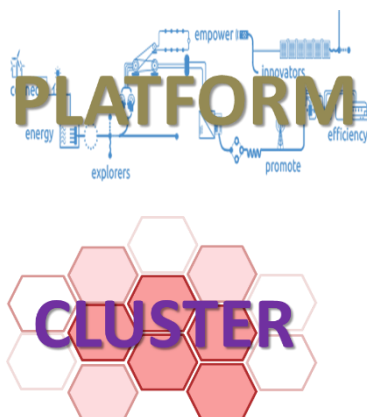




Pre-Feasibility on a Sustainable Energy and Climate Technology Cluster in Barbados

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Acronyms

AC	Air Conditioning
BANANA	Build absolutely nothing near anybody
BB	Barbados
BCC	Barbados Community College
BIDC	Barbados Investment and Development Corporation
BMA	
BNSI	Barbados National Standards Institution
BITA	Barbados Income Tax Act
BNEP	Barbados National Energy Policy
BL&P	Barbados Light and Power Company
BREA	Barbados Renewable Energy Association
CapEx	Capital Expenditure
CCREEE	Caribbean Centre for Renewable Energy and Energy Efficiency
CDB	Caribbean Development Bank
CEO	Chief Executing Officer
CLL	Caribbean LED Lighting
CREF	Caribbean Renewable Energy Forum
CIC	Climate Innovation Center
CROSQ	CARICOM Regional Organization for Standards and Quality
DoET	Division of Energy and Telecommunication
EC	European Commission
ELPA	Electric Light and Power Act
ESCO	Energy Service Company
EU	European Union
EV	Electric Vehicle
FIT	Feed In Tariff
FTC	Fair Trading Commission
FTE	Full Time Equivalents
GEF	Global Environment Facility
GHG	Green House Gas
GoB	Government of Barbados
HVAC	Heating, Ventilation and Air Conditioning
IaDB	Inter-American Development Bank
IPP	Independent Power Producer
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
MIICS	Ministry of Industry, International Business, Commerce and Small Business Development
MoED	Ministry of Environment and Drainage
NIMBY	Not in my back yard
NSRL	National Social Responsibility Levy
OECS	Organization of Eastern Caribbean States
OpEx	Operational Expenditure
PFAN	Private Financing Advisory Network
PIF	Project Identification Form
PPA	Power Purchase Agreement

PPG	Project Preparation Grant
PSV	Private Sector Vehicle
PV	Photo Voltaic
R&D	Research and Development
ICRM	Integrated Climate Risk Management
RE	Renewable Energy
RER	Renewable Energy Rider
RET	Renewable Energy Technology
SET	Sustainable Energy Technology
SDG	Sustainable Development Goal
SIDS	Small Island Developing State
SJPI	Samuel Jackman Prescod Institute of Technology
SJPP	Samuel Jackman Prescod Polytechnic, meanwhile SJPI
SME	Small & Medium Enterprise
ST	Solar Thermal
SWOT	Strength/Weakness/Opportunities/Threats
TA	Technical Assistance
TVET	Technical Vocational Education and Training
TAPSEC	Technical Assistance Programme for Sustainable Energy in the Caribbean
TOR	Terms of Reference
UNIDO	United Nations Industrial Development Organization
UWI	University of West Indies

1 Introduction

In Barbados, the envisaged sustainable energy transformation as part of the “green circular economy” vision of the Government, is facing a number of interrelated barriers that need to be addressed. Among other factors, weak innovation and absorption capacities of the domestic sustainable energy industry are hindering the further uptake of markets for innovative sustainable energy technologies (SET) and services with high GHG emission reduction and value creation potential. The local private sector continues to face various barriers and constraints. Although the Government of Barbados (GoB) has implemented many measures to foster innovation and support small and medium-sized enterprises (SMEs), there is still a clear need to develop incentives to promote and strengthen cooperation between the public sector, educational institutions and the private sector in order to foster a beneficial environment of entrepreneurship.

The Ministry of Industry, International Business, Commerce and Small Business Development (MIICS), the United Nations Industrial Development Organization (UNIDO) and the Caribbean Centre for Renewable Energy and Energy Efficiency (CCREEE) are jointly developing the Global Environment Facility (GEF) funded project “Strategic platform to promote sustainable energy technology innovation, industrial development and entrepreneurship in Barbados”. The project aims to up-scale the domestic sustainable energy manufacturing and servicing industry in technological areas with high potential for GHG emission reduction and local value creation in Barbados. The project is also part of the CCREEE efforts to establish a regional program on innovation and entrepreneurship. The concept for the project was recently approved by the GEF and currently the GEF Endorsement Documents are under preparation. This report forms part of that supporting document.

1.1 Objective of the report

This document summarizes the findings of a pre-feasibility study for a sustainable energy technology cluster/park in Barbados. This document is one of several deliverables of an assignment for external consultants with the established scope of the TOR “Consultancy Services for the GEF project “Strategic Platform to Promote Sustainable Energy Technology Innovation, Industrial Development and Entrepreneurship in Barbados””.

1.2 Definition of specific terms

To clearly distinguish between key words and elements in the field of interest, the following terms which are understood and used in this document as defined here:

- + Network: wide range of connected actors and multipliers relevant for the region
- + Platform: framework for formalized communication and information exchange
- + Cluster: concentrated group of network actors with an organizational framework
- + Hub: technology and entrepreneurship center; place for meetings, trainings, administration, etc.; space as part of a building or park
- + Park: network actors settle in a specific area, ideally around a hub
- + Association: lobbying and advocacy for its members

A cluster typically refers to “a geographic concentration of interconnected economic and innovative activities in a particular field, such as renewable energy”. Experts believe clusters increase members’ productivity and competitiveness. The term business cluster originated in Michael Porter’s ‘The Competitive Advantage of Nations’ [1990]. However, the idea of clusters goes back much further in history; the concept used by towns and cities concentrating on certain trades [the gun quarter, the jewellery quarter] hundreds of years ago.

A modern cluster usually includes stakeholders from universities and research institutes, commercial industry, government or statutory institutions. These stakeholders have common needs for technology and infrastructure and are willing to collaborate with each other and exchange information **to reach mutually beneficial outcomes**. This bundling of resources, strengths and competencies has the potential to provide a unique competitive advantage. Clusters are important to start up local industries and to increase competitiveness and co-operation across a range of stakeholders.

2 Methods

In over twenty-five (25) bilateral meetings and two (2) workshops with over forty (40) participants each, the main stakeholders were first interviewed about their needs and expectations for cooperation and then introduced to the concepts of a platform, cluster and hub for their feedback and validation. In separate working groups during the two workshops answers to specific questions emerged from a collaborative engagement process that led to further elaboration of the concepts for co-operation, co-opetition, joint research and development (R&D), entrepreneur support and networking. In the market assessment a survey was conducted, and some of the information obtained there has been used for this Pre-Feasibility Cluster Report as well.

Figure 1: Collage of pictures from bilateral meetings and workshops.



3 Review of existing initiatives and activities

The following initiatives and activities have been identified as the most relevant ones because they are either directly in the field of interest or serve as examples for a platform or clusters.

3.1 National

Barbados Renewable Energy Association

The Barbados Renewable Energy Association (BREA¹) is a NGO focused on Renewable Energy and Energy Efficiency at the residential, commercial, industrial and national levels. The Association is the brainchild of four (4) persons who met back in August 2010. The Association's Vision Statement is "To create a business environment in renewable energy conservation and energy efficiency initiatives in Barbados conducive to ensuring a sustainable present and future.", and the mission is "To facilitate the growth and development of renewable energy and promote the adoption and implementation of renewable energy, energy conservation and energy efficiency initiatives in Barbados."

BREA has a board, secretariat and about 20 key members. BREA currently has a focus on public awareness on RE & EE and political lobbying for PV.

FAB LAB

Led by the *Ministry of Education, Science, Technology and Innovation*, there are efforts ongoing to establish a *FAB LAB (fabrication laboratory)* in Barbados as a supporting mechanism for inventors and innovators. Working through a committee comprised of the University of the West Indies, The Technical & Vocational Education and Training Council, The Barbados Community College (BCC) and the Samuel Jackman Prescod Institute of Technology (SJPI), the FAB LAB is expected to play a critical role in meeting the policy objective of expanding the role of small and medium-sized business in the economy. Fab-Lab is a concept derived from a model developed in the USA and there is now an international

¹ <http://brea.bb/>

cohort of labs and a Foundation. With a focus on mechanical and electrical elements, a FAB LAB is a small-scale workshop offering (personal) digital fabrication; in addition to mechanical equipment to aid in the development of devices requiring mechanical input. A FAB LAB is generally equipped with an array of flexible computer-controlled tools that cover several different length scales and various materials, with the aim to make a wide range of “items/devices”. Facilitating prototyping, the lab provides an opportunity for the general public to have a space to experiment and explore; it can also be used for product modification and adaptation in a Barbadian context e.g. material or design changes to make it salt-resistant. It relies on the existence of a local private sector with the capacity to commercialize prototypes that emerge.

A proposal currently submitted for approval by the Cabinet of Ministers (of the Government of Barbados) identifies an initial investment of 150,000 USD to set up a lab including equipment costs, but excluding staff costs. The FAB LAB model also envisions an ecosystem approach to innovation similar to that proposed by the SET project. The Fab Lab Foundation is identified as a key partner/collaborator which will provide some key services (support and training largely) in the initial set up phase. A minimum space of three thousand, eight hundred and seventy-five (3,875) square feet has been recommended. The project will engage stakeholders from the education, innovation, private and potentially the investment sector.

Smart Fund

The Sustainable Energy Investment Program or Smart Fund is a partnership of the *Government of Barbados and the Inter-American Development Bank*. Operational since 2012, the 10 million USD program comprises a low interest financing and grant program for renewable energy investments. Aiming to ‘jump start’ the renewable energy and energy efficiency market in Barbados, the Fund targets Small and Medium-sized Enterprises (SMEs) as well as the residential sector. Solar-Water Heating (SWH) Systems are eligible for financing. SMEs, facilitated via the government, benefit from a grace period and an interest rate of 1 % [1] and consumers benefit from facilities that enable innovative finance mechanisms and access to products free of charge e.g. the compact fluorescent lamps available to some consumers via vouchers². Six (6) facilities in all have been established, with a bias to business development (14 million BDD), to support businesses and consumers. Amendments to the Barbados Income Tax Act in 2013, 37J (1) and (2), allow for a claim for tax deduction of 150 % of the interest on a loan for a number of purposes relevant to RE/EE. These include construction of a new facility or upgrading an existing property to enable the generation, supply and sale of electricity from a renewable energy source; constructing a new facility for installing or supplying renewable energy systems or energy efficient products [2]. The fund is implemented in partnership with the Enterprise Growth Fund Limited.

Public Sector Smart Energy Program

A collaboration between the *EU and the Government of Barbados*, the Division of Energy and Telecommunications (DoET), the program has a total budget of 24 million USD, with 17 million USD from the IDB and 7 million USD from the EU as grant funding. It focuses on street light replacement, RE and EE, ocean energy, electric vehicles and capacity building. The project was initially to be implemented between 2013 to 2016 but it is not clear if it has been completed. The program engaged stakeholders from government, NGOs, the private sector and education/training. It aimed to replace up to 30,000 street lights, save up to 3 million USD annually in electricity savings³ and retrofit at least twelve (12) government buildings⁴.

Barbados Incubator for Music Entrepreneurship Initiative

The Cultural Industries Development Authority Barbados has launched a Barbados Incubator for Music Entrepreneurship Initiative. Very recently (in August 2017) it published a report about the creative and cultural sector in Barbados including short and long-term recommendations, as well as suggestions for immediate actions. The report⁵ discusses the concept of a creative cluster at many levels and found that a natural but very diverse cluster with more than 300 practitioners, businesses and organizations working across the entire spectrum of creative and cultural disciplines already exists.

² <http://www.energy.gov.bb/web/energy-smart-fund>

³ <http://newenergyevents.com/barbados-government-launches-24-6m-smart-energy-program/>

⁴ <http://www.energy.gov.bb/web/component/content/article/75-partnerprojects/264-public-sector-smart-energy-program>

⁵ <http://www.cidabarbados.org/docs/170831%20Creative%20Truth%20to%20Power%20v1-5%20FINAL.pdf>

3.2 Caribbean-wide/Regional

TAPSEC

The main objective of TAPSEC is to ensure the access of all CARIFORUM citizens to modern, clean and reliable energy supplies at affordable and stable prices through improved energy efficiency and a significantly increased share of local and regional renewable energy sources. The project was initiated in November 2017 and is now in its early stages with the specific activities in countries are yet to be fully defined. The project will liaise closely with GIZ. Largely a technical assistance program, it focuses on three main areas: policy, information and capacity and finance. With a budget of 9.2 million EUR, the program will support CCREEE as well as CSERMS. In terms of financing, it will explore innovative financing models and packages, on information and capacity it will support learning platforms, public awareness, knowledge exchange and technology transfer. In terms of policy, it will support regulatory reform, quality regional infrastructure, institutional effectiveness and certification. There is expected to be a TAPSEC workshop early in 2018, co-chaired with CARIFORUM; the project includes the Dominican Republic. In Barbados, the national focal point will be the Division of Energy and Telecommunications (DoET). The project targets governments, electric utilities, the RE/EE private sector and regional finance actors. The project is a partnership between the *European Union and CARIFORUM*.

Grid Modernization and Energy Storage

In October 2017, the *Caribbean Development Bank* approved a 350,000 USD grant to assist electric utilities and relevant stakeholders across the region to develop, plan and design energy storage and grid modernization solutions that could accelerate the Caribbean's shift to clean energy⁶. Focused largely on technical assistance and funded through the Canadian Support to the Energy Sector in the Caribbean (CSES-C) Fund, it is expected to help six (6) of the Bank's borrowing member countries. The CSEC-C fund has an overall budget of 5 million CAD (approximately USD 3,820,633.52) and will be implemented for four (4) years from 2016-2020. Broader goals include supporting governments to meet their renewable energy targets and to advance the transition to clean energy.

CARICOM activities and the development of CCREEE

The Energy Unit at CARICOM has been spearheading a number of initiatives within the Caribbean. These activities are aimed at promoting the general movement towards a regional energy sector primarily based on renewable energy technology. CARICOM has produced a regional energy policy highlighting some of the priorities that they expect individual countries to build their own policies and strategies around. Below are the goals of the CARICOM Energy Policy.

Goal 1: CARICOM citizens are well aware of the importance of energy conservation, use energy wisely and continuously pursue opportunities for improving their use of energy, with key economic sectors embracing eco-efficiency.

Goal 2: Member States have modern energy infrastructure with clean and secure generation capacity, ensuring that energy supplies are reliably and affordably transported to homes, communities and the productive sectors on a sustainable basis.

Goal 3: The Region is a global example for renewable energy use, providing secure intra-regional energy supplies at internationally competitive prices and a small carbon footprint, capable of supporting medium- and long- term economic growth, social development and environmental sustainability.

Goal 4: Countries have a well-defined and established governance, institutional, legal and regulatory framework to support the future developments in the energy sector, underpinned by high levels of consultation and citizen participation in this sector.

Their aim is to ensure that the right environment for sustainable energy development is created through:

- Policy frameworks- Regulation and Incentives
- Technical assistance- Technology and Capacity
- Financial support- CapEx and OpEx

⁶ <https://caribbeannewsservice.com/now/barbados-cdb-approves-funding-to-advance-grid-modernisation-and-energy-storage-in-the-caribbean/>

The CARICOM Unit has been pursuing these goals through the Caribbean Sustainable Energy Roadmap CSERMS program. The strategy includes working with regional electric utilities to develop new economic models, which allow for more open markets and a greater degree of competition.

It is expected that these activities will go into the development of CCREEE, which will focus specifically on the areas of renewable energy and energy efficiency development in the Caribbean. CCREEE and the CARICOM Energy Unit will work in close collaboration towards attaining the goals of CSERMS.

3.3 International

UNIDO Approach to cluster development⁷

The underlying concern of UNIDO's cluster development approach is the promotion of private sector based 'pro-poor' growth, defined as a pattern of economic growth that creates opportunities for the poor, and generates the conditions for them to take advantage of those opportunities.

Over the past 20 years, UNIDO has been involved in the implementation of cluster and network development projects in 23 countries. Based on lessons learned from theory and practice, UNIDO cluster initiatives provide technical assistance designed to foster the undertaking of joint actions among firms and support institutions.

The rationale behind this approach rests in the fact that joint actions allow cluster stakeholders to overcome limitations and reap opportunities that are beyond their individual reach.

Supported by the Swiss Agency for Development and Cooperation (SDC), UNIDO has established an interactive platform⁸ to familiarize the interested reader with the main elements of the UNIDO Approach to Cluster Development through the detailed presentation of training modules.

Green/Eco/Cleantech clusters

CLEAN – clean-tech cluster - <https://www.cleanccluster.dk/>

The Danish CLEAN is a horizontally integrated cluster that formalises networking and hence facilitates and develops projects that ensure business growth for its members whilst contributing to a greener planet. By connecting its members, innovative and energy efficient solutions are being developed and implemented. CLEAN considers itself as the one-stop entry to Danish Cleantech. It has about 164+ members from cleantech researchers, businesses, and public authorities. Over fifty (50) projects have been completed by its members.

GreenTechCluster - <https://www.greentech.at>

The Austrian GreenTechCluster in the Green Tech Valley brands itself as the global hotspot for innovative energy and environmental technologies. It is a horizontally integrated cluster that formalises networking and provides support for R&D project development, assessment of technology trends, market opportunities, and establishing global contacts. It is a public-private partnership, both in ownership and funding with the cluster bringing together 200 companies; the cluster has ten (10) employees.

Global Cleantech Innovation Program (GCIP)⁹

The GCIP promotes an innovation and entrepreneurship ecosystem by identifying and nurturing cleantech innovators and entrepreneurs; building capacity within national institutions and partner organizations for the sustainable implementation of the cleantech ecosystem and accelerator approach supporting and working with national policy makers to strengthen the supportive policy framework for SMEs and entrepreneurs.

Private Financing Advisory Network (PFAN) - <http://pfan.net/>

Beginning in 2016, PFAN has been hosted and managed by the UNIDO and the Renewable Energy and Energy Efficiency Partnership (REEEP). PFAN offers free coaching and matching of investors to promising climate and clean energy businesses in low- and middle-income countries. PFAN manages an extensive pipeline of investment-ready projects, and

⁷ http://backonline.apswiss.ch/6001/cluster_approach_print.pdf

⁸ <http://www.clustersfordevelopment.org/>

⁹ <http://www.unido.org/environment/o591190/climate-policies-and-networks/global-cleantech-innovation-programme.html>

has leveraged over USD 1.2 billion in financing for those projects since its founding in 2006. For this project PFAN can serve as a partner and service providers to cluster members and entrepreneurs coming out of the start-up support.

Climate Innovation Centre Caribbean (CIC-C) - <http://www.caribbeancic.org/>

Based in Jamaica, with a regional portfolio, the CIC-C aims to be the main enabler for Green Tech Entrepreneurs' entry into global markets while creating a cleaner and safer environment through innovation in the Caribbean. Focusing on the area of Technology Commercialization, Market Development, Mentoring and Training, and Incubation, the CIC-C focuses largely on climate-related issues. Its overall mission is to "develop a vibrant cleantech ecosystem in the Caribbean and to provide access to space, resources, and funding to empower start-ups and businesses to expand while developing innovative solutions to climate change", an approach aligned to the ecosystem approach also being proposed in the SET cluster concept for Barbados. Launched in 2013 as a Consortium jointly managed by two leading scientific institutions in the Caribbean, the Scientific Research Council (SRC) based in Kingston, Jamaica and the Caribbean Industrial Research Institute (CARIRI) located in Trinidad and Tobago, it is part of infoDev's Climate Technology Program (CTP). Thematically, the Centre is active in (a) water management (b) sustainable agriculture (c) energy efficiency (d) solar energy and (e) resource use efficiency – areas also shared largely with the SET project. Providing technology-enabled business development services, networking, mentoring and training programs, the CIC-C employs a 'hubs and spoke' model to achieve its objectives. Supported by the Government of Canada, the World Bank and other institutions, it also has a strong network including other CICs Centres world-wide. So far, it has more than 700 clients, has created more than 32 new jobs, and trained more than 300 entrepreneurs¹⁰.

Climate KIC - <http://www.climate-kic.org>

Climate KIC is Europe's largest public-private innovation partnership focused on climate change, consisting of dynamic companies, the best academic institutions and the public sector. Climate-KIC is one of three Knowledge and Innovation Communities (KICs) created in 2010 by the European Institute of Innovation and Technology (EIT). The EIT is an EU body whose mission is to create sustainable growth. Climate-KIC supports this mission by addressing climate change mitigation and adaptation. Climate-KIC integrates education, entrepreneurship and innovation resulting in connected, creative transformation of knowledge and ideas into economically viable products or services that help to mitigate climate change.

Climate-KIC has national centres in most of the EU member states and several innovation hubs in the countries involved. The platform attempts to accelerate the development from an idea to the market through existing businesses, new joint ventures and spin-off companies by employing different initiatives and programmes.

Cases of existing technology park models

There are several models for a park or estate type of cluster. Those most relevant to this project focus on the following:

1. industry involvement and value creation
2. demonstration and marketing
3. research– knowledge

Examples:

@1: OSTIM in Turkey - The OSTIM Industrial Zone (Ortodogu Sanayi ve Ticaret Merkezi, OSTIM) is a large industrial park in Ankara, Turkey aimed at SMEs. OSTIM has approximately 5,000 companies in eight main sectors and 50,000 employees over an area of 5 million square metres, it is Turkey's largest industrial production site and was established in the mid-1970s. <http://www.ostim.org.tr/>

@2: Blaue Lagune, Austria - The Blaue Lagune (Blue Lagoon) is Europe's largest park for pre-fabricated homes. On 74,000 m² in the south of Vienna, over 100 suppliers present their products and services continuously to about 150,000 visitors per year. It is a continuous smart expo where pre-fab houses are presented, using different themes and with specific consulting services for soon-to-be home owners. Visitors and clients are given the opportunity to inform themselves about construction, refurbishment/renovation, modern living, smart buildings and sustainable energy. <https://www.blauelagune.at/>

@3: Güssing, Austria

¹⁰ <http://www.caribbeancic.org/impact>

From the 1990s Güssing has developed into a trend-setting energy region through a comprehensive energy-efficiency programme (thermal insulation, use of LEDs) and the broad implementation of renewable energy sources (e. g. district heating, biofuel, biogas, gasification, and photovoltaics) to generate heat and electricity. It is attracting great attention internationally as a leading environmentally-friendly region with more than 30 demonstration facilities.

One of the reasons for success is the close links and cooperation between industry, equipment suppliers and research institutions. After the founding of the European Centre for Renewable Energy (EEE) in 2002, Güssing became a research location with a strong European reputation. In 2009 the research centre “Technikum” that had a focus on biomass gasification and synthetic fuels was opened as part of the COMET programme. The Technikum in Güssing is one of several locations for the “Bioenergy 2020+” competence centre, where, amongst others, the Vienna University of Technology, Graz University of Technology and Joanneum Research are involved.

4 Review of existing policy developments at local and regional level

4.1 National

Barbados National Energy Policy (BNEP 2017-2037)

This policy document was completed in October 2017 and publicly launched in November 2017. The policy was designed to determine general direction for the sector in broad terms, dealing with both renewable and fossil fuel-based energy. The policy was developed using a multi-criteria approach and employed extensive consultations with stakeholders across many sectors. The policy outlines a number of visionary goals around identified core values which include the level of entrepreneurship and the level of collaboration necessary to realize and surpass existing targets. Goals in the Barbados National Energy Policy relating to ‘entrepreneurship’ and ‘collaboration’, have particular relevance to the activities identified in determining the feasibility of the platform and cluster concept for Barbados.

Barbados Income Tax Act

The 2013 BITA, also allows deductions of the costs of training in renewable energy and energy efficient systems for individual tax payers and for minors and young adult students who are under 25 years old and unemployed. There are also deductions for some training available in RE/EE systems that is approved by the Barbados Accreditation Council¹¹. Section 37I, (1) and (2) also allow for a developer, manufacturer and installer of RE systems and EE products to benefit from an income tax holiday of ten years.

Electric Light and Power Act (ELPA)

The ELPA was established as an amendment in 2015, to replace the previous Act which dated to back to 1899. The revisions updated provisions relating to the supply and use of electricity, promotes the use of renewable energy sources as well as emphasizes the need for security and reliability of the supply of electricity and supports efforts to reduce the 800 million BDD fuel import bill of which 50 % is used to generate electricity. It makes provision for Independent Power Producers (IPP) and the Barbados Light and Power Company (BL&P) to supply electricity from RE sources.

4.2 Caribbean

Resilience is now an important watchword for development in the Caribbean and increasingly also in the energy sector. The 2017 Caribbean Renewable Energy Forum (CREF) highlighted the importance of infrastructure resilience and the fact that the Caribbean had shifted from being a “What If” to a “What Next” region. Hurricane damage to St. Maarten alone is estimated to be about 2 billion USD by UNECLAC, with associated infrastructure damage more than 500 million USD.

¹¹

[https://www.barbadosparliament.com/htmlarea/uploaded/File/Bills/2013/Income%20Tax%20\(Amendment\)%20Act,%202013..pdf](https://www.barbadosparliament.com/htmlarea/uploaded/File/Bills/2013/Income%20Tax%20(Amendment)%20Act,%202013..pdf)

In terms of impact on the energy sector, the storms of 2017 have spurred a multibillion dollar focus on battery-pack grids¹² as Barbuda, Dominica, Puerto Rico, Tortola and St Croix all experienced significant delays in energy and power supply recovery and the reconstruction of critical infrastructure. In the context of climate and hurricane resilience, which are the main drivers behind this momentum, a 1 million resilient homes concept has been proposed. A pledging Conference for Caribbean recovery held in late November garnered 2 billion USD in support and includes commitments from Canada (100 million USD over 5 years) and the EU (300 million Euro) in the name of resilient development.

The proposed **1 million resilient homes** with improved energy performance initiative will focus on both power generation and protection. Protection measures will focus on resilient roof design and construction, while power generation includes energy production, grid independence and business continuity and recovery solutions. Given that one of the significant concerns is the undue burden that vulnerability places on the poor and on public budgets and systems, risk transfer and sharing mechanisms such as insurance are also critical to building more systemic resilience at all levels in a small island developing state like Barbados. Remaining questions to be solved via the cluster and collaborative innovation include technology types, affordability, achieving a balance between systems, sectors and individuals and the role of certification in guaranteeing quality and performance.

4.3 Global

The overall scope of the cluster concept also responds to several Sustainable Development Goals (SDG), principally **SDG 7** – ensure access to affordable, reliable, sustainable and modern energy for all; **SDG 9** – build resilient infrastructure, promote sustainable and inclusive industrialization and foster innovation; **SDG 12** – ensure sustainable consumption and production patterns; **SDG 13** – take urgent action to combat climate change and its effects. Indirectly, the project has implications for **SDG 1** (end poverty in all its forms everywhere) particularly target 1.5 to “By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters”¹³, **SDG 5** (achieve gender equality and empower all women and girls), particularly target 5.5 to “Ensure women’s full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life” and **SDG 8** (promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all), particularly targets **8.2** “achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labor-intensive sectors” and **8.3** “promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services”.

5 Stakeholder analysis

The stakeholder profile is wide and diverse and includes individuals, companies from start-ups to large scale multinationals, institutions, associations, public sector actors, development partners and regional organizations. Given experiences of the past and the nature of this industrialization concept, a depth of inputs, expertise and knowledge are needed as well as a rich network to ensure that technical and technological excellence go hand-in-hand with awareness, advocacy, promotion/marketing and behavior change. The resilience challenge which underpins the concept requires an inclusive approach and one adaptive and flexible enough to confront challenges and opportunities in the long-term.

5.1 Private sector analysis

5.1.1 Specific examples

For the sake of brevity, only the most relevant key stakeholders and initiatives of the private sector are described in the following. A wider and more general description of the private sector stakeholders is available in the Market Assessment

¹²<https://www.bloomberg.com/news/articles/2017-10-03/storms-unleash-22-billion-in-spending-for-battery-backed-grids>

¹³<https://sustainabledevelopment.un.org/topics/sustainabledevelopmentgoals>

Report, which is one of the supporting documents for the GEF CEO Endorsement request and has been prepared in parallel to this document.

BREA- GIZ Resilience with Insurance

The Barbados Renewable Energy Association and GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) which provides services in the field of international development cooperation are partnering on the Integrated Climate Risk Management (ICRM) to the Barbados Renewable Energy Sector project¹⁴. The initiative is also expected to include Advancing Climate Risk Insurance Plus (Acriplus) and will promote more opportunity for policy holders to reduce their risk profile and allow for more management of social risk. The project focuses on residual risk, risk transfer and sharing mechanisms such as insurance.

One workshop has already been held in October 2017 and is expected to inform the develop a supporting framework, which encourages the growth of the local renewable energy sector in Barbados as well as a Climate Change Risk Management Road Map for the Renewable Energy Sector. The project engages stakeholders from the financial, insurance and energy sectors. Activities are expected to continue into 2018 and include climate vulnerability assessments for the RE sector, enforcement of building codes, climate modelling, development of risk transfer mechanisms including micro-insurance, training and capacity building, market assessments for confirmed customer segments that would have an interest in a financial risk management instrument.¹⁵ At least three (3) more workshops are expected to be held in 2018¹⁶.

Figure 2: Example of a locally manufactured LED by Caribbean LED lighting (left), Electric vehicles at a charging station of MEGAPOWER (center), battery pack of reused standard Li-Ion cells by Aceleron (right)



MEGAPOWER Ltd

MEGAPOWER ¹⁷ is a privately-owned company, with a female founder and CEO. The company is four years old and promotes and sells electric vehicles (EV) powered by renewables. It links its sale and maintenance of EVs to the expansion of charging facilities including rooftop solar PV. MEGAPOWER current manages a solar carport, which can charge eight vehicles, at Regus in Welches and has also outfitted the USA Embassy with a 20 kW wind turbine. They have positioned themselves as Medium Scale Wind Turbine installers with unit capacities ranging from 20-100 kW.

¹⁴<http://brea.bb/the-brea-giz-funded-integrated-climate-risk-management-workshop-for-the-insurance-and-financial-sector/>

¹⁵<http://brea.bb/wp-content/uploads/2017/10/A-Scoping-Research-Study-on-the-Gap-Analysis-of-the-Climate-Change-Risk-Management-Road-Map-on-Renewable-Energy-in-Barbados.pdf>

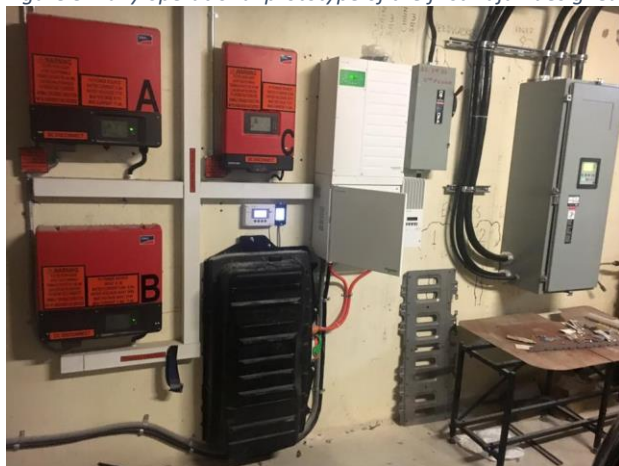
¹⁶<http://brea.bb/wp-content/uploads/2017/10/Applying-Integrated-Climate-Risk-Management-on-the-Renewable-Energy-Sector-in-Barbados-Power-Point-Presentation.pdf>

¹⁷ <http://www.megapower365.com/>

So far, MEGAPOWER has sold 220 electric vehicles and makes annually about 2 million BBD (approximately USD 1 million) with growth expected to double in the coming year. The business expects to continue to flourish as interest in EV increases. Barbados has one of the densest road networks in the hemisphere and the motivation for MEGAPOWER has been stated as 100 % environmental. The business is currently active in other countries beyond Barbados: Antigua, Grenada, St. Vincent and the Grenadines, Dominica, the Bahamas, Turks and Caicos and Trinidad and Tobago. Opportunities for more market niche areas include public service vehicles and fleets, smart-grid technology and battery storage and battery repurposing.

The area of battery re-purposing is a promising and developing area including the retrofitting of golf carts for the Barbados Golf Club and an emerging partnership with Acleron Ltd. One of the biggest costs post-purchase of the EV is battery replacement and halving that cost would go a long way to making EV more affordable to the average Barbadian consumer.

Figure 3: Fully operational prototype of the first Bajan designed, manufactured and tested local PV storage solution by MEGAPOWER.



Acleron Ltd

Acleron Ltd¹⁸ is cofounded by a Barbadian and is a cleantech start-up company seeking to revolutionize access to low-cost energy storage. It provides an alternative to lithium ion and lead acid batteries and provides two main services: testing and grading of batteries for tests and grading of batteries for reuse. Their activities help to reduce the waste battery burden on battery sorters/collectors; and offer a modular battery assembly hardware (patent pending) that allows for the serviceable battery concept. At the end of 2017, Acleron established a Barbadian subsidiary and applied for funding from several international facilities. Acleron and MEGAPOWER are involved in a close collaborative effort on battery storage/after-use options particularly for EV batteries.

Caribbean LED Lighting

Caribbean LED Lighting¹⁹ or CLL is based in Barbados and has been operational since 2011. Its primary activity is light manufacturing/assembly of commercial, industrial and residential LED lighting. As regional specialist in LED lighting they also export to 16 countries. They have experienced consistent growth and they are considered one of the fastest growing companies in the Caribbean with their floor space doubling in 2013. CLL has offices and staff based in St. Lucia and distributors in Trinidad & Tobago, St. Vincent, Antigua, Guyana, St. Kitts & Nevis, Grenada, Turks & Caicos, Dominica and Jamaica. In 2013, they also won the Compete Caribbean Innovation Award for their off-grid renewable energy (RE) system called WinSun, the first time that a Barbadian company had ever done so. CLL also offers services such as comprehensive energy audits with LEED practitioners, lighting audit/surveys and environmental protection in the form of secure disposal of fluorescent lights. Their clients include many private sector actors, statutory bodies as well as development partners such as IDB and UNDP.

¹⁸ <https://www.aceleronltd.com/>

¹⁹ <http://caribbeanledlighting.com/>

5.1.2 General aspects

Exploring new technologies and new markets

In addition to the specific projects discussed above, companies in the sustainable energy business continue, in many cases, to explore new markets in energy supply. Williams Industries continues to pursue large-scale developments of up to 150 kW, but desires to get into the business of utility scale photovoltaics. The national utility Barbados Light & Power have signaled their intention to go further into renewable energy through their development of a 10 MW solar PV farm in St. Lucy. They are also aiming to invest in utility scale (5 MW) battery storage in order to be able to integrate a greater percentage of intermittent renewable energy sources into the grid.

With MEGAPOWER and the development of more EVs for transport, the public utility has the opportunity to also extend its involvement into this market and be a facilitator for the battery technology that is most appropriate for grid connection. This expansion of the role of the electric utility combined with the activities of MEGAPOWER and Aceleron above can form a nucleus that could be central to the cluster model being developed.

On the demand/affordability side, consideration of the limited space in the current context cannot be ignored and moreover the impact this has and can have on household capacity to spend or to take risks. Although there is labor supply, the capacity gaps to be bridged are not insignificant nor are the gaps in certification and standardization easily resolved in this kind of fluid market space. A building code will play a critical role as will engagement with architects, engineers and builders in linking design, application and affordability and also in facilitating the transformation from demonstration to widespread implementation.

Seeking regional and international partners

It is the goal of many of the stakeholders in sustainable energy businesses, most notably Williams Industries, to maintain as much of the ownership of projects in Barbados for Barbadians. However, even as this is sought, many businesses are seeking partnerships within the region and internationally to maximise their potential.

For example, MEGAPOWER has set up a subsidiary in Antigua (MEGAPOWER Antigua). They are also seeking partners in a number of other Caribbean islands as listed above. Internationally, MEGAPOWER has sought a license to represent international companies in the set-up of infrastructure for charging, using the Plugshare platform to facilitate the process. Caribbean LED Lighting, although assembling LED lighting in Barbados while it imports component and production licenses from countries as diverse as Japan, UK, Mexico and the US. It has opened operations in St. Lucia as well and while there is no assembly done there, it serves as a market for exporting the finished product.

Following policy directions and national priorities

In seeking to collaborate with government in developing policies for the sector, companies involved in the industry have a chance to develop businesses which address priorities that are considered of broad national importance. One example of this is the interest of MEGAPOWER in helping government in developing EVs for public transport.

Government's interest in distributing LEDs to residents through the IDB SMART fund has made an impact on a number of selected consumers. Caribbean LED Lighting has played a key role in making the LED technology available.

With the recent development of the Barbados National Energy Policy, players in the sustainable energy market will also need to be involved in directing activities of the Policy's implementation plan that will soon follow. The development of a platform, working groups and potential clusters can be viewed as part of the Implementation plan activities under the umbrella of "Entrepreneurship".

Working with educational institutions to improve capacity

It has generally been noted that there is a gap between the expertise and skills produced from educational institutions in Barbados and the actual needs of the market. Several businesses are attempting to improve the situation by providing internships, particularly for students of the Samuel Jackman Prescod Institute of Technology (SJPI). However there have also been partnerships involving projects developed at the Barbados Community College (BCC) and University of West Indies (UWI) and there have been useful inputs into courses offered by TVET institutes.

Companies such as Williams Ind., BL&P, MEGAPOWER and Caribbean LED Lighting have offered training opportunities for students. As collaboration increases across the cluster, it is expected that there will be more opportunity for information sharing and capacity development.

Similarly, the Fab Lab concept which is being explored by the Ministry of Education in its initial discovery and piloting phase, also engages broadly with the education sector including the SJPI.

In the context of capacity, there is still a generally observed gender differentiation in the sector in terms of technical and other services as well as also in the engagement on the entrepreneurship side. Discussions with MEGAPOWER for example shows a willingness to engage more directly on mechanisms to ensuring equal opportunities to train and to be employed on the technical side, which will in turn need to be linked to service delivery.

Working with standardization institutions to ensure consistent quality of goods and services

Equipment labelling standards have been implemented, however there is additional standards related work that needs to be completed. Further standards are needed for:

- + Design, installation, testing and commissioning of RE technology
- + RE standards specific to artisans and engineers
- + Imported RE and EE equipment. Equipment needs to be suitable for the local market
- + Disposal of RE and EE equipment. E.g. compact fluorescent lights (CFL), batteries
- + Enforcement by regulatory agencies. E.g. Customs and Excise

The commercial segment in sustainable energy sectors have raised their concerns about not having specific standards for products or services within their industry. Yet, even in the area of solar water heaters, where the industry has existed for over 40 years there are no set local or regional standards. There are also no regional standards for other energy efficient appliances or other renewable energy equipment. Although in the case of solar thermal, the unavailability of specific standards did not hamper the market from sustainable growth, nor has the market been overrun by low-quality imports. This suggest that standards and certification schemes need to be developed very carefully in order to not to inhibit further innovation and the introduction of new technologies.

It's more important to note that there are also no certification standards for professionals in the sustainable energy field. This makes it difficult to guarantee standards in the industry in terms of installation, maintenance and other areas. However, there are activities under way to change this with assistance from BREA. Local organizations are working with BREA to determine appropriate standards and international bodies who could be used to provide benchmarks for such standards and certifications. CCREEE could also play a role in combining different country best practices to develop a regional standard.

Seeking Independent Power Producer agreements that are favorable to commercial activities

In the early days of the implementation of the Renewable Energy Rider (RER)²⁰, there was significant investment by companies in installing renewable energy systems in the country, especially in the area of solar PVs. The RER was tied to the fuel clause adjustment and given that the price of oil at that time was high, the price for selling electricity to the grid through renewable energy was attractive. However, over the last year the decline in oil prices has reduced the investment and many have left the market.

Members of the industry and the local electric utility have made representation to the Fair Trading Commission (FTC), and a temporary rate of 41.6 cents/ kWh has been set by the FTC. One of the aspects that has been emphasized by those in the private sector is the need for certainty in the rates for selling electricity to the grid. The set of a rate that does not fluctuate is seen by those in the sector as a step in the right direction, but the fact that the rate set is only for a limited time has still led to a lack of confidence for members in the sector.

Working with government to remove regulatory barriers to business

In a similar manner to the activities to lobby for better rates for Independent Power Producers (IPP), the business sector has also been involved through BREA in pushing for legislation that is favorable to the development of renewable energy businesses. Some tax concessions for importing of energy appliances from overseas have inhibited development of local markets.

This has been observed particularly in the hotel industry, where concessions on electrical heaters have actually led some establishments to change from using solar water heaters back to using electric heaters. The stipulations of policies for integration to the grid such as 'buy all- sell all' have also been discussed. The lobbying role of BREA and the level of discussion and interaction on the development of the platform could improve the situation in terms of legislative and regulatory frameworks for business.

Small scale – grass roots developments

With no or little support (e.g. from the GEF UNDP SGP) many small-scale developments on SET take place in Barbados. Such grass roots developments include exploring new markets (e.g. PV on fisher boats), local manufacturing (e.g. micro-

²⁰ <https://www.blpc.com.bb/bus-reg/bus-energyrider.html>

wind-turbines) and combining different technologies for new market segments (e.g. fully air-conditioned green houses to grow high value crops, powered by green tech).

Figure 4: Examples of grass roots developments: fishing boat with PV module, small scale wind turbine, green houses with automated cooling and humidity control.



Seeking opportunities to collaborate on platforms

One of the principal goals in the set-up of this cluster, is to increase collaboration and interaction among players across the sector. Throughout the discussions and the bilateral meetings, the members of the private sector have agreed that this is a laudable goal. There are already areas of collaboration that have begun even as the cluster structure is in the process of being finalized and formalized. The agreement for collaboration between MEGAPOWER and Acleron is one such example.

5.1.3 Needs and expectations

In order for the cluster to work effectively for the benefit of the private sector there are a few conditions that will need to be in place. Below are some of the key issues that will need to be addressed.

Consistent clear policy, legislation and regulations

This is an important piece of the puzzle. Throughout the discussions, many players in established markets and potential players in new and emerging ones have expressed hesitancy because of the lack of certainty that current policies and regulations provide or the vagueness that exists when transitions occur. While the government's efforts in developing a policy that provides direction for the industry up to 2037 has helped to some extent, there is still a lot of work to be done to make sure that emerging legislation and regulation is conducive to the attainment of the vision and visionary goals set out.

Contradictions between existing policies and fiscal disincentives and tax regimes that increase the cost of doing business could lead to more people leaving the market and a lack of interest of others taking the risk and entering. Still, at the same time it is recognized 100 % certainty is neither viable nor desirable nor is this guaranteed anywhere else. It is the same desire for certainty that has led to the persistence of the concessions to the hotel industry that have been difficult to shift, change or ameliorate.

Access to funding and co-financing opportunities

Given the nature of sustainable energy technologies, they often require significant funding at start-up. Many businesses in the current economic climate are unable to finance large projects and this limits the extent to which SMEs can be involved in the market.

Opportunities for funding and co-financing can help such businesses get started and thrive when they have ideas that are economically viable. BREA is in a partnership with GIZ for technical cooperation. The typical mode of accessing funding for European clusters is that at least three (3) companies apply for funding (regional, national, and international) in the form of co-operation projects. Such projects need to be organizationally supported by the cluster. More of these opportunities, will help competition and develop markets throughout the sector.

Need for a physical space for cluster/ innovation hub

The innovation hub that is being proposed here can help both new and established sustainable energy companies. Given the low level of slack resources that companies have to invest or reinvest in research, it is challenging for companies to remain at the cutting edge of technology. Working in an environment where there is a common space or platform for information sharing can ensure that businesses that start on the innovation path don't become stagnant. For the hub to

work effectively, there will need to be sound management to ensure that the communication works in a manner that benefits all the members whether they are larger players or small emerging participants.

5.1.4 Fields of possible contribution

If the platform, cluster and hub operate in the manner envisaged they should be able to contribute to innovation in many key sectors, these include PV, energy efficiency, storage technology, hurricane resistant construction and biofuels.

Key stakeholders of the private sector are willing to contribute at different levels – ranging from being mentors to start-up businesses, angel investors, sharing testing equipment in the hub, to being involved in full-fledged co-operation projects.

5.2 Government

Setting of policies

The GoB has been working on policies in a number of different sectors. The Barbados National Energy Policy has recently been approved by Cabinet but there are a number of other policies that are also in the process of being developed.

These include the following:

- + Industrial Policy
- + National Quality Policy
- + Education Strategy
- + Agricultural Policy
- + Tourism Master Plan
- + National Development Plan
- + Transport Plan

These Policies and strategic plans will all play a part in giving guidance for activities in many of the areas that are cross cutting with energy development. Implementation Plans will follow that will outline the strategy for attaining the goals and sector targets in five-year increments.

Administering funding e.g. SMART Fund

Funding and grants provided to Barbados need to be managed and administered by government agencies. The IDB SMART Fund, for example, has been administered by the DoET.

Assistance in coordination of activities and events

Government plays an important role in "steering" rather than "driving" the process particularly in its unique capacity to bring different groups together and its access to strategic information at many levels. The role of the MIICs will also be important in ensuring that all three dimensions of sustainable development (economic, social and environmental) are treated equally and that the proposed system makes the connection between the three aspects in effective and innovative ways. The areas in which the government or BREA invests its time should have strategic value in translation of the mission and vision into reality but also in ensuring that key opportunities are not missed. For example, in this project it is important to engage with the Smart Fund or the ICRM/ACRI plus initiative funded by GIZ. Moreover, the government will play a critical role in policy convergence and coherence including leveraging the strengths of key Ministries/Departments/Divisions - Energy, Environment, Education/Science and Technology, Labor, Transport, Housing and Town Planning.

A recent example of collaboration between the Government and private sector is the RE roadshow (Road Crawl Event 2017²¹) where BREA, DoET and BL&P collaborated on showing the possibilities of RE and EV technologies to consumers.

Needs and expectations

There are some very specific needs and expectations of the government if this platform and cluster development is to be deemed a success. Important for them as a stakeholder, will be the wider areas of socio-economic development, including general economic development of citizens in the country. Some of these needs are specified below.

Development of national policy goals and targets

²¹ <http://brea.bb/the-brea-and-blp-road-crawl-event-2017/>

The government in its policy setting activities sets out the framework for the sector given the inputs from the various stakeholders. Although the policy itself is helpful to the parties involved, the real impact is made at the planning and implementation stages.

When the private sector is involved in setting clear targets and indicators that move the national agenda forward, the government as a whole benefits and these new indicators and targets can then be used to inform future iterations of the policy.

Open competition with maximum participation in cluster

One of the principle goals of government policy is to extend and expand the number of persons that are involved in the sustainable energy business in Barbados. A cluster arrangement that fosters that level of participation is important to the government. Diversity in terms of age, race, gender and level of income would also be beneficial in terms of achieving a society where opportunities are available to as wide a range of people as possible, and where economic benefits are shared across the spectrum as a result.

Development of local capacity and trained personnel

In order to ensure an economy based on renewable energy business that is sustainable in the long term, it is essential that the number and level of educated and trained persons in energy and related areas is increased. At the moment, there is a lack of trained persons in many areas critical to sustainable energy and SET.

If programs at the UWI, BCC and SJPI can be implemented in a way that directly meets the changing market needs, there will be an emerging workforce more able to fulfil local needs. This will reduce dependence on foreign labor in undertaking major projects.

Saving of foreign exchange

From a macro-economic perspective, another important element in developing this platform and cluster is to save overall foreign exchange. This can be achieved if innovation and development of projects is done in Barbados rather than overseas, or if there is significant value added to the products through the activities that are undertaken within Barbados.

If the cluster is successful in developing products in that way, it will be a benefit to the national economy. Caribbean LED Lighting already claims that 70 % value is added in Barbados in assembling its lighting fixtures, even though all of the components are imported from overseas. There will need to be more products developed that have a similar value added if the cluster is to be successful.

General Improvements to the natural environment

One of the main duties of a government in any jurisdiction, is the protection of public goods, avoiding the 'Tragedy of the Commons'. The 'commons' generally refer to those resources that are not owned by any particular individual in the country, but that are shared by the community as a whole and are resources that fulfil basic human needs.

Protection of the natural environment is highly placed among the 'commons'. This includes aspects such as air, soil and water quality, and protection of the terrestrial and marine resources. Reduction of climate change impacts have become more prevalent. Renewable energy and energy efficient technologies will be the focus of this cluster. These technologies have the benefit of reducing environmental impacts and climate change. This is why in the cluster it is important to estimate the level of carbon dioxide reduction that can result from a particular innovation.

Fields of possible contributions

Government can lend support to innovation and the success of the cluster through the following activities

- + Training and capacity building
- + Awareness activities
- + Supporting NGOs e.g. BREa
- + Demonstration projects in government facilities
- + Fostering of local and green procurement
- + Regulatory framework to promote development
- + Testing and evaluation of systems and products
- + Protection of intellectual property

Providing in kind support

- + Government is involved in providing support to activities in a number of ways. In this case the provision of physical space for the technology space potentially through the BIDC as described below.

Facilitating collaboration

- + Government has also played a role in facilitating collaboration in the sector by allowing forums to be held with participants throughout the sector. These forums, workshops and other activities help to foster business relationships among persons in the sector with similar interests.

Barbados Investment and Development Corporation

The Barbados Investment and Development Corporation (BIDC) is a statutory body of the GoB with a focus on fostering the development of bold, innovative, dynamic and creative enterprises. BIDC's vision is to be the catalyst for developing innovative, productive and internationally competitive businesses.

BIDC's core services (and strategies) are:

- + Entrepreneurial Development (Assistance in establishing and expanding enterprises; and comprehensive SME support)
- + Export Development and Promotion (Export marketing and the development of export trade; liaising with overseas buyers and exporters of goods and services; exploration of business opportunities and co-operation)
- + Research and Information Services (Access to the latest market and business intelligence)
- + Property Development and Leasing (Provision of operating space on a rent or lease/purchase basis)

Dedicated signature programs are include:

- + Special Technical Assistance
- + Entrepreneurship through Education
- + Going Global
- + Business Incubation
- + Innovation

BIDC tries to support the local industry by bringing groups together in clusters where they are better able to produce for the international markets, in shared facilities that offer modern production processes and better structured factories. Over the last few years BIDC had cluster building activities for the following sectors:

1. furniture manufacture - 50 manufacturers, about 7 large ones
2. condiments cluster (pepper sauce, seasoning) –has been in the process of development for more than 4 years
3. apparel cluster –attempts to develop it for more than 4 years

BIDC has its office at the Bridgetown harbor that houses about 84 staff, 30 work on properties & finance, 15 on business support, research, design and 20 on export & business development. Funding for BIDCs operations is 60 % from MIICS and other central government and the remainder from private sector (rent/lease, rental of roof space, workshops, grants from donors, etc.).

BIDC is expected to play a fundamental role in implementation of the project and support of the cluster.

5.3 Academia

Educational institutions will have an important role to play within the cluster. Academic institutions in Barbados have had a reputation of being somewhat disconnected from businesses. In the development of the cluster it will be vital to ensure that the latest research within the academic institutions is made available to those actively seeking to improve technologies and facilitate business activities within the cluster. At the same time, there will need to be access of the academic institutions to the work done within the clusters in promotion of innovation. In Barbados, the main academic tertiary institution is UWI Cave Hill, however BCC also offers some degree level courses.

Developing training courses and curricula

Apart from teaching courses and making research available, it will be also important for academic institutions to play a role in developing curricula for tertiary level courses as well as other levels of education that can feed into the cluster.

Assistance in setting standards for certified personnel

In equipping various personnel to have the critical skills to participate in the cluster, the institutions will also have a part to play in setting the standards or certification criteria for professionals in new and emerging subsectors of the renewable energy market.

Information and expertise transfer within the cluster

Professionals that work within the university system or that are hired by the university to deliver courses in specialized areas should also be able to share their expertise within the cluster. Such professionals can often bring a perspective that may not be available within the sector on a day to day basis.

Training personnel

In the event that there are persons operating within the cluster that need training in a specific area such as business development, natural sciences or marketing, the university can provide short courses or seminars and have them open to people operating in the working groups or the cluster.

Administering degree courses

In cases where more intense training is needed the university can make short courses available and undergraduate or Master's level degrees in specialized areas.

Needs and expectations

Clear guidelines of industry needs

In order to develop courses and training that is effective for the work of the cluster, it will be necessary for the cluster to provide clear guidelines on the type of training that is needed so that the university can tailor the courses accordingly as well as to determine the potential target audience.

Funding for courses and access to experts to deliver courses

Access to funding to bring in experts if needed will be important to secure, as well as funding for any other training that may require additional facilities such as access to laboratories. Funding needs and resource sustainability concerns can also be ameliorated somewhat by also using telephony and video-conferencing facilities including Skype and Go-to-Meeting. Moreover, approaches such as combining capacity-building with other analytical activities can also be employed to maximize resources as well as the availability of experts.

Fields of possible contributions

Increased number and level of trained personnel, establishment of effective 'train the trainer' programs.

5.4 Development partners

Over the years, international funding agencies and development partners have been involved in providing loans, grant and technical assistance in a number of areas. Given the capital-intensive nature of many of the potential renewable energy technologies, there is often a special need for funding that can be also used to stimulate markets and industries in the sector.

The expectation is that as technologies mature, there will be less need for such assistance. Agencies that have been involved in developmental projects in Barbados and throughout the region include: GIZ, UNDP, CDB, IDB, UNIDO, CCCCC, GCF and the World Bank. These developmental partners have often been involved in co-financing projects, matching funds from other donor organizations. GIZ has been involved in such an arrangement recently with BREA.

Technology transfer

International agencies also have connections with a number of countries and technical institutions worldwide. These connections can be used to facilitate technology transfer between developed and developing countries as well as create and or expand market access. They can also enhance collaboration between countries that are similar or countries that have complimentary needs.

Needs and expectations

Economically viable projects that are appropriate for financing

It is important that the groundwork is done by persons working within the country and within the cluster. This way the projects that are considered for funding or support have a degree of economic sustainability, country ownership and developmental potential built in. This will also help to ensure that this new capacity can be nurtured and expanded at the local level, potentially leading to the development of core expertise as well as mentoring capacity.

Fields of possible contributions include

- + Economically and financially sustainable projects
- + Projects that lead to attainment of national and international climate change targets
- + Socially and environmentally sustainable projects

5.5 Key Barriers for a sustainable energy industry

In Barbados, innovation occurs largely in the private sector industry and technology start-ups although some innovation in the public sector, particularly on energy, has been documented including the transport system with electric vehicles that was designed and used for the Harrison's Cave tourism and natural heritage attraction. The sustainable energy industry in Barbados has recently started to organize itself through the Barbados Renewable Energy Association (BREA), but in general the degree of cooperation and collaboration of the stakeholders remains limited. This barrier was identified as a key one during discussions in the first stakeholder workshop and also at a number of the bilateral meetings, and often also called a cultural relic. Members, especially in industries where there is intense competition, felt uncomfortable about coming together to share information and ideas and potentially reveal important 'trade secrets'. This is in spite of the fact that there was also agreement that there were better overall benefits that could be accrued if people within the business worked together more closely.

It is based on that dilemma that persons within the sector coined the term 'co-opetition' in recognition of the fact that there would need to be co-operation developed within the framework of a competitive market. For this to be achieved there would need to be a greater level of trust developed among persons competing in various sustainable energy industries. Protection of intellectual property and patents could play a role in developing that trust and increase the confidence of new players entering the sustainable energy market. However, the solid foundation for co-opetition needs to be a formal network (platform) between SMEs, industrial clusters, national government ministries, academia, industrial associations (e.g. Barbados Investment Development Corporation, Barbados Chamber of Commerce and Industry, Barbados Manufacturers Association, Barbados Renewable Energy Association, Barbados Association of Energy Professionals), financing institutions, foundations, the diaspora and venture capitals within Barbados and overseas.

Businesses in Barbados - and particularly small businesses, which lack the access to international credit markets that some larger firms enjoy - find it difficult to access credit, despite the availability of funds in the financial system. Existing financing mechanisms of the Government to promote SMEs either do not include sustainable energy as a priority or are only focused on promoting renewable energy and energy efficiency investments rather than industrial up-grading, the creation of start-ups or the promotion of innovative business models, products and services. In this context, incentives for applied research and sustainable energy technology innovation need to be strengthened. Currently, there are no tailored instruments to systematically promote the cooperation of companies and applied research. In general, there was a perception among interviewees that traditional financial institutions do not provide financing for start-ups or R&D investments unless collateral is made available in the form of assets such as land, houses or patents. The reality is that the banking sector in Barbados is largely a "retail banking" sector with a focus on shorter term returns than long-term investments; there are no "development banking" structures in a real sense. This gap stymies the scale, depth and speed at which innovation and experimentation in Barbados can take place.

Innovation and entrepreneurial activities also need the right mix of education and training, research and development, applied science and technology, as well as financing. The promotion of sustainable energy markets requires training of many different stakeholders in different sectors on a variety of skills (e.g. plumbers, architects, engineers, financiers, policy makers, farmers, consultants). There is also the need for a comprehensive certification, qualification and accreditation framework for sustainable energy services and solutions.

The lack of local capacity has been repeatedly reported as the major bottleneck for the implementation of renewable energy and energy efficiency promotion programs in Barbados (e.g. by the IADB). Employment analysis suggests that 700 people would need special training (short or long term) so as to be prepared for the transition to a sustainable energy industry and its related services. The country is well known for its technical, vocational and academic institutions such as the University of the West Indies (UWI), Samuel Jackman Prescod Institute of Technology (SJPI) and the Barbados Community College (BCC), and it is clear that there is a vision within these institutions to create and strengthen the workforce in this field. However, it is commonly agreed that the level of expertise emerging is not enough to reach the scale of technological innovation that the private sector expects and needs. Greater investment in the sustainable energy

area will be required in the coming decades so as to ensure an increase in the number of people trained that can effectively engage in the private sector and the government.

Market expansion and industrialization are constrained also by limited niche market innovation and lack of attention to gender-specific needs particularly for niche sectors; and lack of knowledge about key incentives and tax breaks as well as important initiatives.

It will be critical for the platform/cluster as well as the more formal governance arrangement of the project to actively identify and prioritize activities and investments that can reverse, tackle or mitigate against the effects of these barriers. While there is a robust culture of innovation, it has been disparate and unconnected to a more strategic and formalized ecosystem focused on RE/EE. The networking mechanisms identified in section 6.1.2 as well as the specific activities of the cluster will be critical in countering the short and long-term effects of the identified barriers.

5.6 Conclusion of the stake holder analysis

5.6.1 Key recommendation for the focus of the cluster

Concluding the stakeholder consultation process, which is also reflected in the Market Assessment Report, the first level priority areas recommended for the cluster to focus on are those with the greatest synergies:

- + Energy from the roof (PV, wind, solar thermal...)
- + Resilient energy (battery, storage, inverters, charge controllers...)
- + Resilient (roofs) constructions (design, engineering...)
- + Electric vehicles (services, load management, light assembly...)
- + Associated enabling innovations and financing services. (ICT, forecast, smart phone apps...)

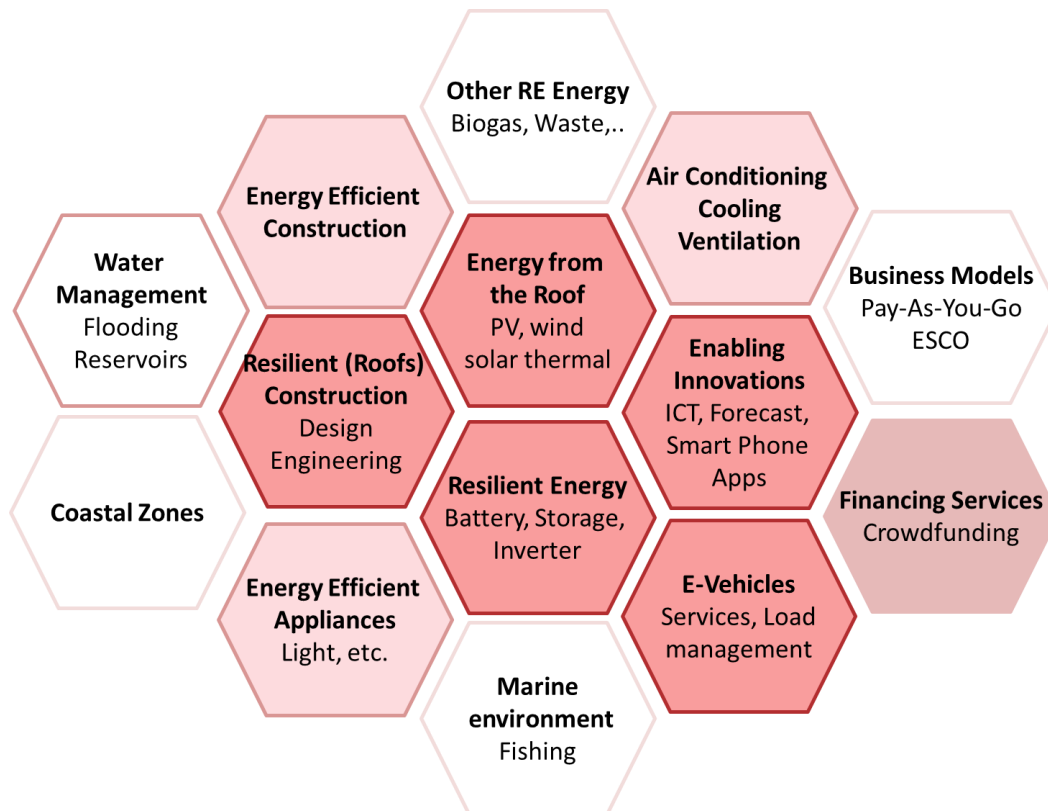
The second level priority areas are:

- + Energy efficient appliances (light, fans...)
- + Energy efficient construction (shading, insulation, thermal mass...)
- + Air conditioning, cooling and ventilation (solar cooling, automatization, smart controllers...)

It is also expected that linking the RE/EE industrialization concept to climate change adaptation will share risks, mobilize resources and deliver multipurpose/multi-benefit technological innovations that better meet the needs of the poor and vulnerable but also respond to the constraints inherent in small economies and small markets. Hence in the future areas of interest are likely to include other RE systems, water management, coastal zones, marine environment and other business models.

The following figure illustrates these priority areas with additional color coding for high priority areas.

Figure 5: Priority technology areas for the strategic platform and cluster (darker ones have the highest priority).



Along with the technologies identified the focus of the cluster should be on the following topics:

- + Marketing - moving from a Barbados idea to commercialization in the Caribbean
- + Fostering co-operation projects that have access to external funding
- + Start up support and a technology hub (makers space/fab lab) for innovation in physical space
- + Sharing of common business administration areas such as legal, financial, human resources, and staff qualifications
- + Standards and enforcement of pieces of legislation such as the building code

5.6.2 Recommendation of actions to be jointly undertaken by the stakeholders to attain collective efficiency gains

Some of the approaches identified in the validation workshop on mechanisms and during the working group sessions, specifically speak to ways to enhance and enable collective efficiency and collaborative innovation. These include finding ways for the various actors to buy-in to the concept and then contribute, champion and promote it. Breakdowns in communication and trust could be quite costly to a process such as this one and directly affect efficiency gains. Some of the proposed actions, which are driven by both efficiency and effectiveness concerns, include:

- + Leadership and leadership capacity
- + Enhancing effective communication within the cluster and to the external audience;
- + A robust understanding of the current fiscal, policy and tax landscape;
- + A communication line for decision-making;
- + A comprehensive approach with very clear focus and scope with a clear theory of change; and
- + Foresight and insight analysis linked to the innovation process

These will be bolstered by more technical endeavours including the design and funding of the platform and cluster infrastructure/ecosystem as well as the enabling of a community of practice approach focused on collaboration and co-opetition and primarily leveraging various capacities for multiple benefits. It is implied that the community involved in innovation in Barbados would be at the core of the success off the strategic platform.

Moreover, considerable support is expected to be provided in terms of communication, marketing and promotions and behavior change. One of the key value-added aspects of the cluster, platform and the collaborative innovation model which underpin them is making the connection between activities that are directly or indirectly tackling some of these barriers.

6 Proposed concept of the cluster

In this section, a concept or composition of a cluster is described that is deemed to be the most suitable and cost-effective design for the technology cluster/park. It is considered to be the most fitting to the needs, has a rather low start-up cost and is scalable and expandable with other components. Hence alternative concepts for the cluster have not been developed.

6.1 Proposed activities, interaction, and work flow definition

The proposed concept of the cluster has several areas elements with the following two most important ones:

1. Working groups
2. Communication and networking

The further ingredients are of high importance as well, but not so elementary for a cluster per se any more:

3. Start-up support
4. Makers space
5. Capacity building
6. Financial support

6.1.1 Working groups

As mentioned the working group is one of the most important elements of a cluster, it can also be called a sub-project or task²² (force). Working groups are formed by a smaller number of platform participants, who can go into depth on a particular topic. A working group can be formed based on a request by at least three (3) platform members and needs the approval of the cluster manager.

First, a working group usually tries to get a common understanding of a problem/baseline through research or other assessments. Next is the development of a strategy to solve the problems/issues on resource mobilization. That could lead to additional funding (co-operation projects funded by special grant schemes, or direct funding from donors, awards), linking up with Universities and strategic research partners or with other companies/sectors. The working group maintains/facilitates cooperation with regards to know-how, research, development, funding or other activities for as long as required. The members might develop solutions or products together as a working group, yet it is also possible that product/services are the sole responsibility of the participating companies (and their intellectual property).

Initial working groups could be elaborating energy from the roof (solar PV, ST, wind) and storing energy (electrical battery and inverter systems), construction, enabling innovations, marketing/export, and other areas where there is already both interest and some momentum or dynamic. Possible questions to be solved in the working groups:

- Design for electrical back up for different capacities and levels of affordability
- Special Caribbean home energy management system (cooling, security...)
- Design of combining roofs with mounting of solar equipment to make it stronger in the end
- Design of roofs that are better insulated and hence save on cooling demand
- Systematic resilience and individual capacity – both need to be addressed
- Design for special aspects of islands (marine environment, salt spray, shipping limitations...)

Later issues such as quality assurance including training, testing, standards, certification would be topics to be followed up on in working groups.

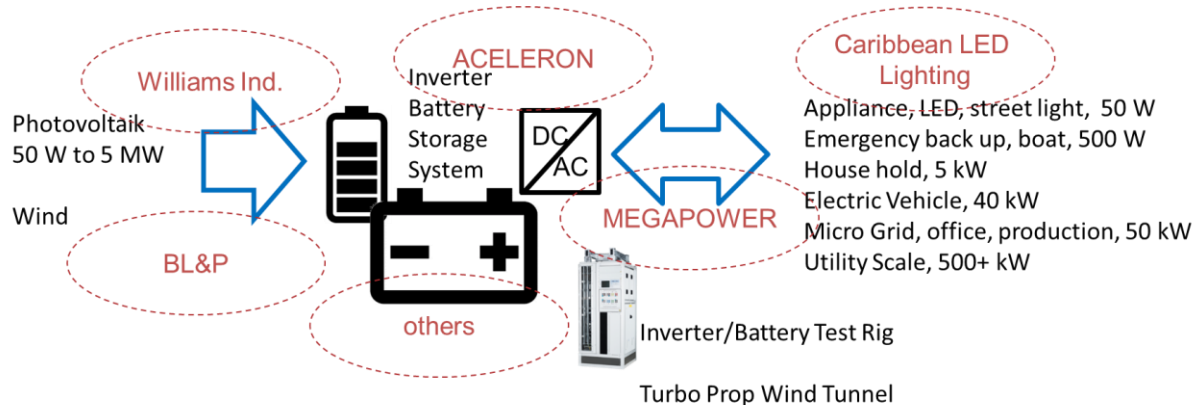
The following shows two examples of working groups that have emerged from the stakeholder consultation process:

²² Compare to Tasks of the IEA's comprehensive programme of energy co-operation

1. Electric energy storage
2. Electric vehicles for public transport

Electric energy storage is the key to modern and smart living (from watches over mobile phones to tablets and laptops and many other smart devices). With regards to more substantial energy supply the technology is increasingly scaled up to meet the requirements of small solar home systems up to utility scale storage solutions. Storage solutions are the key enabling technologies for integration of renewable energy and resilience to disasters such as hurricanes. As the following figure shows, in Barbados there are companies like BL&P, MEGAPOWER, Aceleron, Caribbean LED Lighting, Williams Ind. and others, that have very specific interest in development of storage solutions and solving all associated problems and challenges. While some of them are already working together on certain aspects, there are plenty of other issues and opportunities that need to and can be solved and developed through a specific working group of the cluster.

Figure 6: High potential working group about electric energy storage solutions for different purposes.



Electric vehicles for public transport is an area where other agencies and companies could be involved. Government is very keen on transforming the fleet of buses from diesel to EVs. The working group could work on issues such as advanced business models that are adapted to the change in cost-structure associated with EVs, charging infrastructure, special maintenance of EVs for mass transport, or local solutions and (software) products for data loggers in vehicles that would help in tracking driving behavior and in monitoring and regulating the entire transport industry.

Potential members of a working group on EV for public transport are:

- + BL&P
- + MEGAPOWER
- + Public Transport Utilities
- + Mini-Bus Fleet operators
- + Min. of. Environment
- + Division of Energy and Telecommunications
- + Barbados Union of Public Workers

6.1.2 Communication and networking

An idea, no matter how great, is useless until it is known and understood by others. The cluster must undertake a significant and consistent effort to engage and effectively communicate with its stakeholders. This is true for the communication flowing between and inside the cluster actors/companies (internal communication) as well as for the information and knowledge exchanged between the cluster and its external stakeholders (external communication).

Communication is important in connecting the cluster companies and integrating them into a new entity whose vision, goals and strategy may differ in significant ways from those of the individual members. It is also critical to allow the rapid adaptability of the cluster to the demands of its stakeholders (cluster companies; cluster partners, clients or suppliers).

The cluster has to develop and define an overall communication strategy and a communication plan²³, which also has to be reviewed frequently by the cluster board.

The Cluster Manager is accountable for the communication; he/she monitors the communication plan and ensures the timely availability of the necessary resources for its successful implementation.

This does not mean, however, that other people from the cluster companies should not be involved in the communication plan design and implementation. People other than the cluster manager can hold valuable knowledge about how to reach a specific audience, create a compelling message or choose an appropriate channel.

Equally important is that the cluster manager will create, at the company level, early awareness about the existence, the goals and the strategy of the cluster as the management cycle evolves. Regularly updated newsletters, posts on the web, periodic meetings, can all be of help. This will contribute broad support to the initiative as well as effect intellectual capital flows among the cluster members.

Events and meetings

The main element of interaction in the platform will be the **monthly meetings**. A monthly meeting might have a short formal session for topics that need to be documented in the Minutes, and a very important informal part to facilitate the networking of its members.

A **working group** is another form of interaction where a smaller number of platform participants go into depth on a particular topic. They meet as required in physical or virtual spaces and are facilitated by a common data sharing system (e.g. cloud, SharePoint..).

At an **annual event** the platform has the chance to open up to the public, invite selected guests or exchange on specific topics in technical sessions and side events.

One of the more open-ended initiatives which emerged from the initial workshop is a monthly **“Meet and Greet”** for those active in and interested in renewable energy and energy efficiency. It was a direct result of the September stakeholder inception workshop and so far, two events have been hosted by the consulting team collaborating with local stakeholders. The concept is a simple one involving a “meet-up” at a place convenient to stakeholders where discussions can be free-flowing but centered on the RE/EE sector as a mechanism for stimulating dialogue and creating the foundations for collaborative engagement. People work better and have some initial trust of people they see often and or have worked or collaborated with before. This informal networking activity can potentially begin to break down some of the barriers and is an easily managed mechanism that can be sustained while the formal submission and review process is being undertaken with the GEF.

Formal networking

More formalized networking will be organized by the cluster in cooperation with strategic partners such as the BSBA for trade fairs, or BREA and DoET for outreach events, CCREEE for regional conferences and events, and CARIB-EXPORT for fairs and trade shows. At such events, the cluster will present itself and provide opportunities for involvement and presentation of its members.

Digital communication

To facilitate the face-to-face communication at meetings and events, several (digital) channels can be utilized as underlying support for internal, external and out-of-the-region transmission. Proposed elements for this digital communication support are:

- + Internet / social media sites with
 - Open calendar with all the events, meetings, and important deadlines for calls and tenders
 - Portfolio presentation of members
- + Cloud services to share training materials, proceedings, results and pictures of events
- + Intranet / internal share point for data exchange for members only including bonus materials
 - specific info on tax, export, regulations
 - Information about calls, awards...
 - funding and tendering

²³ Example: <http://www.cadic-guideline.org/cadic-toolbox/cluster-communication-guideline/>

- + External email newsletter featuring new product/service release and other marketing information
- + Internal email newsletter featuring additional material

Keeping these digital channels up-to-date, interesting and lively is an extensive task and requires specific support to the cluster manager.

6.1.3 Start-Up Support

A startup company (startup or start-up) is an entrepreneurial venture which is typically a newly emerged, fast-growing business that aims to meet a marketplace need by developing a viable business model around an innovative product, service, process or a platform.

Experiences of individuals such as Carlton Cummins, the co-founder of Aceleron, show that there is potential in young Barbadians but they are currently not finding the appropriate enabling environment and structures which would help them to develop their ideas and to build potential break-through business. This results in them being forced to go to other countries to do so, potentially losing opportunities for the country and other actors. Supportive mechanisms are simply not strong enough.

The intention is to complement the entrepreneur support services,²⁴ already provided by BIDC, and provide an ecosystem especially for SET start-ups. The ecosystem should contain components such as:

- + Infrastructure: Co-working space and Makers Space (prototyping)
- + Coaching, mentoring and team-building
- + Networking and participation in the cluster
- + Market research support and advanced business planning
- + Assistance with accounting/financial management
- + Support in funding and (structured) financing as well as business model development (technology, team, market, financing, strategy)
- + Mediation between start-ups, well established companies, business angels and investors
- + Further education and specific training in finance, taxes, marketing, sales
- + Financial funding through (business plan) competitions and awards
- + Assistance with intellectual property management

Figure 7: Example of a co-working space (Source: iHub, Nairobi²⁵)



In addition to BIDC and the FAB LAB initiative of the Ministry of Education, Science, Technology and Innovation, the Caribbean Climate Innovation Center²⁶ is a potential partner.

²⁴ <http://bidc.org/entrepreneurs>

²⁵ <https://www.nationalgeographic.com/magazine/2017/12/africa-technology-revolution/>

²⁶ <http://www.caribbeancic.org/>

6.1.4 Makers' space

A maker's space (or FAB LAB – as described in chapter 3.1) offers at the forefront, equipment, tools and instruments for turning ideas into reality. The provision of this hardware is enhanced with training on how to use them (introduction, 101, safety), as well as mentoring and special workshops on how to turn ideas into reality.

The makers' space should have equipment for electrical measurements and testing, tools for welding, 3D printing, CNC or other metal working machines and it should also be continuously equipped with consumables such as wires, sheets, pipes, etc. Using the makers' space requires a person to be a member that has completed an introduction training.

Figure 8: Example of a maker's space



6.1.5 Capacity building

Another key element in any cluster development activity is increasing the intellectual capacity of the individuals and businesses in it – improving the skills and know-how needed to work and grow successfully.

Training should be responsive to the particular demand of the cluster members. Where deemed appropriate, trainings should be co-organized and facilitated by the local training institutes, but it might also include inviting external experts or support of training overseas.

Capacity building within the cluster is expected to include the following main elements:

- + Training – short (1-3 days) seminars and workshops for specific topics, or longer training courses (1-4 weeks) for additional qualifications and certification
- + Job attachments and internships – training on the job is important for the next generation of start-ups and entrepreneurs and should be fostered by the cluster
- + Fact finding missions to other countries in the region for exploring new markets and technologies

BIDC currently provides co-funding for several capacity building activities of companies and individuals that need to be streamlined to the cluster members. The GEF UNIDO project also has a grant component on capacity building that needs to be spent during the implementation period.

6.1.6 Financial support

The cluster will provide financial support to its members for fact-finding missions, experts invitations, study trips and in the form of special awards, competitions and job attachments.

Funding for this financial support could come partly out of the existing funds of BIDC, the GEF funding, and other co-financing including private sector contributions. More details are provided in chapter 7.

6.2 Proposed infrastructure – the HUB

As there is not much industrial production in the country, there is no specific demand for industrial parks (see the Cases of existing technology park models in chapter 3.3) where e.g. vertical integration of manufacturing/production takes place at a park.

There is also not much need for a new demonstration site for specific sustainable energy technologies at the moment as the DoET and BL&P have set up and are in the process of setting up demonstration projects.

With major technical academic institutions such university departments on electrical, mechanical, civil or process engineering missing and further no relevant non-academic research institutes for applied R&D there is no chance for a research park.

Furthermore, the development of a park would face serious land issues as there is not enough space left for new properties, while at the same time many business parks (by BIDC and private property developers) exist that combine all kinds of commerce, from office, to shops, to workshops, to warehouses, to industrial production.

The HUB

The installation of a physical infrastructure (the hub) is proposed to be set up in the following way:

The hub links all the areas by providing a physical space for the management of the cluster, space for meetings of working groups, an open office for start-ups and a workshop floor to house the makers'-space and other facilities such as a test rig or other tools.

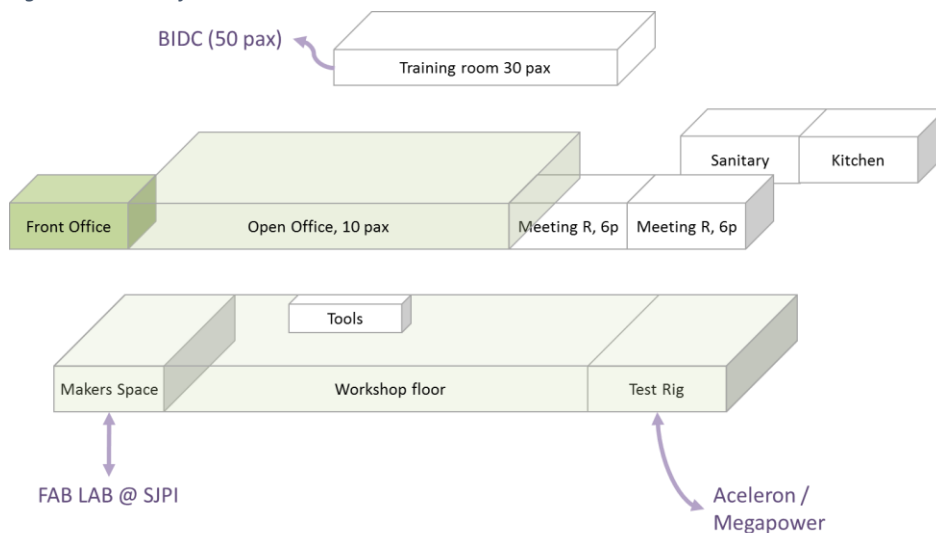
The ideal composition for a physical infrastructure called the HUB would be to provide room for the following:

1. front office for 3-5 staff of the cluster/platform management
2. meeting rooms (at least 2) for at least 6 people to provide a space for work groups and other business meetings
3. open office room for up to 10 desks
4. a large meeting room that can be used for training and other larger group meetings
5. a workshop floor that can host the makers space / FAB LAB, as well as potential test rigs, and other tools and equipment
6. a kitchen for preparing coffee/tea and light meals
7. sanitary facilities

The workshop floor should be accessible by vehicles to test e.g. on electric vehicles. Overall, the floor area should be approximately 400 m² (4000 ft²). The sketch of the HUB in Figure 9 provides an idea of a possible arrangement and further shows current alternative options for some of the facilities. For example, for training the facilities of the BIDC at the harbor can accommodate training sessions and larger meetings easily. At the beginning, the test rig on batteries/inverters could be hosted at MEGAPOWER or Aceleron, and in the event that the Makers' Space is merged with the FAB LAB, there could be space at SJPI.

The ideal location would be a) in the middle of the existing business parks and hence close to the established business and its members; b) close to educational centers such as UWI, SJPI or BCC in order to have a physical proximity to the academic institutes; and c) easy to reach by public transport since young members might not have other means of transport.

Figure 9: Sketch of the HUB



Recommendation of potential places to establish the physical centre of the cluster = the HUB

BIDC has already identified a space that will be available in a few months and would fit most of the requirements: 4,020 ft² of space located at Unit 2B, Building #7 in the Newton Business park. This space is on the first floor of the building and has some of the areas already partitioned and thus may serve the HUB's needs.

The Newton Business Park is well situated in Christ Church, South-East of the capital Bridgetown, on the highway between the Grantley Adams International Airport and SJPI/Wildey Business Park. The main beer brewery and a very successful shirt manufacturer are the lead companies in the park.

Aceleron is already interested in using this space for its first local office to start up their Barbadian subsidiary.

6.3 Embedding in existing bodies and institutional frameworks

Since Barbados is a comparatively small country, it is apparent that the cluster needs to be linked to existing bodies and initiatives and be embedded in the existing institutional framework. It is proposed that the cluster use established services from institutions like BIDC, and be connected with other with targeted initiatives.

It is very important that these linkages are effectively managed in order to achieve synergies and secure win-win situations – this is one of the key roles for the Cluster Steering Committee (see below in the next chapter).

The existing bodies identified so far and their roles and responsibilities are as follows:

BIDC

- + Co-funding in cash and in-kind
- + Platform and cluster management during the start-up phase
- + Support for capacity building activities (administrative, training facilities)
- + Provision of incubation support services (existing)
- + Provision of property for the HUB as in kind contribution

MIICS

- + GEF UNIDO Project coordination and member of the steering committee
- + Co-funding in cash and in-kind
- + Industrial policy development

UNIDO / GEF

- + Funding during the project period
- + Hiring key experts/staff for 4 years

- + Linking to other regional and global initiatives and experts

Established companies

- + Participation in working groups and co-operation projects
- + Mentoring to start ups
- + Using / sharing testing equipment
- + Building the capacities of their staff and their organization
- + Co-funding of cluster activities

BREA

- + Lobbying for most of the platform members (existing)
- + Joint networking, events and communication
- + Cooperation on capacity building activities
- + Special training funded by GIZ for resilience (existing)

CCREEE

- + Regional policy development support for topics like micro grids, IPP, open utility
- + Hub for capacity import from overseas
- + Hub for product and know-how export to region
- + Co-funding of activities

Ministry of Education Science Technology and Innovation

- + Joint development and realization of the FAB LAB / Makers Space concept
- + Cooperation on capacity building activities
- + Cooperation on identification for R&D partners and funding opportunities

Further important stakeholders are

- + SJPI, BCC and UWI as educational institutions
- + The line ministries and division for energy, transport, environment, agriculture, education and fishing for their relevant input and support to working groups and other activities.
- + BNSI and CROSQ as partners in standardization and capacity building for understanding the issues of standards, testing, certification and accreditation
- + Chambers, associations and other organizations as partners in the network and for marketing, lobbying and joint events.

6.4 Proposed organizational structure

The Cluster **Board (Commission)** will be a forum of representatives of the key cluster stakeholders. Its role will be to formulate the strategic objectives for the cluster and to launch and coordinate joint activities among cluster stakeholders. The Cluster Board does not get involved with micro-management or administrative issues.

The Cluster **Steering Committee** consists of major national stakeholders that have a direct interest in the cluster development initiatives being undertaken and can provide useful inputs to them. These are expected to include the Ministry of Industry and Trade, the Ministry of Education, sector-specific line ministries (e.g. Energy, Environment), industrial promotion organizations, export promotion agencies, research institutes and universities and development finance institutions and banks. The Steering Committee will be responsible for promoting and launching the cluster development project, supporting the process of cluster selection and articulating development priorities. As in the case of the Cluster Commission, the Steering Committee will usually not get involved in micro-management and administrative issues.

Cluster Management

The cluster management needs to be strong facilitators (leaders of teams) and be strong on conflict management and change management. Their role is to build trust among the members and bring everyone together with a similar goal. For this, they have to set clear objectives and milestones and develop clear business cases.

The cluster manager is the face that actively uses the channels to communicate among the members to build trust and willingness to cooperate, and also reaches out to external partners. The cluster manager will be supported by an assistant

manager whose role is more in creating an enabling environment for communication between the members through creation of different channels and events. In bit more detail the cluster management engages to:

- + External
 - o ensure visibility - keep the issue in the forefront through public awareness and engagement/media
 - o Report on progress, outputs and impacts
- + Internal
 - o Provide social leadership
 - o Identify key sectors and champions
 - o Communicate with and among members to secure buy-in
 - o Make overall visions reasonable and provide clarity
 - o Provide clear goals and implementation plan to working groups
 - o Focus the working groups on results and continued workflow
 - o Provide a risk management framework (terms of reference, IP arrangements...)

The assistant manager works to:

- + Develop and manage communication channels (real and virtual meetings, data exchange, intranet, web communities, etc.)
- + Organize training and other capacity building activities
- + Organize outreach activities such as events, awards, campaigns, etc.
- + Identify appropriate mechanisms for funding and support
- + Promote clear principles on health, safety and environment

In practical terms the assistant manager is more 'at his/her desk' to organize things, while the cluster manager is more 'on the road' to meet new and existing members, solve issues among members and stakeholders, and to bring things together to develop new ideas within new working groups.

All of the above might be supported by staff for administration, marketing/communication, ICT, interns and part time technical experts if funding allows.

6.5 Proposed timeline of implementation

For implementation of the cluster a phased approach is proposed with the following main phases:

- 1) Formation phase with about 10 catalyst companies from the SET sector
- 2) Growth phase to reach 30 to 40 companies from the SET sector
- 3) Stabilization phase to settle in and achieve measurable results
- 4) Expansion phase to other areas such as. environment, water, adaptation, resilience, construction

The following table attributes these phases to the first 5 years, nevertheless a cluster can be understood as an organism whose growth is not always strictly following the plan set out.

Table 1: Timeline of cluster implementation

Phase	Year 1	Year 2	Year 3	Year 4	Year 5
1) Formation					
2) Growth					
3) Stabilization					
4) Expansion					

7 Feasibility of the proposed concept of the cluster

7.1 Economic assessment

The general experience from clusters all over the world is, that it is a political wish for clusters to be financial independent from government funding, yet this is often an illusion and clusters tend to be funded by some kind of national or regional financing instrument, directly or indirectly.

7.1.1 Costs

Within the framework of the GEF UNIDO project the expenses for the first four years of the cluster is proposed in the following way with some extra cost for cluster set up facilitation in form of special TA, investment in test equipment for e.g. storage solutions, co-funding of co-operation projects and initial investments in the equipment of the makers space.

Table 2: Expenses for the first four years of the cluster

Expenses	Year 1	Y 2	Y 3	Y 4	Total
Communication & networking					279,000
Monthly meet facilitation	6,000	6,000	6,000	6,000	24,000
Marketing / advertising		20,000	20,000	20,000	60,000
Target community(ies) activities		20,000	20,000	20,000	60,000
Publications		5,000	5,000	5,000	15,000
Annual event	20,000	20,000	20,000	20,000	80,000
Trade fair participation	10,000	10,000	10,000	10,000	40,000
Working groups					160,000
Working groups facilitation	5,000	5,000	5,000	5,000	20,000
Research/fact finding missions		10,000	10,000	20,000	40,000
Co funding for co-operation projects			50,000	50,000	100,000
Start up support					240,000
Start-up support		30,000	30,000	40,000	100,000
Start-up training		30,000	30,000	40,000	100,000
Recognition awards/competition	10,000	10,000	10,000	10,000	40,000
Makers space / Fab Lab					315,000
Makers space equipment	100,000	100,000	50,000	50,000	300,000
Makers space usable		5,000	5,000	5,000	15,000
Capacity building					811,000
Training TA	66,000	66,000	66,000	66,000	264,000
Training facilitation	33,000	33,000	33,000	33,000	132,000
Other trainings		25,000	25,000	25,000	75,000
Invite experts	10,000	10,000	10,000	10,000	40,000
Study trips	75,000	75,000	75,000	75,000	300,000
Cluster management					750,000
Cluster set up facilitation (TA)	50,000	20,000			70,000
Shop floor services & usable	10,000	10,000	10,000	10,000	40,000
STAFF - cluster manager (runner)	60,000	60,000	60,000	60,000	240,000
STAFF - assistant manager (doer)	60,000	60,000	60,000	60,000	240,000
STAFF - admin / ICT /web2.0	40,000	40,000	40,000	40,000	160,000
Cluster facilities					925,000
Operations (utilities, ICT, insurance,...)		incl. In rent			
Rent for hub/office	40,000	40,000	40,000	40,000	160,000
OpEx for hub/office	40,000	40,000	40,000	40,000	160,000

Fees for online services and platforms	1,000	1,000	1,500	1,500	5,000
Investment in test equipment		100,000	200,000	300,000	600,000
TOTAL	636,000	851,000	931,500	1,061,500	3,480,000

To keep the level of operation and services approximately at the same level, the annual expenses for the following years after the GEF UNIDO project phase are about **690,000 USD per year**.

7.1.2 Sources of funding

As sources of funding during the project period, a total amount 8,364,985 USD from institutional stakeholders and 900,000 USD from key private sector stakeholders have been identified. These amounts are composed of the following:

- + BIDC has indicated in-kind contributions of up to 4 million USD including rent of space, facilitation and co-financing of training and other already existing services, attribution of staff time for project and cluster management. In addition they have indicated 1 million USD in cash for investments in equipment, hardware and other general TA.
- + MIICS has indicated 1.75 million USD of cofounding which could be composed of 1 million in cash for TA and equipment, awards and other financial support to the cluster and 750,000 USD in-kind for facilitation of communication & networking, start-up support, etc.
- + GEF grants from component 2 and 3 amount to 1,364,985 USD for investments and TA for capacity building and cluster facilitation.
- + ECREEE has indicated a contribution of up to 1 million USD that can co-finance regional communication and networking activities, capacity building and other regional outreach activities.
- + So far, three companies have indicated that they would be willing to invest in the context of the cluster
 - o MEGAPOWER 400,000 USD
 - o Aceleron 250,000 USD
 - o Williams Ind. 250,000 USD

With this indicated funding it seems likely that there will be no financial constraint during the first 4 years.

After the GEF UNIDO project the following funding is expected to continue:

- + BIDC could continue to provide the space for the hub as in-kind contribution and co-finance training and other already existing services, including certain attribution of staff time for cluster management. In addition they will still have a special TA program providing cash that could be tapped by the cluster and other means of funding. The total value is in the range of 100,000 to 250,000 USD per year.
- + MIICS has indicated that on a continuous basis 250,000 USD in cash could be made available for financial support to the cluster.
- + Other external funds from the energy sector available to the Division of Energy could be channeled to the cluster for specific co-operation projects in the range of 100,000 to 500,000 USD per year.
- + The cluster itself will need to apply for funding from the donor community (e.g. GEF 7, GCF) for specific co-operation projects on energy, climate change, resilience and other topics and receive significant grants.
- + ECREEE will remain an important partner with similar financial means in the future for regional communication and networking activities, capacity building and other regional outreach activities.
- + Depending on the success the number of enterprises participating will grow and so will eventually grow the income from member fees and fees for other certain services that the cluster will provide (e.g. renting of test equipment).
- + Further sources of funding for special activities could be sponsorships for events, although this is likely to be below 50,000 USD.

7.2 Impact analysis

7.2.1 Impact and benefits

A well-developed concentration of related businesses in a cluster spurs three important activities: increased productivity, more rapid innovation, and new business formation. But measuring the impact of a cluster is not an easy task, as the baseline for a business is assumed to be in general a growth scenario, and hence the additional benefits gained from joining a cluster are not easy to be filtered from all the other interrelations such as general economic growth, policy changes or natural disasters.

In general cluster performance is measured by annual member surveys with quantitative aspects on economic situation of the member company, number of meetings and activities attended, number of contacts and business opportunities gained within and outside the cluster, and similar aspects. Qualitative interviews with members complement the performance assessments. The main indicators for success are then discussed at the cluster board meetings.

Another main indicator is the number and size of collaboration projects created and implemented by the cluster members and specific funding leveraged for the projects.

A more general impact of the cluster for the whole sector will be increased employment (see below) and more qualified working force, higher turn-over and tax revenues, more spending on R&D, higher general export and less fossil-fuel imports. Strong domestic clusters also help to attract direct foreign investment and establishment of businesses.

A wider view on the development of a sector by analyzing official statistical data could help to identify the real benefits and impacts. Guidance on evaluating the impact of a cluster development with sophisticated methods can be found in [3], [4] and [5].

It is proposed that in a detailed feasibility the baseline and goals for indicators as mentioned above should be assessed and defined.

7.2.2 Social and Environmental Impact Assessment and Management Plan

The direct environmental impact of the project's activities is very low as no new construction is foreseen. However, if the project is successful and new products and a new industrialization push is achieved, there are expected direct impacts on GHG emissions, an increase in the contribution of RE/EE to the energy matrix as well as reduced productivity losses due to the reduction in power outages or the reduction in recovery times. Additionally, the proposed robust approach to RE/EE elements related to infrastructure should also result in reduced losses in roof-based RE/EE components and thus a reduction in waste generation and the land filling needed for such components. The expanded viability of existing and future products, particularly if salt spray damage can be minimized, will also reduce waste generation, land filling needs and reduce the consumption of materials for replacement of systems including the reduction of plastics. The efforts to expand battery life and reuse batteries will directly reduce the entrance of lead acid and lithium batteries into the waste cycle and the impacts these can have on land and water systems in the long-term as they gradually erode. Various examples globally, particularly in Africa, Asia and elsewhere and via research by Pure Earth/Blacksmith Institute highlight the long-term effects of poor disposal capacity and concentrations of these materials on the natural ecosystem as well as human health²⁷. A recent report by Pure Earth defined Used Lead Acid Battery Recycling as one of the top ten polluting industries²⁸. In a country reliant on groundwater resources, efforts to reduce the consumption to waste resource cycle redounds to both nature and people. The fact that the country has recently struggled to manage existing waste effluent on the South coast is a possible signal of the tipping point being reached by current systems, technologies and capacities.

Socially, if the broader ambitions of the Government can be realized in terms of linking the industrialization of RE/EE to a green economy transition then the project can also realize measurable social impact in terms of new business opportunities and employment. The example of the CIC-C Caribbean shows that measurable impact can be realized in terms of new businesses, training and capacity, networks and new jobs created within a four-year project life-span. Critically, given that roof and home vulnerability still impact significantly on the poor and that household quality can still be improved in low-income households, there is potential for the project to narrow the gap between ambition and fulfilment even if not all the existing concerns are fully addressed by the end of project implementation. Such efforts

²⁷ http://www.pureearth.org/wp-content/uploads/2014/12/PE_AnnualReport.pdf

²⁸ <http://www.worstpolluted.org/>

would ensure that low-income households are better included more systematically in an energy transition and transformation and certainly the opportunities provided by the FAB LAB and the examples of Aceleron and MEGAPOWER can also serve to inspire others including young people and women.

It is also hoped that one of the added value components of the project will be a deeper analysis and thinking of a long-term strategy for development funding for this initiative and like sectors which will be part of Barbados's commitment and fulfilment of the SDGs as well as the Paris Accord.

7.2.3 Job creation

According to the Barbados' Green Economy Scoping Study [6] the potential for green jobs lies in retrofitting, lighting, installation and maintenance of efficient appliances and the use of low energy construction material in a sustainable building/housing industry. This is also the case at the regulatory level since new standards of practice would need to be devised and monitored to ensure acceptable levels of compliance.

In the transport sector, opportunities for green jobs would centre primarily on the provision and maintenance of electric vehicles, management of charging infrastructure, and the management of an integrated public transportation system.

The building or construction industry is a major contributor to the country's economic growth and development. The total value-added of the industry in 2010 was 185.5 million USD or about 5 % of GDP. In addition, the industry employs almost 15,000 persons, almost 2,000 more than Barbados' main industry, tourism.

The current employment in sustainable energy technologies is estimated to be 200 full time equivalents (FTE), which will double in 5 years to about 400 people in total. The biggest share has the RE sector, and here it is mainly the existing ST manufacturing and installation, and the PV installation and potentially a PV assembly or special production. Wind power and other alternative energy projects will employ about 25 FTE in 5 years, mainly in project development, sales and maintenance functions.

Energy efficiency technologies and services will employ 75 FTE in 5 years but with already a strong base of 50 due to manufacturing and sales activities on LED lights.

Electric storage and other innovative energy services (Energy 2.0) will grow from currently 8 to about 30 FTE. Electric vehicles will grow from 5 to about 25 staff in 5 years, mainly in the areas of special sales and maintenance services, yet if these jobs will really be new ones or just improved ones from conventional car services can be discussed.

Although the building and construction sector is a large employer, the effects on jobs (+7) as a result of improved energy or resiliency performance is not significant, as the improvements need to happen in the design and engineering phase and employment effects there are relatively low.

Energy services such as auditing, management systems and ESCOs will not have a strong effect on FTEs, yet many more people will be involved. People working on aspects of sustainable energy in government, organizations and larger companies (utility, oil & gas) are already comparatively large number and will become more for project management, R&D, lobbying and other general activities.

With regards to gender equality in this sector, some studies [7] highlight the segmentation of the labor market and that this can affect opportunities and limit gateways/pathways to new and better paid professions including a clear gender pay gap with women earning less than men but less so when they have tertiary education or are in high-skilled professions but are significant amongst the self-employed and private sector employees. "A comparison of earnings for males and females with the same age and education reveals that males earn 25 % of average females' earnings more than females in Barbados", (Ibid, pp.28). In terms of employment, there is labor supply available, at least in theory, with the current unemployment rate in the second quarter of 2017 recorded at 11.3 % with males (11.5 %) and females (11.5 %) and a total number of 16, 600 unemployed [8]. It is notable that the industries relevant to RE/EE e.g. construction, mining and quarrying sectors continue to employ significantly more males than females and electricity, gas, steam and air conditioning have low employment numbers overall but higher male than female. Moreover, fundamental occupations still employ nearly 20 % of those in active employment [9].

To achieve job creation goals, capacity gaps such as the "lack of training programs and regional experts in building/housing; unsustainable public attitude to green initiatives in transportation" (Moore et al, 2012) would need to be addressed.

7.2.4 Quality of knowledge workers

To reach the above mentioned number of 400 FTE in 5 years about 700 people will need some kind of specific training or capacity building. This number is significantly higher than the actual 400 FTE due to the fact that individuals need to understand the linkages between technologies, or are part time active in many areas at the same time, and others might drop out within the 5 years period and individuals replacing them need to be trained as well.

The kind of training required is mostly additional qualification courses starting from several days to a few weeks. About 40 % will be for high skilled persons such as engineers and management with at least a bachelor degree, 50 % of the trainees will be for persons working in manufacturing or installation and service, the remaining 10 % is for people working in system design or administration.

7.2.5 Gender aspects

Respondents in the SET online survey largely found that Barbados was average or below average (21/33), compared to other Caribbean countries, on “gender and income equality as it relates to finance” suggesting there is also more that could be done on making opportunities open for all and ensuring that no one is ‘left behind’ on RE/EE and on the green economy and jobs opportunities therein. The 30+ years-old solar thermal industry and RE in general has relatively few women-owned businesses and similarly in the industry itself the presence of women-led institutions and businesses did not seem significant. A shift in the dynamic emerges in the context of MEGAPOWER whose owner and public face is female suggesting that there are opportunities but clear gaps. Specifically, special attention to engaging and linking students to job opportunities, and encouraging female entrepreneurship in the sector will need to be addressed.

The SET survey results also suggest that there has been limited demand or engagement on gender demands or need for RE/EE including for niche sectors largely populated by women such as hairdressers, cosmetologists and nurses, a potential untapped sector which has specific RE/EE needs including where light manufacturing for components might be involved as has been seen in LED lighting to-date.

The results of the most recent poverty survey in Barbados [9] suggests the following in terms of how gender shapes poverty dynamics in the country as well as defines the low-income domestic/household segment of a potentially more industrialized RE/EE market:

- 11 % of the population has been designed as “non-poor but at risk of poverty” or vulnerable. These are households that are not poor but whose income is less than 1.25 of the poverty line;
- In all key categories – extreme poor, non-extreme poor, poor and vulnerable, females are higher than males; and
- Low quality dwellings still an issue for poorer households as well as the dynamic of larger households and lower consumption.

These factors highlight ways in which this project can engage with both the business and consumer side of the IDB funded Smart Fund program as well as potentially identify specific niche areas services and technologies that can be a catalyst also for business and industry spinoffs. In this, the evidence of potential is visible in the efforts of the efforts of individuals such as Sean Springer who produces small wind turbines for household use and Dr. Van Linton who is working also on battery improvement services and who have both developed and worked on their concepts well outside of the mainstream and with little support or networks. Both initiatives have potential social and environmental impacts particularly in recycling and reuse, alongside RE/EE expansion.

7.3 Sustainability strategy

With regards to financial sustainability the common funding stream for a cluster and its members are national and regional (e.g. EU) funding schemes for innovation, R&D and general private sector development that support co-operation projects, where typically at least 3 companies join their resources for a specific goal. So far, such a funding scheme does not exist in Barbados, but with the work in component 1 of the GEF UNIDO project on policy and strategy development for national development and incentive frameworks this might be available in the future. The broad social, environmental and economic goals of this initiative might also be attractive for crowd-funding, social impact bond schemes as well as results-based financing; these are issues that, though identified, will require deeper analysis during this first phase of the project and throughout the development of the cluster mechanism.

The sustainability strategy also considers the soft side dynamics and the social technology components that are also critical for success. These include strengthening the collaborative management and sharing of resources as well as collaborative innovation. Stakeholders have raised realistic concerns about this in Barbados given the lack of culture of structures to enable it, in this type of industry to-date. In addition to soft and hard technology investments in the platform and working group mechanisms including the latest techniques applicable to this context, the cluster concept and its operational framework considers several supportive mechanisms including a community of practice, incentives and rewards structures as well as the support to be provided by the platform and cluster manager. Members of teams will also receive robust training on leadership and team work and trust building. This will be bolstered by existing structures such as BREA, regular industry meetings as well as the Energy “Meet and Greet” which emerged from the workshop. A Community of Practice which facilitates the warehousing of information, ideas and discussions as well as enabling virtual engagement within the initial cluster as well as with other experts and groups will also be important to keep the process engaging, productive and innovative.

More critically in its implementation, the project is expected to meet important milestones in terms of outputs. Over the life of the project by Year 2 and 3 it is expected that product ideas would have translated into prototyping and incubation leading to at least one new product design or adaptation. Some of the proceeds from that including any sales of the prototype for commercialization would be expected to be reinvested into the cluster, an initial rate of 10-20 % could be a starting point. Additionally, linking the project with existing initiatives such as the Smart Hub, TAPSEC are expected to create important value-added transfers including links to potential markets. Finally, in Year 3 the project would initiate the development of concepts for additional funding including a possible Phase II cluster expansion concept. Funding could come from GEF 7 with a focus on the nexus of climate change adaptation, water and the environment; or with funding from GCF on other current topics at this time.

And last but not least: clusters are allowed to close. It is not ‘a rule’ that a cluster needs to survive forever and at all cost. If members think they have gained most of it and further investments of time, resources and money will not pay off then it can be a consequence that the cluster can be resized, restructured and or closed.

8 Summary, conclusion

The transformation that occurred during the stakeholder consultations alone provides strong reason for confidence that a cluster for sustainable energy technologies in Barbados is very relevant and comes at the right time. While at the beginning of the stakeholder consultations the most frequently heard phrase was ‘collaboration is not in the culture of Barbados’, the arguments at the later stage were about leadership within the cluster, intellectual property rights and about the overall guiding vision of 1 million resilient homes with improved energy performance.

With regards to cluster development , it is fortunate that existing technology focus groups with very enthusiastic catalytic businesses for starting the cluster have identified themselves. With the support of the GoB through MIICS, BIDC and others and the GEF UNIDO project it currently looks like the initiative of cluster development will face no financial constraints. Furthermore, the cluster will be well embedded in existing initiatives like BREA, FAB LAB and CCREEE and will complement them.

The role of cluster management as the focal point for communication with and among members and the important function of gaining the trust and buy-in from the established businesses and providing vision and leadership is the most important one to transform the Barbadian industry from competition to “co-opetition” and fruitful cooperation.

With the main business gaining trust in the cluster and the cooperation within the working groups, the initiative has a high chance of developing new designs, solutions and products that have a high marketability in the Caribbean region and can improve livelihoods, climate resilience, energy independence, the economies and the environment.

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Annex 1: List of keystakeholders

The following persons have been invited to the workshops and the participation in the survey.

Organisation		Name	Surname	Title
ACELERON Ltd.		Carlton	Cummings	Technical Director and Cofounder
ACELERON Ltd.		Kevin	Simmons	
AES ENERGY SYSTEM		Kevin	Devonish	MD
AQUION ENERGY		Miguel	Humphrey	Sales Representative
Atom Solution Inc.		Erwin	Edwards	Consultant
Barbados Cane Industry Corporation	BCIC	Anthony	Christie	
Barbados Cane Industry Corporation	BCIC	Carl	Simpson	Project Manager
Barbados Chamber of Commerce and Industry	BCCI	Carlos	Wharton	ED
Barbados Coalition of Service Industries	BCSI	Elihu	Wahid	Programme Officer
	BCSI	Graham	Clarke	CEO
	BCSI	Liana	Welch	Project Officer
Barbados Community College	BCC	Gladstone	Best	Principal
	BCC	Gomell	Elcock	Business Development Officer
	BCC	Trevor	Headley	Instructor
Barbados Hotel and Tourism Association	BHTA	Rudy	Grant	Chief Executive Officer
Barbados Investment and Development Corporation	BIDC	Dwaine	Stuart	Director - Finance
	BIDC	Jason	Cadogan	Representative
	BIDC	Modou	Diagne	Senior Business Development Officer
	BIDC	Samuel	Harrison	Business Development Officer
	BIDC	Sonja	Trotman	CEO
Barbados Light & Power Company Ltd.	BL&P	Antonio	Sealy	
	BL&P	Charles	Harris	Senior Manager Business Solutions
	BL&P	Johann	Greaves	
	BL&P	Kim	Griffith-Tang How	
	BL&P	Robert	Harewood	Engineer
	BL&P	Roger	Blackman	MD
	BL&P	Rohan	Seale	
Barbados Manufacturing Association	BMA	Tamara	Francis	
Barbados Manufacturing Association	BMA	Jason	Sombrano	
Barbados National Oil Company Limited	BNOCL	Felicia	Cox	RE coordinator
		Winston	Gibbs	General Manager
		Richard	Goddard	
Barbados National Standards Institution	BNSI	Anthea	Ishmael	Director
	BNSI	Fabian R.	Scott	
	BNSI	Jonathan	Platt	
Barbados National Union of Fisherfolk Organizations	BARNUFO	Innis	Henderson	Treasurer
Barbados Private Sector Association	BPSA	Shardae	Boyce	Trade Consultat
Barbados Private Sector Trade Team	BPSTT	Akilah	Phillips	
Barbados Renewable Energy Association	BREA	Aidan	Rogers	President
	BREA	Clyde	Griffith	Technical Adviser
	BREA	Meshia	Clarke	ED
Barbados Small Business Association	BSBA	Lynette	Holder	CEO
Barbados Small Business Association	BSBA	Andrea	Taylor	Business Operation Manager

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Barbados Water Authority	BWA	Alex	Ifill	
Barbados Water Authority	BWA	Wayne	Richards	
Blackstone Megawatt Energy Services Inc.		Michael	Cadogan	Local Representative
Caribbean Centre of Excellence for Sustainable Livelihoods	COESL	Ashley	John	
		Joshua	Forte	
		Marcia	Brandon	Managing Director/ Chief Entrepreneurship Expert
Caribbean Development bank	CDB	Peter	Werner	RE/EE Specialist
Caribbean Development Bank	CDB	Joseph	Williams	Project Director
CARIBBEAN ENERGY SOLUTIONS INC		Peter	Lewis	MD
Caribbean Export Development Agency	CEDA	Christopher	McNair	Manager, Competitiveness and Innovation
		Damie	Sinanan	Senior Advisor
		Pamela Coke	Hamilton	Executive Director
Caribbean Hotel Energy Efficiency Action	CHENACT	Loreto	Duffy-Mayers	CHENACT Project Manager
Caribbean Label Crafts		Roger	McLean	Technical Manager
Caribbean LED Lighting		Gerard	Borely	CEO
Caribbean LED Lighting		Jim	Reid	Chairman & Founder
Caribbean Network of Fisherfolk Organization	CNFO	Vernel	Nicholls	Chair
Caribbean Youth Environment Network	CYEN	Cedric	Mayers	
		Sade	Deane	National Coordinator
CARICOM Energy	CCREEE	Devon	Gardner	PM for Energy
CARICOM Regional Organisation for Standards and Quality	CROSQ	Deryck	Omar	CEO
		Janice	Hilaire	Co-ordinator, Resource Mobilisation and Prog. Dev.
CCREEE	CCREEE	Al	Binger	
CERMES, UWI		Neetha	Selliah	Programme Coordinator
CleanPlant		Maurice	Nipper	
Conscious Spirit Farms		Lisa	Browne	Permaculturalist
Consultant		Jose	Mestres	
Consultant		Leighton	Waterman	
Consultant RTC Solicit		Susanna	Cooper Corbin	
Contractors Trading Associates		Roger	Austin	MD
Core Energy		Kaie	Warner	Principal Consultant
Coventry University		Thomas	Rogers	Lecturer for RE and EnM
DCNS		Emmanuel	Brochard	MD Marine Energies
Delegation of the European Union to Barbados, The Eastern Caribbean States, The OECS and CARICOM/CARIFORUM	EU	David	Green	PM RE & EE
	EU	Jannik	Vaa	Head of Green Economy and Resilience Section
	EU	Kyle	Farnum	PM Energy
Deltro Electric Ltd				Engineer
Deltro Group Ltd		Dean	Del Mastro	CFO
Deltro Group Ltd		Rick	Dykstra	Director of Renewable Energy
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH	GIZ	Andreas	Taeuber	Head of Project REETA
		Glynn	Morris	GIZ Programme Leader - REETA (Renewable Energy and Energy Efficiency Technical Assistance)
		Rainer	Engels	EM
Division of Energy and Telecommunications	DoET	Brian	Haynes	Chief Project Officer
		William	Hinds	Chief Energy Conservation Officer
		Claire	Best	Senior Economist

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		Francine	Blackman	Deputy Permanent Secretary
		Jehu	Wiltshire	Permanent Secretary
		Darcy	Boyce	Energy and Telecommunications Senator
EBN		Dichter	Giordano	Head of Membership Development
Eco Energy Inc.				
EfficiencyOne		Kate	McDonald	Manager, Service Delivery
EFFICIENCYONE SERVICES		Chuck	Faulkner	MD
Emera Caribbean Renewables Ltd.	ECRL	Wayne	Yearwood	Manager
Enermax Ltd.				
ENSMART INC		Jerry	Franklin	MD
Fair Trading Commission	FTC	Elvis	Caddle	Electricity Analyst
Fair Trading Commission	FTC	Peggy	Griffith	CEO
Fair Trading Commission	FTC	Sandra	Ceylins	CEO
Fair Trading Commission	FTC	Marsha	Atherley Ikechi	Director of Utility Regulation
Fireworks Energy				
Future Energy Caribbean				
GEOSYSTEMS INC		David	Woodroffe	MD
Goldfield Solar		Terrence	Haynes	
GREEN TECHNOLOGIES BARBADOS		Nathan	Hart	MD
IDB - BRIDGE Project	IDB	Erwin	Edwards	BRIDGE Project Coordinator
Innogen Technologies Inc		Richard	Singh	Sales Manager
Instituto Interamericano de Cooperación para la Agricultura Delegation to Barbados	IICA	Ena	Harvey	IICA Representative, Barbados
Inter-American Development Bank	IDB	Adriana	Valencia	
		Christiaan	Gischler	
		Leandre	Clarke	Office Support Assistant
		Rochelle	Franklin	Operations Senior Specialist
		Juan Carlos	De La Hoz Vinas	
LED illuminations Inc		Tracy	Catlyn	Sales & Marketing Representative
Life Improvers Battery Service		Van	Linton	Owner
Megapower Ltd.		Ana	Herrera	Sales Executive
Megapower Ltd.		Joanna	Edghill	CEO
Megawatt Energy Inc.	MWEI			
Ministry of Agriculture		Carl	Simpson	Director of CIRP
		Loretta	Walker	
		Yohlanda	Cave	Economist
		Leslie	Brereton	
Ministry of Education		Anderson	Lowe	Consultant
Ministry of Environment and Drainage		Daphne	Kellman	Permanent Secretary, GEF Operational Focal Point
		Donna	King Brathwaite	
		Gina	Belle	Project Coordinator Environment, Energy and Climate Change
		Marcia	Kirton	Deputy GEF Operational Focal Point
		Nicole	Taylor	Deputy Permanent Secretary
		Pedro	Gollop	
		Steve	Devonish	Director
		Ricardo	Marshall	Project Manager

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		Travis	Sinckler	Senior Environmental Officer
		Ricardo	Ward	Project Manager
Ministry of Finance and Economic Affairs		Charmaine	Hippolyte	Chief Accountant
		Nancy	Headley	Permanent Secretary, Senior Administrative Officer
		Patrick	McCaskie	Director of Research
		Seibert	Frederick	Manager of Public Investment Unit
Ministry of Foreign Affairs and Foreign Trade		Jennifer	Cummins	
		Simone	Rudder	GEF Political Focal Point
Ministry of Industry, international Business, commerce and Small Business Development	MIICS	Anderson	Cumberbatch	Chief Bus. Dev. Officer
		Anthony	Joseph	Senior Administrative Officer
		Betram	Johnson	Chief Economist
		Kayode	Worrel	Administrative Officer 1
		Larcy	Husbands	
		Mikala	Stoute	
		Rodney	Payne	Senior Administrative Officer (Ag)
		Shawn	Collymore	
		Sheena	Forde	
		Sonia	Foster	Permanent Secretary
		Juana	Franklin-Leacock	Bus. Dev. Officer
		Patricia	Bayne	Economist
		Richard	Harris	Snr. Bus. Dev. Officer
National Council of Science and Technology	NCST	Charles	Cyrus	
National Petroleum Corporation	NPC	Damian	Catlyn	
		James	Browne	
		Michael	Layne	IT Officer
		Calvin	Watson	Representative
		Eleanor	Carryl	Representative
		Janelle	Clarke	Representative
		Kim	Best	Representative
		Neil	Titus	Representative
		Vincent	Knight	Representative
Partnership for Action on Green Economy	PAGE	Linke Heep	Claudia	Industrial Development Officer
Rubis Eastern Caribbean SRL		Stewart	Gill	Strategy & Business Development Manager
Samuel Jackman Prescod Institute of Technology	SJPI		Balle	
Samuel Jackman Prescod Institute of Technology	SJPI	Henderson	Cadogan	
Sean Springer Enterprise		Sean	Springer	Owner
Sohler Technologies Inc.				
Sol (Barbados) Ltd.		Dale	Dangleben	Engineer
Sol (Barbados) Ltd.		Ezra	Prescod	
Sol (Barbados) Ltd.		Stuart	Gill	
Solar Barbados		Khalid	Grant	Founder
Solar Dynamics Ltd.		James	Husbands	CEO
Solar Energy Innovations Inc.		Lisa	Skinner	
Solar Energy Innovations Inc.		Allan	Simmons	Chairman
Solar Genesis Inc.		Khalid	Grant	Founder
Solar Watt Systems Inc.		Anthony	Duke	Sales representative

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Solar Watt Systems Inc.		Ivor	Trotman	Representative
Solar Watt Systems Inc.		Joshua	Hunte	MD
Solaris Energy				
Stantec		Andrew	Hutchinson	Senior Principal
SunPower		Henry	Jordan	Sales Director
TVET		Matthew	Greaves	
UNDP	UNDP	Destine	Gay	
UNDP	UNDP	Jason	LaCorbinière	Project Coordinator Environment, Energy and Climate Change
UNDP	UNDP	Stephen	O'Malley	UN Resident Coordinator
UNEP	UNEP	???	???	
UNICOMER		Trisha	Tannis	MD
University of the West Indies	UWI	Ayanna	Young-Marshall	Lecturer International Business
		Winston	Moore	Head and Professor of Economist
		Anette	Greene	
		Iyanna	Marshall	Lecturer
Virtus Legal		Aidan	Rogers	Attorney-at-Law
Williams Energy	WI	Stephen "Bob"	Worme	
Williams Industries	WI	Ralph "Bizzy"	Williams	Chairman
Williams Industries Inc.	WI	David	Staples	Director

Annex 2: Minutes of meetings

The minutes of meetings are provided in a separate document.