# Terminal Evaluation of the GEF Project
# "Disaster Risk and Energy Access Management (DREAM)"
# (GEF 5453; PIMS 5186 / BRB10-91628)

## Evaluation Report

Prepared for:
Government of Barbados
Ministry of Energy and Water Resources
St. Michael – Barbados W.I.

UNDP Barbados and the OECS

31 August, 2020

Remi Rijs
Schoonhoven, The Netherlands

## i. PROJECT KEY DATA

| PROJECT AND TERMINAL EVALUATION DATA | |
|---|---|
| GEF Project ID | 5453 |
| UNDP Project ID | BRB10-91628; PIMS 5186 |
| Project Name | Disaster Risk and Energy Access Management (DREAM) |
| Country | Barbados |
| Implementing Agency / Agencies | UNDP |
| Focal Area | Climate Change |
| GEF Strategy / Operational Program | GEF-5 CCM OP-3 Promote investment in renewable energy technologies |
| Date of Work Program approval | 11 December 2013 |
| Date of CEO Endorsement | 14 April 2015 |
| Date of project start / effectiveness | 14 December 2015 (original start date: 1 July 2015) |
| Date of project completion (activities) | 31 December 2019 (original end date: 30 June 2018) |
| Project duration | 48 months (original: 36 months) |
| Name of Evaluator | Remi Rijs |
| Date of Terminal Evaluation start | 26 February 2020 (kick-off) |
| Date of Terminal Evaluation completion | 27 June 2020 (draft report submission); 31 August 2020 (revised final report submission) |

| PROJECT FINANCIAL DATA – PROJECT PREPARATION PDF/PPG GRANTS (IN US$) | | |
|---|---|---|
| **Particulars** | **At approval** | **At PDF/PPG completion** |
| GEF PDF/PPG grants for project preparation | 100,000 | 100,000 |
| Co-financing for project preparation | 9,500 | data not available |

| PROJECT FINANCIAL DATA – GEF PROJECT FUNDING (IN US$) | | |
|---|---|---|
| **Particulars** | **At CEO Endorsement** | **At Project completion** |
| GEF project grant | 1,726,484 | 1,554,382 |
| Co-financing | 30,900,000 | 57,040,000 |
| **Total** | **32,626,484** | **58,594,382** |

## ii. EXECUTIVE SUMMARY

1. This report describes the findings of the independent Terminal Evaluation (TE) of the UNDP/GEF Medium-Size project "Disaster Risk and Energy Access Management (DREAM)". The TE was carried out by a single consultant between February 2nd and June 30, 2020 under contract MEE/36/4 Vol. IV with the Ministry of Energy and Water Resources (MEWR) of the Government of Barbados (GOB). The TE was implemented in adherence to the UNDP Monitoring and Evaluation (M&E) Guidelines[1] and in coordination with the UNDP Country Office for Barbados & the OECS, and the UNDP/GEF Regional Coordinating Unit for the (RCU/LAC).
2. The DREAM Project aimed to reduce greenhouse gas (GHG) emissions from electricity generation by demonstrating the exploitation of renewable energy (RE) resources in Barbados. The Project installed decentralised, solar photo-voltaic (PV) systems at Community and Resource Centres (CRCs), pavilions[2], and polyclinics throughout the country to strengthen Disaster Risk Response (DRR) to extreme events – typically hurricanes. Other components targeted Barbados' energy policy framework including planning of RE capacity, and awareness raising and capacity building. The lessons learned were to be utilised for up-scaling towards a larger share of RE in the national energy matrix.
3. The Project was implemented by the MEWR under National Implementation Modality (NIM) and attained the envisioned GHG emission reduction and RE generation targets. By December 31, 2019, 90% of the GEF budget (US$ 1,554,381) was disbursed leaving a remainder of US$ 172,102. The total PV capacity installed through direct GEF funding was 241-kWp, which is 60% above the committed value. With a view on impact, the current penetration level of Renewable Energy (RE) capacity in Barbados is 13% of total capacity, which is twice as high as the target (6.8%). The results contribute to the Government of Barbados' (GOB) objective of achieving 100% RE-based energy supply by the year 2030.
4. The vertical logic of the Project was rather weak, essentially because the outcome level (i.e. the key development conditions) was not defined and a coherent barrier removal strategy was not in place. Contributions from the baseline were not properly integrated into the design which undermines evaluability and attribution of Project results. The results framework did not provide indicators to measure improved disaster-resilience. Several relevant new outputs were proposed and successfully implemented. This can be considered a good example of adaptive management which was encouraged by UNDP. Particularly relevant is the delivery of a draft utility license, which is a key input to modernise the sector and asset for the GOB to start negotiations with the utility BLPC.
5. The Project implemented 22 grid-tied PV systems with battery back-up at CRCs (70-kWp in total) and 9 grid-tied PV systems combined with existing diesel generation at polyclinics (171-kWp). These facilities serve as relief centres and are part of Barbados' national disaster response plan. After a disaster they will be used to distribute aid and to gather and disseminate information in the surrounding areas. Emergency power is now available in case of a grid failure and under normal conditions, the PV electricity is sold to the grid. Additionally, spare GEF funds were used to upgrade 10 primary schools to provide emergency back-up power. There is a risk that the

[1] Document: "Project-level Evaluation – Guidance for conducting Terminal Evaluations of UNDP-supported GEF-financed projects", UNDP Evaluation Office, 2012 (http://www.undp.org/evaluation).

[2] Community Centres are small facilities where people from surrounding neighbourhoods and villages can gather for social and community development events. Resource Centres typically have some infrastructure for teaching and training, such as a small class room and internet connections. At Project start, the CRCs were under the supervision of the Ministry of Social Care, Constituency Empowerment and Community Development (MoSCCECD), which in 2018 became the Ministry of Youth and Community Empowerment (MYCE). Pavilions are spaces linked to sports areas and are under the National Sports Council (NSC).

emergency power supply at the CRCs may not be sustainable given the weak financial business case and the lack of an O&M strategy and funding plan. It is recommended to GOB to put attention to these aspects.

6. Project execution under the National Implementation Modality (NIM) was successful and the choice to have the NPC and TO recruited and contracted directly by UNDP was appropriate. Delays existed in the preparation and approval of procurement processes. UNDP could have made more use of external project audits (only 2016/17 was audited) and reference prices to confirm the efficient use of GEF project funds and set a benchmark for comparable investment projects across its portfolio. Similarly, a Mid-Term Review (MTR) exercise could have been used to update the results framework and for retooling the workplan (within the limits allowed by GEF).
7. Although a gender plan was not mandatory under GEF-5. GEF and UNDP policies would expect a stronger effort to develop the gender-energy nexus. The absence of a proper inception workshop and stakeholder engagement plan were factors limiting the integration of gender in the Project. Lessons and experiences were discussed internally in the Ministry but not commonly documented and reported. To disclose lessons and make them available to UNDP and the GEF, more time would be needed towards Project closure, as well as funding of specific activities in this direction.
8. Substantial additional funding sources became available during project execution. The GOB strived at optimising the use of these resources to push forward its agenda. This reality could not be truly reflected as "baseline contribution plus GEF incremental action" at the time the Project document was written, as the funding landscape was (and is) more dynamic. For future programming, the Evaluator would recommend to keep this reality in mind to keep GEF funding focused on (niche) aspects were it can really make the difference.
9. The TE rates the overall Project Outcomes and overall Results as Satisfactory (S). A summary of the Project Evaluation is given in the next table.

| SUMMARY PROJECT EVALUATION RATINGS | | | |
|---|---|---|---|
| 1. MONITORING AND EVALUATION | RATING | 2. IA & EA EXECUTION | RATING |
| Overall quality of M&E | MU | Overall quality of IA/IP Execution | S |
| M&E Plan implementation | MU | IA execution - UNDP | S |
| M&E design at project start-up | MS | IP execution – MEWR | S |
| | | | |
| 3. ASSESSMENT OF OUTCOMES | RATING | 4. SUSTAINABILITY | RATING |
| Overall Project Outcomes | S | Overall likelihood of sustainability | ML |
| Relevance | R | Financial resources | MU |
| Effectiveness | S | Socio-economic | ML |
| Efficiency | S | Political | L |
| | | Environmental | L |

| IMPACT | |
|---|---|
| Description | Rating |
| Environmental Status Improvement | M |
| Environmental Stress Reduction | M |
| Progress towards stress/status change | S |
| Overall Project Results | S |

## iii. ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AWP | Annual Work Plan |
| BLPC | Barbados Light & Power Co. |
| BNEP | Barbados National Energy Policy |
| B$ | Barbados Dollar (pegged at B$ 2.00 = US$1.00). |
| CBA | Cost-Benefit Analysis |
| CCM | Climate Change Mitigation |
| CDD | Community Development Department |
| CEO | Chief Executive Officer (GEF) |
| CDR | Combined Delivery Report |
| CO | Country Office (UNDP) |
| CRC | Community and Resource Centre |
| CREF | Caribbean Renewable Energy Fund |
| DEM | Department of Emergency Management |
| DREAM | Disaster Risk and Energy Access Management |
| DRR | Disaster Risk Response |
| DoET | Division of Energy and Telecommunications |
| ELPA | Electric Light and Power Act |
| ESMAP | Energy Sector Management Assistance Program |
| FIT | Feed-In Tariff |
| FTC | Fair Trade Commission |
| GEED | Government Electrical Engineering Department |
| GCF | Green Climate Fund |
| GEF | Global Environment Facility |
| GHG | Greenhouse Gas |
| GOB | Government of Barbados |
| IDB | Inter-American Development Bank |
| IEO | Independent Evaluation Office |
| IP | Implementing Partner |
| IPP | Independent Power Producer |
| IW | Inception Workshop |
| KM | Knowledge Management |
| LAC | Latin America and the Caribbean |
| LCOE | Levelized Cost Of Energy |
| LFA | Logical Framework Analysis |
| MCA | Multiple Criteria Analysis |
| MENB | Ministry of Environment and Natural Beautification |
| MEWR | Ministry of Energy and Water Resources |
| MFEI | Ministry of Finance, Economic Affairs and Investment |
| MSP | Medium-Size Project |
| MTR | Mid-Term Review |
| MTWM | Ministry of Transport, Works and Maintenance |
| MoED | Ministry of Education |
| MoESTI | Ministry of Education, Science, Technology and Innovation |
| MoHW | Ministry of Health and Wellness (formerly: Ministry of Health – MoH) |
| MoSCCECD | Ministry of Social Care, Constituency Empowerment and Community Development |
| M&E | Monitoring & Evaluation |
| NIM | National Implementation Modality |
| NPC | National Project Coordinator |

| | |
|---|---|
| NPD | National Project Director |
| NSC | National Sport Council |
| OECS | Organisation of Eastern Caribbean States |
| PEU | Project Execution Unit |
| PIF | Project Identification Form |
| PIR | Project Implementation Review |
| PIU | Project Implementation Unit |
| PMO | Prime Minister's Office |
| PRODOC | Project Document |
| PSSEP | Public Sector Sustainable Energy Program |
| PS | Permanent Secretary |
| PSC | Project Steering Committee |
| PV | Photovoltaic |
| QPR | Quarterly Progress Report |
| RBF | Results-Based Framework |
| RE | Renewable Energy |
| RER | Renewable Energy Rider |
| RF | Results Framework |
| RTA | Regional Technical Advisor |
| STC | Special Tenders Committee |
| SEFB | Sustainable Energy Framework Barbados |
| SJPI | Samuel Jackman Prescod Institute of Technology |
| SNC | Second National Communication |
| STAP | Scientific & Technical Advisory Panel |
| TE | Terminal Evaluation |
| TO | Technical Officer |
| UAE | United Arab Emirates |
| UNDP | United Nations Development Programme |
| US$ | United States Dollar |
| UWI | University of West Indies (Cave Hill Campus) |
| VRE | Variable Renewable Energy |
| WB | World Bank |
| kW | kilowatt |
| kWp | kilowatt-peak |

# Contents

# 1 INTRODUCTION

1. This report describes the findings of the independent Terminal Evaluation (TE) of the UNDP/GEF Medium-Size project "Disaster Risk and Energy Access Management (DREAM)". The TE was initiated in October 2019 by UNDP Barbados in line with UNDP Monitoring and Evaluation (M&E) Guidelines[3] in coordination with the UNDP/GEF Regional Coordinating Unit for the (RCU/LAC). Since a consultant could not be hired before operational closure of the Project (December 2019), the process was handed over to the Ministry of Energy and Water Resources (MEWR) of the Government of Barbados (GOB). The consultancy was awarded February 17, 2020 under contract reference MEE/36/4 Vol. IV. The TE was carried out by a single consultant ("the Evaluator") between February 2nd and June 27, 2020. The final TE report was submitted August 31, 2020.
2. The DREAM Project aimed to reduce greenhouse gas (GHG) emissions from electricity generation by demonstrating the exploitation of renewable energy (RE) resources in Barbados. The Project installed decentralised, solar photo-voltaic (PV) systems at Community and Resource Centres (CRCs), pavilions[4], and polyclinics throughout the country to strengthen Disaster Risk Response (DRR) to extreme events – typically hurricanes. Other components targeted Barbados' energy policy framework including planning of RE capacity, and awareness raising and capacity building. The lessons learned were to be utilised for up-scaling towards a larger share of RE in the national energy matrix.
3. The Project would result in cumulative direct GHG emission reductions of 276,895 tonnes CO2eq from rooftop solar PV systems at 40 selected CRCs and 10 polyclinics. The budget for the Project ascended to USD 1,726,484 (GEF grant) and total co-finance resources of USD 32,900,000 as follows: GOB, through the Division of Energy and Telecommunications – DoET[5] (USD 30,500,000 in-cash) and UNDP (USD 400,000 in-kind). By December 31, 2019, all project activities - except the TE - had been completed and 90% of the GEF project funds were disbursed or committed.
4. The TE process was hampered by the outbreak of the COVID-19 pandemic which impeded international travel to hold meetings and conduct site visits. In adherence to guidance issued by the UNDP Independent Evaluation Office (IEO) on March 31, 2020[6] the TE was implemented remotely through videoconferences to complement the desk research and analysis. The Evaluator could draw on some impressions gained during an earlier mission to Barbados in November 2019, in which several pilot installations delivered by the DREAM project were visited. The Evaluator also met with the DREAM project staff, UNDP staff and Government officials, and participated in the 2nd Energy Expo, November 23, 2019 to meet stakeholders from private sector and educational institutions.

## 1.1 Purpose of the Evaluation

5. The TE is one of the instruments used by UNDP and GEF to evaluate the degree of success and effectiveness of an intervention. It is a mandatory requirement for all Medium and Full-Sized GEF

[3] Document: "Project-level Evaluation – Guidance for conducting Terminal Evaluations of UNDP-supported GEF-financed projects", UNDP Evaluation Office, 2012 (http://www.undp.org/evaluation).
[4] Community Centres are small facilities where people from surrounding neighbourhoods and villages can gather for social and community development events. Resource Centres typically have some infrastructure for teaching and training, such as a small class room and internet connections. At Project start, the CRCs were under the supervision of the Ministry of Social Care, Constituency Empowerment and Community Development (MoSCCECD), which in 2018 became the Ministry of Youth and Community Empowerment (MYCE). Pavilions are spaces linked to sports areas and are under the National Sports Council (NSC).
[5] In 2018, the Division of Energy and Telecommunications (DoET) under the Prime Minister's Office (PMO) was transformed into the current Ministry of Energy and Water Resources (MEWR).
[6] UNDP IEO briefing March 31, 2020: "Ongoing MTRs/MTEs/TEs of Vertical Fund financed projects should be completed virtually where possible."

projects. The purpose of a TE is to evaluate the achievement of project results, to make specific recommendations to consolidate and enhance the results and benefits delivered, and to draw lessons-learnt for further UNDP and GEF programming.

### 1.2 Scope and methodology

6. The methodology for the TE is given in the recent GEF guidelines for M&E[7], which are adhered to by the Evaluator to the extent possible. The guidelines highlight the need for a theory of change as a basis for evaluation of results. It is observed that "where an explicit theory of change is not provided in the project documents, the evaluators should develop it based on information provided (...) and through consultation with the project stakeholders (par. 10-11)". The Evaluation will rate the Outcomes of the Project on three dimensions according to a six-point scale[8]:
   a. Relevance: Were the project outcomes congruent with the GEF focal areas/operational program strategies, country priorities, and mandates of the Agencies? Was the project design appropriate for delivering the expected outcomes?
   b. Effectiveness: The extent to which the Project's actual outcomes were commensurate with the expected outcomes.
   c. Efficiency: Was the project cost-effective? How does the project cost/time versus output/outcomes equation compare to that of similar projects?
7. The framework to gauge outcome achievement is the Project's Results Framework (RF, or "logframe"). Where measurement of outcome achievements is not realistic at the point of project completion, GEF observes that the quality and level of outputs delivered may be used as a proxy to indicate outcome achievement. Sustainability of the outcomes will be rated on a four-point scale[9] and consider the dimensions: (a) financial resources; (b) socio-political context; (c) political (institutional framework and governance); and (d) environmental factors. Where feasible, the Evaluation should report on progress to impact providing evidence and information sources, and assessing the role of the Project as well as other factors.
8. Other Project aspects that require a rating[10] include:
   - M&E Design and Implementation. Was the M&E plan at CEO Endorsement practical and sufficient? Did it include baseline data and clear (SMART) indicators? Was the M&E system operated as per the M&E plan? Was the M&E plan revised in a timely manner? Was information on specified indicators and relevant GEF focal area tracking tools gathered in a systematic manner? Were resources for M&E sufficient? How was the information from the M&E system used during project implementation?
   - Quality of GEF Agency Implementation (IA). The Evaluation will assess the extent to which the agency delivered on project preparation, appraisal, preparation of detailed proposal, approval and start-up, oversight, supervision, completion, and evaluation[11], focusing on elements that were controllable from the Agency's perspective. The Evaluation will assess how well risks were identified and managed by the GEF Agencies.

[7] Available at: http://www.gefieo.org/sites/default/files/ieo/evaluations/files/gef-guidelines-te-fsp-2017.pdf.
[8] According to the scale: Highly Satisfactory (HS); Satisfactory (S); Moderately Satisfactory (MS); Moderately Unsatisfactory (MU); Unsatisfactory (U): Highly Unsatisfactory (HU); Unable to Assess (UA). The calculation of the overall outcomes rating of projects will consider all the three criteria, of which relevance and effectiveness are critical. The rating on relevance will determine whether the overall outcome rating will be in the unsatisfactory range (MU to HU = unsatisfactory range). If the relevance rating is in the unsatisfactory range then the overall outcome will be in the unsatisfactory range as well. However, where the relevance rating is in the satisfactory range (HS to MS), the overall outcome rating could, depending on its effectiveness and efficiency rating, be either in the satisfactory range or in the unsatisfactory range.
[9] As follows: Likely (L) –Moderately Likely (ML) – Moderately Unlikely (MU) – Unlikely (U). Unable to Assess (UA).
[10] According to the six-point scale HS-S-MS-MU-U-HU.
[11] In alignment with GEF/C.41/06/Rev.01 and GEF/C.39/9.

- Quality of Implementing Partner (IP). The Implementing Partner (also called Executing Agency) is involved in management and administration of Project day-to-day activities under the supervision of the GEF Agencies. It is responsible for the appropriate use of funds, and procurement and contracting of goods and services to the GEF Agency. The Evaluation will assess the extent to which the IP effectively discharged its role and responsibilities.

9. As transversal aspects of IA/IP evaluation are indicated: quality and realism in reporting, adequacy of management processes, and suitability of the chosen implementation modality. The Terminal Evaluation should further assess the following topics (no rating required): (a) need for follow-up, (b) materialization of co-financing; (c) compliance with environmental and social safeguards; (d) gender concerns; and (e) stakeholder engagement. The Evaluation should provide well-formulated lessons that are based on the project experience and applicable to the type of project at hand, to the GEF's overall portfolio, and/or to GEF systems and processes. Recommendations should be targeted and discuss the need for action, and a time frame for it.

### 1.3 Key issues addressed

As part of the initial Terms of Reference (TOR) for the TE, the UNDP CO prepared a set of specific evaluation questions (Annex B). Key issues for UNDP discussed during the inception meeting (February 26, 2020) include:

A. Functioning of the National Implementation Modality (NIM). Did national systems work effectively? Was procurement efficient and timely? Were UNDP support services appropriate and effective? What were the actual costs to implement the Project?

B. Project Results. Were the indicators and targets in the Results Framework appropriate? How strong was the Project's vertical logic including attributability of results? Has there been non-expected impact? To what extent have adaptive management actions been able to enhance project impact and direct benefits?

C. Sustainability. To what extent are the achieved results sustainable beyond the Project's lifetime? What are the risks potentially affecting sustainability?

D. Gender. The DREAM project design did not adequately incorporate gender equality considerations. The TE shall assess the extent to which gender equality considerations were integrated during implementation and issue recommendations for future programming of energy projects by UNDP.

### 1.4 Structure of the evaluation

10. The evaluation report follows the general document structure as suggested for this purpose. Section 2 provides a description of the Project and the devised strategy in relation to its development context. Section 3 presents the findings of the TE covering project design, implementation and results. The sections 4 and 5 summarize the conclusions, lessons learnt and recommendations.

## 2 PROJECT DESCRIPTION AND DEVELOPMENT CONTEXT

### 2.1 Project start and duration

11. The Project Identification Form (PIF) entered the GEF Work Program in 2013 and was approved 11 December of that year. A Project Preparation Grant (US$ 100,000) was requested. Project

development took about 15 months achieving CEO Endorsement by April 14, 2015.[12] The Project was implemented under National Implementation Modality (NIM) by the Division of Energy and Telecommunications (DoET) of the Prime Minister's Office (PMO).[13] A Project Appraisal Committee (PAC) meeting was held June 2, 2015 but the Project Document (Prodoc) between UNDP and Government was only signed by December 14, 2015 as it had to be submitted to Cabinet for review and approval, after which the IP was authorised to sign off. With an envisioned total duration of 36 months, the Project was supposed to end by June 30, 2018.

12. A one-day inception workshop (IW) was held at DoET's premises in Country Road, Bridgetown, on June 29, 2016. The IW was led by the National Project Coordinator (NPC), which was recruited by UNDP in April 2016. The morning session was chaired by the Permanent Secretary (PS) and focused on the Project components 2 (PV installations) and 3 (awareness raising). The afternoon addressed planning, grid stability aspects and PV licensing (Component 1) and was led by the Deputy PS.
13. The original Monitoring and Evaluation (M&E) Plan[14] stipulated a mid-term review (MTR) to be held half-way project implementation; this was not done however. Due to the late start and initial implementation delays, an 18-months project extension was granted, bringing the Project end date to 31 December 2019.[15]

## 2.2 Problems that the project seeks to address

14. From the PIF[16] the following purposes of the DREAM Project can be derived: (1) to contribute to the reduction of Barbados' dependency on fossil fuels; (2) to educate about the benefits of grid-connected solar PV technologies; (3) to demonstrate their uses; and (4) to reduce GHG emissions. As a result, the country's energy security would increase and the Project would contribute to Barbados' overall renewable energy (RE) targets. A set of policy de-risking measures was proposed[17] to reduce or remove specific barriers to the adoption of RE (in particular rooftop PV):[18]
    (i) Uncertainty how much variable RE (VRE) could be injected into the grid, which is an impediment for sector planning and for an increased share of RE;
    (ii) Lack of a comprehensive plan for development of a RE sector including capacity needs, market volumes, employment generation (for local youth) and skilled vocational trades;
    (iii) Uncertainty about needed grid upgrades to absorb VREs;
    (iv) Lack of adequate awareness raising programmes (partly due to capacity limitations within GOB); and:
    (v) Insufficient demonstrations of operational rooftop-solar-PV installations to convince the public of its feasibility.
15. Without the GEF Project, the grid-connected RE market would not develop beyond the modality where BLPC (the utility) controls all electricity generation facilities as the RE knowledge base, and

[12] Source: https://www.thegef.org/project/disaster-risk-energy-access-management-dreampromoting-solar-photovoltaic-systems-public
[13] Which became part of the Ministry of Energy and Water Resources (MEWR) by 2018.
[14] Project Document, p.52.
[15] PSC meeting #6 (February 2019) minutes indicated that Cabinet had agreed a 1-year no-cost extension and that GEF granted extension to November 30, 2019.
[16] Final PIF submitted November 21, 2013, p.4.
[17] According to the PIF, Annex V (p.12) the proposed policy derisking instruments are: (1) permit risk - establishing streamlined licensing procurement processes; (2) transmission risk - developing grid connection strategies and capabilities; (3) counterpart risk - applying utility best practices on cost recovery arrangements; (4) technology risk - developing local capacity for solar PV supply and installations; (5) social acceptance - developing public campaigns and establishing solar PV demo project sites.
[18] GEF CEO Endorsement Request, April 2015, p. 4.

institutional and local entrepreneurial capacities in Barbados will not be sufficient to induce scaled-up investment into PV electricity generation. Uncertainties would dissuade investments from independent RE power producers, namely private property owners in Barbados. [19]

16. The Project further aims to reduce dependence on fossil fuels during extreme weather occurrences by increased access to grid-connected solar PV. [20] According to the Prodoc: "Department of Emergency Management's (DEM) (...) has stated that all CRCs under the Ministry of Social Care, Constituency Empowerment and Community Development (MoSCCECD) do not have reliable backup power. As such, the GOB has aimed to install stand-alone solar-PV systems at emergency shelters and relief centres to provide backup power in the event that the grid is down after a severe storm."
17. In terms of disaster response, the Project is expected to deliver the following benefits[21]: (i) reliable backup power sources from RE at CRCs in the event of an extreme weather event; (ii) reliable, uninterrupted power supplies for polyclinics which serve as relief centres to store medicines and other vital goods. This suggested that power supply provisions were vulnerable under the baseline scenario and that solar PV could improve this, at lower cost.
18. The pursued licensing of PV systems was intended to ensure that quality of RE installations meets best international practices. At Project design, there were insufficient rooftop solar-PV installations on which to design a licensing regime for a scaled-up program of solar-PV installations. A Government-led demonstration programme could serve as a basis to ensure technical quality and build an inclusive supply chain to create employment opportunities for the local youth.

## 2.3 Goal and development objective of the Project

19. The GEF CEO Endorsement Request states the following objective[22]: "*To reduce GHG emissions from fossil fuel-based power generation by demonstrating the exploitation of renewable energy resources for electricity generation in Barbados"*. The PIF postulated a somewhat narrower objective: *"To promote increased access to clean energy in Barbados through solar PV systems in public buildings (e.g. government facilities, community centres, health facilities, schools), thus strengthening climate resilience and disaster risk management"*.[23]
20. The latter describes fairly well what the DREAM Project aimed to achieve operationally and clarifies the origin of the Project Title. The objective at CEO is more aligned with the GEF CCM objective (GHG emission reduction) and highlights the need for demonstrating the viability of grid-connected RE systems in Barbados. Although PV systems were already being installed by households and businesses "behind the meter", there was no comprehensive policy and regulation in place to accommodate decentralised RE power systems as part of the national electricity system.
21. Importantly, in July 2010 the utility BLPC had established the Renewable Energy Rider (RER) scheme – approved by the Fair Trade Commission (FTC) - as a pilot project allowing households to install up to 5-KWp PV systems and commercial establishments up to 50-kWp. The scheme was

[19] Prodoc, par 76, p.34.
[20] However, it is mentioned as a response to Risk 1 - Climate variability in Barbados exacerbating extreme weather events, such as hurricanes, severe storms and other patterns leading to infrastructure disruption, as follows: "The proposed solar PV installations will be an integral part of the disaster risk management activities led by the Office of the Prime Minister. It is expected that their backup support and emergency function will help spread the use of solar photovoltaic as another means of climate change adaptation for the population of Barbados, particularly as the occurrence of extreme events increases." Worthwhile mentioning is that disaster response and energy (DoET) were both under the OPM at that time.
[21] GEF CEO Endorsement Request, April 10, 2015, p.5.
[22] GEF CEO Endorsement Request, April 10, 2015, p.2.
[23] Final PIF submitted November 21, 2013, p.1.

capped at 1.6-MW total capacity, or 200 projects; in 2014 it was extended to 10-MW and another 10-MW for a utility (BLPC) PV farm. By December 2015, over 710 customers had benefitted from the RER Programme with 5.5-MW total installed capacity.

22. BLPC claimed that variable RE (VRE) capacity could not be more than 10% of peak demand as it would affect grid stability and reliability. To challenge this claim, the DREAM project would assist the GOB to implement an independent grid study. [24] As part of the PPG work, UNDP therefore commissioned a preliminary study to characterise the national grid. The report outlines the challenges of VRE for a small island grid as well as advances in power electronics to mitigate adverse effects.[25]

## 2.4 Expected results and indicators

23. The Project was structured along three (3) components with associated outcomes and outputs, as follows:

| GEF Project Disaster Risk & Energy Access Management (DREAM) – Components and Outcomes | | |
|---|---|---|
| Component | Expected Outcomes and Outputs | |
| 1. Renewable energy policy framework | Strategic plans and licensing regime approved for accelerated RE development[26] | |
| | 1.1 | Grid stability assessment |
| | 1.2 | Strategic planning for solar-PV deployment in Barbados |
| | 1.3 | Approved and strengthened licensing procedure for RE projects |
| 2. Clean energy capacity development | Institutional and technical capacity and awareness strengthened for clean energy development | |
| | 2.1 | RE awareness raising programs at community and resource centres |
| | 2.2 | Solar development vocational training programmes[27] |
| 3. Solar-PV installations | Feasible stand-alone solar PV electricity generation investments are successfully demonstrated | |
| | 3.1 | Feasibility studies of specific solar PV installation |
| | 3.2 | Implementation assistance for solar PV projects |
| | 3.3 | Solar PV demo investment projects |

*Table 1 DREAM Project expected outcomes and outputs as per Project Document.*

Each of the outcomes has associated indicators and targets as described in the Project's Results Framework (RF). During Project implementation, some indicators and targets became subject of discussion and two indicators were added to better reflect project actions. The Evaluation will use a consolidated set of indicators to ensure consistency with the latest (2018 and 2019) Project Implementation Reviews (PIRs). The scope of the outputs as outlined in the Project Document is summarised in the tables hereunder.

[24] GEF CEO Endorsement Request, April 10, 2015, p.3.
[25] Grid Characterisation Report, by German ProfEC GmbH, Im Ofenerfeld 23, 26127, Oldenburg, Germany.
[26] Note: the formulation of the Component 1 outcome in the GEF CEO Endorsement Request Table C, April 10, 2015 (p.1) is a mistake. The correct text is derived from the Project's Results Framework, Prodoc, p.41.
[27] According to the Prodoc (p.32), GEF assistance was not required for this output as it was being funded with GOB resources under the PSSEP programme.

| GEF DREAM Project – Outcomes, indicators and Targets | | | | | | |
|---|---|---|---|---|---|---|
| Results Framework Level | Indicator | | Unit | Baseline | Original Target | Revised Target |
| **Objective:** Promotion of increased access to clean energy in Barbados through solar photo-voltaic systems in government buildings to strengthen the country's climate resilience and disaster risk management | #1 | Cumulative direct CO2 emission reductions resulting from the GEF intervention | (ton CO2eq) | 0 | 276,895 | -- |
| | #2 | RE-based electricity from the GEF intervention | (MWh) | 0 | 316,090 | -- |
| | #3 | Number of people using RE-based electricity | (-) | 0 | 18,564 | -- |
| | #4 | Share of RE in the power generation mix of Barbados | (%) | 0 | 6.8% | -- |
| | #5 | Number of RE installations connected to the grid[28] | (-) | 810 | none | 2,000 |
| **Outcome 1:** Strategic plans and licensing regime approved for accelerated RE development | #6 | Number of strategic plans completed for RE development in Barbados with targets and milestones | (-) | 0 | 1 | -- |
| | #7 | Number of grid stability assessments on VRE penetration into the Barbados grid | (-) | 0 | 1 | -- |
| | #8 | Number of RE licenses that received direct Project assistance | (-) | 0 | 6 | -- |
| **Outcome 2:** Institutional and technical capacity and awareness strengthened for clean energy development | #9 | Number of persons attending awareness raising sessions at community centres with regards to the benefits of rooftop solar PV installations that actively seek the introduction of RE | (-) | 0 | 100 | -- |
| | #10 | Number of persons under vocational training programs on solar PV technology and installations that are active in the RE sector | (-) | 0 | 20 | -- |
| | #11 | Number of tradespersons who have local certification to construct, assemble, operate, and maintain RE technologies that are actively providing ESCO-type/other services | (-) | 0 | 50 | (merged into indicator 2.1 |
| | #12 | Number of technicians trained in electrical grid monitoring and analysis[29] | (-) | ?? | none | 20 |
| **Outcome 3:** Feasible stand-alone solar PV electricity generation investments are successfully demonstrated | #13 | Rooftop solar-PV installations financed through GoB RE funds where DoET and BL&P have involvement in operationalisation | (MW) | 0 | 3.225 | -- |
| | #14 | MW capacity of rooftop solar PV projects in planning and design stages | (MW) | 0 | 7.5 | -- |

*Table 2 DREAM Project outcomes, Indicators and targets as proposed in the Project Document. The indicators #5 and #12 were added by the PSC.*

[28] This indicator was added by Project Steering Committee decision. (PSC Meeting #4).
[29] This indicator was added to the Results Framework.

## 2.5 National development context and baseline

24. Barbados has a high per capita GDP, an electrification rate above 99%, and generalised access to essential services including health and education. Similar to most SIDS, Barbados' energy sector is characterised by a dependency on imported fossil fuels and an under-exploitation of local RE sources. Energy costs for end-users are high (approx. US$ 0.21 per kWh) due to the presence of outdated, inefficient thermal power plants in the electricity matrix generation and the fact that fuel costs are passed through to consumers under the Fuel Clause Adjustment.[30] Investment to upgrade the electricity infrastructure is deferred and a vicious circle is created exacerbated by growing electricity demand.[31] The emission factor of grid electricity in 2013 was 0.8760 tCO2eq/MWh. [32] Barbados is vulnerable to extreme weather events, specifically hurricanes, although frequency is less than in other islands in the Caribbean due to Barbados' easterly location somewhat off the hurricane belt.
25. Barbados' energy sector started to change around 2009 when the GOB and the Inter-American Development Bank (IDB) signed an agreement for developing the Sustainable Energy Framework Barbados (SEFB). By 2020, this programme is in its fourth iteration. Until 2013, operations of the public utility Barbados Power and Light (BLPC) were governed by the Electric Light and Power Act (1899). The GOB progressively sold its shares until BLPC became 100% privately-owned by 2015.[33] The Act's Third Schedule extended BLPC's licence period by 42 years from August 1, 1986 to July 31, 2028. In 2013, this Act was repealed by the current Electric Light and Power Act, 2013-21 (ELPA).
26. The 2013 ELPA opened the market for Independent Power Producers (IPPs) while the rights granted under BLPC's licence were respected until 2028. Tariffs, quality standards and other matter concerning the relation between BLPC and its customers, are regulated by the Fair Trading Commission (FTC). The new context created an opportunity for the GOB and all Barbadians to become an energy producer and sell the electricity to the utility (which is so far the sole off-taker), the tariffs being defined under the Renewable Energy Rider (RER) programme that was renewed in 2014. Net billing is in place for RE systems under 3-kW. Above this level, the modality is "buy all – sell all".[34]
27. Importantly, any RE generator above 5-kW connected to the utility grid, requires a request for a licence, to be reviewed and granted by the MEWR. This also applied to the PV systems on public buildings pursued under the DREAM Project. In fact, a Grid Connection Agreement, Power Purchase Agreement, and General Liability Insurance were required.[35] Support to develop a licencing regime for decentralised PV systems (and other RE technologies) was therefore a specific GOB request to the DREAM project designers.[36]
28. Under the Project's time horizon (2016-2020), MEWR has started the process of developing a new market structure to support a more liberalised generation market. Simultaneously, negotiations have started with BLPC to define the terms for their new utility licence. According to BLPC, the current

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[30] See: https://www.blpc.com.bb/index.php/customer-care/fuel-clause-adjustment

[31] In 2011, Barbados spent USD 393,538 million on oil imports, representing 6% of the Barbados GDP. Electricity consumption grew at an average rate of 5.4% annually in the period 2000-2008. Source: Prodoc, p.9.

[32] Presented data adopted from Barbados' Second National Communication to the UNFCCC (SNC), 2018.

[33] It is owned by Emera Caribbean Inc. See: https://www.emera.com/companies/regulated-electric/emera-caribbean

[34] The utility pays you for all the electricity that you generate from your PV system at a rate determined by the FIT
You still have to buy back all the electricity that you use plus the cost of fuel plus VAT. For domestic this works out to be about B$ 0.60. See: https://www.blpc.com.bb/images/pdfs/Domestic_Tariff_Residential_Services.pdf, and https://blpc.freshdesk.com/support/solutions/articles/42000060966-billing-under-the-renewable-energy-rider

[35] As observed during Inception Workshop.

[36] The current license application form, developed with support from the DREAM Project, can be found at: http://energy.gov.bb/web/component/docman/doc_download/81-interactive-application-supply-electricity-to-the-public-utility

uncertainties would make the utility postpone investment in long-term assets (generators) and refrain from signing power purchase agreements beyond 2028. This, in turn, would translate into an impediment for prospective Independent Power Producers (IPPs) to enter the generation market.

29. The current Barbados National Energy Policy (BNEP 2019-2030)[37] sets a goal of to 100% RE to become fossil-free by 2030. Importantly, in September 2019, the FTC approved a feed-in tariff (FIT) framework for RE technologies for installations up to 1-MW.[38] The FIT offers a 20-year fixed tariff, differentiated by technology and project size, based on a levelized cost of energy (LCOE) assessment and a multiple criteria analysis (MCA) of costs and benefits.

## 2.6 Beneficiaries and main stakeholders

30. The following beneficiaries are listed in the Prodoc to take seat in the Project Steering Committee (PSC): (1) Division of Energy and Technology of the OPM (DoET), specifically its Energy Conservation and Renewable Energy Unit (ECRE); (2) Ministry of Education (MoED); (3) Ministry of Health (MoH); and: (4) Ministry of Social Care, Constituency Empowerment and Community Development (MoSCCECD). In 2018, the national Government's structure was modified bringing along changes in ministry names and their mandates and portfolios. To keep track of the stakeholders throughout the project lifetime, a table is provided for reference (see Annex C).
31. The MoH owns and operates the polyclinics, which provide basic health care services to the general population in Barbados. There are also three (3) larger hospitals, which fall under the administrative purview of MoH but are owned by the Ministry of Transport, Works and Maintenance (MTWM). The MoSCCECD own and operates the CRCs throughout Barbados that are used for providing community events such as education and various training programmes. The DEM provides technical guidance to all the ministries having assets used for emergency management purposes such as storm shelters, first aid and relief centres.
32. From the Project's Inception Workshop (June 2016) and the first PSC meeting (April 2016), the following stakeholders can be identified that are direct beneficiaries: (5) National Sports Council (NSC); (6) Government Electrical Engineering Department (GEED); (7) Disaster Emergency Management (DEM); and (8) Community Development Department (CDD). In 2019, the (9) Public Investment Unit (PIU) was appointed by the Ministry of Finance, Economic Affairs and Investment (MFEI) to take part in the PSC meetings. Also the utility BLPC was represented in the PSC.
33. Institutional stakeholders otherwise mentioned include: the Fair Trade Commission (FTC), which evolved from the Public Utilities Board to regulate public utilities such as electricity and telephone services, in particular commercial aspects thereof; and the Barbados National Standards Institute (BNSI); academic and vocational education institutes including: University of West Indies, Cave Hill Campus (UWI)[39], Samuel Jackman Prescod Institute of Technology (SJPI)[40], Barbados Community College; as well as private companies providing training on RE installation and maintenance. Finally, the Barbados Renewable Energy Association (BREA) represents the private sector (project developers, investors and professional) in the field of REs (10).
34. The Prodoc does not include a plan for engagement with stakeholders and beneficiaries. The Evaluator observes that stakeholder groups and individuals (such as community people and public building

[37] Available at: http://energy.gov.bb/web/national-energy-policy-for-barbados-2019-2030
[38] See: https://www.ftc.gov.bb/index.php?option=com_content&task=view&id=370
[39] See: https://www.cavehill.uwi.edu/
[40] See: https://sjpi.edu.bb/

users) are not explicitly identified and characterised. Aspects related to inclusiveness, equitable access to Project benefits, and gender approach were not assessed during project design and no action plans were delivered. No information is available whether these aspects were explicitly included as criteria to select the PV project sites. Clearly, both CRCS and polyclinic buildings have the function to serve the community.

## 2.7 Gender

35. The following positive impacts for women were foreseen: (i) understanding of willingness of women vis-à-vis men to invest in solar PV panels to better address gender-related barriers to the uptake of renewable energy technology; (ii) promoted use of RE by women at the community level to strengthen resilience of households and buildings in Barbados to extreme weather events and adapt to climate change; and: (iii) awareness of the benefits of solar energy and the possible entrance of those interested into further vocational training, translating into jobs for women and men in a scaled-up solar-PV industry in Barbados.
36. With the exception of (iii), the Prodoc did not provide entry points or specific activities towards gender. There was no baseline set and gender elements were not integrated into the Project's theory of change. The Project design did not assess or propose mechanisms for community members to co-invest in PV systems. No data were collected to understand investment capacities according to socio-economic level, rural vs. urbanised, gender and education level.

## 2.8 Project Management arrangements

37. The project management arrangements can be summarised as follows[41]:
    a. National implementation (NIM) as per the standard UNDP implementation guidelines agreed by the GOB. The DoET (MEWR since 2018), as the Implementing Partner, assumed the overall responsibility for the achievement of Project results.
    b. The Ministry's Permanent Secretary (PS) was designated as National Project Director (NPD) for the Project. The Project Management Unit (PMU) consisted of a full-time National Project Coordinator (NPC), recruited directly by UNDP.
    c. The Project Steering Committee (PSC) had oversight of the Project and was chaired by the NPD. The PSC provides strategic guidance to the Project and reviews and approves Annual Work Plans (AWPs) and budget revisions.
    d. Quality assurance by UNDP/GEF is delivered through the Country Office (CO) in Barbados and the Regional Technical Adviser (RTA) in Panama.
38. The envisioned arrangements were adhered to during Project execution.

[41] Prodoc par. 87-88, p.47.

# 3 FINDINGS

## 3.1 Project scope and design

39. The DREAM Project aimed to reduce Barbados' dependency on fossil fuels by demonstrating solar PV systems on public buildings that can be used as shelters in case of natural disaster (most likely: a hurricane event). The Prodoc does not elaborate on technical and economic aspects of the PV alternative and does not provide a justification whether PV would be technically and economically superior for emergency power. The Prodoc is ambiguous concerning the pursued business case as Outcome 3 speaks of "feasible stand-alone solar PV electricity generation". There would be forty (40) 2.5-kWp systems on CRCs and ten (10) 5-kWp systems on polyclinics. The IW clarifies that:

> *"The PV systems to be installed at the community and resource centres (CRCs) will be grid-tied systems with stand-alone capability. (...) Stored energy is sent to an inverter where it is converted to match the system (utility) supply. This power then used in the building and any excess power will be exported to the grid. In the event of an emergency that causes the grid to go off-line, the emergency loads connected to the AC subpanel will be fed from the PV system. The PV system is designed and sized to supply small power and lighting loads which are deemed necessary in an emergency situation, such as egress illumination, exit signs, telecommunications equipment and refrigeration for medicines. (...) The PV systems are designed to operate from solar power for extended periods of time. Although battery back-up costs three to four times more than generator back-up, when O&M costs and the costs of emissions are factored in, the payback period is less than two (2) years on these systems".* [42]

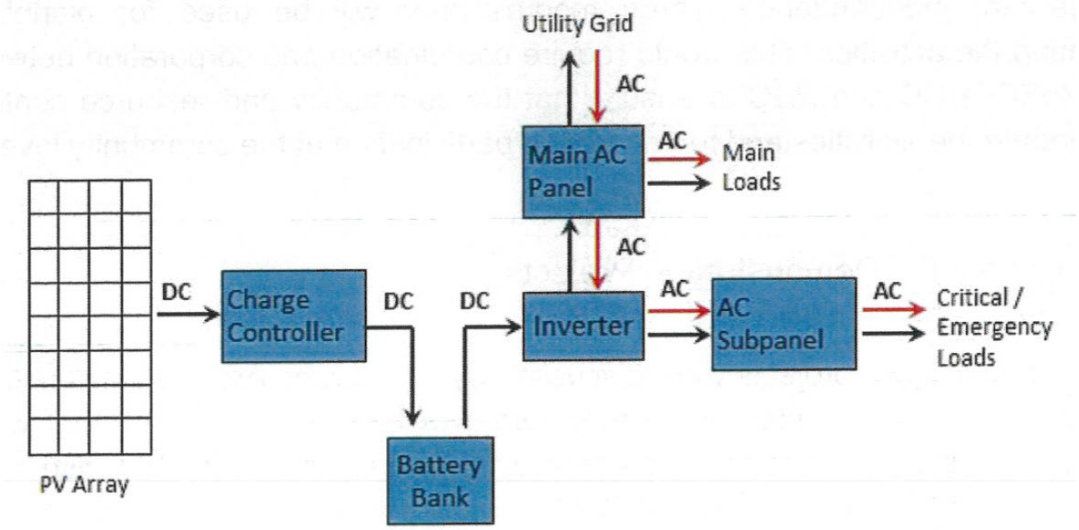


*Figure 1 Block diagram showing grid-tied PV system with stand-alone capacity for emergency loads. Source: DREAM Project inception Report, p.8.*

[42] DREAM Project Inception Report, June 2016, par. 2.4.1.

40. Figure 1 outlines the system configuration as pursued by GOB. In response to a GOB query at IW, it was indicated that one 2.5-kWp system would produce approx. 300 kWh per month and save 120 B$ (60 US$ per month). These figures seem realistic.[43]
41. An important technical measure for disaster-resilient electricity supply in buildings, is the bundling of the critical loads into a separate electrical group. The requirements thereto were not assessed during Project design (and were not included in the scope of work for the CRCs). The concept resilience was not elaborated in the Project Document - no indicator was defined to measure this aspect and no baseline was provided.
42. While polyclinics and CRCs are valid objects, the Project design did not provide an assessment of building energy consumption and the needs of its users in terms of costs, functionality and comfort. In the view of the Evaluator, this is a missed opportunity to better understand the energy-climate resilience nexus in SIDS, including elements such as planning and incorporation of community needs and circumstances and the role and specific needs of women.
43. After Project start, it became clear that all sites had to be inspected (from which the Evaluator deducts that this was not done as part of the PPG, not even for a sample of buildings). In particular in the polyclinics, which are larger buildings, it was found that the electrical circuits were not well documented and the panel breakers often unlabelled. According to the NPC, this is due to a lack of technical supervision after a new building is delivered and inspected by the GEED. Afterwards, changes to the electrical installations are introduced by the building user, who then fails to keep up the level of documentation and labelling of the circuits. The situation suggests that there is scope for energy conservation in the buildings; periodic inspections by GEED might further help detect and remedy potentially unsafe situations.

## 3.2 Barrier analysis and vertical logic

44. The Prodoc identified a series of barriers underpinning project design which are summarised in section 2.2 of this report. The Project's Flow Chart presented three groups of barriers causing "slow growth of RE development in Barbados".[44] However, the Project did not address the barriers in a systematic way to respond to a Logical Framework Analysis (LFA) recommended by GEF and UNDP. The approach appears to be based on a Results-Based Framework instead as there is no comprehensive theory of change.[45]
45. The Prodoc does not make explicit underlying assumptions, neither does it provide arguments that the proposed set of outputs would be adequate and sufficient to deliver on the Project objective. In fact, the outcome level is not defined - in other words, the Project does not explicitly define the development conditions that should be addressed in order to achieve the envisioned objective

[43] Based on supplier data, usable sun hours in Barbados are 4.2 hours/day, or 126 hours/month, which confirms this energy yield estimate. The grid tariff is about US$ 0.20/kWh, effectively translating into a 60 US$ saving per month.
[44] Project Document, Figure 4, p.35.
[45] A logical framework needs a comprehensive set of development conditions to be in place to support or prove that the objective is reached. If the conditions are not provided under the baseline, the intervention (the GEF project) should create them. In a results-based framework, a number of outputs are produced and it is assumed that the envisioned impact will follow. In a logical framework approach, one would expect an argument that the presented barriers provide a comprehensive description of the development problem and that the proposed outcomes are necessary and sufficient to deliver the needed changes and what conditions are assumed to be in place and how remaining risks should be addressed. The DREAM Project Document does not provide such analysis of outcomes and assumed conditions.

(impact).[46] The Results Framework (RF) essentially tracks progress at impact and output level but not at outcome level. Importantly, the action of parallel initiatives (both by GOB and other agencies, in particular the PSSEP and the IDB's SEFB) are not taken into account.

46. The absence of a well-defined outcome level adversely affects evaluability of Project effectiveness and the extent to which results can actually be attributed to the DREAM project. Notably, the technical and economic aspects of the PV pilots were not elaborated as input for a cost-benefit assessment (CBA) and no alternative solutions were presented. The absence of a CBA limits the options for evaluating the efficiency of the Project.

47. The Prodoc exhibits some voids, inconsistencies and ambiguities, perhaps due to capacity constraints or time pressure, even though the PPG throughput time was long. The complexity of the licensing process, as well as the role of the private sector was not clearly described or understood and no stakeholder engagement plan was produced. Since 2016, insight in the implications of a sector reform has grown within MEWR while the RE ambition level was also raised. Given the dynamics of the sector, the baseline as presented in the Prodoc was partly outdated when the Project began, notably in relation to the policy framework. The Evaluator views this as an excellent example of national ownership.

48. Notably, additional funding sources became available alongside the GEF, including the PSSEP, the Sustainable Energy Framework for Barbados (SEFB, funded by IDB) and the IDB/EU Smart Fund. The GOB strived at optimising the use of these resources to push forward its agenda, avoid doubling of efforts and use the funding sources that were timely available. This reality could not be truly reflected as "baseline contribution plus GEF incremental action" at the time the Project document was written, as the funding landscape was (and is) more dynamic. Moreover, parallel funding from non-GEF sources is far larger than GEF grant money, especially for RE investment as markets are nearly mature. For future programming, the Evaluator would recommend to keep this reality in mind to keep GEF funding focused on (niche) aspects were it really makes the difference.

49. Eventually, the DREAM Project, forced into 3-years, struggled to meet timelines from its very start leaving little time for analysis and systematic barrier removal. Moreover, several activities were concluded after project termination, which suggests that a more sustained, programmatic delivery of technical assistance might be preferable. Considering that many islands in the Caribbean face similar barriers, a sustained regional programme may be attractive for Barbados, as it can offer a platform for learning and systematisation of experiences.[47]

50. Disaster-resilience did not receive the attention it claims in the Project's title. The Project design did not assess to what extent electricity supply would improve resilience and did not set a baseline. It is acknowledged that the key institutional beneficiaries (MoHW, MoD, and NSC) were represented in the PSC; yet, information concerning improved resilience was not collected (or made available to the Project). Given UNDP's involvement in Disaster Risk Management worldwide, the Evaluator would have expected stronger emphasis on this aspect during Project implementation, for example by seeking synergies and sharing of peer experiences, moreover since the Caribbean SIDS share a similar vulnerability profile.

[46] According to the OECD Development Assistance Committee, outcomes are "the likely or achieved short-term and medium-term effects of an intervention's outputs. Outputs are the products, capital goods and services which result from a development intervention; may also include changes resulting from the intervention which are relevant to the achievement of outcomes."

[47] The Prodoc mentioned the UNDP Derisking RE Investments (DREI) Framework and the WB-ESMAP SIDS-DOCK project but no operationable actions were proposed.

## 3.3 Project implementation

### 3.3.1 Management arrangements and national systems

51. The management and project execution arrangements were implemented as proposed in the Prodoc. MEWR assigned its Permanent Secretary (PS) as the National Project Director (NPD). The National Project Coordinator (NPC), contracted by UNDP in April 2016, became full-time deployed by June 2016 when the Inception Workshop was held (June 29, 2016). The NPC was hosted within the Ministry. During execution it became clear that the Project required internal technical capacity to push forward the pipeline of PV projects and become an effective counterpart for suppliers. In response, in August 2016 a Technical Officer (TO) was recruited by UNDP from the Project funds.[48] The NPC and TO worked together in a tandem strengthening the presence of the DREAM Project and increasing executing capacities within the Ministry.
52. The Project Steering Committee (PSC) met seven (7) times (see Table 3). The PSC meetings were assisted by the core stakeholder (MEWR, BLPC, MoH, MoSCCECD; and UNDP CO). In addition, representatives from the following entities took part in one or more sessions: MENB (GEF OFP), MFEI (PIU), DEM, CDD, GEED, and NSC.

| Project Steering Committee (PSC) Meetings | |
|---|---|
| 2016 | 19 April; 29 October |
| 2017 | 10 May; 1 November |
| 2018 | 3 July |
| 2019 | 13 February; 24 July |

*Table 3. Dates of Project Steering Committee meetings.*

53. The PSC meeting reports show a good reflection on the proposed activities and their technical and organisational implications. The meetings were remarkably efficient for a PSC made up of such a large number of members. Where considered necessary, the PSC did not hesitate to replace initially proposed outputs by more appropriate ones, which can be considered as a good use of adaptive management. Throughout project execution, there was awareness of Project status in terms of delivery and delays, and efforts were made to put the Project on track. The PSC meetings had a generally technical character in support of the pursued outputs. Suggestions and recommendations into this direction were made by the RTA in the 2019 PIR but there was little time to follow-up on this.

### 3.3.2 Financial monitoring and reporting

54. The Annual Work Plans (AWPs) and budgets were prepared by the NPC and presented for approval to the PSC. In July 2019 also an intermediate budget revision was produced. Expenditures lagged behind the budget as projected in the Prodoc (Figure 2).[49] The Project struggled to comply with the anticipated 3-year project duration and the heavily front-loaded original budget, with 57% of expenditures programmed for Year 1. By July 2019 most of this was committed and as of December 31, 2019, 90% was actually disbursed.

[48] Initially, the TO was hired on a short-time contract to carry out the field inspections to the polyclinics. By end 2016, the position was continued with a broader scope of work, until Project termination end 2019.
[49] The realised expenditures are obtained from the Combined Delivery Report (CDRs) over the period January, 2016 to December, 2019.

55. The Annual Work Plans systematically overestimated the actual expenditure capacity. The AWP 2017 (presented at PSC 2) moved 88% of the budget to Year 2 (64%) and Year 3 (24%) but this proved not feasible either and a project extension had to be requested. The AWP 2019 still had US$ 918,027 (53% of total budget) left on the budget. This can be attributed to an optimistic view on the Project's expenditure capacity; inadequate judgement of the throughput time of required processes, specifically GOB procedures for large procurements [50]; inaccurate input parameters for budget calculations; or a combination of these factors. The low initial delivery capacity was observed in the PIRs but improved substantially during 2018. The Evaluator invites MEWR and UNDP to reflect on the experiences, draw useful lessons for the future and document them for reference.[51]

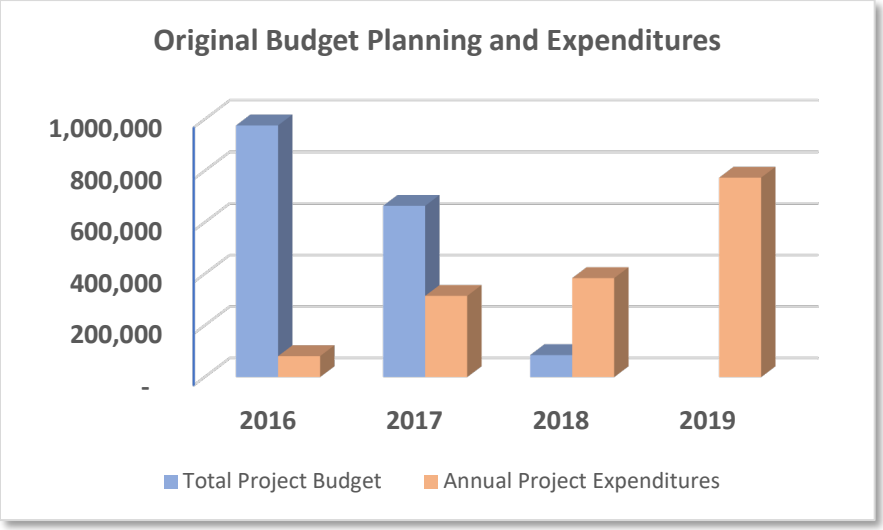


*Figure 2 Realised total annual project expenditures compared to original budget planning. The original Project duration was three years with a front-loaded budget.*

[50] Among other causes, a lengthy contract negotiation process with the main Contractor (over 6 months) and delays in material deliveries due to the hurricane season.

[51] It should be noted that most GEF CC Medium-Size Projects (MSPs) have difficulties to execute more than about US$ 300,000 annually average, while first year expenditures are usually very low. The DREAM project fits into this picture.

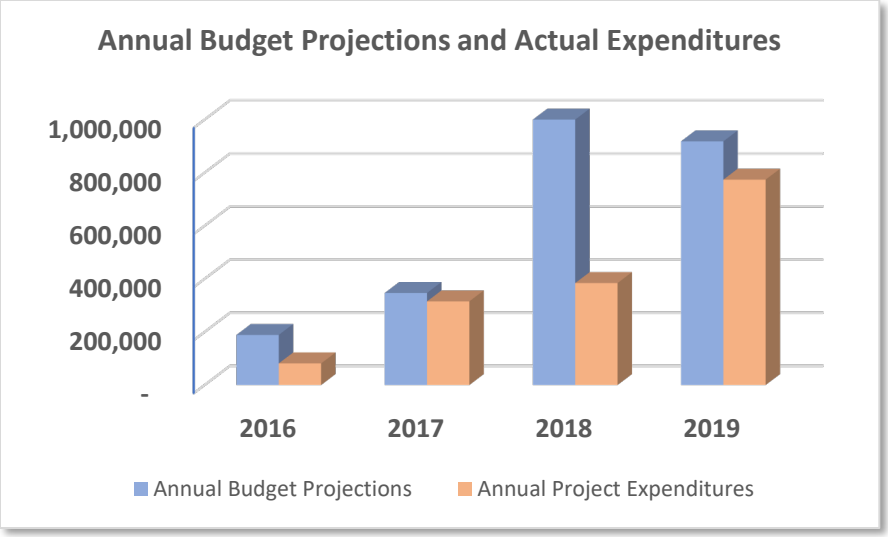


*Figure 3 Budget projections as part of the Annual Work Plans (AWPs) approved by the Steering Committee meetings 2 (2016), 3 (2017), 4 (2018), and 6 (2019). Actual expenditures consistently fall behind programming.*

56. The Evaluator observes that the original, front-loaded Work Plan could only work if all preparatory studies and engineering was done before Project start, preferably under control of the PPG. Since MEWR had little experience with PV project development and procurement by 2015, there was a high risk that issues would arise during start-up. A more relaxed programming for Year 1 would have given time to MEWR and the DREAM Project team to follow a due diligence process, after which procurement could take off. Typically, substantial time is needed to establish a Project Team and become proficient with government and UNDP procedures and procurement rules. The original Work Plan left no room to mitigate any risks and setbacks making delay and eventual Project extension inevitable. It is recommended to take these considerations into account in the design of future GEF projects.

### 3.3.3 Monitoring and evaluation

57. UNDP has a number of instruments for project monitoring and evaluating progress and results, including: (i) Project Inception Workshop and Report (IW/IR); (ii) Annual reporting (APR/PIR); (iii) Quarterly progress reports (QPR); (iv) Annual work plans (AWP); (v) Steering Committee meetings; (vi) Tripartite Reviews (TPR); and (vii) Mid-term and Terminal Evaluations (MTR/TE). These can be complemented with: (viii) field visits by UNDP (CO and RTA) to the Project; and (ix) ad-hoc evaluations and expert missions.

58. An M&E Plan should be finalised during the inception phase[52] and include a time schedule of programmed M&E events. No formal M&E plan was produced however. The Results Framework is the only monitoring tool which is reported in the annual PIRs. According to the NPC, the risk log was updated in ATLAS, while UNDP CO made available a specific tool for planning and monitoring; this is not reflected in the PIRs or other reports made available to the TE. The second PSC meeting (PSC 2)

[52] This is the period in a project between Prodoc signature and the approval of the first Annual Work Plan.

agreed not to pursue the MTR as per UNDP guidance, as by 2017 this was no longer mandatory for MSPs.

59. The IW was a 1-day event organised in June 2016 by MEWR. The IW took place two months after the first PSC meeting (19 April 2016) as the NPC came on board late. The IR is a 23-page document which provides useful information on GOB expectations and concerns, as well as the interpretation of scope and activities by the key stakeholders. However, the IW falls short of the typical UNDP requirements stipulated in the Prodoc, including aspects such as review of project strategy and fine-tuning of indicators; update of identified stakeholders; clarification and understanding of roles of IP and UNDP; and formalisation of M&E plan.[53] The IR does not provide evidence of active involvement of UNDP in the inception process and no key UNDP staff[54] took part. The IW did not discuss or approve the Project's first AWP, as this was already done at PSC 1.
60. The DREAM project's inception phase shows some flaws which were common for projects from the GEF-4 and GEF-5 cohort. As a lesson learnt, UNDP nowadays tries to pay more attention to the inception process and it is considered a milestone in a project's implementation cycle.
61. Based on the above, the Evaluator rates M&E of the Project as Moderately Unsatisfactory (MU).

| MONITORING AND EVALUATION | |
|---|---|
| CRITERIA | RATING |
| Monitoring and Evaluation | MU |
| Overall quality of M&E | MU |
| Application of adaptive management | S |
| M&E Plan implementation | MU |
| M&E design at project start-up | MU |

### 3.3.4 Project documentation and reporting

62. The Evaluator could access the delivered PIRs, IR and QPRs, which are accurate and of good quality. At TE, the Project's Final Report was not ready yet. Since no staff rotation occurred involving NPC, PS and RTA during the Project's lifespan, reporting is also very consistent. Only one external audit was held (covering year 2016/17), which recommends to look into the reasons behind delay in implementation and rate of delivery.
63. The PV procurement process in the first years looks a bit haphazard: subsequent steps seem not fully thought through and duly prepared. While this can in part be attributed to the lack of experience with the proposed technology (of both MEWR staff and NPC), the Evaluator notes that no Project Operations Manual (POM) was compiled. A POM can be a working draft document to describe GOB and UNDP processes and define roles and responsibilities; a basis can be laid through an annex to the inception report, as roles, procedures and first year workplans are (ideally) discussed and approved at the Inception Report. It can help to accelerate the learning curve and facilitate hand-over to new staff. The use of a POM can be considered a good practice.

[53] See Prodoc, p. 52-53
[54] Most relevant staff would be at least one of the following persons: Program Specialist; M&E Officer, Regional Technical Advisor.

### 3.3.5 Knowledge management

64. The Project did not foresee a formal approach to knowledge management (KM). Recognising this deficiency, knowledge was built up within the Ministry and used for shaping the energy policy agenda. The implemented Business Process Review and resulting ICT solution also sought to improve KM within the MEWR. Lessons and experiences were discussed but not commonly documented and reported, as this is not a GOB priority and there is little spare capacity for this. To disclose these lessons and make them available to UNDP and the GEF, more time would be needed towards Project closure, as well as funding of specific activities in this direction.
65. The Project actively promoted sharing of information between market actors by organising, for example, the Energy Expo´s 2018 and 2019. The events brought together a broad range of stakeholders and generated positive exposure for the Ministry and the DREAM Project.

### 3.3.6 Coordination between stakeholders

66. The Evaluator has limited information to assess this aspect. The key Government stakeholders took part in the Inception Workshop and participation in the PSC meetings was consistently strong (although not always represented by the same individuals) and each entity kept record of minutes and other pertinent documentation. The PSC included institutional beneficiaries which are outside the domain of the energy ministry – as such, the PSC was an inter-sectorial body that worked well.
67. On the other hand, there is a notable distance to non-government stakeholders including civil society (communities) and in particular the private sector, whose role for RE portfolio development was highlighted in the Prodoc. Typically, a GEF project seeks to bridge this gap as part of its efforts to induce a market transformation.[55] In the case of the DREAM Project, the engagement and communication appears rather top-down and focused on information and training. The local communities were addressed through the involvement of the Community Development Department. Communities (and women) were empowered and trained to operate and maintain installed systems and participated in the newly developed NVQ Level 1 training. A stakeholder engagement plan defining the mechanism for interaction with stakeholders was not in place (but this was not required as part of the Prodoc at the time the DREAM project was approved).
68. The Project document anticipated on collaborative arrangements with the SIDS-DOCK initiative but the Project nor UNDP (for example through the Regional Coordinating Unit) seem to have followed up on this. The assistance provided by the International Renewable Energy Agency (IRENA) resulted in the mentioned Road Map. Further work to develop the grid model and identify the necessary grid upgrades however did not prosper as BLPC did not make available the necessary input data.[56]

### 3.3.7 Quality of IA and EA implementation

#### *3.3.7.1 UNDP Implementation*

69. The Evaluator did not find evidence of a very active role of UNDP in the DREAM Project. Support was provided to the NPC to capture financial information in ATLAS and produce status reports. Adaptive management was encouraged, notably by allowing the recruitment of a long-term Technical Officer

[55] It is noted that the Prodoc does not cover activities to dlrectly push a private-sector PV porfolio, although indirectly, the private sector benefits from the PV licensing scheme. Outside the DREAM Project, private sector provided inputs for designing the FIT (by the FTC in 2019).
[56] As of 2020, the situation has improved and BLPC and GOB are developing the Integrated Resource and Resilience Plan for the electricity system, to be completed in the course of this year.

and the changes in the scope of Component 1. However, the Evaluator misses strategic guidance to link actions to the Project objectives, which is a fiduciary responsibility towards the GEF. With the rapidly evolving context, a more solid IW and a MTR might have been appropriate for "retooling" the list of outputs. Efforts to add value to the Project by developing the energy-resilience nexus and engage with the beneficiaries, were not made.

70. While at PIF the Project concept was relatively simple, the subject of the Project grew in complexity while other agencies became involved in Barbados' energy sector as well. The Evaluator raises the question whether UNDP has sufficient specific knowledge in-house to add value for the recipient country. The GOB forged a way forward by trial and error but could have benefitted from a high-quality RE expert provided by UNDP. UNDP offered to make available support services under its Green Energy initiative this was not taken over by GOB.[57] If not based in Barbados, such a person could cover a portfolio of projects from the RCU in Panama. The consultant hired for the peer review was a good move into this direction, but a more structured approach would allow frequent contact moments for analysis and for updating of the work plans.
71. From a wider perspective, the Evaluator questions the effectiveness of a project cycle in which UNDP puts significant resources into the development of a Prodoc rather than adding value to the execution thereof. The time span between project idea (mid 2013) and effective start (mid 2016) was as long as the envisioned execution period (3 years). By then, the Project strategy, coordination with parallel projects, and technical profile of the PV pilots, had all changed. The Evaluator rates UNDP implementation in itself as Satisfactory (S), but would like to exhort GEF and UNDP to reflect on the current project modality to remain relevant in the future.
72. With the rise of new sources of investment capital, such as the Green Climate Fund (GCF), there is a niche for funding of experts for project development and technical backstopping. Too often, human resources are viewed as a cost item rather than the engine driving a Project and creating value. PPG funding and timeliness to partner with a country Government after PIF approval is often insufficient to keep momentum. GEF funds for project management are usually very tight while complementary Government staff cannot be assumed to be available to the Project. At Project closure, project staff is usually no longer on board to collect lessons and enrich the GEF community.[58] Without adequate human resources, GEF agencies will face increasing difficulties to apply and enforce transversal themes and safeguards, and fiduciary standards. The DREAM Project can serve as an example to demonstrate these structural problems in the GEF Project cycle.

#### *3.3.7.2 MEWR Implementation*

73. MEWR acted as the lead Implementing Partner (IP) for the Project, delivering its Permanent Secretary (PS) as the National Project Director (NPD). This high-level position ensured country ownership and was a good entry point to engage with Cabinet. MEWR staff had little previous know-how and experience with UNDP and GEF procedures. Since another Project Execution Unit (PEU) exists within MEWR to implement the IDB programmes, some activities (specifically procurement) might have been combined with a view on efficiency. The GEF Project design did not foresee in such arrangement but at daily activity level the project team actively pursued synergies. The DREAM NPC was recruited by UNDP and paid from the GEF budget.

[57] Communication with UNDP RBLAC RTA, July 2020.
[58] In the case of DREAM, the interaction of the ECREU to provide support still allowed for lessons learned and supporting the TE process even though no MEWR member was formally assigned as project staff.

74. The use of national systems for procurement initially led to delay that can be attributed to inadequate preparation of tender documents. UNDP vetted the national procurement rules[59] but the Project Team lacked experience. In 2018, the PSSEP's procurement officer provided guidance, after which DREAM procurement processes became more expedited. Prodoc signature (December 2015) was also delayed by six months as the document had to be formally submitted to Cabinet for approval. Possibly, MEWR or the GEF OFP could have anticipated on this requirement and adjusted activities accordingly.
75. Human resource constraints in MEWR were observed affecting decision-making processes and delivery capacity, which was also observed in the Prodoc. This barrier was addressed by recruiting a Technical Officer (TO), funded by the Project under UNDP contract. A lesson learned can be that the impact of human capacity gaps within the Implementing Partner should not be underestimated. The position of a technical officer or advisor appears as a good practice worth considering by GEF project designers.
76. From interviews with the NPC, the Evaluator deduces that knowledge of GEF and UNDP procedures should have been stronger. This requires training, which seems feasible given the long-term presence of a core staff group in the Ministry. Staff well-versed in reporting and monitoring will feel more confident to think strategically and becomes more expedite. It is recalled that the project inception phase did not correspond to UNDP's requirements (which are part of the Prodoc) and as a result, the IP started from a disadvantaged position. With a view on the quality and consistence among annual PIRs, involvement of the IP and the GEF OFP is important and can be considered a good practice. However, their participation in the process needs to be enforced; to this purpose, the PIR process would need to be adequately planned and organised.
77. Bearing in mind these limitations, the Evaluator considers that the Project Team did a good job on the ground and proved effective in engaging the stakeholders, as evidenced by their sustained participation in the PSC meetings and the enthusiasm for training and promotional events. Based on the above, the Evaluator rates the role of MEWR as the Implementing Partner as Satisfactory (S).

#### *3.3.7.3 IA and IP Rating*

| IA (UNDP AND IP (MEWR) IMPLEMENTATION | |
|---|---|
| CRITERIA | RATING |
| Overall quality of IA/IP Execution | S |
| IA Execution – UNDP | S |
| IP Execution - MEWR | S |

[59] Interview with MEWR senior officer.

## 3.4 Project results

78. In line with the Evaluation methodology, the Project's outcomes are assessed and rated on the dimensions relevance, effectiveness, and efficiency. Relevance refers to the appropriateness of the Project to address a development problem in line with national priorities and GEF and UNDP objectives. Effectiveness considers the ability of the Project to reach the objectives set forth. Efficiency refers to the cost-effectiveness of the Project and the delivery of results in relation to its cost and the projected timeline.

### 3.4.1 Overall Project results

Relevance

79. The DREAM Project was aligned with national and global environmental priorities as well as energy sector and disaster management policies in Barbados. Alignment with UNDP Country Program at Project design could not be assessed as this document was not made available for the TE. The Project remained a relevant factor for the Government to strengthen sector governance during its implementation (2016-2019). Towards End-of-Project, the GOB had achieved to put the sector including the utility BLPC on a pathway towards a more competitive, low-carbon electricity generation market.
80. In view of the Evaluator, it is the combination of baseline GOB work and the sustained technical assistance from the international community, including subsequent IDB programmes and the DREAM project, which enabled this progress (impact). The DREAM project has enhanced human capacity and competencies within the MEWR which has helped to reduce the asymmetry in sector knowledge and information between the utility and the Government which is critical for assuming sector governance. This process is far from completed but important steps are being made. While attribution to one or another donor initiative is hard to define, the relevance of the overall technical assistance provided can hardly be underestimated.

Effectiveness

81. Project achievements at objective level mainly concerns the volume of RE-based electricity generation and the associated emission reductions (GEF-5 CCM indicators, #1 and #2). Some project-specific indicators were added to describe the uptake of RE power systems in the national electricity matrix and the amount of people who received this "clean energy" (indicators #3, #4 and #5).
82. The Project installed 241 kWp PV systems at CRCs and polyclinics, which were funded from the GEF budget. About 3,850 kWp was installed by the GOB in alignment with the projections made in the Prodoc. A list of installed PV systems is provided in the Annexes G-I for reference. As of June 2020, no comprehensive energy production data for the installed pilot systems could be made to the Evaluator.[60] No physical verification of system operation and performance could be carried out. An ex-post assessment of technical and operational aspects of the pilot installations is recommended.

[60] This is mainly due to the fact that the CRCs and polyclinics are still awaiting internet connection to facilitate remote performance monitoring. The Evaluator proposed to manually record some PV production data for a sample of buildings but no action was taken. Another potential information source are BLPC customer billing data. While an agreement was made to share such data with MEWR, no responses were obtained.

| DREAM Project Overall Effectiveness | | | |
|---|---|---|---|
| Objective Indicator[61] | Target (RF) | Achieved (as of 31 Dec 2019) | Achievement (%) |
| Cumulative direct CO2 emission reductions resulting from the GEF intervention (#1) | 276,895 tCO2eq (10 years) | 136,400 tCO2eq (25 years) | 49% (100%) |
| *- from direct GEF investments in PV (241 kWp)* | | *8,050 tCO2eq* | |
| *- from other investments by GOB (3,850 kWp)* | | *128,400 tCO2eq* | |
| RE-based electricity from the GEF intervention (#2) | 316,090 MWh (10 years) | 156,800 MWh (25 years) | 49% (100%) |
| *- from direct GEF investments in PV (241 kWp)* | | 9,200 MWh (25 years) | |
| *- from other investments by GOB (3,850 kWp)* | | 147,500 MWh (25 years) | |
| Number of people using RE-based electricity (#3) | 18,564 persons | 36,300[62,63] | 195% |
| Share of RE in the power generation mix of Barbados (#4) | 6.8% | 13.0%[64] | 190% |
| Number of RE installations connected to the grid (#5) | 2,000 | 1,923[65] | 94% |

*Table 4 DREAM Project Comparison of achieved results and pursued targets.*

83. The Evaluator therefore made an estimate based on energy production projections for PV in Barbados. The results are presented in Table 4. While the calculated achievement for indicators #1 and #2 is 49%, the Evaluator considers these as fully achieved (100%) for the following reasons: (i) the target value in the Prodoc overestimated by specific power production by almost a factor 2[66]; (2) directly installed capacity (241 kWp) is 160% the anticipated value, producing proportionally more energy and GHG reductions; (3) the total GHG reduction target in the Prodoc assumed a 7.5-MW PV portfolio to be developed under cofinancing sources, but was not tracked by the DREAM Project. Notwithstanding, total RE generation grew by 25.6 MW which is 157% of the target value as per indicator #4 (6.8%, or 16.3MW), without considering the 10-MW utility PV plant.
84. For transparency, the achievements for indicators #1 and #2 are presented separately for direct GEF investments and parallel GOB investments. The Prodoc assumed that attribution was 100% but this is disputable. Information to assess the indicators #3, #4 and #5 were obtained from figures communicated by BLPC to the Project Team. Arguably, the attribution to the DREAM Project is weak, as other agents impacted more directly on these results, including the utility (indicators #3 and $3, by

[61] The numbers in parenthesis correspond to the indicator listing as presented in Table 2.
[62] The definition of this indicator is ambiguous and the interpretation of the word "using" was discussed by the PSC, which proposed to estimate this value by dividing total RE capacity (MW) by total installed capacity (MW), multiplied by the total population of Barbados (approx. 280,000 people). Then indicator #3 and #4 are directly correlated. Arguably, the baseline value was not 0 as stated in the Prodoc as already 710 PV installations were registered under the RER by 2015.
[63] No information was made available to the Evaluator about the number of beneficiaries (male/female) for each of the 9 polyclinics, 22 CRCs and 10 primary schools.
[64] Total installed RE capacity in November 2019 was approx. 25.6 MW distributed plus 10-MW utility PV plant (source: email communication BLPC and NPC, December 12, 2019). Total conventional capacity in Barbados was 239 MW (2017). Source: Energy Transition Initiative Islands, NREL (2015), https://www.nrel.gov/docs/fy15osti/64118.pdf.
[65] Status as of November 30, 2019 based on PV connections registered by BLPC... Annual electricity production was 30.84 GWh over period Jan-Nov 2019.
[66] In terms of energy production and GHG emission reduction, the Prodoc departs from a figure of 8.0 usable hours per day, while the PV supplier (polyclinics) uses a value of 4.2 usable sun hours, which is more realistic. On the other hand, an economic lifetime of 25 years is used (with a need for replacing the inverter by year 13) instead of the 10-year time horizon in the Prodoc. Direct GEF investment led to 0.24 MW PV capacity, while parallel GOB funding accrued 3.85 MW.

bringing 10-MW PV on line), and households installing rooftop PV (#5). In the latter case, DREAM's attribution is more relevant by enabling swift handling of license requests.

Efficiency

85. The Evaluation has reviewed a sample of the services and consultancies procured under the Project (see list, Annex E). A simple comparison with other countries is not straightforward as price levels in Barbados tend to be high. Reference costs were requested from MEWR and UNDP but not made available. As a general appraisal, the Evaluator judges the value of the services and goods delivered as acceptable in relation to the cost level. Since the only financial audit (2017) does not give an opinion at this point, the Evaluator would welcome an internal evaluation exercise by MEWR.
86. As per December 31, 2019, the Project had disbursed 90% of GEF funds as per Table 5.

| REMAINING GEF BUDGET AS PER 30 SEPTEMBER 2019 | | |
|---|---|---|
| BUDGET | (US$) | (%) |
| Total project funds (GEF) | 1,726,484 | 100% |
| Total expenditure as of 31 December 2019 | 1,554,381.91 | 90% |
| Remainder | 172,102.09 | 10% |
| Committed funds[67] | 37,000 | 2.2% |
| Nett remainder | 135,102.09 | 7.8% |

*Table 5 DREAM Project overall GEF budget and actual disbursed amount.*

87. The changes in budget categories are presented in Table 6: (i) a three-fold increase of local consultants, from US$ 156,000 (9.0%) to US$ 438,961 (28.2%); (ii) a modest but unforeseen appeal on international individual consultants to the amount of US$ 35,789 (2.3%); (iii) a far lower use of services contracted from companies of US$ 102,641 (6.6%) compared to the programmed US$ 434,000 (25.1%); (iv) procurement of PV installations totalling US$ 760,669 (49%) compared to the originally envisioned US$ 1,072,000 (62.1%)[68]; and (v) significant expenditures US$ 189,491 (12.1%) were incurred under learning costs (budget line 75700), which was not foreseen at Prodoc.
88. The changes compared to the original budget can be explained as follows. The role of the NPC was fulfilled by a qualified engineer who assumed project management part-time while also contributing to deliver the project components. Alongside contracted services, substantial work was done by the Project Team internally. In 2016, a Technical Officer (TO) was brought on board to prepare PV projects, engage with beneficiaries, prepare technical proposals and supervise the contractors. The NPC and the TO were contracted by UNDP under budget line 71400. The GOB also recruited some short-term consultants directly under budget line 71800. Contractual services from companies (72100) falls behind because several large studies under Component 1 were not implemented with Project funds.
89. The PV systems were procured under budget lines 72200 and 72300 (the reason for this differentiation was not clarified). Worthwhile noting is that procurement of the PV systems by GOB was for goods rather than engineering, procurement and construction (EPC). The PV investments are

[67] The project was operationally closed 31 December 2019. The TE was published by UNDP October 2019 but could not be implemented in that year. The committed funds were therefore transferred to GOB to enable execution of the TE and the final audit early 2020.
[68] This is an approximate figure. PV installations were registered under budget lines 72200 (equipment) and 72300 (materials and goods).

about US$ 250,000 less than anticipated, which is partly explained because the remainder of US$ 135,102 could not be used anymore as the Project closed end 2019. Learning costs involved several training activities including training of IP staff (ArcGIS, DIgSilent) and external individuals (specifically the NVQ 1 PV curriculum). Travel expenses were not booked separately (budget line 71600) but included in the other activities.[69] The international consultancy concerns the peer review of the utility license.

| ORIGINAL BUDGET AND ACTUAL EXPENDITURES PER MAIN ATLAS BUDGET LINES (GEF) | | | | | |
|---|---|---|---|---|---|
| BUDGET LINE AND DESCRIPTION | | PROJECT DOCUMENT (US$) | | ACTUAL EXPENDITURE (US$) | |
| 71200 | International Consultants | 0[70] | 0% | 35,789.92 | 2.3% |
| 71300 | Local Consultants | 156,000[71] | 9.0% | 46,228.24 | 3.0% |
| 71400 | Contractual Services – Individuals | 0 | 0% | 322,437.43 | 20.7% |
| 71800 | Contractual Services - Indiv ImpPtnr | 0 | 0% | 70,295.87 | 4.5% |
| 72100 | Contractual Services - Companies | 434,000 | 25.1% | 102,641.21 | 6.6% |
| 72200 | Equipment | 1,000 | 0.1% | 186,065.00 | 12.0% |
| 72300 | Materials and Goods | 1,072,000 | 62.1% | 574,604.03 | 37.0% |
| 72605 | Grants to Institutions | 50,000 | 2.9% | 0 | 0% |
| 75700 | Learning Costs | 0 | 0% | 189,491.70 | 12.2% |
| | Others | 13,484 | 0.8% | 26,828.51 | 1.7% |
| | Total | 1,726,484 | 100% | 1,554,381.91 | 100% |
| | Remainder | | | 172,102.09 | |

*Table 6 Original GEF budget and actual expenditures DREAM project per ATLAS budget line.*

Cofinance

90. Substantial financing sources for investment in RE and EE became available since the DREAM Project was designed, including: (i) PSSEP, funded by the IDB and EU in the sum of US$17 million and Euro 5.81 million respectively; (ii) second phase of the Sustainable Energy Investment Programme "Energy Smart Fund II", funded by IDB and EU to US$ 45 million; (iii) Technical Cooperation Agreement with the Republic of Korea (US$ 3 million grant); (iv) the fourth iteration of the IDB SEFB programme; (v) funding of PV water pumping facilities for the Barbados Water Authority (BWA) by the United Arab Emirates (UAE) Caribbean Renewable Energy Fund (US$ 3.5 million)[72]; and (vi) the Green Climate Fund project "Water Sector Resilience Nexus for Sustainability in Barbados (WSRN S-Barbados)" with a project value of US$ 45.2 million.[73]
91. Table 7 summarises the cofinance resources as committed at GEF CEO endorsement and that reported by the IP by Project closure. The reported total was US$ 5.34 million investment in PV on public buildings (from the PSSEP) and leveraged other sources (US$ 51.17 million) for investment in RE. Concessional loans committed at CEO Endorsement were US$ 29.8 M to deliver 10 MW rooftop capacity. Specific costs however dropped from the envisioned 3,000 US$/kWp to well below 2,000

[69] Notably, 8 MEWR and 2 Project staff travelled to Trinidad to participate in the grid modelling training.
[70] According the CEO ER, p.2 Table 1, International Consultants would be funded from co-finance resources worth US$ 100,000.
[71] Ibidem. Local Consultants would be funded from co-finance resources to the amount of US$ 250,000.
[72] See: http://www.ipsnews.net/2018/11/uae-caribbean-renewable-energy-fund-projects-underway/
[73] See: https://www.greenclimate.fund/project/fp060.

US$/kWp. Rooftop installations at private households with GOB funding hardly happened; these were privately funded and not tracked by the Project. However, large ground-mounted PV project are being brought online, initially the 10-MW BLPC plant and currently the BWA systems. These investments were not monitored by the Project Team.

92. The Ministry did not keep record of in-kind contributions, such as staff support and office space. Considerable cofinancing was involved to deliver national policies (C1), participation in training by GOB staff and communities (C2), and development of tenders (C3). GEF Agency committed US$ 0.4M associated to related projects but there is no evidence of such support.

| DREAM Project - Committed and Reported Cofinance | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Co-Financing (Type/Source) | GEF Agency | | Government | | Other Partners | | Total | |
| | Planned | Actual | Planned | Actual | Planned | Actual | Planned | Actual |
| Grants | 0 | 0 | 0 | 0.14 | - | 3.0 | | 3.14 |
| Loans/concessions | 0 | 0 | 29.8 | 5.2 | - | 48.7 | 29.8 | 53.9 |
| In-kind support | 0.4 | n/a | 0.95 | n/a | - | - | 1.35 | n/a |
| Totals | 0.4 | n/a | 30.75 | 5.34 | - | 51.7 | 31.15[74] | 57.04 |

*Table 7 DREAM Project committed and reported cofinance sources.*

93. The presented figures demonstrate that the DREAM Project was embedded in a very dynamic context with fast growing capital inflows. GEF funding for delivering the licensing regime and supporting an overall planning framework, was relevant to enable current investment rates.

## 3.5 Project results per outcome

### 3.5.1 Outcome 1: Strategic plans and licensing regime approved for accelerated RE development (Budget: US$ 377,000 GEF; US$ 260,000 cofinance)

#### *3.5.1.1 Description of activities and delivered outputs*

94. The purpose of Component 1 (C1) was to address identified gaps in the RE policy framework, specifically the lack of strategic plans (1.1), an independent assessment of the grid to determine the RE capacity that could be connected (1.2), and a licensing regime for grid-connected solar PV systems above 5-kW (1.3). Table 8 presents the outputs and activities as proposed in the Prodoc and the actual deliveries. As can be seen, substantial changes were made. Simplifying matters somewhat, the PSC concluded that Output 1.1 was premature given the previous grid analysis, while Output 1.2 did not need GEF funding. The original scope of work was largely implemented by the GOB and spared GEF funds were redirected towards other activities.

| DREAM Project Component 1 - Renewable energy policy framework | | |
|---|---|---|
| Output 1.1 Grid stability assessment | Scope (Prodoc) | Products Delivered |
| | • Grid characterization to inform GOB, BLPC and other stakeholders; | Not implemented. Because electric system information was not made available by BLPC. |

[74] The planned cofinancing figures used in this table are derived from Prodoc, Table 7. The total amount is US$0.25M above the figure in CEO ER, p.2, Table D (US$30.9M), which seems incorrect.

| | | |
|---|---|---|
| | • Procurement of software for load flow analysis and grid modelling grid planning; and training for grid operational staff; | Implemented.<br>DIGISILENT software purchased September 2017. Supplier training provided 25-29 June 2018.[75]<br>Training October 2019 for MEWR staff (10 persons) at Engineering Institute, UWI Trinidad. |
| | • Grid analysis based on dynamic simulation and load flow for entire island grid; | Not implemented by DREAM project.<br>Two earlier analysis had been carried out (BLPC 2013 and UNDP as part of PPG). A new study was considered not useful without having access to sector data from BLPC (decision: PSC Meeting 2). |
| | • Evaluation of national grid codes applicable to RE generators and recommend enhancements to secure grid stability and reliability; | Not implemented. For similar reasons (decision: PSC Meeting 2). |
| | • Electricity cost estimates for various RE penetration scenarios. | Not implemented by DREAM project as it was covered by a previous study[76] (decision: PSC Meeting 2).<br>Outside the Project and MEWR, cost estimates and methodologies were developed for the FIT by the Fair Trade Commission (September 2019). |
| Output 1.2 Strategic planning for solar-PV deployment in Barbados | SCOPE (PRODOC) | PRODUCTS DELIVERED |
| | • Market assessment of distributed (rooftop) PV and scoping of centralised solar PV farms. | Implemented through cofinance resources (MEWR):<br>Study by Prof. Olav Hohmeyer (2017). |
| | • Strategies, recommendations, actions and codes to secure grid reliability including associated cost of grid upgrades. | Implemented through cofinance resources (MEWR):<br>(1) BNEP Implementation Plan, by L. Harewood (December 2018) and (2) RE Road Map for Barbados, by IRENA (2016). DREAM Project support through participation in workshops and meetings. |
| | • Design of a phased solar-PV programme consisting of an extension of the RER based on new solar-PV installations; possible centralized solar PV generation locations; and required grid investments. | Implemented through cofinance resources (MEWR): BNEP Action Plan.<br>Outside DREAM Project and MEWR, Feed-In Tariff schemed was developed by FTC and approved by Cabinet (September 2019).<br>Centralised solar PV generation was (10 MW) was Implemented by BLPC.<br>Grid investments not implemented pending grid analysis (currently: IRRP). |
| | • Design of a solar-PV allocation system that incorporates principles of parity and equal opportunities for solar-PV installations. | Implemented through cofinance resources (MEWR): BNEP Action Plan (work in progress). |
| Output 1.3 Approved and strengthened licensing procedure for RE projects | SCOPE (PRODOC) | PRODUCTS DELIVERED |
| | • New licensing regime for solar-PV installation. | Implemented (draft)<br>Individual consultancy October – December 2016 (Dr. R. Clarke). |
| | ADDITIONAL ACTIVITIES IDENTIFIED AS A RESULT OF ADAPTIVE MANAGEMENT | |
| | • Peer review of utility licence | Implemented. Following recommendation by UNDP to accompany MEWR during review process.<br>Individual consultancy October - November 2017 (Mr. J. Ramirez). |
| | • Legal review of utility licence | Not implemented. |

[75] Quarterly Report Q1, 2018.
[76] Study "Economic Analysis to Facilitate the Establishment of a Stable Price for Electricity from Renewable Sources", by Dr. Olav Hohmeyer for PMO-DoET, March 2017.

| | | |
|---|---|---|
| | | Individual consultancy for which TOR were developed and discussed with MEWR. |
| | • Knowledge Exchange Workshop | Implemented. Organised by DREAM Project Team to expand and replace legal review.<br>Workshop held April 15-18, 2019 at Marriott Hotel Barbados. Resource persons funded by GEF: Mr. J.P. Morgan and G. Wilson (Jamaica). |
| | • Training on ArcGIS software | Implemented (20 participants, of which 18 successfully completed the course (10 male, 8 female).[77]<br>Training 10 April – 4 May 2018 at CERMES, UWI Cave Hill Campus, by Dr. Kimberly Baldwin. |
| | • Business Process Reengineering (BRP) to enable MEWR to handle RE license requests through redesign of internal processes and Enterprise Content Management (ECM) software. | Implemented.<br>Service contract LPA Corporate Solutions, final report October 20, 2019.<br>ICT Implementation Road Map was submitted. |
| | • Procurement of ICT infrastructure (servers) for implementing CRM, GIS, and DIGISILENT software | Delivered.<br>Server system invoiced by LPA Corporate Solutions, November, 2019. |

*Table 8 DREAM Project Component 1: Renewable energy policy framework.*

Grid characterisation and grid study

95. The implementation of these activities was hampered by the fact that grid data are controlled by BLPC. Through its representative in the PSC, the utility advised of an agreement with the mother company (Emera Caribbean Ltd) that cannot be infringed (PSC 3). Late 2016, the PSC decided not to implement the grid stability study as two earlier analysis had been carried out and a new study was not useful without having access to the data from BLPC.
96. As noted, the electricity sector in Barbados historically was centralised into the vertically integrated monopolist (BLPC). All assets, technical information and operational procedures were (and are) controlled by the utility, while tariffs and quality aspects are governed by the FTC. Since 2009, the GOB is gradually taking more control but large information asymmetries persist, as demonstrated by the difficulties encountered under this activity.[78]
97. Anticipating on an increasingly stronger role for the GOB, the PSC agreed to focus on capacity building in the Ministry. UNDP (PSC 2) suggested to develop proposals into this direction and adjust the Project's scope. Initially (PSC 3), the spared funds were earmarked to implement selected recommendations coming out of the needs assessment being executed by the Public Sector Smart Energy Programme (PSSEP). However, due to delays of the latter the timeframes did not match and the DREAM Project decided to move ahead.

Training and capacity building

98. The Project went on to procure grid modelling software, the package DIgSilent[79] being selected from a shortlist of 3 compliant packages. The purchase included 2 days of online vendor training.

[77] QR Q2, 2018. The training was a joint exercise between MEWR, GEED and the MoH's Vector Unit. The goal is for these ministries to collaborate on a common ArcGIS model for Barbados, eventually to be expanded to all ministries in GOB.
[78] Early 2020, BLPC finalised it internal Expansion Plan. Under purview of MEWR, the Integrated Resource and Resilience Plan (IRRP) was started Q2 2020.
[79] See: https://www.digsilent.de/en/

Orientation to MEWR staff was also provided on the possibilities of geo-referencing mapping tools, through procurement of, and training in ArcGIS software[80]. The PSC recommended MEWR to develop a strategy for the future use of the software but this was not formalised.[81] Also a Smart Board[82] licence was procured to stimulate collaborative working methods at MEWR and improve efficiencies, as the MEWR was essentially paper-based.

99. Given the delayed PSSEP needs assessment, a decision was made (PSC 5) whereby the DREAM project would execute a Business Re-engineering Process (BRP) for the MEWR with the results being fed into the PSSEP. Terms of reference for the BRP were prepared and the consultancy was scheduled for the second half of 2018. The PSC agreed that the BRP should be well documented to validate its usefulness and support the possibility of widespread adoption. Eventually, the contract was signed early February 2019.[83]

100. The deliverables included a roadmap with short, medium- and long-term recommendations towards becoming paperless, reducing inefficiencies and improving ease of doing business with MEWR. The specific focus was on processing and issuing of RE licences. The consultants recommended hardware and software solutions. Towards the end of the consultancy, a server system was purchased from the same supplier to host all software packages and databases developed under the DREAM project.[84] The final report was delivered October 2019.[85]

Strategic plans

101. The Project Steering Committee (PSC 2) determined that national energy policy being developed by the Ministry was adequate and did not need further GEF support. These plans are the Barbados National Energy Plan (updated in 2019), the BNEP Implementation Plan (2018) and the earlier energy roadmap produced by IRENA in 2016; the latter was accepted by the GOB but not published as a formal policy document. The Evaluator concludes that the targeted number of strategic plans (2) is attained using parallel funding, with the DREAM Project Team providing some inputs and feedback to the Ministry. No direct activities were implemented by the Project to deliver these plans.

Utility licence

102. Mid 2016 a national consultant was recruited to develop a new, comprehensive utility license. The deliverables submitted included: (i) Draft Licence Terms and Conditions; and (ii) Draft Application Form. However, review by MEWR proved slow due to human resource constraints. Therefore, PSC 2 proposed that MEWR would hold monthly internal meetings to gain momentum, while a contract extension was offered to 31 March 2017. However, parties agreed to terminate the consultancy contract and the last deliverable was cancelled (PSC 3) leaving no further obligations.

103. Acknowledging the complexity of the matter, an international consultancy was proposed for peer review and completion of the license documents. Terms of reference were submitted May 2017 with

[80] See: https://www.esri.com/en-us/arcgis/about-arcgis/overview/

[81] The following indicator was added to the Results Framework: "number of persons trained in the use of the software disaggregated by gender", baseline 0, target 8.

[82] See: www.smarttech.com/

[83] See: https://lpa-corporate-solutions-caribbean-limted.business.site/

[84] This purchase was not foreseen in the Prodoc work plan and budget. One would expect it to be booked as information technology equipment (ATLAS budget line 72800).

[85] See report: "Consultancy Services for the Execution of a Business Process Reengineering Project for the Ministry of Energy and Water Resources", LPA Corporate Solutions, October 20, 2019.

UNDP carrying out the procurement process. The chosen candidate was selected from the UNDP roster in Panama. Work started on 4 Sept 2017 with a mission to Barbados 28-29 Sept 2017. The peer review proved satisfactory and provided further insight in fundamental challenges and political choices to be made for shaping Barbados' future electricity sector framework.

104. These include the need to license power generation from other utility functions (the typically monopolistic functions (grid operation, transmission and distribution) as well as commercialisation). Generation licences would apply to independent power producers (IPPs) including those based on RE technology, as well as the existing utility (BLPC). The consultancy advised that legal aspects would need to be assessed by a national expert. In response, PSC 5 decided to develop TOR for the legal peer review (2017). Since no agreement could be made about the candidate for the legal peer review, this consultancy was eventually cancelled.

105. Instead, a 4-day workshop "Visioning for 2030" was facilitated by the DREAM project in April 2019. During this workshop, the team was able to identify weaknesses and gaps in the existing ELPA and the draft licensing documents and recommend ways for it to be improved. Experts from the Caribbean region acted as resource persons to clarify the roles and responsibilities of sector entities for MEWR staff under a new license regime. An important outcome of the workshop was that it prepared MEWR start negotiating a new utility licence with BLPC by mid-2020.

#### *3.5.1.2 Relevance*

106. DREAM support under Component 1 was part of a broader thrust towards a restructuring of Barbados' electricity sector. One can argue whether the proposed outputs were properly identified and timely, as the grid study (1.1) was postponed and strategic planning (1.2) was not funded from the GEF budget. As of 2015, the new ELPA had just entered into vigour in the expectation to enable private RE generation through IPPs and an appropriate approval mechanism for RE systems was needed – to be delivered by output 1.3 of the DREAM project.

107. Additional barriers were in place preventing the uptake of IPPs, which were not addressed under the weak (incomplete) vertical logic of the Project. In fact, the utility itself took benefit from the ELPA and the PV licensing system and implemented a 10-MW solar farm in 2018. Progressive insight helped the GOB by 2017 to prepare the current BNEP and its Implementation Plan, which outline the key steps to be taken towards a liberalised electricity generation model. As mentioned, this process is far from completed and by all means too complex to be addressed by a GEF Medium-size Project.

108. Most outputs under this component were delivered through parallel funding sources. The lines between the DREAM Project and other activities were not always drawn sharply, timing was an issue and GOB's approach was pragmatic – not to say that GEF resources were used as basket funding. One may question the need for GEF funding alongside IDB's SEFB; however, the defined targets were valid and actually pursued and delivered. Post-project, work is ongoing including BLPC's expansion plan (April 2020), the IRRP (started June 2020) and negotiation of a new utility licence.

109. In this context, the Evaluator rates Outcome 1 as Relevant (R).

#### *3.5.1.3 Effectiveness*

110. Table 9 presents the achievement of the output indicators for Outcome 1. Note that no outcome level indicator was defined. As can be seen, the Project exceeded the targets set for indicators #6 and #8. However, the baseline situation presented in the Prodoc (April 2015) did not adequately reflect the situation at Project inception (June 2016). Indicator #6 was funded from other sources with little

or no assistance from the Project, while the PSC decided not to implement the grid stability assessments (indicator #7). Hence, none of these results can be attributed to the DREAM Project. On the positive side, the purchase of grid modelling software (DIGSilent) and training prepared GOB and BLPC to use this tool for developing the IRRP in 2020. This can be considered an example of adaptive management as the envisioned impact was eventually achieved.

| OUTCOME 1: STRATEGIC PLANS AND LICENSING REGIME APPROVED FOR ACCELERATED RE DEVELOPMENT | | | | |
|---|---|---|---|---|
| OUTCOME/OUTPUT INDICATOR[86] | TARGET (RF) | ACHIEVED (AS OF 31 DEC 2019) | ACHIEVEMENT (%) | VERIFICATION/ OBSERVATIONS |
| Number of strategic plans completed for RE development in Barbados with targets and milestones (#6) | 1 | 2 | 200% | (1) National Energy Policy (2017, updated 2019) and Implementation Plan (2018); (2) RE Road Map for Barbados, by IRENA (2016). Produced through cofinance. |
| Number of grid stability assessments on VRE penetration into the Barbados grid (#7) | 1 | 0 | 0% | Deemed premature as two studies were produced prior to project start. Hence baseline was 2 and not 0 as in Prodoc. |
| Number of RE licenses that received direct Project assistance (#8) | 6 | 36 | 600% | One hospital and 35 private sector[87] |

*Table 9 Achievement of outcome and outputs for DREAM Project Component 1.*

As most of the targets were achieved, the effectiveness of Outcome 2 is rated as Satisfactory (S).

#### *3.5.1.4 Efficiency*

111. The actual expenditures (GEF funds) to deliver Outcome 1 ascended to US$ 377,645 which is just 0.17% above the original budget (US$ 377,000). However, the scope of the component was modified (PSC 2), making a comparison of ex-ante and ex-post project costs impossible. With the new focus on capacity building and the licensing regime, DIGSilent and ArcGIS software and training software were funded from C1; the results however contribute to C2 (indicator #12). Outputs that were not envisioned at design stage include procurement of a computer server system for MEWR and the BRP enterprise consultancy exercise. Bases on a simple review of the quality of the products delivered and the contract prices, the Evaluator believes that value for money was acceptable. As such, efficiency of Outcome 1 is rated as Satisfactory (S).

#### *3.5.1.5 Outcome rating*

| OUTCOME 1: STRATEGIC PLANS AND LICENSING REGIME APPROVED FOR ACCELERATED RE DEVELOPMENT | |
|---|---|
| CRITERIA | RATING |
| Overall quality of project outcome | S |
| Relevance | R |
| Effectiveness | S |
| Efficiency | S |

[86] The numbers in parenthesis correspond to the indicator listing as presented in Table 2.
[87] No further evidence was provided by the Ministry.

### 3.5.2 Outcome 2: Institutional and technical capacity and awareness strengthened for clean energy development (Budget: US$ 83,000 GEF; US$ 390,000 cofinance)

#### *3.5.2.1 Description of activities and delivered outputs*

112. Project component 2 was intended to build capacity in Barbados to plan[88], design, implement, operate and maintain RE projects. Table 10 summarises the activities as outlined in the Prodoc and the deliveries achieved by the Project.

| DREAM PROJECT COMPONENT 2 - CLEAN ENERGY CAPACITY DEVELOPMENT | | |
|---|---|---|
| Output 2.1 RE awareness raising programs at community and resource centres | SCOPE (PRODOC) | PRODUCTS DELIVERED |
| | • Target awareness through activities at community and resources centres under MoSCCECD | Implemented.<br>Service contract Liz Quintyne and Nayus Consultancy. Final Report April 20, 2017.<br>1st and 2nd Energy Expo held November 24, 2018 and November 23, 2019 at Lloyd Erskine Sandiford Centre.<br>Support to Energy for Young Minds programme January, 2019 (online portal for students giving access to Caribbean energy data).<br>Signage and posters at CRCs and sport pavilions. |
| 2.2 Solar development vocational training programmes | • Vocational workshops on installation and O&M of solar PV installations primarily targeting local contractors and unemployed youth | Implemented<br>The Level 1 National Vocational Qualification (NVQ) in PV installation through the Technical and Vocational Education and Training (TVET) Council, started August 6, 2019 (20 participants). Three 1-day workshops were held by DREAM Project (88 participants). |
| | • Certification of local youth to be employed when demand for such vocational skills increases | Implemented.<br>Level 1 NVQ-TVET. November 2019, 13 individuals certified. Job attachments and internships provided through private sector engagement upon successfully completion of the NVQ. |
| | • Seminars on specific RE topics (PV installation, wind measurements, management and O&M of RE projects). | Implemented.<br>DREAM Project Team offered ad-hoc seminars and information meetings to local stakeholders, on demand. |

*Table 10 DREAM Project Component 2: Clean energy capacity development.*

<u>Community awareness raising campaign</u>[89]

113. In January 2017, a consultancy was commissioned to facilitate and support greater awareness and appreciation of RE, covering aspects such as GOB legislation, costs and technology, training and job opportunities in the sector. The core group were community level youth and under-employed persons, with the underlying intention of GOB to take benefit from the DREAM project to create synergies in terms of job creation. More specifically, identified key target groups included: (1) government housing dwellers; (2) under- or unemployed individuals, typically under age 30, the so-called "guys on the block"; (3) older partially employed males; (4) rural communities; (5) children who

[88] As far as I have seen, the only entity which plans is the GOB and they are not the target group of this component.
[89] For details, see: Final Report – Consultancy to design, develop and deliver Renewable Energy awareness raising programs, by Liz Cupples, Liz Quintyne Inc, 20 April 2017.

will soon leave school; (5) parents of school children, presumably women in majority; and (6) university and vocational college students and graduates looking for future job sectors.

114. After determining the behavioural changes required, the consultancy looked into the materials needed to raise awareness and deliver the key messages. With the eleven (11) workshop locations already set by GOB, communication methods were explored which these target groups could understand and accept. Clearly, the target communities were not groups to engage through a lecture. The consultancy therefore assessed and detailed elements including: branding and promotional theme; articulation of content[90]; overlapping interest areas for the target audience; and their interest for further training.

115. The campaign was branded as "Flip the Switch" with several multiple connotations[91] including changing lifestyles; switching to RE; making a change to a better, healthier life; have the knowledge to make better environmental choices; turn on a new greener lifestyle; turn on clean electricity; etcetera. The consultants acknowledged that the concept was not original but has been used worldwide proving its popularity internationally.

116. The campaign started at the indicated schools, which had mixed results despite intense promotion. This confirmed the general experience that schools are typically less suited for townhall type meetings due to their size, connotation and location. In response, the Ministry decided to change the other previously agreed school venues to community centres in the heart of residential zones mid-campaign, improving attendance at events. Stakeholders agreed to five events in schools – the Princess Margaret School (St Philip), the St Michael School and St Leonard's School, Bridgetown because of their central locations in the community zones, Community College and Samuel Jackman Prescod Polytechnic.

117. The presentation was developed as a Games Night to engage the communities in a competition for prizes where they learn key information about RE "which is generally viewed by the wider public as too technical".[92] By developing a games event, people absorbed the required information in a fun way and repeated it, showing that they understood it. The game format was designed to reach all 4 learning styles: - auditory, kinetic, visual, tactile.[93] The game style method of delivery of information appealed to a wider age-group than expected which can allow for an expansion across Barbados including now older and younger people. The private sector sponsored the events and offered apprenticeships.

118. In summary, the activity was successfully executed and managed to draw the attention of the target groups and provided MEWR with assets for promotion and replication across the island.

<u>Vocational training and certification</u>

119. During project execution, it was found that Level 2 and Level 3 National Vocational Qualifications (NVQs) in solar PV, and courses at these levels, were already being offered at the Samuel Jackson Prescod Institute of Technology (SJPI) and the Barbados Community College (BCC). To facilitate a step-

[90] The following categories were proposed by GOB: "what's in it for me" (job opportunities); learning opportunities; solar PV, and "good to know" (relevant facts and messages).

[91] "Flip the Switch" is a play on words based on the local term 'Flip the Script' familiar to communities and built upon the original main brand message of MEWR "Smart Energy, Live Smart".

[92] Quotation from Final Report Liz Quintyne Inc, 20 April 2017, p. 5.

[93] I.e. the communities heard the information, the visual learners saw cartoon pictures in videos and handouts and a moving game and balloons, the kinetic learners could play darts and beat others by getting their hands in the air, and academic learners had notes and power point notes to read.

in from the target groups into the RE sector, the feasibility of a Level 1 NVQ standard was positively assessed. The Technical and Vocational Education and Training (TVET) Council was engaged to develop the Occupational Standard and curriculum for the solar PV installation Level 1 National Vocational Qualification (NVQ). In 2019, MEWR accepted the proposal from this Council.

120. The Standard stipulates that Level 1 is for persons aged sixteen (16) years and above. There are no formal entry requirements but candidates will require full supervision when undertaking certain tasks. It is an entry-level, competence-based qualification that covers the basic maintenance of PV arrays and systems. It is designed to introduce and educate persons about the technology enabling them to assist seasoned PV installers on the job. Those who complete the Level 1 qualification have an access route to Level 2.[94]

121. The standards of competence covers aspects of the work such as the introduction to the different types of tools used in the industry and how to store them safely. It also explains how to observe Occupational Health and Safety when working at heights and performing basic cleaning activities. It also addresses care for the environment and removal of waste and debris from the work space. Candidates are required to answer theoretical questions and demonstrate their practical skills.

122. Twenty (20) candidates were trained, as a pilot, under the project. The DREAM project supplied the Community Development Department (CDD) with the necessary tools, PV equipment and Personal Protective Equipment (PPE), and paid for the registration and assessment of the first cohort of students being trained in the level 1 NVQ course. Contracts for the two trainers, three assessors and internal verifier were issued.[95] The 3-month course was held every day from 9am to 3pm at the Haggatt Hall Resource Centre, commencing August 6, 2019.

123. Subsequently, thirteen (13) persons registered for assessment to obtain the Certificate. As a result of engagement with PV installers, job attachments and internships were created open for those who successfully completed the NVQ 1. This provided an extra incentive for candidates to finish the course and prepare for the assessment. The course, developed with support from the SJPI and the GEED, is announced at the TVET website.[96] Based on the achievements and context, the Evaluator concludes that the output was successfully delivered and embedded into a solid host institution. [97]

#### *3.5.2.2 Relevance*

124. Component 2 aimed at strengthening the supply chains for solar PV. For SIDS such as Barbados, market size, employment opportunities and business development are as relevant as challenging.

125. The number of bidders to the tenders suggests that insufficient supply was (and is) probably not a large barrier as was assumed. Market players had already pushed for professional training and by Project start, NVQ 2 and 3 Level certification was in place. The Level 1 training looks appealing but would require monitoring over a longer period (several years) to draw conclusions as to whether individuals will become actually employed in the market and whether their initial profile (i.e. no specific competences required) will not prove to be a hurdle for professional growth.

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[94] Source: Qualification Overview NVQB in Photovoltaic Installation Level 1, Technical and Vocational Education and Training Council, Version 1.0, October 2019. TVET, Hastings House West, Balmoral Gap, Christchurch, Barbados.

[95] The activity was actually funded from Component 3 to the amount of approx. US$ 55,000.

[96] See: https://www.tvetcouncil.com.bb/Qualifications/Photovoltaic-Installation-Level-1.aspx

[97] Reportedly, the first Level 2 course at SJPI started January 20, 2015, three months before final submission and clearance of the DREAM project documentation by GEF.
Source: www.investbarbados.org/newsmain.php?view=Barbados%20SJPP%20to%20Launch%20Course%20in%20Photovoltaic%20Installations.

126. The reasoning of attracting young people to the RE sector to speed up RE installation rates seemed too simple. This is an example of the incomplete vertical logic of the DREAM Project. On the other hand, the Level 1 course likely helps community members to become more self-confident and contributes to the cause of RE in Barbados.

127. The PSC suggested to drop indicator #11 as contact with tradespersons was limited. [98] Rather than departing from a training perspective, an SME development approach might have been more appropriate to engage with the private sector in a more comprehensive manner. Given the small home markets in individual SIDS, the Evaluator would recommend MEWR and UNDP to seek opportunities to link the current achievements to business development programmes in Barbados and the broader Caribbean region to preserve momentum and also generate a sufficiently large market for qualified professionals.

128. The training in electric grid analysis and monitoring was useful but primarily targeted MEWR. The Prodoc mentions training of grid operational staff[99], which suggests that training of BLPC staff was also foreseen (as BLPC is the system operator). The original intention was probably that MEWR and BLPC would work together. As of today, the capacities created under DREAM serve MEWR to develop and evaluate IRRP scenarios using the procured software and hardware. In order to assure sustainability of training activities, the PSC recommended to develop a detailed capacity building and training plan within MEWR (which was eventually carried out through the PSSEP).

129. The activities served as a catalyst for outreach to communities and engagement with public entities, suppliers, and educational institutions, which contributed to the overall goal to create awareness and basic understanding of RE and the role of clean, affordable, and resilient energy supply for Barbados.

130. Based on the above, the TE rates Outcome 2 as Relevant (R).

#### *3.5.2.3 Effectiveness*

131. Table 11 assesses the achievement of outputs in relation to the indicators established for Component 2 in the RF. It is noted that the activities towards achievement of indicator #12 were funded under Component 1. Based on a review of the material provided as well as interviews with stakeholders, quality and appropriateness of the activities is evaluated as very good. Indicator #11 was achieved through parallel initiatives (SJPI started training in 2015) with no direct contribution from the DREAM Project. The first batch of qualified students (75) was delivered in 2019.

132. As most of the targets were achieved, the effectiveness of Outcome 2 is rated as Satisfactory (S).

[98] Moreover, no mechanism was envisioned to enable such contact. The Project was embedded within the GOB having the roles of sector supervisor and buyer of goods from private suppliers. Collaborative approaches as often proposed under GEF project often tend to lead to potential conflicting roles or are even not allowed at all. This kind of implications should be duly assessed at project design. In the case of the DREAM Project, some activities could have been assigned to a non-Government entity that is better positioned to act as an intermediary (such as BREA).

[99] Project Document, p. 28: Output 1.1 Grid stability assessment.

| OUTCOME 2: INSTITUTIONAL AND TECHNICAL CAPACITY AND AWARENESS STRENGTHENED FOR CLEAN ENERGY DEVELOPMENT | | | | |
|---|---|---|---|---|
| OUTCOME/OUTPUT INDICATOR | TARGET (RF) | ACHIEVED (AS OF 31 DEC 2019) | ACHIEVEMENT (%) | VERIFICATION/ OBSERVATIONS |
| Number of persons attending awareness raising sessions at community centres with regards to the benefits of rooftop solar PV installations that actively seek the introduction of RE (#9) | 100 | about 190 (100 female, 53%; 90 male, 47%) | 190% | Liz Quintyne final report, p. 9. Of the total, 174 individuals considered the events informative; 79 wish receiving more info on RE; and 66 indicate interest in training. |
| Number of persons under vocational training programs on solar PV technology and installations that are active in the RE sector (#10) | 20 | NVQ Level 1: 20 trained, 13 certified 1 (all male) | 100% | In addition, three 1-day workshops, total 88 persons (62% female, 38% male) |
| Number of tradespersons who have local certification to construct, assemble, operate, and maintain RE technologies that are actively providing ESCO-type/other services (#11) | 50 | How many NVQ2 and 3? | 150% | 15 persons CVQ Level 2 (roofer/fitter) 60 persons NVQ Level 3 (electrical technician)[100] |
| Number of technicians trained in electrical grid monitoring and analysis (#12) | 20 | DIgSilent: 10 MEWR staff; ArcGIS: 20 staff (10 male, 10 female)[101] | 50% | The training targeted MEWR rather than the utility BLPC.[102] |

*Table 11 Achievement of outcome and outputs for DREAM Project Component 2.*

#### *3.5.2.4 Efficiency*

133. The actual expenditures (GEF funds) to deliver Component 2 amounted to US$ 82,547, which is 0.55% below the original budget (US$ 83,000). An inventory of relevant expenditure items however points at a cost of about B$ 262,000 (US$ 131,000) as the grid modelling course, held at the UWI in Trinidad, was paid from C1 while the NVQ 1 training course and the fees for the first group of students coincide with the learning costs of US$ 55,531 reported under C3. The learning costs for grid modelling and ArcGIS are of the order of US$ 100,000, close to the US$ 106,987 reported in 2019 under C1. As these training activities can also be interpreted as support for developing the licensing regime, indicator #12 could have been under C1. In any case, C2 was insufficiently funded to cover all envisioned activities, which explains the funding across components.

134. Based on a qualitative appraisal of the delivered products and activities, the Evaluator considers that obtained value was good and rates the efficiency of Outcome 2 as Satisfactory (S).

[100] Information kindly provided by email TVET Council, 27 August, 2020.

[101] Staff from the following entities: MEWR, GEED, MoHW. The course (UWI ENVT 6101) consisted of 12 teaching days in the period April 10 – May 4, 2018. Source: ETD Training Report, Geoinformatics for Environmental Management, by Dr. Kimberly Baldwin, CERMES, UWI Cave Hill, May 2019.

[102] As of 2020, MEWR's software is being used to carry out the Integrated Resource & Resilience Plan study commissioned by MEWR with involvement of BLPC (funded by the IDB). The capacities created under DREAM will serve MEWR to assess IRRP scenarios using the software. The target figure (20) is not realistic given the small size of the electricity sector in Barbados.

#### *3.5.2.5 Outcome rating*

| OUTCOME 2: INSTITUTIONAL AND TECHNICAL CAPACITY AND AWARENESS STRENGTHENED FOR CLEAN ENERGY DEVELOPMENT | |
|---|---|
| CRITERIA | RATING |
| Overall quality of project outcome | S |
| Relevance | R |
| Effectiveness | S |
| Efficiency | S |

### 3.5.3 Outcome 3: Feasible stand-alone solar PV electricity generation investments are successfully demonstrated (Budget: US$ 1,191,000 GEF; US$ 29,750,000 cofinance)

#### *3.5.3.1 Description of activities and delivered outputs*

135. Project component 3 (C3) aimed to demonstrate the feasibility of solar PV while improving the disaster resilience of Barbadian communities. Table 12 presents the outputs and activities as proposed in the Prodoc and the actually delivered results. As can de deduced from the Table, most activities were implemented, being the most notable deviation the lack of comprehensive feasibility studies (output 3.1) which, in the opinion of the Evaluator, is a major omission. On the positive side, larger RE capacity could be procured than envisioned, and public schools in use as emergency shelters were upgraded.

| DREAM PROJECT COMPONENTS 3 - SOLAR-PV INSTALLATIONS | | |
|---|---|---|
| OUTPUT | SCOPE (PRODOC) | PRODUCTS DELIVERED |
| 3.1 Feasibility studies of specific solar PV installation | • Engineering studies for the solar-PV demo projects on rooftops of government buildings, covering: (i) solar resources, (ii) effort and benefits of these demonstrations, (iii) offsets of diesel fuel; (iv) potential for replication to private households and commercial buildings; (v) financial analysis including cost estimates and rates of return; and (vi) risk analysis and business plans for implementation. | Partially implemented.<br>No previous studies for 40 CRCs (2016).<br>GOB Tender documents for 28 CRCs by DREAM Project (published August – November 2016).<br>Site visits to 28 CRCs April-May 2017.<br>Site visits to polyclinics October 2017.<br>GOB tender documents for 9 polyclinics (published July 208). |
| 3.2 Implementation assistance for solar PV projects | • Support for additional 10 MW PV installations atop government buildings where the participation of the private sector is sought for investment and installations | Parallel investment by BLPC in 10-MW ground-mounted solar wind farm (2018).<br>Parallel investments under PSSEP and IDB-EU SMART-I Programme). |
| | • Preparation of licensing documents for private firms to supply and install solar PV on government buildings | Implemented through cofinance MEWR.<br>35 licences processed and granted for private PV investors (rooftop commercial and domestic buildings). |
| | • Setup of local workshops and businesses that will import, supply, install and provide technical support for solar PV panel installations | Not implemented. |
| | • Assisting project proponents in collaboration with ECRE and BL&P personnel on the design of | Partially implemented. |

| | | |
|---|---|---|
| | rooftop solar installations, and arranging of RE project financing with available sources | Site inspection templates to be used to for monitoring and QA purposes during installation.<br>Solar PV tender documents, specifications, evaluation templates, accepted by MEWR.<br>Improved contract documents to include the nuances of solar PV installation, inspections and approval processes, accepted by MEWR. |
| | • Reporting of the benefits and carbon reductions of solar-PV installations to the MoED. | Implemented.<br>PV systems were transferred to the recipient entities (MoH, CDD, NSC) to be registered as their assets.<br>PV monitoring app that can be used to collect and analyse PV systems data. |
| 3.3 Solar PV demo investment projects | • Forty 2.5 kWp of solar PV installations on 40 community and resource centres under the MoSCCECD | Implemented.<br>Installation of 2.5-kWp (18), 5-kWp (2) and 7.5-kWp (2) grid-connected PV systems (total 70-kWp) with battery backup on 22 CRCs and sport pavilions. Contract awarded to Enermax Ltd (March 2017; signed August 2017). |
| | • Ten 5 kWp solar-PV installations at the polyclinics under the MoH. | Implemented.<br>Installation of 9 on-grid PV systems (total 171-kWp) with existing diesel back-up at 9 polyclinics. Contract awarded to NRG Solar & Renewables (February 2019). |
| | ADDITIONAL ACTIVITIES IDENTIFIED AS A RESULT OF ADAPTIVE MANAGEMENT | |
| | | Connection of existing PV systems to school electrical systems. Contract awarded to Everson Elcock & Co Ltd (April – December 2018). |

*Table 12 DREAM Project Component 3: Solar PV installations...*

Community and Resource Centres

136. In 2016, the MEWR prepared a tender for 35 Community and Resource Centres (CRCs), which was issued August 12, 2016.[103] The tender was prepared before the DREAM Project became fully operational. After some addenda were made, the tender closed November 2, 2016. Public opening of the eleven (11) bids received took place November 3, 2016. The technical evaluation meeting was held November 16, 2016 and three (3) bids were found technically compliant. The financial evaluation was done November 21, 2016. One tenderer was lowest cost and was recommended to be awarded all 4 bid lots. Eventually, the contract was awarded March 2, 2017; however it was not signed until September 25, 2017 after lengthy negotiations with the Contractor.

137. The Project arranged site visits for candidate suppliers between August 24 and September 7, 2016. Seven larger centres having a 3-phase connection were removed from the list as a 2.5-kWh system would be insufficient to cover emergency power requirements.[104] During the IW, the MoSCCECD advised that 7 of the 35 centres were not fit for PV installation due to roof integrity issues; also energy back-up and re-wiring requirements had not been assessed and were not included in the tender.[105] After some changes, a consolidated list of 28 CRCs was defined which served as the scope of work for the Contractor. In January 2017, the TO offered a solar PV workshop for the Community Development

[103] Published in the newspapers The National, and Advocate, August 15, 2016. The tender was also published at the UNDP website. Source: Project Monthly Report August 2016.
[104] Project Monthly Report October 2016.
[105] Project Monthly Report August 2016.

Department (CDD) at the MoSCCECD to inform about the DREAM project and encourage stakeholder buy-in and ownership.[106]

138. During May-April 2017, the TO and the Contractor carried out site visits to the 28 CRCs, assisted by representatives from the CDD and the National Sports Council (NSC). A report with findings was produced.[107] Seven (7) CRCs could accommodate additional PV capacity to reduce grid electricity demand in the buildings under normal operating conditions.[108] PSC 3 (May 2017) agreed to this option to compensate for the reduction in site number and maintain the Project's target (RE capacity installed). Lessons were learned to improve tender documents and procurement guidelines to develop the tender for the polyclinics.[109]

139. By April 26, 2018, an Addendum to the contract was signed between MEWR and the Contractor reducing the number of CRCs to twenty-two (22). The Addenda 2 and 3 were signed in June respectively September, 2018, allowing Contractor to include the increase of National Social Responsibility Levy (from 2% to 10%) and a 2% tax on foreign exchange transaction in the contract price, bringing the total contract sum at B$ 939,142.40. A 17.5% VAT tax was charged on local value, while the imported equipment was exempted from tax and duties.[110]

140. As of July 2018 (PSC 5) most CRCs were 85% completed and inspected by GEED.[111] A three-tier hand-over process was foreseen: (1) Contractor shall obtain GEED inspection certificate; (2) inspection by BLPC and email communication to MEWR; and (3) final inspection by MEWR, which then issues a Taking-over Certificate. According to BLPC, grid instability issues at St. Mark's Community Centre (St. Philip) and James Bryan Pavilion (St. George) were preventing the PV systems from turning on and synchronising with the grid. After an act of vandalism at Dover Pavilion, it was decided to construct more resistant masonry enclosures to secure the equipment; meanwhile, installation at the three remaining sites was suspended. The contract for the enclosures was tendered to a local construction firm who started by May 2019 only.

141. Notably, in March 2019 during an inspection with BLPC, the MEWR found that the Contractor's initial submission to BLPC did not conform to the metering configuration in the utility's grid code. Then the Contractor had simply removed the batteries from the line diagram and resubmitted as grid-tied PV systems without battery back-up. BLPC subsequently started inspection of all systems as such, which did not reflect the actual situation.[112] The Ministry advised the Contractor of its obligations including installation of the critical load meter base and panel in accordance with the grid code, which was done

[106] See: Solar PV Workshop Report – for Community Development Department, by Stuart Bannister, February 27, 2017. Later that year, September 12, a similar workshop was held for staff of the National Sports Council (NSC).

[107] Project internal report "Photovoltaic Installation Assessment Part 1 – For Twenty-eight Community and Resource Centres, by Stuart Bannister, May 17, 2017. The following information was collated or proposed: (i) location of PV modules; (ii) location of PV equipment such as inverter, battery box and charge controller; (iii) assessment of roof; (iv) PV equipment cable runs and measurements; (v) BLPC Meter Number; (vi) electrical main breaker information; and (vii) potential risks and issues. Nineteen (19) centres were identified as low to medium risk sites where installation could commence immediately and be completed in a timely manner. Nine (9) centres were deemed high risk, with three (3) sites requiring enclosures to be built for the equipment (Dover, Crab Hill, and Bridgefield Pavilions); one site (Bayville Community Centre) required an electrical upgrade.

[108] Rices, Haggatt Hall, St. Marks, Drax Hall, and Greens Community Centres; and Keith Boyce and James Bryant Pavilions.

[109] In this context, it is noted that the unit within MEWR did not take advantage from the existence of the Project Executing Unit (PEU) which runs the PSSEP and the IDB/EU SMART Energy Fund. Over time, collaboration improved substantially.

[110] Source: communication with National Project Coordinator.

[111] Photovoltaic Installation Status Report September 2018 – for Community Centres, Resource Centres and Pavilions, MEWR, by Stuart Bannister, September 9, 2018.

[112] PSC Meeting 7, July 2019.

by September 30, 2019. Addendum 4 to the contract was signed September 16, 2019, to extend the deadline to October 30, 2019 and enable finalisation of the remaining 3 sites.

142. Since the scope of work did not include re-wiring of the emergency lights to the PV systems, an addendum was suggested but the Contractor's offer was deemed not of fair market value. The re-wiring was awarded to another company (Everson Elcock & Co. Ltd, which also carried out the upgrades to the 10 primary schools, see below) after three quotations were sought. The winning bid was just 40% of the price offered by the Contractor. Given the delays, the re-wiring was funded by the GOB instead of the GEF, and works were delivered by April 2020.

143. As of December 30, 2019, the Contractor had completed the 22 CRCs and these were taken over by MEWR. The total installed capacity was 70-kWp. Eighteen (18) sites are equipped with 2.5-kW systems (8 panels each); 2 sites are 5-kW and 2 other sites, 7.5-kW. One site (Gall Hill Pavilion) was visited by the Evaluator on November 19, 2019. As of June 2020, no operational energy production data have been made available. As part of the monitoring and evaluation process, the MEWR intends to assess the performance and savings being generated by the PV systems. These calculations require billing data from BLPC. Given that most CRCs still lack the internet connection for remote reading of PV system data, the beneficiaries issued a letter allowing BLPC to share billing data with the Project, but as of June 2019, no data has been shared.

144. The PSC recommended an MOU between MEWR and the beneficiaries but this is not commonly done between government entities in Barbados. The beneficiaries were thus informed by letter of the transfer of the assets and their value, based on which these should be incorporated into the recipient's Registry. The Ministry also bought the mandatory public liability insurance for all connected systems. Yet, it remains unresolved who should be the bearer of the insurance policy afterwards, either the owner of public buildings (which is the Ministry of Housing and Lands - MoHL), or the user (the beneficiary). MoHL holds to the opinion that the PV systems are part of the electrical system and not of the real estate and so far rejects absorbing the assets.

145. The Evaluator raises the question whether the main Contractor was proactive and offering good value for money. Based on information from the NPC, GOB Procurement considers PV systems as a good instead of a project which precluded an EPC type agreement. The evaluation was based on a least-cost criterion. The Contractor offered the lowest price but afterwards negotiations were lengthy and additional cost items were included. The weak tender documents based on incomplete site information created margin for the supplier to negotiate cost items and reduce the number of installations.

Polyclinics

146. In July 2016, PSC 1 decided to carry out site assessments in order to prepare the tender documents for the polyclinics. The visits were implemented by the TO once the initial visits to the CRCs were completed. The Ministry of Health (MoH) offered a technical manager to support the process. End October 2016 (PSC 2), six (6) out of nine (9) polyclinics had been visited and January 2017 a report of the findings was produced.[113] The assessments comprised a collection of electricity bills, site plans and electric panel directories, basic roof evaluation and identification of proposed location for the PV equipment. During the visits, the DREAM Project was presented to the senior clerks or the Doctor responsible for a polyclinic. Monthly electricity consumption rates were found around 11,000 kWh/month for an average building and 25,000 - 40,000 kWh/month for the largest ones.

[113] Solar Photovoltaic Assessment of Polyclinics, by Stuart Bannister, January 20, 2017.

147. The conclusion was drawn that a 5-kW battery backup system was not the best solution as all polyclinics already had 100% diesel backup. The inspections also showed that electrical panel schedules or descriptions were missing, imposing an additional challenge to separate the critical loads. By opting for 100% diesel-PV power supply under emergency conditions, there was no need for re-wiring. It was proposed to eliminate the batteries and redesign the PV systems to save fuel during emergencies while saving on grid electricity under normal conditions. The MoH welcomed the changes considering the advantages of fuel savings during emergency situations, as well as the elimination of batteries simplifying O&M and reducing associated costs.

148. Procurement of the PV systems followed Government's procurement rules and systems. The tender for 9 polyclinics was submitted to the Special Tenders Committee on November 13, 2017 and approved on December 11, 2017. The tender was advertised before Christmas[114] and site visits for the bidders were carried out January 2018. The tender closed January 31, 2018.[115] Taking benefit from falling PV prices, the capacity was raised from nine 5-kW systems (45kWp total) to 12-kW each (108 kWp). Ten (10) bids were received. Evaluation took place February 8, 2018 and one bidder emerged successful. However, the Special Tenders Committee did not accept the recommendation of the Evaluation Committee and indicated that the tender be re-advertised.

149. The Project Team and MEWR then decided to overhaul the tender document to raise the capacity further to 175kWp. The revised tender documents were submitted to the Tenders Committee by July 12, 2018; the tender was published and closed September 12, 2018. This time the recommendation for award was accepted and the contract with the supplier was signed December 2018[116]. The Project team was supported by the PSSEP's procurement specialist who provided guidance for a successful procurement process. The contract with the supplier stipulated a total of 170.9 kWp grid-tied PV to be installed, ranging from 13.1 kWp to 50.4 kWp. The total contract value was B$ 551,159 including equipment and mobilization fee. The contract also covered the delivery of O&M manuals and a defects liability period of 12 months.

150. Based on the experiences at the CRCs, stakeholder engagement was planned to keep beneficiaries informed and ensure smooth implementation. A seminar was held April 4, 2019 addressing the staff of the polyclinics and the Technical Management Unit of the MOHW at their conference facilities. The seminar explained the technology, types of PV equipment and installation process, presented the Contractor, and provided in Question and Answers. The Contractor had submitted the proposed installation schedule to MEWR, which was shared with MOHW so that the polyclinics could be notified in advance and make the arrangements to facilitate the installation.

151. Initial setbacks included an issue with the mobilization payment delaying material ordering and delivery by 6 weeks[117]; another 4-week delay resulted due to a back log at the port caused by the implementation of the ASYCUDA World system in Barbados[118]. Mid 2018, the PV installations at the St. John, St. Philip and Randal Phillips Polyclinics had commenced and the racking and optimizers were installed. The contract was extended to November 30, 2019 to facilitate the completion of the installation.

[114] Posted with Reference Number 43248 at UNDP Procurement Notices, December 18, 2017.
[115] Quarterly Report Q4, 2017.
[116] The contract says 1st February 2019. What is correct???? PV contract could not be issued before Cabinet's approval of the DREAM's project extension.
[117] Quarterly Reports Q2 and Q3, 2018.
[118] The Automated System for Customs Data (ASYCUDA). https://asycuda.org/en/

152. On December 6, 2019, all nine systems, totalling 464 PV panels and 171.68-kWp capacity, were inspected and certified for the Contractor by the GEED.[119] By April 6, 2020, NRG submitted the handover documents for all installations which include technical descriptions of the system, system design data, single line diagram, projected energy yields, and system costs. The documents also state the provided manufacturer's warranties and maintenance and defects liability, and maintenance recommendations. With this result, the Evaluator concludes that the activity was successfully implemented.

Primary schools

153. This activity expanded the "19 PV systems project", completed in 2014, which installed 2.5-kW grid tied PV systems at 10 Government primary schools which dually function as emergency shelters. While the PV panels had been injecting electricity to the grid, the emergency backup function was never implemented. The opportunity to finalise the work was identified by the DREAM Project Team and the scope of work was approved at PSC 5 (July 2018). The GOB's Disaster Emergency Management (DEM) advised they would ensure incorporation of these schools into the national disaster response plan.

154. Since the budget for the works was below B$150,000, direct contracting was used following national procurement rules.[120] The work was tendered among contractors shortlisted by GEED. The tender closed November 22, 2017 and the bids were opened and evaluated the day after.[121] The contract was awarded to Everson Elcock & Co. Ltd on January 24, 2018. The contract was signed only by April 16, 2018, and amounted to B$ 75,088 VAT inclusive.

155. Progress by June 2018 was about 60%[122]. Between 2 and 8 November, the Project's TO carried out a final inspection with the Contractor. A list of issues was compiled[123] after which the works were 100% completed by December 12, 2018. The contract included a 6-month maintenance period. The Contractor submitted the As-Built Drawings and the electrical panel schedules for each school, as per contract requirements, on June 27, 2018.

#### *3.5.3.2 Relevance*

156. The DREAM Project successfully implemented solar PV systems at public buildings (CRCs, polyclinics, and primary schools) and exceeded the total kW-target set for the pilots directly funded from the GEF budget. This achievement contributes to demonstrating the feasibility of RE-based power generation under normal and emergency conditions. Upscaling of system capacity is financially attractive for GOB as it helps reducing utility electricity bills. The installed PV capacity also adds to the total installed RE capacity in Barbados and as such contributes directly to the BNEP target of 100% RE by 2030. With the establishment of the FIT in September 2019, this investment model has become even more attractive as surplus electricity must be bought by the utility at a defined price.

157. Another positive impact is the improved power supply for emergency shelters. However, this impact is not evaluated by means of an indicator and no baseline was set. Arguably, the re-wiring of emergency loads into dedicated electrical circuits and panels is at least as relevant as the solar PV

[119] Information extracted from the nine certificate forms that were shared with the Evaluator (June 2020).
[120] This means that the tender is issued by MEWR directly and is not passed to the Tenders Committee for review and approval.
[121] PQR Q3, 2017.
[122] Electrical modification to Photovoltaic Systems at 10 Government primary schools – Progress Report, by Horace Archer, MWER, June 26, 2018.
[123] DREAM Project Electrical Modification at Ten Schools - Snag List, by Stuart Bannister, November 13, 2018.

powering. The Evaluator would definitely recommend an ex-post evaluation to assess operational aspects including O&M costs, and validate energy yields and the deployment of the shelters during an emergency situation. Not all communities initially intended were reached. Instead of electricity bill savings flowing back to the GOB, a trust fund could be devised to collect revenues to implement EE measures in all public buildings and cover the costs of O&M of installed systems.[124]

158. The value of GEF grant funding as an enabler for the pilots is not demonstrated, given the existence of the PSSEP and IDB/EU SMART Fund as a mix of grant and sovereign loans. As a result, capital costs were minimal for the GOB and monetary benefits started to accrue as soon as the systems were put into operation. With the fund earmarked for power generation, energy conservation and energy efficiency opportunities in the buildings were not actively incorporated, although typical payback times are 3-4 times shorter than for PV. The simple payback period for the PV systems at the polyclinics is estimated at 5 years, which is reasonable. For the CRCs this figure is 21 years due to the cost of the batteries, which questions their economic viability. This result strongly contrasts with the expected payback period of 2 years discussed during the IW.[125] For private building owners who cannot rely on grant funding and must cover capital costs, these investments would not have been financially viable.

159. As a whole, a rather mixed picture emerges with strengths and weaknesses. Based on the above, the Evaluator rates Outcome 3 as (moderately) Relevant (R).

#### *3.5.3.3 Effectiveness*

160. The Project implemented grid-tied solar PV systems with battery back-up to provide power to selected critical loads under emergency conditions at 22 CRCs, totalling 70-kWp capacity. This is 30% lower than envisioned at Project design (40 sites totalling 100-kW). The choice of the pilot sites seems somewhat opportunistic with a view on avoiding delays in Project execution. Those CRCs requiring upgrades to the electrical installation, or having roof integrity issues, were removed from the list. All installations have a GEED inspection number but no formal proof of acceptance and hand-over to the end-user was submitted to the Evaluator. The time between awarding the contract (March 2017) and delivery (November 2019) was about 2.5 years, more than double the anticipated throughput time.

161. Early in the Project, the number of targeted polyclinics was determined at 9 (instead of 10 as erroneously set in the Prodoc).[126] Since all polyclinics were already equipped with diesel back-up to operate 100% of the load, it was decided not to incorporate battery back-up. As a result, these systems are all grid-tied, diesel-PV systems. Under normal operating conditions, PV power is sold to the utility under the Feed-in Tariff mechanism. In an emergency, the PV acts as a fuel saver for the diesel plant. The supplier contract was signed February 2019 and delivery was December 2019, a throughput time of 10 months. A total of 171-kW was installed compared to the target of 50-kW, an increase of 350%.

162. The combined installed PV capacity at the CRCs and polyclinics is 0.24 MW (indicator #13). In addition, 10 primary schools were upgraded enabling the existing 2.5-kW PV systems to operate emergency loads. Table 13 presents the achievement of the output indicators for Outcome 3. Note that no outcome level indicator was defined, for example to measure the demonstration effect.

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[124] According to the MEWR communication, such a mechanism is proposed under the asset management model that is currently being developed (as of August, 2020).

[125] See page 19.

[126] For the obvious reason that there are only 9 polyclinics on the island.

| OUTCOME 3: FEASIBLE STAND-ALONE SOLAR PV ELECTRICITY GENERATION INVESTMENTS ARE SUCCESSFULLY DEMONSTRATED | | | | |
|---|---|---|---|---|
| OUTCOME/OUTPUT INDICATOR | TARGET (RF) | ACHIEVED (AS OF 31 DEC 2019) | ACHIEVEMENT (%) | VERIFICATION/ OBSERVATIONS |
| Rooftop solar-PV installations financed through GOB RE funds where DoET and BL&P have involvement in operationalisation (#13) | 3.225 MW | 4.09 MW | 127% | Lists of pilot installations. See Annexes G, H, J. |
| - from direct GEF investments in PV | | 0.24 MW | | |
| - from other investments by GOB | | 3.85 MW | | |
| MW capacity of rooftop solar PV projects in planning and design stages (#14) | 7.5 MW | 0 | 0% | No further information provided to assess this indicator. |

*Table 13 Achievement of outcome and outputs for DREAM Project Component 3.*

163. Additional investments in PV capacity through parallel GOB funding (indicator #13) has happened under the PSSEP and the SMART-I Project, totalling 3.85-MW. These installations were not tracked by the Project team. The Evaluator lacks information to quantify the attainment of indicator #14. Note that in 2018, BLPC also implemented a 10-MW ground-mounted PV plant. The indicator #5 (number of RE installations connected) provides an indication of market development triggered by the improved licensing regime and the FIT but no target value has been reported.

164. Based on the achievement of indicator #13 and the over-performance in terms of PV capacity installed with direct GEF investment, effectiveness of Outcome 3 is rated as Satisfactory (S).

#### *3.5.3.4 Efficiency*

165. The actual expenditures (GEF funds) to deliver Outcome 3 ascended to US$ 1,024,499, which is 14% below the original budget (US$ 1,191,000). The difference is explained by the undisbursed budget remainder. In terms of direct investment, cost-effectiveness at design was 7,940 USD/kWp; and the actually achieved cost level was 4,250 USD/kWp[127] which is largely explained by the drop in costs of PV technology over the project period. The specific cost of the PV systems at the CRCs are 420% higher than at the polyclinics (6,708 USD/kWp, respectively 1,584 USD/kWp).[128] This difference can be partly ascribed to the costs of the batteries at the CRCs. Notably, the costs for the PV equipment enclosures and the re-wiring, which were separately contracted, still have to be added.

166. In comparison with a current cost figure of the order of 3,500 USD/kWp (for Jamaica)[129], the DREAM Project appears to have obtained reasonable value for money over the overall portfolio. Based on the above, the Evaluator rates efficiency of Outcome 3 as satisfactory.

[127] At design: 1.191M USD / 0.150 MW = 7.94M USD/MW. Actually achieved: 1.025M USD / 0.241 MW = 4.25M USD/MW
[128] See Annex F.
[129] Updated benchmarking figures for Barbados could not be retrieved.

#### *3.5.3.5 Outcome rating*

| OUTCOME 3: FEASIBLE STAND-ALONE SOLAR PV ELECTRICITY GENERATION INVESTMENTS ARE SUCCESSFULLY DEMONSTRATED | |
|---|---|
| CRITERIA | RATING |
| Overall quality of project outcome | S |
| Relevance | R |
| Effectiveness | S |
| Efficiency | S |

## 3.6 Sustainability, impact and catalytic effects

### 3.6.1 Sustainability

| PROJECT OVERALL SUSTAINABILITY | | |
|---|---|---|
| CRITERIA | RATING | COMMENTS |
| Overall likelihood of sustainability | ML | Sustainability issues are acknowledged by the Ministry which is taking steps to close gaps. Issues addressed are: capacity building plan for Ministry (proposed under PSSEP), PV asset management and maintenance (for which funding is sought under a new GEF-7 SMARTER proposal under development). However, no formal exit strategy has been presented to close the DREAM project.[130]<br>The long-term sustainability of the installed PV-battery systems remains a point of concern as they are 100% grant-funded and economic feasibility is very weak (over 20-years simple payback time). |
| Financial resources | MU | The installed RE generates a virtual positive cashflow but payback times for CRCs are very long. No financial feasibility studies (cost-benefit analyses) were developed before or during the project to demonstrate that the investments are economically sound. Also, no funding is allocated to assure sustainability of O&M and an appropriate management and financing model by GOB would need to be developed. |
| Socio-economic | ML | The GOB remains strongly dependent on external funding sources to pursue the energy transition. In particular, investment in RE pilot systems under DREAM was 100% grant-based, which is not a sustainable model. Promotion of IPPs taking benefit from concessional loans, would assist the transition towards a sustainable funding model. |
| Political | L | Political support for low-emission energy sector is strong with Ministry strengthening its capacities to govern the sector. |
| Environmental | ML | The implemented RE capacity translates into reduced electricity sector GHG emissions.<br>Additional work is needed to manage e-waste and batteries, which may possibly require a regional approach in the Caribbean. |

*Table 14 DREAM Project overall sustainability.*

[130] An internal note on sustainability and exit strategy was shared with the Evaluator who understands that this was produced after Project closure and not formally shared with UNDP.

### 3.6.2 Partnerships

167. The Project established good relations with national stakeholders, in particular the Barbados Renewable Energy Association (BREA). Partnerships were not envisioned at Project design, and the Evaluator tends to believe that a GEF project strongly embedded in the Government, as the DREAM Project, has fewer opportunities to build formal partnerships due to public administration restrictions.[131] Yet, the Project Team did a good job by reaching out to non-government stakeholders and setting up the Energy Expo's and keeping good presence in the market.

## 3.7 Overall project rating

168. The next tables summarize the overall Project achievements. Table 15 presents the ratings of the Project outcomes in the domains relevance, effectiveness and efficiency. The partial ratings are used to generate a rating for the overall Project results. Table 16 provides the summary of project evaluation ratings. Table 17 shows the overall Project impact.

169. Based on the scores, the TE rates overall Project Results as Satisfactory (S).

| Criteria | Rating | | | |
|---|---|---|---|---|
| | Outcome | | | Project |
| | 1 | 2 | 3 | |
| Overall quality of project / outcome | S | S | S | S |
| Relevance | R | R | R | R |
| Effectiveness | S | S | S | S |
| Efficiency | S | S | S | S |

*Table 15 DREAM Project overall outcome rating*

| Summary Project Evaluation Ratings | | | |
|---|---|---|---|
| 1. Monitoring and Evaluation | Rating | 2. IA & EA Execution | Rating |
| Overall quality of M&E | MU | Overall quality of IA/IP Execution | S |
| M&E Plan implementation | MU | IA execution - UNDP | S |
| M&E design at project start-up | MS | IP execution – MEWR | S |
| 3. Assessment of Outcomes | Rating | 4. Sustainability | Rating |
| Overall Project Outcomes | S | Overall likelihood of sustainability | ML |
| Relevance | R | Financial resources | MU |
| Effectiveness | S | Socio-economic | ML |
| Efficiency | S | Political | L |
| | | Environmental | L |

*Table 16 DREAM Project evaluation ratings summary.*

[131] There is usually a "firewall" between public administration and private companies and individuals, to avoid conflicts of interest and ensure transparency.

| RATING PROJECT IMPACT[132] & CATALYTIC EFFECTS[133] | | |
|---|---|---|
| CRITERIA | RATING[134] | OBSERVATIONS |
| Environmental status improvement | M | Reduction of GHG emissions due to investments in PV systems. These benefits can be partly attributed to the DREAM Project. |
| Environmental stress reduction | N | Not measured but negligible. |
| Progress towards stress/status change | S | Positive contribution to regulatory and policy changes to foster RE technologies reducing GHG emissions. |
| Catalytic effects | S | (1) Contributions to enhanced electricity sector regulatory framework. (2) improved procurement and contract models for RE in public sector. (3) Enhanced business operations in key Ministry (MEWR) and awareness on sustainability issues for O&M. |

*Table 17 DREAM Project Overall impact rating.*

[132] UNDP-GEF TE Guide, p.52 suggests to assess the following domains: a) verifiable improvement in ecological status; and/or b) verifiable reductions in stress on ecological systems; c) through specified process indicators that progress is being made towards achievement of stress reduction and/or ecological improvement; d) regulatory and policy changes at regional, national and/or local levels.

[133] Ibidem, whether the Project has exhibited a) scaling up (to regional and national levels), b) replication (outside of the project), c) demonstration, and/or d) production of a public good (lowest level of catalytic effect, such as new technologies and approaches).

[134] Rating scale: Significant (S), Minimal (M), Negligible (N).

# 4 CONCLUSIONS

1. The Disaster Risk and Energy Access Management (DREAM) Project (GEF 5453) was successfully implemented by the Ministry of Energy and Water Resources (MEWR) and attained the envisioned GHG emission reduction and RE generation targets. By December 31, 2019, 90% of the GEF budget (US$ 1,554,381) was disbursed leaving a remainder of US$ 172,102. The total PV capacity installed through direct GEF funding was 241-kWp, which is 60% above the committed value. With a view on impact, the current penetration level of Renewable Energy (RE) capacity in Barbados is 13% of total capacity, which is twice as high as the target (6.8%). The TE rates the overall Project Outcomes and overall Results as Satisfactory (S).
2. The envisioned Project duration of three (3) years was insufficient and the Project was granted a 1-year extension. The original budget planning was heavily front-loaded with 57% of GEF expenditures in Year 1. This is not realistic as GEF Projects typically need the first year to establish themselves and get familiar with national and agency procedures. The Project was also too optimistic concerning the throughput time of GOB processes (in particular those requiring Cabinet approval). The time between tender publication and delivery of the works for the CRCs was 3.5 years (August 2016 – December 2019) where one (1) year was assumed. There was no time for a proper inception phase after Prodoc signature; and – in a rush to complete activities before Project termination –neither for collecting information and collating lesson learnt in preparation of the Terminal Evaluation. Some minor elements of the PV pilots were completed post-project using GOB funds.
3. The vertical logic of the Project was rather weak, essentially because the outcome level (i.e. the key development conditions) was not explicitly defined and a coherent barrier removal strategy was not in place. Contributions from the baseline were not properly integrated into the design which undermines evaluability and attribution of Project results. In the context of a rapidly evolving baseline, execution of Component 1 was characterised by a search of activities to add value; similarly, identified capacity barriers in the supply chain (Component 2) were largely resolved when the Project became operational. This demonstrates the erosion of an established project design if not timely implemented.
4. The Project's Steering Committee agreed on outputs under Component 1 (RE policy framework) that were relevant and successfully implemented. This can be considered a good example of adaptive management, and was encouraged by UNDP. Particularly relevant was the delivery of a draft utility license, which is a key input to modernise the sector and asset for the Government of Barbados to start negotiations with the utility BLPC. Complementary activities included training and software for grid modelling (DIgSilent), use of GIS technologies (ArcGIS), peer reviews and knowledge exchange workshops on energy market topics.
5. Project Component 3 delivered 22 grid-tied PV systems with battery back-up at CRCs (70-kWp in total) and 9 grid-tied PV systems combined with existing diesel generation at polyclinics (171-kWp). All these facilities serve as relief shelters for the population and are part of Barbados' national disaster response plan. As a result of the DREAM Project, emergency power supply is available in case of a grid failure. Under normal conditions, the PV electricity is sold to the grid. Spare GEF funds were used to upgrade 10 primary schools as relief shelters with emergency back-up, which is an unforeseen positive

result. The Project did not provide in indicators to actually measure improved disaster-resilience. [135] No baseline was set and no analytical work was done to assess the nexus energy-disaster resilience.

6. The envisioned feasibility studies for the PV pilots were not delivered according to the scope laid out in the Project Document. An explicit financial model, O&M plan and management structure were not prepared and is not available at Project termination. With a simple payback time of 21 years, the PV systems at the CRCs would not be economically feasible without grant funding to cover the capital expenditures (CAPEX). The estimated simple payback time for the polyclinics (5 years) is reasonable, primarily because the specific cost of PV systems (US$/kWp) dropped by roughly 50% between 2016 and 2018 and bids are increasingly competitive. Other factors include the scale of the PV systems at the polyclinics (typically 15-kWp compared to 2.5-kWp for the CRCs) and the cost of the batteries at the CRCs (about 25% of project cost).
7. Substantially more work (30.5%) was done by individual consultants than foreseen (9.0%), while contracted services by companies were less (6.6% compared to 25.1%) due to the cancellation of some consultancies. Investment in PV pilots was also lower (49% vs. 62.1%) due to falling PV costs and the unspent budget remainder. Substantial content was produced by the Project Team members (local consultants) supported by MEWR staff. In the course of Year 1 it was acknowledged that MEWR internal capacity was insufficient to implement the DREAM Project's work program, and a Technical Officer (TO) was recruited in response to increase delivery and strengthen presence in the field.
8. There is a risk that the pursued electricity supply under emergency conditions may not be sustainable given the weak financial business case and the lack of an O&M strategy and funding plan. Lifetime of batteries and invertors is about 12 years, after which they need to be replaced. One can think about strategies to make economic use of the batteries under normal operating conditions, for example to improve grid stability and match peak demand. The environmentally responsible management and disposal of e-waste, including batteries and PV panels is a long-term sustainability condition not looked into by the DREAM Project. Barbados may benefit from UNDP guidance to develop strategies to this purpose, possibly in the context of the Caribbean region.
9. Project execution under the National Implementation Modality (NIM) was successful and the choice to have the NPC and TO recruited and contracted directly by UNDP was appropriate. Delays existed in the preparation and approval of procurement processes (notably the large PV contracts) by GOB; however, these delays were not specific for the DREAM Project and it is unlikely that direct UNDP contracting would have resulted in a more expedited process. UNDP could have made more use of external project audits (only 2016/17 was audited) and reference prices to confirm the efficient use of GEF project funds and set a benchmark for comparable investment projects across its portfolio. Similarly, a Mid-Term Review (MTR) exercise could have been used to update the results framework and for retooling the workplan (within the limits allowed by GEF).
10. No quantitative data is available to assess the actual costs for implementing the Project (in terms of Project Management) and implementation support provided by UNDP. Very substantial work was done by MEWR to prepare the PV pilots; compile and review the tender documents; review and evaluate bids; negotiate with suppliers and supervise the works. These costs were not considered in the Project design and capacity constraints within the MEWR were addressed by recruiting the TO from the GEF budget. A value of about 15% of the investment sum can be taken as a proxy for project development and supervision costs.

[135] Relevant parameters could be:historical number and frequency of grid outages under emergency conditions;

11. Gender aspects were not addressed in detail in the Project design. The absence of a proper inception workshop and the lack of a stakeholder engagement plan were factors limiting the integration of gender after Prodoc signature. The focus on end-user needs and conditions in the DREAM Project was weak. The Project did not provide in a framework to promote resilience of public services and critical community activities that rely on electricity and did not collect relevant data on this matter. One should acknowledge that MEWR's mandate is primarily on energy supply rather than the final uses of energy.

## 4.1 Lessons learnt

1. Although a Results Framework is built around deliverables (outputs), one should try to visualise also the underlying processes. The use of project planning software may be a useful tool to determine throughput times, bottlenecks and critical path. Experiences from the GEF CCM project portfolio indicate that expenditures in a first project year tend to be low (US$ 100,000 or less) and that smaller countries rarely expend more than US$ 400,000 annually. The lesson learnt is that project designers should define the throughput time of a GEF Project based on realistic parameters.
2. The time between DREAM Project concept and effective deployment was almost three (3) years. Long preparation and approval times undermine relevance of a project design and causes loss of momentum and continuity in the engagement with national partners. By the time DREAM became operational, several outputs were already completed with funding from other sources. An obsolete design severely reduces evaluability and attribution of results to a project. A lesson learnt is to keep project preparation processes as short and diligent as possible.
3. Lessons and experiences were discussed internally in the Ministry but not commonly documented and reported, as this is not a GOB priority and there is little spare capacity for this. To disclose lessons and make them available to UNDP and the GEF, more time would be needed towards Project closure, as well as funding of specific activities in this direction.
4. Long-term human resources on a project budget are not only a cost item but also the thrust behind a Project and creating value. The position of a Technical Officer or Technical Advisor is a good practice worth consideration by project designers.

# 5 RECOMMENDATIONS

1. As of June 2020, energy production data for the installed PV pilot systems had not been made available and no physical verification of system operation and performance could be carried out. The Evaluator recommends an ex-post evaluation to assess operational aspects including O&M costs and validate energy yields, as well as the deployment of the shelters during an emergency situation.
2. Not all communities benefitted equally from the DREAM Project and not all those initially intended were reached. Instead of electricity bill savings flowing back to the GOB, a trust fund could be devised to collect revenues to cover O&M costs of installed PV systems and for implementing EE measures. The Evaluator would recommend the GOB to develop and evaluate proposals into this direction to enhance sustainability and impact.
3. The subsequent project workplans overestimated actual expenditure capacity. The Evaluator would recommend MEWR and UNDP to analyse delay factors, draw lessons for the future and document them for reference. As a good practice, first year programming should allow for proper planning, establishing the required relationships and communication / sensitisation of relevant stakeholders, moreover when a due diligence process is required in preparation of investment.
4. Instead of developing Project Component 2 from a training perspective, an SME development approach might have been more comprehensive to engage with the private sector. Given the small home markets in individual SIDS, the Evaluator would recommend MEWR and UNDP to seek opportunities to link the current achievements to business development programmes in Barbados and the broader Caribbean region to preserve momentum and also generate a sufficiently large market for qualified professionals.
5. National implementing partners are typically not trained in systematic monitoring, and data collection and analysis to this purpose is usually not their priority. It is recommended to UNDP/GEF to support implementing partners to deliver on M&E duties to meet UNDP and GEF guidelines. The most appropriate moments in the Project cycle are: design of the M&E Plan; Inception Workshop (IW); and first Project Implementation Report (PIR). In other words, it is recommended to enforce existing mandatory M&E and oversight procedures. To do so, UNDP and GEF are recommended to make available the necessary resources, either from the project budget or institutionally. This investment will pay off for the rest of a project's life and increase proficiency of project coordinators.
6. Substantial additional funding sources became available during project execution. The GOB strived at optimising the use of these resources to push forward its agenda. This reality could not be truly reflected as "baseline contribution plus GEF incremental action" at the time the Project document was written, as the funding landscape was (and is) more dynamic. For future programming, the Evaluator would recommend to keep this reality in mind to keep GEF funding focused on (niche) aspects were it can really make the difference.

# 6 ANNEXES

## Annex A. Terms of Reference

# APPENDIX 1

## SCOPE OF WORKS

### *Objective and Scope*

The objective of the Disaster Risk & Energy Access Management (DREAM): Promoting Solar Photovoltaic Systems in Public Buildings for Clean Energy Access, Increased Climate Resilience and Disaster Risk Management (DREAM) project is to reduce GHG emissions from fossil fuel-based power generation by demonstrating the exploitation of renewable energy resources for electricity generation in Barbados. To achieve this objective and strengthen the country's Disaster Risk Response (DRR), the Project will promote decentralized solar photo-voltaic electricity generation in Barbados at community development centers and poly-clinics throughout the country. Project activities will include (i) the strengthening of the country's renewable energy policy framework including a grid stability analysis and assistance in the strategic planning of RE investments; (ii) increasing the awareness and capacities of appropriate institutions and individuals to support RE developments in Barbados; and (iii) installations of solar-PV demonstration projects at community development centers, polyclinics and schools. The lessons learned from the demonstration projects will be utilized to scale-up investments for other solar-PV and RE installations in the public and private sector, all aimed at achieving a greater share of RE in the energy mix of Barbados.

These objectives will be achieved through the removal of systemic barriers at the national level, through the following project components:

**Component 1: Renewable energy policy framework:** This component addresses the barrier concerning policy gaps in the regulatory framework that would fully address the realization of the market potential for solar-PV in Barbados under the targets of SEFB and provide more confidence to potential investors of the opportunities for solar-PV investments in Barbados. The expected outcome from the outputs that will be delivered by the activities that will be carried out under this component is the formulation of clear policy and regulations supported by a solar-PV action plan and an approved and enforced licensing regime that will promote broad-based renewable energy generation in Barbados.

**Component 2: Clean energy capacity development**. This component is intended to address the barriers associated with the lack of capacity in Barbados to plan, design, implement, operate and maintain RE projects. The expected outcome from the deliverables of the activities to be conducted under this component is raised awareness and increased capacity of government personnel, local entrepreneurs and tradesmen to support the scaled-up development of solar-PV installations in Barbados and by

geographic extension, other CARICOM countries. The outputs from this component will contribute to the: (a) awareness of policymakers and government personnel with significant roles in RE development, primarily within ECRE and BL&P; and (b) strengthening the capacity of technical and trades personnel from Barbados-based private sector contractors and supply entrepreneurs as well as similar personnel from other CARICOM countries.

**Component 3: Solar PV installations**: This component will address the barrier of low capacity and low level of awareness of the feasibility of solar-PV installations in Barbados. This component will provide support and investment towards the demonstration of sustainable solar-PV installation business models in Barbados to potential investors.

## *Evaluation Approach and Method*

An overall approach and method for conducting project terminal evaluations of UNDP supported GEF financed projects has developed over time. The evaluator is expected to frame the evaluation effort using the criteria of relevance, effectiveness, efficiency, sustainability, and impact, as defined and explained in the UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects. **The evaluation must analyse the project through the lens of these five criteria and provide comprehensive recommendations based on findings in each of these areas, as relevant.** A set of questions covering each of these criteria have been drafted and are included with this TOR (Annex C).

The evaluator is expected to amend, complete and submit this matrix as part of an evaluation inception report, and shall include it as an annex to the final report. The evaluation must provide evidence-based information that is **credible, reliable** and **useful**.

The evaluator is expected to follow a participatory and consultative approach ensuring close engagement with government counterparts, including GEF operational focal point, UNDP Country Office, project team, UNDP GEF Technical Adviser based in the region and key stakeholders.

The evaluator will review all relevant sources of information, such as the project document, project reports – including Annual APR/PIR, project budget revisions, midterm review, progress reports, GEF focal area tracking tools, project files, national strategic and legal documents, and any other materials that the evaluator considers useful for this evidence-based assessment. A list of documents that the project team will provide to the evaluator for review is included in Annex B of this Terms of Reference.

The evaluator is expected to conduct a field mission to Barbados to undertake site visits and carry out relevant data collection. There are over 30 sites where interventions have been made under DREAM and the following is representative list proposed for site visits:

| Site Name | Description of System Installed |
|---|---|
| | |
| Haggatt Hall Resource Centre, Robert Ten Rd. Haggatt Hall, St. Michael | 7.5kWp grid tied battery back-up system. |
| Drax Hall Resource Centre, Lower Section Drax Hall, St. George | 5kWp grid tied battery back-up system |
| Ivy Community Centre, Black Ivy, St. Michael | 2.5kWp grid tied battery back-up system |
| Charles F. Broome Primary School, Government Hill, St. Michael<br>All Saints Primary School, Pleasant Hall, St. Peter<br>Hillaby Turners Hall Primary School, Dunscombe St. Thomas | These hurricane shelters were previously outfitted with a battery back-up PV system under a different project. The DREAM project facilitated the electrical modifications needed to enable these existing PV systems to supply the lighting and power in critical areas. |
| Dover Pavilion, Dover, Christ Church | 2.5kWp grid tied battery back-up system |
| | |
| Bayville Community Centre, Field Place Bayville, St. Michael | 2.5kWp grid tied battery back-up system |
| David Thompson Health & Social Services Complex (St. John Polyclinic) | This is the largest installation at 50kWp. It is also the newest of the polyclinics in the island. |
| Bradford Taitt Polyclinic, Black Rock, St. Michael | 15kWp grid tied system |
| | |

The following is an indicative list of the individuals/institutions whose views should be fully reflected in the final report.

| Name | Agency/Department | Contact Information |
|---|---|---|
| **Ms. Danielle Evanson** | Programme Manager, Environment, Energy and Climate Change | danielle.evanson@undp.org |
| **Ms. Destine Gay** | National Project Coordinator (DREAM), UNDP / MEWR | destine.gay@undp.org |
| **Mr. Stuart Bannister** | Technical Officer (DREAM), UNDP/MEWR | stuart.bannister@undp.org |
| **Ms. Francine Blackman** | Permanent Secretary, Ministry of Energy and Water Resources (NPD) | fblackman@energy.gov.bb |

| | | |
|---|---|---|
| **Ms. Heather Sealy** | Deputy Chief Electrical Officer, GEED | heather.sealy@publicworks.gov.bb |
| **Mr. Ronald Thompson** | Senior Technical Officer, National Sports Council | nsc-bdos@caribsurf.com |
| **Ms. Sandra Greenidge** | Chief Community Development Officer, Community Development Department | sandra.greenidge@barbados.gov.bb |
| **Ms. Bridgette Marshall-Griffith** | N/CVQ Coordinator, Community Development Department | Bridgette.Marshall-Griffith@barbados.gov.bb |
| **Ms. Naomi Cumberbatch** | Public Investment Unit | naomi.cumberbatch@barbados.gov.bb |
| **Ms. Marica Strickland** | Public Investment Unit | marica.strickland@barbados.gov.bb |
| **Ms. Joy-Anne Johnston** | Programme Officer, Disaster Emergency Management | Joy-anne.johnson@barbados.gov.bb |
| **Ms. Gina Belle** | Project Coordinator, Ministry of Environment and Drainage (GEF Operational Focal Point) | gina.belle@barbados.gov.bb |
| **Ms. June Chandler** | Permanent Secretary, Ministry of Health and Wellness | june.chadler@health.gov.bb |
| **Mr. Dave Thorne** | Head of Technical Management Unit, Ministry of Health and Wellness | Dave.thorne@health.gov.bb |
| **Mr. Keith Codrington** | Maintenance Supervisor, Ministry of Education, Technology and Vocational Training | kcodrington3000@hotmail.com |
| **Ms. Joan Bourne** | Engineering Manager, Planning/Projects, Barbados Light and Power Co. Ltd. | joan.bourne@blpc.com.bb |
| **Mr. Carlos Edwards** | Managing Director, Enermax Ltd. | enermax@caribsurf.com |

| | | |
|---|---|---|
| **Mr. Akeil Haynes** | Managing Director, NRG Solar & Renewables Ltd. | ahaynes@nrgrenewables.com |
| **Mr. Christopher Reid** | Solar PV Installation NVQ candidate<br><br>2/3 Trainees, individuals to comment on their training experience) | kris-reid@hotmail.com |
| **Mr. Maurice Hope** | Solar PV Installation NVQ candidate | 837-0728, no email contact |
| **Mr. Colin Harewood** | Community Centre Aide at Haggatt Hall Resource Centre | haggatthall.rc@gmail.com |
| | 5/10 members of the community that use the centres | |

## *Evaluation Criteria & Ratings*

An assessment of project performance will be carried out, based against expectations set out in the Project Logical Framework/Results Framework ( Annex A), which provides performance and impact indicators for project implementation along with their corresponding means of verification. As noted, the evaluation will at a minimum cover the criteria of: **relevance, effectiveness, efficiency, sustainability and impact.** Ratings must be provided on the following performance criteria. The completed table must be included in the evaluation executive summary. The obligatory rating scales are included in Annex D.

| **Evaluation Ratings:** | | | |
|---|---|---|---|
| **1. Monitoring and Evaluation** | ***rating*** | **2. IA& EA Execution** | ***rating*** |
| M&E design at entry | | Quality of UNDP Implementation | |
| M&E Plan Implementation | | Quality of Execution - Executing Agency | |
| Overall quality of M&E | | Overall quality of Implementation / Execution | |
| **3. Assessment of Outcomes** | **rating** | **4. Sustainability** | **rating** |
| Relevance | | Financial resources: | |
| Effectiveness | | Socio-political: | |
| Efficiency | | Institutional framework and governance: | |
| Overall Project Outcome Rating | | Environmental: | |
| | | Overall likelihood of sustainability: | |

| 5. Impact | rating |
|---|---|
| Environmental Status Improvement | |
| Environmental Stress Reduction | |
| Progress towards stress/status change | |
| Overall Project Results | |

### Criteria Comments

**Monitoring and Evaluation:** Highly Satisfactory (HS), Satisfactory (S) Moderately Satisfactory (MS), Moderately Unsatisfactory (MU), Unsatisfactory (U), Highly Unsatisfactory (HU)
Overall quality of M&E (rate 6 pt. scale)
M&E design at project start up (rate 6 pt. scale)
M&E Plan Implementation (rate 6 pt. scale)

**IA & EA Execution:** Highly Satisfactory (HS), Satisfactory (S) Moderately Satisfactory (MS), Moderately Unsatisfactory (MU), Unsatisfactory (U), Highly Unsatisfactory (HU)
Overall Quality of Project Implementation/Execution (rate 6 pt. scale)
Implementing Agency Execution (rate 6 pt. scale)
Executing Agency Execution (rate 6 pt. scale)

**Assessment of Outcomes** Highly Satisfactory (HS), Satisfactory (S) Moderately Satisfactory (MS), Moderately Unsatisfactory (MU), Unsatisfactory(U), Highly Unsatisfactory (HU)
Overall Quality of Project Outcomes (rate 6 pt. scale)
Relevance: relevant (R) or not relevant (NR) (rate 2pt. scale)
Effectiveness (rate 6 pt. scale)
Efficiency (rate 6 pt. scale)

**Sustainability:** Likely (L); Moderately Likely (ML); Moderately Unlikely (MU); Unlikely (U).
Overall likelihood of risks to Sustainability: (rate 4pt. scale)
Financial resources (rate 4pt. scale)
Socio-economic (rate 4pt. scale)
Institutional framework and governance (rate 4pt. scale)
Environmental (rate 4pt. scale)

**Impact:** Significant (S), Minimal (M), Negligible (N)
Environmental Status Improvement (rate 3 pt. scale)
Environmental Stress Reduction (rate 3 pt. scale)
Progress towards stress/status change (rate 3 pt. scale)

**OVERALL PROJECT RESULTS** (RATE 6 PT. SCALE)

## *Project Finance / Co-finance*

The Evaluation will assess the key financial aspects of the project, including the extent of co-financing planned and realized. Project cost and funding data will be required, including annual expenditures. Variances between planned and actual expenditures will need to be assessed and explained. Results from recent financial audits, as available, should be taken into consideration. The evaluator(s) will receive assistance from the Multi-Country Office (CO) and Project Team to obtain financial data in order to complete the co-financing table below, which will be included in the terminal evaluation report.

| Co-financing (type/source) | UNDP own financing (mill. US$) | | Government (mill. US$) | | Partner Agency (mill. US$) | | Total (mill. US$) | |
|---|---|---|---|---|---|---|---|---|
| | Planned | Actual | Planned | Actual | Planned | Actual | Actual | Actual |
| Grants | | | | | | | | |
| Loans/Concessions | | | | | | | | |
| • In-kind support | | | | | | | | |
| • Other | | | | | | | | |
| Totals | | | | | | | | |

## *Mainstreaming*

UNDP supported GEF financed projects are key components in UNDP country programming, as well as regional and global programmes. The evaluation will comprehensively assess the extent to which the project was successfully mainstreamed with other UNDP priorities, including poverty alleviation, improved governance, the prevention and recovery from natural disasters, and gender. The project should be comprehensively reviewed and critically assessed with reference to the relevant UNDP Gender Strategy (2014-2017). This analysis should provide a basis for understanding how effectively the project addressed gender and other cross-cutting issues and the extent to which it reflected an appreciation of the nexus between energy and sustainable human development.

## *Impact*

The evaluators will assess the degree to which the project is achieving impacts or progressing towards the achievement of impacts. Key findings that should be brought out in the evaluations include whether the project has demonstrated: a) verifiable improvements in ecological status, b) verifiable reductions in stress on ecological systems, **c) energy-related impact results (emissions avoided, energy saved, increase in installed renewable energy capacity), d) leveraged new sources of financing and investment** and/or e) demonstrated progress towards these impact achievements.[1]

[1] A useful tool for gauging progress to impact is the Review of Outcomes to Impacts (ROtI) method developed by the GEF Evaluation Office: ROTI Handbook 2009

## *Conclusions, Recommendations & Lessons*

The evaluation report must include a chapter providing a set of **conclusions, recommendations and lessons**. In order for these recommendations and lessons to be useful, they should be presented with a clear, logical connection to the findings and results of the evaluation. This section should therefore reflect on the triangulation of information from various sources, including document reviews, inclusive stakeholder feedback and strategic site visits. Recommendations should be categorized for key stakeholders, including UNDP, with proposed actions and responsibilities identified to enhance the impact of the current project as well as inform the design and implementation of future interventions.

## *Implementation Arrangements*

The principal responsibility for managing this evaluation resides with the Ministry of Energy and Water Resources who will be responsible for liaising with the Evaluators team to set up stakeholder interviews, arrange field visits, coordinate with the Government etc.

## *Evaluation Timeframe*

The total duration of the evaluation will be *20* days according to the following plan:

| **Activity** | Time Required | Deadline |
|---|---|---|
| **Preparation (Inception Report)** | *3* days | *5 business days after contract signature* |
| **Evaluation Mission** | *5* days | *15 business days after contract signature* |
| **Draft Evaluation Report** | *8* days | *30 business days after contract signature* |
| **Final Report** | *4* days | *40 business days after contract signature* |

## Annex B. Evaluation Consultant Agreement Form

### ANNEX E: EVALUATION CONSULTANT CODE OF CONDUCT AND AGREEMENT FORM

Evaluators:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study imitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

Evaluation Consultant Agreement Form[13]

Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: Remi Rijs

Name of Consultancy Organization (where relevant): individual consultant

I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.

Signed at *Schoonhoven, March 5, 2020*

Signature: _____

[13] www.unevaluation.org/unegcodeofconduct

## Annex C. Evaluation Questions

| EVALUATIVE CRITERIA QUESTIONS | INDICATORS | SOURCES | METHODOLOGY |
|---|---|---|---|
| Relevance: How does the project relate to the main objectives of the GEF focal area, and to the environment and development priorities at the local, regional and national levels? | | | |
| • Does the project relate to the GEF Climate Change focal area and has it been designed to deliver global environmental benefits in line with relevant international climate change objectives? | • The project includes the relevant GEF outcomes, outputs and indicators<br>• The project makes explicit links with global climate action goals (e.g. SE4ALL) | • Project Document<br>• GEF 5 Focal Area Strategies<br>• PIF | • Desk Review of Documents |
| • Is the project aligned to National development objectives, broadly, and to national energy transition priorities specifically? | • The project design includes explicit links (indicators, outputs, outcomes) to the national development policy/national energy policies. | • Project Document<br>• National development strategies, energy policies, Nationally Determined Contributions, etc.<br>• PIF | • Desk Review of Documents |
| • Is the project relevant to stated regional development objectives as defined by CARICOM, OECS and other regional frameworks? | • Explicit links are made within the project to regional development policies, action plans and associated initiatives such as the CARICOM Energy Policy. | • Project Document<br>• CARICOM Energy Policy<br>• PIF | • Desk Review of Documents |
| • Is the project's Theory of Change relevant to addressing the development challenge(s) identified? | • The Theory of Change clearly indicates how project interventions and projected results will contribute to the reduction of the three major barriers to low carbon development (Policy, institutional/technical capacity and financial) | • Project Document<br>• PIF | • Desk Review of Documents |
| • Does the project directly and adequately address the needs of beneficiaries at local and regional levels? | • The Theory of Change clearly identifies beneficiary groups and defines how their capabilities will be enhanced by the project. | • Project Document<br>• PIF | • Desk Review of Documents |
| • Is the project's results framework relevant to the development challenges and are results at the appropriate level? | • The project results framework adequately measures impact<br>• The project indicators are SMART<br>• Indicator baselines are clearly defined and populated and milestones and targets are | • Project Document<br>• PIF | • Desk Review of Documents |

| EVALUATIVE CRITERIA QUESTIONS | INDICATORS | SOURCES | METHODOLOGY |
|---|---|---|---|
| | • The results framework is comprehensive and demonstrates systematic links to the theory of change | | |
| • Is the project appropriately aligned with relevant UN system priorities, including thematic objectives at the national/regional and international levels? | • The project's results framework includes relevant thematic outcomes and indicators from the UNDP Strategic Plan, the UNDAF, UNDP CPD and other relevant corporate objectives | • Project Document<br>• UNDP CPD, UNDAF, SP | • Desk Review of Documents |
| • Have the relevant stakeholders been adequately identified and have their views, needs and rights been considered during design and implementation? | • The stakeholder mapping and associated engagement plan includes all relevant stakeholders and appropriate modalities for engagement.<br>• Planning and implementation have been participatory and inclusive | • Stakeholder mapping/engagement plan and reporting<br>• Quarterly Reports<br>• Annual Reports (PIR)<br>• Stakeholder Consultation Reports | • Desk Review of Documents<br>• Stakeholder Interviews |
| • Have the interventions of the project been adequately considered in the context of other development activities being undertaken in the same or related thematic area? | • A Partnership framework has been developed that incorporates parallel initiatives, key partners and identifies complementarities | • Project Document<br>• Quarterly Reports<br>• Annual Reports (PIR)<br>• Stakeholder mapping/engagement plan and reporting | • Desk Review of Documents<br>• Stakeholder Interviews |
| • Have relevant lessons learned from previous projects informed the design, implementation, risk management and monitoring of the project? | • Lessons learned are explicitly identified and integrated into all aspects of the Project Document | • Project Document<br>• PIF | • Desk Review of Documents |
| • Did the project design adequately identify, assess and design appropriate mitigation actions for the potential social and environmental risks posed by its interventions? | • The SES checklist was completed appropriately and all reasonable risks were identified with appropriate impact and probability ratings and risk mitigation measures specified | • Project Document<br>• SES Annex | • Desk Review of Documents |
| Effectiveness: To what extent have the expected outcomes and objectives of the project been achieved? | | | |
| • Has the project achieved its output and outcome level objectives? | • The project has met or exceeded the output and outcome indicator end-of-project targets | • Quarterly Reports<br>• Annual Reports (PIR)<br>• Monitoring Reports<br>• Beneficiary testimony | • Desk Review of Documents<br>• Interviews with project staff, |

| Evaluative Criteria Questions | Indicators | Sources | Methodology |
|---|---|---|---|
| | | • Site visit/field reports<br>• Pilot Data Analysis/Reports | stakeholders and beneficiaries<br>• Site visits |
| • Were lessons learned captured and integrated into project planning and decision-making? | • Lessons learned have been captured periodically and/or at project end | • Steering Committee Meeting Minutes<br>• Quarterly Reports<br>• Annual Reports (PIR) | • Desk Review of Documents<br>• Interviews with project staff, stakeholders and beneficiaries |
| • How well were risks (including those identified in the Social and Environmental Screening (SES) Checklist), assumptions and impact drivers being managed? | • A clearly defined risk identification, categorization and mitigation strategy (updated risk log in ATLAS) | • ATLAS Risk Log<br>• M&E Reports | • Desk Review of Documents<br>• Interviews with project staff, stakeholders and beneficiaries |
| • Were relevant counterparts from government and civil society involved in project implementation, including as part of the project steering committee? | • The steering committee participation included representatives from key institutions in Government | • Steering Committee Meeting Minutes | • Interviews with project staff, stakeholders and beneficiaries |
| • Has the project contributed directly to any changes in legislation or policy in line with the project's objectives? | • Draft legislation has been developed or enacted to catalyse the reduction of barriers to the increased penetration of renewable energy/energy efficient technologies | • Draft legislation<br>• Policy Documents<br>• Action/Implementation Plans | • Desk Review of Documents |
| • Is there evidence that the project outcomes have contributed to better preparations to cope with natural disasters? | • The project has directly contributed to reductions in one or more vulnerabilities associated with natural disasters | • Quarterly Reports<br>• Annual Reports (PIR)<br>• Stakeholder/beneficiary testimony | • Desk Review of Documents<br>• Interviews with project staff, stakeholders and beneficiaries |
| • Has the project carefully considered the thematic issues related to human rights? In particular, has the project sought to and actively pursued equality of access to clean energy | • A gender mainstreaming plan was completed<br>• The project results framework has incorporated gender equality considerations, as relevant. | • Gender Mainstreaming Plan<br>• Project Document<br>• Stakeholder analysis and engagement plan | • Desk Review of Documents |

| Evaluative Criteria Questions | Indicators | Sources | Methodology |
|---|---|---|---|
| services and opportunities for women and men (i.e. project team composition, gender-related aspects of pollution impacts, stakeholder outreach to women's groups, etc.) | • Multi-dimensional poverty reduction is an explicit objective<br>• The project prioritized the most vulnerable as key beneficiaries | | |
| • Efficiency: Was the project implemented efficiently, in-line with international and national norms and standards? | | | |
| • Did the project adjust dynamically to reflect changing national priorities/external evaluations during implementation to ensure it remained relevant? | • The project demonstrated adaptive management and changes were integrated into project planning and implementation through adjustments to annual work plans, budgets and activities<br>• Changes to AWP/Budget were made based on mid-term or other external evaluation<br>• Any changes to the project's planned activities were approved by the Steering Committee<br>• Any substantive changes (outcome-level changes) approved by the Steering Committee and donor, as required | • Annual Work Plans<br>• Steering Committee Meeting Reports<br>• Quarterly Reports<br>• Annual Reports (PIR)<br>• Stakeholder/beneficiary testimony<br>• Revised Project Results Framework | • Desk Review of Documents<br>• Interviews with project staff, stakeholders and beneficiaries |
| • To what extent were the Project results delivered with the greatest value for money? | • Value for money analyses, requests for information, market surveys and other market intelligence were undertaken for key procurements.<br>• Procurement is done on a competitive basis, where relevant. | • VFM, RFI, Market Surveys<br>• Procurement Evaluation Documents | • Desk Review of Documents<br>• Interviews with project staff and government stakeholders |
| • Was co-financing adequately estimated during project design (sources, type, value, relevance), tracked during implementation and what were the reasons for any differences between expected and realised co-financing? | • Co-financing was realized in keeping with original estimates<br>• Co-financing was tracked continuously throughout the project lifecycle and deviations identified and alternative sources identified<br>• Co-financiers were actively engaged throughout project implementation | • Annual Work Plans<br>• Steering Committee Meeting Reports<br>• Quarterly Reports<br>• Annual Reports (PIR) | • Desk Review of Documents<br>• Interviews with project staff, stakeholders and beneficiaries |
| • Was the level of implementation support provided by UNDP adequate and in keeping with the implementation modality and any related agreements (i.e. LOA)? | • Technical support to the Executing Agency and project team were timely and of acceptable quality. | • LOA (s)/Cooperation Agreement(s)<br>• UNDP project support documents (emails, | • Desk Review of Documents |

| EVALUATIVE CRITERIA QUESTIONS | INDICATORS | SOURCES | METHODOLOGY |
|---|---|---|---|
| | • Management inputs and processes, including budgeting and procurement, were adequate | procurement/recruitment documents)<br>• Quarterly Reports<br>• Annual Reports (PIR) | • Interviews with project staff, UNDP personnel |
| • Have the capacities of the executing institution(s) and counterparts been properly considered when the project was designed? | • An ex-ante analysis was undertaken of the internal control framework and internal capacities of the IP<br>• An ex-ante capacity analysis was undertaken of key partners with explicit responsibilities for implementation of project funds<br>• The cash transfer modality and implementation modality appropriately reflected the findings of any ex-ante analyses | • HACT Assessment(s)<br>• Capacity Assessments | • Desk Review of Documents |
| • Has the M&E plan been well-formulated, and has it served as an effective tool to support project implementation. | • The M&E plan has an adequate budget and was adequately funded<br>• The logical framework was used during implementation as a management and M&E tool<br>• There was compliance with the financial and narrative reporting requirements (timeliness and quality)<br>• Monitoring and reporting has been at both the activity and results levels | • Project Document<br>• M&E Plan<br>• AWPs<br>• FACE forms<br>• Quarterly Narrative Reports<br>• Site visit reports | • Desk Review of Documents<br>• Interviews with project staff and government stakeholders |
| • Has the project adequately used relevant national systems (procurement, recruitment, payments) for project implementation where possible? | • Use of national systems was in keeping with relevant national requirements and internal control frameworks<br>• Management of financial resources has been in line with accounting best practice<br>• Management of project assets has been in line with accounting best practice | • Procurement/Recruitment reports<br>• FACE forms<br>• CDRs | • Desk Review of Documents<br>• Interviews with project staff and government stakeholders |
| • Were financial audit/spot check findings adequately addressed and relevant changes made to improve financial management? | • Appropriate management responses and associated actions were taken in response to audit/spot check findings.<br>• Successive audits demonstrated improvements in financial management practices | • Project Audit Reports<br>• | • Desk Review of Documents |

| EVALUATIVE CRITERIA QUESTIONS | INDICATORS | SOURCES | METHODOLOGY |
|---|---|---|---|
| **Sustainability: To what extent are there financial, institutional, social-economic, and/or environmental risks to sustaining long-term project results?** | | | |
| • Are there financial risks that may jeopardize the sustainability of project outcomes? | • The exit strategy includes explicit interventions to ensure financial sustainability of relevant activities | • Project Exit Strategy<br>• Risk Log | • Desk Review of Documents |
| • Do the legal frameworks, policies, and governance structures and processes within which the project operates pose risks that may jeopardize sustainability of project benefits? | • The exit strategy identifies relevant socio-political risks and includes explicit interventions to mitigate same | • Project Exit Strategy<br>• Risk Log | • Desk Review of Documents |
| • Have key stakeholders identified their interest in project benefits beyond project-end and accepted responsibility for ensuring that project benefits continue to flow? | • Key stakeholders are assigned specific, agreed roles and responsibilities outlined in the exit strategy<br>• MOU(s) exist for on-going monitoring, maintenance and oversight of phased down or phased over activities | • Project Exit Strategy<br>• Risk Log<br>• MOU(s) | • Desk Review of Documents |
| • Are there ongoing activities that may pose an environmental threat to the sustainability of project outcomes? | • The exit strategy identifies relevant environmental risks and includes explicit interventions to mitigate same | • Project Exit Strategy<br>• Risk Log | • Desk Review of Documents |
| **Impact: Are there indications that the project has contributed to, or enabled progress toward, reduced environmental stress and/or improved ecological status?** | | | |
| • Are there verifiable improvements in ecological status, or reductions in ecological stress, that can be linked directly to project interventions? | • The project has contributed directly to improved ecological conditions, including through reduced GHG emissions for energy generation and transportation | • Quarterly Reports<br>• Annual Reports (PIR)<br>• Monitoring Reports<br>• Pilot Data Analysis/Reports | • Desk Review of Documents<br>• Site visits |

## Annex D. Itinerary

As per the inception report, a mission to Barbados was scheduled for 16-20 March, 2020. This had to be cancelled due to the outbreak of the COVID-19 pandemic.

## Annex E. Persons interviewed

In the period March 1 – June 30, 2020, regular meetings were held with the National Project Coordinator, Ms. Destine Gay.

Structured interview were held as follows:

| Name | Position | Date |
|---|---|---|
| Ms. Ludmilla Diniz | UNDP Regional Technical Advisor | April 29, 2020 |
| Mr. Jason LaCorbinière | UNDP Barbados M&E Officer | May 6, 2020 |
| Mr. William Hinds | MEWR Chief Renewable Energy and Energy Conservation Officer | June 25, 2020 |
| Ms. Danielle Evanson | UNDP Barbados Programme Officer | July 13, 2020 |

## Annex F Participation in PSC meetings

| STEERING COMMITTEE MEETINGS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | **PSC 1** | **PSC 2** | **PSC 3** | **PSC 4** | **PSC 5** | **PSC 6** | **PSC 7** |
| | | | 19 Apr 16 | 26 Oct 16 | 10May17 | 1 Nov 17 | 3 Jul 18 | 13 Feb 19 | 24 Jul 19 |
| **MEWR** | | **Post / Organization** | | | | | | | |
| Jehu Wiltshire | MEWR | Permanent Secretary | X | X | | | | | |
| Francine Blackman | MEWR | Deputy Permanent Secretary | X | X | X | X | X | | |
| William Hinds | MEWR | Chief Energy Conservation Officer | X | X | | X | X | | |
| Horace Archer | MEWR | Senior Technical Officer | X | | X | X | X | X | X |
| Dara Haynes | MEWR | Technical Officer | X | X | X | | | X | |
| Laura Burnett | MEWR | Administrative Assistant | X | X | | | | | |
| **UNDP** | | | | | | | | | |
| Stephen O'Malley | UNDP | Resident Representative | X | X | X | | skype | | |
| Chisa Mikami | UNDP | Resident Representative a.i. | | | | X | | X | |
| Danielle Evanson | UNDP | Programme Manager EECC | X | X | X | X | | X | X |
| Allan Franklin | UNDP | Programme Specialist EECC | | | | | | X | X |
| Jason LaCorbiniere | UNDP | M&E Specialist | X | X | X | X | X | | X |
| Destine Gay | PROJECT | National Project Coordinator DREAM | X | X | X | X | X | X | X |
| Stuart Bannister | PROJECT | Technical Officer DREAM | | | X | X | X | X | X |
| **Other Committee Members** | | | | | | | | | |
| Gina Belle | MENB | Project Coordinator (GEF OFP) | | | X | X | X | X | |
| Tennyson Springer | MoH | Permanent Secretary | X | | | | | | |
| Samuel Deane | MoH | Chief Health Planner | X | | | | | | |
| Karen Broome | MoH | Senior Medical Officer | | X | | X | | | |
| Naomi Cumberbatch | PIU | Public Investment Unit | | | | | | X | X |
| Marica Strickland | PIU | Public Investment Unit | | | | | | X | |
| Robert Harewood | DEM | Deputy Director | X | | | | | | |
| Joy-Anne Johnston | DEM | Programme Officer | | | X | X | X | X | |
| Kerry Hinds | DEM | Disaster Emergency Management | | | | X | | | |
| Bertram Bispham | CDD | Community Devt Officer | | X | | X | X | | |
| Alexis Nurse | CDD | Deputy Chief Community Devt Officer | | | | | X | X | |
| Sandra Greenidge | CDD | Chief Community Devt Officer | | | | | | X | |
| Bridgette Marshall-Griffith | CDD | Community Devt Officer | | | | | | | X |
| Yolande Skeete | CDD | Community Devt Officer | | | | | | | X |
| Heather Sealy | GEED | Deputy Chief Electrical Officer | | X | X | X | X | X | |
| Ronald Thompson | NSC | Senior Technical Officer | X | X | X | X | X | X | X |
| Joan Bourne | BL&P | Engineering Manager Planning Projects | X | | | | X | | X |

## Annex G List of installed PV systems at CRCs

| OVERVIEW INSTALLED PV INSTALLATIONS AT COMMUNITY CENTRES, RESOURCE CENTRES AND PAVILIONS | | | | | |
|---|---|---|---|---|---|
| **Name of Location** | **Address** | **Latitude** | **Longitude** | **PV capacity (kWp)** | **GEED inspection number** |
| Harold Nurse Community Centre | Friendship, St. Michael | 13.130295 | -59.595286 | 5.0 | 299757 |
| Haggatt Hall Resource Centre | Robert Ten Rd, Haggatt Hall, St. Michael | 13.111070 | -59.577220 | 7.5 | 299753 |
| Dover Pavilion | Dover, Christ Church | 13.068391 | -59.568021 | 2.5 | 300496 |
| Clapham Community Centre | Clapham Park, Chirst Church | 13.088998 | -59.581298 | 2.5 | 299760 |
| Emmerton Community Centre | Elkes Pasture, Emmerton Lane, St. Michael | 13.102140 | -59.621013 | 2.5 | 299759 |
| Ivy Community Centre | Black Ivy, St. Michael | 13.105934 | -59.591216 | 2.5 | 299764 |
| Bayville Community Centre | Field Place, Bayville St. Michael | 13.086486 | -59.604276 | 2.5 | 299755 |
| James Bryan Pavilion | Market Hill, St. George | 13.153195 | -59.564446 | 2.5 | 299751 |
| Ellerton Community Centre | Ellerton, St. George | 13.130482 | -59.539009 | 2.5 | 299766 |
| Branchbury Community Centre | Branchbury, St. Joseph | 13.188635 | -59.549258 | 2.5 | 299767 |
| St. Elizabeth Community Centre | St. Elizabeth Village, St. Joseph | 13.209072 | -59.528176 | 2.5 | 299761 |
| Bridgefield Pavilion | Bridgefield, St. Thomas | 13.158156 | -59.594342 | 2.5 | 300495 |
| Black Bess Resource Centre | Black Bess Pavilion, Black Bess, St. Peter | 13.239379 | -59.615668 | 2.5 | 299758 |
| Keith Boyce Pavilion | Diamond Corner, St. Peter | 13.275794 | -59.596020 | 2.5 | 299762 |
| Crab Hill Community Centre | Crab Hill, St. Lucy | 13.316057 | -59.639625 | 2.5 | 300497 |
| Checker Hall Pavilion | Checker Hall, St. Lucy | 13.285953 | -59.643085 | 2.5 | 299763 |
| Drax Hall Resource Centre | Lower Section Drax Hall, St. George | 13.137879 | -59.519482 | 5.0 | 299750 |
| Greens Resource Centre | Greens, St. George | 13.148174 | -59.531115 | 2.5 | 299768 |
| Rices Community Centre | Rices Pavilion, Rices St. Philip | 13.103804 | -59.456013 | 2.5 | 299756 |
| St.Marks Resource Centre | St. Marks St. Philip | 13.163253 | -59.461002 | 7.5 | 299752 |
| Colleton Community Centre | Colleton Gardens, St. John | 13.178072 | -59.485119 | 2.5 | 299754 |
| Gall Hill Pavilion | Gall Hill, St. John | 13.182995 | -59.501333 | 2.5 | 299765 |
| | | | **TOTALS** | **70.0** | |

The supplier did not specify the projected energy yield per system.

| PV COMMUNITY CENTRES, RESOURCE CENTRES AND PAVILIONS - KEY FIGURES | | | |
|---|---|---|---|
| Investment (CAPEX) | 939,142.40 | B$ | |
| | 469,571 | US$ | |
| Specific investment cost | 6,708.16 | US$/kWp | |
| Usable hours | 4.20 | kWh/kWp, per day | |
| Energy production | 294 | kWh/day | |
| | 107,310 | kWh/yr | |
| | 2,682,750 | kWh | (25 year) |
| | 2,682 | MWh | |
| Monetary value (@.208 USD/kWh) | 558,012 | US$ | total savings |
| | 22,320 | US$/yr | |
| Payback time | 21.0 | simple payback time (yr) | |
| GHG Emission reductions | 2,334 | tCO2 lifetime | |
| | 2.33 | kton CO2 | |

## Annex H. List of installed PV systems at polyclinics

| OVERVIEW INSTALLED PV INSTALLATIONS AT POLYCLINICS | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Name of Polyclinic** | **Address** | **Latitude** | **Longitude** | **System cost (B$)** | **Panel capacity (kWp)** | **Number panels (-)** | **Panel capacity (Wp)** | **Inverter (kW)** | **Usable sun hours (h)** | **Projected energy yield (kWh)** | | **Price (B$)** | **Cost savings (B$)** |
| | | | | | | | | | | **per day** | **per month** | **per kWh** | **per day** |
| St. Philip Polyclinic | Six Roads, St. Philip | 13.118072 | -59.476292 | 48,183.73 | 15.5 | 36 | | 14.4 | | 65.3 | 1,958 | | 27.15 |
| Brandford Taitt Polyclinic | Black Rock , St. Michael | 13.118143 | -59.618375 | 46978.33 | 15.5 | 42 | | 20.0 | | 65.3 | 1,958 | | 27.15 |
| St. John Polyclinic | Glebe, St. John | 13.182037 | -59.496334 | 169,760.63 | 51.1 | 138 | | 66.6 | | 214.5 | 6,433 | | 89.21 |
| Randal Philips Polyclinic | Oistins, Christ Church | 13.062070 | -59.540705 | 45,736.74 | 13.3 | 36 | | 14.4 | | 55.9 | 1,677 | | 23.25 |
| Glebe Polyclinic | Glebe, St. George | 13.135044 | -59.563415 | 42,636.61 | 13.3 | 36 | 370 | 14.4 | 4.20 | 55.9 | 1,677 | 0.416 | 23.25 |
| Eunice Gibson Polyclinic | Warrens, Polyclinic | 13.140955 | -59.605832 | 47,546.47 | 15.5 | 42 | | 14.4 | | 65.3 | 1,958 | | 27.15 |
| Maurice Byer Polyclinic | Church Street, Speightstown, St. Peter | 13.253605 | -59638659 | 48,183.73 | 15.5 | 42 | | 14.4 | | 65.3 | 1,958 | | 27.15 |
| Edgar Cochrane Polyclinic | Wildey, St. Michael | 13.092649 | -59.586424 | 45,638.46 | 13.3 | 36 | | 14.4 | | 55.9 | 1,677 | | 23.25 |
| Winston Scott Polyclinic | Jemmotts Layne, St. Michael | 13.092444 | -59.607281 | 56,495.10 | 20.7 | 56 | | 28.8 | | 86.9 | 2,608 | | 36.17 |
| | | | **TOTALS** | **551,159.80** | **173.9** | **464** | **-** | - | - | **730.17** | **21,905** | **-** | **303.75** |

| PV SYSTEMS POLYCLINICS - KEY FIGURES | | | |
|---|---|---|---|
| Investment (CAPEX) | 551,159.80 | B$ | |
| | 275,580 | US$ | |
| Specific investment cost | 1,584.70 | US$/kWp | |
| Usable hours | 4.20 | kWh/kWp, per day | |
| Energy production | 730 | kWh/day | |
| | 266,450 | kWh/yr | |
| | 6,665,000 | kWh | (25 year) |
| | 6,665 | MWh | |
| Monetary value (@.208 USD/kWh) | 1,386,320 | US$ | total savings |
| | 55,453 | US$/yr | |
| Payback time | 5.0 | simple payback time (yr) | |
| GHG Emission reductions | 5,789 | tCO2 lifetime | |
| | .80 | kton CO2 | |

## Annex I. Implemented PV Back-up installations (re-wiring) at 10 Primary School.

| OVERVIEW IMPLEMENTED PV BACK-UP AT GOB PRIMARY SCHOOLS | |
|---|---|
| **Name of School** | **Inspection** |
| 1. St. Matthew's Primary School | November 2, 2018 |
| 2. Luther Thorne Primary School | November 2, 2018 |
| 3. Grantley Prescod Primary School | November 2, 2018 |
| 4. All Saint's Primary School | November 5, 2018 |
| 5. Good Shepherd Primary School | November 5, 2018 |
| 6. Hillaby Turners Hall Primary School | November 5, 2018 |
| 7. Hilda Skeene Primary School | November 8, 2018 |
| 8. Reynold Weeks Primary School | November 8, 2018 |
| 9. St. Albans Primary School | |
| 10. Charles F. Broome Memorial Primary School | |
| 11. Pine Wildey Primary School | |

## Annex J. Implemented PV Capacities and GHG Emission Reductions

| IMPLEMENTED PV CAPACITIES, ESTIMATED ENERGY PRODUCTION AND GHG EMISSION REDUCTIONS | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RF Indicator** | **Description** | **Detail** | **PRODOC** | | | | **PIR 2018** | **PIR 2019** | **End of Project** | | | | | |
| | | | **Capacity** | **Energy** | **GHG Reduction** | | **Capacity** | **Capacity** | **Capacity** | **Energy** | | **GHG Reduction** | | |
| | | | **(MW)** | **(MWh / year)** | **(tCO2 / year)** | **(tCO2, 10 years)** | **(MW)** | **(MW)** | **(MW)** | **(MWh / year)** | **(MWh, 25 years)** | **(tCO2, 25 years)** | **(%)** | |
| #13 Rooftop solar-PV installations financed through GoB RE funds where DoET and BL&P have involvement in operationalisation (MW) | **Grid-connected solar PV panels** | 40 community and resource centres with 2.5 kWp solar PV installations (purchased and installed by Project) | 0.100 | 292 | 256 | 2,558 | 0 | 0.063 | 0.070 | 107 | 2,683 | 2,334 | 2% | |
| | | 10 polyclincs each with 5 kW grid-tied system (equipment purchased and installed by Project) | 0.050 | 146 | 128 | 1,279 | 0 | 0 | 0.171 | 267 | 6,665 | 5,798 | 5% | |
| | **Co-financed solar PV installations that benefit from TA from the Project including the grid stability analysis** | 150 kWp (438MWh/yr) at Gymnasium (Chinese Grant) | 0.150 | 438 | 384 | 3,837 | 0.150 | 0.150 | 0.150 | 230 | 5,749 | 5,001 | 4% | |
| | | 450 kWp (1,314 MWh/yr) at 3 Water Authority Sites (Chinese Grant) | 0.450 | 1,314 | 1,151 | 11,511 | 0.400 | 0.400 | 0.150 | 613 | 15,330 | 13,337 | 11% | |
| | | 75 kWp (219 MWh/yr) at 30 schools under EDF-11 Funding) | 0.750 | 219 | 192 | 1,918 | - | - | n/a | - | - | - | - | |
| | | DoET PPP for 2.5 MW on public buildings (7,300 MWh/yr) | 2.500 | 7,300 | 6,395 | 63,948 | - | - | n/a | - | - | - | - | |
| | | PSSEP - 13 government buildings | | | | | | 2.460 | 2.460 | 3,771 | 94,280 | 82,023 | 70% | |
| | | MEWR for 4 schools | | | | | 0.040 | 0.040 | 0.040 | 61 | 1,533 | 1,334 | 1% | |
| | | Under Sustainable Energy Framework for Barbados (SEFB) | | | | | 0.096 | 0.096 | 0.096 | 147 | 3,679 | 3,201 | 3% | |
| | | National Petroleum Corporation (NPC) | | | | | 0.150 | 0.150 | 0.150 | 230 | 5,749 | 5,001 | 4% | |
| | | Other PV installations identified | | | | | | | 0.310 | | | | | |
| **TOTALS Indicator #13** | | | **4.0** | **9,709** | **8,505** | **85,051** | **0.836** | **3.359** | **3.850** | **5,902** | **147,551** | **128,370** | **100%** | |
| # 14 MW capacity of rooftop solar PV projects in planning and design stages (MW) | | DoET PPP for 7.5 MW on public buildings (21,900 MWh/yr) | 7.500 | 21,900 | 19,184 | 191,844 | | | n/a | - | - | - | - | |
| **TOTALS Indicator #14** | | | **7.5** | **21,900** | **19,184** | **191,844** | 0 | 0 | 0 | **0** | **0** | **-** | **-** | |
| **TOTAL** | | | **11.5** | **31,609** | **27,689** | **276,895** | | | | | | | | |