermal generation	MWh	0	0	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
Reduction in CO_2 emissions	tCO_2	0	0	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
+ Saved cost of generation with diesel/fuel oil	US$ '000	0	0	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960
- O&M of geothermal generation	US$ '000	0	0	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
+ Reduction in CO_2 emissions	US$ '000	0	0	625	625	625	625	625	625	625	625	625	625
Benefits	US$ '000	0	0	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096
PV benefits	US$ '000	**88,920**											
Geothermal Costs													
Geothermal Capital Expenditures	US$ '000	7,000	61,300	0	0	0	0	0	0	0	0	0	0
PV costs	US$ '000	**61,732**											
Benefits - Costs	US$ '000	-7,000	-61,300	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096
Cost-benefit of geothermal project	US$ '000	**27,188**											
IRR	%	17.4%											

2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960
1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
625	625	625	625	625	625	625	625	625	625	625	625	625	625	625
12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096

2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960	12,960
1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
625	625	625	625	625	625	625	625	625	625	625	625	625	625
12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096
0	0	0	0	0	0	0	0	0	0	0	0	0	0
12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096	12,096

Table A.2: Schedule of Annual Economic Costs and Benefits of Geothermal Project in Grenada

Grenada		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Geothermal Monetary Savings													
Geothermal generation	MWh	0	0	0	0	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
Reduction in CO_2 emissions	tCO_2	0	0	0	0	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
+ Saved cost of generation with diesel/fuel oil	US$ '000	0	0	0	0	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239
- O&M of geothermal generation	US$ '000	0	0	0	0	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
+ Reduction in CO_2 emissions	US$ '000	0	0	0	0	625	625	625	625	625	625	625	625
Benefits	US$ '000	0	0	0	0	14375	14375	14375	14375	14375	14375	14375	14375
PV benefits	US$ '000	**83,977**											
Geothermal Costs													
Geothermal Capital Expenditures	US$ '000	6,000	14,000	21,000	61,300	0	0	0	0	0	0	0	0
CO_2 emissions	tCO_2												
PV costs	US$ '000	**78,873**											
Benefits - Costs	US$ '000	-6,000	-14,000	-21,000	-61,300	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375
Cost-benefit of geothermal project	US$ '000	**5,104**											
IRR	%	12.8%											

2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239
1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
625	625	625	625	625	625	625	625	625	625	625	625	625	625	625
14375	14375	14375	14375	14375	14375	14375	14375	14375	14375	14375	14375	14375	14375	14375
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375

2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239	15,239
1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
625	625	625	625	625	625	625	625	625	625	625	625	625	625
14375	14375	14375	14375	14375	14375	14375	14375	14375	14375	14375	14375	14375	14375
0	0	0	0	0	0	0	0	0	0	0	0	0	0
14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375	14,375

Table A.3: Schedule of Annual Economic Costs and Benefits of Geothermal Project in Nevis

Nevis		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Geothermal Monetary Savings													
Geothermal generation	MWh	0	0	0	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
Reduction in CO_2 emissions	tCO_2	0	0	0	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
+ Saved cost of generation with diesel/fuel oil	US$ '000	0	0	0	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286
- O&M of geothermal generation	US$ '000	0	0	0	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
+ Reduction in CO_2 emissions	US$ '000	0	0	0	625	625	625	625	625	625	625	625	625
Benefits	US$ '000	0	0	0	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423
PV benefits	US$ '000	**87,968**											
Geothermal Costs													
Geothermal Capital Expenditures	US$ '000	14,000	21,000	61,300	0	0	0	0	0	0	0	0	0
PV costs	US$ '000	**81,618**											
Benefits - Costs	US$ '000	-14,000	-21,000	-61,300	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423
Cost-benefit of geothermal project	US$ '000	**6,350**											
IRR	%	12.9%											

2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286
1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
625	625	625	625	625	625	625	625	625	625	625	625	625	625	625
13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423

2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286	14,286
1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
625	625	625	625	625	625	625	625	625	625	625	625	625	625
13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423
0	0	0	0	0	0	0	0	0	0	0	0	0	0
13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423	13,423

Table A.4: Schedule of Annual Economic Costs and Benefits of Geothermal Project in Saint Lucia

Saint Lucia		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Geothermal Monetary Savings													
Geothermal generation	MWh	0	0	0	0	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920
Reduction in CO_2 emissions	tCO_2	0	0	0	0	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093
+ Saved cost of generation with diesel/fuel oil	US$ '000	0	0	0	0	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806
- O&M of geothermal generation	US$ '000	0	0	0	0	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978
+ Reduction in CO_2 emissions	US$ '000	0	0	0	0	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251
Benefits	US$ '000	0	0	0	0	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078
PV benefits	US$ '000	**164,031**											
Geothermal Costs													
Geothermal Capital Expenditures	US$ '000	6,000	14,000	42,000	106,300	0	0	0	0	0	0	0	0
CO_2 emissions	tCO_2												
PV costs	US$ '000	**127,644**											
Benefits - Costs	US$ '000	-6,000	-14,000	-42,000	-106,300	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078
Cost-benefit of geothermal project	US$ '000	**36,387**											
IRR	%	**15.3%**											

2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920
125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093
29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806
2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978
1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251
28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078

2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920	148,920
125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093	125,093
29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806	29,806
2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978	2,978
1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251	1,251
28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078
0	0	0	0	0	0	0	0	0	0	0	0	0	0
28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078	28,078

Table A.5: Schedule of Annual Economic Costs and Benefits of Geothermal Project in Saint Vincent and the Grenadines

Saint Vincent and the Grenadines		2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Geothermal Monetary Savings													
Geothermal generation	MWh	0	0	0	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
Reduction in CO_2 emissions	tCO_2	0	0	0	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
+ Saved cost of generation with diesel/fuel oil	US$ '000	0	0	0	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044
- O&M of geothermal generation	US$ '000	0	0	0	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
+ Reduction in CO_2 emissions	US$ '000	0	0	0	625	625	625	625	625	625	625	625	625
Benefits	US$ '000	0	0	0	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180
PV benefits	US$ '000	**86,380**											
Geothermal Costs													
Geothermal Capital Expenditures	US$ '000	0	35,000	61,300	0	0	0	0	0	0	0	0	0
PV costs	US$ '000	**80,118**											
Benefits - Costs	US$ '000	0	-35,000	-61,300	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180
Cost-benefit of geothermal project	US$ '000	**6,262**											
IRR	%	12.9%											

2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044
1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
625	625	625	625	625	625	625	625	625	625	625	625	625	625	625
13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180

2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055
74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460	74,460
62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546	62,546
14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044	14,044
1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489	1,489
625	625	625	625	625	625	625	625	625	625	625	625	625	625
13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180
0	0	0	0	0	0	0	0	0	0	0	0	0	0
13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180	13,180

Appendix B: Annual Economic Costs and Benefits of the Street Lighting Projects

This Appendix presents the schedule of the annual economic costs and benefits of the Energy Efficiency ('EE') projects in each country. The schedules show the annual net cash flows from the EE projects and the net present value and internal rates of return. We find that each of the EE projects has positive net economic benefits and an internal rate of return ('IRR') that exceeds the 12 percent discount rate. Therefore all of the EE projects are economically viable.

Table B.1: Schedule of Annual Economic Costs and Benefits of Street Lighting Project in Saint Lucia

		2015	2016	2017	2018	2019	2020
Net Benefits (before monetizing reduction in CO2 emissions)							
Net savings, street lights	*US$*	(12,740)	0	(2,084,545)	(1,510,633)	1,148,264	1,148,264
Net savings, public buildings EE measures	*US$*	0	0	0	0	0	0
Total net savings		(12,740)	0	(2,084,545)	(1,510,633)	1,148,264	1,148,264
Net Savings - check	*US$*	(12,740)	0	(2,084,545)	(1,510,633)	1,148,264	1,148,264
NPV of Net Benefits	*US$*	**2,222,390**					
IRR	*%*	**25.68%**					
Net Benefits after monetizing reduction in CO2 emissions							
Net savings, street lights	*US$*	(12,740)	0	(2,084,545)	(1,497,152)	1,175,225	1,175,225
Net savings, public buildings EE measures	*US$*	0	0	0	0	0	0
Total net savings		(12,740)	0	(2,084,545)	(1,497,152)	1,175,225	1,175,225
NPV of Net Benefits	*US$*	**2,348,396**					
IRR	*%*	**26.39%**					

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
1,148,264	1,148,264	1,154,904	1,154,904	1,154,904	1,154,904	1,154,904	1,154,904	1,154,904	577,452	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,148,264	1,148,264	1,154,904	1,154,904	1,154,904	1,154,904	1,154,904	1,154,904	1,154,904	577,452	0	0	0	0	0
1,148,264	1,148,264	1,154,904	1,154,904	1,154,904	1,154,904	1,154,904	1,154,904	1,154,904	577,452	0	0	0	0	0
1,175,225	1,175,225	1,181,865	1,181,865	1,181,865	1,181,865	1,181,865	1,181,865	1,181,865	590,932	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1,175,225	1,175,225	1,181,865	1,181,865	1,181,865	1,181,865	1,181,865	1,181,865	1,181,865	590,932	0	0	0	0	0

Table B.2: Schedule of Annual Economic Costs and Benefits of Street Lighting Project in Dominica

		2015	2016	2017	2018	2019	2020
Net Benefits (before monetizing reduction in CO2 emissions)							
Net savings, street lights	*US$*	(12,740)	0	(1,179,545)	(923,408)	512,713	512,713
Net savings, public buildings EE measures	*US$*	0	0	0	0	0	0
Total net savings		(12,740)	0	(1,179,545)	(923,408)	512,713	512,713
Net Savings - check	*US$*	(12,740)	0	(1,179,545)	(923,408)	512,713	512,713
NPV of Net Benefits	*US$*	**617,719**					
IRR	*%*	**18.96%**					
Net Benefits after monetizing reduction in CO2 emissions							
Net savings, street lights	*US$*	(12,740)	0	(1,179,545)	(914,372)	530,785	530,785
Net savings, public buildings EE measures	*US$*	0	0	0	0	0	0
Total net savings		(12,740)	0	(1,179,545)	(914,372)	530,785	530,785
NPV of Net Benefits	*US$*	**702,181**					
IRR	*%*	**19.86%**					

2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
512,713	512,713	519,353	519,353	519,353	519,353	519,353	519,353	519,353	259,677	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
512,713	512,713	519,353	519,353	519,353	519,353	519,353	519,353	519,353	259,677	0	0	0	0	0
512,713	512,713	519,353	519,353	519,353	519,353	519,353	519,353	519,353	259,677	0	0	0	0	0
530,785	530,785	537,425	537,425	537,425	537,425	537,425	537,425	537,425	268,713	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
530,785	530,785	537,425	537,425	537,425	537,425	537,425	537,425	537,425	268,713	0	0	0	0	0

SUSTAINABLE ENERGY FACILITY (SEF) FOR THE EASTERN CARIBBEAN

(RG-L1071)

ANNEX 4. DONOR COORDINATION

There are other donors supporting the Eastern Caribbean region's energy development. The SEF will provide financing, according to demand by beneficiaries, that is complementary to efforts currently undertaken by other donors aiming to create synergies among donors and facilitate coordination, which could make current programs more effective. The CDB and IDB communicate with these donors on a regular basis and have conversations to collaborate and avoid duplication of efforts. Donor programs are presented here in two sections: **I.** Overall Sustainable Energy Support, and **II.** Geothermal Specific Support

I. Sustainable Energy Support

a. DFID Caribbean's (DFIDC) current operations are focused on three areas: Wealth Creation, Governance and Security and Climate Change, and Disaster Risk Reduction (CCDRR). Under the CCDRR activities have been approved that will seek to improve regional and national energy security through the development of renewable energy and energy efficiency.

The UK government has approved and allocated £17.4 million to support two activities (i) support to the Sustainable Energy for the Eastern Caribbean (SEEC) program (£2.5 million) and; (ii) support for geothermal development (£14.9 million) –see below.

DFIDC will provide support to the SEEC in collaboration with the Caribbean Development Bank (CDB) and the Caribbean Investment Facility of the European Commission. UK funds will be used towards institutional strengthening and capacity building; provision of technical assistance in support of the development of RE and EE programs; and contribution to the CDB's concessional financing to facilitate greater investment in RE and EE. DFID's target countries under this activity are Dominica, Grenada, St. Lucia and St. Vincent & the Grenadines.

b. The 11TH EUROPEAN DEVELOPMENT FUND (EDF) Caribbean Regional Indicative Program (CRIP) has as one of three focal areas Climate Change, Environment, Disaster Management and Sustainable Energy, with an indicative allocation of EUR 61.5 million, with three overall objectives: 1) to improve regional resilience to impacts of climate change and natural disasters affecting sustained economic and social development; 2) to support regional capacity for the sustainable use of natural resources; and 3) **to promote Energy Efficiency (EE) and development and use of renewable energy**. Under this last objective, the **indicative intervention program includes de following two envisioned programs and results**:

Results	Possible operations
Clean energy security and RES investment framework enhanced	• Measures to enhance CARIFORUM energy sector governance management and capacity • Strengthening of Energy Information Systems and Statistics • Development of Sustainable Investment Framework • Deployment of Renewable Energy Resource Assessments and EE potential assessments • Actions aimed at involvement of and reporting to civil society organisations on regional RE/EE targets • Measures to optimize use of Renewable Energy resources and mitigate risks and encourage investments developed
Policy, legislative and regulatory framework for energy sector management (EE and RES) and transition towards renewable energies improved	• Development of regional **policies, model legislation and regulation for energy sector management and transition towards renewable energies** • Capacity support for mobilizing investments in EE, renewable energy, interconnectivity. • Enhancing regional energy sector governance framework and capacity • Development of regulations/favorable fiscal regime/subsidies aimed at promoting private sector investments and innovative financing mechanisms for RE & EE potential. • Supporting smart grid pilot projects and RES/EE investments • Measures for EE improvements in generation, transmission and improved consumption

c. CARICOM

- The Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS) is a regional energy planning and management and implementation framework being developed by CARICOM for expediting the implementation renewable energy and energy efficiency dimensions of the Caricom Energy Policy. CARICOM is proposing to have the following five working groups: financing, technical assistance, capacity building & research, information & knowledge management and policy and regulations. In addition, CARICOM is organizing to have four Caribbean communities of practice: electric utilities, buildings, education, and sustainable transport.
- The Caribbean Renewable Energy Development Programme (CREDP)'s overall goal is the reduction of the Caribbean Region's dependence on fossil fuels and contributing to reducing GHG-Emissions. The specific aim of the project is "Improved political, regulatory and institutional framework conditions, and the development of specialist technological and economic competencies are favourable to investment in RE/EE within the Caribbean region". The Programme has the following cooperation partners:
    - Energy Unit of the CCS, Guyana
    - OECS Commission, St. Lucia
    - CARILEC, St. Lucia
    - CDB, Barbados
    - Other regional energy projects and initiatives, e.g. REETA, CSEP, ECPA etc.

- International Organizations and Donors, e.g. EU, UKAid, USAid, OAS, WB, IDB, EIB, KfW, UNDP, IRENA, NGOs etc

CREDP will be completed in March 2016 and the following are the a**ctivities in its final phase:**
- Complete project activities and projects and provide project pipeline to Banks (e.g. CDB) and other partners for implementation;
- Document results, achievements and lessons learned and make them available for similar projects and initiatives;
- Provide TA to the CDB and their Partner Banks (Development Banks in Member States) to increase their knowledge about RE and EE.

d. OLADE - OLADE and CARICOM have been working together under the Caribbean Energy Agenda Memorandum of Understanding agreed on March 03, 2010, that includes the promotion of sub-regional plans for energy integration, cooperation and follow-up for designing, structuring and implementing sub-regional energy policies, technical assistance in energy matters, information exchange, energy planning and capacity building.

In 2013 the Ministers of Energy, in addition to the approval of the CARICOM Energy Policy, also approved and agreed on OLADE's Energy Information Systems and methodologies to be adopted for use across CARICOM Member States, to provide a harmonized approach to energy sector statistical data management and energy planning in CARICOM. In 2014 CARICOM member countries formally requested the support of OLADE in terms of energy statistics management training and agreed in following OLADE´s Energy Balance Methodology as standard.

In order to streamline the efforts to harmonize Caribbean energy statistics with the rules, procedures and an applicable methodology, OLADE has offered to carry out the following activities: 1. Institutionalization: Human Resources Management, Energy Statistics & Planning Awareness; 2. Training in Energy Information Management to six OLADE's nonmember countries; 3. Training in Energy Information Management to CARICOM Officials; 4. Implementation and capacity building in the Regional Energy Information System for the Eastern Caribbean Countries and The Bahamas; and 5. Additional technical support of the Regional Energy Information System

e. The **German International Cooperation (GIZ)** –REETA program has committed EUR 5 million until 2017. The general objective of the REETA program is for regional and national stakeholders in the field of Renewable Energy and Energy Efficiency to be increasingly able to meet the political, organizational and technical challenges of a growing market in the Caribbean region. The program has the following 5 components and related activities:

Component	Activities
Regional Strategy (C-SERMS)	• Update of C-SERMS (C-SERMS 2), • Internet Site of the CARICOM Energy Unit, • Energy Information System with OLADE, • 100 % RE Strategy CARICOM, • Bioenergy resource assessment, Energy Efficiency Building Code, Energy Policy Montserrat, Caribbean Energy Week
Capacity Building	• Cooperation with IDB in the BRIDGE program, PV Mobile Training Kits, RE Curriculum UTECH Jamaica
Private Sector	• Development of feasibility studies and business concepts in various sectors and countries; Cooperation with selected European companies to develop the Caribbean market
Model Projects	• E-Mobility in Saint Lucia, Integration of RE and EE in the Caribbean, fisheries sector, Energy Management at the CARICOM, • Secretariat and other public buildings in the Caribbean using ESCO models, • Hydropower project in Guyana, Utility scale PV integration into the grid, Waste to Energy
Financial Sector	• Investment calculation training with CDB; Development of bankable projects in various sectors and countries; Promotion of community based financing of utility solar systems

f. **Organization of American States** (OAS), with Energy and Climate Partnership of the Americas and the United States Government, under the Sustainable Energy Capacity Building Initiative (SECBI), has assigned funding for Antigua and Barbuda Capacity building to support the Sustainable Island Resource Framework Fund (SIRF Fund). Specific objectives: a) Structuring project finance strategy and business model for the SIRF (led by Clean Energy Solutions Center); b) Training and Resource Development for Project Negotiation and Close; and c) Manual and Training to support the Sustainable Island Resource Framework Fund (SIRF Fund).

g. **Caribbean Development Bank (CDB)**

- <u>Sustainable Energy For the Eastern Caribbean (SEEC) program</u>
  - Approved in March 2015
  - Regional Program Manager is being recruited
  - Soft roll out being done in countries whilst formalities of Agreement sign off being done
  - A visit to the participating countries has been carried out
- CDB is boosting its internal capacity to support SE - with support from GIZ (REETA Project), specifically, with support for mainstreaming RE/EE.
- CDB has also intensified cooperation with some Partners – OECS Commission; CARICOM Secretariat; Engagement with CANADA for potential TA support.

h. The **Clinton Climate Initiative (CCI)**, an initiative of the Clinton Foundation, has been providing some EC countries with transaction advisory services to negotiate with current or potential GE developers. CCI announced in May 2015 its partnership

with Rocky Mountain Institute (RMI) and Carbon War Room (CWR) to promote a transition to RE and EE solutions in the Caribbean region.

II. Geothermal Specific Support

In terms of GE interventions, the following are the main actors engaged and the way the SEF is and will be coordinating with them:

a. **The World Bank (WB)** is currently providing technical cooperation support to DOM and SL. Further support in the form of concessional lending using CTF resources is being considered by the WB. Thus, the possibility that the SEF could finance elements that are complementary to those the WB would finance in these two countries will be explored (i.e. the transmission line from the GE Plant to the main center of consumption in DOM and regulatory framework and capacity building in SL).

b. **International Renewable Energy Agency (IRENA)** and the Abu Dhabi Fund for Development (ADFD) have approved a loan to SVG for US$ 15 million for GE development. The SEF could provide financing to SVG for exploration as it is better suited to mitigate exploration risk.

c. The **Government of New Zealand (GNZ)** has provided technical assistance to EC countries with GE potential, such as surface exploration studies in GRE and SL, completion of an update on a feasibility study for a small geothermal power plant in Dominica, and, along with the US State Department, GNZ conducted a high level study on the environmental impacts of an inter-island electricity connection in St Kitts and Nevis. GNZ envisions another phase of support, with possible technical advice for St Vincent & the Grenadines. GNZ's support may be coordinated through the project execution unit of the GeoSmart facility based at the CDB headquarters.

d. **UK DFID** is supporting SL with exploratory drilling. The support to geothermal development will also be focused on countries in the OECS. Activities will vary by country as the countries are in different stages of development regarding the potential geothermal resource. Further scoping work will be undertaken to determine the type and level of activity to be undertaken in each country. Overall, funds will be used to assist in the identification of the actual resource, thus reducing some of the resource and technology risk. Reducing some of these risks will serve to increase the likelihood of commercial investment of this technology for these islands. CDB and IDB are in discussions with UK DFID to support early stage exploration in GRE and SVG.

e. The **Regional Council of Guadeloupe in cooperation with the Regional Council of Martinique, the Government of the Commonwealth of Dominica, ADEME, BRGM, AFD, CDC and the ES Groupe, with the support of the European Union** through the INTERREG IV, Espace Caraïbe, are leading the Geothermal in the Caribbean Phase II project, which is meant to support the industrial development of the sector in the area.

   The project led to the production of several studies and achievements related to the exploitation of geothermal in volcanic islands, with a prominent attention paid to the respect of communities, the protection of our environment and biodiversity. The outputs of the project will be shared and presented in September 2015 in a Geothermal International Seminar in Guadeloupe. The CDB and IDB will pay attention to results of this projects and lessons learned that may be applicable to the SEF.

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ANNEX 5. GENDER ASPECTS

I. GENDER CONTEXT

1.1 Men dominate energy jobs in the Eastern Caribbean labor market. As well as those activities that contributed the highest percentage to GDP (as construction or transportation) or that are strategic for the economy of the islands (as agriculture and fisheries). Women are dominant in teaching, services, clerks, service workers, and technicians. As a result of education levels in some countries, women are beginning to work in the commercial sector, banking and insurance. However, better educational achievement has not yet equated to improved employment outcomes for women. Throughout the most productive economic sectors, women are predominating in positions that are precarious, lower paying and that reinforce unequal gender roles.

1.2 Women entrepreneurs predominate in the informal economy as street and market vendors of agricultural produce and other commodities in the inter-island trade, and vendors at tourism sites.

1.3 The region includes a high proportion of female-headed households in which women struggle to support children on their own, often impeded by lower levels of education and skills, high levels of unemployment and under-employment, and a resulting economic and social insecurity. For example, in Grenada with a 41.1% of women- headed households almost one-quarter (24%) of poor female heads of households are not in the formal labor force; and of those seeking to participate, only 21% are employed. In urban households, 44% of female heads are in the three lowest consumption quintiles, compared to only 18.6% of male heads[1].

1.4 Eastern Caribbean has a high incidence of gender-based violence. At least 40 to 50%[2] of women experience domestic violence. Women are also victims of sexual harassment at work.

[1] Caribbean Development Bank, 2014, Grenada Country Gender Assessment.
[2] USAID, 2010, Gender Assessment USAID/ Barbados and Eastern Caribbean

II. GENDER ACTIVITIES

2.1 Given this context, the project will incorporate in its components elements which will contribute to the achievement of the first strategic gender objective in the IDB's *Implementation Guidelines for the Operational Policy on Gender Equality in Development* that is empowering women economically by facilitating women's access to economic opportunities and promoting women's entrepreneurship.

2.2 The project will promote gender equality in hiring. The companies will be encouraged to adopt practices such as hiring under equal conditions, review of hiring requirements to detect criteria that potentially exclude women, and the possibility of setting targets related to women participation. Besides, the project will promote the inclusion of local women in training activities for the construction, operation and maintenance work that does not require specific qualifications.

2.3 As we just mentioned poor women head of households work in the informal sector, when possible the project will support a shift from the informal to the formal sector for women's businesses that provide services such as cleaning, food services, textile production for uniforms, etc. to the geothermal facility.

2.4 To secure the working environment of women employed in the plant there will be exclusive bathroom for women, and appropriate uniforms for females. The companies will promote an environment free form sexual harassment in which this type of attitude and behavior is prevented, and where conflict reporting and resolution are facilitated.

III. INDICATORS

3.1 Matrix Result Indicators:

Output: Women participate in consultation processes retaliated to the projects.

Indicator: Number of men and women who participate in consultations (Objective: 35%)

3.2 Other indicators:

Number and % of women trained in construction, operation and/or maintained of the geothermal plant (Objective: 30%)