

COUNTRY STUDY:

Barbados

Project: Energy and Climate Change

**PHASE IV: DEVELOPMENT OF CASE STUDIES AND
CAPACITY STRENGTHENING FOR THE CDM**

Date: November, 2008



**Canadian International
Development Agency**



**UNIVERSITY OF
CALGARY**

This report was published in the management of

Carlos Arturo Flórez Piedrahita

Executive Secretary of the Latin American Energy Organization (OLADE)

Néstor D. Luna González

Director of Planning and Projects

Byron Chilibringa Mazón

Coordinator of Renewables & Environment

With the support of:

**The Canadian International Development Agency (CIDA) and
the University of Calgary**

The author of this document is:

Oscar Coto Chinchilla

**The ideas expressed in this document are the responsibility of the author and do
not compromise the above mentioned organizations.**

Use of this information contained herein is authorized, provided the source is cited.

TABLE OF CONTENTS

Acronyms.....	4
Executive Summary.....	5
1. Introduction.....	8
2. Institutional Framework for the CDM in Barbados.....	9
3. Project Development for the CDM in Barbados.....	16
4. Conclusions.....	32
REFERENCES.....	34
Annex 1.....	35

Acronyms

CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CIDA	Canadian International Development Agency
COP	Conference of Parties
CPA	Specific project activity in a programme of activities in the CDM
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board of the CDM
EIA	Environmental Impact Assessment
GHG	Greenhouse Gas
OLADE	Latin American Energy Organization
LAC	Latin American and Caribbean Region
MOP	Meeting of Parties to the Kyoto Protocol
MSW	Municipal Solid Waste
PIN	Project Idea Note
PDD	Project Design Document
POA	CDM Programme of Activities
p.v.	Solar photovoltaic technology
SD	Sustainable Development
UNFCCC C	United Nations Framework Convention on Climate Change

Executive Summary

This document has been developed as part of the implementation of the Climate Change Initiative - Phase IV, developed by the Sustainable Energy Program currently carried out by the Latin American Energy Organization and the University of Calgary, with financial support from the Canadian International Development Agency (CIDA).

The objective of this Initiative is to strengthen OLADE member countries technical and institutional capacity to participate in the Clean Development Mechanism (CDM), through the provision of up-to-date information regarding CDM procedures and activities, critical analysis of regional and national CDM activities, and provision of targeted training and technical assistance.

The document presented here corresponds to the Barbados National Case Study. Its major purpose is to provide Barbados CDM National Authority, the Ministry of Environment, Water Resources and Drainage; as well as other in-country national stakeholders, with a study on the national status of the participation on the mechanism, aiming at increasing in-country capacity for participation in the CDM.

The document first describes the CDM institutional framework in Barbados, and in accordance with the expressed interest of the DNA; presents suggested procedures for the issuance of the CDM national letter of approval for CDM projects. The procedures include relevant issues related to scope of the approval process, steps of the process, required documentation to be submitted by project developers and aspects to be considered in the review process itself. The suggested procedures are inclusive of the issuance of letters of no-objection to CDM project development as an early action sometimes required or requested by project developers and carbon buyers interested in a CDM project.

Presentation is done on the overview of the major trends in the energy sector of the country, and identified key renewable energy project development as well as biofuels. The energy project analysis is followed by the identification of targeted potentials for emissions reductions in the short term implementation of the identified projects as well as policy initiatives in the country. These include:

1. The estimated emissions reductions from the renewable energy electricity generation projects identified in the existing renewable energy portfolio of Barbados:

Project	Installed Capacity (MW)	Expected Electricity Generation (MWh)	Expected Emissions Reductions (ton CO _{2eq} /year)
Lamberts East Wind Farm	10	28,000 ¹	22,400
Sugar Cane Restructuring Project: electricity cogeneration	20	157,000 ²	126,144
Mangrove Pond	4.	24,500	19,600

¹ Estimated by assuming a wind farm capacity factor of around 32%.

² Estimated by assuming year round biomass supply as it has been indicated by a recent presentation of the CIRP at the OLADE National CDM Workshop in Barbados, 2008.

Project	Installed Capacity (MW)	Expected Electricity Generation (MWh)	Expected Emissions Reductions (ton CO _{2eq} /year)
Waste to Energy Plant			
Total potential emissions reductions from near term renewable energy projects in Barbados			168,144

2. The estimated emissions reductions from the identified biofuel projects in Barbados:

Project	Amount of Biofuels Produced (litres/year)	Potential Emissions reductions (tonss CO _{2eq} /year)
Cane Industry Restructuring Project: Ethanol from sugar cane component	23 million	90,513
Other ethanol production from waste water treatment facilities	n.a.	311,678
Production of biodiesel from recycled cooking oil	4.5	12,345
Total potential emission reductions from biofuel scenarios in Barbados		102,858 – 414,536

3. The estimated emissions reductions from a 12% effort towards a programmatic CDM in energy efficiency in the field of efficient lights and improve air conditioning through labelling standards, with a total of 86,276 Tons CO_{2eq}/year.

Contribution has been made to the country also in the elaboration of a CDM Project Idea Note (PIN) for the Integrated Solid Waste Management in Barbados through Composting and Electricity Generation from RDF at the Vaucluse Project Site, project that has shown to have the potential to mitigate up to 34,081 tones of CO_{2eq}

The document concludes that there are specific synergies between energy policy, sustainable development and climate mitigation for the country that can be catalyzed by the CDM, and therefore the country should make all possible efforts to develop and incorporate carbon streams to the on going identified projects. In other areas, such as biofuels, special attention should be paid as to assess the methodological developments in the CDM as to determine if an opportunity exists for integrating carbon issue to the on going activities in the country. A specific opportunity exists in manufacturing of biodiesel from used cooking oil that can tackle CDM financing in order to assist waste management in the country.

There are interesting opportunities for programmatic CDM in Barbados, but renovated efforts must be conducted with support from international organizations in developing business plans as well as institutional involvement in the country as well as in the sub region of the Caribbean; in order to fully assess the contribution of this new window of

opportunity in facilitating the adoption of sectoral policies in energy efficiency and solar technologies.

1. Introduction

This document was developed as part of the implementation of the Climate Change Initiative - Phase IV, currently being carried out by the Latin American Energy Organization and the University of Calgary, with financial support from the Canadian International Development Agency (CIDA).

The objective of this Initiative is to strengthen OLADE member countries technical and institutional capacity to participate in the Clean Development Mechanism (CDM), through the provision of up-to-date information regarding CDM procedures and activities, critical analysis of regional and national CDM activities, and provision of targeted training and technical assistance.

The Phase IV of the project builds on earlier phases of information gathering (Phase I) as well as other phases that had already assisted the strengthening of CDM in several other LAC countries including Nicaragua, El Salvador, Jamaica and Cuba.

The current document presented here corresponds to the Barbados National Case Study. Its major purpose is to provide Barbados's CDM Designated National Authority, the Ministry of Environment, Water Resources and Drainage; as well as other in-country national stakeholders, with a document on the national status of the participation on the mechanism, with the aim of contributing to the in-country process for implementing the CDM.

Chapter 1 describes the CDM institutional framework in Barbados. It includes a description of the current development situation of the CDM National Designated Authority, its mandate and activities as well as a description of the National CDM Project Approval Process together with the evaluation criteria currently used for the assessment of sustainable development contribution to the national objectives of Barbados, focussing on presenting recommendations for improvement of the national procedures for CDM in the country, discussing the spaces available to streamline institutional developments in the context of regulatory and promotional aspects of the CDM.

Chapter 2 presents the overview of the identified projects in the CDM portfolio of Barbados as well as some case studies on the status of development of some projects in the country, followed by a presentation on the current status of identification of promising project ideas for the CDM. As part of this chapter, some comments are included on the development of local capacity for the undertaking of formulation of CDM projects, suggesting potential actions to be developed in the country in order to increase local capacity to participate and manage different aspects of the CDM project cycle.

The document concludes with a summary conclusion of key points and possible actions that may assist the development of the CDM in Barbados.

2. Institutional Framework for the CDM in Barbados

2.1 The CDM Designated National Authority (DNA)

The Ministry of Environment, Water Resources and Drainage is the Designated National Authority to the Clean Development Mechanism in Barbados. As of the end of January 2009, proper reporting to the UNFCCC Secretariat is still pending on the designation.

2.2 The existing CDM project approval process in Barbados

- There is no specific and formal approval process for CDM projects in Barbados at present, although the technical offices within the Ministry of Environment, Water Resources and Drainage with the support from other government departments have the sound capabilities for conducting an approval process that is to be adopted internally and under the sovereign mandate of the country as a signatory party of the Kyoto Protocol.
- Barbados has strengths for conducting the necessary procedures related to the national approval for CDM projects: it has ratified the Kyoto Protocol, it has a sound Sustainable Development Policy (published in 2004) and has a National Strategic Plan of Barbados for the period 2006-2025; all of which are elements that permit the CDM DNA the adequate evaluation of the contribution of CDM project activities to the sustainable development of the country.
- The implementation of an explicit CDM project approval process is important in order to give interested project developers with the knowledge of the procedures that are to be followed when requesting the approval from the Government of Barbados.
- It will be important to consider by the DNA in Barbados, whether or not letters of no objection to CDM projects will be granted as part of the approval processes in the country. Due to the nature of project development in some sectors of the country, where ventures and alliances are foster in the style of public-private partnerships, it seems important and timely for the DNA to consider extending letters of no objection with respect to the CDM project development. The issuance of letters of no objection is a customary procedure in small developing countries where project development activities may take relatively longer periods of time, given the project developer the possibility of counting with a initial no objection from the government to develop the carbon revenues from any given project. Project financing in many projects in developing countries could benefit from such no objections, in order to leverage the consideration of the carbon revenue stream in supporting perceived risk mitigations on the investment side or as to reduce perceived country risks for project development. It is clear that the issuance of early stage no objection letters for CDM project development, does not interfere with the formal approval process that the country will request at the time of granting the formal letter of CDM approval to be used for validation and registration of a CDM project under the Kyoto Protocol.

2.3 Supportive and existing developments for the CDM in Barbados

Barbados has achieved important milestones required for the implementation of CDM projects, as well as it has sound and articulate sets of policies that are complementary to the effort of climate change mitigation and adaptation, that can include the development of CDM projects:

- The existing “Global Excellence/Barbadian Traditions: The National Strategy Plan of Barbados 2006-2025”, as published in 2007 clearly identifies global environmental degradation including climate change as a major threat to the sustainable development of the country, therefore directing the attention of policy makers and society in general to dealing with the causes and consequences of climate change; and from this the country derives an important presence in the international for a and conventions dealing with the climate change issue, as well as articulating organizational strategies, programs and projects related to adaptation and mitigation to this pressing issue.
- The Draft National Energy Policy of Barbados as submitted in 2006 is another important step taken by the country in articulating and integrating the principles of sustainable development in the energy sector of the country, given birth to a series of potentially interesting energy sector developments that can greatly contribute to the climate change mitigation in the country.
- The Barbados Sustainable Development Policy, established in 2004, provides the policy aims, definitions and policy objectives and goals as well as the principles for sustainable development of the country, providing a clear framework for the process of determination of the contribution to sustainable development of the country from projects aiming at the carbon revenues in order to enter the CDM.
- The existing of important sectoral programmes and projects, for example in the sugar cane restructuring, solid waste management and others; permit the identification of a series of projects that can generate emissions reductions at the same time of providing important contributions to the sustainable development of the country.
- Barbados has a Government Information Network that can be used for providing access to the general public as well as to project developers interested in the CDM, on the documentation and procedures required for CDM project approval in the country.

2.4 Suggested procedures for national approval of CDM projects in Barbados

Some of the most important points to be included in the definition of the national approval process are:

Scope is defined in terms of the compliance to the relevant decisions and modalities and procedures of the CDM requesting a host country to express the voluntary participation in the CDM as well as the confirmation of the contribution to sustainable development by the proposed project activity to be registered in the CDM.

Efficiency is related to the criteria and procedures to be used as well as the definition of maximum allowed times allocated for the response to a project proponent.

Transparency related to the support for the decision making process involved based on sound technical criteria and feedback loops used by the DNA that are to be available published in the web site of the DNA.

Sustainable development reflects on the overarching normative, ministerial decisions and balance when considering environmental, and socio economic aspects of sustainable development.

2.5 Procedure for issuance of letters of no objection

Over the course of the last year, at least one specific request has been submitted by interested project developers in order to obtain a letter of no objection for a CDM project. It is important to say that the letter of no objection is sometimes required by project developers in order to create interest on a forthcoming project activity in the CDM, and that this type of letter is not part of the official documentation to be submitted at registration of a CDM project, therefore the consideration of its issuance does not substitute at any time the formal procedure and sovereign decision of a host country with respect to the official national letter of approval.

The **procedure for issuance of a letter of no objection** for a CDM project should encompass the following steps:

1. The interested Project Developer should submit a letter to the Ministry of Environment, Water Resources and Drainage as acting designated Barbados CDM National Authority, requesting the issuance of a letter of no-objection to the start or continuation of project development activities pursuing to the potential development of the proposed project as a CDM project activity.
2. The Project Developer (may be a private entity or a government agency or other), must submit a Project Idea Note/Project Information to DNA, together with the letter requesting the no objection letter.
3. The Project Idea Note is reviewed by the Barbados CDM DNA (through the internal assignment to the suitable climate change office within the Ministry). The review criteria should be based on the grounds of eligibility of the proposed activity under the CDM and also general compliance with the Barbados National Sustainable Development Policy.
4. Internal recommendation on the issuance of the letter of no objection is passed from the designated climate change office in the Ministry to the Office of the Permanent Secretary at the Ministry.
5. Formal communication on the issuance of the letter of no objection is then formally passed to the interested project developer, through the appropriate

mechanisms established in the Ministry of Environment, Water Resources and Drainage as acting CDM DNA in Barbados.

The required documentation for the process should include at least the following:

- a. A letter from the Project Developer to the CDM DNA in Barbados, requesting the issuance of a letter of no objection, and also providing information on the project developer itself, the stated interest in a CDM project to be developed in Barbados, as well as information demonstrating the legal representation capacity of the project developer.
- b. A Project Idea Note / Project Information document on the proposed project according to one of the internationally accepted formats for the submission of CDM project ideas.
- c. Declaration from the project developer on why the proposed project contributes to the Sustainable Development of Barbados.

Although it is anticipated that CDM project developers are knowledgeable on international carbon market regulations and trends on project information, the DNA in Barbados should make an effort in providing some guidance to project developers on the information requirements at this stage. For example, a Project Idea Note normally includes the following information on a project:

Project Idea Note or PIN

Description of size and quality expected of a PIN

Basically a PIN will consist of approximately 5 pages providing indicative information on:

- the type and size of the project
- its location
- the anticipated total amount of Greenhouse Gas (GHG) reduction compared to the “business-as-usual” scenario (which will be elaborated in the baseline later on at Project Design Document [PDD] level)
- the suggested crediting life time
- the suggested Certified Emission Reductions (CER)/Emission Reduction Unit (ERU) price in US\$/ton CO₂eq reduced
- the financial structuring (indicating which parties are expected to provide the project’s financing)
- the project’s other socio-economic or environmental effects/benefits

While every effort should be made to provide as complete and extensive information as possible, it is recognised that full information on every item listed in the template will not be available at all times for every project.

With respect to the sustainable development impact of a project, any project developer will benefit tremendously if the DNA includes a section in the official website of the Ministry, detailing the forms for PIN submission as well as directing the attention to the Sustainable Development Policy of the country, where the project developer may find useful criteria,

that can be used to express the views and justifications on the expected contribution of the proposed CDM project to sustainable development in Barbados.

The in-house DNA process for reviewing the documentation for letters of no objection should aim to be a fast track checking procedure that can include the following activities:

- Check on eligibility of the project activity proposed under the Modalities and Procedures of the CDM, by checking on sectoral scope of the project, determination of the project as a mitigation or carbon sequestration project, adequate description of the technology to be used, and other aspects included in the PIN.
- Check on general compliance with the Barbados National Sustainable Development Policy (perhaps a positive list based on the NSDP).
- DNA may consider discussing the PIN with any other government office that may be deemed relevant to the sector, scope or impacts of the proposed project.

The general framework of time for the issuance of letters of no objection should be in the order of up to 30 working days.

2.6 Procedure for the national approval of CDM projects in Barbados

The national approval of CDM projects is one of the main functions of the acting in-country DNA, according to the modalities and procedures of the CDM. The national approval of a CDM project is a key requirement for the registration of a project in the CDM, and it must followed the general guidelines issued by the Executive Board of the CDM as per the contents that such approval must include, but at the same it must respect the sovereign decisions of the host country with respect to the approval and requirements necessary to be fulfilled by the project.

The documentation to be required in order to request a letter of approval for a CDM project should include:

- a. Letter of request.
- b. Legal certification supporting the power invested on the person signing the letter of request for national approval for a CDM Project Activity, as legal representative of the Project Participant in the CDM Project Activity.
- c. Project Design Document (PDD) of the proposed CDM Project Activity.
- d. Declaration from the Project Participant on his/her views on why the proposed project contributes to the Sustainable Development of Barbados.
- e. Statement by the Project Participant on compliance with required permits in Barbados.

- f. Copies of permits required in Barbados (planning, environment, etc), showing state of compliance with local requirements.

The ***procedure for issuance of the letter of national approval for a CDM project*** should include at least the following steps:

1. Letter from Project Participant (PP) to the Barbados DNA, requesting the national approval for a CDM project and issuance of the national letter of approval for a CDM project. The letter must be signed by the legal representative of the Project Participant, as defined in the Modalities and Procedures of the CDM, and as it appears in the Project Design Document (PDD).
2. Screening for completeness of information is conducted by the suitable office in the DNA in Barbados.
3. If Step 2 is completed satisfactorily, the approval procedure moves to Step 4, otherwise if the check on required documentation is not satisfactory, the project participant receives a letter stating the need to resubmit the required information for consideration.
4. In case the information accompanying the request for letter of approval is complete, the procedure allows for the evaluation of the contribution to sustainable development of the project under the coordination of the DNA and with technical back stopping from the designated offices in the Ministry of Environment, Water Resources and Drainage as acting DNA for the CDM.
5. If the Sustainable Development Evaluation is positive, a recommendation is given requesting the issuance of the letter of approval. If the sustainable development evaluation conducted does not yield a positive opinion on the proposed project, the project participant receives a letter stating the rejection to the request.
6. The DNA issues the National Letter of Approval of the proposed CDM Project Activity, in a format that complies with the guidance of the Executive Board of the CDM, stating at least the ratification of the Kyoto protocol by Barbados, the nature of the voluntary participation and the contribution to sustainable development of the project activity to Barbados.

It is suggested that the time required for consideration, evaluations and issuance of a letter of national approval should be of up to 45 working days.

2.7 Criteria for sustainable development considerations of CDM projects in the country

As it has been mentioned before, Barbados has a very explicit Sustainable Development Policy, published since 2004. This National Policy provides for the basic principles of sustainable development in the country.

Those principles consider the five reference overarching elements of: quality of life, conservation of resources, economic efficiency, equity and participation. The National Sustainable Development Action Plan includes targets for sustainable development of at least 23 sectors in Barbados, including transportation, agriculture, forestry, energy, land resources, waste management, as well as targets for stakeholder involvement, human health, well being and poverty, etc. The Sustainable Development Policy and Plan, create the framework for the evaluation of sustainable development contribution of CDM project in Barbados, and to a certain extent create a positive list that can allow the DNA to implement a sound evaluation at the time of issuance of a national letter of approval for a CDM project.

Taking into account the principles, policies and goals of sustainable development in Barbados, a simplified matrix can be used to assess contribution to sustainable development on a project basis, for example:

Sustainable Development Criteria Operational in a Project Context

Dimension of Sustainable Development	Criteria
Economic	generate employment
	reduce economic burden of energy imports
	provide financial returns to local entities
	positive impact on Balance of Payments
	technological change
	cost-effectiveness
Social	increase equity
	increase energy access
	gender issues
	education and training
	Health
	alleviate poverty
	legal framework
	Governance
Environmental	information sharing
	GHG emission reductions
	local environmental benefits, e.g. related to: air pollution, water, soil, waste
	use of exhaustible resources
	use of renewable resources
	biodiversity

3. Project Development for the CDM in Barbados

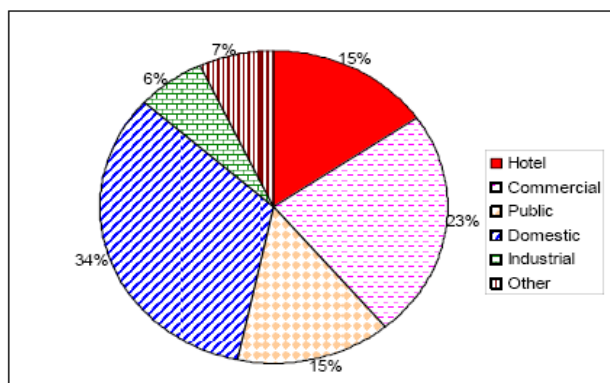
3.1 Potential for CDM Projects

The total final consumption of energy in the country in 2005³ was 2,026 thousand barrels of oil equivalent, and total electricity consumption was 0.93 TWh, with an average energy consumption increase on the order of 4% per year.

The most important consumers of petroleum imports in the country are the electrical utility and transportation sectors of the country.

Users	Percentage Consumption of Petroleum Imports (%)
Agriculture	0.84
Commercial	1.67
Cement Production	2.84
Government	0.71
Residential	5.09
Electric Utility	49.76
Tourism	0.41
Manufacturing	5.35
Road Transportation	33.03
Sugar Manufacturing	0.11
Other	0.19

The most important consumers of electricity in the country are the residential sector, followed by the commercial sector.



Vehicle information fleet information for the country indicates that in 2004 there were a total of around 106,000 transportation units in the country.

³ OLADE. Energy Statistics Report 2005, available at www.olade.org

Year	Total	Private Cars	Buses/Coaches Hired/ Taxis	Lorries/Vans	Other Commercial Vehicles
1992	46,957	38,257	3,067	5,040	593
1995	54,670	42,701	3,551	4,348	1,724
1998	68,094	53,763	3,630	5,196	2,521
2001	71,756	55,479	5,133	6,502	1,127
2004	106,178	86,240	4,785	6,893	2,641

Current generating capacity in Barbados is around 240 MW. Assuming a 4% yearly increase in peak electricity demand, by 2026, Barbados will require 520 MW of electricity generating capacity.

Plant ID	Description	Maximum Continuous Rating (MW)	Can be converted to burn Nat. gas
S1	Steam Turbine	20	YES
S2	Steam Turbine	20	YES
D10	Low speed diesel generator	12	NO
D11	Low speed diesel generator	12	NO
D12	Low speed diesel generator	12	NO
D13	Low speed diesel generator	12	NO
CG01	Waste heat turbine	1.5	NO
D14	Low speed diesel generator	29.7	NO
D15	Low speed diesel generator	29.7	NO
CG02	Waste heat turbine	2.2	NO
GT02	Gas turbine (Garrison)	13	NO
GT03	Gas turbine (Seawell)	13	YES

Plant ID	Description	Maximum Continuous Rating (MW)	Can be converted to burn Nat. gas
GT04	Gas turbine (Seawell)	20	YES
GT05	Gas turbine (Seawell)	20	YES
GT06	Gas turbine (Seawell)	20	YES
Total capacity		237.1	

Source: Barbados Light and Power Holdings Ltd. 2006

The Draft Energy Policy of Barbados states that:

As shown in Table 4.1, current generating capacity in Barbados is approximately 240 MW. Assuming 4% annual growth in peak electricity demand, Barbados will require approximately 520 MW of installed capacity by 2026. Within the next 5 years it is anticipated that approximately 40 MW of electricity will be generated by renewable energy (30 MW from biofuels, 10 MW from wind), representing 17% of current capacity or 7% of capacity in 2026.

Within 20 years, it is anticipated that additional renewable energy generating capacity will be achieved as follows:

- | | |
|---|------------|
| • Additional wind farming (on and off-shore): | 20 - 40 MW |
| • Waste-to-Energy (landfill gas recovery) | 5 – 10 MW |
| • Other technologies | 10 – 20 MW |
| • Photovoltaics | 0 – 5 MW |
| • Second Biofuel project (gasification) | 20 - 30 MW |

This is a total potential renewable energy generating capacity of 95 – 145 MW over the design period, representing 18 – 28% of the required generating capacity in 2026.

Therefore, an achievable energy mix for electricity generation by 2026 could be as follows:

Natural gas:	70%
Renewable:	20%
Fuel oil:	10%

The Barbados National Greenhouse Gas Inventory submitted to the UNFCCC indicates that:

Barbados is heavily dependent on the importation and use of fossil fuels for energy and transportation requirements. As a small island developing state, Barbados is not a major contributor to global warming and climate change, but is likely to be significantly impacted if adaptation measures are not implemented. The national Green House Gas (GHG) inventory for the years 1990, 1994 and 1997 revealed the following:

- CO₂ emissions made up 94% - 96% of total GHG emissions, with progressive increases over the years reported on (1,564.23 Gg (1990), 1913.81 (1994), and 2198.40 Gg. (1997)
- Electricity generation via combustion of fossil fuels accounted for the majority of the CO₂ emissions (74%) over the 3 years investigated, followed by road transportation (14%), and all others (9%) – i.e manufacturing/industrial, commercial/institutional, residential and agricultural sectors.

Abatement options recommended in The Barbados First National Communications Report under the United Nations Framework Convention on Climate Change (UNFCCC) include:

- Efforts By the Government – increase the use of renewable energy
- Efforts by The Barbados Light and Power Co. Ltd. to reduce fuel consumption in electricity production and, where possible, shift towards the use of cleaner energy sources (e.g. natural gas).
- Emphasis on energy efficiency measures in the industrial, commercial, institutional and residential sectors
- Reduction of CO₂ emissions from the cement industry
- Introduction of Electric Vehicles and Hybrids
- Reducing disposal of organic materials in landfills
- Recovery of landfill gas from the Mangrove Pond Landfill
- Increased support for Research and Development

According to the Draft Barbados National Energy Policy, the Government is looking to introduce gasohol based on a 10 percent ethanol to gasoline mix. Under the reform of the sugar industry it intends for approximately 14.7 million litres of ethanol to be produced annually to meet that requirement. The levels of ethanol content in the gasoline are to be progressively increased over the 20-year design period. Recognizing that ethanol can be

used in the production of biodiesel, Government has pledged to encourage further investment in ethanol production.

Barbados consumes approximately 100 million litres of diesel annually. The Government has also proposed in the draft policy to mandate two percent biodiesel content for all diesel-fuelled vehicles by 2012, increased to 10 percent by 2025. An estimated 4.5 million litres of used cooking oil annually generated can be converted into biodiesel. The Government has expressed the intention of providing incentives to the private sector for the development of the biodiesel industry.

Barbados has estimated natural gas reserves of 141.4 million cubic metres, with an annual consumption of 29.17 million cubic metres. With national supplies expected to run out in the next five to fifteen years, the Government has turned its attention to its oil-rich neighbour Trinidad and Tobago as a source of natural gas. The Cabinet recently approved the importation of gas through the pipeline being constructed by Trinidadian private company Eastern Caribbean Gas Pipeline Co. The pipeline is designed to deliver gas from Tobago to Barbados, St Lucia, Martinique, Guadeloupe and Dominica. The Minister of Energy has stated that the increased volume of gas (between 30 million and 40 million cubic feet a day) would allow the national grid to expand in the first five years to supply a further 13,000 households across Barbados with natural gas, while guaranteeing security of supply to the Barbados Light & Power, which is in the process of constructing an 80-megawatt generation plant at Trenches, St. Lucy capable of using natural gas.

A feasibility study was carried out to build a wind farm in the north of the island. Barbados Light and Power, estimates that the facility could generate as much as 26 million KWh annually. Given the current price of fuel imports, the facility could save \$4.6 million a year.

A Fuel Cane Power Generation feasibility assessment was also carried out. A 20-30 MW plant could generate 263 million KWh and reduce the fuel import bill by US \$29 million per year.

The Government is looking to increase energy-efficiency by promoting energy efficient technologies and usage. The Government has recently turned its attention to energy conservation and efficiency in sectors of the economy to promote its vision of "Green Economics". Initiatives in these sectors will include incentives to:

- Manage/ minimize solid waste; promote recycling and separation;
- Promote "Green" building techniques and standards;
- Use alternative fuels/ renewable energy (tax incentives);
- Purchase "Green" products i.e. solar pumps, solar lights, composters; water-storage/ saving devices;
- Energy conservation in the public sector.

The Government has also committed to:

- Implementing economic incentives to promote energy conservation; efficient energy use; promoting renewable energy sources;
- Introducing standards for efficient energy use in technologies;
- Encourage the large-scale generation of energy using renewable sources;
- Promoting research and development into renewable energy;

As part of the GEF-4, Barbados has set a solar power expansion project (currently at the concept level) as a national priority, aiming at:

- Inventory and selection of suitable building types;
- assessment of infrastructural requirements including monitoring equipment;
- Installation of Photo-Voltaic (PV) systems at pilot sites,
- Publicizing results of pilot,
- Definition of a framework for integrating independent power production into the grid.

Information available on the Renewable Energies Potential in Barbados, as it has been presented above indicates that:

1. A growth rate of 4.0% per year in electricity consumption is expected to be maintained.
2. Estimated peak electricity demand in Barbados in 2026 will be on the order of 520 MW, from the current installed capacity of 240 MW.
3. It is expected that in the next 5 years, around 40 MW of renewable energy will be installed (20-30 MW biomass, 10 MW wind, 4 MW waste to energy), representing 17% of current installed capacity in the country.
4. Current drafts of the national electricity policy set a target for 10% contribution for renewable energies in 2012 and 20% by 2026.
5. The achievable energy mix for the electricity sector in 2026 is estimated to be 70% natural gas, 20%renewables and 10% fuel oil, showing at the same time the very important contribution of transformation of existing plants and new thermal capacity additions to be based on natural gas.

For the purpose of estimation of the carbon emission reductions in Barbados over the next few years, especially with respect to projects that incorporate renewable electricity into the national grid, a conservative value of the fuel emission factor⁴ of the national grid in the order of 0.8 tonss of CO₂/MWh is used in this document.

The ***estimated emissions reductions from the renewable energy electricity generation projects identified in the existing renewable energy portfolio of Barbados*** are presented below:

⁴ This fuel emission factor has been conservatively estimated based on the operating mix of the grid, the estimated efficiency of current plants, and a comparison with other electricity grids in countries in the Caribbean.

Project	Installed Capacity (MW)	Expected Electricity Generation (MWh)	Expected Emissions Reductions (tonss CO _{2eq} /year)
Lamberts East Wind Farm	10	28,000 ⁵	22,400
Sugar Cane Restructuring Project: electricity cogeneration	20	157,000 ⁶	126,144
Mangrove Pond Waste to Energy Plant	4.	24,500	19,600
Total potential emissions reductions from near term renewable energy projects in Barbados			168,144

Although eligibility of biofuels for CDM project activities is still somehow limited due to the non availability of approved CDM methodologies, it is possible to conduct a very early stage calculation of the baseline emissions that the proposed biofuels projects may have in the country (obviously as an indication of potential baseline emissions in case there is future development of baseline methodologies in this area of the CDM).

According to available information the Cane Industry Restructuring Project aims at producing up to 23 million litres of anhydrous ethanol, and the government also expects a biodiesel industry to be developed from the roughly 4.5 million litres of used cooking oil available in the country. A recent study conducted by IADB⁷ in relation to CDM and biofuels in the Caribbean has roughly determined that the potential emissions reductions from the use of the ethanol from sugar cane project can yield around 90,513 tons CO_{2eq}/year and the emissions reductions that can be potentially achieved from alcohol production from a series of other waste water treatment facilities could be as higher as 311,678 tonss CO_{2eq}/year.

Taking into consideration that the government aims at producing around 4.5 million litres of biodiesel from recycled cooking oil available in the country, the associated emissions reductions that can be expected from the displacement of diesel oil, amounts to around 12,345 tonss of CO_{2eq}/year. Such emissions have been estimated by assuming that a litre of cooking oil roughly produces about a litre of biodiesel and that the emissions associated to diesel are on the order of 74,100 kg CO₂/TJ (according to IPCC, and by

⁵ Estimated by assuming a wind farm capacity factor of around 32%.

⁶ Estimated by assuming year round biomass supply as it has been indicated by a recent presentation of the CIRP at the OLADE National CDM Workshop in Barbados, 2008.

⁷ Orlando Jimenez, IADB Consultant. CDM for Biofuels in the Caribbean 2008. Contact: Orlando.jimenez@gmail.com

using the average density of diesel oil at 855 kg/m³ and the net calorific value of diesel oil at 43.3 TJ/1000 tonss).

Therefore ***the estimated emissions reductions from the identified biofuel projects in Barbados*** are as follows:

Project	Amount of Biofuels Produced (litres/year)	Potential Emissions reductions (tonss CO_{2eq}/year)
Cane Industry Restructuring Project: Ethanol from sugar cane component	23 million	90,513
Other ethanol production from waste water treatment facilities	n.a.	311,678
Production of biodiesel from recycled cooking oil	4.5	12.345
Total potential emission reductions from biofuel scenarios in Barbados		102,858 – 414,536

It is clear that in the short term, Barbados should develop the CDM components of the existing renewable energy projects as identified, and should pay close attention to the development of methodologies for biofuels in the CDM, in order to assess the CDM contributions to assist in the development of proposed biofuel projects in the country.

Barbados should also pay attention to the development and potential for conversion of existing power plants from fuel oil to natural gas in case the proposed natural gas pipeline from Tobago continues its development. There are some available methodologies that could be used in order to assess emissions reductions from such fuel switch, but special attention should be paid to additionality considerations for the CDM development of such projects.

3.2 Existing CDM Project Portfolio in Barbados

Barbados does not have any registered project under the CDM, and most of the CDM project development for the CDM is currently at the Project Idea Note level. Identified and concrete actions are identified in the following projects:

Lamberts East Wind Farm

Information presented in this description is taken from presentation by Barbados Light and Power Company Limited, during the Barbados CDM Workshop, organized by OLADE and the Barbados DNA in 2008.

Why Lamberts?


- One of four sites designated by the Government in the National Physical Development Plan
- The Barbados Light & Power completed a feasibility study in 2004 that considered environmental, technical, financial and wind information to rank the sites.
- The study determined that this site located on the Lamberts Plantation, St. Lucy was the preferred site.
- Measurements show that Lamberts has an excellent wind regime. There is sufficient wind for the turbines to be generating electricity for over 90% of the time.

- National Physical Development Plan, Map 4




Project Overview

- The Lamberts East wind farm will consist of 11 wind turbines.
- Total installed capacity will be around **10 MW** and annual production **28 million kilowatt-hours**
 - enough to meet the average annual needs of about **9,275 homes**
 - reducing fuel costs by approximately **BDS\$ 5.6 million per year**



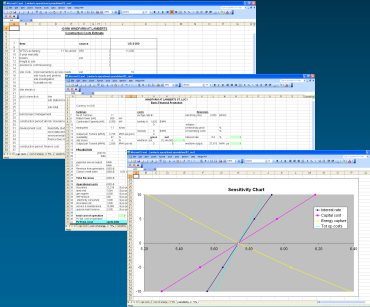
Project Overview


- The Lamberts East wind farm will consist of 11 wind turbines.
- Total installed capacity will be around **10 MW** and annual production **28 million kilowatt-hours**
 - enough to meet the average annual needs of about **9,275 homes**
 - reducing fuel costs by approximately **BDS\$ 5.6 million per year**



Economics

- Projected Capital Cost:
BDS\$30.4 Million
- Average Production Cost:
BDS\$0.135 per kWh





Environmental Benefits

- The main greenhouse gas is Carbon Dioxide.
- Reducing electricity generation on hydrocarbon fuels reduces the amount of carbon dioxide produced.
- A 10 MW Wind Farm could reduce Carbon Dioxide output by around **20,000 tonnes per year**, the equivalent of:
 - planting **6,700 acres of trees**
 - or
 - removing **4,400 cars** from the roads of Barbados

Environmental Impact Assessment

- EIA Completed in 2007
- Study available on-line: www.blpc.com.bb
- Main issues addressed:
 - Set-back from residences
 - Land-take
 - Visual Impact
 - Noise
 - Shadow Flicker
 - Ecological effects

CDM Considerations

- Carbon credit assessment and application assistance from the European Investment Bank
 - Climate Change Technical Assistance Facility (CCTAF)
- Consultants selected:
 - Ecosecurities – carbon feasibility and project design
 - DNV – project validation

Next Steps

- 2008
 - Obtain planning permissions
 - Obtain Board approval
 - Tender design
 - Evaluation of tenders
 - Contract negotiations
 - Detailed site investigations
- 2009
 - Commence civil work and equipment installation
- 2010
 - Commission wind farm

The Mangrove Pond Landfill Gas to Energy Project

Information presented in this description is taken from a presentation by Mr Ricardo Marshall during the Barbados CDM Workshop organized by OLADE and the Barbados DNA in 2008.

THE SOLID WASTE PROJECT



Mangrove Pond Landfill – Landfill Gas-to-Energy Project

Project Goal: To reduce greenhouse gas (GHG) emissions from the Mangrove Pond Landfill utilizing a landfill gas control system

Project Phases: Phase I – Design, construction and operation of a landfill gas (LFG) collection and flaring system. 1 year timeline



THE SOLID WASTE PROJECT



Phase II - Design, construction and operation of a 2-5 MW electricity generating plant or a Leachate Treatment System (dependent on gas production consistency)

THE SOLID WASTE PROJECT



Agencies involved:

- Government Agencies – **Solid Waste Project Unit Project, Sanitation Service Authority**, Economic Affairs, Environmental Protection Department, Barbados National Oil Co. Ltd., National Petroleum Corporation, Environment Division, Energy Division
- Private Sector Company

THE SOLID WASTE PROJECT



Description of Physical Location

- In the Parish of St. Thomas
- Closest communities Rock Hall, Arch Hall, Bennetts, Bucks, Sandy Lane
- Surrounding land uses include agriculture, quarrying and solid waste management
- Phase I (1986-1992), **Phase II (1992-2003)**, **Phase III (2003- present)**

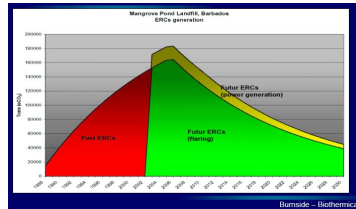
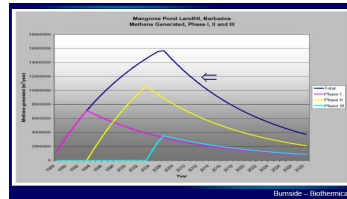
THE SOLID WASTE PROJECT



LFG Recovery System Description

- Vertical Extraction Wells- perforated and non-perforated PVC pipes, well head with meters
- Horizontal LFG Transport Pipes- non-perforated PVC pipes, condensate traps, Plastic and soil cover
- Pumping Station – blower, filter, multi-gas meter and shut-off
- Flaring System – combustion chamber, flares/ burners (capped) so no flame visible, sampling port
- Entire landfill will also have soil cap and be vegetated
- Test wells already in place and feasibility tests concluded

Mangrove Pond Landfill



Depending on the collection efficiency of the active system, the expected yearly average emissions reductions will range from 50 - 80,000 Tones CO₂eq/year.

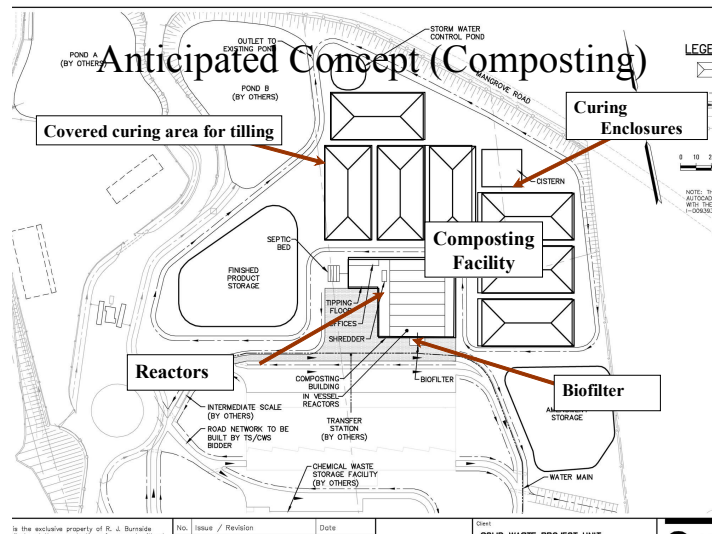
37

Taking into account the observed delays in the development of the project, it is possible that new technical-economical diuillgence should be carried out in order to fully assess if the energy component of this project should be developed taking into account that from the initially predicted dates of start of operation (considered at the time of feasibility study development) have been delayed for almost 2 years, therefore sustained average gas productivity should be determined in order to take the economic decision of developing the power generation component.

Solid Waste Management Centre at Vaocluse

Information presented in this project description is taken from the presentation done by Mr. Ricardo Marshall at the Barbados National CDM Workshop 2008.





The project includes the development of a composting facility as well as several waste management facilities that will assist Barbados in implementing a state of the art waste management centre.

Under the execution of project activities by OLADE in the country, a PIN was developed for this project concept, determining that the annual average emissions reductions from this project will be on the order of 34,801 tonnes CO_{2eq}/year for the next 10 years.

Annex 1 of this report includes the PIN developed for this project under this initiative.

3.3 Identification of Other Areas of CDM Project Activity in Barbados

Programmatic CDM

The programmatic CDM was originated out of criticism to the CDM from the following perspectives:

- Unsatisfactory sustainable benefits: more than half of the accumulated 2012 CERs will come from HFCs, N₂O emission reduction projects, with limited Sustainable Development side benefits
- Fail to benefit LDCs and poor communities
- High transaction costs and complicated rules
- Leave energy efficiency among households, service sector, renewable for end users, transportation, much untouched

According to the accepted definitions for a Program of Activities in the CDM:

A **programme of activities (PoA)** is a voluntary coordinated action by a private or public entity which coordinates and implements any policy/measure or stated goal (i.e. incentive schemes and voluntary programmes), via an unlimited number of CPAs, therefore establishing two levels of action,

- PoA - programme of activities
- CPA - CDM programme activity - a project activity under a programme of activities. A CPA is a single, or a set of interrelated measure(s), to reduce GHG emissions or result in net anthropogenic greenhouse gas removals by sinks, applied within a designated area defined in the baseline methodology.

Some of the most important modalities and procedures for the development of programmes of activities in the CDM are:

- One Methodology and one type of technology: All CPAs of a PoA shall apply the same approved baseline and monitoring methodology, involving one type of technology or set of interrelated measures in the same type of facility/installation/land.
- Additionality: The PoA shall demonstrate that net GHG emission reductions or removals for each CPA are real and measurable, accurate, and are uniquely attributable to the PoA.
- Requirements for CPA: Each CPA shall be uniquely identified, defined and localized in an unambiguous manner including the exact start and end date of the crediting period and meet requirements set in PoA.
- Duration of the PoA, (1) max. 28 years for regular projects shall be fixed at the time of request for PoA registration. Any CPA can be added to the PoA at any time during the duration of the PoA by the Coordinating Entity. The crediting period of a CPA will be either a max. of 7 years with at most 2 renewal or a max. of 10 years, but must end no later than the PoA.
- Renewable of Credit Period: The latest version of the “Procedures for Renewal of a Crediting Period of a Registered CDM project activity” shall be applied, to a PoA every 7 years. Any resulting changes to the PoA shall be applied by each CPA at the time of its first crediting period renewal after such PoA change.
- Monitoring: The emission reductions or removals of each CPA shall be monitored as per the registered monitoring plan. The verification method or approach shall ensure the accuracy of emission reductions, and can include sampling within CPAs.

The Government of Barbados has expressed an explicit interest in the development of policies and implementation agenda for increase energy conservation and dissemination of solar water heaters as well as solar photovoltaic technologies for electricity generation, the latter especially applied to the household sector.

Current electricity sales from the utility in Barbados include 294.8 GWh to the domestic sector and 608.6 GWh to the commercial sector. Assuming a 12% energy use reduction due to energy efficiency improvements due to increase dissemination of efficient light fixtures, improve air conditioning and refrigeration units, it is possible to think that an initial target on energy efficiency may yield up to 108.4 GWh. Taking into account the carbon emissions factor of the Barbados grid estimated at 0.8 ton of CO₂/MWh, the estimated potential for emissions reductions from energy efficiency programs may be in the order of 86,726 tonnes CO_{2eq}/year. It is well known that energy efficiency investments will happen over a period of years, so the ultimate achievement of the program will be related to the dissemination strategy to be followed by the government and the utility in the country.

It is possible to think that a programmatic CDM approach could be followed in the country in order to implement at least 2 types of small scale programmes of activities related to:

1. Dissemination of efficient light fixtures,
2. Dissemination through standards of air conditioning units for the commercial sector.

It is recommended that the Government of Barbados should pay attention to the p-CDM as a tool that can assist the government in achieving financing and provide sustainability to the on going energy efficiency activities in the country, and not to consider the CDM in this field as a way to finance the technology transfer; it has to be remembered that a major effort for a country like Barbados is that of sustaining the policy efforts already established in the Draft Energy Sector Policy, and that the p-CDM can play a significant role in this direction.

Although no specific information was obtained detailing the scope of the solar thermal and solar p.v. programmes in the government, it can be initially concluded that the p-CDM can be an instrument for its development, although careful baseline assessments must be developed especially in the area of solar thermal applications.

Barbados can play an instrumental role in addressing the potential of the p-CDM in the Caribbean, where attention must be paid to the consideration of multi-country involvements in pursuance of common energy and development goals.

4. Conclusions

The objective of this report has been the presentation of the current state of affairs related to institutional development as well as the environment for CDM project development in Barbados.

The work presented in this report is based on two in-country visits implemented by the consultant to Barbados in 2007 and 2008. The purpose of the first visit was to get acquainted with the level of institutional development taking place in the country, and the conducting of several meetings with representative stakeholders involved in CDM project development, in order to identify and report on CDM project development status in the country. During the second visit to the country, a National Workshop on the CDM was delivered with support from the Ministry of Environment, Water Resources and Drainage; to key identified local stakeholders on relevant CDM issues. This workshop was also supported by the UNEP RISOE Centre on Energy and Climate Change and the CD4CDM Project.

The Ministry of Environment, Water Resources and Drainage is the Designated CDM National Authority in Barbados and has been duly communicated as such to the UNFCCC, fulfilling requirements as a signatory country of the Kyoto Protocol.

Over time, and functioning as the DNA in Barbados, the environmental and climate change units at the ministry have undertaken different levels of activities related to the CDM in country, both at the in-country level as well as within the international representation to the MOP of the Kyoto Protocol. Another set of actions have been associated to the dissemination and promotion of the CDM amongst a varied constituency of interested stakeholders.

During the time of the in-country visits to the country, the DNA expressed the interest in receiving technical assistance backstopping for the development of procedures for national approval of CDM projects that lead to the issuance of the national approval letter.

The work undertaken has provided the Barbados CDM DNA with a set of suggested procedures for the issuance of national letters of approval for CDM projects as well as no-objection letters for early CDM project development. The report makes a series of specific recommendations to the DNA in four specific areas related to: guidelines and principles that drive the approval process (definition of scope, transparency, criteria, and sustainable development), requisites for documentation to be presented by project proponents, criteria to be used for assessment).

The report then identifies the status of CDM project development in Jamaica, firstly assessing the potential in some specific sectors (wind energy, sugar cane processing, biofuels); that offers estimates ranging from around 271,000 -582,680 tons of CO_{2eq}/year identified in a handful of projects and technological choices. Special effort has been put into the assessment of the potential contribution of energy efficiency activities as a mean to mitigate emissions reductions in Barbados through programmatic CDM activities, rendering interesting potentials on the order of up to 86,726 tons CO_{2eq}/year. Obviously, realizing such potentials needs the concerted effort of complementary regulatory, policy and investment support activities in Barbados, and most likely in order to remove

transactions costs, the concerted sub regional effort of multiple countries joining together in such development of energy efficiency programs under the CDM.

Three projects can be said to be making progress in the CDM project cycle, information is provided on the status of each as on some of the lessons learned from their development.

The report concludes that in the interest of developing the CDM potential in Barbados, an effort should be placed in fostering the enabling environment both regulatory and financially for the development of the wind, sugar cane and waste to energy projects. All of those projects can greatly support the explicit sustainable development policies in the country. The consideration of CDM credits in those projects can assist in the achievement of the technology transfer and provision of win-win situations for implementing key projects that can enable the country's energy policy.

REFERENCES

- Thorne, S. and S. Raubenheimer, 2001. *Sustainable Development (SD) appraisal of Clean Development Mechanism (CDM) projects – experiences from the SouthSouthNorth (SSN) project*. In: <http://www.southsouthnorth.org>
- UNEP Risø Centre on Energy, Climate and Sustainable Development, 2004. *CDM Sustainable Development Impacts*. Developed for the UNEP project “CD4CDM”. Risø National Laboratory, Roskilde, Denmark.
- UNFCCC Conference of Parties, 2001. *Modalities and procedures for a clean development mechanism as defined in Article 12 of the Kyoto Protocol*. The Marrakesh Accords and the Marrakesh Declaration. Decision 17/CP.7 10 November.
- Ministry of Economic Affairs & Development. Global Excellence/Barbarian Traditions: The National Strategic Plan of Barbados 2006-2025. February 2007.
- National Commission on Sustainable Development. The Barbados Sustainable Development Policy. Government of Barbados, January 2004.
- Biothermica/Burnside. Implementation of Green Energy Complex: Phase 1 Feasibility Study, Mangrove Pond Landfill Site. May 2004.
- Ministry of Finance. Economic and Financial Policies of the Government of Barbados. March 14, 2007.
- Barbados Light and Power Company Limited. Operating Statistics for 2006.
- Holder, Lindsay. BAMC Ltd. Sugar Cane Industry in Barbados as a source of renewable energy. Power Point presentation, No date.
- Amec Earth and Environmental. Environmental Impact Assessment of the BP&L Lamberts East Wind Generating Station. April 2007.
- Ministry of Energy and Environment. Draft Barbados Energy Policy. December 2006.
- Barbados Light and Power Company Limited. Report of operations for 2006.
- Ministry of Energy and Environment. Biofuels in Barbados. Power Point presentation, 12/November 2007.
- OLADE. Energy Statistics Report 2005, available at www.olade.org
- Government of Barbados. Barbados First National Communication to the UNFCCC. 2001.

Annex 1

PIN for Composting Facility at Vaucluse, Barbados

PROJECT IDEA NOTE (PIN)

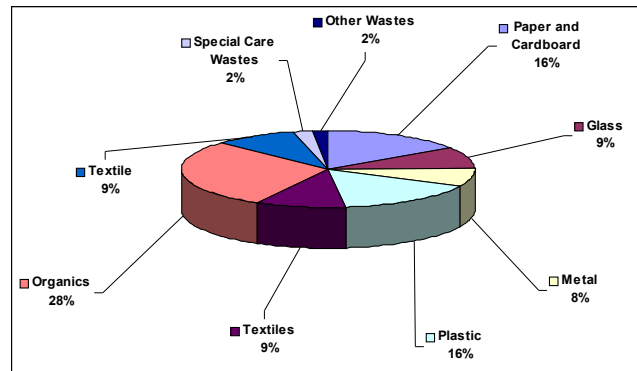
Name of Project : **Integrated Solid Waste Management in Barbados through Composting and Electricity Generation from RDF**

Date submitted : **October 15, 2008**

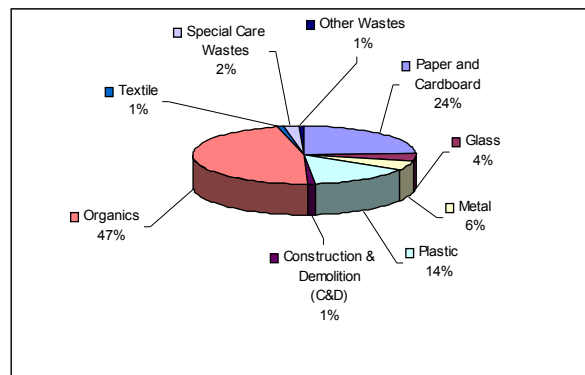
A. PROJECT DESCRIPTION, TYPE, LOCATION AND SCHEDULE

OBJECTIVE OF THE PROJECT	<p>The solid waste composting project is a part of the Integrated Solid Waste Management Programme (ISWMP), which is an infrastructural project critical to the social and economic development of Barbados. The programme is a major component of the general sustainable development policy and encompasses the whole island of Barbados, providing for the preparation of a long term (20 year) vision of managing solid waste in Barbados.</p> <p>The main objective of the ISWMP is to develop a modern, dependable and efficient waste management system which would be accessible to all citizens, which would protect the environment, improve the standard of public health in Barbados and foster the participation of the private sector in a structured manner.</p> <p>This Integrated Solid Waste Management Programme comprises both physical and non-physical components. The most important physical components include: the development of new landfill sites, a MSW Transfer Station, a Materials Recovery Facility and Chemical Waste Storage Facility, and an In-Vessel Composting Facility; together with an energy generation complex. The non physical components include public awareness and education programmes, as well as related policy development for MSW in the country.</p> <p>The objective of the specific CDM project activity described in this PIN relates to the avoidance of methane generation due to the composting facility to be installed.</p>
PROJECT DESCRIPTION AND PROPOSED ACTIVITIES	<p>The facility is to be designed for a daily reception of up to 1,300 tons per day of MSW. The total amount of organics is estimated to be 300 tonnes per day, some of which will be separated out by the green waste materials recovery facility, and some by the in-vessel composting facility while a small fraction would remain in the waste residue.</p> <p>The typical composition of the MWS in Barbados resulting from recent waste characterization studies is presented below:</p>

Residential waste characterization:



Industrial, commercial and institutional waste characterization:

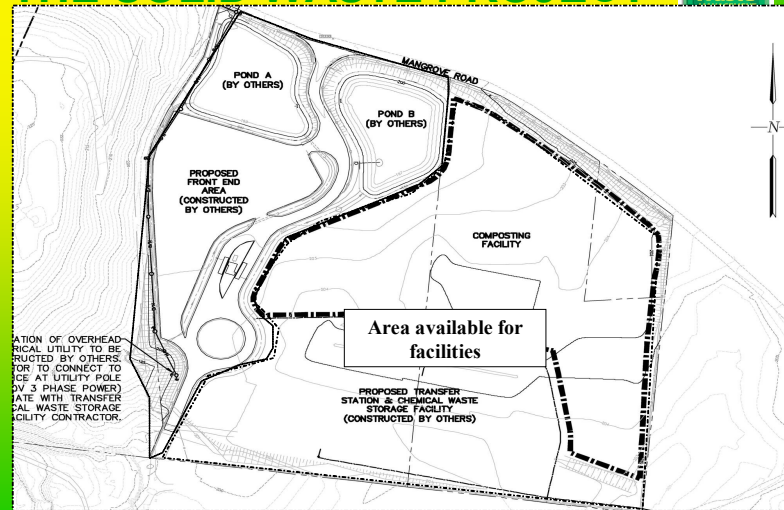


In accordance to IPCC characterization, the organic component of the waste has a 60% of food, food waste and beverage; and the remaining 40% is garden, yard and park waste, percentages that will be used for estimative purposes in this PIN.

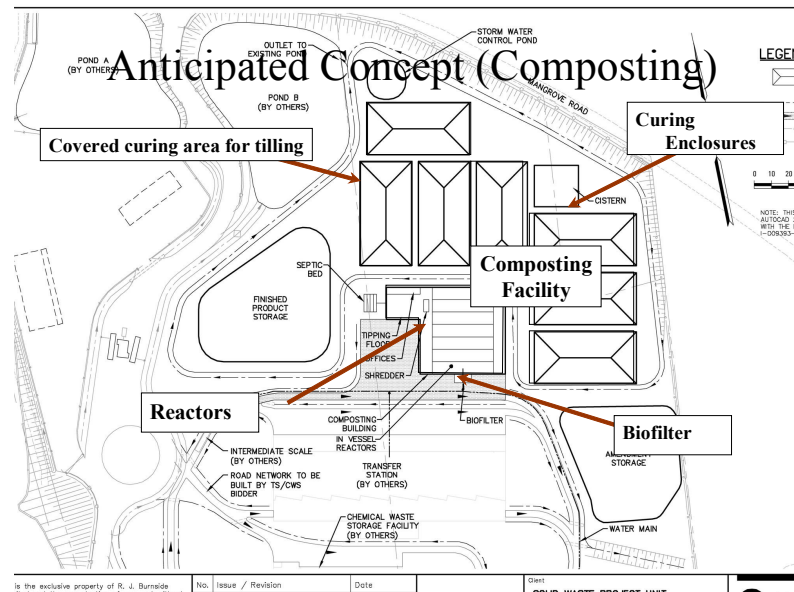
The facility is to be operated during 21 years. The MSW Transfer Station, Materials Recovery Facilities and Chemical Waste Storage Facilities are scheduled for completion in December 2008. The In-Vessel Composting Facility has been delayed due to international demands and is likely to be completed in September 2009. The full waste-to-energy is not likely to be completed until December 2010.

The general layout of the proposed infrastructures is presented below:

THE SOLID WASTE PROJECT



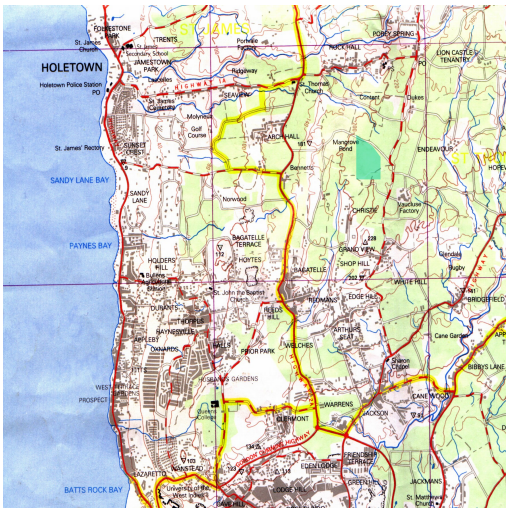
The anticipated concept for the composting facility is:



The electricity consumption of the overall facility will be in the order of about 3 MW, with electricity generation from the compost overs alone (58 tonnes per day) of about 4MW, allowing for a potential electricity export to the grid on the order of 1 MW equivalent to a yearly electricity exportable generation in the order of 7,884 MWh.

TECHNOLOGY TO BE EMPLOYED

The technology of choice for the composting facility is Bedminster rotating drum digester with an enclosed compost maturation building with all air directed through a filter. There will also be a Green Waste Materials Recovery Facility for the production of mulch, wood chips etc.

	Technology used for potential electricity generation is likely going to be Rankine Cycle thermal generation.
TYPE OF PROJECT	
Greenhouse gases targeted CO ₂ /CH ₄ /N ₂ O/HFCs/PFCs/SF ₆	CH ₄ /CO ₂
Type of activities Abatement/CO ₂ sequestration	Abatement
Field of activities (mention what is applicable) See annex 1 for examples	Waste management Renewable Energy Generation
LOCATION OF THE PROJECT	
Country	Barbados
City	Vaucluse
Brief description of the location of the project	<p>A map of the location of the project is presented below:</p> 
PROJECT PARTICIPANT	
Name of the Project Participant	Solid Waste Management Programme
Role of the Project Participant	Sponsor
Organizational category	Government
Contact person	Ricardo Marshall, Project Manager. Solid Waste Project Unit.
Address	"Maxwell town", Collymore Rock, St. Michael, Barbados, W.I.
Telephone/Fax	Phone: (246) 5910/11 Fax: (246) 426 2510
E-mail and web address, if any	solid@sunbeach.net www.solid.gov.bb

Main activities	The Integrated Solid Waste Management Programme is an infrastructural project critical to the social and economic development of Barbados. The programme deals with different aspects of waste management in Barbados, ranging from the landfill operations, supervision of different aspects of the waste management chain, outreach activities, and implementation of the national policies in the SWM area.
Summary of the financials	It is anticipated that the project operator will be selected by the GoB according to the local regulations.
Summary of the relevant experience of the Project Participant	The Solid Waste Management Programme is well acquainted with the development of feasibility studies and designing of SWM infrastructure. It has experience in the operation of the different aspects of the SWM business since it operates the existing landfill site in Barbados, currently executing an active LFG capture and energy conversion project.
<i>Please insert information for additional Project Participants as necessary.</i>	
EXPECTED SCHEDULE	
Earliest project start date <i>Year in which the plant/project activity will be operational</i>	2009 for the composting facility, and 2010 for the waste to energy component
Estimate of time required before becoming operational after approval of the PIN	The time schedule of the project is currently being defined, but it is expected to be operational within 12 months on the composting facility and 24 months for the energy generation complex.
Expected first year of CER/ERU/VERs delivery	2010
Project lifetime <i>Number of years</i>	21 years
For CDM projects: Expected Crediting Period <i>7 years twice renewable or 10 years fixed</i>	7 years twice renewable.
Current status or phase of the project <i>Identification and pre-selection phase/opportunity study finished/pre-feasibility study finished/feasibility study finished/negotiations phase/contracting phase etc. (mention what is applicable and indicate the documentation)</i>	Feasibility/negotiations and contracting phase. The project has already developed feasibility studies as well as initial engineering design stages, coupled with economic evaluations. The GoB is currently developing the tendering documents for the selection of the operator. No indication is yet known on the selected operator for the facility.
Current status of acceptance of the Host Country <i>Letter of No Objection/Endorsement is available; Letter of No Objection/Endorsement is under discussion or available; Letter of Approval is under discussion or available</i>	The Barbados DNA is aware of the proposed project activity, although no formal letter of no-objection has been given yet.

(mention what is applicable)	
The position of the Host Country with regard to the Kyoto Protocol	<p>Has the Host Country ratified/acceded to the Kyoto Protocol? Yes</p> <p>Has the Host Country established a CDM Designated National Authority / JI Designated Focal Point? Yes</p>

B. METHODOLOGY AND ADDITIONALITY

ESTIMATE OF GREENHOUSE GAS EMISSIONS ABAVED/CO₂ SEQUESTERED <i>In metric tons of CO₂-equivalent</i> <i>, please attach calculations</i>	<p>Annual average: 34,801 tCO₂-equivalent</p> <p>Up to and including 2012: 58,078 tCO₂-equivalent</p> <p>Up to a period of 7 years: 193,491 tCO₂-equivalent</p> <p>Up to a period of 21 years: 730,821 tCO₂-equivalent</p>
	<p>1. The baseline for the methane avoidance component due to the composting process is calculated based on the appropriate directive of Methodology AMS.III.F:</p> <p>Baseline</p> <p>17. The baseline scenario is the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere. The baseline emissions are the amount of methane emitted from the decay of the degradable organic carbon in the biomass solid waste composted or anaerobically digested in the project activity. When wastewater is co-composted, baseline emissions include emissions from wastewater co-composted in the project activity. The yearly Methane Generation Potential for the solid waste is calculated using the first order decay model as described in the 'Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site'.</p> <p>Baseline emissions shall exclude emissions of methane that would have to be captured, fuelled or flared to comply with national or local safety requirement or legal regulations.</p> $BE_y = BE_{CH_4,SWDS,y} - (MD_{y,reg} * GWP_{CH_4}) + (MEP_{y,WW} * GWP_{CH_4}) \quad (1)$

Where:

$BE_{CH_4, SWDS, y}$ Yearly methane generation potential of the solid waste composted or anaerobically digested by the project activity during the years "x" from the beginning of the project activity (x=1) up to the year y estimated as per the 'Tool to determine methane emissions avoided from dumping waste at a solid waste disposal site' (tCO₂e). The tool may be used with the factor "f=0.0" assuming that no biogas is captured and flared. With the definition of year x as 'the year since the landfill started receiving wastes, x runs from the first year of landfill operation (x=1) to the year for which emissions are calculated (x=y)'

$MD_{y, reg}$ Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations (tonne)

$MEP_{y, ww}$ Methane emission potential in the year y of the wastewater co-composted. The value of this term is zero if co-composting of wastewater is not included in the project activity (tonne)

GWP_{CH_4} GWP for CH₄ (value of 21 is used)


For the purpose of estimations, methane avoidance has been estimated by supposing that in the absence of the composting facility, the organic content of the waste would have gone to a sanitary landfill with a 90% flaring efficiency and that passive venting/flaring would have been the baseline condition for such a hypothetical landfill in Barbados with a passive flaring of around 5% of the generated LFG.

No estimation is included on the project emissions due to the electricity consumption since it is estimated that the internal consumption of electricity of the plant is to be supplied by the incorporated energy complex that will use the refused derived fuel generated by the complex itself, therefore not requiring additional electricity consumption from the local grid for internal operation, except for the first year.

2. The baseline scenario for the electricity generation component of the complex is to be estimated according to Methodology AMS I.D, although in this PIN, calculation is conducted of the emission factor of the electricity grid in Barbados based on a first tier approach based on representative efficiencies of the types of existing power plants; giving a representative value of 0.8 ton CO₂/MWh, which is typical of highly thermal energy generation grids, such as the one in Barbados.

Calculations have been performed for a period of 21 years of operation of the facility, based on a model formulated based on the application of the relevant methodological tools from the specific methodologies applicable from the CDM..

Year	Emissions reductions due to methane avoidance of the organic content of the MSW into the composting	Emissions reductions due to displaced electricity in the Barbados grid	Total emissions reductions
	(t CO ₂ e)	(t CO ₂)	(t CO ₂ e)
2009-2010	9,147	-	9,147
2010-2011	15,748	6,307	22,055

	2011-2012	20,569	6,307	26,876
	2012-2013	24,136	6,307	30,443
	2013-2014	26,809	6,307	33,116
	2014-2015	28,839	6,307	35,146
	2015-2016	30,401	6,307	36,708m
	2016-2017	31,617	6,307	37,924
	2017-2018	32,576	6,307	38,883
	2018-2019	33,339	6,307	39,646
	2019-2020	33,952	6,307	40,259
	2020-2021	34,449	6,307	40,756
	2021-2022	34,855	6,307	41,162
	2022-2023	35,188	6,307	41,495
	2023-2024	35,463	6,307	41,770
	2024-2025	36,000	6,307	42,307
	2025-2026	36,400	6,307	42,707
	2026-2027	36,800	6,307	43,107
	2028-2929	37,200	6,307	43,507
	2029-2030	37,500	6,307	43,807
BAS ELIN E SCE NARI O CDM /JI proje cts must result in GHG emis sions being lower than "busi ness- as- usual " in the Host Coun try. At the PIN stage	The proposed project activity avoids:			
	<ol style="list-style-type: none"> 1. Methane emissions due to the decomposition of the organic component of MSW in a landfill site, 2. Carbon dioxide emissions due to electricity generation in the national grid. 			
	<p><u>The baseline scenario for the avoidance of methane emissions due to the decomposition of the organic component of the MSW</u> is the current practice in the country for disposal of MSW in landfill sites with only passive/intermittent flaring of LFG.</p>			
	<p>The Mangrove Pond Landfill, the landfill site currently in operation is nearing the end of its lifespan. This landfill was the first of its type in Barbados to be fitted with a clay liner and leachate collection system. Over the years there have been many social issues arising out of the operation and management of the Mangrove Pond Landfill. Inadequacy of resources, which in the past had plagued its operations, gave rise to nuisances such as fires and offensive odours. In recent time however the management of the landfill has improve considerably. Landfilling activities at Mangrove Pond will cease when the new National Sanitary Landfill at Greenland becomes operational.</p>			
				

questions to be answered are at least:

- W
- W

About ¼ - ½ page

National Sanitary Landfill

The new landfill at Greenland is situated on a site that had been previously used as a quarry. The site which covers about 13.8 ha. has been designed and engineered to have an estimated lifespan of about twenty years. The Greenland landfill is a sanitary engineered landfill.



Bagatelle Bulky Waste Landfill

The solid waste disposal site at Bagatelle, St. Thomas is used for the disposal of "bulky" types of waste, such as building material, rubble, scrap automobiles and non-combustible items such as old appliances which comprise a significant proportion of the solid waste stream. These items are not normally prone to producing odours, or large amounts of leachate with contaminants of environmental or health concerns and, as such, the requirements and constraints for disposing of bulky waste are less demanding than those for other constituents of the waste stream.

The baseline situation for the electricity generation in the country is represented by the characteristics of operation and capacity additions of the Barbados electricity grid.

The Barbados Light & Power Co. Ltd. (BL&P) presently generates electricity using the least expensive available fuel, over 90% of the fuel used by the company is heavy fuel oil. A small amount of natural gas (approximately 250 MCF/day) is supplied by the National Petroleum Corporation (NPC) on an interruptible basis.

BL&P supplies electricity to the various sectors at rates ranging between US\$0.18 to 0.21/kwh. This is a substantial price when compared to the T&T's (Trinidad & Tobago's Electrical Company) price which ranges between US\$0.030 to 0.038/kwh. This price has been attainable over the years mainly because the Trinidadian electric company has utilized a lower price fuel, namely natural gas which is sold at approximately US\$1-1.25/MMBTU. A lower price fuel will substantially impact local tariff rates since both fuel oil and diesel are priced around US\$9.30/MMBTU and US\$10.35/MMBTU respectively.

Table 4.1: BL&P's existing Generating Units

Plant ID	Description	Maximum Continuous Rating (MW)	Can be converted to burn Nat. gas
S1	Steam Turbine	20	YES
S2	Steam Turbine	20	YES
D10	Low speed diesel generator	12	NO
D11	Low speed diesel generator	12	NO
D12	Low speed diesel generator	12	NO
D13	Low speed diesel generator	12	NO
CG01	Waste heat turbine	1.5	NO
D14	Low speed diesel generator	29.7	NO
D15	Low speed diesel generator	29.7	NO
CG02	Waste heat turbine	2.2	NO
GT02	Gas turbine (Garrison)	13	NO
GT03	Gas turbine (Seawell)	13	YES

Plant ID	Description	Maximum Continuous Rating (MW)	Can be converted to burn Nat. gas
GT04	Gas turbine (Seawell)	20	YES
GT05	Gas turbine (Seawell)	20	YES
GT06	Gas turbine (Seawell)	20	YES
Total capacity		237.1	

Source: Barbados Light and Power Holdings Ltd. 2006

Table 4.1 illustrates that BL&P has the ability to utilize their existing plant to convert to the cheaper fuel—natural gas, if it becomes available in the required volumes. The government of Trinidad and Tobago has reserved 40 MMCF/day to the eastern Caribbean and a technical team including the Ministry of Energy and Environment is to make a recommendation to the responsible Minister on the method of transport. NPC has computed that the local natural gas requirements will range between 22–46 MMSCF/day over a twenty five year period. BL&P has indicated that the project will only be feasible if BL&P uses natural gas to power most of its generating plant.

Expected Generation Expansion by 2012

Currently, BL&P has invested approximately BDS \$800 million in the electric network. It has applied for planning permission to install a new 30 megawatt (MW) generation plant at Trents, St. Lucy. Current energy mix is approximately 90% fuel oil, 2.5% natural gas and the remainder diesel.

Because of its many economic and environmental benefits, natural gas has become the fuel of choice for electricity generation. Gas-fired combined-cycle technology is the overwhelming choice in new generating plants. Combined-cycle plants offer extremely high efficiency, clean operation, low capital costs and shorter construction lead times. The efficiency of combined-cycle units is now approaching 60 percent compared with roughly 34 percent efficiency for traditional boiler units — regardless of the fuel source.

	<p>As shown in Table 4.1, current generating capacity in Barbados is approximately 240 MW. Assuming 4% annual growth in peak electricity demand, Barbados will require approximately 520 MW of installed capacity by 2026. Within the next 5 years it is anticipated that approximately 40 MW of electricity will be generated by renewable energy (30 MW from biofuels, 10 MW from wind), representing 17% of current capacity or 7% of capacity in 2026.</p> <p>Within 20 years, it is anticipated that additional renewable energy generating capacity will be achieved as follows:</p> <ul style="list-style-type: none"> • Additional wind farming (on and off-shore): 20 - 40 MW • Waste-to-Energy (landfill gas recovery) 5 – 10 MW • Other technologies 10 – 20 MW • Photovoltaics 0 – 5 MW • Second Biofuel project (gasification) 20 - 30 MW <p>This is a total potential renewable energy generating capacity of 95 – 145 MW over the design period, representing 18 – 28% of the required generating capacity in 2026.</p> <p>Therefore, an achievable energy mix for electricity generation by 2026 could be as follows:</p> <table> <tr> <td>Natural gas:</td><td>70%</td></tr> <tr> <td>Renewable:</td><td>20%</td></tr> <tr> <td>Fuel oil:</td><td>10%</td></tr> </table>	Natural gas:	70%	Renewable:	20%	Fuel oil:	10%
Natural gas:	70%						
Renewable:	20%						
Fuel oil:	10%						
<p>ADDITIONALITY</p> <p>Please explain in which additional arguments apply to the project:</p> <p>(i) there is no regulation or incentives</p>	<p>Additionality of the proposed project activity can be approached both from the investment and barriers demonstration sides. The relevant barriers for the project activity are elaborated below:</p> <p>Economic and financial barriers:</p> <p>In Barbados, the Environmental Levy Act, 1996, seeks to promote efficient solid waste management and implement the Polluter-Pays Principle by defraying costs of waste collection and disposal of imported goods. The Act provides that a tipping fee of \$40.00 (US\$ 20.00) per tonne of waste deposited in a landfill (to be charged at the landfill). The Act also imposes an environmental levy on a wide range of goods including: a) a rate of \$10.00 (US\$10.00) per unit for motor vehicle tires, and \$1.00 (US\$0.5) per unit for other types of tires; and b) a 1% levy on all goods imported in containers of plastic, glass, metal, or paperboard, in addition to empty containers imported made of plastic, glass, metal, or paperboard. Such tariffs which are in general representative of developing countries, can hardly account for investments in advanced solid waste management technologies, such as the ones considered in this project. More in depth detail needs to be assessed in due course of CDM documentation preparations.</p> <p>Technical barriers:</p> <p>A composting plant is technologically more advanced than operating a sanitary landfill site, and the overall technical requirements for running a first of its kind operation in a small island state are important.</p> <p>Other Barriers:</p>						

<p>tive sche me in place cover ing the proje ct (ii) the proje ct is finan cially weak or not the least cost optio n (iii) count ry risk, new techn ology for count ry, other barri ers (iv) other</p>	<p>Market barriers: The fertilizer market in Barbados is dominated by the chemical type. Bio-organic fertilizer use is non-existent and little is known on its benefits and applicability in different applications.</p>
<p>SEC TOR BAC KGR OUN D Pleas e descr ibe the laws, regul ation s, polici es and</p>	<p>The proposed project activity is not required by any law in Barbados, and furthermore the project is in compliance with sustainable development policies, policies that suggest that for the well being of the country it is important to achieve better sustainable management of solid waste management, as well as renewable energy generation.</p> <p>The project is not operational, and CDM revenues have been considered since the early stages of project planning.</p>

<p>strategies of the Host Country that are of central relevance to the proposed project, as well as any other major trends in the relevant sector.</p> <p>Please in particular explain if the project is running under a public incentive scheme (e.g. preferential tariffs</p>	
---	--

<p>grant s, Offici al Deve lopme nt Assis tance) or is requi red by law. If the proje ct is alrea dy in oper ation, pleas e descr ibe if CDM /JI reven ues were consi dere d in proje ct plann ing.</p>	
<p>MET (i) proje ct is cover ed by an existi ng Appr oved CDM Meth odolo gy or Appr oved CDM Small</p>	<p>(i) The project is covered by an existing Approved CDM Small Scale Methodology: AMS III.F. Avoidance of methane emissions through controlled biological treatment of biomass (ii)The energy component of the project is covered by a relevant methodology for small scale renewable electricity generation for the grid.</p>

<p>- Scale Methodology (ii) projects need a new methodology (iii) projects need modification of existing Approved CDM Methodology</p> <p>For JI projects: (iv) project will use a baseline and monitoring plan in accordance with Appendix B of the JI Guid</p>	
---	--

eline s and furth er JISC guida nce (v) proje ct will use Appr oved CDM or CDM Small - Scale Meth odolo gy	
---	--

C. FINANCE

TOTAL CAPITAL COST ESTIMATE (PRE-OPERATIONAL)	
Deve lopm ent costs	US\$ million (Feasibility studies, resource studies, etc.)
Instal led costs	US\$ million (Property plant, equipment, etc.)
Land	US\$ million – if the associative centre is implemented
Other costs (plea se speci fy)	US\$ million (Legal, consulting, etc.) – legal aspects of included farms.
Total proje ct costs	Total Project Costs are currently being developed at the feasibility stage.
SOURCES OF FINANCE TO BE SOUGHT OR ALREADY IDENTIFIED	
Equit y Nam e of the orga nizati ons,	NA

status of financing agreements and finance (in US\$ million)	
Debt – Long-term Name of the organizations, status of financing agreements and finance (in US\$ million)	NA

Debt – Short term Name of the organizations, status of financing agreements and finance (in US\$ million)	NA
Carbon finance advance payments ⁸	NA
SOURCES OF CARBON FINANCE Name of carbon financiers	Non defined yet
INDICATIVE CER/	Suggested CER price at Euros 11 (US\$17)

⁸ Advance payment subject to appropriate guarantees may be considered.

tCO ₂ e	
TOTAL EMISSION REDUCTION PURCHASE AGREEMENT (ERPA) VALUE	
A period until 2012 (end of the first com mitm ent period)	US\$ 987,326.00
A period of 7 years	US\$ 3,289,347

D. EXPECTED ENVIRONMENTAL AND SOCIAL BENEFITS

LOCAL BENEFITS E.g. impacts on local air, water and other pollution.	<p>(i) Impacts on local air. The project will drastically reduce the odours coming from the current practice of landfilling of organic waste as well as reducing fire hazards from landfill operation.</p> <p>(ii) Impacts on soil: the project will have an important impact in the sustainability and recovery of carbon content in soils in Barbados, a very important issue for a small island state.</p> <p>For Small Island Developing States (SIDS) like Barbados, the disposal of waste is a serious constraint to sustainable development. The limited land area and resources for safe disposal, growing population, unsustainable consumption patterns and increasing imports of polluting and hazardous substances combine to make pollution prevention and the management of waste a critical issue. Long-term disposal options being limited, Barbados is looking for ways to minimize waste and/or convert waste into resources (e.g. composting). The ISWMP addresses all aspects of solid waste management with a view to improving the existing system for solid waste management through the provision of physical and non-physical components that will enhance the Island approach to solid waste management.</p>
Describe if other global benefits than greenhouse gas emission reduction	<p>(i) Reduction of the global chemical fertilizer production and its related impacts.</p> <p>(ii) Contribution to the global climate change efforts through participation in the CDM.</p>

<p>tions can be attributed to the project.</p>	
SOCIO-ECONOMIC ASPECTS	
<p>What social and economic effects can be attributed to the project and which would not have occurred in a comparable situation without that project? Indicate the communities and the number of people that will benefit</p>	<p>Social contributions</p> <p>The project creates new opportunities for the development of several layers of employment in the integrated waste management in Barbados, it is expected that several jobs will be established in the operation of the facility, but also due to the new product being created (compost) and the associated delivery chain in the country.</p> <p>Economic contributions</p> <ul style="list-style-type: none"> (i) Reduced requirements for imported oil in the country (ii) Improved flow of valuable natural goods into the economy.

it from this project. About ¼ page	
What are the possible direct effects (e.g. employment creation, provision of capital required, and foreign exchange effects)? About ¼ page	<p>(i) Employment creation. It is expected that the project operation will create a stable number of new jobs,</p> <p>(ii) Creation of new employment opportunities. New personnel will be required (1) For the operation at the composting site (2) For the transport and application of compost.</p> <p>(iii) Provision of capital. CER revenues are very important to support the cost structure of the proposed project, since there will be no initial associated revenues in the composting facility.</p> <p>(iv) National Economy. Displacement of chemical fertilizer will contribute in a positive impact on the balance of payments for the country.</p>
What are the possible other effects (e.g. training/education associated with	<p>(i) Training/education effects. Personnel that will work in the new facility and in plantations will be trained in the use of compost and its production. It is likely that other stakeholders in the country will benefit in terms of the educational and research aspects of compost development.</p> <p>(ii) Transfer new technology and development of know-how. It is the first composting plant of agricultural waste in the country which will lead the way for 'best waste management practices' in the country.</p> <p>(iii) New product. Compost from MSW will be available as a new product for the plantation, creating awareness of zero waste management concepts and hopefully promoting the development of environmental passives in the economy.</p>

<p>the introduction of new processes, technologies and products and/or the effects of a project on other industries)? About ¼ page</p>	
<p>ENVIRONMENTAL STRATEGY/PRIORITIES OF THE HOST COUNTRY A brief description of the project's consistency with the</p>	<p>The project is in line with the environmental priorities and policies in Barbados as expressed in:</p> <ul style="list-style-type: none"> ▪ Barbados Draft Energy Policy, 2006. ▪ The National Strategic Plan of Barbados 2006-2025. ▪ Barbados First national Communication to the UNFCCC, 2001. ▪ The Barbados Sustainable Development Policy, 2004.

