

Report on Stakeholders Consultations:

Development of Nationally Appropriate Mitigation Actions (NAMAs) at Grenada

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Submitted by

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1 Executive Summary

The Japan-Caribbean Climate Change Partnership (J-CCCP) aims to support selected Caribbean countries in advancing the process of low-emission risk-resilient development by improving energy security and integrating medium to long-term planning for adaptation to climate change. One of the eight participating countries includes Grenada. In Grenada the J-CCCP project is providing assistance to develop a NAMA in the energy sector as per the priority of the government of Grenada.

This project is funded by the Government of Japan and is being implemented by United Nations Development Programme (UNDP), with UNDP Barbados & the OECS sub-regional office as a lead agency.

UNDP has retained the services of an international consultant, Mr. Dinesh Aggarwal (India) to support the Ministry of Energy on the development of a NAMA for the energy sector in Grenada. A mission was undertaken to Grenada to carry out consultations with the stakeholders to discuss the priorities of the country and the preferences for the sector, and structure the proposed NAMA. The findings of the stakeholder consultations along with the agreed upon action plan are provided in this report.

The consultations with the stakeholders were carried out in bilateral meetings. Appendix 1 provides the details of the mission schedule and the stakeholders consulted. During the meetings with different stakeholders, the discussed focused on the issues and concerns specific to the stakeholder and the general issues specific to the country and the community.

During the meetings it was observed that the preference of the government stakeholders are for a NAMA which leads to a direct reduction in the energy bill of the government and which will make electricity more affordable for the people.

One of the challenges towards implementation of the NAMA in the energy sector is the absence of a regulatory body for issuance of licenses, decision on a feed in tariff, availability of grid to any prospective independent power producer using RE technologies etc. The new 'Electricity Supply Bill' and the 'Public Utilities Regulatory Commission Act' (PURCA) which has been passed by the parliament very recently, will address this regulatory issues. The PURCA/Commission, will regulate the electricity sector at Grenada. One of the other challenges is that given the size of the country, the scale and size of the NAMA project would be small for it to be attractive enough for a funding agency to support the NAMA project. This challenge can be addressed to some extent by selecting and structuring the NAMA project in such a manner that the quantum of GHG mitigation is attractive enough.

Potential negative environmental impacts of the possible NAMA interventions would need to be taken into account, while designing the NAMA. For example, in case of replacement of lamps a method to dispose old lamps needs to be designed; in case of implementation of solar PV at scale infrastructure for disposal of used batteries would need to be worked out.

Based on the discussions with the stakeholders and preliminary evaluation of different GHG mitigation options, a list of possible NAMA candidates at Grenada was prepared. The same is given below:

- EE (largely EE lighting retrofit) in public buildings (hospitals, schools and government offices)
- Solar PV for the public building
- Wind / diesel, Solar / diesel Hybrid systems for power generation at the three islands
- Solar PV scale up program
- Battery operated vehicles to be charged using solar / RE
- EE in the public lighting (Retrofitting of the public lighting like street lights, and lighting at other public places)
- Roof top solar PV
- sequestration projects like agro forestry program for fruits trees, timber, energy plantations, industries
- Solar PV based water desalination project
- RE (biomass / solar) based decentralized power generation (mini grids or solar home systems) for the areas not connected to the grid
- Hydro power
- Waste to energy projects (sewage, solid waste)
- Solid waste composting for bio-fertilizer
- Industrial effluent (from Rum factory, Brewery and soft drink plant) to biogas
- Geo thermal power
- Biogas production for treatment of sewage
- Solar PV for Hotels
- Co-generation from exhaust of the power generators
- Using the power plants in tri-generation mode at the university
- Solar pumps for agriculture
- Solar PV for agro processing in the cottage sector (for making jams etc.)
- Use of shells of Nutmeg for power generation

These options were discussed with the Energy Division and the Department on Economic Cooperation during a debriefing session towards the end of the mission. The two prioritized options were:

- EE in public lighting
- solar PV for public and commercial buildings and households

Considering that the solar PV would have a larger impact both in terms of direct energy savings and GHG emission reductions it was decided that the NAMA should focus on solar PV for public and commercial buildings and households. Further, it was suggested that the NAMA needs different incentive schemes for the different users groups. For example, it was suggested that part capital subsidies and grants would suit best for the hotel sector, whereas for public buildings either an ESCO model or part grant would be required.

2 Background

The Japan-Caribbean Climate Change Partnership (J-CCCP) was launched in January 2016. It aims to support eight Caribbean countries in advancing the process of low-emission risk-resilient development by improving energy security and integrating medium to long-term planning for adaptation to climate change. Interventions under the J-CCCP includes, supporting policy innovation through the development of a number of Nationally Appropriate Mitigation Actions (NAMAs) and National Adaptation Plans (NAPs). The participating countries are Belize, Dominica, Grenada, Guyana, Jamaica, St. Lucia, St. Vincent and the Grenadines, and Suriname. In Grenada the J-CCCP project is providing assistance to develop a NAMA as per the priority of the government of Grenada.

This project is funded by the Government of Japan and is being implemented by United Nations Development Programme (UNDP), with UNDP Barbados & the OECS sub-regional office as a lead agency. UNDP, together with the Government of Japan is providing assistance to Grenada towards development of NAMAs in national priority sectors, arising from in-country consultations and the country's Intended Nationally Determined Contribution (INDC).

The Government of Grenada (GOG) has already taken steps towards defining mitigation actions to address national vulnerabilities. The national government is in the process of developing its Second National Communication for submission to the United Nations Framework Convention on Climate Change (UNFCCC). To this end, activities are currently being undertaken to produce an updated and improved greenhouse gas inventory. Most recently, with the support of the JCCCP and in collaboration with the UNFCCC, national capacity building activities have been undertaken in which training in NAMA development and implementation was provided to a number of key stakeholders. Additionally, in an effort to assess the extent of the climate actions, determine their success and guide the way forward; the JCCCP is also supporting a Baseline Assessment of national climate initiatives which includes the analysis of current mitigation activities and plans and the assessment of the status of NAMA development post COP 21. Further, UNDP is working closely with UNFCCC to develop national standardised baselines for Grenada.

UNDP has retained the services of an international consultant, Mr. Dinesh Aggarwal (India) to work on the design and development of a NAMA for the energy sector in Grenada. The broader defined objective of the consulting engagement is to provide technical assistance to the relevant government counterparts in Grenada on the design and development of a NAMA in the energy sector. The engagement would lead to a NAMA document. The consultant is to work in accordance with the agreed upon work plan as per the inception report which was prepared by the consultant and agreed upon by UNDP.

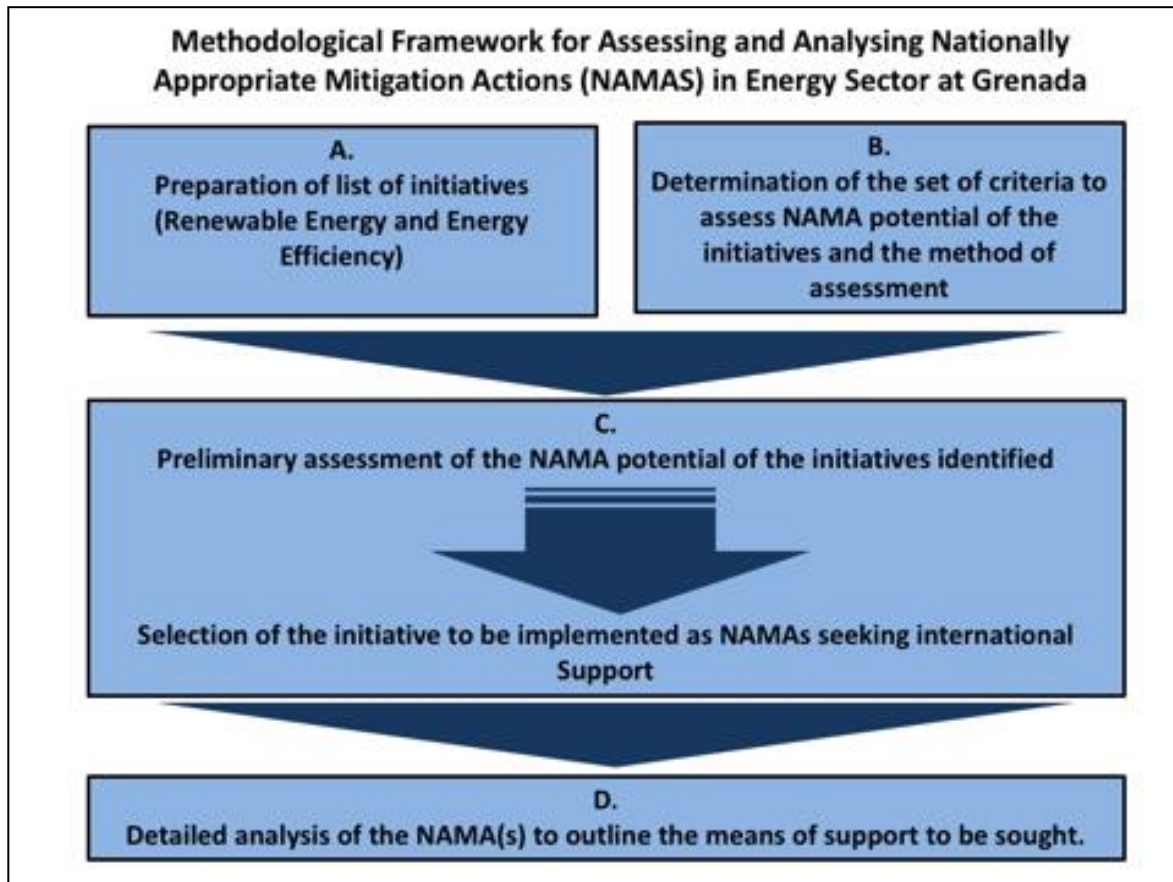
The NAMA at Grenada is to be developed in the national priority sectors, arising from in-country consultations and the country's Intended Nationally Determined Contribution (INDC). This involves determination of the priorities of the country and evaluation of the INDCs of the country. A mission was undertaken to Grenada to carry out consultations with the stakeholders to learn about the priorities of the country and the preferences for the sector, shape and structure of the proposed NAMA at Grenada.

The findings of the stakeholders' consultation along with the agreed upon action plan are provided in this

report.

3 Objectives

The overall process of identification of the NAMA and its development involves the activities and steps given in the figure below.



The objective of the stakeholders' consultations was to get the inputs and views of the stakeholders for activities A, B and C as detailed in the figure above. The targeted end result of the consultation process was to select and agree upon the NAMA interventions.

4 Tasks and activities

A mission of five working days from 1st March 2017 to 8th March 2017 to Grenada was undertaken to carry out the stakeholder's consultations. The following stakeholders were contacted during the mission:

- Economic & Technical Cooperation
- Energy Division
- Min of Agriculture

- Carriacou and Petite Martinique Affair
- NaDMA
- Grenada Hotel and Tourism Association (GHTA)
- Grenada Industrial Development Corporation (GIDC)
- Grenada Chamber of Industry & Commerce (GCIC)
- Grenada Electricity Services (GRENLEC)
- Grenada Development Bank (GDB)
- Grenada Solid Waste Management Authority (GSWMA)
- T.A Marryshow Community College (TAMCC)
- UNFCCC RCC
- Statistics Division

During the meetings with different stakeholders, the discussions focused on the issues and concerns specific to the stakeholder and the general issues specific to the country and the community. Depending upon the stakeholder, the discussions were focused on the the following points:

- The possible GHG mitigation opportunities within their ministry / department which can be considered for the NAMA
- Possible GHG mitigation opportunities at the country level which can be considered for the NAMA
- Size of the activity and some basic figures to determine the GHG mitigation options being suggested
- Barriers for implementation of GHG mitigation options, including policy gaps and support needs.
- Selection of priority interventions.
- Support needs for implementation of the prioritized interventions.
- The possibility of private sector engagement and financing.
- The possible role and the support the stakeholder organisation being consulted can provide in the design, implementation, management and MRV for the NAMA.

The meetings with the stakeholders was followed up with mails to confirm the main discussions with them and to gather any after thoughts / additional view which might has got missed out during the discussions.

During the meetings it was observed that the preference of the government stakeholders is for a NAMA which leads to reduced energy costs for the government and which will make electricity more affordable for the people. The preference for the GHG mitigation initiatives which largely benefits the corporates and the private sector enterprises (e.g. privately owned industries and businesses) was put after those options which would reduce the government's energy bill and would make energy more affordable for the masses.

5 Discussion Points

The table below provides the summary of the discussions with different stakeholders:

Stakeholder	Persons	Summary of Discussions
Energy Division	Mr. John Auguste	<ul style="list-style-type: none"> • A NAMA is presently being developed for the EE in the residential lighting sector and it may not be feasible to do this in another NAMA. EE in the lighting sector in public buildings can be considered as one of the options for NAMA. • It was discussed that the public buildings which could be included are schools, hospitals, government offices. It was discussed that the school buildings don't offer much potential in terms of energy savings as the schools generally operates during day time with very limited use of electricity for lighting. It was pointed out that retrofitting of EE lights in three large complexes of the government buildings has already been carried out and what is left out is some of the smaller government buildings. It was concluded that there is some potential to carry out EE lighting in the three government hospitals. It was decided that some data regarding the hospitals like the connected load, number and type of lights being used will be organized to explore the potential of savings. • It was discussed that solar PV option of public buildings can be considered as one of the NAMA options. The public buildings which could be included are the schools, hospitals and some of the government buildings (roof top solar PV as there is no space near most of the government buildings). • The possibility of using the heat of the exhaust of the engines for power generation to run a vapor absorption chiller (for air conditioning and refrigeration needs) was explored. It was concluded that given the current location of the power plants (wherein any potential user of refrigeration / air conditioning is not located near to the power plants), it is not possible to carry out such an initiative. It was however pointed out that one of the possibilities of doing such an activity may exist at the University which consumes lots of power and also has huge air conditioning needs, also the university has existing no site generation facilities (owned by the electricity company). It was agreed to explore this further with GRENGEN • It was discussed that in case of hotels the option of generation of electricity on site so that generation of cold for air conditioning / refrigeration can also be done may not be that good. This is considering that the most of the hotels in Grenada do not have centralized air-conditioning (rooms has individual air conditioning units). This idea was to be explored further with the Hotels Association • On the potential to take up comparatively large size grid connected renewable energy generation as potential NAMA projects it was pointed out that presently some work is being done by the World Bank

		<p>for Solar energy in Grenada. It was decided that more details about the World Bank project will be found out and shared</p> <ul style="list-style-type: none"> • Following ideas were shortlisted to be examined further to decide on the climate change mitigation action which can be developed as a NAMA. <ul style="list-style-type: none"> ○ EE (largely EE lighting retrofit) in public buildings (hospitals and schools) ○ Vapor absorption chillers at the University ○ Wind / diesel, Solar / diesel Hybrid systems for power generation at the three islands ○ Solar PV scale up program: The idea is to bring Solar PV as one of the major sources of energy in the country, wherein, we have solar roof tops, small and medium grid connected solar PV by private investors, one or two large grind connected solar PV by IPPs. The overall project may have components like technical skill development, technical education and curriculum on solar PV, capacity development of the government officials, demonstration / pilot projects, policy and regulations for large scale uptake of solar PV etc. ○ Battery operated vehicles to be charged using solar / RE ○ EE in the public lighting (Retrofitting of the public lighting like street lights, and lighting at other public places
Economic & Technical Cooperation Division	Mr. Fitzroy James Mr. Rickie Morain	<ul style="list-style-type: none"> • Following ideas were shortlisted to be examined further to decide on the climate change mitigation action which can be developed as a NAMA. <ul style="list-style-type: none"> ○ Solar PV for the public building. The public buildings which could be included are schools, hospitals, government offices. ○ Roof top solar PV ○ Carbon sequestration projects like agro forestry program for fruits trees, timber, energy plantations, industries ○ EE in street lighting ○ Solar PV based water desalination project ○ RE (biomass / solar) based decentralized power generation (mini grids or solar home systems) for the areas not connected to the grid ○ Electrical vehicles (based on RE / Solar PV charging stations) ○ Hydro power ○ Waste to energy projects (sewage, solid waste) ○ Solid waste composting for bio-fertilizer ○ Industrial effluent (from Rum factory, Brewery and soft drink plant) to biogas ○ Geo thermal power
Grenada Solid Waste Management Authority - GSWMA	Mr. Raymond Neptune	<ul style="list-style-type: none"> • Current and the planned solid waste management practices in Grenada and the opportunities to reduce the emissions of GHG from the solid waste which can be taken up as NAMA for Grenada. The options which were discussed included conversion of solid waste to

		<p>compost, waste to energy (either direct combustion or through biogas route), capping of waste dump sites and recovery of methane.</p> <ul style="list-style-type: none"> • In Grenada there is an old dump site (which is used only in case of emergency), the present dump site has almost reached its capacity level and there is a plan to develop a new site as a planned dump site for solid waste. Capping of the sites and recovery of methane would be a very good option for the old dump site and the present site which is being planned to be closed. For the new solid waste disposal site composting may be a good option. In order to explore these GHG mitigation opportunities to be developed as NAMA an evaluation would be needed. A preliminary evaluation can be carried out at this stage to examine the potential on a preliminary basis. For doing this following information / data would be needed. <ul style="list-style-type: none"> ○ Historical use of the old dump site. ○ Approximate number of years for which the site was used. ○ The year the site was closed. ○ Approximate depth of the dumping pit ○ Since how long the present dump site is in use. ○ Approximate dimensions of the site ○ Quantity and composition of the solid waste which is being dumped at the site • Additionally, following GHG mitigation opportunities in the effluent treatment sector were discussed <ul style="list-style-type: none"> ○ Biogas production using the effluent from the three Rum factories, one Brewery and soft drink facility ○ Biogas production for treatment of sewage
Grenada Hotel and Tourism Association	Ms. Pancy Cross	<ul style="list-style-type: none"> • It was pointed out that a NAMA for EE lighting sector may not be a good option as one such program has already been carried out wherein 50% subsidy was provided by CARACOM (through Grenada Development Bank) for retrofitting of the lighting in the hotels. About 25 properties benefited from this program. All the major hotels got covered. A small number of smaller hotels which could not manage 50% of their own funds got left out. • It was discussed that captive generation by hotels using solar PV could be a good option of NAMA in Grenada. • It was clarified that now with the new electricity act already in place it would not be difficult to implement such a project. • One of the other measures which was discussed was solar PV based lighting for the periphery and outside areas of the hotels. • Considering that most of the hotels are smaller in size and use decentralized air-conditioning it was advised that on site power generation by hotels in cogeneration mode (for air conditioning using vapor absorption cycle may not be a good option.
Grenada Electricity Services Ltd (GRENLEC)	Mr. Shawn Charles Mr. Jusceno Jacobs	<ul style="list-style-type: none"> • Following EE / RE projects were discussed <ul style="list-style-type: none"> ○ LED street lighting ○ Roof top solar in the residential, public and commercial buildings

	Mr. Sylvester Joseph	<ul style="list-style-type: none"> ○ Co-generation from exhaust of the power generators. It was shared that a proposal to use the exhaust of the engines to generate steam and run a steam turbine for generating additional power is presently under consideration. ○ To the suggestion of using the exhaust of the engines for tri-generation and supplying the air conditioning to the buildings, it was pointed out that it is not feasible as there are no air conditioned buildings close to the power plant. ○ Possibility of using the power plants in tri-generation mode at the university was discussed. On a prima facia basis this appeared to be a feasible proposition. Particularly considering that large part of the demand of power at the university is for air conditioning. It was discussed that implementation of tri-generation at the university, apart from savings on fuel would be able to free some of the existing electricity generation capacity could be used for feeding the grid. Some technical information of this was shared with GRENGEN ○ Electrical vehicles. It was explained by GRENGEN that the electrically operated vehicles are much more efficient at an aggregate level (even if the electricity is generated using fossil fuels) ○ Wind-diesel or solar-diesel Hybrid power generation systems. It was pointed out by GRENGEN that all the three islands have very good wind potential with wind speeds up to 8 m/s and capacity utilization factor for wind turbines would be of the order of 35%. It was shared that Grengen is already considering to go for the hybrid systems in the three islands of Granada and the issues like land availability etc. are being looked into.
T. A Marryshow Community College	Mr. John Telesford	<ul style="list-style-type: none"> ● Details of some of the ongoing projects / programs in Grenada to address climate change were shared. It was agreed to share more details of the following projects / programs <ul style="list-style-type: none"> ○ Technology need assessment for climate change mitigation being carried out by UNEP and Danish Technology University. This is presently at the inception stage. It was agreed to share the inception report ○ 'Building Resilience to Climate Change In the Energy Sector of Small Island Developing States (SIDS)' project being implemented by Swedish Energy Agency. The Grenada component of the project is provision of solar PV for one of the shelters (in a school building). Capacity of the solar PV is 2 KW with battery back up. It was agreed to share the details like cost, configuration, expected power generation etc. ● Some of the GHG mitigation projects which were discussed as a potential NAMA project are; <ul style="list-style-type: none"> ○ Solar PV for hospitals, schools and government buildings. It was shared by you that Grenada has one college. 70 primary schools

		<p>and 19 secondary schools. You also shared that the consumption of energy by the schools is being monitored at the ministry level.</p> <ul style="list-style-type: none"> ○ Geo thermal power ○ Electrical vehicles
Min of Agriculture	<p>Ms. Merina Jessamy (PS) Mr. Trevor Thompson Mr. Daniel Lewis</p>	<ul style="list-style-type: none"> ● It was pointed out that the GHG mitigation options in the energy and waste management sector for Grenada are detailed out in the NDC document. The NDC document was shared ● Specifically, for the agriculture sector following GHG mitigation options which can be considered for NAMA were discussed: <ul style="list-style-type: none"> ○ Solar pumps for agriculture. It was told that there are about 100 pumps (ranging in capacity from 5 HP to 20 HP) which are being used by individuals for irrigation. On an average the pumps are used for 3-4 hours a day for 4 days a week. ○ Solar PV for agro processing in the cottage sector (for making jams etc.) ○ Use of shells of Nutmeg for power generation
Min of Carriacou and PM (Online)	<p>Mr. Davon Baker Mr. Senator Norland Cox Mr. Javan Williams</p>	<ul style="list-style-type: none"> ● It was pointed out that given the small size of the two islands it may not be feasible to have something specific for them as NAMA except for RE based power generation and Solar PV based water desalination units ● Any EE or RE based NAMA which would be taken up for the mainland Grenada can be implemented at Carriacou and PM as well
Central Statistics Office	<p>Ms. Caren Richards</p>	<ul style="list-style-type: none"> ● Following data were collected ● Buildings Permits Granted (Quantity) ● Buildings Permits Granted (Area) ● Historical Fuel and Electricity Prices ● Motor Vehicles Stock ● Selected Tourism Indicators ● Selected Industrial production ● Production and Consumption of Electricity
Min. of Environment and H. R Affairs	<p>Mr. Kevin Andall (PS) Ms. Aria St. Louis</p>	<ul style="list-style-type: none"> ● It was pointed out that presently a study at Grenada is underway to for Technical Needs assessment to address climate change at Grenada. It was agreed to share the contact details of the consultant carrying out the assignment and see the possibilities of data sharing and collaborating ● I was pointed out that disposal of soiled waste and waste water in Grenada is one of the problems and any NAMA to address this would be welcome. It was pointed out that the options for waste to energy are capital intensive in nature and the energy recovered alone may not be sufficient to make the propositions of waste to energy commercially viable. ● Following specific GHG mitigation options were suggested for NAMA <ul style="list-style-type: none"> ○ EE in government buildings ○ RE / EE in transport sector ○ Solar PV

Grenada Investment Development Corporation	Mr. Che Keens-Douglas	<ul style="list-style-type: none"> • It was shared that GIDC has some big buildings with large roof and solar PV may be taken up on these roofs. • It was discussed that some of the larger and capital intensive GHG mitigation options like waste to energy, waste management, RE based grid connected independent power producers can be taken up in private sector with some support. It was discussed that it is important to carry out feasibility studies for these projects and viability gap be determined. Fiscal instruments like grants, subsidies, feed-in tariff may be worked out to cover the viability gap.
Grenada Development Bank (GDB)	Mr. Mervyn Lord General Manager	<ul style="list-style-type: none"> • Possible roles of GDB in the NAMA implementation were discussed • It was shared that presently GDB has some funds available from Caribbean Development Bank which could be leveraged to provide loans as lower rate of interest for implementation of EE and RE measures in Grenada. In particular, following funds were discussed: <ul style="list-style-type: none"> ○ USD 500 thousand from Caribbean Development Bank at 6% rate of interest ○ Tripartite agreement between GDB, Caribbean Community Climate Change Centre and Ministry of Finance under which 1.6 million USD can be made available (0.4 million grant plus 1.2 million matching fund by GDB) ○ 5 Million USD from Caribbean Development Bank for General Business at interest rate of 7% per annum • It was discussed that GDB would be willing to participate for implementation of a NAMA requiring funding support
UNFCCC-RCC (on Skype)	Ms. Maria Laura Vinuela	<ul style="list-style-type: none"> • UNFCCC has come out with the standardized baseline for the energy sector at Grenada, which can be used of the NAMA at Grenada • UNFCCC RC can help for collection of data and other co-ordination activities for development and implementation of NAMA at Grenada • The options of Solar PV and EE at public lighting (street lighting) were discussed and were found to be attractive NAMA projects.

6 Challenges

One of the challenges towards implementation of the prioritized NAMA interventions in the energy sector is the absence of a regulation / regulatory body to decide on the issues like generation licenses, feed in tariff, availability of grid to any prospective independent power producer using RE technologies etc.

Till recently the energy generation and distribution in Grenada was the monopoly of the Grenada Electricity Company (GRENLEC). The framework to determine the tariff comprised of two-part tariff (a fixed part related to the capital cost plus a variable part related to the fuel cost) wherein, any variation in the fuel price was passed on to the end consumer. This provided very little incentives to carry out any supply side EE measures at Grenada.

In June 2016 the parliament of Grenada has approved the ‘Electricity Supply Bill’ for operations of the

electricity sector in Grenada. The bill seeks to end the monopoly of GRENLEC in the supply of electricity to the island. The bill, once it comes into effect, will repeal and replace the 1994 Electricity Supply Act, that provides for GRENLEC to maintain its monopoly up to the year 2073. The bill provides a platform for new domestic and foreign investment, new projects.

The new Public Utilities Regulatory Commission Act (PURCA) that was simultaneously introduced with the Electricity Bill will allow PURCA/Commission, to set electricity rates. The new Commission that will be put in place will set rates that are chargeable by licensees for the supply of electricity and other services. In addition to serving as the regulator of the energy sector, the Commission will be tasked with the enforcement all the licenses for the supply of electricity, the resolution of consumer and self-generator complaints, and the processing and approval of all license applications.

With long years of monopoly of GRENLEC the government institutions at Grenada may require technical assistance and capacity building in the matters relating to regulations and tariff fixation in the electricity sector. This would be one on the requirements to ensure uptake of renewable energy sector on a significant scale.

One of the other challenges is that given the size of the country, the scale and size of the NAMA project would be small for it to be attractive enough for a funding agency to support the NAMA project. This challenge can be addressed to some extent by selecting and structuring the NAMA project in a manner that there is GHG mitigation is attractive enough.

The environmental impact of the GHG mitigation initiative selected for NAMA would need to be taken into account, while designing the NAMA. For example, in case of replacement of lamps a method to dispose of the old lamps needs to be worked out; in case of implementation of solar PV on a significant scale infrastructure for disposal of the old used batteries would need to be worked out.

7 Conclusion

Based on the discussions with the stakeholders and preliminary evaluation of different GHG mitigation options a list of possible NAMA candidates at Grenada was prepared. The same is given below:

	GHG mitigation Option	Brief	GHG Mitigation potential and comments	Possible NAMA Components and Financial Mechanisms
1	EE (largely EE lighting retrofit) in public buildings (hospitals, schools and government offices)	EE for the three larger government buildings has already been done. This leaves schools and hospitals. As schools largely work during day time there would not be much savings due to EE in the lighting. There are three hospital buildings which can be explored	EE opportunities are restricted to the lighting for the three hospital size buildings. These three buildings are not big enough. Thus, there is not much potential	
2	Solar PV for the public building. The public buildings which could be included are schools, hospitals, government offices.	There are three large government building complexes at Grenada and a couple of smaller buildings. Apart from the government offices the school buildings and hospital buildings are also owned by the government. There is not much space near some of these government buildings, in such cases solar PV would need to be installed on the roofs of the buildings. In other cases, land available near the buildings (apart from the roofs) can also be utilized.	<p>There would be direct savings for the government.</p> <p>All the roof space and the land would not be suitable for solar PV due to directional orientation, slope, structural strength, shading due to structures in the neighborhood etc. Considering that an area of about 12000 Sq. meters may be available on the roof tops and on land near the government buildings, it may be possible to install Solar PV of about 1200 KW capacity on the government buildings.</p> <p>Emission Factor: 0.634 tons CO₂/MWh Capacity Utilization Factor: 20% GHG emission reduction = $1.2\text{MW} * 365\text{days} * 24\text{hrs} * 20\% * 0.634 = 1333 \text{ tons CO}_2/\text{Yr}.$</p>	<p>Different components of NAMA may comprise of the following</p> <ol style="list-style-type: none"> 1. Installation of Training module and training of trainers on Solar PV at the the college: NAMA Project supported activity 2. Development of training curriculum and training of technicians on operation and maintenance of solar PV systems: NAMA Project supported activity 3. Capacity building and technical assistance to establish a regulatory framework and regulatory body for the electricity sector: NAMA project supported activity 4. Pilot project / demonstration project with limited capacity (say 100 KW) established at one of the government buildings. NAMA project supported activity 5. Information dissemination and awareness creation activities: NAMA project supported activity 6. Establishment of an ESCO company / companies to install, manage and operate solar PV units at the government buildings. Some capital subsidy or corresponding tariff support (may be about

			Approximate GHG mitigation potential would be 1200 to 1800 tons CO2 / Yr.	30-40%) and soft loan to the extent of 50% of CAPEX to be provided to the ESCO company. Balance CAPEX (about 10 to 20%) would be invested by the ESCO company. ESCO company would have an agreement with the government to supply electricity to the government buildings at the rate lower than the present cost of electricity (say at about 50% of the present rate). The structure of financing and the electricity rate would be mutually decided based on a feasibility study and revenue modeling to be done by an independent consultant. Capital subsidy / tariff support would may be provided by the NAMA project
3	Wind / diesel, Solar / diesel Hybrid systems for power generation at the three islands	<p>The three islands of Grenada seem to have good potential for wind power and solar power projects.</p> <p>The government may like to develop these projects with private sector participation.</p>	<p>This can be taken up at Grenada on commercial basis.</p> <p>A detailed feasibility study needs to be carried out to determine the commercial viability of these projects to be developed with private sector participation. In case of viability gap and ways to bridge the viability gap needs to be worked out so that these are attractive investment propositions for the private sector.</p> <p>A capacity of about 10 MW grid connected Solar PV / Wind / Hybrid systems may be established at selected locations.</p> <p>Emission Factor: 0.634 tons CO2/MWh Capacity Utilization Factor: 25% GHG emission reduction = $10\text{MW} * 365\text{days} * 24\text{hrs} * 25\% * 0.634 = 13845 \text{ tons CO2/Yr.}$</p>	<ol style="list-style-type: none"> 1. Resource assessment for wind and Solar PV at selected locations: Activity supported by the NAMA project 2. Feasibility study and revenue for wind and solar PV at the selected locations: Activity supported by the NAMA project 3. Capacity building and technical assistance to establish a regulatory framework and regulatory body for the electricity sector: NAMA project supported activity 4. Establishment of grid connected solar PV / wind / Hybrid systems by private sector. Feed in tariff support / capital subsidy may be provided by the NAMA project to cover the viability gap

			GHG emission reduction potential is about 12000 to 15000 tons of CO ₂ / Yr.	
4	Solar PV scale up program	The idea is to make Solar PV as one of the major sources of energy in the country wherein we have solar roof tops, small and medium grid connected solar PV by private investors, a couple of large (say with capacity of 1 to 2 MW each) grid connected solar PV by IPPs. The overall project may have components like technical skill development, technical education and curriculum on solar PV, capacity development of the government officials, demonstration / pilot projects, policy and regulations for large scale uptake of solar PV etc.	<p>Over a period of 5-7 years it would be possible to meet about 15-20% of the demand for electricity at Grenada using solar PV. This would be a longer term project spanning over a period of 3-4 years.</p> <p>Actual investment would largely come from individuals and the private sector</p> <p>Solar PV based capacity = 15 to 25 MW Emission Factor: 0.634 tons CO₂/MWh Capacity Utilization Factor: 20% GHG emission reduction = 20MW*365days*24hrs*20%*0.634 = 22215 tons CO₂/Yr.</p> <p>Approximate GHG mitigation potential would be 12000 to 25000 tons CO₂ / Year.</p>	<p>Different components of NAMA may comprise of the following</p> <ol style="list-style-type: none"> 1. Installation of Training module and training of trainers on Solar PV at the college: NAMA Project supported activity 2. Development of training curriculum and training of technicians on operation and maintenance of solar PV systems: NAMA Project supported activity 3. Capacity building and technical assistance to establish a regulatory framework and regulatory body for the electricity sector: NAMA project supported activity 4. Pilot project / demonstration project with limited capacity (say 100 KW) established at one of the government buildings. NAMA project supported activity 5. Pilot project / demonstration project at rooftops of a couple of households: NAMA project supported activity 6. Soft loan for installation of solar roof top PV by the households by creating an interest rate draw down support under the NAMA project 7. Soft loans and part capital subsidy combined with accelerated depreciation benefit to commercial establishments (hotels, private institutions, shopping malls, industry. Office complexes etc.) for solar PV. Part capital subsidy to be provided by the NAMA project. 8. Information dissemination and awareness creation activities: NAMA project supported activity

				<p>9. Establishment of an ESCO company / companies to install, manage and operate solar PV units at the government buildings. Some capital subsidy or corresponding tariff support (may be about 30-40%) and soft loan to the extent of 50% of CAPEX to be provided to the ESCO company. Balance CAPEX (about 10 to 20%) would be invested by the ESCO company. ESCO company would have an agreement with the government to supply electricity to the government buildings at the rate lower than the present cost of electricity (say at about 50% of the present rate). The structure of financing and the electricity rate would be mutually decided based on a feasibility study and revenue modeling to be done by an independent consultant. Capital subsidy / tariff support would may be provided by the NAMA project</p>
5	Battery operated vehicles to be charged using solar / RE		<p>This is a very capital intensive option as apart from facilities for generation of RE power, it will require replacement of rolling stock (vehicles) as well. The overall design may also require battery storage</p>	
6	EE in the public lighting (Retrofitting of the public lighting like street lights, and lighting at other public places		<p>There is a good buying from the government as it reduces its energy bill of the government.</p> <p>Electricity consumption for Street lights in 2016= 4701 MWh Electricity savings @ 50% of consumption = 2350 MWh Emission factor = 0.634 tons CO2 /MWh GHG emission reductions = 2350*MWh*0.634 = 1490 tons of CO2 /Yr.</p>	<p>Establishment of an ESCO company / companies to install and manage EE lights. Some capital subsidy and some soft loan to be provided to the ESCO company from the NAMA project. Balance CAPEX (about 10 to 20%) would be invested by the ESCO company. Energy savings achieved would be monitored and the government will pay a part of the savings achieved (say 40 to 60%) to the ESCO company.</p>

			Approximate GHG mitigation potential would be 1200 to 1800 tons CO ₂ / Yr.	
7	Roof top solar PV		<p>This will include solar PV on houses, commercial buildings etc</p> <p>Solar PV based capacity = 0.75 to 1 MW</p> <p>Emission Factor: 0.634 tons CO₂/MWh</p> <p>Capacity Utilization Factor: 20%</p> <p>GHG emission reduction = 0.75 MW*365days*24hrs*20%*0.634 = 833 tons CO₂/Yr.</p> <p>GHG mitigation potential would be off the order to 800 to 1000 Tons CO₂ / Yr.</p> <p>.</p>	<p>Different components of NAMA may comprise of the following</p> <ol style="list-style-type: none"> 1. Capacity building and technical assistance to establish a regulatory framework and regulatory body for the electricity sector: NAMA project supported activity 2. Pilot project / demonstration project with limited capacity (say 20 KW) established at one of the buildings. NAMA project supported activity 3. Pilot project / demonstration project at rooftops of a couple of households: NAMA project supported activity 4. Soft loan for installation of solar roof top PV by the households by creating an interest rate draw down support under the NAMA project 5. Information dissemination and awareness creation activities: NAMA project supported activity
8	Carbon sequestration projects like agro forestry program for fruits trees, timber, energy plantations, industries		These can be better taken up as REDD projects	
9	Solar PV based water desalination project		Capital intensive with little GHG mitigation potential	
10	RE (biomass / solar) based decentralized power generation (mini grids or solar home systems) for the areas not connected to the grid	About 90 percent of the households in Grenada are grid connected. Thus potential is very less	This scores high from the view point of the development objectives and the aim of the government to provide access to electricity to all.	

			However, there won't be much GHG emission reductions due to smaller scale of operations	
11	Hydro power	There are a couple of sites at Grenada which are considered to be good for Micro / Mini Hydro power projects.	A detailed feasibility study needs to be carried out to determine the commercial viability of these projects to be developed with private sector participation. In case of viability gap and ways to bridge the viability gap needs to be worked out so that these are attractive investment propositions for the private sector.	<ol style="list-style-type: none"> 1. Resource assessment at selected locations: Activity supported by the NAMA project 2. Feasibility study and revenue modeling at the selected locations: Activity supported by the NAMA project 3. Capacity building and technical assistance to establish a regulatory framework and regulatory body for the electricity sector: NAMA project supported activity 4. Establishment of grid connected small hydro and / or Micro Hydro systems by private sector. Feed in tariff support / capital subsidy may be provided by the NAMA project to cover the viability gap
12	Waste to energy projects (sewage, solid waste)		A detailed feasibility study needs to be carried out to determine the commercial viability of these projects to be developed with private sector participation. In case of viability gap and ways to bridge the viability gap needs to be worked out so that these are attractive investment propositions for the private sector.	
13	Solid waste composting for bio-fertilizer		<p>Annual generation of waste= 35000 to 40000 tons / Yr. Decay able organic matter content of waste= 45%</p> <p>GHG mitigation potential would be about 1200 to 1500 tons CO₂ / Yr. (Computed using a reference approach. Registered CDM waste to composting project at Kolhapur, India has been used as the reference)</p>	<ol style="list-style-type: none"> 1. Feasibility study to determine the viability gap. Feasibility study will be supported under the NAMA project 2. Capital subsidy / carbon finance to cover the viability gap to be provided by the NAMA project 3. Actual investment to be done by a private sector party

14	Industrial effluent (from Rum factory, Brewery and soft drink plant) to biogas	The spent waste which is still rich in organic matter is a disposal problem. The effluent may be used to generate biogas. The biogas can be used onsite for generation of steam. Steam is generally one of the forms of energy used at these factories. In case there is no demand for steam the biogas may be used for captive power generation.	This may be taken up by one of owners of the factories with assistance from GIZ. Other factories may be asked to do the same	
15	Geo thermal power	Grenada is said to have good potential for geo-thermal energy.	A detailed feasibility study needs to be carried out to determine the commercial viability of these projects to be developed with private sector participation. In case of viability gap and ways to bridge the viability gap needs to be worked out so that these are attractive investment propositions for the private sector.	<ol style="list-style-type: none"> 1. Resource assessment at selected locations: Activity supported by the NAMA project 2. Feasibility study and revenue modeling at the selected locations: Activity supported by the NAMA project 3. Capacity building and technical assistance to establish a regulatory framework and regulatory body for the electricity sector: NAMA project supported activity 4. Establishment of grid connected geo-thermal power generation systems by private sector. Feed in tariff support / capital subsidy may be provided by the NAMA project to cover the viability gap
16	Biogas production for treatment of sewage	A detailed feasibility study needs to be carried out to determine the commercial viability of these projects to be developed with private sector participation. In case of viability gap and ways to bridge the viability gap needs to be worked out so that these are attractive investment propositions for the private sector.	GHG mitigation potential would be about 600 to 1000 tons CO ₂ / Yr.	<ol style="list-style-type: none"> 1. Feasibility study to determine the viability gap. Feasibility study will be supported under the NAMA project 2. Capital subsidy / carbon finance to cover the viability gap to be provided by the NAMA project 3. Actual investment to be done by a private sector party

17	Solar PV for Hotels	Total 1MW of solar PV can be installed on the roofs of the hotels	<p>Solar PV based capacity = 1 MW Emission Factor: 0.634 tons CO₂/MWh Capacity Utilization Factor: 20% GHG emission reduction = $1\text{MW} \times 365\text{days} \times 24\text{hrs} \times 20\% \times 0.634 = 11110 \text{ tons CO}_2/\text{Yr}.$</p> <p>GHG mitigation potential would be about 800 to 1500 tons CO₂/ Yr.</p> <p>The hotel industry is keen to take this up as long as it is commercially viable.</p>	<ol style="list-style-type: none"> 1. Assessment of commercial viability: Activity to be carried out under the NAMA project 2. Provide subsidy / feed in tariff support to cover the viability gap
18	Co-generation from exhaust of the power generators	This is already being done by the GRENGEN (electricity company) at Grenada		
19	Using the power plants in tri-generation mode at the university.	This is most likely to be commercially very attractive proposition and may be taken up by Electricity company and the university on commercial basis	<p>Present connected load at University = 3 MW Connected load after installation of waste heat based vapor absorption chillers = 1 MW Savings 2MW of load PLF = 80% Emission factor = 0.634 tons CO₂ / MWh</p> <p>GHG emission reductions = $2 \text{ MW} \times 365 \times 24 \times 80\% \times 0.634 = 8886 \text{ tons of CO}_2 / \text{Yr}.$</p> <p>GHG mitigation potential would be about 5000 to 7500 tons CO₂/ Yr.</p> <p>GRENGEN is interested to take this up and has agreed to examine the possibilities at tis own</p>	

20	Solar pumps for agriculture		<p>Approximate number of agriculture pumps at Grenada = 100 Connected Load of each pump = 10 KW Hours of operations = 2 hrs. per day 4 days a week GHG emission factor = 0.634 tons CO₂/ MWh Emission reductions= (100*10KW*2 hrs.*4 days*52 weeks*0.634) / 1000 = 263 tons CO₂ / Yr.</p> <p>GHG mitigation potential would be about 150 to 300 tons CO₂ / Yr.</p>	Not attractive enough from GHG mitigation view point
21	Solar PV for agro processing in the cottage sector (for making jams etc.)		Would get covered under the solar roof top for residential sector	
22	Use of shells of Nutmeg for power generation		May be explored by the Nutmeg processing companies	

These options were discussed with the Energy Division and the Department on Economic Cooperation during a debriefing session towards the end of the mission. Based on discussions it was agreed that either EE in public lighting (option number 6 in the above table) or a larger solar PV (combining options 2, 7, 17 in the table above) be taken up as NAMA at Grenada. It was deliberated that a solar PV project (combining options 2, 7 and 17) would take care of the options 20 and 21 as well.

Considering that the solar PV would have a larger impact both in terms of direct savings in the energy bill of the government and the aggregate level GHG emissions, it was decided that under the present project development of solar PV as a NAMA would be most appropriate. Further, it was suggested that the NAMA needs to have different kind of structure and support for different end users (hotels, government buildings, solar roof top, grid connected solar PV etc.). For example, it was suggested that a financial model of part capital subsidy/ grant would suit best for the hotel sector, whereas for government buildings either an ESCO model or complete grant would be required.

8 Recommendations and next steps

A reconfirmation from the stakeholders about the selection of solar PV for Government buildings, private buildings (hotels, shopping malls, etc.) and households as a NAMA project will be sought.

There after it will be developed as the NAMA project at Grenada. The specific work to be carried out for NAMA development would include

- Stocktaking and gap analysis: Review the work conducted under the J-CCCP Baseline Assessment and any other previous studies and identify any relevant additional information needed. Areas for review would include, existing sector plans strategies and policies.
- Specify NAMA objectives and select mix of instruments: This will include formulation of NAMA objectives with reference to the expected GHG emission reduction and Sustainable Development Goals; determination of the scope of the NAMA; selection of mix of measures and instruments to be included.
- Policy Analysis: This will include identification of relevant national and sector strategies and policies; NAMA alignment with national and sector strategies and policies
- Baseline information and NAMA targets: This will involve setting of the Baseline boundary; Review of the updated GHG baseline and mitigation targets; Sustainable Development baseline and co-benefit targets; assessment of the Transformational change
- Measures and Interventions under the NAMA: This will involve defining of the NAMA interventions and NAMA measures for the relevant sector, including capacity development needs.
- NAMA Costs and Financial Mechanism: This will involve assessment of the costs of interventions and measures;. This will also include assessment regarding National and international financial sources; methods for Financial distribution and mechanisms; Donor exit strategy
- NAMA Implementation Structure: This will include description of operational bodies and implementing partners; NAMA operational and management system; Implementation plan and an Implementation schedule for the NAMA

- NAMA Measuring and Reporting: This will include methods for measurement of GHG emission reductions; qualitative and quantitative description of sustainable development impacts; Reporting; Verification and Evaluation

As the focus of the assignment is on NAMAs in the energy sector the work will be carried out in close consultation with the Department of Energy & Sustainable Development (Minister of Finance, Planning, Economy, Energy, & Co-operatives). Other important stakeholders which will also be consulted on a regular basis.

NAMA would be developed as a supported NAMA wherein, the kind of support sought from international agencies would include financial instrument, funding mechanism, technical support, institutional capacity building, and others. Specific focus would be on a sustainable finance mechanism with a clear donor exit strategy and private sector engagement.

Appendix- 1: Mission Schedule and Persons Consulted

Date	Stakeholder	Persons
28 Feb 2017	Arrival of Dinesh Aggarwal	
01 Mar 2017	Energy Division	Mr. John Auguste
	Economic & Technical Cooperation Division	Mr. Fitzroy James Mr. Rickie Morain
02 Mar 2017	Grenada Solid Waste Management Authority - GSWMA	Mr. Raymond Neptune
	Grenada Hotel and Tourism Association	Ms. Pancy Cross
	Grenada Electricity Services Ltd (GRENLEC)	Mr. Shawn Charles Mr. Jusceno Jacobs Mr. Sylvester Joseph
03 Mar 2017	T. A Marryshow Community College	Mr. John Telesford
	Min of Agriculture	Merina Jessamy (PS) Trevor Thompson Daniel Lewis
	Min of Carriacou and PM (Online)	Mr. Davon Baker Senator Norland Cox P.S Javan Williams
06 Mar 2017	Central Statistics Office	Ms. Caren Richards Caris_rich@yahoo.com gogeconstatsgd@gmail.com 4401369
	Min. of Environment and H. R Affairs	Mr. Kevin Andall (PS) Ms. Aria St. Louis
	Grenada Investment Development Corporation	Mr. Che Keens-Douglas
07 Mar 2017	Debriefing Meeting: Ministry of Energy and Department of Economic Technical Cooperation	Mr. John Auguste (Energy) Mr. Fitzroy James (E&TC)
	Grenada Development Bank (GDB)	Mr. Mervyn Lord General Manager
08 Mar 2017	UNFCCC-RCC (on Skype)	Ms. Maria Laura Vinuela
	Closure of Mission and departure of Dinesh Aggarwal	