United Nations Development Programme
Country: St. Vincent and the Grenadines

PROJECT DOCUMENT

Project Title: Promoting Access to Clean Energy Services in St. Vincent and the Grenadines (PACES)

UNDAF Outcome(s): Outcome 1 Improved governance and regulation of environmental and energy issues for more resilient economies by 2016

UNDP Strategic Plan Environment and Sustainable Development Primary Outcome: Outcome 1 Growth and development are inclusive and sustainable, incorporating productive capacities that create employment and livelihoods for the poor and excluded.
UNDP Strategic Plan Secondary Outcome: Outcome 5 Countries are able to reduce the likelihood of conflict and lower the risk of natural disasters, including from climate change

Expected CP Outcome(s): Outcome 3. Energy and Environment: Improved environmental sustainability of development processes

Expected CPAP Output(s): Outcome #1: Enhanced capacity of national, sub-regional and regional institutions and stakeholders to: effectively manage natural resources; build resilience to the adverse impacts of climate change and natural and anthropogenic hazards; improved energy efficiency and use of renewable energy; improved policy, legal, regulatory and institutional frameworks for environmental and energy governance

Executing Entity/Implementing Partner: Energy Unit of the Ministry of National Security (MoNS)
Implementing Entity/Responsible Partners: VINLEC (Implementing Entity) / Ministry of Health, Wellness and Environment (MoHE) (Responsible Partner)

Brief Description

The objective of the Project is to reduce GHG emissions from fossil fuel-based power generation by exploiting the renewable energy resources for electricity generation in St. Vincent and the Grenadines (SVG). To achieve this objective, the Project will promote clean energy decentralized electricity solutions in Saint Vincent and the Grenadines from unused renewable energy resources that may include hydropower, wind, solar and biomass waste. The basic approach of the Project will be to promote renewable energy (RE) in SVG through Project activities aimed at achieving a greater share of RE in its energy mix by (i) the strengthening of the country's clean energy policy framework including the streamlining of processes for RE investment approvals; (ii) increasing the capacities of appropriate institutions and individuals to support clean energy developments in SVG; and (iii) mobilizing investments for RE demonstration projects utilizing solar resources for electricity generation. The lessons learned from the demonstration projects will be utilized to scale-up investments for other on-grid RE projects and RE technologies in SVG as well as other member states of CARICOM.

Programme Period:	2014 - 2017
Atlas Award ID:	00080915
Project ID:	00090426
PIMS #	5146
Start date:	1 July 2014
End Date	30 June 2017
Management Arrangements	NIM
PAC Meeting Date	25 August 2014

Total resources required	$	91,351,484
Total allocated resources:	$	91,351,484
• GEF	$	1,726,484
• Energy Unit (MoNS)	$	725,000
• VINLEC	$	10,300,000
• Private Sector	$	78,000,000
• Private Property Owners	$	600,000
Total:	$	91,351,484

MINISTRY OF NATIONAL SECURITY

Agreed by (Executing Entity/Implementing Partner): 11.12.14

Date/Month/Year

AIR AND SEA PORT DEVELOPMENT

Agreed by (UNDP):

Date/Month/Year

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ACRONYMS

Acronym	Meaning
AA	Administrative Assistant
APR	Annual Progress Report
BAU	Business-as-usual
BLPH	Barbados Light & Power Holdings Limited
BTOR	Back-to-office report
CARICOM	Caribbean Community Secretariat
CCCCC	CARICOM's Climate Change Center
CEIS	Caribbean Energy Information System
CPAP	Country Programme Action Plan
CRECS	Caribbean Renewable Energy Capacity Support
CREDP	Caribbean Renewable Energy Development Programme
CTA	Chief Technical Advisor
CWSA	Community Water and Sanitation Agency
EC	Eastern Caribbean
ECCAA	East Caribbean Civil Aviation Authority
ECERA	Eastern Caribbean Energy Regulatory Authority
EDF	European Development Fund
EE	Energy Efficiency
EIAs	Environmental Impact Assessments
EOP	End of Project
EPSS	Electric power supply systems
ESA	Electricity Supply Act
ESIA	Environmental and social impact assessment
EU	European Union
EV	Electric vehicle
EWH	Electric water heaters
FIT	Feed-in tariff
FPS	Financial Procurement Specialist
FY	Fiscal year
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gases
GHI	Global horizontal irradiance
GIZ	German Agency for International Cooperation
GoSVG	Government of St. Vincent and the Grenadines
GJ	Gigajoules
GWh	Gigawatt-hour
HEV	Hybrid-electric vehicle
ICAO	International Civil Aviation Organization
IEA	International Energy Agency
INC	Initial National Communication
IPP	Independent power producers
IRENA	International Renewable Energy Agency
kWh	Kilowatt hours
LAC	Latin American Caribbean Regional Center
LoI	Letter of intent
LPG	Liquid Propane Gas

Acronym	Meaning
MDG	Millennium Development Goals
M&E	Monitoring and Evaluation
MJ	Megajoules
MoHWE	Ministry of Health, Wellness and Environment
MoNS	Ministry of National Security
MW	Megawatt
MWh	Megawatt - hour
NAMA	Nationally appropriate mitigation actions
NEP	National Energy Policy
NEAP	National Energy Action Plan
NGOs	Non-Government Organizations
NPD	National Project Director
NPM	National Project Manager
NREL	National Renewable Energy Laboratory
NWRMSP	National Water Resource Management Study Programme
OECS	Organization of Eastern Caribbean States
PACES	Promotion of Access to Clean Energy Services in St. Vincent
PIR	Project Implementation Report
PMU	Project Management Unit
PPA	Power purchase agreement
PPP	Public private partnership
ProDoc	UNDP Project Document
PSC	Project Steering Committee
PV	Photovoltaic
RE	Renewable energy
RET	Renewable energy technology
RO	Reverse osmosis
SIDS-DOCK	Small Island Developing States – Island Energy for Island Life
SNC	Second National Communication
SPACC	Special Project on Adaptation to Climate Change
SVG	Saint Vincent and the Grenadines
SWH	Solar water heaters
TJ	Tera joules
TOE	Tons of oil equivalent
ToR	Terms of Reference
UNDP	United Nations Development Programme
UNDAF	United Nations Development Assistance Framework
UNFCCC	United Nations Framework Convention on Climate Change
VINLEC	St. Vincent Electricity Services Limited
VRE	Variable renewable energy
WTE	Waste-to-energy

1. Currency Equivalents[1]

Currency Unit = Eastern Caribbean Dollar (EC$)

1 USD = EC$ 2.68

[1] www.oanda.com (exchange rate effective January 2, 2014)

SITUATION ANALYSIS

Context and Global Significance

1. Countries in the Caribbean region are heavily dependent on imported fossil fuels for their energy supplies with petroleum products accounting for an estimated 93% of commercial energy consumption including conventional methods of electricity production through fossil fuel plants. This serves as a primary source of greenhouse gas (GHG) emissions. Despite the Caribbean's substantial renewable energy (RE) resource, RE exploitation lags far below potential, due to policy, financing, capacity and awareness barriers. At the same time, the expansion of electricity generation is a key aspect to economic development in the Caribbean countries. Cuba and Trinidad & Tobago possess the largest installed capacities, 4,300 and 1,253 MW, respectively. Since Caribbean countries have relatively high electricity coverage, off-grid renewable energy (RE) systems for rural electrification only applies to non-electrified jungle areas in a small group of countries such as Guyana, parts of Belize, and Suriname.

2. Caribbean countries are also highly vulnerable to global oil price volatility; with a rise of oil prices, a commensurately larger allocation of national budgets needs to be diverted to pay for these fuel imports. This has a deleterious impact on foreign currency reserves, balance of payments and availability of budgetary resources for social sectors such as health, education and national security. *Energy security as related to affordability and reliability of supplies is therefore a real concern for most Caribbean countries.*

3. Moreover, owing to the geography, small market size, the absence of inter-state inter-connections, and the fact that electricity generation is largely characterised by inefficient diesel combustion, electricity tariffs in many Caribbean countries are among the highest in the world. Since energy is a critical input in virtually all sectors of any economy, the current energy situation directly undermines efforts to improve the economic competitiveness of these countries and their ability to fully integrate in the global economy. As such, *these countries have recognised that they must seek to explore and develop indigenous energy resources, especially renewable energy resources to break their over-dependence on imported petroleum and petroleum products.*

4. While many Caribbean countries are endowed with various indigenous sources of renewable energy (particularly wind, solar, hydro, geothermal and bio fuels), the lack of effective policy, legislative and regulatory framework with a low level of awareness has constrained the pace of RE development with limited financing for project preparation and development.

5. Over-dependence on imported petroleum and petroleum products within Caribbean Community Secretariat (CARICOM) member states[2] is unsustainable, especially considering regional energy demand is projected to double over the next 18 years. In response, several CARICOM member states have sought to promote development of indigenous energy resources, increased use of renewable energy as well as energy efficiency and conservation. In recent years, these efforts have intensified although the overall impacts are marginal. To this end, a number of CARICOM countries have embarked on the process of elaborating their national energy policies (Jamaica, St Lucia,

[2] http://www.caricom.org/

St Vincent and the Grenadines, and Grenada having approved national energy policies) to exploit renewable energy resources and increase the contribution of energy efficiency as priorities. Some notable developments within CARICOM member states include wind and hydropower development in Jamaica, geothermal power developments in St. Kitts and Nevis, and Dominica, hydropower developments in Guyana and Suriname, and solar thermal for water heating in Barbados.

6. In 2004, GEF supported the **Caribbean Renewable Energy Development Programme (CREDP) Project** that was aimed at dismantling identified barriers (in the areas of policy, capacity, information, awareness and finance) to the increased use of RE in the region. CREDP was implemented by UNDP, and executed by the Energy Programme within the CARICOM Secretariat with co-financing from GIZ. GEF support for CREDP was concluded in 2009 with only GIZ support continuing until 2012.

7. While CREDP did not achieve all of its objectives, it did strengthen capacity and raised awareness of RE issues, laying a useful foundation for further developments in RE and EE in CARICOM countries. In April 2008, the CARICOM Secretariat established an **Energy Programme** with the key objective of finalizing a CARICOM Energy Policy and facilitating its implementation. The Energy Programme provided greater focus on regional energy sectors issues and development by implementing a programmatic approach to regional energy sector developments. In March 2013, CARICOM completed the **Community Energy Policy,** the primary goals of which are to improve regional energy security through diversification of energy supplies and greater utilization of renewable energy and cleaner fossil fuel such as natural gas. The policy also seeks to encourage the establishment of more sustainable energy systems.

Energy Situation in Saint Vincent and the Grenadines

8. St. Vincent and the Grenadines (SVG) is a multi-island state comprising the main island of St. Vincent and seven smaller inhabited islands as well as about 30 uninhabited islets constituting the Grenadines as shown in Figures 1 and 2. The islands are home to a population of 120,000 people and cover a land area of 389 square kilometres. Aside from the main island of St. Vincent, other Grenadine islands with significant energy demands include the islands of Bequia, Union and Canouan. The country is almost completely dependent on imported petroleum products such as diesel (transport and electricity generation), gasoline (for transport), kerosene (cooking) and butane/LPG (cooking and water heating).

9. The persistent high cost of imported fossil fuels into SVG has led to high generation costs as well as high electricity tariffs. In December 2004, domestic customers paid on average USD 0.275/kWh (EC$0.74/kWh) in comparison with the 2013 cost of electricity of USD 0.35 per kWh which is among the highest in the region. The average annual household bill in SVG for electricity is more than USD 52 per month (EC$140 per month). The rise in electricity tariffs shadows the significant increases on imported fossil fuel based products experienced in SVG along with other CARICOM nations. The highest price rises for petroleum products were recorded between 2004 and 2008 with the global price of USD 32 per barrel in 2004 to a record price of USD 147 per barrel in 2008. The import value of petroleum and related products into SVG rose to a record high of over USD 59 million (EC$158 million) in 2008 decreasing to USD 41 million (EC$110 million) in 2009. These price spikes have impacted all the major sectors including transport, domestic and commercial, electricity generation sectors. All fuel prices to end-use

consumers are government controlled and therefore not reflective of the actual variations of prices on the import market.

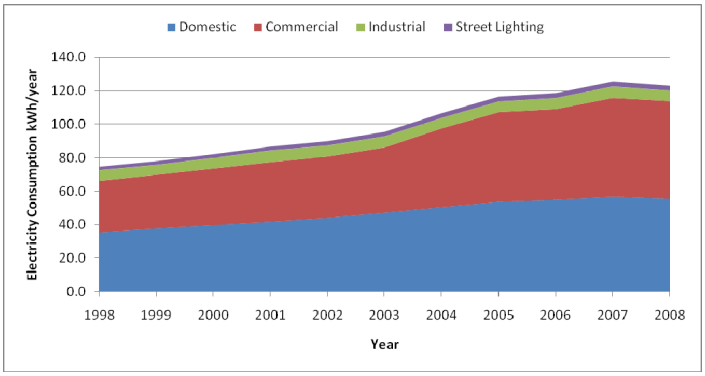
Figure 1: The Caribbean Region

Figure 2: St. Vincent and the Grenadines

10. Exacerbating the rising cost of energy in SVG is the increased consumption of electricity generation. As demonstrated in Figure 3, the consumption of electricity from 1998 to 2008 has grown 65%. The high carbon content of fossil fuels also results in high GHG emissions per capita. For example, if the 122,000 MWh of electricity consumed in 2008 as shown on Figure 3 were replaced by renewable energy sources, the GoSVG would save approximately USD 14.5 million in imported fuels, and reduce CO_2 emissions from the electricity sector in the range of 77,400 tons per year[3].

[3] "Energy Action Plan for SVG" by the Government of Saint Vincent and the Grenadines, First Edition, January 2010.

Figure 3: Electricity Consumption in 2010 by Sector[4]



11. SVG is one of a handful of CARICOM states whose utility company is wholly state owned (other countries includes the Bahamas (one of two), St. Kitts & Nevis, Suriname, Guyana and the transmission and distribution facilities in Trinidad & Tobago). The electrification penetration rate for SVG is 99%. The St. Vincent Electricity Services Ltd (VINLEC) is the lone power generating company on the island that is government owned with exclusive rights to generate, transmit and distribute electricity since its formation in 1961. The monopoly of VINLEC has been legally established with the enforcement of the Electricity Supply Act of 1973. The company works under an exclusive statutory license which will expire on or about 2033.

12. VINLEC has an installed capacity of over 40 MW of which 33.2 MW are operated on the main island St. Vincent alone. The remaining 6.8 MW is distributed amongst Bequia (2.9 MW), Union Island (1.3 MW), Canouan (3.1 MW) and Mayreau (180 kW). The other Grenadines islands are supplied by privately owned electricity systems based on diesel plants. Bequia, Union Island, Canouan and Mayreau are also completely reliant on diesel power, while mainland St. Vincent has some 5.6 MW of available hydropower, which contributed 17% (equal to 25.54 GWh) of the total electricity generated by VINLEC in 2012. VINLEC reports that hydropower contributed 25% of the electricity generated in 2013, the highest share in recent memory.

13. In 2010, total primary energy supply (fossil fuel only) was about 880 GWh or about 75,600 tonnes of oil equivalent (TOE)[5]. This has risen to 1,180 GWh or 102,000 TOE in 2012, a rise of 34% over 2 years. In 2010, SVG generated an estimated 117,000 MWh of electricity of which hydropower contributed slightly more than 24,000 MWh comprising about 20% of the total energy generation (not counting non-commercial biomass and charcoal)[6]. This included the consumption of almost 5.5 million imperial gallon (25 million litres) or 48% of the total diesel imported into SVG for electricity generation for VINLEC's power generation assets. The CO_2 emissions from the power sector in 2010 is estimated to be 67,060 tonnes (based on 25 million litres of diesel used) and comparable to 77,400 tonnes CO_2 from the GoSVG in 2008 (see Para 10).

[4] Ibid 3
[5] US Energy Administration at http://www.eia.gov/countries/country-data.cfm?fips=VC
[6] UN Energy Statistics Database at http://data.un.org/Data.aspx?d=EDATA&f=cmID:ET;trID:01

14. While the cost of diesel fuel for VINLEC electricity generation in 2004 was US$9.0 million (EC$ 24.2 million), the cost increased more than 50% over the next 2 years to USD 14.6 million (EC$39 million) in 2005, and USD 16.8 million (EC$45 million) in 2006; this was followed by the price spikes of 2008 where the cost of diesel fuel increased to USD 59 million (EC$158 million) in 2008, and decreasing to USD 41 million (EC$110 million) in 2009.

15. Adding to the cost of electricity production in SVG is the use of old inefficient equipment by VINLEC that are in need of replacement. Prior to 2006, the specific energy output of all diesel-powered generators in SVG was 17 kWh per imperial gallon, well below comparable energy output data from neighbouring countries. A new diesel plant of 9 MW at Lowmans Bay on the southwestern side of the island commenced operations at the end of 2006 using diesel supplied under the PetroCaribe Agreement. New generating units were also installed in Canouan and the Bequia in 2012.

16. Despite the high cost of electricity production in SVG and most island nations of CARICOM, the Petrocaribe Cooperation Agreement between many CARICOM states and Venezuela is a source of cheaper fossil fuels to CARICOM countries; unfortunately for the development of renewable energy in CARICOM nations, the availability of these cheaper fossil fuels is the most attractive and convenient energy alternative, notwithstanding the opposition to the Agreement by Trinidad and Tobago, one of the major fossil fuel suppliers of the region. SVG along with other small island nations in CARICOM states of the region are now in need of long term energy solutions that will bring sustainability, independence and control to its energy needs.

17. St. Vincent is the only island in the group with renewable hydro resources that are exploited for electricity generation. This hydropower generation capability has enabled SVG to have an energy mix of more than 83% petroleum base and about 17% hydropower. The hydropower plants on St. Vincent are distributed among three plants with an available plant capacity is 5.2 MW during the rainy season, while the output drops to around 2 MW during the dry period. Since hydropower is not available at full scale year-round with some diesel plants working only as back-up systems, firm capacity is far lower and reached only approximately 31 MW by the end of 2005. For St. Vincent alone, firm capacity was 26.1 MW, while peak demand was 18.6 MW in 2005 leaving sufficient reserve margin during most of the year.

Renewable Energy Development Initiatives in SVG

18. As a state owned company, VINLEC has a responsibility to ensure that the people of St. Vincent and the Grenadines pay the least cost for electricity for which it has a legal mandate to generate and distribute. To do so, they have an obligation to explore renewable energy options to diversify its energy mix, thereby reducing its dependence on imported diesel fuel. Notwithstanding the rising costs of imported fuel between 2004 and 2008, there has only been limited development of RE in SVG where there are a number of barriers that constrain the efforts required to transform the country's renewable energy portfolio.

19. VINLEC has examined several options to increase its *hydropower generation capacity*. Hydrological data has been collected and analyzed along several watercourses including Richmond, Wallabou, Buccament (Vermount) South and Owia Rivers. In 2009, a

decision was taken to focus development efforts on existing plants. With a limited number of suitable hydropower sites, VINLEC's most viable options included:

- *rehabilitation of existing plants in South Rivers and Richmond* at an estimated cost of USD 4.5 million (EC $12 million) that included an increase in the capacity of the South Rivers plant from 870 KW to 1.5 MW. The contract of USD 2.5 million (EC$ 6.8 million) for the first phase of the project has been awarded and is expected to be completed in late 2014. This plant has served several communities including South Rivers, Park Hill and Colonarie for several decades and has been part of the social and economic life of the people in those communities; and
- *building a new 1.2 MW plant downstream on the Colonarie River* which supplies water to the South Rivers power plant at an estimated cost of USD 9.0 million (EC $24 million) to provide an additional 4.5 GWh of power annually. This project will include the installation of new turbines at both Richmond and South River plants to provide additional power. Project approval is currently pending the completion of an environmental and social assessment.

20. There has been some growth in the use of *solar water heaters* (SWH) imported from Barbados in larger residential homes that displaces the use of electric heaters. This initiative, however, has not had a significant impact on reducing energy costs in smaller homes and commercial buildings in SVG, mainly due issues of affordability for most households and commercial establishments.

21. The development of solar energy has been restricted to a few donor financed initiatives including:
    - A 10KW solar PV system at VINLEC's engineering complex in 2010 that was financed by VINLEC;
    - A 545 kW PV system at various government buildings as a demonstration project on renewable energy investment by VINLEC at a cost of USD 1.3 million (EC $3.5 million) in 2011. Technical assistance for the installation was provided from an EU-funded Energy Conservation Project;
    - A 75.9 kW PV system at the reverse osmosis (RO) desalination plant on Bequia Island that was commissioned in October 2011 to supply 170,000 kWh annually to the plant. The plant and PV panel installations were financed utilizing a World Bank grant from GEF resources.

22. The development of *wind energy* in SVG has been studied by VINLEC since 2005 with the assistance of the GIZ. The studies focused on wind studies at Brighton and later at Ribishi Point on the southern side of the St. Vincent Island. While wind measurements at Brighton have been recently discontinued, VINLEC continued its pursuit of 3.6 MW wind power development at Ribishi Point with the completion of environmental and social impact assessment studies. Progress of a USD 6 million Ribishi Point wind farm, however, has been halted due to issues raised by the East Caribbean Civil Aviation Authority (ECCAA) regarding the proximity of a 4 x 0.9 MW wind farm to the new airport at Argyle. A possible resolution to the ECCAA issues under consideration is scaling down of the project with smaller and less obstructive wind turbines. Wind energy development has also been studied on some of the Grenadines islands including Mayreau (250 inhabitants), which showed encouraging results; however, wind energy development for Mayreau has not yet been pursued.

23. There is the potential for *geothermal energy* development in St. Vincent due to its volcanic geology. GoSVG in collaboration with VINLEC and two foreign companies are

currently in the advanced stages of exploring the development of a 10 MW geothermal plant. As of January 2014, a drilling program at the Soufriere Volcano is in progress. Analysis of the drilling program is expected during 2014 to assess the nature of geothermal energy available for development;

24. The potential to develop renewable energy from *biomass* waste in SVG is moderate; however, there is an estimated 50,000 tons of biomass available annually of which 30% is waste from the cutting of trees and shrubs. To date, there have only been expressions of interest by external companies to develop a waste to energy project, with no concrete proposals to date.

25. A summary of the renewable energy potentials in SVG is provided on Table 1. Table 2 provides a breakdown of this installed capacity.

Table 1: Renewable Energy Potential for St. Vincent and the Grenadines

Renewable Energy Sources	Qualitative Description of Potential
Solar	The potential for solar photovoltaic and solar thermal energy is good. The global horizontal irradiance for SVG is 5.8 kWh/m^2/day.
Wind	Favourable wind site was identified some years ago in Canouan with no further work done. Ribishi Point on the southeastern areas of St. Vincent was identified as favourable for wind power development.
Biomass	No projected figures (no formal assessment to date)
Mini- and Micro-hydro	There are several small rivers throughout the country that could accommodate mini and micro hydro plant particularly in the rural communities for specific applications.
Wave and Tidal	No projected figures (no formal assessment done)

Table 2: SVG RE Based Power Capacity as of December 2012[7]

RE Technology	Current Capacity (MW)
Hydropower	5.6
Rooftop solar PV systems	0.187
Solar systems (government offices)	0.01
Solar systems (commercial establishments and shopping malls)	0
Homes	0.40
Wind energy	0
Biomass based electricity	0
Biogas based electricity	0
Total	**6.2**

Threats and Root Causes

26. A root cause for the lack of RE development in SVG and many CARICOM nations is the fact that they are small islands or small energy markets where electricity generation was originally developed through the use of diesel fuels; many of these systems have not been changed and have evolved into inefficient diesel generation systems. Until the

[7] Energy Unit, Ministry of National Security, December 2012

fossil fuel price spikes of 2008 and 2009, there has been a lack of drivenness by the local utilities to improve the status quo.

27. SVG as well as most CARICOM countries have small grids that are a result of technical and financial barriers to constructing connections mainly between island nations; this has resulted in SVG and CARICOM states having some of the highest electricity tariffs in the world. With energy being a critical input for all sectors of a country's economy, the high cost of energy for SVG as well as most other CARICOM countries directly undermines their efforts for increased economic competitiveness and their ability to fully integrate in the global economy.

28. One of the threats to the lack of development of more sustainable and domestic renewable energy sources in SVG and other CARICOM member states is their lack of fiscal resources to invest in renewable energy resulting in an over-dependence on imported fossil fuels and a lack of local capacity to develop RE projects. The recent price volatility of global oil prices leaves SVG and CARICOM member states in a highly vulnerable state, where oil price increases are paid for through diversion of national budgets. This adversely impacts foreign currency reserves, balance of payments and availability of budgetary resources for social sectors such as health, education and national security. *Energy security as related to affordability and reliability of supplies is therefore a real concern for most CARICOM Member States.*

29. In response to the aforementioned threat, the GoSVG approved a National Energy Policy (NEP) and a National Energy Action Plan (NEAP) in February 2009 and April 2010 respectively to encourage a reduction in the dependence of imported fossil fuels for electricity generation through RE development and the promotion of energy efficiency[8]. SVG also has the Electricity Supply Act of 1973 (ESA) that grants VINLEC a universal licence for generating, transmitting and distributing electricity in SVG until 2033. While SVG has the NEP and NEAP that encourage the development and use of RE for electricity generation under the ESA, they also set the framework for laws and other secondary legislation. However, despite SVG being endowed with various indigenous sources of renewable energy, the pace of RE development in SVG has been restricted due to the lack of clear provisions in the regulations, rules and other subsidiary legislation that support the NEP; clarification of these provisions would ease the concerns of potential investors into SVG RE projects.

30. Another threat to RE development in SVG is the lack of an independent regulator to set electricity tariffs as well as regulatory practices over the quality of electricity supplied. The resulting impact is reduced investor confidence. OECS is spearheading a study (with financial support from the World Bank) for the establishment of the Eastern Caribbean Regulatory Authority (ECERA), a sub-regional regulatory commission to serve the Eastern Caribbean countries; this initiative, however, does not appear to be gaining traction with the GoSVG. In contrast, there are independent regulators with oversight responsibility for the electricity sectors in other OECS countries including Dominica, Barbados, Belize, Guyana, Trinidad & Tobago and Jamaica.

[8] As a comparison with other CARICOM states, Jamaica and St. Lucia also have approved National Energy Policies while Barbados, the Bahamas, Grenada, Antigua and Barbuda and Dominica have comprehensive Draft National Energy Policies. Activities on the formulation of national renewable energy policies have commenced in Suriname and Trinidad & Tobago.

31. In summary, SVG as well as CARICOM member states lack the historical experience in major RE development that is critical in building a viable RE portfolio. A root cause of this is the lack of awareness on the critical issues on the development of RE projects. This has caused risk-averse financial institutions to be reluctant to support initiatives promoted by private developers in the region. Despite efforts by the Caribbean Renewable Energy Capacity Support (CRECS) project and its predecessor CREDP to improve the knowledge base and awareness of the people of the Region, additional efforts to raise awareness of RE development are still required to increase the likelihood of developing viable RE projects in SVG and other CARICOM member states.

Barrier Analysis

32. Since the late 1990s, several concerns were raised in the region as to the reasons RE development is not gaining momentum. Notwithstanding previous efforts by regional governments and private sector groups to promote RE as a means of reducing the country's dependence on fossil fuel and consequently the cost of energy, no serious analytical work was done from a regional perspective to ascertain barriers to RE development. The Caribbean Energy Information System (CEIS) in 2000 identified barriers to RE with the mandate to promote clean energy in the Caribbean region.

33. Three barriers are identified as obstacles to further development of RE in SVG:

- *Regulatory, policy and legal barrier*: There is the lack of an investment-friendly policy and regulatory framework to attract investment by independent power producers (IPPs) and enable RE development;
- *Knowledge and capacity barrier*: There is a lack of awareness and technical capacity amongst policy makers, local entrepreneurs, tradespersons and the general public to support RE development. This would include the lack of a comprehensive knowledge of potential renewable energy projects in SVG and the means to develop and sustain the operation of these projects; and
- *Market and financial barrier*: The historic monopolistic development of electricity supplies for small island nations including SVG has resulted in a lack of incentives for the development of more efficient generation of electricity, notably from renewable sources where there are high upfront capital costs required.

Regulatory, policy and legal framework barrier:

34. SVG and other CARICOM countries share similar history with regards to old colonial laws which empowered the lone power companies with the right to generate, transmit and distribute power. In the case of SVG, the Electricity Supply Act of 1973 granted VINLEC a universal licence for generating, transmitting and distributing electricity in SVG until 2033. This law was a deterrent to IPPs who had an interest in developing RE generation facilities in SVG. SVG formulated its National Energy Policy (NEP) and a National Energy Action Plan (NEAP) in February 2009 and April 2010 respectively to encourage a reduction in the dependence of imported fossil fuels for electricity generation through RE development with the technical assistance of GIZ. However, development of enabling instruments to implement the RE aspects of NEAP are still required. This would also have the impact of de-risking RE investments in SVG. Examples of enabling instruments include clear guidance on water and land use policy restrictions for hydro and wind power developments, shared RE resource assessments,

rules and procedures for becoming an independent power producer (IPP), and clear processes for the procurement, tendering and licensing of electricity generation facilities.

35. Given the current urgency of developing RE in SVG, the country still does not have laws that are in line with other developing countries who are promoting and developing RE. This includes the lack of energy sector oversight by an independent regulatory commission. In the absence of this commission, VINLEC determines electricity tariffs that serve as a disincentive for IPPs to consider larger RE investments in SVG. While SVG is one of six countries that have received assistance to amend the relevant laws to accommodate RE development under CRECS, there has not been sufficient discussion amongst stakeholders on SVG's energy policy on the role of all stakeholders and actions that need to be taken to enhance RE development to maximize national benefits.

Knowledge and capacity barrier:

36. SVG is one of several countries in the region that has a demonstrated commitment to developing renewable energy. It recently formed an Energy Unit comprising of three persons, and an oversight Board. The current weakness, however, of the Energy Unit and to some extent VINLEC is the general lack of experience amongst its officers on developing a diversified RE portfolio, and the lack of capacity to prepare and manage RE projects. Major energy-related investment decisions including renewable energy investments, involve VINLEC.

37. Traditionally, the lone power company in SVG, VINLEC, was opposed to RE on the grounds that RE was in general more costly than conventional diesel power generation, notwithstanding the social, environmental and long term economic benefits to be derived. The heightened awareness of RE has encouraged SVG policymakers to get VINLEC to participate in this discussion with a view to examine all possible practical alternatives to fossil fuel based electricity generation. Today, VINLEC is more amenable to RE development as demonstrated by its decision to invest in other forms of RE other than hydro. However, there remain two barrier issues to further advancement of RE development in SVG:

    - VINLEC's limited knowledge of the resources available to develop other RE projects. For instance, the volume of biomass waste generation has not been formally analyzed by the Energy Unit or VINLEC nor has there been a comprehensive overview of available hydropower or wind energy sites. As such, the Energy Unit does not have the knowledge of what RE resources are available to support a commercially viable waste to energy plan, another small hydropower station or other wind power plants;
    - VINLEC as the only electric utility in SVG that determines power tariffs for SVG. The setting of power tariffs, notably feed-in tariffs, needs to be determined with a third party and independent regulatory commission (as described in Para 30) to provide arms-length regulation and oversight of VINLEC to achieve cost efficiency in electricity supply and by extension lower but fair electricity rates to consumers in the medium to long term.

38. Outside of the public sector in SVG, there is a general lack of experience and knowledge amongst private sector consultants and suppliers in the design, implementation, operation and maintenance of RE power projects. This would also include a lack of vocational skills in the general population to construct, operate and maintain RE

technologies. While RE is an emerging investment sector in the region and especially in SVG, potential investment into RE in the region is deemed higher risk due to the general lack of capacity to support RE development. Until recently, post-secondary and tertiary educational institutions at the national and regional level have not provided courses and training on energy related matters that would provide the sector with a cadre of trained personnel in relevant RE technologies. Most of the technical support required for RE project design, implementation and maintenance in SVG as well as the region has been provided from developed countries such as Germany and Canada. This lack of local capacity affects the ability of SVG to attract RE investments as well as the management of RE projects.

Market and financial barrier:

39. For SVG, there is an issue of small market size for RE opportunities that has led to the monopolistic nature of this energy market. With higher capital costs associated with most RE technologies, the financing and realization of a satisfactory return on RE investments in SVG is a challenge.

40. Investors involved in direct investments (foreign or domestic) into RE in SVG cannot obtain RE funding from multilateral investment funds, and financial institutions are often reluctant to support RE projects without requisite in-house capacity to evaluate RE projects. If SVG can successfully demonstrate that appropriate RE projects can be developed and operated by an IPP, RE projects would no longer be considered high risk. To date, however, existing RE projects in SVG are state owned and managed, with the most recent RE projects being the solar PV projects which are in part demonstration projects.

Stakeholder Analysis

41. *The Ministry of National Security (MoNS)* was established in May 2001 with the mission to "develop and maintain a peaceful, safe and secure environment nation wide in which citizens and visitors can have confidence and be willing to invest in areas critical to National Development re: Air and Sea Ports and Renewable Energy"[9]. As part of the Government's response to rising energy costs due to escalating crude oil prices on the international market, an Energy Conservation Fund was established in 2008 with a capital allocation of USD 1.0 million per annum over a 3-year period (2008-2010) to develop an Energy Conservation Program aimed at developing indigenous resources to produce energy, provide training, create local employment, secure transfer of technology, and further develop SMEs and micro-finance programmes. Under the Energy Conservation Fund, an *Energy Unit* in the Prime Minister's Office was established to assist with the formulation and implementation of Government's policies related to energy, and to coordinate specific activities related to Government's renewable energy and energy efficiency initiatives.

42. *The Ministry of Health Wellness and Environment (MoHWE)* has the responsibility, amongst other mandates more related to national health care, to facilitate intra and inter-sectoral coordination in the protection and preservation of the environment. As such, MoHWE is responsible for approving environmental impact assessments of large

[9] http://www.security.gov.vc

projects that may affect the living standards and well-being of those impacted by such projects.

43. *VINLEC* is the government-owned utility corporation that owns and operates two diesel generating stations as well as run-of-the-river hydroelectric power from several smaller hydroelectric generating stations, and is the sole provider of electricity in St. Vincent and the Grenadines.

44. *Light and Power Holdings Ltd. (BLPH)* in Barbados are majority-owned subsidiary of Emera, and in partnership with Reykjavik Geothermal have an agreement with the GoSVG to evaluate the potential for the development of a geothermal plant with a capacity in the range of 5 to 15 MW to provide base-load power.

Baseline Analysis

45. Through the development and approval of the 2009 National Energy Policy (NEP) and 2010 National Energy Action Plan (NEAP), the GoSVG recognizes the need for decreasing reliance on fossil fuels through development of RE. While the NEP and NEAP provide a framework and guidance for the diversification of energy sources through the development of RE, there are a myriad of reasons outlined in the following text that can be attributed to the lack of sustained investments into RE development in SVG.

Regulatory Framework

46. The NEP was approved in 2009 by the Cabinet of Ministers of the GoSVG. The guiding principles upon which this policy was prepared include strengthening the national economy by reducing the dependence on import of fossil fuels, stabilizing and reducing the energy consumption per capita in the medium and long term, and reducing the dependence on imported energy through continued and expanded exploitation of indigenous resources and improvement of energy efficiency and/or conservation of energy use.

47. The NEAP was approved in 2010. The NEAP forecasts possible energy scenarios in SVG until 2030, and provides short (1-5 years), medium (5-10 years), and long- (10-20 years) term actions to implement the policies and goals of the NEP. These actions foster amongst others, the diversification of energy sources including the delivery of 30% of electricity output from renewable sources by 2015 and 60% by 2020.

48. NEAP under Action 23[10] recognizes the need for independent power producers (IPPs) for RE development given the high investment costs required for the construction of new generation facilities, which may exceed the financial capabilities of VINLEC. Moreover, the participation of new and experienced stakeholders in the exploitation of new wind, solar, hydropower and geothermal resources could be essential for the deployment of new generation facilities of this type. The Electricity Supply Act (ESA) of 1973, however, does not allow for the engagement of IPPs in SVG, unless they have been authorized by VINLEC with the consent of the Ministry responsible for electricity supply.

[10] Under Page 38 in the First Edition of the NEAP

49. Action 23 of NEAP also stipulates that "the Ministry of Energy" with international assistance, will either amend the Electricity Supply Act in such a form that it allows for the generation of electricity from renewable energy sources by IPPs, or mandate VINLEC to issue sub-licences for electricity generation activities whenever the Government instructs it to do so. VINLEC will maintain its role as sole-buyer, transmitter and distributor of electricity. It will purchase the power that comes exclusively from renewable energy sources from any IPP on the basis of long-term bilateral power purchase agreements. The Government will act as supervisor in this process, unless a "neutral regulatory body is delegated with such power".

50. Further to the ESA, it is currently being amended to have the necessary enabling instruments to provide the certainty that RE investors seek prior to investigating RE opportunities in SVG. This would include:

- Provision of clear guidance on water and land use policy restrictions to be considered ahead of various RE developments. Guidance on water and land use restrictions is now being clarified for geothermal projects, specifically the Mount Soufriere Geothermal Project;
- Legislation on required and permissible activities to develop specific renewable energy projects such as geothermal, solar or biomass projects. A final draft of geothermal legislation is now being presented to the GoSVG Cabinet to support the ongoing developmental work on the Mount Soufriere Geothermal Project. Legislation for other RE projects is now being drafted using CARICOM legislation as a template;
- Renewable energy resource assessments that can be shared with potential RE investors that would include wind speeds at promising sites, hydrological information at specific hydropower sites, and biomass availability. RE resources assessments are incomplete and currently are not posted on any website;
- Rules and procedures for becoming an independent power producer (IPP) or undertaking a public-private partnership (PPP) under VINLEC for RE development. Clarity over IPP status and PPPs in SVG is required to improve RE investor confidence. This will facilitate financing of new RE projects that are required to meet the supply and demands for electricity as well as developmental concerns in SVG where local employment can be created from such projects;
- Incentives for setting up renewable energy generation projects such as duty-free import of RE equipment, tax concessions for RE generation and streamlined permitting;
- A grid code that provides clarity on the ability of the local grid to take in the variable input loads typical of renewable energy sources such as wind and hydropower (see Para 51 for further details); and
- Clear processes for the procurement, tendering and licensing of electricity generation facilities in SVG.

51. Currently, no grid code exists for the St. Vincent's electric power supply systems (EPSS) that would define upgrade requirements to build the capacity of the grid to absorb variable renewable energy (VRE) inputs, and provide stable and reliable electricity supply to customers for VRE inputs[11]. A GIZ-supported study from October 2012[12] examines:

[11] Such a code would provide the assurance that the installed VRE technologies are based on recent technology regarding grid aspects such as "fault-ride-trough behaviour" or "reactive power supply". This is important for the

- the main constraints that limit the penetration of variable renewable sources in small island power generation systems. VRE constraints may significantly affect the operational characteristic of the EPSS, the generation units and inevitably their performance reliability and power quality;
- the maximum deterministic VRE penetration for St. Vincent's electricity generation system according these constraints;
- technical measures and operational changes necessary to increase VRE penetration[13] with the aim of upgrading the EPSS needs to an extent that RE inputs can be maximized while maintaining a reliable supply of stable electricity.

52. The study also outlines important equipment additions to the SVG grid to accommodate VRE inputs that includes:
    - a synchronous condenser that controls grid voltage while transmitting reactive power during implementation of a "diesel off" mode;
    - batteries for storage as they will act as storage facilities during the "diesel off" mode to compensate for the fluctuation of VRE generation. During diesel off mode, the "battery" controls the frequency;
    - flywheel storage to reduce the short term fluctuation in the energy flow caused by wind or solar variation and improve the life time of batteries. In combination with batteries as long term storages, flywheels reduce the fluctuation in power, voltage and system frequency and improve the power quality and reliability.

53. There are efforts by OECS to setup a body that acts as an independent utility regulator for the island nations of CARICOM. The Eastern Caribbean Energy Regulatory Agency (ECERA) is expected to provide arms-length regulation and oversight of the electricity utilities to achieve cost efficiency in electricity supply and by extension lower electricity rates to consumers in the medium to long term. Another associated benefit of ECERA is the provision of advisory services to CARICOM Governments on renewable energy development, electricity sector plans and cross border interconnection, which is critical for geothermal development within the OECS. Stronger ties between ECERA and the energy stakeholders of SVG, namely the Energy Unit, VINLEC and the energy consumers of SVG, are needed to increase the confidence of potential RE investors. The outputs of ECERA in a discussion with these stakeholders would be fair electricity tariffs and codes and guidance for VINLEC on implementing best international practices to deliver quality electrical supplies from RE generation sources.

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operator of the transmission system where VRE sources such as wind or hydropower units can increase risks of power outages when there are voltage dips or short circuits. A grid code will define the compensation of a wind turbine's own reactive power demand, the reactive power supply in dependency of the voltage dip and the maximum power output of VRE units.

[12] "Study on maximum permissible intermittent electricity generators in an electricity supply network based on grid stability power quality criteria" by Michael Knopp, October 2012 under the supervision of GIZ

[13] Two options include a) Diesel units that have to be replaced should be peak load units instead of base load units; these new diesel units should be capable for low load operation to allow a maximum spinning reserve supply during high VRE penetration, and smaller diesel units should be chosen to maximize flexibility in the operation of multiple diesel generator sets; b) Improved VRE forecast where a weather forecast would allow a more precise VRE yield forecast. This is necessary to estimate the required spinning reserve due to VRE sources. A precise forecast would allow reducing the spinning reserve and especially the secondary reserves. Additionally, a forecast system would allow operating the hydro dispatch unit according to the VRE yield instead of demand. A forecast system would also be necessary in later setups for a "diesel switched off" operation based on storage systems. To assess and manage the diesel backup systems, a forecast system is necessary to estimate the need for further capacities under long periods of low VRE penetration and low storage conditions.

On-Grid Small Hydropower Projects

54. VINLEC in collaboration with the GoSVG and initially assisted through the CREDP and supported by the European Development Fund (EDF), selected appropriate river sites for possible future hydro power plants and started a long-term gauging programme to collect reliable hydrological data covering various seasons and giving sufficient evidence on the medium availability of water for run-of-river power stations. This undertaking has been done in collaboration with the National Water Resource Management Study Programme (NWRMSP) with a Hydrometeorologic Unit was set up for all long term water resource measurements in SVG to ensure future collection of hydrometric data. The GoSVG, VINLEC and CWSA jointly manage the Hydrometeorologic Unit to ensure its sustainability, and to ensure the holistic management of water resources, some of which can be developed for hydropower generation. One of the management actions of GoSVG has been to design a plan for the reforestation with the NWRMSP within hydrological sensitive areas and establish guidelines for a long-term environmental recovery of these watersheds.

55. The NWRMSP makes the assumption that there are untapped rivers at Fancy, as well as larger rivers like Wallibou, Buccament and Rabacca, where there are possible additional hydropower resources of significance. Even with no immediate development of further new hydropower sites under consideration, assessing the potential of other hydropower locations will provide benefits in the securing of a future diverse and sustainable energy mix in SVG. Considering that reliable hydrological data should be based on data collection over 10- to 20-year periods, a comprehensive river gauging programme needs to be started as soon as possible to determine if there are other hydropower sites that can be developed for SVG. The RE regulatory and capacity development support promoted by the project will help raise awareness about the need to still consider hydropower as an additional option to promote access to clean energy.

56. VINLEC also have committed in principle their resources for the development of a new 1.2 MW hydroelectric plant on the Colonarie River that supplies water to the South Rivers power plant. The plant will provide an estimated additional 4.5 GWh of power annually to the SVG grid through the installation of new turbines at both Richmond and South River plants to provide additional power. The development is pending the completion of a thorough ESIA that is planned for 2015. The start-up of project implementation by the end of 2014 will assist in building the momentum to consider hydropower developments.

Geothermal Development

57. The development of SVG's potential geothermal resources has been studied since the 1990s. Rising global oil prices since 2006 has driven the GoSVG to more thoroughly investigate the geothermal potential of Mount Soufriere, the active volcano in the northern area of St. Vincent Island. With funding from the Clinton Foundation, the St. Vincent and the Grenadines government, Barbados Light & Power Holdings (BLPH) (majority-owned by Emera Inc. (Canada)) and Reykjavik Geothermal, a desktop study was completed in July 2013 to estimate the geothermal resource of Mount Soufriere[14]. The study consisted of a review of existing literature, sampling and analysis of

[14] "Geothermal Generation in St. Vincent – Desktop Feasibility Study", Light & Power Holdings Ltd, Emera, Reykjavik Geothermal, July 2013

geothermal water coming to the surface, resistivity testing and modelling of the volcano, and structural analysis of the volcano through this data and aerial photos. The data reviewed resulted in a conceptual geothermal reservoir model focusing on a cross section between the Wallibou hot spring area and the summit of Mount Soufriere.

58. With the resulting geothermal reservoir model, the consortium is currently undertaking a detailed risk assessment of an extensive drilling program to source geothermal wells with a decision to be taken in late 2014. In addition, the consortium is expecting an official "Letter of Intent" (LoI) from the GoSVG for the geothermal project. While the desktop study estimates that a 10 to 15 MW geothermal plant could be developed, the drilling program will refine this estimate by early 2015. Moreover, exact locations of the geothermal wells can be determined to bring more certainty to the capital costs and risks of the project.

59. Prior to the approval of further financing and development of the Mt. Soufriere Geothermal Project, the geothermal project proponents are seeking de-risking measures to increase the certainty of any commercial arrangements for developing geothermal energy in SVG[15]. This would include:
    - Formulating geothermal legislation that allows drilling to take place as well as any other activities necessary to ensure the viability of a geothermal project. As mentioned in Para 50, a final draft has been prepared for approval by Cabinet at the time of the writing of this report;
    - An independent regulatory agency to determine free and fair electricity tariffs for SVG as well as enforcing best international practices in the SVG energy sector during the development of the project;
    - Government support to overcome infrastructural hurdles associated with the project[16]; and
    - Clear guidelines for assessing environmental impact of the drilling program, infrastructure development, and the development and operation of the geothermal power plant[17].

Wind Energy Development

60. SVG as well as the other small island developing states of the Eastern Caribbean islands lies in the Trade Wind belt. The eastern coast of St. Vincent as well as the Grenadine Islands are impacted by the prevailing northeast trade winds. Recent wind measurements at Ribishi Point and Brighton at the southeast corner of St. Vincent indicate favourable wind regimes of approximately 8.1 m/s along the eastern coast of St. Vincent and the Grenadine islands of Canouan, Bequia and Mayreau during the period from September to May. The results of these measurements resulted in a proposed 9 MW wind farm at Ribishi Point.

61. However, the sites investigated to date were deemed to be the most appropriate for SVG but its development is impacted by land use issues. As a result, there is a shortage of

[15] Personal communication with Managing Director of Light & Power Holdings Ltd.
[16] This would include the development of roads to transport equipment to a power plant site near Mount Soufriere along the west coast of St. Vincent and for transmission lines that will be routed through rough terrain and dense vegetation
[17] There is no national legislation on EIAs in SVG and no experience on ESIAs given the small size of SVG and the lack of large capital projects

other appropriate sites for wind power development. The Ribishi Point site is constrained by its proximity to the airport that is currently under construction at Argyle; the proximity of the proposed wind turbines violates ICAO obstacle limitations, thus placing a barrier to international recognition of the new Argyle Airport if the Ribishi wind turbines were to be installed as designed. Wind measurements have also been taken on Canouan Island which are promising based on preliminary data collection. There is no comprehensive inventory of wind energy sites in St. Vincent or on the Grenadine islands that can be posted on a website for viewing by potential RE investors and developers.

Solar Energy Development

62. SVG has a global horizontal irradiance (GHI) that averages 5.8 kWh/m^2/day throughout its low-lying lands, sufficient solar resource for flat-panel PV and solar hot water systems. Despite this viable resource, SVG has only developed initiatives utilizing solar energy since 2011. These solar initiatives were designed by GoSVG using grant funds to demonstrate that solar energy can be used in the country to offset fossil-fuel based electricity generation. GoSVG, however, have not yet made any substantial efforts to encourage private investment into more solar investments.

63. In October 2011, a 75.9 kWp of solar PV panels were commissioned on Bequia Island to provide electricity to the island's reverse osmosis water treatment plant[18]. The system was installed on the roof of the hangar at the Bequia Airport and connected to the national VINLEC grid, and is monitored via an installed meter which can be read on-line[19]. A power purchase agreement has been agreed upon between VINLEC and MoHWE (the owner of the water treatment plant) to ensure all energy required for the operation of the desalination plant is guaranteed, while surplus electrical energy is transmitted to the island's grid to allow for expansion, but also to reduce energy production, operation, and maintenance costs. This project was executed by the CARICOM's Climate Change Center (CCCCC) utilizing a grant provided by the World Bank with GEF resources, on behalf of the Commonwealth of Dominica, Saint Lucia and Saint Vincent and the Grenadines[20]. The intention of the project was to replicate this success on other Grenadine Islands to expand the provision of potable water to the Grenadines. To ensure optimal utilisation of water resources on the Grenadines as well as other islands of similar size, the project made concerted efforts to promote conservation measures and best water use practices and to address quality and reliability of the water resource.

64. Solar photovoltaic systems were also installed on several government buildings in SVG under the EU-funded Energy Conservation Project during the past 2 years. This was done to promote an increase in the share of RE in SVG's energy mix. The primary driver to this effort was the increased diesel consumption to meet the country's base electricity demands while an estimated 20% of SVG's hydroelectric supply in the 1990s has been steadily decreasing to around today's mix around 16% (notwithstanding the 25% in 2013 as reported by VINLEC). The GoSVG is currently seeking funding and suppliers for additional solar PV-system installations for other public and government buildings

[18] CCCCC/WorldBank/GEF, Technical Note 5C/SPACC-12-05-01, "Implementation of adaptation measures to address the absence of fresh water and coastal vulnerabilities in Bequia, St. Vincent and the Grenadines", May 15, 2012

[19] http://www.sunnyportal.com/Templates/PublicPageOverview.aspx?page=f1ab5fb0-5daa-42a1-a0ac-e633037bc282&plant=274e4d44-ffec-4a07-ac98-bb2717d7a868&splang=en-US

[20] GEF resources were sourced from the Special Project on Adaptation to Climate Change (SPACC)

including the new Argyle International Airport located on the southeastern corner of St. Vincent. The solar PV-systems could assist efforts to:

- offset diesel consumption for electricity generation for the new airport and reduce its operational costs;
- offset petrol consumption for motor vehicle transport through piloting solar PV-systems as charging stations for hybrid motor vehicles.

65. The NEAP also contains a milestone to reduce the projected consumption of fossil fuel in the transport sector by 15% by 2020. The GoSVG has stated its intention of piloting the use of hybrid or electric vehicles for its government fleet using a 10 kW solar PV installation at the Administrative Building as a charging station, replicating a similar program being undertaken by the private sector in Barbados. The GoSVG is currently seeking suppliers and investors in such a scheme that will work towards the substantial consumptive reduction of and dependence on imported fossil fuels for local road transportation. More details of this proposed pilot scheme are provided in Annex VII.

66. The market penetration for solar thermal energy in SVG is relatively modest. Similar to other Caribbean countries, electric water heaters (EWHs) are used by households in SVG. Currently, solar water heaters (SWHs) are sold in SVG through a private distributor to those who are able to afford the USD 2,000 cost. The primary barrier to its wider diffusion is the USD 2,000 cost, relatively marginal energy savings and long payback periods. The GoSVG currently are not engaged in the promotion of solar water heaters, and as such, do not have any financial incentives that may encourage its wider use. Moreover, the GoSVG likely have higher RE development priorities given that the overall energy savings in transforming EWHs is not significant in comparison to rooftop solar PV installations.

67. In summary, current priorities of the Energy Unit are to further develop grid-connected solar installation demonstrations in on top of various government buildings and the new airport at Argyle. These installations would raise awareness of the technical and economic feasibility of directly feeding solar energy from a rooftop into the grid and provide an impetus towards increasing demand for rooftop solar installations on private property. With the global reduction in solar energy development costs and the high tariff rates being paid by electricity consumers in SVG[21], the potential of such a program has the best potential for reducing electricity costs in the short term and to create stable employment in the country.

<u>Biomass Energy Development</u>

68. There are currently no plans for the exploitation of biomass for use in electricity or biogas generation. Only charcoal is used for cooking purposes in SVG in an unsustainable manner. The availability of biomass for electricity generation in SVG is limited by its size and population. An estimated 50,000 ton of biomass waste is generated annually in SVG with potential for 4 MW of power generation. A study was completed in 2009 by GFA Envest GmbH in collaboration with Caribbean Bio-Energy Technology Ltd. on the feasibility of available agriculture and municipal biomass resources for the production of electricity using biogas plants. The study concluded, among other things, that the quality of *jatropha curcas* (or locally known as “Barbados nut”) biomass residues is not sufficient

[21] The financials assumed for SVG for solar PV installations is USD 4,000 per installed kilowatt and USD 0.38 per kWh electricity tariff.

for biogas generation, but that other feedstock may be sufficient in quantities for a 4MW plant[22]. NEAP also identifies the use of coconut oil extract oil and oils from other seeds for conversion into biodiesel. Results of the study were presented to the National Energy Committee, the Ministry of Agriculture and other energy stakeholders in 2010. The RE regulatory and capacity development assistance from the GEF-financed intervention will help consider policy support towards the development of biomass as another clean energy option for St. Vincent and the Grenadines.

69. The issue with the GFA Envest study, however, is the evaluation of biomass resources in relation to a specific technology. With a low level of awareness in SVG on the potential for generating energy from biomass, there is no discussion amongst stakeholders on how biomass can be turned into a source of renewable energy for SVG. An analysis of various technologies that can utilize biomass to contribute to the energy mix of SVG is required. This will require continued dialogue with development partners and interested private sector developers of biomass waste-to-energy technologies as well as a source of development funding for implementation of an initial phase of a waste-to-energy plant.

STRATEGY

Project Rationale and Policy Conformity

70. The 2000 Initial National Communication (INC) of St. Vincent and the Grenadines underscored the country's heavy reliance on fossil fuel imports, poor management and limited human resources in energy generation, which this project will help address. The NC considered the energy sector as a priority to develop appropriate national responses to climate change, due to its impact on other sectors. The Second National Communication (SNC) under preparation is also paying attention to the barriers to be removed for the deployment of renewable energy. The project is also in line with the 2009 National Energy Policy (NEP) of St. Vincent and the Grenadines, and the multilateral environmental agreements (MEA) signed by SVG, contributing to its goal of strengthening the national economy through the reduction of the dependence on fossil fuel imports. PACES will contribute to the NEP goals of 30% of projected electricity output to come from renewable energy by 2015, and 60% by 2020.

Country Ownership: Country Eligibility

71. The GOSVG ratified the UN Framework Convention on Climate Change (UNFCCC) on 2 December 1996, and the Kyoto Protocol on 31 December 2004.

Country Drivenness

72. To improve the energy security of SVG, the GoSVG has also issued its National Energy Action Plan (NEAP) in 2010 that identifies specific strategies in its Section 4.3 to develop renewable energy as a means to reduce the country's dependence on imported fossil fuels for electricity generation. This includes actions to scale-up development of geothermal, hydropower, wind energy, biomass and waste-to-energy, solar electricity and solar thermal. In addition, NEAP also identifies actions to be taken to deploy de-

[22] http://www.reegle.info/profiles/VC

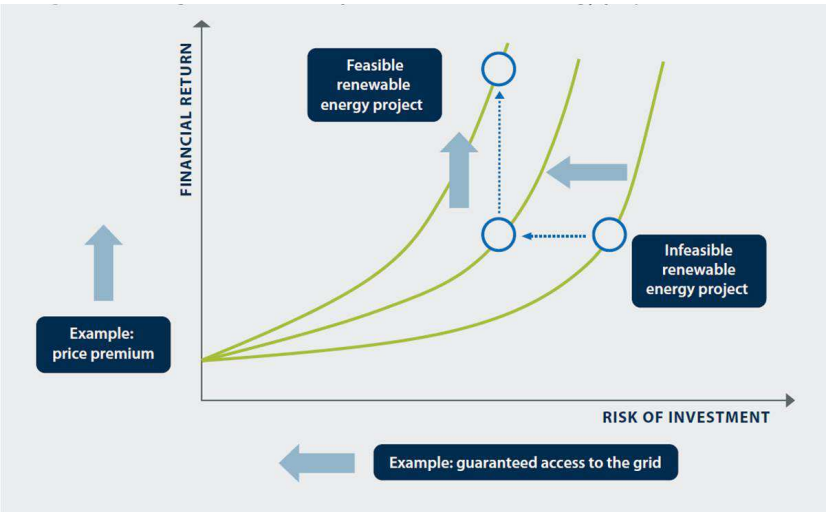
centralized renewable energy applications for the Grenadine Islands as well as buildings and households that have costly connections to the grid.

Design Principles and Strategic Considerations

73. The barrier removal activities envisioned for this proposed GEF project are designed to catalyze investments in renewable energy-based power generation that will deliver renewable energy to a level that will meet GoSVG goals for RE to be 30% of SVG's energy mix by 2015, and 60% by 2020.

74. The general approach of PACES will be to employ UNDP-GEF's approaches to strengthen policy derisking instruments[23] (as depicted on Figure 4) that would include strengthening of the current RE policy framework, assessment of available RE resources in SVG, capacity building of the Energy Unit and VINLEC for the promotion and regulation of RE project developments, resolving issues related to the SVG grid and the addition of variable RE inputs, and the training of technical and vocational skills for local operation and maintenance of RE projects. In addition, PACES will also facilitate design of direct financial incentives through the formulation of appropriate electricity tariffs for IPP generation of electricity from RE sources. The impact of these instruments will be increased confidence of both VINLEC and private investors towards RE investments in SVG. The implementation of demonstration RE projects under PACES will accelerate efforts to build institutional and local capacity, improve RE knowledge amongst all RE stakeholders of SVG, and demonstrate that RE projects in SVG can be developed and operated with appropriate rates of return for investors.

Figure 4: UNDP-GEF Derisking Instruments - Risk-Reward Profile Shift



75. Two important strategic considerations for the design of PACES are:
    - a focus on building the capacity of both the Energy Unit (under the Prime Minister's Office) and VINLEC. The Energy Unit, in particular, is viewed as SVG's window to imported technologies and the agency best positioned to promote the Government's RE agenda. The Energy Unit with the assistance of VINLEC will need to determine the RE priorities for the country as well as being a gateway to the quality control of incoming RE technologies and projects. As such, they need to have the exposure of

[23] UNDP, "Derisking Renewable Energy Investment", March 2013

best international practices to promote and develop RE projects to the extent that targets of NEAP are met, and that electricity costs for the country are substantially reduced for the benefit of the nation;

- the deployment of rooftop solar PV installations since these installations and their economics will provide the highest probability of successfully catalyzing RE investment in SVG[24].

Project Goal, Objective, Outcomes and Output/Activities

76. The objective of this project is reduction in the annual growth rate of GHG emissions from fossil fuel-fired power generation in St. Vincent and the Grenadines through the exploitation of the country's renewable energy resources for electricity generation. This will be achieved through the removal of barriers to the application of RE-based power generation in SVG.

77. **Component 1: Establishment of a clean energy enabling policy framework:** This component addresses the barrier concerning the lack of appropriate policy and a regulatory framework that is not conducive to attracting investment for developing RE projects in SVG. The expected outcome from the outputs that will be delivered by the activities that will be carried out under this component is the evolution of the Energy Unit with the support of VINLEC into a facilitation center that will attract and support private sector RE investment development, enable energy regulators to determine fair flexible tariff structures, bring confidence to private RE investors, and increase the number of approved RE projects. The following outputs will contribute to the achievement of this outcome:

    - *Output 1.1: Approved framework and assessment of RE resources for long-term energy planning that support RE targets of the 2010 Energy Action Plan*. Activities required to deliver this output includes:
        - Preparation of an inventory of RE resources that can be posted on a website to facilitate private sector interest in investment. This may include hydrometric data for specific hydropower sites, wind data at promising sites, available waste volumes for potential waste-to-energy projects, solar readings at specific locations for PV (e.g. public building rooftop installations), and geothermal sites. *GEF support will be required for technical assistance for preparation of this inventory*;
        - The completion of technology options at the specific RE sites with estimates of capital and socio-economic costs and benefits. This will provide confidence to potential investors that there are no major external costs to these RE projects. *GEF support will be required for technical assistance for the assessment of these technology options*;
        - Amendments to the Electricity Supply Act (1973) to accommodate provisions for the development of RE in SVG. Details of these amendments are provided in Annex III. The GoSVG are currently undertaking these amendments. *No GEF assistance is required for these amendments*;

[24] A 1.0 kW solar PV installation will generate 32 kWh against an average daily consumption of 18.2 kWh/day (based on household electricity demand in Barbados from 2011 MPRA study on "Price Reform and Household Demand for Electricity", pg 11, available on http://mpra.ub.uni-muenchen.de/40934/1/MPRA_paper_40934.pdf). For example, if 13.8 kWh/day can be sold back to VINLEC for USD 0.30 per kWh, a USD 4,000 investment into the solar PV system can be paid back in less than 4 years.

- Augmenting the 2010 NEAP with specific milestones that work towards the targets of 30% share of RE by 2015 and 60% by 2020. The specific milestones will be updated based on the aforementioned RE resource inventories, target dates for their development (based on private sector interest generated from the dissemination of the RE resource information), and actual progress achieved with each specific development. *GEF support will be required for technical assistance to augment the 2010 NEAP with updated and specific milestones*;
- Periodic review of the National Energy Policy (NEP) that will maximize its effectiveness given the expected changing circumstances of RE development in SVG from this Project. *No GEF assistance is required for this activity.*

- *Output 1.2: Approved and streamlined procedures for RE project development*. Activities required to deliver this output includes:
  - Rules and procedures for becoming an independent power producer (IPP) or undertaking a public-private partnership (PPP) under VINLEC for RE development. IPPs and PPPs need to be considered to meet the supply and demands for electricity in SVG as well as developmental concerns where local employment can be created from such projects. This also includes licensing, power purchase agreements (PPAs) and a net billing system to establish the basis on which IPPs are remunerated for electricity sales. These rules and procedures will be tailored to allow private homes or commercial establishments to become IPPs with rooftop solar PV-installations or other RETs that may be proposed by other RE investors. *GEF support will be required for technical assistance to formulate these rules and procedures*;
  - Preparing rules for the operation of IPPs in SVG that will include streamlined procedures for developing RE projects in SVG. As such, streamlined IPP procedures for RE development will include permitting procedures (for construction, land leases, environmental impact assessments, etc), approval of RE incentives (such as duty-free imports), rules on PPPs, and power purchase agreements (PPAs) where VINLEC purchases RE from IPPs. *GEF support will be required for technical assistance for preparing IPP operational rules tailored specifically to rooftop solar PV installations with private homes and commercial establishments*;
  - Provision of clear guidance on water and land use policy restrictions to be considered ahead of hydro and wind power developments. *No GEF assistance is required on this activity as guidelines for RE developments are currently being formulated under GoSVG*;
  - Legislation on required and permissible activities to develop specific renewable energy projects such as geothermal, solar or biomass projects. A focus of this legislation is required on RE project types that are of priority and feasible. *No GEF assistance is required on this activity as the GoSVG is currently nearing completion of legislation preparation for required and permissible activities, specifically for geothermal projects as well as other RE developments*;
  - Incentives for setting up renewable energy generation projects such as grants, soft-loans, tax credits, reduction or exemption from duty taxes. The GoSVG will undertake a review of possible RE incentives during the course of the Project. *As such, no GEF assistance is required on this activity*;

- A clear assessment of the requirements to stabilize the local grid during periods when the variable input loads from renewable energy sources such as wind and hydropower (see Output 1.3) are fed into the grid. GoSVG and IRENA are currently in discussion with regards to the provision of foreign technical assistance and support for this assessment. As such, *GEF assistance is not required to complete this assessment*; and
- Clear processes for the procurement, tendering and licensing of electricity generation facilities in SVG. GoSVG will undertake the formulation of these processes. *As such, no GEF assistance is required on this activity*;

- *Output 1.3: Grid code that will define the requirements for variable renewable energy sources to reduce the risks of power outages resulting from voltage dips and sudden drops in renewable energy inputs.* Based on the GoSVG's commitment to collaborate with IRENA to setup a grid code for VINLEC and upgrade its grid, *GEF assistance is not required for the following technical assistance activities*:
  - Preparing a characterization of the SVG grid system and its capacity to absorb VRE sources;
  - Assessing the impacts on grid operation based on SVG's vision of new VRE sources (based on Output 1.1);
  - Preparing strategies, recommendations, actions and codes to safeguard the grid from faults from new VRE sources;
  - Assistance in the procurement process for upgrading of the SVG grid[25] for intaking VRE sources based on new RE priorities as outlined in Output 1.1;

- *Output 1.4: Institutional arrangements that involve an independent energy regulatory authority to determine fair market electricity tariffs for SVG.* Activities to deliver this output includes:
  - Assistance to the Energy Unit to initiate and sustain stronger ties with ECERA, the proposed energy regulatory authority for Eastern Caribbean countries under the OECS. *GEF support will be required for this activity;*
  - Establishing the Terms of Reference under which ECERA will be involved with regulating the electricity generation and supply of SVG. This may include objectives of achieving cost efficiency in electricity supply and by extension, lower electricity rates to consumers in the medium to long term, and provide advisory services to GoSVG on best international practices towards renewable energy development, electricity sector planning and cross border interconnection (critical for geothermal development within the OECS). *GEF support will not be required for this activity*;
  - Formulating procedures for determining FITs. This will include a study on feed-in-tariffs (FITs) that will provide the SVG Government with the costs and benefits of various FITs that are set for various RE technologies. The study with possible technical assistance from ECERA will be provided to the Energy Unit and VINLEC for their use in discussions with representatives of civil society in SVG and ECERA. *GEF support will not be required for this activity;*

- *Output 1.5: Energy Unit RE investment facilitation center.* Assistance will be provided to the Energy Unit to initiate development and operationalize an RE investment facilitation center or a "one-stop shop" facility for private sector investors and project developers getting into the SVG RE market. *GEF technical assistance*

[25] This may include "smart-grid technology" if deemed appropriate

will be required to develop this center including the development of promotional materials, setup of a strategically located office to interface with investors, civil society and financers, the setup of a monitoring system to track RE development and GHG reductions, and the launching and sustained updating of a Government RE website. Such a website will contain all information (from Outputs 1.1, 1.2 and 1.3) necessary for potential RE investments for the benefits of RE investors and developers. This would include the Government's RE priority projects, RE resource datasets, financial incentives for RE development offered by the GoSVG, participating financial institutions and funds for developing RE projects in SVG, rules and regulations for receiving RE concessions in SVG[26], rules and regulations for RE development, roster of accredited locally available technical assistance for RE, list of ongoing RE developments, and web-posting of national benefits of RE development including GHG reductions from the offsetting of fossil fuels for electricity. These activities will complement the capacity building activities of Outcome 2 where Energy Unit officers will have improved knowledge to more effectively promote RE projects in SVG.

This Project component is expected to result in (a) clarification of RE development resources required to meet the targets of the EAP of 2010; (b) streamlined and clarified legal and regulatory procedures and incentives for IPPs to undertake RE project developments in SVG; (c) the determination of fair flexible tariff structures that will bring confidence to private RE investors and increase the number of approved RE projects; and (d) the use of best international practices for the delivery of quality and less costly electricity services to end users.

78. **Component 2: Clean energy capacity development**. This component is intended to address the barriers associated with the lack of capacity in SVG on RE issues and the development, operation and management of RE projects. The expected outcome from the deliverables of the activities to be conducted under this component is raised awareness and increased capacity of government personnel, local entrepreneurs and tradesmen to support the development of RE projects in SVG and by geographic extension, other CARICOM countries. The outputs from this component will contribute to the: (a) awareness of policymakers and government personnel with significant roles in RE development, primarily within VINLEC and the Energy Unit but also other CARICOM countries; and (b) strengthening the capacity of technical and tradesman personnel from SVG-based private sector contractors and supply entrepreneurs as well as similar personnel from other CARICOM countries. The following outputs will contribute to the achievement of this outcome:

- *Output 2.1: RE learning and mentoring programs*: This output will target the capacity building of local government personnel, contractors and entrepreneurs on RE development activities. These programs will enable participants to improve understanding of the efforts necessary to support the deployment of RE projects from Output 1.1. *GEF assistance is required for the following activities*:
  - Prepare and design local training and capacity building activities that will build the capacity of SVG energy officers on the full cycle of RE development. The materials being prepared for Outputs 1.1, 1.2 and 1.3 can be used as training material along with other materials collected from other CARICOM countries

[26] This may include integration with other government departments involved in environmental impact assessments and town planning

where similar activities are occurring. The CARICOM Secretariat's Energy Programme will serve as a source for training materials;
- Conduct a series of technical workshops on the development of solar, wind, biomass, geothermal and hydropower projects that primarily target the Energy Unit, VINLEC and various local contractors and other SVG-based RE project development personnel but also similar stakeholders from other CARICOM countries needing to develop RE;
- Conduct a series of vocational workshops on the installation, operation and maintenance of solar PV installations that primarily targets local contractors and unemployed youth. These workshops will provide certification and position local youth to be employed when demand for such vocational skills increases with the solar-PV rooftop installations for private properties;
- Solicit workshop feedback and improve the quality of workshops delivered.

- *Output 2.2: Dissemination of best practices and lessons learned on the development of RE solutions for SIDS*: On this activity, *GEF assistance is required for the following activities*:
  - Collection and dissemination of learning material into printed audio-visual formats and postings on a PACES Project website;
  - Conducting CARICOM sub-regional workshops;
  - Conducting seminars on specific RE topics such as solar PV installations, wind measurement readings, site selection criteria for small hydropower, and the management and operation and maintenance of RE projects.

  An assessment of current technical capacity for RE development in other SIDS countries can be found in Annex VIII.

79. **Component 3: Clean energy RE-based electricity generation demonstrations**: This component will address the barrier of the lack of successful RE projects in SVG and provide support towards the demonstration of sustainable RE business models in SVG to potential investors. The planned demonstration RE investments assumed for this Project includes: (a) an estimated 100 kWp of solar PV installations on selected government buildings; (b) an estimated 130 kWp of solar-PV installations at the new Argyle Airport; and (c) a solar PV project that can be used for offsetting diesel-based electricity and re-charging automobiles for the purposes of offsetting the use of petroleum products for local transport. Technical support will also be provided for the proposed geothermal project in the area of the Soufriere Volcano in the northern areas of St. Vincent as well as specific RE site resource assessments for wind, hydropower and biomass as required by the Energy Unit. The expected outcome is RE investment demonstrations are mobilized and operational. This would increase investor confidence and catalyze RE investment in SVG leading to an increase the share of renewable energy in SVG's power generation mix. The following outputs will contribute to the achievement of this outcome:

    - *Output 3.1: Completed specific Project site RE assessments*. This will include resource assessments at planned RE demo project sites. *GEF will provide technical assistance to assess the renewable energy resource potential and the risks associated with the climate resilience of the project investment (i.e. hurricanes, flooding events, drought, etc) that will include*:
      - Other wind power farm sites along the east coast of St. Vincent and selected Grenadine islands. Based on the ICAO's latest communiqué to the GoSVG on a wind farm at Ribishi Point (near the new Argyle Airport), the Project can assist in

the identification of sites for wind measurement data, and provide "investment" funding for one wind measurement station if deemed appropriate. Sites near the Argyle Airport will need sufficient buffer area from flight paths as recommended by ICAO. Data collected over a 2-year period will then be compiled into a user-friendly and internationally recognized format that can be used by potential wind investors and developers;

- Other hydropower sites where possibly two hydrometric stations can be strategically located for further investigations as proposed under the NWRMSP that was completed in 2011. *GEF assistance will also be provided to compile this information into a user-friendly and internationally recognized format that can be used by potential hydropower investors and developers*;
- An assessment of available biomass waste (that advances the findings of previous SVG biomass studies) that would be available for gasification and conversion into electricity or biofuel for local transportation. *GEF assistance will be required to provide the technical assistance using a reputable consulting firm or a company interested in a waste-to-energy investment in SVG to complete an assessment to determine the viability of the biomass resource on St. Vincent* (currently valued to produce 3 to 4 MW), and a determination of the best possible technologies that could be used to convert this waste into a form of energy that will reduce local energy costs;

- *Output 3.2: Feasibility studies.* This will include comprehensive analysis of the RE technology being deployed at each demo site. *GEF assistance will be required to collect all technical specifications and information of RE technologies being proposed and to assess their capacity for energy generation including*:
  - The setup of 2 10-kW solar PV charging stations for a demonstration of hybrid-electric vehicle (HEV) technology. The study will examine the effort and cost of two 10 kW PV solar charging stations, and the fossil fuel offsets from the demonstration and possible replication actions towards the purchase and use of more HEVs in the SVG. Lessons learned from the recent uptake of HEVs and electric vehicles (EVs) in Barbados and other island nations as well as the establishment of PV charging stations by the utility and private sector will be incorporated into this study and pilot design where appropriate. The charging stations could be setup at the new Argyle Airport and the VINLEC building in downtown Kingstown, and initially provide charging for a government HEV or EV fleet. The feasibility studies will determine the best HEVs or EVs to procure taking into consideration battery replacement costs, the actual energy consumption and vehicle performance on the hilly terrain of St. Vincent, and the energy efficiencies of various HEVs and EVs;
  - The installation of 130 kW solar panels for the new Argyle Airport to assist in offsetting grid electricity to operate the main terminal. The study will examine the effort and benefit from such a demonstration, and estimate the offsets of diesel fuel electricity generation;
  - The installation of 100 kW solar panels for various government buildings to assist in offsetting grid electricity and to demonstrate the feasibility of generating electricity from building rooftops into the grid. The study will examine the effort and benefits of these demonstrations, estimate the offsets of diesel fuel electricity generation, and the potential for replication of solar-PV deployment to private households and commercial buildings;
  - A biomass waste-to-energy plant that could displace costly generation of electricity using imported diesel fuel at Lowman's Bay or Cane Hall. The biomass

WTE plant could convert organic waste to electricity using either a combustion engine fuelled by producer gas or the conversion of biomass to heat to a steam turbine. The study should be able to clarify the best possible technology for the biomass available for conversion into electricity or biofuel;

- The Soufriere Geothermal Project where an environmental and social impact assessment of the project will be conducted by a reputable firm with experience on power project ESIAs in CARICOM nations. The selected firm will work closely with the GoSVG's Ministry of Environment to ensure compliance with World Bank guidelines and standards for ESIAs;

- *Output 3.3: Bankable documents containing business plans and financing options for RE demo projects*. *GEF assistance will be required to*:
  - prepare feasibility-level engineering designs for the demo technology projects with information from Outputs 3.1 and 3.2 and other information collected as well as the financial analysis of demo projects including cost estimates, financing modalities (based on available sources of financing), rates of return, risk analysis and business plans for implementation. Based on the information available, bankable feasibility documents would likely be prepared for:
    - ⇒ the 10 kWp PV solar charging stations and HEVs or EVs;
    - ⇒ the 130 kWp solar PV installations at Argyle Airport; and
    - ⇒ the 100 kWp solar PV installations on rooftops of various government buildings;
  - prepare documents for the financial analysis and risk assessments for a program for rooftop solar PV installations on private property in collaboration with a local bank and solar PV supply and installation company. The documents should be sufficient to permit the implementation of such a program in SVG during Year 2.

- *Output 3.4: Support for implementing RE demo projects. GEF assistance will be required for*:
  - assisting project proponents to streamline preparation of legal and regulatory documents pertaining to environmental clearance, permission to construct the RE demo project, and procurement of RE equipment;
  - reporting of the benefits and carbon reductions of their projects.

  The absence of this support would increase the risk that contractors do not install equipment as designed, thus placing risk on the investment and its ability to generate the returns from RE.

- *Output 3.5: Replication plans for additional RE projects.* The activities to deliver the aforementioned outputs under this component should catalyze interest in the replication of additional RE investments in SVG as well as other CARICOM countries. To deliver this output, VINLEC and the Energy Unit will (as a facilitation center for RE development) work closely with private entrepreneurs, private investors and RE financing institutions to promote and support the various RE development in SVG. In particular, the Project will support solar PV installations atop private households and commercial establishments. *GEF support will include*:
  - An assessment of private buildings and commercial establishments on the space requirements and improvements necessary to accommodate rooftop solar PV installations, and to feed electricity to the grid;
  - Setup of local workshops and businesses that will import, install and provide technical support for solar PV panel installations. This activity will be closely tied

to vocational training under Output 2.1 to meet an expected increase in demand for skilled construction labourers, construction equipment operators, welders, structural iron and steelworkers, electricians and solar photovoltaic installers;

- Design of fiscal incentives that would encourage private property owners to allow the installation of rooftop solar PV panels and metering equipment to feed electricity back to the grid. This may include landowner options to own the solar PV panels (financed through debt and equity) or to lease the rooftop to VINLEC for the solar panels. Various rooftop solar program designs are available globally including successful programs in Ontario (Canada) and Germany. These models will be used for guidance in the design of the SVG rooftop solar program;
- Assistance to VINLEC to promote a national program for rooftop solar PV installations given VINLEC's own interest in reducing peak loads and electricity generation costs. Assistance could include (a) arrangement of circulars and printed media on planning, design, implementation and operation of RE projects; (b) workshops and seminars for private property owners on developing rooftop solar PV installations and other RE projects; (c) conducting a survey of the willingness of households to invest in rooftop solar panels based on responses of each gender. While it is intuitive that most households would invest in rooftop solar panels to reduce monthly electricity costs, a gender disaggregated survey would provide valuable information on how to best ensure the uptake of solar energy on rooftops is maximized in SVG (there are no issues to consider with regards to indigenous populations); and (d) assisting project proponents in collaboration with VINLEC and Energy Unit personnel on the design of rooftop solar installations (anticipated to be in the order of 150 kWp by EOP), and arranging of RE project financing with available sources.

- *Output 3.6: RE demo investment projects. GEF assistance will be required for*:
  - ensuring the RE demo project is constructed as designed (to ensure it generates energy and revenue as designed); and
  - assisting project proponents in the proper operation and maintenance of the RE demo project;

  Demonstration projects that are expected to be supported towards completion with GEF Project resources include the demonstration projects mentioned in Output 3.3: the PV solar charging stations, and solar PV installations at Argyle Airport and various government buildings.

  GEF funds in this output will also be used for the investment into:
  - one 10 kW charging station at the new airport with the other 10 kW charging station being procured through VINLEC;
  - one HEV or EV, with another similar HEV or EV to be procured through VINLEC;
  - 65 kW of solar PV panels at the new Argyle Airport. The other 65 kW will be procured through VINLEC;
  - 50 kW of solar PV panels at selected government buildings on St. Vincent. The other 50 kW will be procured by VINLEC.

  Co-financing from Barbados Light & Power Holdings will go towards geothermal development.

80. Without these planned interventions and successful demonstrations for renewable energy power generation projects, it is difficult to envision the current growth of RE

development meeting the NEP targets for 2015 and 2020. Without the GEF project, the current knowledge base in SVG will not be sufficient to induce RE investments into solar PV electricity generation, and the investment conditions will not attract the independent renewable energy power producers (that includes private property owners in SVG). Without the removal of the identified barriers, the grid-connected renewable electricity market will not develop outside the current modality where VINLEC controls all new electricity generation facilities, if it has the resources to develop these RE facilities at all.

81. Figure 5 is a flowchart of how the Project will be implemented. Figure 6 is an indicative implementation schedule of how PACES will be implemented.

Figure 5: Project Flowchart

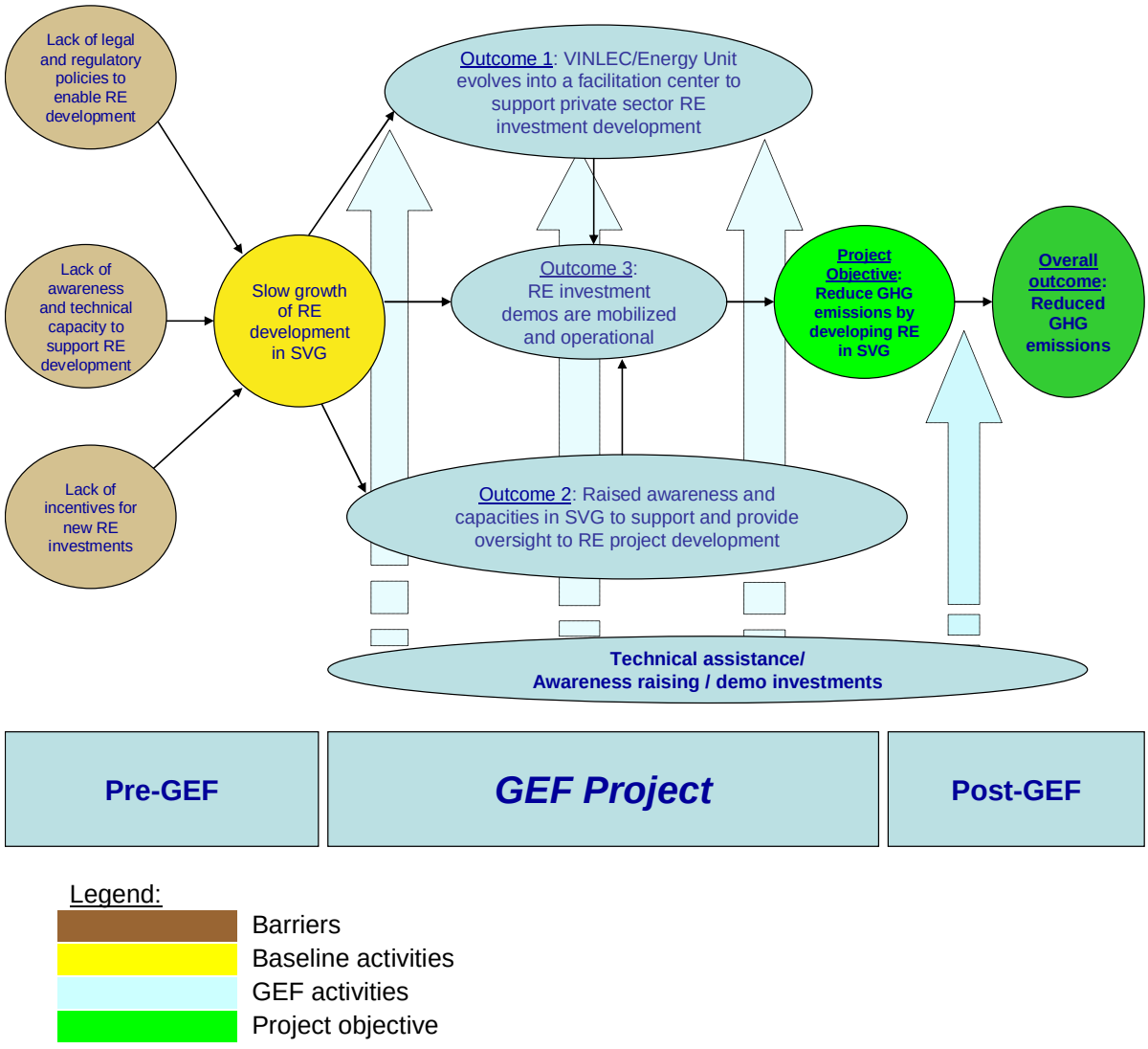
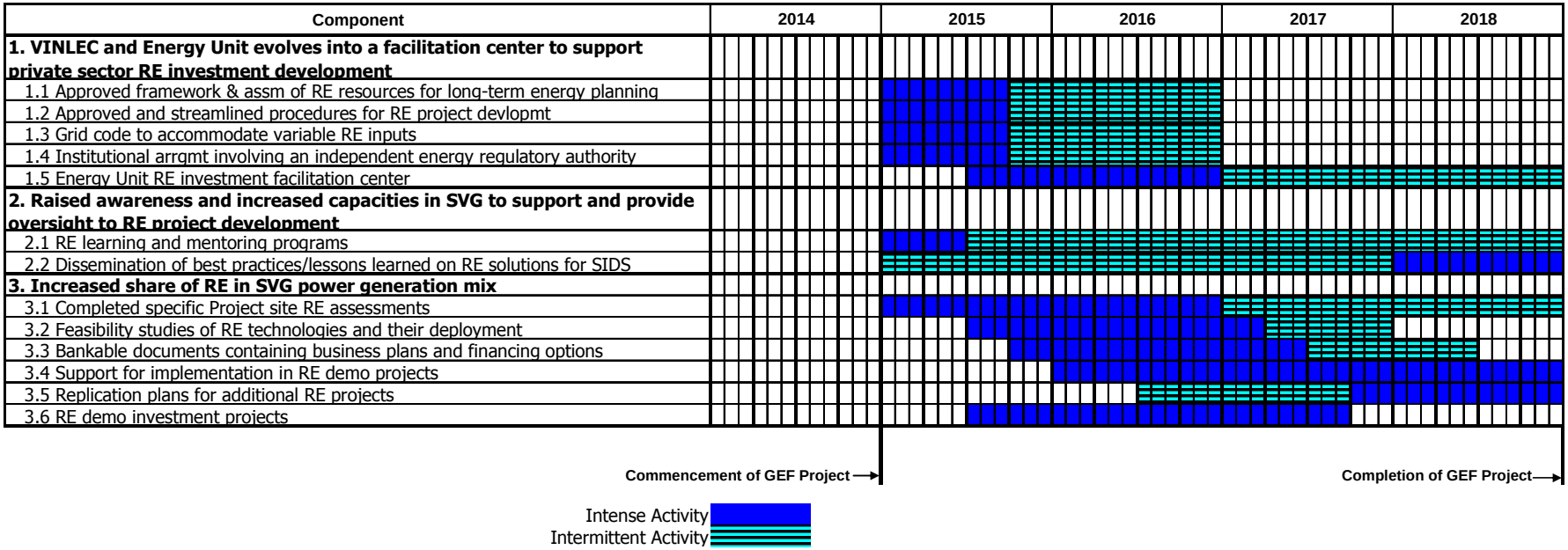


Figure 6: Indicative Implementation Schedule for PACES



Key Indicators and Risks

Indicators

82. The most direct impact of the proposed Project as it relates to core GEF objectives is the reduction in CO_2 emissions from the power sector. Impact indicators to gauge the success of the Project includes:
    - Reduction in CO_2 emissions from the use of hybrid or electric vehicles for road transport.
    - Number of RE project proponents assisted by Energy Unit and VINLEC staff including private property owners who wish to have solar-PV installations on their rooftops;
    - Number of managers from the Energy Unit and VINLEC dedicated to the promotion of RE investments;
    - Number of technical personnel in VINLEC, Energy Unit and in the private sector who can provide technical oversight on RE project development in SVG and other OECS countries;
    - Number of tradespersons who have local certification to construct, assemble, operate and maintain RE technologies;
    - Number of RE projects that are privately financed and connected to VINLEC electricity grid by EOP;
    - Megawatts of RE on-grid projects installed by EOP;
    - MW capacity of RE generation projects (on-grid and off-grid) in planning and design stages by EOP
    - % reduction in electricity drawn from the grid for each household with on-grid rooftop solar-PV panels.

    Table 5 provides a summary of the expected direct and post-project indirect GHG emissions from the Project.

Risks

83. The overall project risk is moderate. While all possible efforts have been made in the design of PACES to mitigate perceived project risks, there are inevitably some unavoidable residual risks that will have to be carefully monitored and managed to ensure project success. Project risks can be categorized as external (global and policy-related) and internal (risks inherent to the Project design that could be controlled by Project management). Internal risks and recommended mitigation measures are summarized on Table 6 and provided in detail in the "Offline Risk Log" in Annex I.

84. External risks include:
    - Continued or sustained levels of energy subsidies to fossil fuels and electricity prices. While the GoSVG is trying to reduce these subsidies, political pressure may result in the GoSVG being unable to reduce subsidies to the extent that the economics of renewable energy projects may not be attractive;
    - Inability to build the necessary institutional and local capacity during the Project period due to lack of qualified personnel;
    - Failure to secure co-financing from potential project partners. This may result from the unforeseen diversion of government budgets and resources towards issues with more pressing priorities such as disaster relief and large infrastructure projects that would generate significant economic benefits.

Table 5: Summary of Direct GHG Emissions from Project Interventions

Intervention Description	Detail	Tonne CO_{2eq}[27]	
		GHG Reductions[28] (1-4 years)	GHG Reductions[29] (5-10 years)
Grid-connected solar PV panels	130 kWp of solar PV panels that are installed during Year 1 at new Argyle International Airport (Project will procure 65 kWp)	4,541	10,596
	100 kWp of solar PV panels that are installed during Year 1 on rooftops of selected government buildings. These demonstration solar PV installations will be used as pilots for similar installations on several other rooftops on other government buildings and private properties (Project will procure 50kWp)	3,493	8,150
	50 kWp of solar PV panels on private rooftops that are installed during Year 2 (Project will provide TA for design and installation)	1,164	4,657
	100 kWp of solar PV panels on private rooftops that are installed during Year 3 (Project to provide TA for design and installation)	1,164	10,479
	400 kWp of solar PV panels on private rooftops that are installed after EOP but received TA from Project for design and installation	0	44,245
Solar PV charging station	Two solar 10 kWp charging stations that are installed during Year 1, one in Kingstown near the Administration Building and the other at the Argyle International Airport for charging the batteries in two HEVs or EVs to offset petrol consumption for road vehicles (Project will procure one 10 kWp charging station and one HEV or EV)	62	900
Grid-connected geothermal power station[30]	10 MW geothermal plant near Mount Soufriere will generate base-load electricity by Year 4, and another 5 MW to be commissioned 9 years after EOP (Project will provide TA for ESIA study)	138,758	69,379[31]
Totals:		***148,147***	***140,594***

[27] Grid emission factor for SVG assumed to be 0.90 tonnes CO_{2e}/MWh. Although 15 to 25% of SVG's electricity comes from hydro, the impact of any new RE sources into the relatively small SVG grid will be the complete offsetting of fossil-fuel electricity generation.

[28] This is the cumulative emissions reduction during the Project period.

[29] This includes cumulative emission reductions for the first 10 years after the EOP.

[30] No direct project emission reductions are claimed after 2019 as it is assumed that the geothermal project in a BAU scenario would have been operational by 2020; PACES assistance with the ESIA advances the geothermal project start date to 2017.

[31] Project will only take credit for advancing the start date of the geothermal project by 3 years. These post-project ERs are only counted for one year after the EOP.

Table 6: Internal Project Risks and Mitigating Actions

Risk	Level of Risk	Mitigating Actions
Terms and conditions for replication phase are not sufficiently attractive for private investors (IPPs)	Moderate	The Project will be designed to minimize the risk profile of RET projects in SVG, specifically solar PV rooftop installations that are deemed to have a higher probability of success for demonstration and replication. The Project will reduce the risk profile of these RE installations through two modalities: a) solar PV panels are procured and operated by private property owners who can recover their investment through a net billing mechanism; or b) solar PV panels are installed by VINLEC on private rooftops that are leased to VINLEC. To sustain the growth of RE deployment, the Project will also strengthen local capacity on RE issues; assist in improving the terms and conditions for RE private investors (including attractive tariffs, lease arrangements, off-take and payment guarantees); and improve the financial climate for RE investments. RE projects will be developed as a partnership between project proponents and the GoSVG.
Delays due to lack of government capacity	High	The Project is designed for implementation by the Energy Unit of MoNS, whose mandate is to promote renewable energy project development in SVG. Capacity building efforts of the Project will strengthen the Energy Unit and VINLEC in their capacity to promote and support development of RE in SVG.
Insufficient capital made available for RE investment scale-up	Moderate	Implementation of pilot projects will demonstrate to potential RE investors that RE projects can be successfully implemented in SVG, raising the confidence of financial institutions to avail capital financing through carbon funds or NAMA financing. Moreover, the economics of developing a rooftop solar PV programme appears to be attractive, thus increasing the probabilities of its successful scale-up.
Returns on investment not realized due to RETs or RE projects not generating sufficient renewable energy	Moderate	The Project will provide quality control assistance to RE project and operational personnel on international standards and best practices for RE deployment that will ensure maximum power generation and return of investment, and to procure RE equipment that have performance guarantees and technical support from suppliers and manufacturers. The Project will also strengthen linkages with ECERA, the proposed regional energy regulatory authority to provide guidelines and enforcement mechanisms to ensure that the delivery of electricity from RE sources follows best international practices.

Cost Effectiveness

85. The GEF contribution of USD 1,726,484 will result in a cumulative direct emission reduction of 148,147 tonnes CO_{2eq} from the installation of solar PV panels at Argyle International Airport and selected government building rooftops, and the pilot program for solar charging of HEVs or EVs for road transport, and removal of a regulatory barrier for the development of the 10 MW geothermal plant near Mount Soufriere. In consideration of the service life of the RE technologies, direct and direct post-project emission reductions[32] will be 288,741 tonnes CO_{2eq}. This translates into a GEF abatement cost of USD 5.98 per tonne CO_{2eq}.

[32] Direct post-project emissions in this context refer to a 10-year GEF influence period after the EOP.

86. In the absence of PACES or BAU scenario, the generation of direct and direct post-project emission reductions of 248,739 tonnes CO_{2eq} simply will not occur; there are no other RE resources apart from solar, wind and geothermal that can generate this level of emission reductions. This includes any energy efficiencies that could be achieved in SVG.

87. PACES will assist in catalyzing development of solar energy sources and accelerate geothermal energy development that will translate into GHG reductions from the SVG energy sector. PACES will boost investor confidence and generate lessons and knowledge on effective implementation of solar and geothermal projects in SVG that can be extrapolated to similar island nations of CARICOM. This will catalyze RE investment, mostly in rooftop solar PV installations and geothermal projects, after completion of PACES. As such, PACES will also generate indirect emission reductions resulting from:
    - Well-managed pilot programs (bottom-up) that will result in the reduction of 18,653 tonnes CO_{2eq} based on a replication factor of 2; and
    - The development of a renewable energy investment facilitation center (managed by the Energy Unit) and an enabled RE investment environment (top-down) that will result in the reduction of 963,800 tonnes CO_{2eq} based on a causality factor of 40%.

88. PACES also seeks to produce knowledge of global value on how to implement adaptation measures in small island states that can be applied in other countries in the region that are not participating in the Project and even for islands in other regions of the world. The value of these early lessons will make the GEF resources applied, more cost-effective in the medium term.

Sustainability and Replicability

Sustainability

89. PACES is designed to ensure that RE investment conditions by the EOP are favorable to the extent that RE development in St. Vincent and the Grenadines is sustained well after Project completion. Sustainability of this GEF project will be ensured through:
    - The development of a functional RE investment facilitation center in the Energy Unit that will be staffed by Government personnel with improved knowledge on RE development and regulatory approval issues; and
    - The deployment of renewable energy technologies that will demonstrate their technical and financial feasibility in SVG that will improve the confidence of local and foreign RE investors.

Replicability

90. The pilot RET deployment in SVG will provide valuable developmental and operational experience and data to boost investor confidence that on-grid RE projects can be successfully developed in SVG with adequate rates of return. This demonstration of RE viability in SVG will facilitate replication of RE projects throughout SVG.

PROJECT RESULTS FRAMEWORK

Primary applicable Key Environment and Sustainable Development Key Result Area (same as that on the cover page, circle one): 1. Mainstreaming environment and energy OR 2. Catalyzing environmental finance OR 3. Promote climate change adaptation OR 4. Expanding access to environmental and energy services for the poor.
Applicable GEF Strategic Objective and Program: GEF-4 CC4 Strategic Program SP3: Increased production of renewable energy in electricity grids
Applicable GEF Expected Outcomes: Total avoided GHG emissions from on-grid RE electricity generation
Applicable GEF Outcome Indicators: Market penetration of on-grid renewable energy (% from renewables); GHG emissions from electricity generation (tons CO_{2eq}/kWh); and $/ tons CO_{2eq}

	Indicator	Baseline	Targets End of Project	Source of verification	Assumptions
Project Objective: [33] Reduction in GHG emissions from fossil-fired power generation and fossil fuel consumption for road transport through the exploitation of SVG's renewable energy resources for power generation	▪ Cumulative direct and direct post-project CO_2 emission reductions resulting from the RE technical assistance and investments by end-of-project (EOP), ktons CO_2. ▪ % share of RE in the power generation mix of SVG by EOP	▪ 0 ▪ 15.5[34]	▪ 0.25 [35] ▪ 21[36]	▪ Project final report as well as annual surveys of energy consumption & reductions for each RE project	▪ Economic growth in the country will continue ▪ Government support for RE development and utilization will not change
Outcome 1:[37] The Energy Unit with the support of VINLEC evolves into a facilitation center to support private sector RE investment development, enable regulators to	• Number of on-grid RETs approved based on studies of improved RE policy and tariffs and RE grid integration • Number of RE development project proponents that were	• 0 • 0	• 2[38] • 352[39]	• Completed studies on RE policy/tariffs, and RE grid integration[40] • Guidebooks on operational rules that assist VINLEC on developing RE power	• Continued government support for legislative and regulatory reform to promote and accelerate RE development • Capacity of government does not substantially delay approval

[33] *Objective (Atlas output) monitored quarterly ERBM and annually in APR/PIR*
[34] Based on figures from Table 2 where 6.2 MW of installed capacity of renewable energy against total installed capacity of 40 MW in 2012
[35] Over a period of 10 years from RE projects developed during PACES and during the 10-year GEF influence period after the EOP, and with an assumed grid emissions factor of 0.90 tonnes CO_{2eq}/MWh.
[36] Total RE capacity to be added during PACES includes solar PV installations of 130 kW at the new airport, 100 kW at selected government buildings, 150 kW on private property rooftops (Project will provide TA to implement these installations) and 10 MW for geothermal (Project will provide TA for EIA, removing a regulatory barrier for the geothermal project proponents)
[37] *All outcomes monitored annually in the APR/PIR.*
[38] This will include solar PV rooftop installations and geothermal
[39] This would include approximately 150 private property owners who have their 1.0 kW solar PV systems installed during the Project, 200 private property owners who install their 1.0 kW systems within 2 years after EOP plus VINLEC and BLPH (for the geothermal project)
[40] These studies are to be completed under GoSVG support with possible funding and support from IRENA and ECERA

	Indicator	Baseline	Targets End of Project	Source of verification	Assumptions
determine fair flexible tariff structures, bring confidence to private RE investors, and increase the number of approved RE projects	assisted by staff from the Energy Unit and VINLEC in the technical design of their projects			projects in SVG • VINLEC project approvals • Annual reviews of key performance indicators of VINLEC Strategic Plan	of RE policies and RE projects
Outcome 2: Raised awareness and increased capacity of government personnel and local entrepreneurs to support the development of RE projects in SVG and by geographic extension, other CARICOM countries	• Number of managers in VINLEC and Energy Unit dedicated to promoting of RE investments • Number of technical personnel in VINLEC, Energy Unit and in the private sector who can provide technical oversight on RE project development in SVG and other OECS countries • Number of tradespersons who have local certification to construct, assemble, operate and maintain RE technologies	• 1 • 2[41] • 0	• 3 • 8 • 50	• Workshop and seminar proceedings • RE training course materials • Training evaluations by participants	• Government budgets for RE data collection are replenished on an annual basis •
Outcome 3: Renewable energy accounts for an increased share of SVG's power generation mix	• Number of RE projects that are financed through RE funds where VINLEC has involvement in operationalization by EOP • Number of privately-financed RE projects connected to VINLEC electricity grid by EOP • MW of RE on-grid projects	• 0 • 0 • 6.2 [42]	• 2[43] • 151 [44] • 16.58 [45]	• Studies of RE assessments and potential • Feasibility studies of RE technologies and their deployment at specific sites • Bankable documents with business plans and financing options for RE demo projects • PPAs and approval	• Sufficient annual replenishment of RE development funds • Capacity of government does not substantially delay approval of RE policies and RE projects

[41] These personnel are from the Energy Unit
[42] Based on information from Table 2 (pg 12)
[43] This would include the rooftop solar PV installations for the new airport (130 kW) and selected government buildings (100 kW)
[44] Assumes 10 MW from the Mount Soufriere Geothermal Project, and rooftop solar-PV panels installations at the new airport (130 kW), selected government buildings (100 kW), and 150 private homes (@ 1.0 kW each).
[45] Ibid 43

	Indicator	Baseline	Targets End of Project	Source of verification	Assumptions
	installed by EOP • MW capacity of RE generation projects (on-grid and off-grid) in planning and design stages by EOP • % reduction in electricity drawn from the grid for each household with on-grid rooftop solar-PV panels	• 0 • 0	• 5.20 [46] • 50 [47]	permits to construct • Contract documents for construction and RE technology installation • Work inspection reports • Plans for additional RE plants in SVG and in neighboring OECS countries • Surveys of electricity consumption after solar-PV rooftop installations	

[46] Based 200 private property owners that are planning to install 1.0 kW of solar-PV panels on their rooftops, and the planning of a "phase 2" 5 MW geothermal plant to be developed for generation 9 years after EOP.

[47] Assumes a 1.0 kW solar PV installation will generate 32 kWh, with average daily consumption of 18.2 kWh/day (based on electricity demand for Barbados from 2011 MPRA study on "Price Reform and Household Demand for Electricity", pg 11, available on http://mpra.ub.uni-muenchen.de/40934/1/MPRA_paper_40934.pdf) of which conservatively 13.8 kWh/day can be sold back to VINLEC. The household will still need to draw electricity from the grid for the evenings which is assumed to be in the order of 9 kWh/day or 50% of the daily electricity consumption. As such, the indicator is assumed to be a 50% reduction in household electricity drawn from the grid

TOTAL BUDGET AND WORK PLAN

Award ID:	00080915	Project ID(s):	00090426
Award Title:	Promoting Access to Clean Energy Services in St. Vincent and the Grenadines (PACES)		
Business Unit:	BRB 10		
Project Title:	Promoting Access to Clean Energy Services in St. Vincent and the Grenadines (PACES)		
PIMS no.	5146		
Implementing Partner (Executing Agency)	Energy Unit of the Ministry of National Security		

GEF Outcome/Atlas Activity	Responsible Party/ Implementing Agent	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount (USD) Year 1 2014	Amount (USD) Year 2 2015	Amount (USD) Year 3 2016	Amount (USD) Year 4 2017	Total (USD)	Notes
Outcome 1: The Energy Unit with VINLEC support evolves into a facilitation center to support private sector RE investment development, enable regulators to determine fair flexible tariff structures, bring confidence to private RE investors, and increase the number of approved RE projects		**62000**	GEF	71200	International Consultants	9,000	9,000	9,000	9,000	36,000	Note 1
				71300	Local Consultants	36,000	32,000	20,000	13,000	101,000	Note 2
				72100	Contractual Services	20,000	30,000			50,000	Note 3
				71600	Travel	6,600	6,600	6,600	6,600	26,400	Note 4
				72300	Materials and Goods		6,000	6,000	1,400	13,400	Note 5
				75700	Training Workshops	12,000	12,000	12,000	12,000	48,000	Note 6
	Total GEF Outcome 1					83,600	95,600	53,600	42,000	274,800	
	Total Outcome 1					**83,600**	**95,600**	**53,600**	**42,000**	**274,800**	
Outcome 2: Raised awareness and increased capacities in SVG to support and provide oversight to RE project development		**62000**	GEF	71200	International Consultants	3,000	3,000	3,000	3,000	12,000	Note 7
				71300	Local Consultants	12,000	8,000	8,000	12,000	40,000	Note 8
				72100	Contractual Services	5,000	10,000	0	0	15,000	Note 9
				71600	Travel	1,500	1,500	1,500	1,500	6,000	Note 10
				72300	Materials and Goods	0	0	0		0	
				75700	Training Workshops	10,000	20,000	20,000	20,000	70,000	Note 11
	Total GEF Outcome 2					31,500	42,500	32,500	36,500	143,000	
	Total Outcome 2					**31,500**	**42,500**	**32,500**	**36,500**	**143,000**	

GEF Outcome/Atlas Activity	Responsible Party/ Implementing Agent	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount (USD) Year 1 2014	Amount (USD) Year 2 2015	Amount (USD) Year 3 2016	Amount (USD) Year 4 2017	Total (USD)	Notes
Outcome 3: Renewable energy accounts for an increased share of SVG's power generation mix		**62000**	GEF	71200	International Consultants	12,000	12,000	12,000	12,000	48,000	Note12
				71300	Local Consultants	90,600	98,600	110,600	113,600	413,400	Note13
				72100	Contractual Services	100,000	68,000	25,000	12,000	205,000	Note14
				71600	Travel	3,000	3,000	3,000	3,000	12,000	Note15
				72300	Materials and Goods	3,000	3,000	3,000	3,512	12,512	
				72600	Grants	250,000	250,000	30,000		530,000	Note 16
					Total GEF Outcome 3	458,600	434,600	183,600	144,112	1,220,912	
					Total Outcome 3	**458,600**	**434,600**	**183,600**	**144,112**	**1,220,912**	
PROJECT MANAGEMENT (including M&E)		**62000**	GEF	71200	International Consultants	0	0	0	0	0	
				71300	Local Consultants and Local Staff	13,000	13,000	13,000	13,000	52,000	Note 17
				72400	Communications	1,000	1,000	1,000	1,000	4,000	
				72300	Materials and Goods	2,000	1,200	1,200	1,000	5,400	
				72500	Office Supplies	1,000	2,000	2,000	1,372	6,372	Note 18
				74100	Audit	5,000	5,000	5,000	5,000	20,000	
					Total GEF Project Management	22,000	22,200	22,200	21,372	87,772	
					Total Project Management	**22,000**	**22,200**	**22,200**	**21,372**	**87,772**	
GEF Total						**595,700**	**594,900**	**291,900**	**243,984**	**1,726,484**	
UNDP Total										**0**	
Grand Total						**595,700**	**594,900**	**291,900**	**243,984**	**1,726,484**	

Summary of Funds:

	Amount Year 1	Amount Year 2	Amount Year 3	Amount Year 4	Total
GEF	595,700	594,900	291,900	243,984	1,726,484
Energy Unit	200,000	225,000	100,000	200,000	725,000
VINLEC	800,000	900,000	3,600,000	5,000,000	10,300,000
Barbados Light and Power Holdings	8,000,000	20,000,000	22,000,000	28,000,000	78,000,000
Private Sector Investors			150,000	450,000	600,000
TOTAL	9,595,700	21,719,900	26,141,900	33,893,984	91,351,484

Notes:

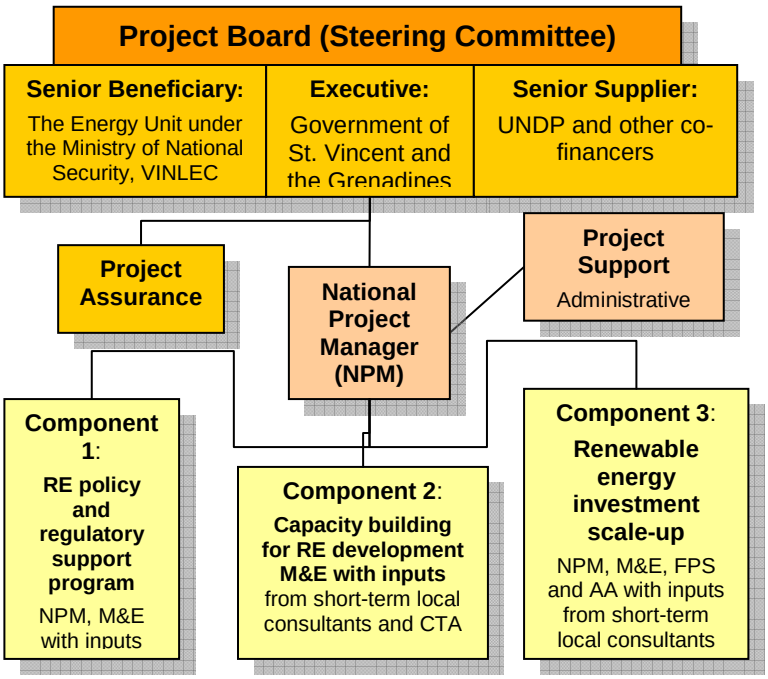
1. This includes professional time for the Chief Technical Advisor (CTA) (@USD 3,000/week) being in SVG 3 weeks per year on this component
2. This includes professional time for the National Project Manager (NPM) @USD 2,000/week for a total of 36 weeks and the M&E Officer (M&E) @USD 1,000/week for a total of 29 weeks
3. This includes USD 30,000 for study on RE resource availability, USD 20,000 on report on recommended regulatory streamlining. GEF will not fund the grid integration study (to be funded under IRENA for ~USD 35,000) and a feed-in tariff study (to be funded under ECERA for ~USD 25,000)
4. This includes per diems and air travel for CTA
5. For promotional materials for Facilitation Center
6. Cost of capacity building workshops over the 48-month period of the Project with 5 workshops conducted each year on various RE topics
7. This includes professional time for the CTA (@USD 3,000/week) being in SVG for 1 week per year for Years 1 to 4
8. This includes professional time for the NPM @USD 2,000/week for a total of 8 weeks and the M&E @USD 1,000/week for a total of 24 weeks
9. USD 15,000 for local IT firm to setup secure website
10. Only includes per diems for international consultants
11. Workshops on RE project development, vocational skills required for setting up RE projects and RE project operation for SVG stakeholders and OECS countries
12. This includes professional time for the CTA (@USD 3,000/week) for a total of 16 weeks from Years 1 to 4
13. This includes professional time for the NPM @USD 2,000/week for a total of 140 weeks, the Financial Procurement Specialist (FPS) @ USD 800/week for a total of 48 weeks, the M&E @USD 1,000/week for a total of 67 weeks, and the AA @USD 500/week for a total of 14 weeks from Years 1 to 4
14. Allocation includes USD 25,000 for specific RE assessments, USD 30,000 for bankable RE studies, and USD 150,000 for Geothermal EIA
15. Includes per diems for 50% of CTA's time
16. These are grant investment funds of Output 3.6 to match VINLEC procurement of rooftop solar panels, hybrid car and solar charging station that are allocated as follows: USD 260,000 for 65 kWp solar PV panels at the new airport, USD 200,000 for 50 kWp solar PV panels on selected government buildings, USD 40,000 for 10 kWp solar PV panels for the hybrid-electric car charging station, and USD 30,00 towards procurement of a hybrid or electric car
17. Project Management Unit (PMU) time is allocated as follows: NPM @USD 2,000/week for a total of 8 weeks, the M&E @USD 1,000/week for a total of 16 weeks, and the AA @USD 500/week for a total of 40 weeks from Years 1 to 4.
18. Office stationary and supplies

MANAGEMENT ARRANGEMENTS

Project Organization Structure

91. The project will be executed according to UNDP's National Implementation Modality (NIM), as per the NIM project management implementation guidelines agreed by UNDP and the Government of St. Vincent and the Grenadines. The Project is co-financed with funding from the GEF and UNDP acts as the *GEF Executing Agency*. Components 1, 2 and 3 of the Project will be implemented by the Energy Unit of MoNS, who will assume the overall responsibility for the achievement of Project results as the *Implementing Partner (GEF Local Executing Agency).* The Energy Unit will designate a senior official as the *National Project Director (NPD)* for the Project. The PACES Project Management Unit (PMU) will consist of a National Project Manager (NPM), an international Chief Technical Advisor (CTA), a Monitoring and Evaluation Officer (M&E), a Finance/Procurement Specialist (FPS), and an Administrative Assistant (AA). The organization structure of PACES is depicted on Figure 7. The Terms of Reference (ToRs) of PMU personnel are provided in Annex VI.

Figure 7: Project Organization Structure



92. The NPD will be responsible for overall guidance to project management (for all components), including adherence to the Annual Work Plan (AWP) and achievement of planned results as outlined in the ProDoc, and for the use of UNDP funds through effective management and well established project review and oversight mechanisms. The NPD also will ensure coordination with various ministries and agencies provide guidance to the Project team to coordinate with UNDP, review reports and manage administrative arrangements as required by the Government of St. Vincent and the

Grenadines and UNDP. This would include the contribution of office space within the premises of the Energy Unit to personnel in the Project Management Unit (PMU).

93. PACES has been designed as an umbrella project that will initially develop and provide coordination for SVG efforts to promote the development of renewable energy in SVG. As such, the NPD in close collaboration with the Project's NPM will chart and implement the activities of this Project towards its objectives of catalyzing RE development in SVG. This will include outsourcing of technical assistance such as the EIA for the geothermal project, RE resource availability studies, and bankable RE feasibility studies that may include a report on setting up the rooftop solar PV program for private property owners.

94. UNDP will provide overall management and guidance from its Country Office (CO) in Barbados and the Latin America Caribbean Regional Centre (LAC) in Panama City, and will be responsible for monitoring and evaluation of the project as per normal GEF and UNDP requirements. The PMU under the CO will manage the day-to-day activities of the Project under the guidance of the NPD. The PMU will have one full-time staff, the National Project Manager, and two part-time staff, the M&E Officer and an Administrative Assistant. Terms of reference (ToRs) for these PMU staff are contained in Annex IV.

General

Collaborative Arrangements with Related Projects

95. The proposed Project will have collaborative arrangements with a number of other donor initiatives that support renewable energy, described as follows:
    - The Eastern Caribbean Energy Regulatory Authority (ECERA) is an OECS and World Bank funded initiative to provide oversight to energy sectors of member states;
    - SIDS-DOCK Initiative provides a mechanism to help SIDS transform their energy sector, and to facilitate the sharing of experiences, pursuing of mutual goals, and sharing resources across regions and small island nations that remain dependent on imported fuels. SIDS DOCK has been developed to be the institutional mechanism that will support transformation of their energy sectors. The mechanism is a "*DOCK*ing station," to connect the energy sector in SIDS with the global market for finance, sustainable energy technologies and with the European Union (EU) and the United States (US) carbon markets, and able to trade the avoided carbon emissions in those markets;
    - The International Renewable Energy Agency (IRENA) who have had discussions with the Energy Unit to provide technical assistance on the formulation of a grid code and the necessary grid upgrades that will sustain the delivery of variable renewable energy to VINLEC customers.

96. This proposed Project will establish the necessary communication and coordination mechanisms through its PMU and PSC with the Project Management Board to ensure proper coordination between the various projects. UNDP Barbados and OECS will also take the lead in ensuring adequate coordination and exchange of experiences. The Project will seek to coordinate its actions with other UNDP energy and climate change activities in the region; similar strategies of the proposed Project may extend an opportunity to share lessons and exploit synergies, in particular in areas of harmonization and mutual recognition. The proposed Project will also seek to coordinate actions with other existing government commitments and non-government initiatives.

97. The Energy Unit will ensure co-finance and cooperation from its other programs, some of which are funded by other donor agencies. Co-financing details are provided on Table 7.

Table 7: Co-Financing Details

Co-Financer	Amount (USD)	General Description of Co-Financed Activities
Barbados Light and Power Holdings	78.0 million	• Preparations and implementation of a drilling program (USD 8 million) to site the geothermal wells; • Engineering, financing and development of a 10 MW power plant from the geothermal resources of Mount Soufriere with an estimated capital cost of USD 70 million.
Energy Unit under the MoNS	0.725 million	• Component 1 (in-kind): Inventory of RE resources, augmenting NEAP, periodic review or NEP, amendments to ESA (Output 1.1); guidelines for developing RE projects, RE incentives, clear processes to procurement, tendering and licensing (Output 1.2); RE investment facilitation center (Output 1.5), energy regulatory agency liaison (Output 1.4); • Component 2 (in-kind): Provision of workshop venues; • Component 3 (in-kind): Support for RE demo implementation (Output 3.4); replication plans for RE projects (Output 3.5); • Project management (in-kind): Office space and various administrative support for the Project.
VINLEC	10.30 million	• Component 1: Rules and procedures for becoming an IPP, local grid assessment (Output 1.2), formulation of grid code (Output 1.3); • Component 2: Provision of workshop venues; • Component 3: Specific RE resource assessments (Output 3.1); feasibility studies of RE technologies (Output 3.2); support for RE demo implementation (Output 3.4); replication plans for RE projects (Output 3.5). • Purchase and installation of more than 50 kW of solar-PV panels for installation on rooftops of government buildings; • Purchase and installation of more than 65 kW of solar-PV panels for installation on rooftops of the terminal and other airport buildings; • Purchase and installation of 1 - 10 kW solar charging stations, and the procurement of one HEV or EV; • Procurement and installation of more than USD 1.0 million of equipment required to stabilize the national grid when taking in variable renewable energy inputs and its capacity to efficiently deliver electricity to end-users.
Private Sector Investors	0.60 million	• For rooftop solar-PV installations on private property anticipated to be 150 kWp by EOP • Private property owners will be identified during the course of Project
Total:	**89.625 million**	

Prior Obligations and Prerequisites

98. There are no prior obligations and prerequisites.

Audit Arrangements

99. The Government will provide the UNDP Resident Representative with certified periodic financial statements, and with an annual audit of the financial statements relating to the status of UNDP (including GEF) funds according to the established procedures set out in the programming and finance manuals. The audit will be conducted by the legally recognized auditor of the Government, or by a commercial auditor engaged by the Government.

Agreement on Intellectual Property Rights and Use of Logo on Project Deliverables

100. To accord proper acknowledgement to GEF for providing funding, a GEF logo should appear on all relevant GEF-supported project publications, including among others, project hardware, if any, purchased with GEF funds. Any citation on publications regarding projects funded by GEF should also accord proper acknowledgement to GEF. Alongside GEF and UNDP logo, a GoSVG logo may also be featured as the Implementing Partner of the proposed project.

MONITORING FRAMEWORK AND EVALUATION

101. The project team and the UNDP Office in Bridgetown supported by the UNDP-GEF Regional Coordination Unit in Panama City will be responsible for project monitoring an evaluation conducted in accordance with established UNDP and GEF procedures. The Project Results Framework provides performance and impact indicators for project implementation along with their corresponding means of verification. The GEF CC Tracking Tool will also be used to monitor progress in reducing GHG emissions. The M&E plan includes: inception workshop and report, project implementation reviews, quarterly and annual review reports, independent mid-term evaluation, and independent final evaluation. The following sections outline the principle components of the Monitoring and Evaluation Plan and indicative cost estimates related to M&E activities. The M&E budget is provided on Table 8.

102. Project start: A Project Inception Workshop will be held within the first 4 months of the project starting with those with assigned roles in the project organization structure, UNDP country office and where appropriate/feasible regional technical policy and program advisors as well as other stakeholders will be invited. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan. The Inception Workshop would address a number of key issues including:
    a) Assisting all partners to fully understand and take ownership of the project;
    b) Detailing the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis-à-vis the project team;
    c) Discussing the roles, functions, and responsibilities within the Project's decision-making structure including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference of project staff will be discussed again as required;

Table 8: M&E Work Plan and Budget

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time Frame
Inception Workshop and Report	▪ Project Manager ▪ UNDP CO, UNDP GEF	Indicative cost: 5,000	Within first four months of project

Type of M&E activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time Frame
			start up
Measurement of Means of Verification of project results.	▪ UNDP GEF RTA/Project Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members.	To be finalized in Inception Phase and Workshop.	Start, mid and end of project (during evaluation cycle) and annually when required.
Measurement of Means of Verification for Project Progress on *output and implementation*	▪ Oversight by CTA with support from the Project Manager ▪ Project team	To be determined as part of the Annual Work Plan's preparation.	Annually prior to ARR/PIR and to the definition of annual work plans
ARR/PIR	▪ Project manager and team ▪ UNDP CO ▪ UNDP RTA ▪ UNDP EEG	None	Annually by July
Project Board meetings	Project Manager	To be determined as part of the Annual Work Plan's preparation. Indicative cost: 6,000 (1,500 x 4 years)	Following IW and annually thereafter.
Periodic status/ progress reports	2. Project manager and team	None	Quarterly
Final Evaluation	1. Project manager and team, 2. UNDP CO 3. UNDP RCU 4. External Consultants (i.e. evaluation team)	Indicative cost : 30,000	At least three months before the end of project implementation
Project Terminal Report	• Project manager and team • UNDP CO • local consultant	0	At least three months before the end of the project
Audit	1. UNDP CO 2. Project manager and team	Indicative cost: 4,000 (1,000 x 4 years)	Yearly
Visits to field sites	• UNDP CO • UNDP RCU (as appropriate) • Government representatives	For GEF supported projects, paid from IA fees and operational budget	Yearly
Dissemination of lessons learnt	• Project Manager and team • Local consultant	Indicative cost: 5,000	At least three months before the end of the project
TOTAL indicative COST Excluding project team staff time and UNDP staff and travel expenses		Total: 50,000 approx. (GEF funded, not including co-financing resources)	

d) Finalization of the first annual work plan based on the project results framework and the relevant GEF Tracking Tool if appropriate. A review and agreement on the indicators, targets and their means of verification will be required as well as a re-check of assumptions and risks;
e) Providing a detailed overview and reach consensus on reporting, monitoring and evaluation (M&E) requirements, the M&E work plan and budget;
f) Discussion of financial reporting procedures and obligations, and arrangements for annual audit;
g) Planning and scheduling Project Board meetings;
h) Clarification of roles and responsibilities of all project organisation structures as well as planned dates of meetings where the first PSC meeting should be held within the first 12 months following the inception workshop.

103. An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

104. Quarterly Progress Report: Contents of the QPR include:
- Progress made as reported in the Standard Progress Report and monitored in the UNDP Enhanced Results Based Managment Platform;
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS (if applicable otherwise outside ATLAS). Risks become critical when the impact and probability are high;
- Project Progress Reports as generated in the Executive Snapshot and based on the information recorded in Atlas;
- Other ATLAS logs that are used to monitor issues and lessons learned. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

105. *Annual Project Review /Project Implementation Reports (APR/PIR)*: APRs/PIRs are key reports prepared to monitor progress since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and GEF reporting requirements, and includes, but is not limited to, reporting on the following:
    - Progress made toward project objective and project outcomes, each with indicators, baseline data and end-of-project targets (cumulative);
    - Project outputs delivered per project outcome (annual);
    - Lesson learned/good practice;
    - AWP and other expenditure reports;
    - Risk and adaptive management;
    - ATLAS QPR;
    - Portfolio level indicators (i.e. GEF focal area tracking tools) that are used by most focal areas on an annual basis.

106. Periodic Monitoring through site visits: UNDP CO and the UNDP RCU staff will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

107. Mid-term of project cycle: The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation. The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office

Evaluation Resource Center. The relevant GEF Focal Area Tracking Tools will also be completed during the mid-term evaluation cycle.

108. End of Project: An independent Final/Terminal Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

109. The Final Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center. The relevant GEF Focal Area Tracking Tools will also be completed during the final evaluation. During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

110. Learning and knowledge sharing: Results from the project will be disseminated within and beyond the Project intervention zone through a number of existing information sharing networks and forums. In addition:
    - The Project will participate, as relevant and appropriate, in UNDP/GEF sponsored networks, organized for senior personnel working on projects that share common characteristics;
    - The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned.

111. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identifying and analyzing lessons learned is an on-going process and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered not less frequently than once every 12 months. UNDP/GEF shall provide a format and assist the project team in categorizing, documenting and reporting the lessons learned. To this end a percentage of project resources will also need to be allocated for these activities.

LEGAL CONTEXT

112. This Project Document shall be the instrument referred to as such in Article I of the Standard Basic Assistance Agreement (SBAA), the Government of St. Vincent and the Grenadines and the United Nations Development Program, signed by the parties on 17 November 1993. The host country-implementing agency shall, for the purpose of the SBAA, refer to the government co-operating agency described in that Agreement.

113. Consistent with the Article III of the SBAA, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in

the implementing partner's custody, rests with the implementing partner. The implementing partner shall:

- Put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
- Assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

114. UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

115. The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via: http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

ANNEXURES

Annex I: Risk Analysis

OFFLINE RISK LOG

Project Title: Promoting Access to Clean Energy Services in St. Vincent and the Grenadines (PACES)	**Project ID: 00090426**	**Date:**

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Management Response	Owner	Submitted, updated by	Last Update	Status (compared with previous evaluation)
1	Terms and conditions for replication phase are not sufficiently attractive for private investors (IPPs)		Political	P = 1 I = 5	The Project will be designed to minimize the risk profile of RET projects in SVG, specifically solar PV rooftop installations that are deemed to have a higher probability of success for demonstration and replication. The Project will reduce the risk profile of these RE installations through two modalities: a) solar PV panels are procured and operated by private property owners who can recover their investment through a net billing mechanism; or b) solar PV panels are installed by VINLEC on private rooftops that are leased to VINLEC. To sustain the growth of RE deployment, the Project will also strengthen local capacity on RE issues; assist in improving the terms and conditions for RE private investors (including attractive tariffs, lease arrangements, off-take and payment guarantees); and improve the financial climate for RE investments. RE projects will be developed as a partnership between project proponents and the GoSVG.	Project manager	Submitted by Project Proponent, updated by Project Manager		

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Management Response	Owner	Submitted, updated by	Last Update	Status (compared with previous evaluation)
2	Delays due to lack of government capacity		Political	P = 4 I = 5	The Project is designed for implementation by the Energy Unit of MoNS, whose mandate is to promote renewable energy project development in SVG. Capacity building efforts of the Project will strengthen the Energy Unit and VINLEC in their capacity to promote development of RE in SVG.	Project manager	Submitted by Project Proponent, updated by Project Manager		
3	Insufficient capital made available for RE investment scale-up		Financial	P = 3 I = 4	Implementation of pilot projects will demonstrate to potential RE investors that RE projects can be successfully implemented in SVG, raising the confidence of financial institutions to avail capital financing through carbon funds or NAMA financing. Moreover, the economics of developing a rooftop solar PV programme appears to be attractive, thus increasing the probabilities of its successful scale-up.	Project manager	Submitted by Project Proponent, updated by Project Manager		
4	Returns on investment not realized due to RETs or RE projects not generating sufficient renewable energy		Technical	P = 3 I = 5	The Project will provide quality control assistance to RE project and operational personnel on international standards and best practices for RE deployment that will ensure maximum power generation and return of investment, and to procure RE equipment that have performance guarantees and technical support from suppliers and manufacturers. The Project will also strengthen linkages with ECERA, the proposed regional energy regulatory authority to	Project manager	Submitted by Project Proponent, updated by Project Manager		

#	Description	Date Identified	Type	Impact & Probability	Countermeasures / Management Response	Owner	Submitted, updated by	Last Update	Status (compared with previous evaluation)
					provide guidelines and enforcement mechanisms to ensure that the delivery of electricity from RE sources follows best international practices.				

Submitted by Project Manager _____ Approved by UNDP Programme Analyst _____

Annex II: Detailed CO_2 Calculations and Assumptions

A. Direct Emission Reductions

There are four RE activities that will lead to direct emission reductions during the proposed 4-year duration of PACES include:

- 130 kWp of solar PV installations at the new Argyle International Airport;
- 100 kWp of solar PV installations at selected government building rooftops;
- 2 - 10 kWp solar PV installations for charging hybrid or electric vehicles for road transport; and
- Completion of a 10 MW geothermal plant where PACES resources will be utilized to prepare an EIA for a geothermal plant to be located near Mount Soufriere and supporting infrastructure that includes access roads and transmission lines;
- 150 kWp of rooftop solar PV installations on private property resulting from PACES resources being utilized to design, setup and implement a program permitting property owners to own solar PV panels for electricity generation and sale to the grid.

B. Direct Post-Project Emission Reductions

Direct post-project emission reductions will also generate emission reductions after completion of the Project from:

- RETs that were installed during the Project period (see listing in Section A of Annex II). The exception to this would be the geothermal project where only one year (2019) was claimed for direct post-project emission reductions. This is due to the assessment that the geothermal project would have been operational by 2020 without PACES. By assisting with the ESIA, PACES will provide the benefit of advancing the operational date of the geothermal project by 3 years;
- RETs that receive technical and financial assistance from the Project that include (for the purposes of estimating GHG reductions) the following RET deployments:
    - ⇒ Another 200 kWp of solar PV installations on rooftops of government buildings 2 years after the EOP;
    - ⇒ An estimate of 200 private households that receive TA for the installation of 1.0 kWp of rooftops solar panels. Installation of the 200 kWp is assumed to be during the first 2 years after the EOP.

C. Indirect Emission Reductions

These are estimated using the GEF Manual for guidance on top-down and bottom-up factors. The calculations and assumptions are shown on Table II-4.

Table II-1: Emission Reductions from Demonstration Solar PV Systems

Description of Solar PV System	Installed Capacity (kWp)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Total
Argyle Airport	130		1,514	1,514	1,514	1,514	1,514	1,514	1,514	1,514	1,514	1,514	0	0	0	**15,137**
Selected Government Buildings	100		1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	0	0	0	**11,644**
Private Rooftops in 2017	50			582	582	582	582	582	582	582	582	582	582	0	0	**5,822**
Private Rooftops in 2018	100				1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	1,164	0	**11,644**
Private Rooftops in 2019	200					2,329	2,329	2,329	2,329	2,329	2,329	2,329	2,329	2,329	2,329	**23,287**
Private Rooftops in 2020	200						2,329	2,329	2,329	2,329	2,329	2,329	2,329	2,329	2,329	**20,958**
Private Rooftops in 2021 (see Note 12)	0															**0**
Private Rooftops in 2022 (see Note 12)	0															**0**
Private Rooftops in 2023 (see Note 12)	0															**0**
Total Solar Energy Generated (MWh)		**0**	**2,678**	**3,260**	**4,425**	**6,753**	**9,082**	**9,082**	**9,082**	**9,082**	**9,082**	**9,082**	**6,404**	**5,822**	**4,657**	**88,491**
Annual Emission Reduction (tCO_{2eq})		**0**	**2,410**	**2,934**	**3,982**	**6,078**	**8,174**	**8,174**	**8,174**	**8,174**	**8,174**	**8,174**	**5,764**	**5,240**	**4,192**	**79,642**
Cumulative ERs		**0**	**2,410**	**5,344**	**9,326**	**15,404**	**23,578**	**31,752**	**39,926**	**48,099**	**56,273**	**64,447**	**70,210**	**75,450**	**79,642**	

End of GEF Project →

Notes and Assumptions:

1. GHI Index for SVG is 5.8 kWh/m2/day
2. A 1.0 kW installation is 5.5 m2 of solar flat panel
3. Electricity generation from 1.0 kW solar PV flat panel is 31.9 kWh per day or 11.64 MWh/yr
4. Each private household would invest in a 1.0 kW solar PV installation to generate 31.9 kWh per day
5. Average electricity consumption assumed to be 546 kWh/month or 18.2 kWh/day (based on electricity demand for Barbados from 2011 MPRA study on "Price Reform and Household Demand for Electricity", pg 11, available on http://mpra.ub.uni-muenchen.de/40934/1/MPRA_paper_40934.pdf)
6. SVG grid emissions factor 0.90 tonnes CO_2/MWh
   This factor is used despite 20% of electricity coming from hydro, since each electricity from each solar PV installation will be used to displace diesel-based electricity generation
7. ERs/year for each 1.0 kW solar PV installed 10.5 tonnes CO_2/year
8. Direct ERs during Project 9,326 tonnes CO_2
9. Cumulative ERs 10 yrs after EOP 70,315 tonnes CO_2
10. Assumed service life of solar PV 10 years
11. Lifetime of energy production for solar PV installation assisted by Project 326,949,480 MJ
12. Private rooftop solar PV installations implemented after 2020 would not have received TA during the Project, and thus cannot be counted as post-project direct emission reductions
13. Direct ERs from:
    - Argyle PV installation 4,087 tonnes CO_2
    - Government buildings 3,144 tonnes CO_2
14. Direct post-project ERs from:
    - Argyle PV installation 9,536 tonnes CO_2
    - Government buildings 7,335 tonnes CO_2
    - Private properties 53,444 tonnes CO_2

Table II-2: Emission Reductions from Geothermal Plant

Plant Description	Installed Capacity (MW)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Total
Geothermal Plant 1 (see Note 1)	10				77,088	77,088	77,088	0	0	0	0	0	0	0	0	0	**231,264**
Geothermal Plant 2 (see Note 10)	5														43,800	43,800	**87,600**
Geothermal Plant 3 (see Note 11)	5																**0**
Geothermal Plant 4 (see Note 11)	5																**0**
Total Geothermal Energy Generated (MWh)		**0**	**0**	**0**	**77,088**	**77,088**	**77,088**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**43,800**	**43,800**	**318,864**
Annual Emission Reduction (tCO_{2eq})			**0**	**0**	**69,379**	**69,379**	**69,379**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**39,420**	**39,420**	
Cumulative ERs		**0**	**0**	**0**	**69,379**	**138,758**	**208,138**	**208,138**	**208,138**	**208,138**	**208,138**	**208,138**	**208,138**	**208,138**	**247,558**	**286,978**	

Start of GEF Project → **End of GEF Project** →

Notes and Assumptions:

1. No emission reductions are claimed after 2019 as it is assumed that the geothermal project in a BAU scenario would have been operational by 2020; PACES assistance with the ESIA advances the project start date to 2017
2. Avg number of hours that the geothermal plants are operating and generating electricity is 24 hr/day & 365 days/year
3. Geothermal plant sizing and expansion plan is from "SVG Geothermal Project - Phase I - Preliminary Assessment of Electricity System Technical and Economic Issues" by Peter Williams Light and Power Holdings, Barbados, July 2013". According to their forecast, geothermal plant #2 would be commissioned in 2027
4. Avg net capacity factor 88%
5. SVG grid emissions factor 0.90
6. Direct ERs during Project 138,758 tonnes CO_2
7. Cumulative ERs 10 yrs after EOP 148,219 tonnes CO_2
8. Assumed service life of geothermal plants 25 years
9. Lifetime of energy production for geothermal plant assisted by Pr 6,937,920,000 MJ
10. Emission reductions from this plant are considered indirect
11. These plants would be developed when there is increased energy demand that would be outside the 10-year GEF influence period

Table II-3: Emission Reductions from Solar-Charged Hybrid or Electric Vehicles

Baseline: Diesel Motor Vehicles

Diesel consumption per vehicle	liters/100 km	13.000	Assumed in the absence of any vehicel fuel consumptive data
Average distance per year	km/yr	10,000	
Diesel consumption	liters/yr	1,300	
Energy content of diesel	MJ/liter	36.4	IPCC default number
Carbon emission factor for diesel	$kgCO_2$/liter diesel	2.68	IPCC default number
Estimated CO_2 emission of diesel vehicle	kgCO2/diesel vehicle/yr	3,484	
	t CO2/diesel pump/yr	3.5	
Eastern Caribbean Dollar per USD	EC$/USD	$2.68	

Assumptions for Solar Charged Hybrid or Electric Vehicles

Energy saved through displacement of one diesel fuelled vehicle	MJ/yr-diesel vehicle	47,320
ERs generated per solar-charged vehicle	tCO_2	3.484
Cost of Electric or hybrid vehicle	USD	$30,000

	Unit	Value	Year -1	Year 0	Year 1	Year 2	Year 3	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Total
			2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
Displacement of Diesel with Electric Vehicles charged with solar PV panels																		
Number of diesel motor vehicles displaced in 2014			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of diesel motor vehicles displaced in 2015				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of diesel motor vehicles displaced in 2016					2	2	2	2	2	2	2							14
Number of diesel motor vehicles displaced in 2017						4	4	4	4	4	4	4						28
Number of diesel motor vehicles displaced in 2018							4	4	4	4	4	4	4					28
Number of diesel motor vehicles displaced in 2019								8	8	8	8	8	8	8				56
Number of diesel motor vehicles displaced in 2020									20	20	20	20	20	20	20			140
Cumulative SLs installed up to 2028				0	2	6	10	18	38	38	38	36	32	28	20	0	0	***266***
Energy Savings and ER Generation																		
Cumulative Number of electric or hybrid vehicles where diesel is displaced				0	2	6	10	17	37	37	37	35	31	27	19	0	0	
Annual diesel energy saved	GJ			0	95	284	459	826	1,744	1,744	1,744	1,652	1,469	1,285	918	0	0	12,221
	liters			0	2,600	7,800	12,610	22,698	47,918	47,918	47,918	45,396	40,352	35,308	25,220	0	0	
	MWh			0	26	79	128	230	485	485	485	459	408	357	255	0	0	
Total ER volume year	tonnes CO_{2eq}			0	7	21	34	61	128	128	128	122	108	95	68	0	0	900
Cumulative ERs	tonnes CO_{2eq}		0	0	7	28	62	122	251	379	508	629	738	832	900	900	900	

Start of GEF Project → ***End of GEF Project*** →

Notes and Assumptions:

1. Assumed service life of electric or hybrid ve 10 years
2. Two 10 kWp solar PV panels can provide up to 233 MWh/yr of energy to charge vehicles
3. Lifetime of solar energy production per hybr 12,221 MJ
4. Direct ERs: 62 tonnes CO_2
5. Post project direct ERs: 900 tonnes CO_2

Table II-4: Indirect Emission Reductions from Rooftop Solar PV Installations and Geothermal Power Station

Promotion of Access to Clean Energy Services for St. Vincent and the Grenadines (PACES)

	Activities Contributing to Indirect Emissions Reductions
1)	Success and replication of solar PV rooftop installations for private properties
2)	Successful development of initial 10 MW geothermal power plant
3)	TA towards the successful setup and operation of the Energy Unit as a facilitation center for potential RE investors
4)	Training of GoSVG personnel on the planning, design, construction, installation, operation and maintenance of RE projects
5)	Vocational training and certification of students and youth to assemble, install and maintain solar PV systems on rooftops

Indirect Bottom-up

Step 15	Enter Replication Factor. Please refer to section 2 (e) in the Manual for further guidance. Also see table below for standardized suggestions. Not all projects will fit these suggestions, if using a different replication factor explain rationale in the assessment	**15)** **Replication Factor**	2
Notes:	Bottom up approach can only be attributed to the direct ERs from solar PV installations		
Assumptions:	Direct ERs for bottom-up only include solar PV installations	Direct Emissions Reductions	9,326

Standardized Suggestions	
Project Type	**Suggested Replication Factor**
Solar Home Systems	2
ESCO	2
Market transformation and demonstration capital	3
Credit and guarantee	4

Step 16	Sense check automatic results	**16)**	**Results: Indirect bottom up-emissions**	**18,652.89 Tons CO2 e**
				18.65 KT CO2 e
				0.02 MT CO2 e

Indirect Top Down

Step 17	Enter 10 year market potential	**17)** **Enter P10 (Tons CO2 e)**	**2,409,500**
Notes:	Solar rooftop PV potential is 23 MW (pg 92 of NREL-OAS Study of "Energy Policy and Sector Analysis in the Caribbean 2010-11) plus a 20 MW geothermal potential		
Assumptions:	Each 1.0 kW solar PV panels will generate 11.64 MWh/yr. 23 MW of solar PV panels has the potential to generate 267,720MWh/yr resulting in 240,950 tonnes CO_2 reduced per year. While there is also potential for geothermal development to go to 20 MW resulting in 134,030 tCO_2/yr, geothermal potential is not counted in indirect top down calculation.		

Step 18	Enter GEF Causality Factor. Please refer to section 2 (e) in the Manual for further guidance. Also see table below for standardized	**18)** **Enter Causality Factor (%)**	40
Notes:	Project will support the development of an enabling investment environment for private solar PV panel installations		
Assumptions:	A strong liklihood of adoption of program as a means to reduce household electricity costs; hence a "modest" causality factor is assumed		

Standardized Suggestions	
Pick Causality Factor	**%**
Level 5 - "Critical"	100
Level 4 - "dominating"	80
Level 3 - "substantial but modest"	60
Level 2 - "modest"	40
Level 1 - "weak"	20

Step 19	Sense check automatic results	**19)**	**Results: Indirect top-down emissions**	**963,800 Tons CO2 e**
				963.80 KT CO2 e
				0.96 MT CO2 e

Annex III: Possible Amendments to the Electricity Supply Act

- **Legislative review** of existing laws, SVG should adopt the CARICOM's Model legislation with a view to formulate national RE legislation or draft amendments to existing electricity supply legislation to include RE provisions;

- **Modernization of the electricity supply systems** of the Grenadines islands, integrating the use of wind and solar energy, and use such undertaking as a model for other small islands. Ensuring that there is grid stability to facilitate additional power from RE.

- **Parallel operation** with the public grid and **feed-in of excess electricity** should be allowed at least in such cases, where this leads to a considerable reduction in energy inputs and environmental benefits (compared to the status-quo situation or regular alternative solutions), e.g. for cogeneration with waste heat use at or near the site of electricity production. Preferential conditions (e.g. priority dispatch) could apply to co-generation plants using biofuels, for instance biodiesel or solid agricultural or other organic residues. No prior tendering should be required for (small-scale) self-generators of electricity and in such cases, where this leads to a considerable reduction in energy inputs and benefits to the environment (compared to the status-quo situation or regular alternative solutions).

  - For **additional electricity supply** from the grid and emergency situations in case of production outages fair tariffs should be established. This is also valid for **excess electricity** fed into the grid, taking into account the capacity factor of the cogeneration facility.

  - **Grid-connection of PV systems**, coupled with so-called "net-billing", should be allowed in any cases, if certain technical standards and rules are met (can be copied from German experience, where more than 50,000 home systems with normally between 1 and 5 kW_p are already in operation). Due to the high generation costs and lack of funding, such systems will only be installed in few exceptional cases over the next years (for example by home-owners with environmental consciousness and sufficient financial resources).

  - **Free choice of electricity supplier** should be allowed at least for all major consumers (large hotels, industries) above a certain consumption limit. This does not imply that anybody can enter the market as electricity producer. Strict rules will be necessary to avoid stranded investments and maintain a safe and reliable electricity supply.

  - **Grid access and electricity transport** should be allowed in any cases of self-generation or supply by third parties (power providers) serving directly the complete or partial demand of industries or the tertiary sector, based on renewable energies. Example: Wind turbine operator A supplies electricity on a bilateral contract basis from location B to factory C at location D. This will require the establishment of transparent grid access and transport fees. Licensing of such independent power producers with contracted customers should be non-bureaucratic and supervised by an **independent regulator**.

- **Tax-free import** of machinery for generation and transport of electricity (as well as other fiscal incentives) should generally apply to all stakeholders, not only to the monopoly utility, and give preference to RES application. All other clauses of ESA favouring solely the monopoly utility (like exemption from stamp duty and land acquisition by the Government) should be extended.

- In the case of non-firm (intermittent) RES electricity, operators could be obliged to run their own **back-up systems.**

- The **tariff scheme** should offer preferential conditions for customers agreeing to a load management curbing the peak demand of the electricity system.

Annex IV: Soufriere Geothermal Assessment

Background Data

- The first sizable geothermal exploration study published on the Soufriere geothermal prospects was carried out by Geotermica Italiana (Geotermica Italiana, 1991). The study was a part of a larger Eastern Caribbean geothermal reconnaissance project, funded by the United Nations and Caribbean Community Secretariat (CARICOM). In St. Vincent, the project area covered the whole island with geological and volcanological studies, as well as petrography and volcanic hazard studies. Water samples were collected from cold and hot springs as well as steam from fumaroles on La Soufriere. In their conclusion, St. Vincent was not short-listed as a primary development area in the Caribbean.

- A study by Huttrer (1996) also addressed the geothermal potential of St. Vincent and delivered a resource assessment report suggesting that there is almost 900 MW of generating capacity available (Maynard-Date and Farrell, 2011). RG was not able to identify any supporting evidence. Huttrer also made effort to gather aerial photos of St. Vincent and interpreted them for structures. His analysis suggests recent faulting striking N25E. Strong correlation is reported between these lineaments and locations of hot springs. This observation is particularly important as it implies that the geothermal reservoir is deep hosted and apparently fracture controlled in permeability. It also means that structural mapping is likely to produce important data for a better well drilling strategy and should therefore be incorporated in future surface exploration phases of this project.

- The second large scale study on Soufriere was conducted by Caribbean Power St. Vincent Ltd (1998). Most of the actual field work was conducted by EGS Inc. (Dames and Moore, 1998; Brophy and Haizlip, 2003). The emphasis of the study was put on geochemistry and resistivity surveys. Unfortunately, the reporting was not completed as the contractor ceased operation before project completion. However, their initial work produced valuable conclusions for geothermal development, namely that Mt. Soufriere is likely hosting a 150-200°C temperature prospect which would be able to sustain 50-75 MW of electrical power generation (Brophy and Haizlip, 2003).

- Canadian Bluewater Renewables also produced a resource assessment report using the same publications as discussed above for its independent analysis (Geothermex, 2011). A most likely resource area of 11 km2 and a resource temperature in the 150 to 260°C range was proposed. It concluded that while the possible resource has 90% probability for sustaining 43 MW for 20 years, the most likely capacity is 60 MW. A conceptual reservoir model is put forward in a cross section to the NNE which suggests a directional drilling approach to reach a possible geothermal reservoir.

- Another data source that contributes to the analysis of the Soufriere geothermal potential is a Volcanic Hazard Atlas of the Lesser Antilles. This publication contains numerous maps and figures on St. Vincent and the Soufriere volcano (Lindsay et al., 2005). It is an excellent first stop for existing literature on the island and has value in the next stage of this project when it comes to assess the volcanic risk when developing geothermal on St. Vincent.[48]

[48] July 22, 2013 St. Vincent Geothermal Feasibility Study Page 4

- RG had access to the University of West Indies Seismic Centre personnel who have local expertise on the volcano and browsed through their literature for missing pieces in the geological history of St. Vincent.

- RG also collected three additional water samples during a 2012 site visit to support their analysis.

- Control Source Audio-frequency Magneto-Telluric (CSMAT) performed a resistivity survey in 1998 and created resistivity profiles that indicate 3-D resistivity variations.

Scope Summary

- Review the available reports and literature and present how the geoscience data at hand can be used to assess the feasibility of developing a possible geothermal resource.

- Develop a first assessment of the risks facing structures and wells on the slopes of the Soufriere prospect, known for explosive volcanism.

- Conduct an analysis of the geochemistry of the warm springs, fumaroles and address resistivity data.

- Create a conceptual reservoir model by cross-correlate the many indicators for a geothermal resource at hand.

Risks Assessment

The following list is the key areas of risk identified during the analysis:

- Difficult Terrain and Access - steep terrain caused by volcanic buildup and existing poor road system will influence the location of the early geothermal installments on the Soufriere prospect and will increase infrastructure costs.

- Potential Volcanic Eruption – there have been at least 5 major historic eruptions of the Soufriere (latest in 1979) that have included basaltic andesite lava domes in the crater area followed by phreatomagmatic explosions generating pyroclastic flows. The risk is primarily related to pyroclastic flows, mudflows and ash fallout. It would be advisable to erect expensive structures such as power stations to the south of the hazard zone and to protect production wells with earthworks.

Recommendations

The following is a list of recommendations based on the findings of the analysis. These recommendations are aimed at elaborating the technical and business analysis required to advance a final investment decision. Costs identified with each recommendation are meant to be order of magnitude estimates only and are intended to help stakeholders better understand the scope of any near term investment decision.[49]

[49] July 22, 2013 St. Vincent Geothermal Feasibility Study

Stakeholder Awareness

Develop a community awareness program to build and maintain government and community support for geothermal exploration and development.

Legislative Framework

Complete the legislative framework to support development activity (e.g. licenses, royalties, permitting, etc.).

Surface Exploration

Initiate a surface exploration campaign in the identified area to better delineate the outer boundaries of the possible resource. To include: resistivity, surveying, structural mapping, risk studies and geochemistry of fumaroles.

Identify Drilling Targets and Location of Wellpads and Power Plant

Interpret results of the surface exploration campaign and High Resolution Mapping to identify drilling targets, locate accessible well pads, design wells and identify preliminary power plant location.

Risk Mitigation

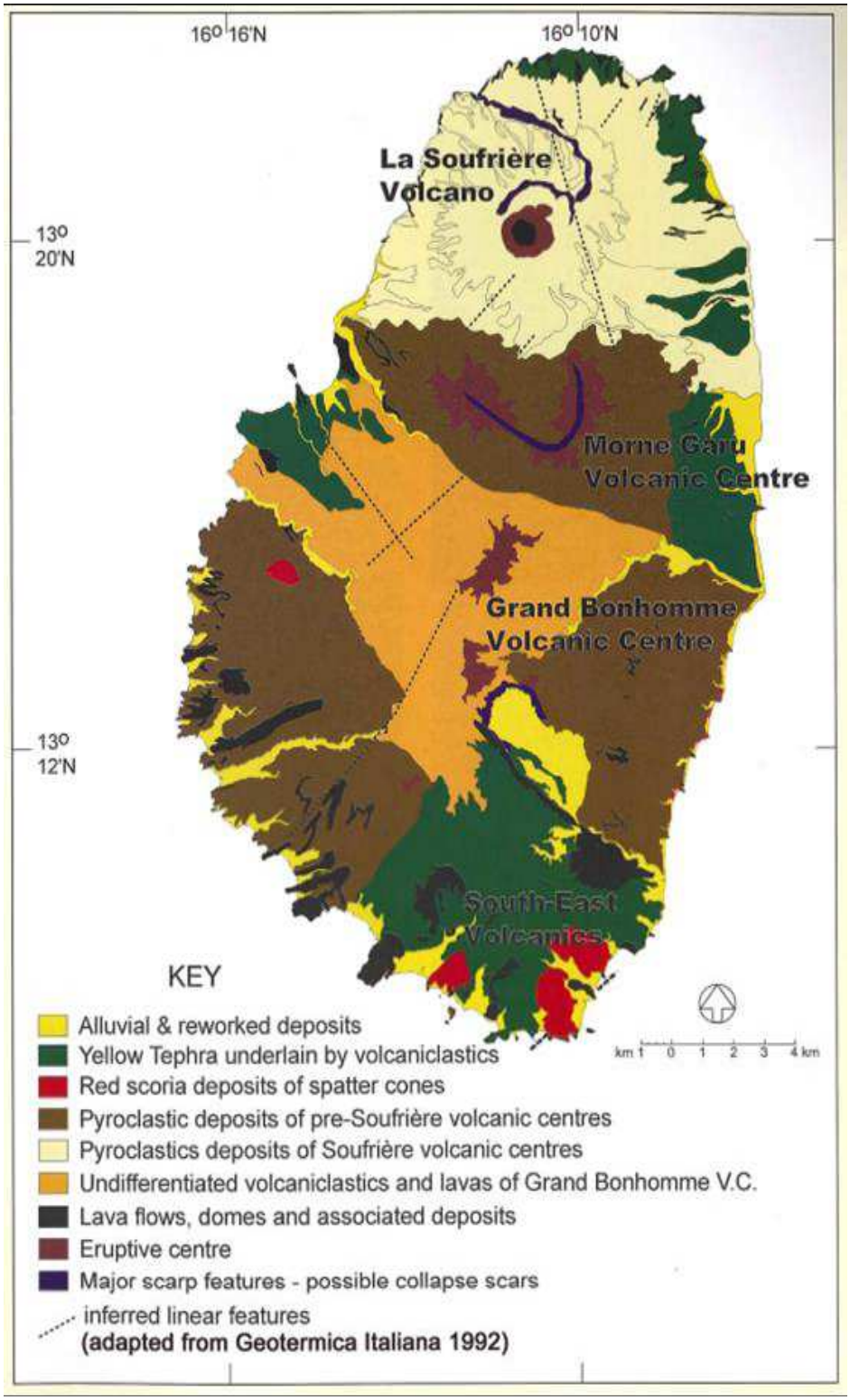
Develop a volcanic risk mitigation report.

Geological and Geothermal Setting

The Soufriere stratovolcano dominates the northern half of the island of St. Vincent and is one of the many active volcanoes in the Lesser Antilles arc. Activity of this volcano extends back at least 600 thousand years (Briden et al., 1979). There are several other major but extinct volcanic centres on the island. The age of the Morne Garu (Richmond Peak–Mt Brisbane) centre to the immediate south of Soufriere, and the Grand Bonhomme centre further south are not precisely known, but the pre-Soufriere lavas dated by Briden *et al*. (1979) yielded radiometric ages of between 1 and 3 Ma.

The geological evolution of the Soufriere volcano is characterized by four main volcanic formations shown on Figure IV-1. These represent protracted periods of predominantly effusive or explosive volcanism, which may be controlled more by the geomorphological and hydrological features of the volcano than by the silica and volatile contents of the magmas (Sigurdsson & Carey, 1991). Early activity (~0·6 Ma–10 ka) was characterized by the extrusion of basaltic and basaltic andesite lavas from a central vent, with <5% pyroclastic deposits. These are named the Pre-Somma Lavas because they pre-date a probable major structural failure of the volcano's southern flank which created the Somma scarp and generated a thick debris flow. Some Pre-Somma lavas from the southern flanks of Soufriere are unusually magnesian, and may possibly have been erupted from a different centre or centres.

Figure IV-1: Volcanic Centers of St. Vincent[50]



[50] Sigurdsson & Carey, 1991

Minor intrusions occur within the Soufriere volcano summit. Three dikes are exposed in the walls of the main crater. These dikes trend northerly and are several meters in thickness. It is likely that dikes are widely distributed in the volcanic structure as suggested earlier by Huttrer (1996). A general geologic map of the main crater region is shown in Figure IV-2.

Figure IV-2: Geologic map of the Soufriere Crater

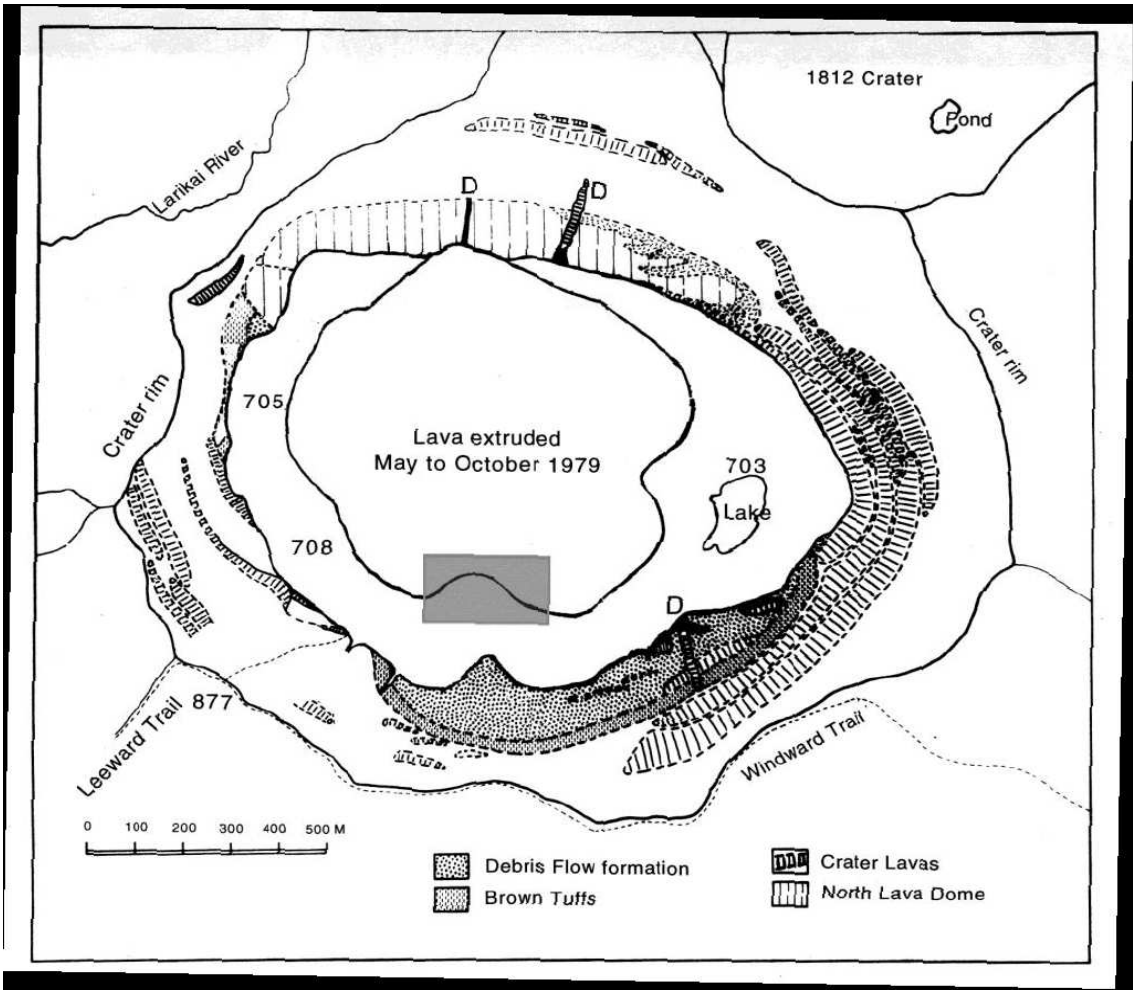
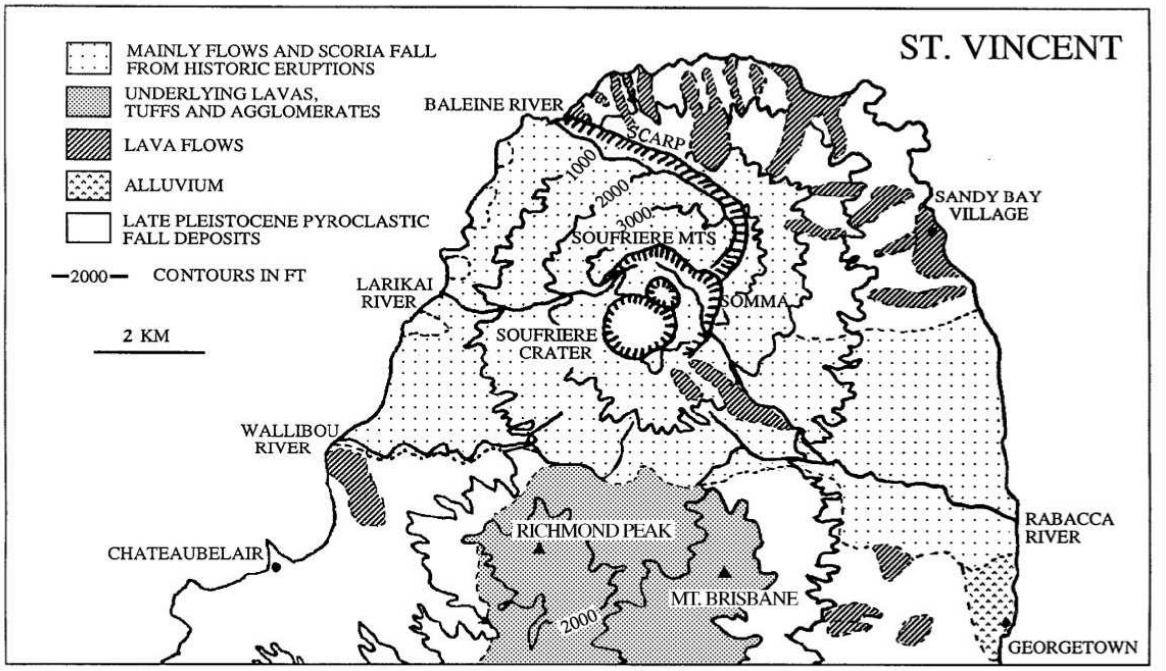


Figure IV-2 depicts the 1812 crater to the northeast. The main crater is about 1,500 m wide and over 200 m deep. Major formations in the crater wall include the Debris Flow, the Brown Tuffs and the Crater Lavas. A cross-section of earlier lava dome is exposed in the north wall. Three basaltic dikes occur in the crater wall, marked “D”. Central part of the main crater is the basaltic and site lava dome that was extruded in the 1979 eruption. The grey shaded square at the lava dome south margin is an active fumarolic field. The fumaroles are emitting steam at or above 100°C and depositing sulphur crust, as well as altering the dome rock and crater floor sediments to clays. The fumarole field has remained stable or slightly expanded since the dome formed in 1979. This has also been frequently documented as far back as late 17th century.

The upper reaches of the Wallibou River are a region of hydrothermal activity as seen on Figure IV-3. Warm springs issue out in the river bed at several places. One of these locations is at 13°, 18.759, 61° 12.383, 230 m above sea level. Here in the north river bank, warm water issues out of the rock at the river's level. A second hot spring is located at N13°, 18.735, W61° 11.926 and at elevation of 240 m. This spring occurs also on the river north bank, where the river has eroded into a 2 m thick vertical basaltic dike that trend about 140 degrees (NW-SE). This is similar to the trend of the southern dike within the main crater region. Other warm springs occur higher up in the Wallibou, about 2 km directly to the south of the main crater.

Figure IV-3: Structural and topographic features of the Soufriere volcano



A series of well-bedded pyroclastic fall deposits mantles much of the island of St Vincent, and has been tentatively correlated with coarse tephra beds exposed in the crater and on the flanks of Soufriere. The units range from black scoria to yellow lapilli and pumiceous tuff, and are collectively known as the Yellow Tuff Formation, with an estimated volume of 48 km3 (Rowley, 1978). Radiocarbon dating indicates that the formation spans the period 3600–4500 years bp. The rarity of unconformities suggests rapid deposition. The vents feeding the Yellow Tuff Formation have not been identified with certainty; but the sequence was probably erupted from the central Soufriere vent[51].

A predominantly effusive phase of activity followed the emplacement of the Yellow Tuff Formation, with the eruption of ponded basaltic and basaltic andesitic Crater Lavas. The most recent phase of activity has been characterized by vulcanian explosive eruptions, generating a thick succession of pyroclastic fall and flow deposits, named the Pyroclastic Formation. Recent 14C dates[52] suggest that the Pyroclastic Formation may extend back much further than the

[51] Ibid 45

[52] Sigurdsson *et al*., 1998

1,300 years[53], and possibly overlaps with the Yellow Tuff Formation. There have been at least five major historic eruptions of the Soufriere (1718, 1812, 1902, 1971, 1979); the activity has been characterized by the extrusion of basaltic andesite lava domes in the crater area followed by phreatomagmatic explosions generating pyroclastic flows.

Summary Assessment

- Data suggests a conceptual reservoir model focusing on a cross section between the Wallibou hot spring and the summit of Mt. Soufriere. Basic components include the repeated magmatic informs up under the top crater, allowing for fracturing and deep and hot fluid circulation.

- The warm water springs of Mt. Soufriere are believed to demonstrate a medium temperature reservoir with a short water residence time. This is commonly seen on many high-enthalpy areas; the real high-temperature reservoir water does not reach the surface and can only be sampled using fumaroles and steam vents.

- The geochemical data indicates that thermal manifestations of the Soufriere prospect originate from a high-enthalpy resource located in the roots of the volcano. A deep geothermal reservoir temperature in excess of 200°C is likely. Uncompleted geochemistry and resistivity assessments from 2003 suggest the resource temperature range is in the order of 150-260°C. The resource area is approximately 11 km2.

- Deep groundwater reservoir is sitting on top of a low resistivity and permeability clay rich layer, acting as a cap rock for a possible high temperature reservoir underneath.

- Direction of dykes inside the Soufriere crater and aerial photo lineaments suggest a northerly direction of the maximum stress and infer best permeability for drilling. This makes the Wallibou River up toward the Soufriere crater a priority site for surface drilling.

- Mt Soufriere is a relatively young volcano and the inferred geothermal system is probably evolving and growing. The system is a permanent feature of the volcanic activity.

- The Soufriere prospect has all the right ingredients to host a >200°C geothermal reservoir at depth and additional investment in surface exploration activities that better delineate the project

- Following a January 2013 letter of intent signing between the government of St Vincent and the Grenadines on one hand and Reykjavik Geothermal and Light & Power Holdings consortium (RG/LPH) on the other, a comprehensive desk study has been carried out on the geothermal power potential of the Soufriere volcanic complex. The data review results in a conceptual reservoir model focusing on a cross section between the Wallibou hot spring area and the summit of La Soufriere Basic components of this model are the repeated magmatic inflows up under the top crater, allowing for fracturing and deep and hot fluid circulation. This magmatic energy source is constantly replenishing heat losses by fumaroles and thermal conduction to surface.

[53] Ibid 45

- Part of the steam escape is visible in the crater area while another fraction is being condensed into a regional groundwater flow surfacing as warm springs in the Wallibou River. This 100-300 m thick regional groundwater reservoir is sitting on the top of a low resistivity and permeability clay rich layer, acting as a cap rock of the possible high temperature reservoir underneath. The resistivity data at hand and the existence of a crater lake prior to 1979 eruption suggests this clay zone reaches surface at the current crater floor but then dips gradually down with distance away from the magma plume.

- The geochemical data indicates a deep geothermal reservoir temperature in excess of 200 °C. Direction of dykes inside the Soufriere crater, at Wallibou River and from aerial photos lineaments suggest a northerly direction of the maximum stress and infer best permeability to drill into. These in turn makes the area from the Wallibou River and up towards the Soufriere crater a priority site for additional surface exploration work. The central part of the possible high-temperature geothermal reservoir, although under a rugged terrain, can then be reached by drilling directionally into it from the sides.

- The risk of developing geothermal power at the slopes of Mt Soufriere appears best managed and mitigated by a combination of methods like separating well fields and power facilities between high and low risk zones, and by recovering the power investment prior to next eruptive phase of the volcano.

- Subject to positive outcome of upcoming discussion between the Government of St Vincent and RG/LPH, a surface exploration campaign is envisioned. Bulk of the work will be resistivity surveying using the joint TEM/MT approach, accompanied with structural mapping, volcanic risk studies and geochemistry of fumaroles. Optimally this work is complete before end of year 2013, to be followed by exploration drilling if primary resource and business model parameters continue to be positive.

Annex V: Co-Financing Letters

See attached

Annex VI: Terms of Reference for Project Staff and Consultants

5. National Project Manager (NPM):

Duties and Responsibilities: The incumbent will be responsible for implementation of the project, including mobilization of all project inputs, supervision of project staff, consultants and oversight of sub-contractors. The PM will be the leader of the Project Team (PT) and shall liaise with the government, UNDP, and all stakeholders involved in the project. S/he will be specifically responsible for (a) overall management of the project, (b) work closely with project stakeholders and ensure the project deliveries as per project document and work plan, (c) ensure technical coordination of the project and the work related to legal and institutional aspects, (d) mobilize all project inputs in accordance with UNDP procedures and GEF principles, (e) finalize the ToR for the consultants and subcontractors and coordinate with UNDP Procurement for recruitment, procurement and contracting, (f) supervise and coordinate the work of all project staff, consultants and sub-contractors, (g) ensure proper management of funds consistent with UNDP requirements, and budget planning and control, (h) prepare and ensure timely submission of monthly reports, quarterly consolidated financial reports, quarterly consolidated progress reports, annual, mid-term and terminal reports, and other reports as may be required by UNDP; (i) submit the progress reports and key issue report to the **National Steering Committee**, (j) prepare quarterly and annual work plan, (k) provide regular input to UNDP corporate system ATLAS for financial and program management on project progress, financial status and various logs, (l) arrange for audit of all project accounts for each fiscal year (m) undertake field visit to ensure quality of work, and (n) undertake any activities that may be assigned by UNDP and **National Steering Committee**.

Qualifications and Experience: The incumbent should have a minimum Bachelor degree in Engineering with MBA/Master degree or Masters in energy/environment or other relevant academic discipline and profession qualifications with at least ten (10) years professional experience at senior level. S/he should have extensive experience and technical ability to manage a large project and a good technical knowledge in the fields related to private sector development, climate change, energy efficiency and institutional development and/or regulatory aspects. S/he must have effective interpersonal and negotiation skills proven through successful interactions with all levels of project stakeholder groups, including senior government officials, financial sectors, private entrepreneurs, technical groups and communities. S/he should have ability to effectively coordinate a complex, multi-stakeholder project and to lead, manage and motivate teams of international and local consultants to achieve results. Good capacities for strategic thinking, planning and management and excellent communication skills in English are essential. Knowledge of UNDP project implementation procedures, including procurement, disbursements, and reporting and monitoring will be an added advantage.

Additional roles and responsibilities include:

- In close collaboration with the CTA, provide a baseline for skills and absorptive capacity within the Energy Unit and VINLEC to promote and regulate RE development, and with prospective RE managers, operators and plant personnel to manage an RE plant or an RET diffusion program;
- Consult with relevant institutions, government officers, financial institutions, and the consulting industry on the RE knowledge gaps of these stakeholders;
- Design and deliver appropriate training materials and workshops on RE planning, design, implementation, operation and maintenance as well as financing of RE projects.

6. **Monitoring and Evaluation Officer (M&E):**

Duties and Responsibilities: Under the direct supervision of UNDP and the Project Manager, the incumbent will be assigned to develop and implement a monitoring system to capture the project activities and results under the supervision of Project Manager. S/he will be responsible specifically for (a) developing and setting up the overall framework for project monitoring and evaluation (M&E), (b) prepare the monthly, quarterly and annual monitoring plan for project activities, (c) monitor and evaluate the compliance of actual progress and performance against the planned work plan and expected quality, (d) analysis of the effect of current actual performance to the project timetable and budgets, (e) prepare reports for project management including identification of problems, causes of potential bottlenecks (if any) in project implementations, (f) recommendations on how to reduce the impact of deviations vs. work plans, (g) prepare the ToRs for mid-term and final evaluation in accordance to UNDP and GEF guidelines, (h) design and implement a system to identify, analyze, and disseminate lesson learned, (i) assist the PM in preparation of various progress report, (j) coordinate with the international and national consultants and other stakeholders, (k) facilitate exchange of experiences by supporting and coordinating participation in any existing network of UNDP/GEF projects sharing common characteristics, (l) identify and participate in additional networks, for example scientific or policy-based networks that may also yield lessons that can benefit project implementation and (m) any other related activities as assigned by Project Manager.

Additional roles and responsibilities include:

- Prepare and deliver appropriate training materials and workshops on RE planning, design, implementation, operation and maintenance as well as financing of RE projects;
- Provide oversight in the full-cycle of RE development and RET quality including serving as a key resource in the planning and design of RE projects and evaluator of RETs brought into the Project diffusion programs with an emphasis on rooftop solar PV installations;
- Serve as the key inspector of new RET equipment upon arrival, and to be the key officer to ensure supplier obligations vis-à-vis equipment repairs and replacements are enforced with an emphasis on solar PV equipment;
- Provide construction and installation oversight for civil, mechanical and electrical equipment for pilot on-grid RE plants;
- Work closely with personnel from the Energy Unit and VINLEC as well as project proponents to ensure lessons learned on-the-job are imparted to them.

Qualifications and Experience: The incumbent should have a minimum Masters degree in Energy/Environment or other relevant academic disciplines from a recognized university. S/he should have at least five (5) years hands-on experience in energy and environment field where past experience in monitoring and evaluation of projects would be considered an asset. S/he should have the ability to plan, design and implement an effective M&E system, the logical framework approach and other strategic planning approaches, training in M&E development and implementation and/or facilitating learning-oriented analysis sessions of M&E data with multiple stakeholders, data and information analysis and analytical report writing. S/he should have the willingness to undertake regular field visits and interact with different stakeholders, especially primary stakeholders. S/he must have willingness to undertake regular field visits and interact with different stakeholders, especially primary stakeholders. Computer proficiency in MS Office (Word, Excel and PowerPoint) and other common software is a prerequisite. Computer literacy in graphic design software will be appreciated. Fluency both in written and spoken English is essential.

7. **Admin Assistant (AA):**

Duties and Responsibilities: The incumbent will be responsible to provide overall administration and financial services of the project such as processing payments, raising requisition, purchase order, projects logs etc. using UNDP corporate software ATLAS. S/he will be responsible to provide information to UNDP Project web, RRMC reporting and administrative trouble shooting. S/he will also perform (a) word processing, drafting routine letters/messages/reports, mailing (b) arrange travel, itinerary preparation for project related travels, (c) assist to arrange workshops/seminar/training programs and mailing, (d) work at reception desk and make appointments and schedule meeting, (e) assist in work-plan and budgeting, (f) photocopying, binding and filing, (g) maintenance of all office equipment and keeping inventory/records of supplies and their usage and any other duties assigned by Project Manager or concerned officials.

Qualifications and Experience: The incumbent should have at least a Bachelor degree in any discipline from a recognized university. S/he should have at least 3 years relevant working experience with foreign aided projects or international development or organizations. Computer proficiency in MS Office (Word, Excel and PowerPoint) and other common software is a prerequisite. Diploma in computer/secretarial science is desirable but not essential. Basic knowledge in procurement, petty cash handling, logistics supports, and filling systems is a basic requirement. Knowledge of UNDP project implementation procedures, including procurement, disbursements, and reporting and monitoring is preferable. Fluent both in written and spoken English is required.

Key Short-term Consultants

Detailed TORs of the national and international consultants will be developed during the Project Inception period, in the first 3 months after project start-up, by the NPM in consultation with UNDP and the implementing partners.

4. International Consultant: Chief Technical Advisor (CTA) for Components 1, 2 and 3

- Provide management oversight for project as required and recommend actions that focus work plans on achieving key milestones in a timely manner;
- Recommend special expertise to be deployed on the Project to assist in its achievement of key milestones;
- Provide the interface between Project team and key specialist consultants, both domestic and international when appropriate;
- Assess the baseline conditions for capital financing of RE projects and RET diffusion programs;
- Closely assess available mechanisms for financing capital costs for RE projects including geothermal, biomass, solar and wind;
- Determine feasible financial mechanisms for scaling-up RE investments in SVG;
- In close collaboration with the NPM and the M&E Officer:
  - ⇒ Provide a baseline for skills and absorptive capacity within VINLEC to promote and regulate RE development, and with prospective RE managers, operators and plant personnel to manage an RE plant or an RET diffusion program; and
  - ⇒ Design and deliver appropriate training materials and workshops on RE planning, design, implementation, operation and maintenance as well as financing of RE projects;
- Provide work plan and oversight for local procurement, assembly and commissioning teams to facilitate operation of RE investments.

5. National Consultant: Financial/Procurement Specialist (FPS) – Component 3

- Review RE facilitation process under VINLEC and determine where contractual agreement assistance is required;
- Provide assistance on the financing design of RE projects and RE diffusion programs, notably with the rooftop solar-PV program;
- Provide templates and support for RE concessions for the tendering and contracting of supply and installation services for RE equipment and technologies as determined by the NPM;
- Assist VINLEC in the implementation of financial mechanisms as recommended by the CTA and collaborating banks;
- Facilitate capital and RE financing from foreign banks with carbon funds or NAMA-linked funds under the direction of senior project staff;
- Assist in streamlining the procurement of RE and solar-PV-related equipment into SVG duty-free;
- Serve as the key facilitator in the evaluation of bids and award of contracts for RE concessions and key supply and install contracts;
- Provide legal advice on contractual issues for the supply and service contracts of the project;
- Provide legal advice on arbitration issues during the execution of the contracts involving direct project involvement (i.e. through direct investments or Project TA).

Annex VII: Introduction of Solar Charging for Hybrid Vehicles in SVG (by the Energy Unit)

Background

Saint Vincent and the Grenadines (SVG) is an island country in the Lesser Antilles chain, namely in the southern portion of the Windward Islands, which lie at the southern end of the eastern border of the Caribbean Sea where the latter meets the Atlantic Ocean.
Its 389-square-kilometre (150 sq. mi) territory consists of the main island of Saint Vincent and the northern two-thirds of the Grenadines, which are a chain of smaller islands stretching south from Saint Vincent Island to Grenada.

SVG is currently heavily dependent on imported petroleum products for all its energy requirements. SVG has an energy mix with more than 96% petroleum base and about 3% hydro which is used for electricity generation. The transportation sector has the highest percentage of energy consumption.

In 2010, the Government's Cabinet adopted an Energy Action Plan (EAP) to be implemented within the framework of the approved National Energy Policy. The EAP outlines a number of renewable energy and energy efficiency milestones to be achieved through specific actions to be accomplished within short, medium and long-term timeframes. One of these milestones is to reduce the projected consumption of fossil fuel in the transport sector by 15% by 2020.

Project Objectives

The main objective of the project is to contribute towards Saint Vincent and the Grenadines (SVG)'s efforts to reduce reliance on imported fuels by reducing the amount of energy consumed by the transportation sector. This involves introducing a Hybrid Electric Vehicle (HEV), to SVG, to investigate the feasibility of purchasing a fleet of HEVs for the Government's use and, by extension, to the private sector.

Objectives:

- To purchase and test and a HEV on SVG's dynamic terrain.
- To reduce the consumption of fossil fuels in the transportation sector
- To build technical capacity within SVG by involving the St. Vincent Community College: Division of Technical & Vocational Education (SVGCC: DTVE) in the training and maintenance of this new technology.
- To install a charging station powered by a 10kW solar PV system already commissioned at the Administrative Building.
- To make the public aware of the benefits of this technology by providing all the necessary information needed for them to consider investing in HEV technology.
- To reduce carbon output by the transportation sector.

Outcomes:

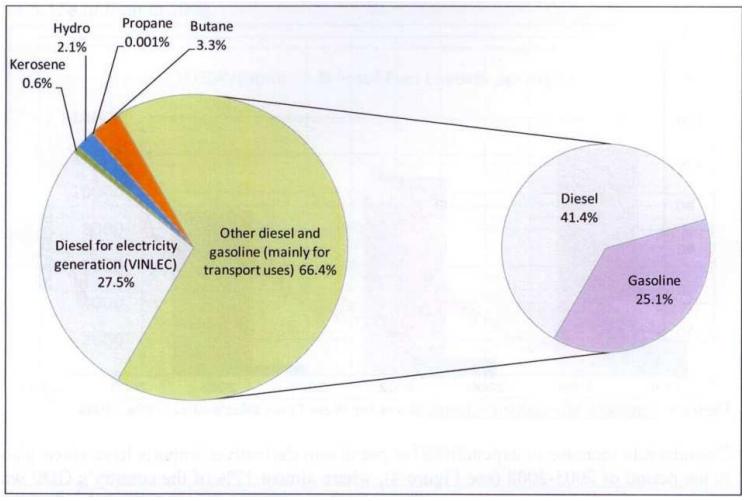
- To prove the viability of introducing HEVs to our terrain.
- Increased knowledge and capacity in Hybrid technology.
- Adoption of HEVs into the Government's fleet.
- Public is well aware of HEV technology to make informed decisions when purchasing vehicles.
- A solar powered charging station installed at the Administrative Building.
- Reduction in carbon output by transportation sector.

Project Rationale

St. Vincent and the Grenadines is almost entirely dependent on imported petroleum products. Gasoline is used in transportation while diesel is used in both transportation and electricity generation in proportions as depicted on Figure VII-1. Others such as kerosene and LPG are used for cooking and in the industrial sector.

The recent rises in oil prices have had a dampening effect on SVG's economy due to its high dependency on these products. As it is the task of the Energy Unit, as stated in its mandate, to reduce the dependence on imported energy through the improvement of energy efficiency and/or conservation of energy use; it has decided to address this issue by reducing the consumption of fossil fuel in the transportation sector.

Figure VII-1: Fossil Fuel Usage in SVG



Of all the petroleum products imported, 66.4 % is consumed for transportation uses. This represents a significant amount of expenditure. A reduction in this figure would prove to be greatly beneficial, as it would mean less petroleum products will be imported, resulting in significant savings and, ultimately, reduced carbon emissions.

The Government of SVG has a large fleet of vehicles, most of which are used extensively on a daily basis. These vehicles contribute to the large amount of petroleum products consumed and to the CO_2 emissions. It is argued that HEV technology does not reduce CO_2 emissions but simply transfers the source to an electricity provider considering some HEV rely on electricity for charging their batteries. This project will address this issue by utilizing a 10kW solar PV system to power a charging station which will be located at the Administrative Building. The Government will welcome any initiative that will reduce our fuel consumption, once viable. It is for this reason that this first hybrid vehicle should be used for testing its performance on our mountainous terrain.

Hybrid Technology

With the prices of gasoline and fuel always on the increase, car manufacturers have today found a new form of car technology that is fuel efficient and low in pollution. This technology is called the hybrid car technology where the cars have a rechargeable energy storage system (RESS) found in the vehicle, along with some fuel propulsion source.

Hybrid Cars integrate the power of the conventional gasoline engine with that of an electric motor. A high powered battery pack provides energy to the motor which itself gets recharged when the car is decelerating. This is called as regenerative braking. The gas engine can also assist the battery in recharging. This kills the need to plug the car to an external source of energy.

There are two types of hybrid vehicles, termed Mild Hybrids and Full Hybrids. In the Mild hybrid, the electric motor acts as a side-kick to the gas engine, assisting it whenever surplus power is needed. The electric motor alone is incapable of independently operating the vehicle. Here, the gasoline engine provides the main source of power, and the electric motor provides additional power whenever needed.

The second type of hybrid can be termed as a Full Hybrid, where the gasoline engine and the electric motor can operate the vehicle separately. In this type, the electric motor can drive the vehicle at lower speeds. In need of more speed, the gasoline engine will kick in. Both mild hybrids and full hybrids are capable of providing lower emissions and better fuel efficiency.

The Internal-Combustion Engines (both gasoline and diesel) installed in Hybrid cars are often smaller than those in normal cars for a simple reason that Hybrids have the electric motor for assistance. The motor can take care of city travel which poses stop and go conditions as well as power-consuming add-ons such as the A/C or power-windows and power-steering. At high speeds, the gasoline engine supplies power. This switching of power sources is computer controlled and nothing needs to be manually done.

Power to the electric motor comes from the battery-pack. Recharging of the battery is automatic and need not be done by external sources. When the car is in uniform motion or when it is decelerating, it generates power which charges the batteries which utilizes the valuable kinetic energy.

Benefits

- Hybrids combine clean energy of the electrical motor with the power of the gas-powered engine which results into lower emissions and better mileage.
- Due to improving technology, hybrids perform at par with the normal gas-powered vehicles, if not better.
- Hybrids are reliable and comfortable as any traditional car.
- The Government of St. Vincent and the Grenadines is prepared to offer purchase incentives for Hybrid vehicles.
- Hybrids are much cleaner cars than normal vehicles with lesser CO and other greenhouse gas emissions.
- The future for hybrids looks bright with rapid developments in hybrid technology to improve engine efficiency.
- Due to the Regenerative Braking technology, the batteries need not be charged by an external source.
- Hybrids help reduce the dependency on fossil fuels which directly affects fuel prices.

Logical Framework for Solar Charging for Hybrid Vehicles

Narrative Summary	Indicators	Verification	Assumption/ Risks
Goals (1) To purchase and test and a HEV on SVG's dynamic terrain. (2) To reduce the consumption of fossil fuels in the transportation sector. (3) To build technical capacity within SVG by involving the (SVGCC: DTVE) in the training and maintenance of this new technology. (4) To install a charging station powered by a 10kW solar PV system already commissioned at the Administrative Building. (5) To make the public aware of the benefits of this technology. (6) To reduce carbon emissions by the transportation sector.	(1) A functioning HEV used for testing purposes. (2) Less fossil fuel being consumed by the transportation sector. (3) Implementation of a training course or program within the curriculum. (4) Charging station installed to recharge the HEV. (5) Citizens are more educated about benefits of HEV technology. (6) Less fossil fuel purchased.	(1) Logbook to record all journeys, maintenance and fuel consumption. (2) Fuel expenses reduced. (3) Increasing number of students trained in HEV technology. (4) No additional costs incurred by charging the HEV. (5) Purchase of HEVs by private sector. (6) Less fossil fuel used results in reduction in carbon emissions.	(1) Performance may not be desirable. (2) Fuel expenses may be reduced but maintenance cost could increase.
Purpose The main objective of the project is to contribute towards Saint Vincent and the Grenadines (SVG)'s efforts to reduce reliance on imported fuels by reducing the amount of energy consumed by the transportation sector while introducing the public to the idea of HEVs.	Increased popularity of HEVs, due to heightened awareness of the public, resulting in reduced fossil fuels imported.	Ministry of Finance or Statistics Department report.	The outcome of the testing of the HEV was desirable.
Outputs (1) A suitable HEV purchased and ready for testing. (2) Reduced consumption of fossil fuel within the transportation sector. (3) Increased technical capacity in the field of HEV technology. (4) A solar powered charging station at the Administrative Building. (5) Citizens who are more aware of HEV technology and its benefits. (6) Reduction in carbon emissions by the transportation sector.	Report stating the amount of fossil fuel avoided and it associated cost, and CO2 avoided. Enrollment of students in HEV technology programs increased and public enquiries knowledge as it relates to HEV technology increased.	Importation of fossil fuel reduced as indicated by statistical department.	Proper project management. Collaboration of other intuitional partners involved in the project.
Activities (1) Purchase and testing of a HEV. (2) Installation of a charging station. (3) Training and public awareness.			

Annex VIII: Capacity Assessment Report and Development Strategy for Stakeholders

Renewable energy is an emerging sector in SVG as well as other small developing states of the Caribbean. For this reason, institutional as well as human and financial resource capacity must be developed consistent with the needs of the sector. The following discussion assesses the capacity of stakeholders with a view to articulate development strategy that would advance the sector forward.

In the past, efforts to build awareness about renewable energy matters have been low-keyed. The level of awareness amongst the general public, technocrats and policymakers in relation to the RE technologies and related matters is relatively low and represents a significant barrier to higher penetration of RE. For this reason, an Energy Awareness Week is highlighted annually not only in SVG but also throughout CARICOM member states.

It is imperative that renewable energy technologies (RETs) be understood by those who intend to use them as well as those who will be impacted by the technologies. In this regard, the issue of awareness is paramount from the point of view of stakeholders. In SVG, many persons have an understanding of hydropower technology given the hydro plants assets on St. Vincent. It is, however, incumbent on potential project developers to obtain a diverse understanding of the other RETs, particularly those that could be applied in SVG. This could include technologies that utilize biomass, solar photovoltaic, solar thermal technologies for specific applications.

From the energy market perspective, the general public also needs to understand the benefits of RETs in the context of cost reduction of electricity, environmental preservation, poverty reduction and energy security and improve their quality of life vis a vis traditional fossil fuel based energy. It is within this context that SVG needs to develop an ongoing awareness strategy targeting a range of stakeholders.

There is also a need for continuing RE education for key decision makers, policymakers and other stakeholders in finance, industry and electric utility sector. Opportunities will be seized by the utility company as well as the Energy Unit to make periodic presentations using various media as a part of existing programmes. As a matter of priority, energy security must become part of the psyche of the people so that they can be engaged in intelligent discussions on this important issue and make informed choices.

The SVG Energy Policy must be used as a tool to guide the government in setting priority and accomplishment goals. Along with the requisite training, adequate resources must be provided to enhance the capacity of the Government on energy planning and all energy-related issues; where there is a lack of capacity and knowledge in RE project design and implementation, the establishment of Energy Services Company (ESCOs) is critical in bridging this gap to provide specific energy related services such as project feasibility studies, implementation and leveraging funds for RE projects. These are services that may otherwise be sought from outside the country at exorbitant cost. SVG will benefit significantly because there is a dearth of energy related expertise in the country.

In general, the capacity to undertake technical policy development and enhancement work at the level of the small states like SVG is weak. In many instances, policy implementation efforts are not advanced due to lack of technical support for follow-up, monitoring and response to queries. The availability of technical expertise is therefore seen to be very important not only in

assisting with the development of appropriate policy to encourage RE but also to assist in the process of implementation. The Energy Unit needs to be strengthened by additional technical staff with the requisite project preparation, monitoring and implementation skills. The absence of these skills will require the involvement of contracted consultants.

SVG is currently facilitating foreign investors in the exploration of geothermal energy resources. To effectively facilitate and support a geothermal project for SVG, the Government must strengthen its regulatory framework such as supporting geothermal ordinance, geothermal field rules, and regulations.

Notwithstanding the fact that the SVG energy market is small, there is a need for secure long-term investments and electricity supplies that may be limited due to lack of participants for open competition amongst different electricity producing entities. The electricity supply market should be accessible by independent power providers producing on the basis of indigenous and/or cost-competitive energy sources, either alone or in collaborative joint ventures with VINLEC. To encourage open competition, Government should review existing energy-related legislation with a view to possible amending them to allow for the engagement of independent power producers. In so doing, it should remove any existing legal or other barriers for the use of renewable energy supply of electricity to the national grid, unless such legal requirements provide for the protection of the environment and human health.

The Government must also establish and strengthen networks with regional and international organizations[54] from which several benefits can be derived in the form of training, project funding, technical support and technology transfer in energy related disciplines. These organizations often support energy programmes geared towards poverty reduction particularly in rural communities through targeted intervention that includes irrigation programmes, solar drying, and modular energy projects.

It has been proven that one of the most effective ways to disseminate the message of RE is through educating the young citizens. Energy and particularly RE must be a component of the science curriculum at all levels of the school system, as a new thrust in attempting to change the mindset and behavior of the population. Secondary and post-secondary institutions throughout the country must offer training in various aspects of renewable energy with the aim of building long term experience and expertise around various specialization so that students could be prepared with the basics to enable them to enter the RE market.

Despite the many years of studies being carried out in the Region, very few RE projects have been implemented. The Government in collaboration with VINLEC and international organizations should organize investment fora that will bring together the key actors and identify opportunities to catalyze investment in RE sector. Moreover, every effort should be made to attend energy investment fora when the opportunities present themselves. Given the perceived risks associated with the development of renewable energy, it is imperative that the Government embark on public private partnership to leverage funds for RE project and in the process share risks. It would also be necessary to devise innovative financing mechanisms in order to increase the availability of funds for renewable energy projects

[54] This would include the Latin America Energy Organization (OLADE), the Caribbean Energy Information System (CEIS), the Caribbean Energy Efficiency Development Project (DEEPC), the Caribbean Renewable Energy Development Programme (CREDP) and the Renewable Energy and Energy Efficiency Project (REEEP)

Annex IX: UNDP-GEF Environmental and Social Screening Procedure (ESSP)

Annex IX-A: Environmental and Social Screening Checklist

QUESTION 1:

Has a combined environmental and social assessment/review that covers the proposed project already been completed by implementing partners or donor(s)?

Select answer below and follow instructions:

X NO → Continue to Question 2 (do not fill out Table 1.1)

€ **YES** → No further environmental and social review is required if the existing documentation meets UNDP's quality assurance standards, and environmental and social management recommendations are integrated into the project. Therefore, you should undertake the following steps to complete the screening process:

1. Use Table 1.1 below to assess existing documentation. (It is recommended that this assessment be undertaken jointly by the Project Developer and other relevant Focal Points in the office or Bureau).
2. Ensure that the Project Document incorporates the recommendations made in the implementing partner's environmental and social review.
3. Summarize the relevant information contained in the implementing partner's environmental and social review in Annex A.2 of this Screening Template, selecting Category 1.
4. Submit Annex A to the PAC, along with other relevant documentation.

Note: Further guidance on the use of national systems for environmental and social assessment can be found in Annex B.

TABLE 1.1: CHECKLIST FOR APPRAISING QUALITY ASSURANCE OF EXISTING ENVIRONMENTAL AND SOCIAL ASSESSMENT	**Yes/No**
1. Does the assessment/review meet its terms of reference, both procedurally and substantively?	**N.A.**
2. Does the assessment/review provide a satisfactory assessment of the proposed project?	**N.A.**
3. Does the assessment/review contain the information required for decision-making?	**N.A.**
4. Does the assessment/review describe specific environmental and social management measures (e.g. mitigation, monitoring, advocacy, and capacity development measures)?	**N.A.**
5. Does the assessment/review identify capacity needs of the institutions responsible for implementing environmental and social management issues?	**N.A.**
6. Was the assessment/review developed through a consultative process with strong stakeholder engagement, including the view of men and women?	**N.A.**
7. Does the assessment/review assess the adequacy of the cost of and financing arrangements for environmental and social management issues?	**N.A.**

Table 1.1 (continued) For any "no" answers, describe below how the issue has been or will be resolved (e.g. amendments made or supplemental review conducted).
N.A.

QUESTION 2:

Do <u>all</u> outputs and activities described in the Project Document fall within the following categories?

- € Procurement (in which case UNDP's Procurement Ethics and Environmental Procurement Guide need to be complied with)
- € Report preparation
- € Training
- € Event/workshop/meeting/conference (refer to Green Meeting Guide)
- € Communication and dissemination of results

Select answer below and follow instructions:

X NO → Continue to Question 3

€ **YES** → No further environmental and social review required. Complete Annex A.2, selecting Category 1, and submit the completed template (Annex A) to the PAC.

QUESTION 3:

Does the proposed project include activities and outputs that support *upstream* planning processes that potentially pose environmental and social impacts or are vulnerable to environmental and social change (refer to Table 3.1 for examples)? (Note that *upstream* planning processes can occur at global, regional, national, local and sectoral levels)

Select the appropriate answer and follow instructions:

€ **NO** → Continue to Question 4.

<u>X YES →Conduct the following steps to complete the screening process:</u>

1. Adjust the project design as needed to incorporate UNDP support to the country(ies), to ensure that environmental and social issues are appropriately considered during the upstream planning process. Refer to Section 7 of this Guidance for elaboration of environmental and social mainstreaming services, tools, guidance and approaches that may be used.
2. Summarize environmental and social mainstreaming support in Annex A.2, Section C of the Screening Template and select "Category 2".
3. If the proposed project ONLY includes upstream planning processes then screening is complete, and you should submit the completed Environmental and Social Screening Template (Annex A) to the PAC. If downstream implementation activities are also included in the project then continue to Question 4.

TABLE 3. 1 EXAMPLES OF UPSTREAM PLANNING PROCESSES WITH POTENTIAL DOWNSTREAM ENVIRONMENTAL AND SOCIAL IMPACTS	Check appropriate box(es) below
1. Support for the elaboration or revision of **global- level** strategies, policies, plans, and programmes. *For example, capacity development and support related to international negotiations and agreements. Other examples might include a global water governance project or a global MDG project.*	
2. Support for the elaboration or revision of **regional-level** strategies, policies and plans, and programmes. *For example, capacity development and support related to trans-boundary programmes and planning (river basin management, migration, international waters, energy development and access, climate change adaptation etc.).*	
3. Support for the elaboration or revision of **national-level** strategies, policies, plans and programmes. *For example, capacity development and support related to national development policies, plans, strategies and budgets, MDG-based plans and strategies (e.g. PRS/PRSPs, NAMAs), sector plans.*	**X**
4. Support for the elaboration or revision of **sub-national/local-level** strategies, polices, plans and programmes. *For example, capacity development and support for district and local level development plans and regulatory frameworks, urban plans, land use development plans, sector plans, provincial development plans, provision of services, investment funds, technical guidelines and methods, stakeholder engagement.*	**X**

QUESTION 4:

Does the proposed project include the implementation of *downstream* activities that potentially pose environmental and social impacts or are vulnerable to environmental and social change?

To answer this question, you should first complete Table 4.1 by selecting appropriate answers. If you answer "No" or "Not Applicable" to all questions in Table 4.1 then the answer to Question 4 is "NO." If you answer "Yes" to any questions in Table 4.1 (even one "Yes" can indicated a significant issue that needs to be addressed through further review and management) then the answer to Question 4 is "YES":

€ **NO → No further environmental and social review and management required for downstream activities. Complete Annex VII-B by selecting "Category 1", and submit the Environmental and Social Screening Template to the PAC**

X YES → Conduct the following steps to complete the screening process:

1. Consult Section 8 of this Guidance, to determine the extent of further environmental and social review and management that might be required for the project.
2. Revise the Project Document to incorporate environmental and social management measures. Where further environmental and social review and

management activity cannot be undertaken prior to the PAC, a plan for undertaking such review and management activity within an acceptable period of time, post-PAC approval (e.g. as the first phase of the project) should be outlined in Annex A.2.

3. Select "Category 3" in Annex A.2, and submit the completed Environmental and Social Screening Template (Annex A) and relevant documentation to the PAC.

TABLE 4.1: ADDITIONAL SCREENING QUESTIONS TO DETERMINE THE NEED AND POSSIBLE EXTENT OF FURTHER ENVIRONMENTAL AND SOCIAL REVIEW AND MANAGEMENT		
1.	**Biodiversity and Natural Resources**	**Answer** (Yes/No/ Not Applicable)
1.1	Would the proposed project result in the conversion or degradation of modified habitat, natural habitat or critical habitat?	**Yes**
1.2	Are any development activities proposed within a legally protected area (e.g. natural reserve, national park) for the protection or conservation of biodiversity?	**Yes**
1.3	Would the proposed project pose a risk of introducing invasive alien species?	**No**
1.4	Does the project involve natural forest harvesting or plantation development without an independent forest certification system for sustainable forest management (*e.g. PEFC, the Forest Stewardship Council certification systems, or processes established or accepted by the relevant National Environmental Authority*)?	**No**
1.5	Does the project involve the production and harvesting of fish populations or other aquatic species without an accepted system of independent certification to ensure sustainability (*e.g. the Marine Stewardship Council certification system, or certifications, standards, or processes established or accepted by the relevant National Environmental Authority*)?	**No**
1.6	Does the project involve significant extraction, diversion or containment of surface or ground water? *For example, construction of dams, reservoirs, river basin developments, groundwater extraction.*	**Yes**
1.7	Does the project pose a risk of degrading soils?	**Yes**
2.	**Pollution**	**Answer (Yes/No/ Not Applicable)**
2.1	Would the proposed project result in the release of pollutants to the environment due to routine or non-routine circumstances with the potential for adverse local, regional, and trans-boundary impacts?	**No**
2.2	Would the proposed project result in the generation of waste that cannot be recovered, reused, or disposed of in an environmentally and socially sound manner?	**No**
2.3	Will the propose project involve the manufacture, trade, release, and/or use of chemicals and hazardous materials subject to	**No**

TABLE 4.1: ADDITIONAL SCREENING QUESTIONS TO DETERMINE THE NEED AND POSSIBLE EXTENT OF FURTHER ENVIRONMENTAL AND SOCIAL REVIEW AND MANAGEMENT		
	international action bans or phase-outs? *For example, DDT, PCBs and other chemicals listed in international conventions such as the Stockholm Convention on Persistent Organic Pollutants, or the Montreal Protocol.*	
2.4	Is there a potential for the release, in the environment, of hazardous materials resulting from their production, transportation, handling, storage and use for project activities?	**No**
2.5	Will the proposed project involve the application of pesticides that have a known negative effect on the environment or human health?	**No**
3.	**Climate Change**	
3.1	Will the proposed project result in significant[55] greenhouse gas emissions? *Annex E provides additional guidance for answering this question.*	**No**
3.2	Is the proposed project likely to directly or indirectly increase environmental and social vulnerability to climate change now or in the future (also known as maladaptive practices)? You can refer to the additional guidance in Annex C to help you answer this question. *For example, a project that would involve indirectly removing mangroves from coastal zones or encouraging land use plans that would suggest building houses on floodplains could increase the surrounding population's vulnerability to climate change, specifically flooding.*	**Yes**
4.	**Social Equity and Equality**	**Answer (Yes/No/ Not Applicable)**
4.1	Would the proposed project have environmental and social impacts that could affect indigenous people or other vulnerable groups?	**Yes**
4.2	Is the project likely to significantly impact gender equality and women's empowerment[56]?	**No**
4.3	Is the proposed project likely to directly or indirectly increase social inequalities now or in the future?	**No**
4.4	Will the proposed project have variable impacts on women and men, different ethnic groups, social classes?	**Yes**
4.5	Have there been challenges in engaging women and other certain key groups of stakeholders in the project design process?	**No**
4.6	Will the project have specific human rights implications for vulnerable groups?	**No**

[55] Significant corresponds to CO_2 emissions greater than 100,000 tons per year (from both direct and indirect sources). Annex E provides additional guidance on calculating potential amounts of CO_2 emissions.

[56] Women are often more vulnerable than men to environmental degradation and resource scarcity. They typically have weaker and insecure rights to the resources they manage (especially land), and spend longer hours on collection of water, firewood, etc. (OECD, 2006). Women are also more often excluded from other social, economic, and political development processes.

TABLE 4.1: ADDITIONAL SCREENING QUESTIONS TO DETERMINE THE NEED AND POSSIBLE EXTENT OF FURTHER ENVIRONMENTAL AND SOCIAL REVIEW AND MANAGEMENT	
5. Demographics	
5.1 Is the project likely to result in a substantial influx of people into the affected community(ies)?	**No**
5.2 Would the proposed project result in substantial voluntary or involuntary resettlement of populations? *For example, projects with environmental and social benefits (e.g. protected areas, climate change adaptation) that impact human settlements, and certain disadvantaged groups within these settlements in particular.*	**No**
5.3 Would the proposed project lead to significant population density increase which could affect the environmental and social sustainability of the project? *For example, a project aiming at financing tourism infrastructure in a specific area (e.g. coastal zone, mountain) could lead to significant population density increase which could have serious environmental and social impacts (e.g. destruction of the area's ecology, noise pollution, waste management problems, greater work burden on women).*	**No**
6. Culture	
6.1 Is the project likely to significantly affect the cultural traditions of affected communities, including gender-based roles?	**Yes**
6.2 Will the proposed project result in physical interventions (during construction or implementation) that would affect areas that have known physical or cultural significance to indigenous groups and other communities with settled recognized cultural claims?	**Yes**
6.3 Would the proposed project produce a physical "splintering" of a community? *For example, through the construction of a road, power line, or dam that divides a community.*	**No**
7. Health and Safety	
7.1 Would the proposed project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides and erosion, flooding or extreme climatic conditions? *For example, development projects located within a floodplain or landslide prone area.*	**Yes**
7.2 Will the project result in increased health risks as a result of a change in living and working conditions? In particular, will it have the potential to lead to an increase in HIV/AIDS infection?	**No**
7.3 Will the proposed project require additional health services including testing?	**No**
8. Socio-Economics	
8.1 Is the proposed project likely to have impacts that could affect women's and men's ability to use, develop and protect natural resources and other natural capital assets? *For example, activities that could lead to natural resources degradation or depletion in communities who depend on these resources for their development, livelihoods, and well-being?*	**Yes**

TABLE 4.1:	ADDITIONAL SCREENING QUESTIONS TO DETERMINE THE NEED AND POSSIBLE EXTENT OF FURTHER ENVIRONMENTAL AND SOCIAL REVIEW AND MANAGEMENT	
8.2	Is the proposed project likely to significantly affect land tenure arrangements and/or traditional cultural ownership patterns?	**No**
8.3	Is the proposed project likely to negatively affect the income levels or employment opportunities of vulnerable groups?	**No**
9.	**Cumulative and/or Secondary Impacts**	**Answer (Yes/No/ Not Applicable)**
9.1	Is the proposed project location subject to currently approved land use plans (e.g. roads, settlements) which could affect the environmental and social sustainability of the project? *For example, future plans for urban growth, industrial development, transportation infrastructure, etc.*	**No**
9.2	Would the proposed project result in secondary or consequential development which could lead to environmental and social effects, or would it have potential to generate cumulative impacts with other known existing or planned activities in the area? *For example, a new road through forested land will generate direct environmental and social impacts through the cutting of forest and earthworks associated with construction and potential relocation of inhabitants. These are direct impacts. In addition, however, the new road would likely also bring new commercial and domestic development (houses, shops, businesses). In turn, these will generate indirect impacts. (Sometimes these are termed "secondary" or "consequential" impacts). Or if there are similar developments planned in the same forested area then cumulative impacts need to be considered.*	**Yes**

ANNEX VIII-B: ENVIRONMENTAL AND SOCIAL SCREENING SUMMARY
(To be filled in after Annex VII-A has been completed)

Name of Proposed Project: "Promoting Access to Clean Energy Services for St. Vincent and the Grenadines" (PACES)

A. Environmental and Social Screening Outcome

Select from the following:

€ Category 1. No further action is needed

€ ☑ Category 2. Further review and management is needed. There are possible environmental and social benefits, impacts, and/or risks associated with the project (or specific project component), but these are predominantly indirect or very long-term and so extremely difficult or impossible to directly identify and assess.

€ ☑ Category 3. Further review and management is needed, and it is possible to identify these with a reasonable degree of certainty. If Category 3, select one or more of the following sub-categories:

€ ☑ Category 3a: Impacts and risks are limited in scale and can be identified with a reasonable degree of certainty and can often be handled through application of standard

best practice, but require some minimal or targeted further review and assessment to identify and evaluate whether there is a need for a full environmental and social assessment (in which case the project would move to Category 3b).

- Category 3b: Impacts and risks may well be significant, and so full environmental and social assessment is required. In these cases, a scoping exercise will need to be conducted to identify the level and approach of assessment that is most appropriate.

B. Environmental and Social Issues (for projects requiring further environmental and social review and management)

Environmental Issues: The Project will facilitate the development of over 230 kW of solar PV installations on government-owned buildings and a 10 MW geothermal plant on Mount Soufriere on the north side of St. Vincent Island, and catalyze investment into renewable energy projects in SVG. *Environmental issues related to the development of rooftop solar PV installations on government buildings include*: a) ensuring PV panels are engineered and installed to withstand increased severity of storms associated with climate change; b) ensuring the installation and operation of these panels demonstrate best practices for future solar PV panel proponents in the private sector; c) reduced GHG emissions from the decreased use of electricity from diesel-fueled power plants. *Environmental issues related to the geothermal plant include*: a) the impacts associated with the investigative drilling program to site the wells; b) potential impacts to water and biodiversity with the conversion of a greenfield site on which a proposed geothermal plant will be located; c) potential impacts to water and biodiversity with the development of the access road and transmission lines to and from the proposed geothermal plant; and d) reduction of GHG emissions from the use of geothermal electricity instead of electricity from diesel-fuel power plants. *Environmental issues related to the catalyzing of renewable energy investments in SVG include*: a) lack of firm government framework for regulating environmental standards related to new capital investments related to renewable energy plants; b) lack of government capacity to manage private RE projects and enforce environmental standards on such projects. The net environmental result of the Project should be the reduction of GHG emissions from solar-PV panels feeding electricity into the grid and the use of electricity from the geothermal plant. In addition, the decreased use of electricity from the diesel fuelled power plants will reduce local air pollution.

Social Issues: While there are few adverse social impacts resulting from Project activities, there are a number of positive social impacts expected from the Project including: a) the training of engineers and technicians in the supply, design, installation and maintenance of solar PV panels on rooftops of buildings; b) creation of a number of jobs for youth in the installation, operation and maintenance of these rooftop solar PV panels; and c) increased availability of government funds for social programming from the reduced cost of electricity generation and reduced use of diesel fuel for these power plants. The impact of reduced personnel in diesel power plants is considered to be insignificant with any lost jobs at these plants being offset by the job opportunities created by the rooftop solar-PV plant.

C. Next Steps (for projects requiring further environmental and social review and management):

The Project design already has components and outputs that will provide oversight and mitigative actions to counter any adverse impacts from the sustained development renewable energy in SVG:

- Output 1.2 will support the development of rules and procedures for the installation of RETs, notably rooftop solar PV installations on government buildings. These rules and procedures will provide more confidence to RE investors that government will support the development of RE

projects. These rules and regulations will also cover standards of how these RETs are to be installed to withstand extreme climate events that may become more frequent under climate change;

- Outputs 1.4 and 1.5 will assist the Government in strengthening its institutional arrangements that will increase the confidence of local and foreign IPPs that investments made in RETs in SVG will yield desired rates of return. This will involve the Energy Unit as the focal point for promoting RE for the SVG Government and VINLEC who will be tasked to provide assistance towards the development of RE on its own or with private investors and to enforce RE quality standards. Through raised investor confidence from these developments, the country will increase its deployment in RETs, the offsetting of fossil fuel based electricity generation, and GHG emission reductions;

-Component 2 is dedicated to building the capacity of the citizens of SVG to plan, design, construct, operate and maintain RET assets in SVG. This will have the impact of improving investor confidence with local knowledge of operating RET assets in SVG, increasing opportunities for local engineers, technicians, and entrepreneurs to setup RE projects, and increasing employment opportunities for manual laborers to service and maintain RET assets in SVG, notably for rooftop solar PV installations

-Component 3 is setup to provide the full cycle of RE project development in SVG. A specific RET to be developed in SVG will be rooftop solar PV installations for which the Project will provide assistance on ensuring the installations are planned and designed using best international practices to withstand extreme events associated with climate change (Output 3.2), cost estimates that will give assurances to financial institutes on reasonable rates of return (Output 3.3), supervisory overview of installations to reduce the risk of improper RE installations (Output 3.4), and technical assistance for the preparation of plans to replicate RE projects (Output 3.5).

- Output 3.2 will provide assistance to both the SVG Government and the project proponents of the geothermal project in the preparation of an environmental and social impact assessment (ESIA) that use best international practices for such assessments

D. Sign Off

Project Manager	**Date**
PAC	**Date**
Programme Manager	**Date**