**Technical Annex**

**Regional Integration**

**Sustainable Energy Facility (SEF) for the Eastern Caribbean Expanded - (SEF Expanded)**

**(RG-L1112)**

**&**

**Green Climate Fund (GCF) Grant for the SEF Expanded**

**(RG-G1013)**

**&**

**Republic of Italy (REI) Grant for the SEF Expanded)**

**(RG-G1015)**

**Executive Summary**

The proposed operation, the Sustainable Energy Facility for the Eastern Caribbean Expanded (SEF-Expanded) is a complement to the Sustainable Energy Facility (SEF) for the Eastern Caribbean approved by the IDB in October 2015 (SEF-2015), and together they comprise the SEF Program.

Like the SEF-2015, the SEF-Expanded meets the Bank’s requirement as a regional integration project that generates regional additionality through the “Energy Integration” of the region.

The Eastern Caribbean electricity markets are relatively small and geographically isolated. They lack the scale necessary to utilize cheaper and cleaner fossil fuel options, such as natural gas, and have not yet fully developed other RE endowments. Consequently, they depend on costly imported liquid fossil fuels for electricity generation resulting in high electricity costs for final users. The proposed program works to radically change the energy matrix of the six Eastern Caribbean Countries (ECC) reducing the cost of electricity generation and improving energy security. To this end the program supports the development of geothermal energy (GE) resources for which all ECC except for Antigua & Barbuda (A&B) have potential.

GE resources can be harnessed to produce electricity locally that could be provided to neighboring islands with a future undersea cable (integrating infrastructure). As a consequence of reduced electricity prices, the region’s economies are expected to become more competitive globally.

* The *Sustainable Energy Facility (SEF) for the Eastern Caribbean Expanded* (RG-L1112 & RG-G1013 & RG-G1015) has been evaluated using the Bank’s *Sector Strategy to Support Competitive Global and Regional Integration* (GN-2565-4) framework, to analyze and validate the project’s contribution to the regional cooperation and integration financing goal.
* This annex aims to demonstrate in a quantitative and deliberative way that the *Program* will decrease base load energy prices in the Eastern Caribbean making the regional economies more globally competitive by:
  + Getting the Eastern Caribbean countries to address energy as a problem with a regional solution.
  + Allowing the first steps to be taken towards a plan to connect the energy systems of different Eastern Caribbean island countries.
* This annex is structured into three sections.

1. Program description.
2. Program aspects relevant to the Bank’s goals of Global and Regional Integration.
3. Validation through the Bank’s Regional Integration Framework.

## Program description

* 1. The Sustainable Energy Facility for the Eastern Caribbean Expanded (SEF-Expanded) is a complement to the Sustainable Energy Facility (SEF) for the Eastern Caribbean approved by the IDB in October 2015 (SEF-2015), and together they comprise the SEF Program.
  2. The SEF-2015 intends to contribute to the diversification of the energy matrix in the Eastern Caribbean countries (ECC) by deploying renewable energy (RE) technologies with particular emphasis on geothermal energy (GE) and promoting the implementation of energy efficiency (EE) measures to reduce the region’s dependency on liquid fossil fuels while reducing the cost of power generation. To achieve this, the SEF-2015 has three components: (i) Loans to public sector actors to promote the incorporation of Energy Efficiency technologies; (ii) Technical assistance to improve the regulatory framework, increase capacity, and strengthen the institution; and (iii) Loans to implement Renewable Energy projects of both variable and base load sources. Support for GE comes under the latter. Beneficiary countries are Antigua and Barbuda (A&B), Dominica (DOM), Grenada (GRE), Saint Kitts and Nevis (SKN), Saint Lucia (SL), and Saint Vincent and the Grenadines (SVG).
  3. The SEF-Expanded aims to help de-risk GE projects making it more likely that GE development attracts private investment and expertise, leverages other commercial debt resources, and allows for electricity tariffs to reflect an appropriate mix of concessional finance, commercial debt and equity. To this end, a line of credit to the Caribbean Development Bank (CDB) will include resources from different donors which the CDB will make available on-demand to meet the 5ECCs financing needs for unlocking geothermal development. While SEF-2015 resources are available for all six ECC and to support EE and RE broadly, SEF-Expanded resources are available only for GE development and hence only five of the ECC can access this funding (5ECC)[[1]](#footnote-1). To achieve its objectives the SEF Expanded has the following components:
  4. **Component 1 –GE Project Development (US$80.45 million).** Will support GE projects as they advance through successive stages of development all the way to plant construction by offering funding under:
  5. **Sub-component 1.1 - Pre-feasibility (US$4.45 million).** Will be financed with the non‑reimbursable TC provided by REI (RG-T3170) for purposes of carrying out pre‑feasibility studies required to identify promising exploratory drilling sites.
  6. **Sub-component 1.2 –****Exploration Drilling (US$16 million).** Grant resources that will be provided by GCF[[2]](#footnote-2) (RG-G1013) for exploratory drilling risk mitigation.
  7. **Component 2: Technical Assistance: Regulatory Framework, Institutional Strengthening and Capacity Building (US$5.16 million).** Will be financed by a grant for US$4 million from GCF[[3]](#footnote-3) (RG-G1013) to provide non-reimbursable TC to the CDB and the 5ECC. Additional funds from REI (RG-T3170) for US$1.16 million will be used to provide technical assistance to the 5ECC. Technical assistance to the CDB includes the following activities: (i) developing staff capacity to evaluate and execute sub-loans; (ii) consulting services to provide specific skills and advisory services when required for sub-project preparation; and (iii) drafting of legal documents (i.e. loan contracts for GE sub-loans). Technical assistance to the 5ECC governments will support the ministries responsible for energy and electric utilities, to develop an effective legal, policy and regulatory framework for the implementation of GE projects, as well as to make progress in negotiations with private sector actors to develop GE. To this end, resources from GCF or REI will support: (i) transaction advisory support to structure projects and negotiate with private partners; (ii) training to acquire the necessary skills to enable GE development and project execution; and (iii) capacity building to strengthen governments technical, institutional, environmental and regulatory capacity.

## Project Aspects Relevant to Global and Regional Integration

* 1. This section develops the justification of how the project *Sustainable Energy Facility for the Eastern Caribbean Expanded* will contribute to global and regional integration.
  2. The Eastern Caribbean has some of the highest and most volatile electricity prices in the world. This is due to the countries being isolated economically and geographically and having small energy/electricity markets. As of 2012, the average electricity price for 10 utilities in the Caribbean was US$0.33 per kWh, compared with an average tariff of US$0.11 per kWh in Florida. Of the utilities chosen, it was the big market utilities (in this case three utilities in the Dominican Republic) that had tariffs below US$0.30 per kWh. The smaller more isolated electricity markets like those in the ECC had tariffs that were above the average price, US$0.39 per kWh in 2013 (Table 1). The following map shows the location of the ECC, quite distant from larger electricity markets and relatively small when compared to other countries.

Figure 1: Geographical distribution of the 5ECC



**GREE**

**SL**

**DOM**

**SKN**

**SVG**

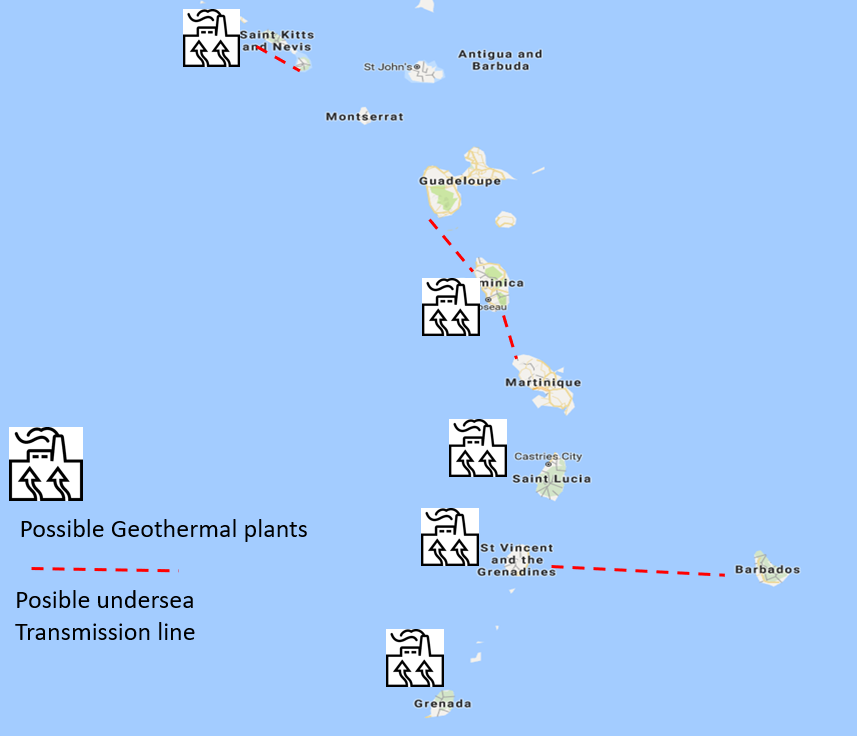


Table 1: Electricity Prices in the Eastern Caribbean[[4]](#footnote-4)

| **Country** | **Average Tariff (US$/kWh sold)** | |
| --- | --- | --- |
| **2013** | **2015 Est.** |
| Antigua &Barbuda | 0.44 | 0.34 |
| Dominica | 0.41 | 0.32 |
| Grenada | 0.40 | 0.28 |
| Santa Lucia | 0.37 | 0.25 |
| St. Kitts | 0.35 | 0.31 |
| Nevis | 0.37 | 0.33 |
| Saint Vincent & the Grenadines | 0.36 | 0.27 |

* 1. The initial solution would seem to be that the smaller energy markets should use a cheaper, possibly RE source, such as wind or GE. However, the small market size often makes it difficult to finance the large upfront capital expenditure required to construct the necessary infrastructure for a less expensive generation source (e.g. geothermal or natural gas turbines if they require a special LNG terminal) or the renewable source is too intermittent or is not available to be used as a base source in the location (e.g., wind and solar power generation sources). A second reason for high cost is the small scale of procurement of energy technologies. Small energy/electricity markets are often required to purchase generation and energy efficiency materials and technologies in such small quantities that it drives up purchasing prices, reducing their cost effectiveness. For example, a 2kW grid tied solar system in Belize costs US$4.40 per watt[[5]](#footnote-5) while a similar system in the United States costs from US$1.50 to US$2.50 per watt.[[6]](#footnote-6) A good portion of this difference is due to the scale at which the United States can purchase such systems compared to Belize.[[7]](#footnote-7)
  2. The project Sustainable Energy Facility for the Eastern Caribbean Expanded will help reduce the Eastern Caribbean’s energy prices by encouraging regional integration to increase the scale of the markets, which will reduce procurement costs and make cheaper technologies with high upfront costs more affordable by:
  + Promoting integration of the Eastern Caribbean countries to create a larger demand of goods and services, which will allow them to reduce generation costs by addressing energy as a regional problem. In this case the procurement of new, efficient energy technologies will reduce energy supply costs.
  + Allowing the first steps to be taken to connect the energy systems of different Eastern Caribbean island countries. Figure 2 shows the possible interconnection transmission lines.

Figure 2: Possible GE plants and interconnection transmission lines ECC



* 1. Physically connecting the islands electrical infrastructure is an easy way to increase the scale of the market. Progress has already been made in developing such a plan to physically connect some of the isolated energy/electricity markets in the Caribbean and increase the scale of appropriate generation solutions. The World Bank based on a study completed by NEXANT[[8]](#footnote-8) determined that by developing geothermal energy sources on those islands that have such resources (Dominica and St. Kitts), they could develop the power sources in excess of local needs and provide it by undersea transmission lines to neighboring islands (Martinique, Guadeloupe, and Nevis).[[9]](#footnote-9) All this was found to be more economical than the current diesel and heavy fuel oil generation sources, more predictable as the geothermal sources will be stable unlike the highly variable prices for hydrocarbon fuel sources, and more reliable as it would provide a renewable base power source (in contrast with intermittent renewable energies such as wind and solar which can only be delivered when the wind blows and the sun shines). In this context, the installation of geothermal power plants is the first step to allow future interconnections.
  2. Working together as a region on energy, even without physically linking the isolated economies together, can bring significant economic benefits to the countries. The purchase of energy technologies in bulk can greatly reduce the cost.[[10]](#footnote-10) As noted earlier, Belize pays twice the price per kWh to buy and install photovoltaic panels than the United States, due to its small purchasing size. Similar benefits could be arranged for the purchase of fuel oil, natural gas, renewable energy technologies, bundling of carbon credits, energy efficiency equipment (e.g. LED street lighting), etc. It just requires a regional approach to purchasing in the region.
  3. This is not the first time that the Inter-American Development Bank has determined that the above activities are important for the regional integration of the Caribbean region. The Caribbean Country Department’s Strategic Agenda on Integration from August 2014 determined that “reducing the cost of electricity is the highest priority for the regional energy sector,” and that this can achieved by “Regional collaboration [as it] can help capture economies of scale,” geothermal power can be generated in excess on some islands and be exported by an undersea grid interconnection to other islands, and “bundling of [carbon] emissions will create economies of scale in the use of energy efficient technologies.”

## Validation of Project Criteria with the Integration Strategy Framework

* 1. The Program is aligned with the development challenge of regional integration included in the Bank’s Institutional Strategy 2010-2020 (GN-2788-5) due to the contribution it makes, by providing end to end financing solutions for the entire geothermal development cycle, to enable ECC governments to engage private sector actors to develop GE projects with the possibility of exporting power to neighboring islands via undersea cables[[11]](#footnote-11), making the interconnection between electricity markets in the ECC possible.
  2. According to the Bank’s *Sector Strategy to Support Competitive Global and Regional Integration* (GN-2565-4), regional integration operations are aligned with one or more of the four general strategic criteria: (i) a cross-country focus; (ii) national subsidiarity; (iii) regional additionality; and (iv) compensation of coordination failures.
  3. Considering the scope of the project outlined in the first section of this Annex, and according to the Guidelines for the Classifications of Regional Integration Projects (GN-2733 and GN-2650) this project contributes to regional additionality, as it supports simultaneously in a group of countries national level policy reforms or investments that are part of a specific supra-national plan, program or initiative to contribute with regional objectives. The project has a direct effect on improving the integration of the region’s independent energy systems. The project is critical for the Eastern Caribbean Countries to reduce their energy prices and become more economically competitive with the rest of the world.
  4. The activities that support global and regional integration can be classified in three main areas: (i) Infrastructure; (ii) Institutional strengthening and capacity development; and (iii) Functional cooperation and regional public goods. In accordance with the described components in the loan proposal, the operation is classified under the area of infrastructure as it will construct energy infrastructure that will contribute to regional generation capacity.
  5. This operation belongs to the Energy Integration Subsector as it contributes to greater efficiency and energy security through the physical integration of power grids, the regulatory harmonization of regional energy markets and the development of regional generation capacity. In accordance with the Guidelines for Classifying Lending Program Priorities (GN-2650) the “Energy Integration” subsector implicates automatic eligibility for the completion of the financing goal to back regional cooperation and integration.

|  |  |  |  |
| --- | --- | --- | --- |
| Sub-sector | Code | Description | Automatic(A)/Conditional(C) |
| Energy Integration | EN-INT | Activities that contribute to greater efficiency and energy security through the physical integration of power grids, the regulatory harmonization of regional energy markets and the development of regional generation capacity. | A |

1. As A&B does not have GE potential, it is eligible to receive SEF-2015 resources but not eligible to receive SEF-Expanded resources meant to support GE development exclusively. [↑](#footnote-ref-1)
2. Component 1. Output 1.1. Exploration Drilling as per funding proposal to the GCF. [↑](#footnote-ref-2)
3. Component 2. Output 2.1. Regulatory Framework; and Output 2.2. Institutional Strengthening, Capacity Building as per funding proposal to the GCF.Gen [↑](#footnote-ref-3)
4. World Bank – World Development Indicators; 2013 Annual Reports for DOMLEC, GRENLEC, LUCELEC, and VINLEC (2011); Email from General Manager of NEVLEC on 5 November 2014; Farrell Cartwright (Nevis Geothermal Project and Power Take-off Presentation 2012); SKELEC (Request for Proposal Renewable Energy Infusion Study 2013), U.S. Energy Information Administration. [↑](#footnote-ref-4)
5. ProSolar Engineering Ltd. [↑](#footnote-ref-5)
6. Affordable Solar, Go Green Solar, and Wholesale Solar costs (as reported by Castalia in the Caribbean Regional Energy Integration Assessment, 2014). [↑](#footnote-ref-6)
7. Castalia (2014). “Caribbean Regional Energy Integration Assessment.” [↑](#footnote-ref-7)
8. NEXANT (2010). “Caribbean Regional Electricity Generation, Interconnection, and Fuels Supply Strategy.” [↑](#footnote-ref-8)
9. World Bank (2011). “Caribbean Regional Electricity Supply Options: Toward Greater Security, Renewables and Resilience.” [↑](#footnote-ref-9)
10. See footnote 3. [↑](#footnote-ref-10)
11. Nevis could be connected to St Kitts, Dominica to Guadeloupe, and Dominica to Martinique with a 5km, 70km and 100km undersea cable respectively. [↑](#footnote-ref-11)