INTER-AMERICAN DEVELOPMENT BANK

Implementing Sustainable Energy Projects in the Bahamas

Final Evaluation Report (FER)

GEF ID: 3891

Oswaldo Patino, Consultant

10/17/2017

Abbreviations and Acronyms

BEC	Bahamas Electricity Corporation
BEST	Bahamas Environment, Science & Technology Commission
CCB/CBH	IDB Country Office in Bahamas
CDM	Clean Development Mechanism
CERS	Carbon Emission Reductions
CFLs	Compact Fluorescent Lamps
EA	Environmental Assessment
EE	Energy Efficiency
ESP	Energy Sector Policy
ESR	Environmental and Social Review
GBPC	Grand Bahama Power Company (Private Company)
GEF	Global Environmental Facility
GEO	Global Environmental Objective
GHG	Greenhouse Gases
GoBH	Government of Bahamas
HFO	Heavy fuel Oil
HVAC	Heating, Ventilating and Air Conditioning
IDB	Inter-American Development Bank
IG	Investment Grant
INFRAFUND	Infrastructure project Preparation Fund
IPPs	Independent Power Producers
ISEPs	Implementing Sustainable Energy Projects in Bahamas
M&E	Monitoring and Evaluation System
MOTE	Former Ministry of Environment
MTE&H	Ministry of Environment and Housing
PEU	Project Execution Unit
PM	Project Manager
POM	Program Operations Manual
PV	Photovoltaic or PV solar system
RE	Renewable Energy
SECCI	Sustainable Energy Climate Change Initiative
SWH	Solar Water Heater
TA	Technical Assistance
TC	Technical Cooperation
TOR	Terms of Reference
URA	Utilities Regulation Act
WE	Waste Energy

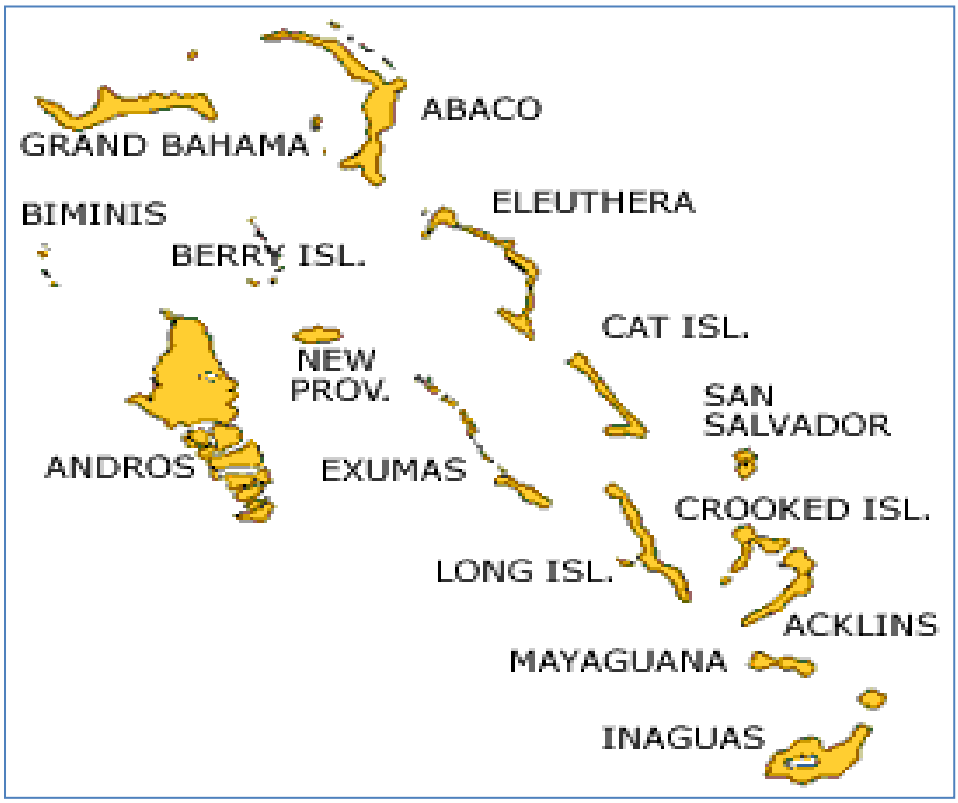
I. Project Context

Country and sector issues.

The Commonwealth of The Bahamas (The Bahamas) comprises approximately 700 islands and cays with a total land area of around 4,400 square miles/ 11,400 square kilometers spread over 100,000 square miles of ocean.

The total population of the country is around 310,000, of which 85% reside in the main islands of New Providence and Grand Bahama (69% reside in New Providence, mostly in and around the capital city of Nassau; 16% reside in Grand Bahama, in and around Freeport, Bahamas' second city). The remaining 15% of the population is scattered among the other 28 inhabited islands (see Figure 1).

Figure 1: The main islands of the Commonwealth of The Bahamas



Electricity generation in Bahamas is based entirely on thermal plants powered byfossil fuels. The larger-unit plants are operated by the Bahamas Electricity Corporation (BEC), a publicly owned utility company, and by another private sector company based in Grand Bahama – the Grand Bahama Power Company (GBPC).

BEC is a vertically integrated, state-owned operation that is responsible for the generation, transmission, distribution and commercialization of electricity across most of the Bahamas, serving approximately 85% of all electricity consumers.

Although approximately 60% of the country's population resides on New Providence Island, BEC's area of supply extends to all of the major islands of the Bahamas with the exception of Grand Bahama and Inagua Islands, which are under a unified national tariff for electricity. BEC operates 29 generating plants (28 diesel engine stations and 1 gas turbine power station) with an installed capacity of 438MW, providing service to approximately 98,000 customers. The Grand Bahama Power Company supplies electricity on the island of Grand Bahama serving some 40,000 consumers using diesel and turbine engines.

The annual consumption of (100% imported) fossil fuels used to generate electricity was 9,490,000 barrels for the year 2008 and the electricity demand growth has progressed at an annual rate of around 3% for the last few years.

The volatility in the cost of oil, coupled with the increased national demand for energy has generated a huge economic burden for the Caribbean in general and in particular for the Bahamas, which could significantly benefit from incorporating Renewable Energy (RE) as well as Energy Efficiency (EE) programs into their energy matrix. This would lead to significant benefits including a drop in the import of fossil fuels, generating important savings and energy security to the Government of Bahamas (GoBH), and most importantly it would also lead to a decrease in carbon emissions. The latter is especially important given that the annual average emission of 6.7 tons of CO_2 per person places The Bahamas among the highest per capita emitters of Greenhouse Gases (GHGs) in the world.

The Bahamas has RE resources that could generate electricity, such as solar and wind power, waste, and ocean thermal energy and, like many of the Caribbean islands, it could benefit significantly, by incorporating RE as well as EE programs into its energy matrix. Not only would the imports of fossil fuels drop, generating important savings to the nation, but also carbon emissions would decrease, which could generate an interesting potential to sell Carbon Emission Reductions (CERs), through the Clean Development Mechanism (CDM) developed under the Kyoto Protocol or other carbon voluntary markets. One outcome of the project—Implementing Sustainable Energy Projects in the Bahamas—was to assess the potential for CERs following the Global Environment Facility (GEF) guidelines for the calculation of CERs although it was not financing the preparation of Project Design Documents (PDDs) or similar instruments to trade carbon credits.

The Bahamas also has a high-untapped potential for the implementation of EE measures. Its economy is predominantly based on the provision of services (i.e., tourism and banking), which demand significant amounts of power for the provision of lighting, cooling, and operating electrical equipment and appliances. Between 40 to 60 percent of the electrical power demand at hotels is used for cooling due to the use of inefficient Heating, Ventilating and Air Conditioning (HVAC) technologies and existing building designs. Domestic lighting is still dominated by incandescent lighting and close to 90 percent of households have electric water heaters. Cooling and lighting services for government and commercial buildings represent another area with significant EE potential.

The IDB's Country and Sector Strategies: The IDB country strategy for The Bahamas for 2003-2007 (document GN-2290-1) had four principal areas of strategic focus: (i) sustaining economic growth and private sector development; (ii) promoting social development and equity; (iii) improving environmental management and natural resources conservation; and (iv) public sector modernization.

IDB's Technical Assistance in the Bahamas: In response to the GoBH request for Technical Assistance (TA), the Inter-American Development Bank (IDB) approved the following Technical Cooperation (TC) projects:

i. **BH-T1012 in execution ATC/OC-11436-BH (US$700,000)**: This TC was financed by the IDB´s Infrastructure Project Preparation Fund (Infrafund) to achieve the sustainability of BEC by upgrading and strengthening BEC's institutional, operational and financial capacity, and by providing alternatives to minimize the Bahamas' dependency on fossil fuels.

ii. **BH-T1016 in execution ATN/MC-11467-BH (US$750,000)**: This TC was financed with funds from the Sustainable Energy and Climate Change Initiative (SECCI) to carry out a resource assessment for RE, determine potential for EE and Waste to Energy (WE), as well as recommend and prepare energy legislation, regulatory and policy studies.

In addition to the Infrafund and SECCI approved TCs, IDB prepared another project to support EE in Bahamas, namely:

i. BH-T1018 (US$500,000): This Investment Grant (IG) funded by the SECCI, aimed to reduce the electricity bills of the most vulnerable sector of the Bahamian population through energy savings with the provision of Compact Fluorescent Lamps (CFLs), and increasing awareness of the benefits of energy efficiency and conservation. The IG resources were to finance the phase-out of incandescent lights by replacing them with CFLs, which was part of the EE implementation plan under this GEF program.

The GEF project - Implementing Sustainable Energy Projects in The Bahamas: This GEF project was complementary to the Infrafund and SECCI TCs, because GEF resources (BH-X1001) were to be used to implement pilot projects in EE and RE. The project was to provide the GoBH with tools and information required for decision making, in particular through design and implementation of demonstration pilots in EE and RE which were intended to lead to an investment loan for BEC, estimated at US$50 million, to refinance the company and include RE and EE technologies in their expansion plan.

The GEF project aimed to promote and support the development and implementation of sustainable energy sources in the Bahamas by providing alternatives to reduce dependency on imported fossil fuels, via a combination of Technical Assistance (TA) and the design and implementation of three pilot projects, two of which were to be financed with GEF funds.

This GEF project broadly supported the pillars of the Country Strategy in areas (i) and (iii) and was also consistent with the goals of the Energy Sector Policy (ESP) of the IDB because it sought to: (i) develop alternative sources of energy, especially from renewable resources; (ii) reduce and/or replace the utilization of hydrocarbons in the production of energy; (iii) promote the efficient use of

energy; and (iv) create and/or strengthen the institutional and technological base of the energy sector.

It was also consistent with the pillar of "Infrastructure for Growth and Environmental Sustainability" of the Country Strategy 2008-2012 for The Bahamas, as confirmed with the GoBH during the Policy Dialogue Mission conducted in October of 2008.

This GEF project was also in accordance with some of the activities described in the ESP because it aimed to improve efficiency in the use of energy in the various sectors of economic activity and also studied the possibilities of utilizing new sources of energy, including research toward adapting energy production procedures which, because of their technological and socioeconomic characteristics, may signify an alternative source of energy for the future of Bahamas.

Project Objective. The general objective of this GEF project was to promote and support sustainable energy, including RE and EE programs in order to ensure sustainable development in the Bahamas, providing alternatives to minimize the dependency on fossil fuels.

The specific objectives of this project were to: (i) provide technical assistance to the GoBH to achieve EE in public buildings, the residential sector and commercial sectors, and to implement demonstration projects, in particular the phase-out of incandescent lights by replacing them with CFLs and installation of Solar Water Heater (SWH) systems at the residential level; (ii) explore alternatives for RE, and implement pilot projects in RE, in particular a demonstration project for household Photovoltaic (PV) systems connected to the grid using net metering devices; (iii) strengthen the energy sector in Bahamas; (iv) support the GoBH with a review of energy legislation, regulatory and policy issues to promote sustainable energy as well as institutional strengthening in the areas EE and RE and (v) dissemination of findings. The GEF resources were to be used to finance two pilot-demonstration projects one in RE consisting of the installation of solar Photovoltaic systems using net metering devices as well as an EE program via the installation of SWH in representative parts of the Bahamas.

Project Components

Component I – EE for public buildings, commercial and residential sector: This component was to address the following activities:

i. **Subcomponent I.1 - EE Assessment (Financed by BH-T1016 and GEF):** This subcomponent was to: (i) assess energy uses and electricity consumption patterns; (ii) adapt energy audit protocol and procedures to standardize energy audits in the Bahamas; (iii) conduct EE surveys and audits for public buildings, residential and commercial sector, and determine the cost for new EE appliances, public lighting, EE cooling systems, etc.; and (iv) design a financial instrument to promote EE. This subcomponent was also to finance studies to determine if a market approach is the most feasible option for expanding the use of EE; and (v) training courses for SWH installers and plumbers.

ii. **Subcomponent I.2 - CFL Pilot Project (financed with SECCI funds from BH-T1018):** The goal of this pilot project was to replace a portion of the incandescent light bulbs in a sample population of low and middle-income households with CFLs throughout BEC´s territory in the Bahamas. The aim of the overall pilot project was to replace up to approximately

150,000 incandescent lights with CFLs. The program was to be implemented within New Providence in a sample population of five low and middle-income neighborhoods where most of these households have at least 10 bulbs in use and on average more than 50% are incandescent bulbs. On average, light bulbs are used 4-5 hours daily, an adequate quantity of hours to generate attractive savings. The typical capacities of functioning incandescent light bulbs are 60W and 75W and the average monthly electricity bill for these households was expected to represent between 5% and 15% of the average income of a low and middle-income household in New Providence. On average, there are 4 to 8 persons per household.

The key activities of the pilot program comprised: (i) the replacement of functioning incandescent bulbs with an equal number of compact of CFLs; (ii) the disposal of the functioning incandescent bulbs in accordance with environmentally sensitive disposal practices; (iii) installation of CFLs by MOTE's contractor and/or by BEC's employees in the selected households, corroborating that the electrical installations were in accordance with code and maintaining electricity consumption at the same level during the implementation of the pilot project (i.e., at least 2 to 3 months); and (iii) before and after the replacement of incandescent bulbs took place, a public awareness campaign on the benefits of EE and conservation measures with particular emphasis on efficiency lighting was to be established.

iii. **Subcomponent I.3 – SWH Pilot Project (Financed by GEF)**: With GEF funds, the project was to implement a Solar Water Heater (SWH) pilot project to evaluate the capital and energy savings potential that could be achieved by using SWH systems on a large scale and provide an indication of the incentive levels to be given. The high availability of solar radiation (5.4 kWh/m2 day) and its regularity meant that SWH ought to be an excellent technology to provide this basic service.

The SWH pilot project was to encompass the following activities: (i) installing one 100% subsidized SWH system per house in a social housing development to be selected in a range of about 134 households, depending on the SWH model installed in each household; (ii) two models of SWH will be installed—a small one (SWH140) for dwellings of 2 rooms, and a larger one (SWH210) for dwellings with 3 rooms; (iii) SWH systems were to include a monitoring system for metering and storing data on solar production, hot water consumption and other useful variables that would provide real data on domestic thermal energy consumption levels; (iv) participation of the building contractor for the social housing government program, who was to be responsible for the installation of the SWH systems with its own plumbers; (iv) implementation of a parallel training program targeting certified plumbers and contractors to provide adequate capacity building and training; and (v) development of a marketing strategy with adequate financial tools including subsidies, for future large scale replication.

Component II – Assessment of the RE potential, cost and viable options to include RE and WE in the energy matrix: This component was to address the following activities:

i. **Subcomponent II.1 – RE Assessment (Financed by BH-T1016 and GEF)**: This subcomponent was to: (i) assess the potential for RE; (ii) determine the cost of implementation of these RE technologies; (iv) establish a prioritized plan of action to include RE in the energy matrix of the Bahamas; (v) support the preparation of a WE assessment that would identify the

possible options to obtain energy from landfills and other sources of waste; and (vi) identify potential for bio-energy production, including the potential to develop a biodiesel market from recycled cooking oil from cruise ships and the tourism industry. The subcomponent was also to finance studies to determine if a market approach was the most feasible option for expanding the use of PV in households around the Bahamas; and (v) training courses for PV installers and electricians.

ii. **Subcomponent II.2 – Pilot projects for household PV systems and net metering devices (Financed by GEF)**: The GEF funds were to finance the design and implementation of a pilot project for RE, covering grid connected PV plants. Net metering was to be considered as a part of the pilot project, to clearly identify the energy delivered /received by the customer/producer. The Solar PV pilot project was to encompass the following activities: (i) develop technical and operational procedures for grid connection, based on net metering principles; (ii) implement an application procedure for users to apply for the subsidy, including the technical and financial requirements to be submitted by applicants; (iii) enable the execution of a representative sample of PV systems, to be installed in a range of 20 to 30 private households; (iii) PV systems in each household should contribute to a maximum of 70% of their current average electricity consumption; (iv) include a tender for the provision of technical assistance services; (v) provide for PV systems that include an exhaustive monitoring equipment to log performance data (solar production, balance of electricity, electricity fed into the grid, performance ratio, etc.); (vi) include actions on capacity building and training for BECs technical personnel, certified electricians and private contractors in order to stimulate stakeholders entrepreneurship; (vii)develop a mixed-market driven promotion scheme, based on the combination of a subsidy and co-financing by consumers; and (vii) draw possible large scale replication scenarios, considering a PV penetration rates (% of PV contribution to the Bahamas generation mix) of 5%, 10% and 20%.

Component III –Strengthening the Energy Sector in the Bahamas (Financed by BH-T1012): This Component was to include a TA designed to: (i) review the results of the financial audit made to BEC; (ii) assist BEC in improving its operational and financial management (e.g., establishment of indicators for measurable improvements of operational efficiency, tariff structure, including technical and commercial losses, thermal generation efficiencies, increased collection ratios) in order to strengthen the capacity to service debt; (iii) based on the results of the review, analyze alternatives on how to improve BEC's cash management; and (iv) prepare a strategic pipeline that includes refinancing options, future financing needs for expansion of its system and financial viability for BEC's long terms investments (analyzing and prioritizing projects). This component was also to explore alternatives for BEC's expansion plan specifically including RE through: (v) the assessment of BEC's expansion plan, including the potential diversification of their energy matrix by using RE; (vi) preparation of a prioritized list of projects; (vii) determining cost of implementation of RE technologies; and (viii) establish a prioritized plan of action to include RE in the energy matrix of the Bahamas.

Component IV – Institutional Strengthening and capacity building in the areas of EE and RE (Financed by BH-T1016): This component was to: (i) review and recommend legislation, regulatory and policies issues to adopt EE measures in public buildings, residential and commercial sector (including tourism sector); (ii) provide TA to review and recommend legislation, regulatory and policy issues to integrate RE and WE and traditional energy (diesel, fuel oil and eventually NG, if it is

available) in the energy matrix of The Bahamas; (iii) provide the GoBH with training and capacity building to prepare energy conservation plans, prepare RE and WE programs to reduce their dependency of fossil fuels, train energy audits, energy technicians and operators to erect, operate and maintain RE technologies; and (iv) with the information gathered and generated in the previous components this subcomponent was to support the preparation of the National Energy Policy and the reformulation of the Bahamas Electricity Act.

Component V – Dissemination of findings (Financed by BH-T1012 and BHT1016): This component was to finance at least two workshops to validate and disseminate the findings of the technical studies and pilot projects, helping the Ministry of the Environment of the Bahamas (MOTE) to identify the interested sectors (the affected community in particular) and develop communication and participation strategies during project development and implementation. MOTE in coordination with the GoBH was to implement a long-term public education and awareness strategy for sustainable energy in the country.

Executing Agency. The Executing Agency for the investments components was the Ministry of Environment (MOTE, which was later reformulated as the Ministry of Environment and Housing - MTE&H). The MOTE was responsible for the selection and contracting of the goods, services, and consultancies required under the project, following the Bank's procurement policies. The Ministry was also responsible for the supervision, installation and operation of the goods and services financed with IDB's resources, while the Bank administered the GEF funds.

Significant Changes. The project was due to close in August 2011, but the grant was extended three times to December 2016, to allow for completion of some remaining activities, mainly dissemination of findings and repairing and installing PV systems damaged during Hurricane Matthew. The Bank and GoBH agreed to cancel US$174,478.80 out of the GEF Project, mainly because it was time consuming and difficult to procure and reinstall the PV systems damaged within the last extended period of the grant.

II. Assessment of the Project Results

2.1. Relevance of Objectives and Design

Relevance of Objectives. *The relevance of the Project Objectives is assessed as high*. The objectives of Implementing Sustainable Energy Projects in Bahamas are relevant to the development priorities of the GoBH. The country has several key areas of strategic focus in the energy sector: (i) economic efficiency, (ii) EE using less energy to provide the same level of service, (iii) energy conservation as a result of a more efficient use of energy, (iv) clean energy, including RE, (v) diversification and security of energy supply, and (vi) meeting the energy needs of the poor. The project was consistent with numerals (ii) through (vi) and has assisted the GoBH to develop a National Energy Policy, strengthen BEC's technical and financial capacity and promote EE and RE pilot programs.

The strategy that the country is pursuing for the energy sector seeks to ensure energy security and reduction of imported oil by introducing RE in the energy matrix and maximizing EE measures, diversifying the energy matrix and allowing Independent Power Producers (IPPs) and Small Power Producers (SPPs) to sell power to the grid, achieving environmental benefits such as carbon emission reduction in the long-term. Thus, the objective to develop policy frameworks, selectively improve energy efficiency and promote the most effective alternatives for RE generation are and will continue to be highly relevant for the country.

Relevance of Design. *Relevance of design is assessed as substantial*. The project's design was consistent with the Global Environmental Objective (GEO) and the project results framework, forming a logical chain that included the right activities to achieve the desired results. The design included activities that directly addressed the general objective, which aimed to improve efficiency in the use of energy in various sectors of economic activity, and also in developing studies that would create the likelihood of utilizing new sources of energy towards adapting energy production and providing an alternative source of energy for the future of Bahamas.

2.2. Achievement of Global Environment Objective (GEO) (Effectiveness)

The general objective of this GEF project was to promote and support sustainable energy, including RE and EE programs in order to ensure sustainable development in the Bahamas, providing alternatives to minimize the dependency on fossil fuels. *The achievement of the PDO (GEO) is rated moderately satisfactory.* This rating is based on the completion of two outcomes as satisfactory, two as moderately satisfactory and one as unsatisfactory. An assessment of each of them follows:

Objective 1. Provide Technical Assistance to the GoBH to achieve EE in Public Buildings, the residential sector and commercial sector and to implement demonstration projects, in particular, the replacement of incandescent lights with CFLs and installation of SWH systems at the residential level. This objective is rated as moderately satisfactory based on achievement the following specific objectives.

1.1 Technical Assistance. *This outcome is rated satisfactory*. Through the FICHTNER study, the project fully achieved its planned EE assessment, inclusive of a proposed national energy efficiency program, energy audit protocols and procedures, and energy audits for households, hotels and public buildings, as well as the assessment of energy uses and consumption patterns and financial instruments to promote EE. The study also identified financial options geared toward the promotion of EE in the Bahamas. However, there was no training undertaken for SWH installers or plumbers during the implementation period for the project.

1.2 Replacement of incandescent lights with CFLs. *The CFL pilot project is rated moderately satisfactory.* The original objective was to purchase 150,000 CFLs and distribute them to low-income families in the Family Island and New Providence. The project purchased 270,000 CFLS and distributed approximately 121,074 CFLs among the beneficiary households. At the end of project, it is estimated that the energy savings from the installed CFLs (121,074 confirmed) was 7,954 MWh/yr., less than the original target envisaged at appraisal, equivalent to 9,855 MWh/yr. or 81%.

The reduction of the outcome target was affected by poor record keeping and data management throughout the project implementation period 2009-2010, which was particularly evident in the CFL monitoring and assessment, and to a lesser extent, in the CFL distribution,[1] recipient tracking and disposal program. Furthermore, the beneficiary households were not tracked and, accordingly, the "missing" CFLs could not be tracked. In hindsight, the distribution, installation, record keeping and disposal of such a large amount were not properly designed in light of the limited human resources assigned to the PEU. Nevertheless, the evaluation reports prepared on January 29th, 2013, stated

[1] The distribution method was modified from the initial plan for MOTE/BEC agents to deliver and install the CFLs with a comprehensive program to increase awareness and facilitate reliable monitoring by the PEU. The alternate distribution method employed was the use of the Royal Bahamas Defense Force (RBDF) to distribute the bulbs, along with the use of designated depots in New Providence and local government administrators in the Family Islands.

that at least 121,074 CFL bulbs were installed (112,656 CFLs in the Family Islands and 8,418 in New Providence).

Thus, the project results are mixed. On one hand, the outcome target was moderately satisfactory given the assumption that at least 150,000 CFLs or more were distributed, and the energy savings from the installation of the CFLs were moderately satisfactory. However, the energy saved that can be attributed to the project is less than optimal in light of the verified 121,074 CFLs for which the PEU had monitoring data. On the other hand, there were several administrative shortcomings such as: (i) poor record keeping, and data management that have negatively affected the project's ability to achieve a higher level of outcome and (ii) no proper disposal of the old light bulbs as the bulb eater machine was not received until November 2012 and the collection sites were not mobilized. It is important to mention that there is no data on how many light bulbs were crushed and the subsequent disposal process.

With regard to the beneficiaries, the project registered a partial success in carrying out the awareness campaigns on energy efficiency (EE) and enhanced knowledge of CFLs, through a public awareness program with technical support and involvement of the PEU team, and the Minister of the Environment. It is worth mentioning that the beneficiaries interviewed declared that they were very satisfied with the benefits experienced by the CFLs.

1.3 Installation of SWH System in residential level. *The SWH pilot project is rated moderately satisfactory*. The project aimed to achieve savings equivalent to 1,955 kWh/year, however, the actual outcome was 782 kWh/year at project completion. Although the project achieved the installation of 133 SWH in selected households, in New Providence and the Family Islands as planned, there are only 40% out of the 133 SWH systems installed that are working properly and efficiently. The remaining 60% of the SWH systems are currently suffering corrosion and other technical issues. Due to these technical issues, the useful life of those SWH systems was no more than 2 years while the expected lifetime for a SWH system is between 7 to10 years. Though the full project outcome will not be realized as a result of these issues, the short-term success of the SWH project illustrated the technical viability of the systems to The Bahamas for future operations.

Objective 2. Explore alternatives for RE, and implement pilot projects in RE, in particular a demonstration project for household Photovoltaic (PV) systems connected to the grid using net metering devices. *This outcome is rated satisfactory.* The RE pilot project was successfully implemented as the output target was achieved as planned with the purchase and installation of the 33 Photovoltaic (PV) systems in selected households- 22 in New Providence, 10 in Grand Bahamas and one in Andros island—including their inverters to allow connection to the household and the electricity grid. However, during implementation, there was an issue with the inverters, which were not working with the electricity grid. However, this was corrected with the support of the IDB and the PEU through the purchase and installation of new inverters that were technically fit for the type of grid existing in the Bahamas.

The satisfactory outcome rating is justified due to the following reasons: (i) out of the 22 PVs system installed in New Providence, eleven (11) PV systems were damaged during Hurricane Matthew while the remaining eleven (11) PV systems have been fully connected to the utility grid of the BEC; and (ii) ten (10) PV systems have been installed in Grand Bahama, however, these have not been connected yet to the electricity grid of the privately-owned Grand Bahamas Power Company (GBPC) due to existing utility fluctuating grid. The GBPC needs to work with the pilot participants to allow

the PV systems installed to connect to the electricity grid. As a result, eleven (11) PVs systems installed in New Providence are now connected to the electricity grid while, in Grand Bahama, the utility company did not make sufficient effort to connect the 10 PV systems to the electrical grid due the energy fluctuations.

In general, the PV's pilot project exceeded its main objective despite the many set backs and problems encountered during implementation that may have been inevitable for an ambitious pilot project. The project has illustrated the technical viability of the solar energy and improved the acceptance of RE sources in the Bahamas.

Objective 3. Strengthen the energy sector in Bahamas. *This outcome is rated moderately satisfactory*. With project resources, the PEU hired the FICHTNER GmbH & Co.KG (consortium) to develop several activities related to the BEC's management procedures and a proposal for BEC's expansion plan. The outputs of the consultancy were achieved through the provision of financial and operational technical assistance focusing on operational and financial management procedures, developing a financial model, and developing alternatives for BEC´s Expansion Plan. The diagnostic and proposals were completed and handed over to the BEC, however, further analysis of these activities was required and, as a result, Castalia Consultants were contracted to prepare a detailed action plan which included the strategy for diversification of BEC's energy matrix using RE. It is important to mention that the consortium did not carry out implementation of the action plan nor the training programs. At the time of this assessment, it was not clear whether BEC had implemented any recommendations from either of the two studies prepared during the project execution period.

Objective 4. Support the GoBH with a review of energy legislation, regulatory and policy issues to promote sustainable energy as well as institutional strengthening in the areas EE and RE. *This outcome is rated satisfactory.* The FICHTNER study examined where there were obstacles in the existing laws impacting on EE and RE and also made recommendations on policies related to both EE and RE. The EE policy recommendations proposed, among other things, efficiency standards, specifically introducing minimum energy standards in all new buildings, tax exemptions— reduced tax rates on EE equipment and appliances, as well as the establishment of a Sustainable Energy Unit and EE programs for the households, hotels and public buildings.

In terms of the RE policy recommendations, these included the increase of awareness, implementation of training programs for RE technologies, facilitating access to capital to cover the high up front costs associated with RE, incentives to the power company and clear grid connection rules. It is important to mention that at the time of this assessment there is no evidence that the GoBH has implemented the energy legislation and regulatory aspects.

Objective 5. Dissemination of findings. *This outcome is rated unsatisfactory.* This project component allocated resources to finance two workshops for dissemination of findings; however, these workshops were not carried out during project execution, and the project funds were cancelled at closing of the project. Nevertheless, it is worth mentioning that Householders Dissemination and Awareness raising campaigns were performed while replacing light bulbs with CFLs for low-income households across the islands. This included the provision of several training programs to the beneficiary householders for raising awareness for changing EE habits. The activities included the following: (i) meetings with beneficiary stakeholders, (ii) workshops and (ii) detailed training. The company in charge of the installation of CFLs organized these activities.

Results Framework Project Matrix. Table 1 shows the outcome indicators achieved and the intermediate outcomes (outputs) generated by the ISEP project. The table also presents the level of achievement and comments per each outcome and output indicators proposed in the Project Results Framework Matrix.

Table 1
Results Framework Matrix
Achievement of Project Outcome and Outputs Indicators

(a) Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Component 1	**EE for public building, commercial and residential sector with the implementation of demonstration projects in EE, in particular the replacement of incandescent lights with CFLs and installation of SWH systems at the residential level.**			
Sub component 1.1.	**Technical Assistance –EE for Public Buildings, commercial and residential sector.**			
Outcome 1.1	Potential for EE is identified.			
Indicator 1.1:	Energy consumption of buildings, appliances and equipment used.			
Value (quantitative or qualitative)	No EE regulations /incentives exist. No EE in commercial, residential and commercial buildings applied	National EE program		National Energy Efficiency Program developed under the FICHTNER study
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement:** 100% of target achieved. **Comments:** The potential for EE was identified through the FICHTNER study handed over to BEC and the GoBH.			
Sub component 1.2.	**Pilot project to promote the use of CFLs in The Bahamas**			
Outcome 1.2:	EE savings are demonstrated via the implementation of a pilot project to replace incandescent lights with CFLs, a portion of the incandescent light bulbs in low-income households.			
Indicator 1.2:	EE benefits in terms of energy and cost savings.			
Value (quantitative or qualitative)	No EE measures tending to save energy in low income households are in place.	Energy savings of 9855 MWh/yr. and 6.75 MW	Estimated energy savings are 17,739 MWh/year	7,954 MWh/yr.-
Date achieved	2009	2011	2012	2012
Comments (incl. % achievement)	**Achievement:** 81% of target achieved based on the grant original target. And 44% of the CFLs purchased but not tracked its installation. **Comments:** Under the subcomponent, the Project purchased 270,000 CFLs but due to lack M&E system in place, the PEU only registered the installation of 121,074 CFLs. Data collection of the remaining low income household beneficiaries could not estimated, thus, energy savings produced could have been exceeded the original target as envisioned at appraisal. The Final Evaluation of the Promotion of Energy Efficient			

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
	Residential Lighting did not collect the data nor the PEU had an adequate monitoring and evaluation system of the CFLs distributed across the household beneficiaries in the islands.			
Sub component 1.3.	**Pilot Project for Solar Water Heater (SWH) systems.**			
Outcome 1.3:	EE savings are demonstrated via the implementation of a pilot project to install SWH in households.			
Indicator 1.3:	EE savings			
Value (quantitative or qualitative)	-	The install of 134 SWH in households are saving around 1,970 kWh/year		133 SWH in households are saving around 1,955 kWh/year
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement:** 100 % of Target Achieved, but unsatisfactory operational long-term results **Comments:** 133 SWH were installed in low and middle-income households. There is an issue about long-term sustainability of the SWH due to corrosion and technical operational issues.			
Component 2	**Assessment of the RE potential, cost and viable options to include RE in the energy matrix with the implementation of a demonstration project in RE – household PV systems using net metering devices.**			
Outcome 2.1	Feasibility of different RE technologies participating in the energy of BH is demonstrated.			
Indicator 2.1:	Number of feasibility studies on different technologies.			
Value (quantitative or qualitative)	Very limited economic and technical data different RE.	Feasibility studies done for RE alternatives		Energy Efficiency Program included in FICHTNER Study
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement:** 100% of target achieved. **Comments:** The FICHTNER study provided feasibility analysis on wind energy, solar energy, ocean energy, bio energy and waste-to-energy.			
Sub component 2.1.	Pilot Project for household Photovoltaic systems and net metering devises.			
Outcome 2.2	RE potential is demonstrated via the implementation of a pilot project to install PV systems connected to the grid.			
Indicator 2.2:				
Value (quantitative or qualitative)	N.A.	33 photovoltaic of 2 kw solar systems installed		33 PV systems were installed in New Providence, Grand Bahamas and Andros Islands.
Date achieved	2009	2001		2013
Comments (incl. % Achievement)	**Achievement:** 100% of target achieved. **Comments:** The Hurricane Mathews damaged 11 PV systems out of the 22 installed in New Providence. Only 11 have been fully connected to the utility grid by BEC			

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
	The 10 PV systems installed in Grand Bahamas have not been connected yet to the electricity grid of the Grand Bahamas Power Company.			
Component 3	**Strengthening the energy sector in Bahamas.**			
Outcome 3.1	Capacity to assess financial and operational aspects of the energy sector including uses of RE is built.			
Indicator 3.1:	BEC´s Management Procedures and Inclusion of RE in BEC´s expansion plan.			
Value (quantitative or qualitative)	Lack of knowledge on how to asses uses of RE with regard to financial and operational aspects	Provide feasible alternatives for the improvement of BEC's Management Procedures within 12 months Achievement of financial and operational sustainability in BEC within 12 months		Expansion plan was prepared and incorporates improvements to BEC's management procedures
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement:** Target is 100% achieved**.** **Comments:** The FITHCHER and Castalia studies addressed the improvements of management at BEC as well as a provided financial and operational models aimed at achieving financial sustainability.			
Outcome 3.2	Bahamas Electricity Corporation (BEC) includes RE alternatives in its expansion program.			
Indicator 3.2:	- Assessment of BEC's potential for diversification with RE - Expansion program objectives			
Value (quantitative or qualitative)	Dependency on fossil fuels that impacts on the financial situation and operating costs of BEC.	-Establish a plan of action that includes RE projects in the energy matrix of the Bahamas.		Plan of action that included RE projects completed.
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement:** 100% of target achieved **Comments:** A plan of action was prepared with data collected from BEC through technical assistance given by the Castalia consultants.			
Component 4	**Institutional strengthening, analysis of the regulatory framework and integration and capacity building in the areas of EE and RE.**			
Outcome 4.1	GoBH institutions strengthened for the adoption of EE and RE.			
Indicator 4.1:	Develop a National Energy Policy and proposal for Bahamas Electricity Act.			

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Value (quantitative or qualitative)	Lack of capacity for the inclusion of RE and EE measures as part of a National Energy Policy and the Bahamas Electricity Acts	Promotion of the use of RE and EE measures including recommendations to adopt EE measures in public buildings, residential and commercial sectors		Promotion of the use of RE and EE measures were detailed in the FICHTNER Study
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement:** 100% of target achieved. **Comments:** FICHTNER study analyzed the use of RE and EE measures and proposed recommendations for public buildings, residential and commercial sectors as well as the strengthening of the GoBH through the establishment of a Sustainable Energy Unit.			
Component 5	**Dissemination and findings.**			
Outcome 5.1	Results of the project are disseminated.			
Indicator 5.1:	Two workshops for project dissemination and findings			
Value (quantitative or qualitative)	-	Two workshops implemented		N.A
Date achieved		2011		
Comments (incl. % Achievement)	**Achievement:** Target not achieved. **Comments:** The project findings and dissemination through two workshops were not carried out. Project funds were cancelled.			

(b) Intermediate Outcome Indicators (outputs)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Component 1	**EE for public building, commercial and residential sector with the implementation of demonstration projects in EE, in particular the replacement of incandescent lights with CFLs and installation of SWH systems at the residential level.**			
Output 1.1.1	Assess energy uses and electricity consumption patterns.			
Indicator 1.1.1	Energy consumption of buildings, appliances and equipment.			

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Value (quantitative or qualitative)	No energy Consumption baseline by end use / sector.	Energy consumption baseline by end use for each sector is developed.		An assessment of energy uses and electricity consumption patterns included in FICHTNER Study.
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: 100% of target Achieved. **Comments**: The potential for EE was identified through the FICHTNER study handed over to BEC and the GoBH.			
Output 1.1.2:	Standardized energy audit protocol and procedures.			
Indicator 1.1.2:	Energy audit protocol data.			
Value (quantitative or qualitative)	No standardized energy audit protocol and procedures	Standardized energy audit protocol and procedure in place		FICHTNER study included an energy audit protocol and procedure.
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: 100% of Target Achieved. **Comments**: The potential for EE was identified through the FICHTNER study handed over to BEC and the GoBH.			
Output 1.13:	Energy audits are performed and energy and cost of new EE equipment is determined.			
Indicator 1.1.3:	Energy consumption of buildings, equipment and appliances, equipment and appliances.			
Value (quantitative or qualitative)	Energy audits not done	List of potential energy efficiency measures by sector (at least 4 for residential, 3 for hotels and hospitals and 2 for restaurants). Energy Efficiency Model is in place		Energy Audits performed under FICHTNER Study for sectors. EE model proposed under the FICHTNER study
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: 100% of Target Achieved. **Comments**: Energy audits were performed through the FICHTNER study handed over to BEC and the GoBH.			
Subcomponent 1.2	**Pilot project to promote the use of CFLs in Bahamas**			
Output 1.2.1	Implementation program for CFLs replacement in place.			
Indicator 1.2.1	Number of households accepting the replacement of the incandescent bulbs.			

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Value (quantitative or qualitative)	No bulb replacement program in Bahamas is in place for low-income households. Small penetration of the CFLs in the low income households: less than 50% of the total number of lights	Pilots project is implemented 150,000 light bulbs replaced	Increased from 150,000 to 270,000 CFL	At least 121,074 CFL bulbs installed and verified.
Date achieved	2009	2011	2012	2013
Comments (incl. % achievement)	**Achievement**: 80% of original target achieved. **Comments**. (i) 270,000 CFLs were purchased. There are 12,000 bulbs in excess that were returned from the Family Island, (ii) based on, the evaluation reports prepared on January 29th, 2013, it shows that at least 121,074 CFL bulbs were installed (112, 656 CFLs in the Family Islands and 8,418 in New Providence), (iii) although the reports described that there are some 258,000 bulbs purchased and were distributed (112,656 in Family Island and 145,344 in New Providence), these numbers could not be objectively verified in New Providence as stated in the Final Evaluation Report "Promotion of Energy Efficient Residential Lighting". CFLs distribution report did not include comprehensive list of actual beneficiaries in either the Family Island or New Providence. The report mentioned that there were no guidelines for CFLs disposal program nor for disposal for the old light bulbs replaced with CFLs.			
Output 1.2.2	Lessons learned from the pilot project published and disseminated			
Indicator 1.2.2	Number of attendants at seminars. Number of publication distributed			
Value (quantitative or qualitative)	Lack of experience in EE projects Lack of understanding of impact in energy consumption of EE measures	Provide guidelines for future EE campaigns Delivery knowledge on: (i) Energy conservation by using EE lamps (ii) Energy savings potential in the residential sector (iii) Preparation of EE programs Impact assessment	-	Educational materials were prepared and disseminated prior to delivering the CFLs. Community based seminars conducted in the Family Islands but at a lesser level in New Providence (seminars at schools). Webpage was not Sustained.
Date achieved	2009	2011		2012

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Comments (incl. % achievement)	**Achievement**: 100% of target achieved. **Comments**: The former Ministry of the Environment (MOTE), together with The Bahamas Hotel Association (BHA), The Ministry of Education (MoE), and private sector partners conducted the first event on Energy Awareness in 2011. Under the theme "Public-Private Sector Partnerships in the Promotion of Energy Efficiency" these events, throughout a week, aimed to target various levels of society including Primary/Elementary School, High School Visits, The College of the Bahamas, etc.			
Output 1.2.3	EE awareness campaign designed and implemented on top of the CFLs inclusion campaign.			
Indicator 1.2.3	Public awareness is in place to promote the use of CFLs and EE.			
Value (quantitative or qualitative)	The population knows about the CFLs but they don't know about their benefits No public awareness in EE measures' benefits	At least 1 (one) Awareness Campaign implemented to:		Public awareness campaigns were conducted in six (6) island locations. In each location, public meetings were held in small communities, where a total of over 200 participants were educated in over ten (10) communities.
		Increase knowledge of CFLs technology, their benefits in terms of energy reduction and costs		Minimal threshold of increased knowledge of CFL technology was attained demonstrably through town hall meetings and the distribution of over 100,000 CFL light bulbs in the Family Islands.
		Increase knowledge of EE measures		Again, the minimum threshold of increased knowledge was met through the door-to-door program and the installation of the CFLs.
Date achieved	2009	2011		2012
Comments (incl. % achievement)	**Achievement**: This target was 100% achieved. **Comments**: the project implemented and promoted public awareness campaigns that supported and increased the knowledge of CFL technology over ten communities.			

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Output 1.2.4.	Monitoring and evaluation plan is implemented			
Indicator 1.2.4:	Established procedures to measure the energy savings			
Value (quantitative or qualitative)	No monitoring and evaluation plan	A monitoring and evaluation plan is in place		A CFLs Monitoring Plan was designed but it was not implemented.
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: Target was not achieved. **Comments**: At first, the IDB plan of operation required a comparative analysis of those households' consumption over a 3-month period and it was to serve as the basis for the monitoring of CFLs installation, beneficiary behavior and estimation of energy savings. However, the monitoring mechanism was not implemented nor carried out due to the lack of personnel. To collect consumption data, a request was made to BEC in order to get consumption data as of June 2011 for all the qualifying accounts submitted to the project in order to make comparison of their consumption between 2010 vs. 2011. The data was not collected.			
Sub component 1.3.	**Pilot Project for Solar Water Heater (SWH) systems.**			
Output 1.3.1.	Financial and administrative model for SHW systems program is in place			
Indicator 1.3.1	Pilot SHW systems level of operation after 6 months of the service start-up			
Value (quantitative or qualitative)	No promotion scheme for SWH available at the moment	Good performance of more than 80% of the pilot domestic SWH systems installed after 6 months following service startup		100% of SHW installed have been operating exceptionally for about two years
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: 100% of the Target achieved. **Comments**: These SWH systems have been operating exceptionally well for about two years, then 40% stop working due to corrosion that resulted from hard water from the city mains, and from being made from materials that is not conducive for the Bahamas environment, which is humid and has a high salt content.			
Output 1.3.2.	Capacity building to certified plumbers and contractors			
Indicator 1.3.2	1. Private key actors (certified plumbers and building development contractors) strengthened for the promotion and installation of SWH systems. 2. Participation of the target groups in the capacity building events organized			
Value (quantitative or	1. Few private key actors (certified plumbers and	1. Capacity building of 10		Contract to install the SWH systems was

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
qualitative)	building development contractors) have been involved in solar systems, mainly PV systems for electricity self-consumption. 2. No specific integral training events have been realized on Solar Thermal technologies in the Bahamas	certified plumbers and contractors		granted to more than 10 SWH certified plumbers in Techsystems Solar, Solar Revolution, and Northern Bah. Utilities and alternative Power Supply.
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: 100% of the Target achieved. **Comments**:			
Output 1.3.3	Implementation of demonstration projects.			
Indicator 1.3.3	1. Progress of pilot SWH systems execution. 2. Involvement of the key stakeholders. 3. Public awareness.			
Value (quantitative or qualitative)	1. No integral promotional SWH scheme existing	1. 100% of the planned pilot SWH systems are commissioned and started operating.		1. 100% of SWH installed have been operating exceptionally for two years.
		2. All the relevant stakeholders participate, support the pilot project and perform their respective duties with excellence.		2. Various institutions like technical schools and local and middle-income households were used to locate potential installers.
		3. Local and international media report on the pilot project		3. Nationwide media coverage informing of the benefits of solar technologies.
Date achieved	2009	2011		
Comments (incl. % Achievement)	**Achievement**: 100% of target achieved. **Comments**: All participants who were contacted concerning the installed SWH indicated that they are satisfied after the SWH systems were installed. The Nationwide media informed about: (i) cost and benefits of SWH and (ii) how SWH systems use can help offset this environment impact.			

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Output 1.4.4:	Operational data from pilot sites is available for large-scale replication			
Indicator 1.4.4.	1. Basic performance parameters 2. Operational performance parameters			
Value (quantitative or qualitative)	1. Only data on solar radiation is available	1.Basic performance parameters are readily available for 80% of the pilot SWH systems. 2. Operational performance parameters are readily available for 80% of the pilot SWH systems		No data was collected due to a weak M&E system.
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement**: Target not achieved. **Comments**: Robust M&E system was not in place to collect data and results.			
Component 2	**Assessment of the RE potential, cost and viable options to include RE in the energy matrix with the implementation of a demonstration project in RE – household PV systems using net metering devices.**			
Output 2.1.1	Determine potential for RE, determine best RE options and support preparation of the RE policy			
Indicator 2.1.1	Data from resource measurement programs (i.e., wind, solar, etc.)			
Value (quantitative or qualitative)	No information on RE resource potential	Study for the assessment of RE application is established		An assessment of RE potential and application was carried out, and included in the FICHTNER Study
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: 100% of Target Achieved. **Comments**:			
Output 2.1.2:	Determine implementation cost for RE alternatives			
Indicator 2.1.2:	Clear understanding of the cost structure (investment, and (O&M) for different RE technologies			
Value (quantitative or qualitative)	No implementation cost data exist	Cost analysis of implementation for RE technologies is in place		Cost Analysis of RE technologies were carried out in the FICHTNER Study
Date achieved	2009	2011		2013

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Comments (incl. % achievement)	**Achievement**: 100%Target Achieved. **Comments**:			
Output 2.1.3:	Prioritized plan of action to include RE in energy matrix			
Indicator 2.1.3:	Development of an action plan for RE in Bahamas			
Value (quantitative or qualitative)	No RE in energy matrix	Plan of action on how to incorporate RE /WE in the energy matrix is in place		Plan of Action to incorporate RE/WE was included in the FICHTNER Study
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: 100% of Target Achieved. **Comments**:			
Sub component 2.1.	**Pilot Project for household Photovoltaic systems and net metering devises.**			
Output 2.2.1:	Financial and administrative model for grid connected PV systems program is in place			
Indicator 2.1.3	1. Pilot PV systems level of operation after 6 months from the service start-up 2. Level of Interest for large-scale replication after the pilot project			
Value (quantitative or qualitative)	1. No promotion scheme for domestic PV available at the moment	1. Good performance of more than 80% of the pilot domestic PV systems installed after 6 month, following service startup. 2. Applications are received for installing PV systems in more than 5% of New Providence households		Only 33 % (11) have been fully connected to the utility grid. -
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement**: 33% of target achieved. **Comments**: 33 photovoltaic systems were installed. 22 in New Providence, 10 in Grand Bahamas and 1 in Andros Island. However, only 33 % (11) have been fully connected to the utility grid. Hurricane Mathew damaged 11 PV systems in New Providence.			
Output 2.2.2:	**Capacity building to BEC personnel, certified electricians and contractors**			
Indicator 2.2.2	1. BEC technical staff strengthened for the commissioning of grid connected of PV systems, and security aspects (general protections, islanding); 2. Private key actors (certified electricians and building development contractors) strengthened for the promotion and installation of PV systems. 3. Participation of the target groups in the capacity building events organized			

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Value (quantitative or qualitative)	1. BEC technical staff has no previous experience on small (<100kW) generators connection to the grid	1. Training of 5 technical staff at BEC on commissioning and safety aspects		No training was under taken under the project.
	2. Few private key actors (certified electricians and building development contractors) have been involved in stand-alone PV systems, for self-consumption. 3. No specific integral training events have been realized on grid-connected PV systems in the Bahamas	Capacity building of 10 certified electricians and contractors		N.A
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement**: Target was not achieved **Comments**:			
Output 2.2.3:	**Implementation of demonstration projects**			
Indicator 2.1.3	1. Progress of pilot PV systems execution, 2. Involvement of the key stakeholders, 3. Public awareness.			
Value (quantitative or qualitative)	1. No integral promotional PV scheme existing	1. Up to 65 kWp in approx. 26 PV plants are installed. 2. All the relevant stakeholders participate, support the pilot project and perform their respective duties with excellence 3. Local and international media report on the pilot project		1. More than 65 kW in 33 PV systems installed. 22 PV systems were installed and 11 PV systems are in operation. Hurricane Mathew damaged 11 PV systems. 2. Low Income Household Stakeholders participated during the PV awareness campaigns and during implementation and operation.

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
				3. Nationwide media coverage informing of the benefits of solar technologies.
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement**: 100% of target achieved, 33 PV systems were installed. **Comments**: The Nationwide media campaign informed about: (i) costs and benefits of PV system technologies and (ii) on how PV systems use can help offset negative environment impacts.			
Output 2.2.4:	Operational data from pilot sites is available for large-scale replication			
Indicator 2.2.4	1. Basic performance parameters, 2. Operational performance parameters			
Value (quantitative or qualitative)	1. Only data on solar radiation is available	1. Basic performance parameters are readily available for 80% of the pilot PV systems 2. Operational performance parameters are readily available for 80% of the pilot PV systems		N.A
Date achieved	2009	2011		
Comments (incl. % Achievement)	**Achievement**: Target was not Achieved **Comments**: M&E system was not in place.			
Component 3	**Strengthening the energy sector in Bahamas.**			
Output 3.1.1.	Analysis of technical and nontechnical electricity losses in transmission and distribution lines			
Indicator 3.1.1	Percentage of electricity losses in transmission and distribution lines at BEC			
Value (quantitative or qualitative)	Lack of monitoring of Electricity losses	Locate and measure electricity losses in order to improve the transmission and distribution lines by minimizing them. Reduce electricity losses to 10%		Analysis of technical and nontechnical electricity losses in transmission and distribution lines was carried out but not implemented.
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement**: Target not achieved **Comments**: the Final Project Report did not include data about transmission and distribution lines.			
Output 3.1.2.	**Diagnostic of BEC's operational and financial current situation**			

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 3.1.2.	Financial statements of BEC. Operational procedures of BEC. BEC'S cash management			
Value (quantitative or qualitative)	No understanding of BEC's current operational and financial current situation	Provide an analysis to improve the operational and financial situation of BEC		Under the Action Plan developed by FICHTNER and Castalia, an Analysis of improving BEC's operational and financial situation was prepared.
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement**: Target Achieved. **Comments**: FICHTNER study proposed an analysis of the operational and financial situation of BEC.			
Output 3.1.3.	Modeling and forecasting BEC's financial statements based on expansion programs			
Indicator 3.1.2.	Financial statements of BEC. Financial forecasts including expansion activities			
Value (quantitative or qualitative)	Need for refinancing options Need to explore financial viability for BEC's long term investments	Provide assistance in the development of forecast and modeling based on expansion programs including RE		Under the FITCHER study, a Forecast Model of financial statements was developed.
Date achieved	2009	2011		2013
Comments (incl. % Achievement)	**Achievement**: Target Achieved. **Comments**: FICHTNER study proposed a model for financial statements project of BEC based on expansion programs.			
Output 3.2.1	RE alternatives are included in the expansion plan of BEC and the energy sector of the Bahamas.			
Indicator 3.2.1	Expansion Plan.			
Value (quantitative or qualitative)	Very limited inclusion of RE in the energy matrix	Prioritized list of RE projects including technology costs		Under the Action Plan an Expansion Plan of BEC was prepared.
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: Target Achieved. **Comments**: FICHTNER study proposed RE alternatives in the expansion plan for BED.			
Component 4	**Institutional strengthening, analysis of the regulatory framework and integration and capacity building in the areas of EE and RE.**			
Output 4.1.1	Provide guidelines for energy legislation, regulatory framework and policy options to adopt EE measures in public buildings, residential and commercial sectors.			
Indicator 4.1.1	Guidelines, Legislation, Regulations, Policies.			
Value (quantitative or qualitative)	Lack of promotion of the use of RE in the National Energy Policy	Provide guidelines for the creation of a regulatory		Guidelines for the creation of a regulatory

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
		framework in a 12-month period for The Bahamas to ensure the sustainable development of the national energy sector		framework prepared under the FICHTNER Study
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: Target achieved. **Comments**: Guidelines for the creation of a regulatory framework prepared under the FICHTNER Study			
Output 4.1.2	Recommend regulation and policies to integrate RE and traditional energy in the energy matrix			
Indicator 4.1.2.				
Value (quantitative or qualitative)	No regulations and policies for the integration of RE in the energy matrix	Regulation and policy recommendations for the integration of RE in place		Regulation and policy recommendations for the integration of RE prepared under the FICHTNER Study
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: 100% of Target Achieved. **Comments**: FICHTNER prepared a regulatory and policy framework.			
Output 4.1.3	Training and capacity building on RE and EE issues			
Indicator 4.1.3.	Diagnostic of the present situation, based in existing information and interviews of key stakeholders			
Value (quantitative or qualitative)	Lack of tools and knowledge on how to include in RE and EE in the energy matrix	-Delivery of training in Energy conservation plans formulation - Preparation of RE and WE programs - Energy audits -Erection, operation and maintenance of RE technologies		N.A
Date achieved	2009	2011		2013
Comments (incl. % achievement)	Achievement: Target not achieved. Comments:			
Output 4.1.4.	Support preparation of National Energy Policy and reformulation of Bahamas Electricity Act.			
Indicator 4.1.1:	National Energy Policy. Bahamas Electricity Act.			
Value (quantitative or	Current National Energy Policy and Bahamas	- Recommendations		Recommendations for a National Energy

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
qualitative)	Electricity Act do not support the inclusion of RE and EE in the energy matrix	for a National Energy Policy and changes to the Bahamas Electricity Act -Updated Bahamas Electricity Act		Policy and proposed amendments to the Bahamas Electricity Act was prepared under the FICHTNER Study
Date achieved	2009	2011		2013
Comments (incl. % achievement)	**Achievement**: 100% of Target Achieved. **Comments**: FITCHNER prepared recommendations for a National Energy Policy and the Electricity Act.			
Component 5	**Dissemination of findings**			
Output 5.1.1	Two workshops to provide the GoBH officials with capacity and training on EE and RE			
Indicator 5.1.1:	Number of workshops			
Value (quantitative or qualitative)	Number of workshops. Number of attendees	Need for training on RE and EE issues	2 workshops done to provide training	N.A
Date achieved	2009	2011	2011	2016
Comments (incl. % achievement)	**Achievement**: Target Not Achieved **Comments**: Grants resources were cancelled.			

2.3. Efficiency (Intermediate outcomes)

Project efficiency is rated moderately satisfactory. The quality of the outputs contributed favorably to project efficiency.

Under Component 1. The project planned to undertake technical assistance to execute an EE assessment, as well as implement the CFL and SWH pilot projects.

The EE assessment study was completed and included the following activities: (i) an assessment of energy uses and electricity consumption patterns; (ii) provision of energy audit protocols and procedures to standardize energy audits; (iii) development of EE surveys and audits for public buildings envelops -in terms of insulation, sun protection and air conditioning-, hotels, residential and commercial sector, and the determination of the cost of new EE appliances, public lighting, EE cooling systems; and (iv) design of a financial instrument to promote EE. While the study also reviewed options for expanding the use of EE, the training courses for SWH installers and plumbers were not executed.

The CFL Pilot project planned originally to replace 150,000 incandescent light bulbs with CFLs allocating a budget of US$445,000. At closing, the project registered the purchase of 270,000 CFL bulbs at less than the budget allocated, i.e. the 270,000 CFLs cost US$304,000 saving US$141,000 from the total budget. However, the project only confirmed the distribution of 121,074 CFLs.

Additionally, the plan for the SWH Pilot project comprised the purchase and installation of 134 SWHs. At project closing, 133 SWHs had been purchased and installed, practically achieving the outputs. However, no monitoring system was installed on the SWHs to gather data for metering, and storing data on solar production, hot water consumption and other relevant variables. Nevertheless, it is estimated that the installed systems would have saved approximately 1,955 kWh/yr. However, due to corrosion issues, only 40% of the 133 SWHs are fully operational. While the studies were completed to assess the necessary inputs to future large-scale replication such as marketing strategy—the planned training program for certification of plumbers and contractors was not implemented.

Under EE Component 2. The project planned to undertake a RE assessment as well as implement a solar PV pilot project. The RE assessment included, inter alia, an assessment of the potential for RE from various power sources, a determination of the cost of implementation of the identified RE technologies and a prioritized plan of action to include RE in the energy mix of Bahamas. This RE assessment was carried out by FICHTNER. The project did not accomplish training for PV installers during the implementation period.

With regard to the solar PV pilot Project, 33 PV systems, with their net metering devices had been purchased and installed. However, this pilot did not produce enough operational data to inform and prepare a large-scale replication strategy. At closing, only 11 PV systems had been connected to the grid while Hurricane Matthew had destroyed 10 in New Providence. As mentioned earlier, ten (10) PV systems were installed in Grand Bahamas, but they are still awaiting connection to the GBPC electricity grid.

Under RE Component 3. The technical assistance to recommend strategies for the strengthening of Bahamas' energy sector was completed, and was also followed up with an additional study to develop an action plan for the Bahamas Energy Company (BEC). The studies focused, inter alia, on a review of the results of the financial audit of BEC, recommendations to improve the operational and financial management of the company, preparation of Purchase Power Agreements, and the preparation of a prioritized list of projects as well as a prioritized plan of action to include RE, and WE into the energy mix of the Bahamas.

Under RE Component 4. One planned activity was accomplished with the undertaking of the FICHTNER study to review and recommend legislation, regulatory and policy issues to adopt EE measured in buildings. Also, the company reviewed the mandate of the Public Utilities Commission, recommended regulation and policies for on-grid connected WE and RE operated IPPs or BECS owned facilities, and recommendation to achieve a long-term sustainability of BED. However, there was no provision of training to the GoBH to prepare energy conservation plans, prepare RE and WE programs or train energy auditors, energy technicians and operators to operate and maintain RE technologies.

Under RE Component 5. It was planned that the PEU would undertake two workshops aimed at validating and disseminating the findings of the technical studies and pilot projects; however, these activities were not carried out during project implementation.

2.4. Project Cost and Financing

Project Cost. The total cost of the Project was estimated to be US$3,851,000. The Project was planned to be financed by IDB and GoBH as follows: (i) through an IDB/GEF Project—Implementing Sustainable Energy projects—for US$1 million, and (ii) other IDB's grants such as Promoting Sustainable Energy in Bahamas (BH-T1016) for US$751,000, Strengthening the Energy Sector in the Bahamas (BHX1012) for US$700,000, and Promotion of Energy Efficient Residential Lighting (BH-X1002) for US$510,000.

At Project closing, the Project disbursed most of the grant funds assigned, with the exception of the GEF grant, which, out of the US$1 million granted, had undisbursed funds of US$174,478 that were cancelled. **Annex 1** presents the Total Project Cost showing the original and final project costs by component and by source of financing.

Borrower contributions. The Borrower was committed to contribute about US$590,000 and with private sector funds the amount of US$310,000. At Project closing, the counterpart contributions were coming from the beneficiaries of the SWH and PV solar systems. The beneficiaries committed US$351,907 for the financing of selected project activities.

Extensions of GEF Project Grant. Due to delays in procurement activities and personnel turnover in project managers, project execution and disbursements were delayed. These delays resulted in three extensions to the grant's closing date. The original project closing date was August 2011 while the final disbursement deadline or closing date for the project was December 2016.

2.5. Other Unintended Outcomes and Impacts (positive and negative)

Poverty impacts, Gender Aspects and Social Development. Poverty and social impacts of the Project are not easily estimated due to the lack of an M&E system. However, it should be noted that at the household level, the project contributed to a decrease in the monthly electricity bill with the CFLs and SWHs and in some cases a generation of a small income for households that invested in the PV solar systems that are currently fully operational at New Providence and Grand Bahama once the PV solar system would be connected to the grid with the Grand Bahama Electricity Company.

For the GoBH, the Project contributed to the definition of the energy EE and RE long-term strategy and identified RE potential and RE future project options. For the BEC, it provided technical assistance that helped the company to strengthen its financial and operational performance, and to identify RE potential and RE future project options. At the private sector level, it contributed to the creation of technical and operational capacity, with the implementation of the SWH and PV solar system pilots in New Providence and Grand Bahama.

2.6. Justification of Overall Outcome Rating and Global Environment Outcome Rating

The overall outcome of the Project is rated Moderately Satisfactory. This takes into account the high relevance of the project, the moderately satisfactory achievement of objectives, the achievement of most of the intermediate outputs, especially the execution of the CFLs, SWH and PV pilot projects as demonstration for future operations in The Bahamas for reducing fossil fuel consumption. The Project's objectives continue to be relevant today. Despite the technical issues encountered with the installation and operation of the PVs and SWH systems during implementation, most of the project activities were completed by Project close including the technical assistance to BEC and the policies, guidelines and regulations proposals handed over to the GoBH, with the exception of the

objective to carry out two workshops to disseminate project findings among the stakeholders involved.

III. Assessment of Risks to Sustainability of Project Outcomes

The project risks to sustainability of the project outcomes are rated low. The project pilots have illustrated the viability of the renewable energy systems and the EE strategy by introducing the CFLs pilot project in the country. The MTE&H and BEC have been strengthened with the RE and EE pilot projects and key institutional studies, respectively. The pilots projects in RE and EE, despite the many set backs and problems, have demonstrated the opportunities to continue with changing the energy matrix in the Bahamas and that the RE projects can be sustainable with proper technical designs and measures to certify PV and SWH systems in the country, and then, to expand the design and implementation of energy projects.

Institutional framework and governance risks
N/A

Environmental risks. CFLs contain mercury: as their use increases, and if disposal is not carefully handled, CFLs can potentially represent a health and environmental threat to The Bahamas. The environmental assessment (EA) for CFLs was carried out under component 1 which provided an overview of the mitigation measures for CFLs' final disposal. The project required the design and approval of mitigation measures for environmental impact in terms of measures. These mitigation measures were not designed under the project nor implemented during the distribution of 150,000 or more CFLs. Also, the project should have developed a plan for disposal of incandescent light bulbs. There is no data collection about the disposal on the light bulbs replaced by CFLs or their whereabouts.

IV. Catalytic Role

The Project, financed partially with GEF funds, has had a catalytic role in the GoBH committing to the promotion of sustainable energy practices, mainly (i) using renewable energy (RE) sources, and encouraging energy efficiency (EE) and energy conservation (EC) as means to reducing the country´s dependency on fossil fuels, and (ii) improving the economy´s competitiveness, and achieving greater environmental sustainability. This strategy is in line with the GEF long-term strategy.

V. Assessment of Monitoring & Evaluation (M&E) Systems

5.1. M&E Design

The Monitoring and Evaluation of the output and outcome indicators was developed and presented in the Project Results Framework that would have permitted the monitoring of the day-to-day activities of the project. Also, the development and installation of an M&E system was planned in order to have an integrated and cost-effective M&E system at the PEU and to be able to disseminate the findings of the technical studies and pilots projects.

The set of outcome and output indicators for measuring progress were designed adequately from a technical and operational point of view and reflected in the request to the GEF Trust Fund. The allocation of grant resources was focused mainly in the implementation of CFLs, SWH and PV pilot projects. The Ministry of the Environment and Housing (MTE&H) and its PEU were supposed to be

in charge of overall M&E for the GEF and IDB grants and for collecting the appropriate data to determine outputs and outcome indicators.

5.2. M&E Plan Implementation

The Government counterparts did not provide data for all indicators. The evaluation reports prepared by former Project Managers did not consider the Project Results Framework Matrix. The consultant hired for assessing grant performance had difficulties in collecting data and supervising outputs and outcomes indicators. For instance, data on number of distributed CFLs were collected in general terms, however, there are no statistics on the final beneficiaries of the CFL Pilot project. In general, a M&E system was not created or implemented to follow up project results on the ground.

5.3. M&E Utilization

The M&E utilization has mixed results due to the fact that there were three project managers. On one hand, there was no collection of data on the number of distributed CFLs and final household beneficiaries of the pilot project. The project had a substandard level of monitoring, record keeping and reporting that has resulted in the inability to assess the true effectiveness and impact of the CFLs pilot project—for example—there was a lack of M&E data to confirm the number of CFLs distributed, a lack of information to explain why over 12,000 CFLs were returned from the Family Island, and no consumption data from those who received CFLs six months after in order to compare with initial consumption.

On the other hand, there was data on PV solar systems and SWHs installed and in operation. The latter permitted the calculation of financial savings due to avoidance of diesel purchases and carbon emissions. For future or follow up energy operations, it is important to implement an M&E system within a unit or division at the Project's Executing Agency. This unit or group should be created at the start of the project in order to demonstrate the benefits of renewable energy activities supported by the GEF and IDB grants to the country and in doing so, this will help to justify follow-up operations.

VI. Monitoring of Long-Term Changes

Monitoring the performance of energy pilot projects and institutions helps increase their effectiveness, provides increased accountability and transparency in how public monies are used, and can inform the budgetary process and the allocation of public resources, and can monitor results on the ground through proper outputs and outcome indicators, thus improving their effectiveness in improving competitiveness and reducing dependency on imported fossil fuels.

Establishing a M&E unit within the Executing Agency will also permit use of the results obtained for improving resource allocation, assisting in the incorporation of EE and RE in the formulation of electricity sector strategies; and providing information for dissemination and debate on energy public policies. For the long-term, it is proposed to have a M&E unit within the MTE&H that would serve as the data collection point for future energy projects.

VII. Assessment of Factors Affecting Attainment of Project Results

a) Project preparation and Design

Adequacy of Government Commitment. One of the pillars of the GoBH's overall economic strategy at the time of the project preparation was to support the development and implementation of sustainable energy sources by providing options to reduce dependency on imported fossil fuels and generating savings and energy security through the introduction of RE, WE and EE programs into the country energy matrix. The project was supported by the GoBH, which could significantly benefit from incorporating RE and EE programs into its energy matrix.

Assessment of Project Design. The project PDO, as designed, was adequate and its outcomes were linked to the operation, specifically the activities financed by the GEF and IDB grants. The project objectives were important for the country and energy sector and to the IDB country assistance strategy and GEF priorities (Kyoto Protocol or other carbon voluntary markets) by addressing the key EE and RE energy studies and pilot projects. The project design was responsive to these priorities and supported them through the following actions such as: (i) providing technical assistance to achieve energy efficiency alternatives and (ii) implementing demonstration projects, in particular the phase out of incandescent bulb lights by replacing them with CFLs, installing SWH in low and middle income households as well as installing PV systems connected to the grid in New Providence and Grand Bahamas as sample projects to the BEC and Grand Bahamas utility companies.

b) Key Factors affecting project implementation

Lack of a Program Operations Manual. The utility of a Program Operations Manual (POM) has been established as best practice among development banks. The lack of a POM for the ISEP contributed to a weakened performance in program administration, fiduciary aspects, and monitoring and evaluation. Although the MTE&H (PEU) has proper internal organization and procedures for grants implementation, a POM would have been ideal to have in place as it defines and compiles in one document: the institutional organization of the PEU, key staffing, internal organizational structure, financial and accounting procedures, reporting formats, and external auditing and the hiring of key staff for the PEU. Having a POM is key for identifying staff needed during implementation and the assignment of their roles and responsibilities by project components. For example, the PEU did not implement a robust M&E system, which would have permitted the collection of data and reporting for each of the project components. This constraint could have been identified in the POM prior to the start of implementation.

Frequent turnover of key staff. A change of project managers (PM) throughout project implementation, affected project start up as well as delayed the procurement of equipment; distribution, public awareness program (energy efficient lighting), audit of CFLs component and the execution of component (v) Dissemination of Findings through the execution of two workshops. As a result, the project had a delay of two years requiring extension of the grant closing date. It is worth noting that the changes in personnel did not weaken the Government's commitment to project objectives.

Inverters issue for PV systems. On September 18, 2015, the MOTE (now MTE&H) reported issues with the inverters to the Bank. The inverters were for the Photovoltaic (PV) systems financed under GR/FM11832-BH, which purchased 33 PVs and their inverters to allow the connection between the beneficiary households and the electricity grid (utility company) so that the household can send the excess power from the PVs to the grid and/or take power when the PV is not operating (night or

cloudy day). Under the pilot project, the residential PV installations were to be connected to the grid with a maximum generation capacity of 2kw. However, at that time, the systems could not be connected to the grid for two reasons: (i) the purchased inverters, which were the devices used to transform direct current (DC) to alternate current (AC) were procured and installed, but they were not functioning correctly as they were designed for a different grid frequency. To solve the issue, the PEU contracted PV specialists, electrical engineers and certified solar PV installers in order to assess the specific technical problem. After the assessment, the PEU was advised that the inverters were the wrong type for The Bahamas as they had difficulty aligning to the electrical grid and its fluctuations. The PEU purchased the new inverters and re-installed in the selected beneficiary households. The inverters were installed in the 33 PV systems.

Hurricane Matthew. In October 2016, an extremely powerful Atlantic hurricane of Category 5, passed over the Bahamas and left in its wake major damage to homes, specially roofs—where the mentioned pilot project PV systems were attached for participating household owners. An inspection was conducted to ascertain the extent of damages if any to the installed pilot PV systems in New Providence, Grand Bahamas and Andros islands. The results of the inspection indicated that 11 PV systems were damaged in New Providence with some losing all panels and a few with several panels being blown off and the roof destroyed. Additionally, the racking systems, which hold the panels, were damaged along with the wiring for the panels.

Therefore, during project implementation, the IDB and GoBH intended to reinstall the damaged 11 PV systems, however, this could not have been done due to the grant's closing date. Out of the original 22 PV systems installed in New Providence, there are only 11 PVs working properly and connected to the BEC grid. It is worth noting that the installed 10 PV systems in Grand Bahamas were not damaged due to a better technical installation model of the racking systems over the roof. The model should be disseminated as best practice for installing PV system for countries that are affected by hurricanes.

Delays in obtaining PV installation approval to connect to the grid. The PV system installation approval suffered delays from BEC and GBPC to connect to the grid. The process was lengthy and required more proactivity from the utility companies. In addition, gaining approval from the Ministry of Public Works' building control department was another delay factor, as the building control department requested a change in the racking system, to a racking system that is hurricane certified. These requirements generated delays extending the time for approval as these new racks had to be ordered and shipped to The Bahamas.

SWH's corrosion and technical issues after operation. After the SWHs installation, and during their operation, it was discovered that they presented corrosion issues caused by the hard water from the city mains, the humidity and salt in the environment, as they were made of tin and iron, instead of high-grade stainless steel, or aluminum. Furthermore, installation of SWH on roof tops, where line pipes were sent through the roof instead of running the pipes down the roof and then into the home resulted in many water leaks to home as sealing of the holes with silicone tends to shrink after months in the hot sun and lose its sealing capabilities. Thus, all water lines should not have permeated the roofs, but run down then into the home near the water lines. In addition, selected beneficiaries should have been trained on how to conduct a quarterly maintenance flush on their system to reduce hard water issues.

Lack of CFLs, PV and SWH campaigns and dissemination of findings to reduce suppressed demand. The Project didn't demonstrate to the community the important impact that the replacement of

incandescent bulbs by CFLs had on reducing the suppressed demand for CFLs prevalent in the country to maintain and consolidate advances in energy efficiency. The Bahamian public knows little about CFLs, SWH or PV and often confuses the latter two as electricity producing systems. As a result, most people are unaware of the costs and benefits associated with CFLs, SWH and PV systems and are unable to make informed purchasing decisions. Thus, it is important to develop and implement broad awareness campaigns and dissemination of findings to support the GoBH's efforts in promoting and implementing the use of EE and RE measures that aim to help reduce The Bahamas' fossil fuel dependency.

Lack of guidelines for safe disposal/recycling of CFLs prior to distribution of CFLs. The CFLs were purchased and distributed without a confirmed disposal procedure in place. This resulted in both incandescent bulbs and blown CFLs being disposed of with regular household garbage despite the need to carefully dispose of the mercury in the CFLs.

Lack of a well-developed PV or SWH workforce. As solar technology is fairly new to The Bahamas there is a limited workforce possessing in-depth experience and expertise with the installation and maintenance of solar technologies. This contributed to the improper installations and subsequent leakages of the SWH in the homes of beneficiary households. Further, this smaller workforce limits the potential for rapid expansion of the SWH and PV market in The Bahamas.

Lack of knowledge of basic maintenance of the SWH. The SWH systems installed had corrosion issues caused by hard water from the city mains, which could have been, avoided with quarterly maintenance flushes by the beneficiary householders.

Poor coordination with external stakeholders. The inability to connect the pilot PV systems to the grid because of the lack of approval by the GPBC negatively impacted results. Processing of the request for approval was not approved and would have benefited from more proactivity from project executing unit. The inability to sell or be credited for electricity generated weakened the impact that should have been achieved through the PV pilot project. Also, all PV installations had to have a uni-rack or certified hurricane resistant racking systems to secure the solar panels onto the roofs of homes due to the possibility of a hurricane, before approval would be granted, according to the building control unit of the MTE&H. The racking systems of the PV systems installed in Grand Bahama where better designed for hurricane resistance.

Permitting costs and requirements. As this was the first official grid tied program, permitting requirements are still evolving for the PV and SWH industry. There were no standardized requirements in place for PV and SWH installations. This translated to higher cost and increased uncertainty for PV and SWH installers. There were no solar system forms at the Ministry of Works to have the systems inspected.

c) Country Ownership

The GoBH's strong ownership towards increasing the introduction of renewable energy sources facilitated the implementation of the pilot projects envisioned at project appraisal. The project has illustrated the viability of solar energy and improved the acceptance of RE sources in The Bahamas. It has also provided technical assistance and institutional development in the relevant government agencies to enhance their operations and policies to deal with RE technologies. Also, the technical assistance provided to BEC for reducing technical losses and having an expansion program will provide a roadmap for changing the energy matrix in the energy sector.

d) Post-Completion Operation/Next phase

Although this was not a loan operation, the IDB support to the GoBH, in this key sector, remains strong, and the IDB is planning to continue with technical assistance and advisory services in promoting sustainable development projects that will generate global environmental benefits through carbon emission reductions and financial savings due to the reduction of fossil fuel consumption.

VIII. Lessons Learned

Develop a Program's Operations Manual (POM). The POM was to be a requirement in the Non-Reimbursable Financing Agreement GRT/FM-11832-BH, in Chapter II, Section 2.05. Although the Bank granted a waiver to this condition due to the small size of the Project, its development and implementation would have given a transfer of knowledge to the various project managers assigned to the project, and would have assisted in counteracting the negative impact of high staff turnover, as well as help to align project monitoring and oversight of project outputs and outcome indicators, which for this grant were too many indicators to track. It is an established best practice to require the development of a Program Operations Manual prior to project grant effectiveness. Its preparation is justified for the following reasons: (i) provides specific details related to the Program's institutional arrangements, (ii) details the rules and regulations of procurement, financial management, internal and external controls, and (iii) defines the key staff to be hired for the PEU, detailing their functions, roles or terms of reference. Besides, the POM also includes a description of the monitoring and evaluation plan and the environmental and social aspects of the Program, as well as the fiduciary arrangements for financial management.

Ensure robust project administration. The implementation of the project grants suffered many delays due to inadequate human resources, which contributed to poor project administration, including record keeping and monitoring outputs and outcomes. Though they were small grant projects, for the project administration to be adequately completed in the short time allotted for project execution, the project team would have required more human resources to monitor results on the ground.

The project would have benefitted from the assignment of a larger team commensurate with the project scope to be achieved within the allotted timeframe. At minimum, the unit should have included, a project assistant who would have been responsible for, among other things, follow ups, ensuring that the project records and minutes are kept current and ensuring that regular project reports are prepared.

Ensure the buy-in of key stakeholders. Securing the full support of the BEC and GBPC would have helped to minimize the delays in approval for the PV systems to be connected to the grid, as well as the transfer of data to the MOTE for the monitoring of impact of the CFLs. Further, it would also have helped to ensure that the BEC staff assisted with the distribution and installation of the CFLs as originally planned.

Continuous awareness raising and incentives are essential to sustain consumers' use of energy-efficient technology. Although the project carried out public awareness campaigns that included distribution of educational material, and conducted community-based seminars in six island locations, the interviews with key project stakeholders revealed that continuous awareness campaigns are required to ensure that the beneficiary households that received the CFLs would voluntarily purchase additional or replacement CFLs and change consumption habits at home.

Procedures for recycling of incandescent lights bulbs should be established prior to distribution of CFLs. The selected private company in charge of distributing CFLs, under the technical specifications of the project, was supposed to do the recycling of the old light bulbs; however, the evaluation report did not mention what happened with light bulbs nor how many were distributed among the CFL's beneficiaries due to the lack of record keeping and monitoring system. Therefore, it is important that prior to distributing CFLs to the beneficiaries, procedures and guidelines for record keeping, disposal and recycling of old light bulbs be established.

Procedures and guidelines for safe disposal of CFLS should be established prior to distribution of CFLs. The selected private company in charge of purchasing and distribution CFLs, under the technical specifications of the project, was supposed to do the disposal the old light bulbs; however, in the contract there was not such a clause at the time of evaluation. Due to the lack of data collection, the storage place of the 150,000 light bulbs is unknown. It is important that the ME&H act quickly in collecting the light bulbs and proceed with the crushing of the light bulbs and the corresponding recycling. Thus, it is important that prior to implementing EE measures, procedures and guidelines for disposal and mitigation of non- EE equipment be established.

Improve qualifications criteria to attract bidders and enhance product testing such as with the inverters. The experience of the pilot project for purchasing PV systems and its inverters highlighted the need for testing the inverters before shipment and stronger eligibility criteria at the time of procurement to ensure the supply of high quality goods. A few countries have now introduced a pre-qualification stage in which an independent party verifies the manufacturing facility and product quality, and only the vendors that meet the eligibility conditions are allowed to submit their bids. There is also a need for in country testing of inverters. Having testing centers will allow manufacturers to compare products and will allow products to be tested against the specific grid conditions thereby facilitating the purchase of the correct inverters based on the specifications of the country's electricity grid.

Technical diagnostics of water conditions should be performance prior to purchasing SWH system and in accordance with the country environment. The SWHs have been producing very hot water. These systems were being operating exceptionally well for about two years, then, 40 % stop working adequately due to corrosion due to hard water from the city mains and from the material being made that are not conducive for the Bahamas environment, which is humid and has high salt content. Prior to procurement of SWHs a robust technical diagnostic must be carried to define clear the materials and design of the SWHs in accordance with the conditions of the county's environment.

Technical Design and Installation of the PVs and SWHs for greater protection against Hurricanes. All PVs and SWH installations and racking systems should be hurricane certified.

***RE systems should have insurance for hurricanes*.** Due to the fact that hurricanes affect the Bahamas almost every year, all renewable energy systems, especially those that are affixed to the building roofs should be insured. This can either be added to an existing home insurance or an additional insurance can be acquired to insure against damage or loss.

Train beneficiaries in basic maintenance of RE systems. The provision of basic maintenance training to beneficiary households for the RE systems introduced into their homes would have helped to maximize the longevity of the systems and the sustainability of the impacts derived from the pilot projects.

Include all relevant technical personnel in the development of specifications for RE systems. The inclusion of stakeholders with the relevant technical training and experience in the process to develop specifications for RE systems would minimize the instances of systems being installed in environments which surpass their ability to withstand the environment's level of wear and tear on them, and would also minimize the instances of re-work as all technical requirements would be specified and adhered to in the first installation process.

Training should be provided to installers prior to installation of SWHs. The provision of installation training to the chosen installation firms would have resulted in the application of appropriate installation techniques, thereby reducing the instances of SWH-related leakages developing in the homes of beneficiaries.

***Implementing an M&E system within the Government's executing unit*.** The data on CFLs, PV and SWH systems installed should have been collected throughout project implementation. Having a M&E team on the project execution unit, or at least a team within the executing agency, would have had a strong impact on improving project implementation and oversight of the results on the ground. In particular, in the case of the CFLs, where there were some deficiencies in record keeping of the number of CFLs distributed, the number of bulbs actually installed in beneficiary households, the impact which the CFLs had on energy consumption, and the lack of an issues log to document the return of 12,000 CFLs from the Family Islands. Additionally, post installation surveys, in reference to all the pilot projects, would have helped to detect early CFL failure rates, the identification of SWHs operational issues which would have prompted taking remedial measures, and the replacement of those PV systems which had been damaged in the passing of a hurricane.

Focus on M&E during project implementation/supervision needs. The PEU of the ME&H experienced difficulties in collecting data with respect to M&E, which although noted during the design and appraisal, were not adequately focused on during project implementation and supervision.

Annex 1. Original Project Cost vs. Final Project Cost

Projet Components	Total Final Project Cost US$ 2016									Total Final Project Cost US$ 2017							
	GEF	Co - Financing			Local Counterpart	Private Sector	Total			GEF	Co - Financing			Local Counterpart	Private Sector	Total	
		IDB (INFRAFUND)	IDB (SECCI)								IDB (INFRAFUND)	IDB (SECCI)					
	BX-X1001	BH-T1012	BH-T1016	BX-X1002						BX-X1001	BH-T1012	BH-T1016	BX-X1002				
	INVEST	INFRAFUND	CT Fondos	INVEST				Method	Estimated	INVEST	INFRAFUND	CT Fondos	INVEST				
Component I: EE for public buildings, commercial and residential sector	**354,561.10**		**90,362.50**	**397,761.00**			**842,684.60**			**354,561.10**		**90,362.50**	**397,761.00**			**842,684.60**	
1 EE assessment	18,576.00		90,362.50	-			108,938.50			18,576.00		90,362.50	-			108,938.50	
2. Pilot Project to Promote the use of CFLs	-		-	397,761.00			397,761.00	ICB	250,000.00	-		-	397,761.00			397,761.00	
3. SWH Pilot Project	335,985.10	-	-				335,985.10	ICB	350,000.00	335,985.10	-	-				335,985.10	
Component II: Assessment of the RE potential in the Bahamas	**434,579.00**		**589,636.69**	**-**			**1,024,215.69**			**434,579.00**		**589,636.69**	**-**			**1,024,215.69**	
1 RE Technical assesssment	90,000.00		589,636.69	-			679,636.69			90,000.00		589,636.69	-			679,636.69	
2. PV Pilot Project	344,579.00		-	-			344,579.00	ICB	174,878.50	344,579.00		-	-			344,579.00	
Component III: Strengthening the Energy Sector in the Bahamas	**-**	**429,416.12**	**-**	**-**			429,416.12			**-**	**429,416.12**	**-**	**-**	**351,907.00**		781,323.12	
Component IV: Institutional strengthening	**-**	**200,000.00**	-	**-**			200,000.00			**-**	**200,000.00**	-	**-**			200,000.00	
Component V: Dissemination of findings	**-**	**20,583.88**	-	**-**			20,583.88			**-**	**20,583.88**	-	**-**			20,583.88	
Project management , supervisión, audits and contigencies	**36,381.10**	**40,729.88**	**67,789.25**	**38,374.00**			183,274.23	LCS	10,000.00	**36,381.10**	**40,729.88**	**67,789.25**	**38,374.00**			183,274.23	
Total	**825,521.20**	**690,729.88**	**747,788.44**	**436,135.00**			**2,700,174.52**			**825,521.20**	**690,729.88**	**747,788.44**	**436,135.00**	**351,907.00**		**3,052,081.52**	

Annex 2. List of Documents

No.	Document Name	Author	Date
1.	Final Report Bahamas Electricity Corporation (BEC).	Alberto Brugman, consultant	November 3, 2008.
2.	Bahamas Strengthening The Energy Sector In The Bahamas (BH-T1012) *Plan of Operations*	Inter – American Development Bank	December 17, 2008
3.	Request for CEO Endorsement/Approval *Project Type: MSP*	The GEF Trust Fund	July 31, 2009
4.	Bahamas Implementing Sustainable Energy Projects In The Bahamas (BH-X1001) *Non-Reimbursable Operation Financed with GEF Resources* *Plan of Operations*	Inter – American Development Bank	October 15, 2009
5.	Procurement Plan *Period covered: October 2009 to June 2011*	Ministry Of The Environment (MOTE)	
6.	Back to office Report Promoting Sustainable Energy in the Bahamas (BH-T1016) Strengthening the Energy Sector in the Bahamas (BH-T1012) Implementing Sustainable Energy Projects in the Bahamas (BH-X1001) and Promotion of Energy Efficient Residential Lighting (BH-X1002) Energy Mission: The Bahamas	Inter – American Development Bank	March 16-19th, 2010
7.	Nonreimbursable Financing Agreement No. GRT/FM-11832-BH *Implementing Sustainable Energy Projects in The Bahamas*	The Commonwealth Of The Bahamas Inter – American Development Bank	March 21, 2010
8.	Promoting Energy Efficiency and Sustainable Energy in The Bahamas (ICB No: GRT/FM-11832-BH (BX-X1001)-1-1) *Procurement of CFL's, SWHs, and PVs* *Letter od Award – Solar Water Heaters*	Ministry Of The Environment	June 25, 2010
9.	Promoting Sustainable Energy in The Bahamas *Draft Final Report*	Fichtner	September, 2010
10.	Procurement Plan *Period covered: January 2012 to June 2013*	Ministry Of The Environment (MOTE)	

No.	Document Name	Author	Date
11.	Action Plan for Transforming the Electricity Sector in The Bahamas	Inter – American Development Bank	January 17, 2012
12.	Final Progress Report GRT/MC-11799-BH (X1002) – Promotion of Energy Efficient Residential Lighting	The Ministry of the Environment & Housing	November 16, 2012
13.	Final Evaluation of the Project "Promotion of Energy Efficient Residential Lighting" GRT/MC-11799-BH-X1002 FINAL	Inter – American Development Bank The Commonwealth Of The Bahamas	January 29, 2013
14.	Strengthening The Energy Sector In The Bahamas Financial Statements Period from 31 March 2009 to 31 January 2013	BDO Bahamas	April 26, 2013
15.	Promotion Sustainable Energy In The Bahamas Financial Statements Period from 31 March 2009 to April 2011	BDO Bahamas	April 29, 2013
16.	Contract documents for Installation, maintenance and monitoring of photovoltaic systems. Project: implementing sustainable energy Project in The Bahamas (GRT/FM-11832-BH). Installer Northern Bahamas Utilities.	Ministry of Environmental and Housing, The Bahamas	26 August 2013
17.	Contract documents for procurement and installation of solar inverters. Solar photovoltaic. Project: Implementing sustainable energy projects in The Bahamas (GRT/FM-11832-BH). Purchaser: Ministry of Environment and Housing, The Bahamas. Supplier: Alternative Electric Co.	Ministry of Environment and Housing, The Bahamas.	3 March 2016
18.	Memorandum IDBCOCS #40117286.	Inter – American Development Bank	February 10, 2016.
19.	Executive Financial Summary For ATC/OC-11436-BH	Inter – American Development Bank	July 17, 2017
20.	Executive Financial Summary For ATN/MC-11467-BH	Inter – American Development Bank	July 17, 2017
21.	Executive Financial Summary For GRT/FM-11832-BH	Inter – American Development Bank	July 17, 2017
22.	Executive Financial Summary For GRT/MC-11799-BH	Inter – American Development Bank	July 17, 2017

No.	**Document Name**	**Author**	**Date**
23.	Implementation of Sustainable Energy Project *Final Project Report*	Inter – American Development Bank The Commonwealth Of The Bahamas The GEF Trust Fund	
24.	Strengthening the energy sector in The Bahamas. Financial statements period from 31 March 2009 to January 2013		
25.	Promoting sustainable energy in The Bahamas. Financial statements period from 31 March 2009 to 29 April 2011. Procurement plan 2012 – 2013.		
26.	No reimbursable Financing Agreement N° GRT/FM-11832-BH.	Inter – American Development Bank	March 21 2010