DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

BARBADOS

DEPLOYMENT OF CLEANER FUELS AND RENEWABLE ENERGIES IN BARBADOS

(BA-L1012)

LOAN PROPOSAL

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ELECTRONIC LINKS

REQUIRED

1. Pluriannual Execution Plan (PEP)
2. Annual Operational Plan (AOP)
3. Monitoring and Evaluation Plan (M&EP)
4. Environmental and Social Management Report (ESMR)
5. Procurement Plan

OPTIONAL

1. Analysis of Compliance with the Public Utilities Policy
2. Cost-Benefit Analysis (CBA)
3. NPC Institutional Capacity Assessment
4. Gender Annex
5. Barbados Energy Dossier
6. Integration Annex
7. Natural Gas in the Caribbean - Feasibility Studies
8. Operations Manual (OM)
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ABBREVIATIONS	
AOP	Annual Operation Plan
AFS	Audited Financial Statements
bcfpd	billion cubic feet per day
BL&P	Barbados Light and Power
BNOCL	Barbados National Oil Company Limited
CO_2	Carbon dioxide
CBA	Cost-Benefit Analysis
EA	Executing Agency
GDP	Gross Domestic Product
GOB	Government of Barbados
GHG	Green House Gases
GWh	Gigawatt-hour
HFO	Heavy Fuel Oil
IDB	Inter-American Development Bank
IIC	Inter-American Investment Corporation
INDC	Intended Nationally Determined Contribution
IRP	Integrated Resource Plan
kW	Kilowatt
EE	Energy Efficiency
EIRR	Economic Internal Rate of Return
ELPA	Electric Light and Power Act
ENPV	Economic Net Present Value
ESA	Environmental and Social Assessment
ESMP	Environmental and Social Management Plan
ESMR	Environmental and Social Management Report
ESS	Environmental and Social Strategy
ETD	Energy and Telecommunications Division
FTC	Fair Trading Commission
LFF	Liquid Fossil Fuels
LNG	Liquefied Natural Gas
M&E	Monitoring and Evaluation
MFE	Ministry of Finance and Economic Affairs
mmcfpd	million cubic feet per day
MOE	Ministry of Energy
MW	Megawatt
NG	Natural Gas
NPC	National Petroleum Corporation
OC	Ordinary Capital
OM	Operations Manual
O&M	Operation and Maintenance
PEP	Pluriannual Execution Plan
PEU	Project Execution Unit

POD	Proposal for Operation Development
PPP	Public-Private Partnership
PV	Photovoltaic
RC&I	Residential, Commercial and Industrial
RE	Renewable Energy
RER	Renewable Energy Rider
SCC	Strategic and Coordination Committee
T&T	Trinidad & Tobago
US$	United States Dollar
VS	Very Small

PROJECT SUMMARY
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<table>
<tr><th colspan="5">Financial Terms and Conditions</th></tr>
<tr><td colspan="3" rowspan="2">Borrower: Government of Barbados (GOB)</td><td colspan="2">Flexible Financing Facility[a]</td></tr>
<tr><td>Amortization Period:</td><td>24 years</td></tr>
<tr><td colspan="3" rowspan="2">Executing Agency: National Petroleum Corporation (NPC)</td><td>Original WAL:</td><td>15.25 years</td></tr>
<tr><td>Disbursement Period:</td><td>6 years</td></tr>
<tr><td>Source</td><td>Amount (US$)</td><td>%</td><td>Grace Period:</td><td>6.5 years</td></tr>
<tr><td rowspan="3">IDB (Ordinary Capital-OC): [c]</td><td rowspan="3">34,000,000</td><td rowspan="3">100</td><td>Supervision and Inspection Fee:</td><td>[b]</td></tr>
<tr><td>Interest rate:</td><td>Libor-based</td></tr>
<tr><td>Credit Fee:</td><td>[b]</td></tr>
<tr><td>Total:</td><td>34,000,000</td><td>100</td><td>Currency of Approval:</td><td>US$ dollars chargeable to the OC</td></tr>
<tr><th colspan="5">Project at a Glance</th></tr>
<tr><td colspan="5">Project Objective/Description: the objective of this project is to enhance Barbados' energy security and sustainability by diversifying its energy matrix through promoting the use of cleaner fuels for power generation, and increasing the use of Renewable Energy (RE) sources. Specific objectives include: to (i) upgrade existing natural gas infrastructure to ensure NG service continuity; (ii) increase Energy Efficiency (EE) and RE applications within the NPC's and Barbados National Oil Company Limited (BNOCL)'s operations to reduce Greenhouse Gas (GHG) emissions; (iii) enable implementation of a Public Private Partnership project to import and supply liquefied natural gas for power generation; and (iv) provide technical support to NPC/BNOCL to foster organizational and operational efficiency.</td></tr>
<tr><td colspan="5">Special contractual conditions prior to the first disbursement of the loan: the Executing Agency (EA) shall provide evidence that: (i) the Project Execution Unit (PEU) staff has been selected or assigned a Project manager, Project accountant, Procurement officer, Project administrator, Project engineer, and Quality assurance officer in accordance to the terms of reference agreed with the Bank and included as annex to the Program Operations Manual (OM) (¶3.2); (ii) the OM has been approved by the EA pursuant to the terms previously agreed with the Bank and has entered into effect, including the principles and requirements from the Environmental and Social Management Plan (ESMP) draft (¶3.5); and (iii) the Borrower shall submit to the Bank signed correspondence by the EA for the purposes of transferring the loan resources and the execution obligations of the project from the Borrower to the EA (¶3.1).

Special contractual execution conditions: The Borrower by itself, or through the EA, agrees to maintain the PEU in place and operational throughout the implementation of the project, including all its staff positions as indicated in the loan contract (¶3.2). Prior to the bidding of works financed under Components 1 and 2, the EA shall provide evidence that: (i) the final ESMP has been finalized and the OM has been updated with the final ESMP version annexed (¶2.6); and (ii) the final engineering designs of the infrastructure to be financed have been finalized as previously agreed with the Bank (¶3.5).</td></tr>
<tr><td colspan="5">Exceptions to Bank Policies: none</td></tr>
<tr><th colspan="5">Strategic Alignment</th></tr>
<tr><td colspan="2">Challenges[d]:</td><td>SI ☐</td><td>PI ☑</td><td>EI ☑</td></tr>
<tr><td colspan="2">Cross-Cutting Themes[e]:</td><td>GD ☐</td><td>CC ☑</td><td>IC ☑</td></tr>
</table>

[a] Under the Flexible Financing Facility (FN-655-1), the borrower has the option to request modifications to the amortization schedule as well as currency and interest rate conversions. In considering such requests, the Bank will take into account operational and risk management considerations.

[b] The credit fee and inspection and supervision fee will be established periodically by the Board of Executive Directors during its review of the Bank's lending charges, in accordance with the relevant policies.

[c] Pursuant to Document AB-2990, the disbursement of loan resources will be subject to the following maximum limits: (i) up to 15% during the first 12 months; (ii) up to 30% during the first 24 months; and (iii) up to 50% during the first 36 months. All these periods will be counted from the time the loan operation is approved by the Board of Executive Directors.

[d] SI (Social Inclusion and Equality); PI (Productivity and Innovation); and EI (Economic Integration).

[e] GD (Gender Equality and Diversity); CC (Climate Change and Environmental Sustainability); and IC (Institutional Capacity and Rule of Law).

I. DESCRIPTION AND RESULTS MONITORING

A. Background, Problem Addressed, Justification

1.1 Located in the Eastern Caribbean, Barbados has a population of 284,644 people living across 431 square kilometers, making it one of the most densely populated islands in the world. Around 25% of the population lives in the capital Bridgetown with a total urbanization rate of 44%.[1] The four main sectors contributing to Gross Domestic Product (GDP) are retail trade, business and other services, government services, and tourism. The largest foreign exchange earning sectors are the tourism and hospitality industry, international business services, manufacturing and agriculture. Electricity costs are ranked by firms as a one of the major constraints to doing business in the island.[2]

1.2 Barbados is a net importer of energy with imported oil products accounting for 93% of total primary energy supply. The remainder was locally produced Natural Gas (NG) (3.5%), local biomass and waste.[3] Lacking refining capacity, Barbados ships its crude oil to Trinidad & Tobago (T&T) for refining, subsequently importing the refined products back into the island to meet only about 15% of total energy needs.

1.3 Figure 1 shows the institutional organization of the energy sector. The Energy and Telecommunications Division (ETD) within the Office of the Prime Minister and the Minister of Energy (MOE) monitor this sector, including activities of the Barbados National Oil Company Limited (BNOCL) and the National Petroleum Corporation (NPC). BNOCL is tasked with exploration, production, and procurement of oil and NG. NPC is in charge of NG distribution to residential, commercial, and industrial (RC&I) customers. Both institutions have been collaborating over the years on strategies to optimize energy use throughout Barbados. They have also been working on the legal and institutional arrangement for their amalgamation into a single legal entity following a directive from the Cabinet of Ministers.[4]

1.4 Barbados's sole utility-scale electricity provider is the Barbados Light & Power Company Limited (BL&P),[5] a vertically integrated electric utility responsible for the generation, transmission and distribution of electricity serving 125,991 customers. It operates under a non-exclusive license valid until 2028. BL&P is regulated by the Fair Trading Commission (FTC) which was established in 2001 following the FTC Act. The FTC is an independent regulator for the electricity sector as well as for domestic and international telecommunications services and NG.

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[1] Achieving Sustainable Energy in Barbados: Energy Dossier; IDB 2016.

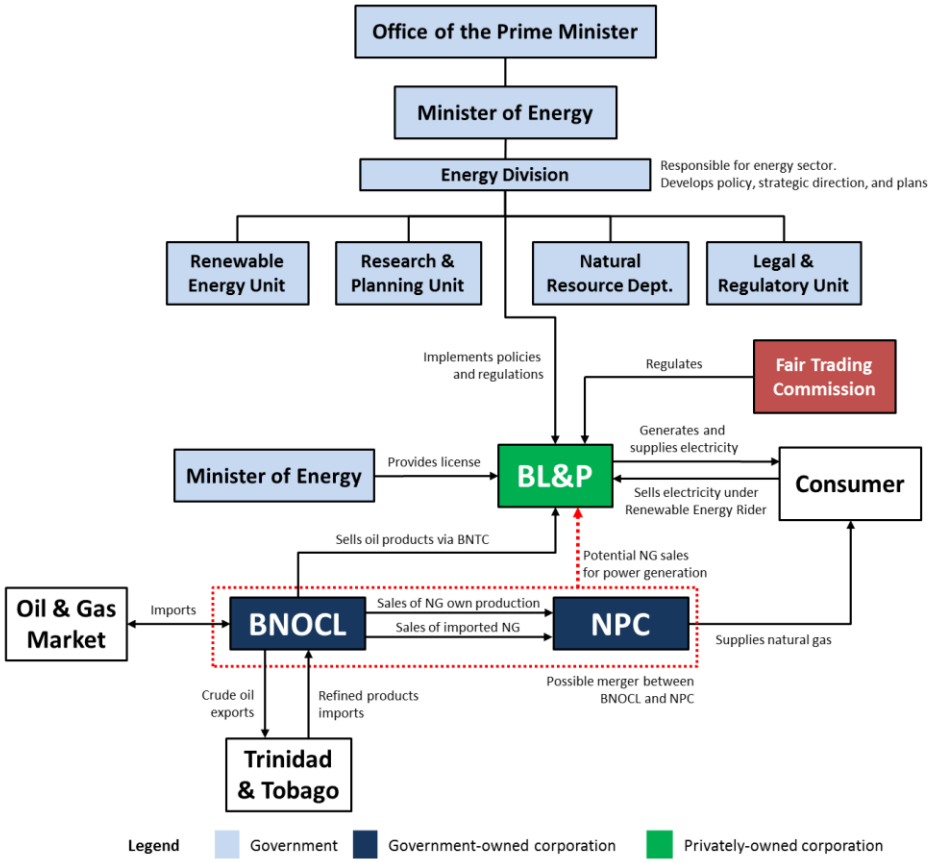
[2] Enterprise Survey Country Bulletin, Barbados, 2013, Page 4.

[3] Energy Dossier; IDB 2016; out of the 9,500 barrels of oil equivalent per day supplied in 2011, 8,870 came from imported oil products.

[4] GOB announced in 2014 its intention to amalgamate NPC/BNOCL into a single legal entity in an effort to reduce the public deficit. While the process has been moving forward, a date for its completion has not been announced.

[5] Owned by EMERA Caribbean Inc.

Figure 1: Organization of the Energy Sector, 2015[6]



1.5 A total of 1.0 million cubic feet per day (mmcfpd) of NG is locally produced to supply domestic consumption by NPC's approximate 20,800 RC&I customers. However, current average domestic NG sales amount to 1.4mmcfpd. Since local demand cannot be fully met with local production, the remainder 0.4mmcfpd has recently come from Liquefied Natural Gas (LNG) imports. BNOCL installed a LNG regasification facility at the Woodbourne Terminal (Micro LNG Plant) with capacity to handle 4 iso-containers per week to supply around 0.5mmcfpd of NG. The prevailing NG deficit poses a challenge to satisfy current and future consumption, a situation which is exacerbated during peak tourism seasons,[7] and prevents new consumers from using a cleaner and more affordable fuel than liquid fossil fuel (LFF) alternatives. Considering the latter, NPC estimates that additional demand of 0.3mmcfpd could be added in the immediate term bringing total demand up to 1.7mmcfpd.[8] The supply deficit is expected to grow as oil and gas production continues its one decade-long declining trend.[9]

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[6] Achieving Sustainable Energy in Barbados: Energy Dossier. IDB, 2016.

[7] During tourist season (November 2014 to April 2015), BNOCL could not meet local demand. Shortages affect all users but especially the tourism sector which is a key driver of growth, employment and main foreign exchange earning sector in Barbados.

[8] Direct communication with NPC officials, 2016.

[9] NG production peaked at 1.6mmcf/year in 2000 and has declined by approximately 30% since then.

1.6 Although its electricity sector is one of the most efficient in the Caribbean,[10] the country's reliance on imported Heavy Fuel Oil (HFO) and Diesel leads to high and volatile electricity costs that affect all economic sectors. HFO powers almost all of BL&P's installed capacity of 239.1MW.[11] HFO-based generation (819.3GWh) accounted for 85% of produced electricity, while Diesel-based generation (148.5GWh) contributed 15%. BL&P's least cost expansion plan as identified in its Integrated Resource Plan (IRP) is based on a NG expansion scenario. However, since NG is not yet available in sufficient quantities, BL&P has adopted an IRP recommendation that new generating capacity be dual-fuel (HFO/NG) so it can use NG when and if it becomes available. Approximately 40MW of HFO-based installed capacity is expected to be retired and replaced in 2017 and an additional 50MW in 2019 creating the opportunity to substitute HFO with NG thus reducing Greenhouse Gas (GHG) emissions.[12]

1.7 Concentration of the energy matrix on LFF affects the cost of living of citizens who at times of high oil prices have paid a high electricity tariff compared to other countries in the region. Figure 2 presents a comparison of power production costs in selected countries using NG and HFO in high and low oil price scenarios. Even with low oil prices NG appears to be a better alternative because in times of low oil prices, NG prices have also dropped. It is the differential between these prices what determines the competitiveness of NG with respect to LFF. Figure 3 shows the effect of using NG instead of HFO for power generation on electricity tariffs in Barbados in high and low oil prices scenarios. Since the tariff is composed by a fuel component and a fixed cost component, the recent drop in oil prices has resulted in the fuel component of the tariff,[13] declining by more than 50% with respect to 2014 when oil prices were at their highest.[14] However, and even at times of low oil prices, NG can offer opportunities to reduce tariffs for final users depending on the differential between NG and oil prices which presents less volatility. For this reason and to avoid the volatility and unpredictability of LFF and the fiscal constraints that come with high and volatile energy prices, the Government of Barbados (GOB) wants to persevere in the diversification of energy sources. According to the Barbados Statistical Services, Barbados spent US$427 million in oil products imports in 2014 accounting for 9% of GDP. Replacing LFF consumption with cleaner fuels can have a positive effect on fiscal revenues as well as on the country's balance of payments. An assessment of the benefits of this operation including on the country's fiscal situation is part of the Cost-Benefit Analysis (CBA) of the project.

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10 Average technical and non-technical losses are 7%, the lowest in Latin America and the Caribbean where the average is 17%.

11 In 2015 net electricity generation by BL&P stood at 967.8GWh with sales of 915.2GWh.

12 Barbados Light & Power Co. Ltd. – 2012, IRP.

13 The fuel component of the tariff, or Fuel Clause Adjustment, is a regulatory mechanism intended to allow the utility to recover the cost of fuel used in the generation of electricity.

14 The recent drop in oil prices has resulted in the fuel component of the tariff declining by more than 50% with respect to 2014 when oil prices were much higher. The fuel surcharge peaked at US$0.23/kWh in August 2014 and stands at US$0.11 as of September 2016.

Figure 2: Comparison of power production costs with NG and HFO[15]

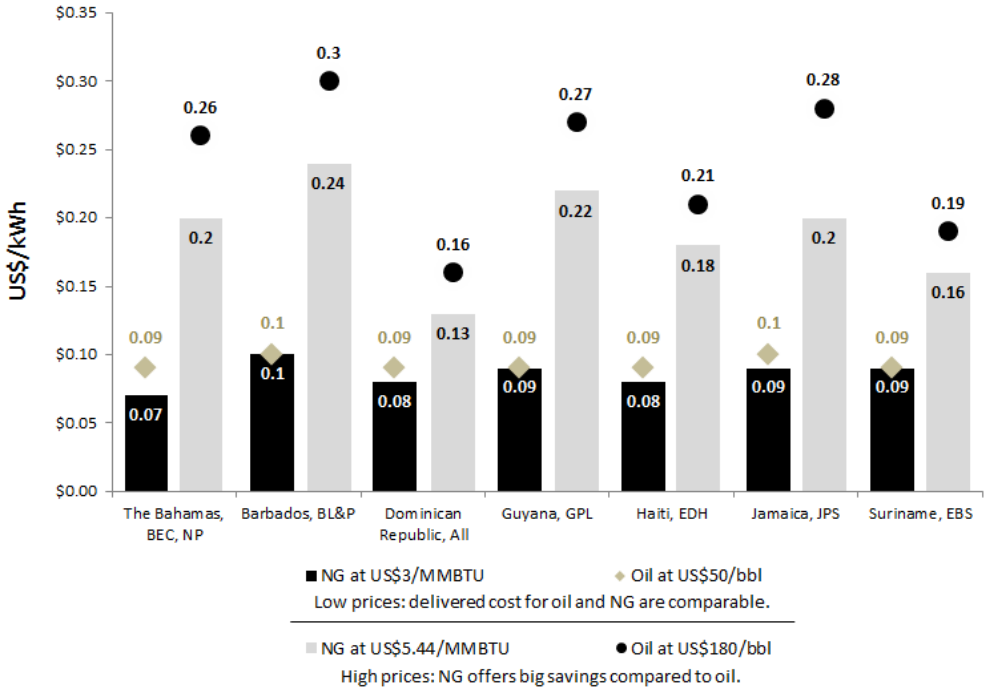
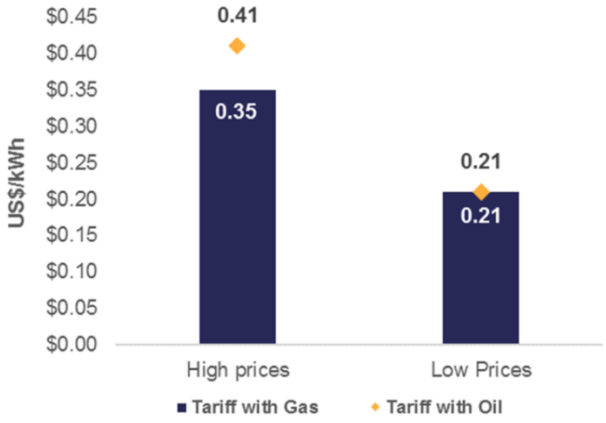


Figure 3: Tariff implications for Barbados[16]



1.8 **Macro context.** Macroeconomic stability in Barbados is challenged by high fiscal deficits and public debt in an environment of low growth. As a net oil importer, Barbados is benefitting from lower international oil prices and higher tourist arrivals that had a positive impact on output in 2015. Over the past 5 years, output grew by an average 0.4% annually. The economy grew by 0.9% in 2015 and by 1.3% for the first 6 months of 2016. The current account deficit fell from 10.5% to 7.8% of GDP in 2015 and further declined to 6.8% by the end of June 2016. Lower fuel prices represented a 33% drop in the fuel import bill that, along

15 Natural Gas in the Caribbean - Feasibility Studies.
16 Idem.

with weaker domestic consumption that constrained imports, narrowed the balance. On the downside however, fiscal revenues have been hit by weak domestic demand and lower fuel excises. Tourism is the driver of growth and directly contributes around 12% of GDP through hotels and restaurants. Moreover, tourism indirectly contributes over 40% of GDP and supports the demand of the non-tourism sectors, like construction and services. Looking forward, the Central Bank estimates output growth at 1.5% in 2016, while the International Monetary Fund estimates 2.3% for 2017 if economic activity picks up with private investment in tourism projects. Due to the importance of energy affordability for the aforementioned sector, reducing electricity prices and price volatility while ensuring security of energy supply is fundamental for supporting growth and increasing competitiveness in Barbados.

1.9 **Barbados' energy sector is changing**. The Electric Light and Power Act, 2013 (ELPA)[17] charts a new course and sets the government's priorities in the electricity sector which are to reduce electricity prices, increase energy security and the use of cleaner fuels, and reduce negative environmental impacts. As per its Intended Nationally Determined Contribution (INDC) from September 28, 2015, Barbados intends to achieve a 23% economy-wide reduction in GHG emissions compared with the 2008 baseline year. Barbados aims to have Renewable Energy (RE) contribute 65% of total peak electrical demand by 2030 and achieve a 22% reduction in electricity consumption by 2029 compared to a business-as-usual scenario.[18] As a result, and as mentioned in the Barbados Medium-Term Growth and Development Strategy (2013-2020), Barbados is seeking to promote Energy Efficiency (EE) and RE, and ensure a reliable source of cleaner fuels for power generation.

1.10 Even before the ELPA, two key initiatives had already initiated the transformation of the energy sector by bolstering small scale RE development: the Renewable Energy Rider (RER) program and the IDB-sponsored Smart Energy Fund (¶1.15). RER, introduced by BL&P in 2010, provides billing credit to eligible customers with RE sources, especially solar photovoltaic (PV) panels, allowing them to sell excess power to the grid.[19] The maximum total capacity limit for the RER program was set at 7MW and soon increased to 9MW. The ELPA, however, set the basis for further expanding the RER limit to 20MW due to the rider's success[20] and considering the results of BL&P's IRP. Additionally, the Smart Energy Fund, approved in 2010, has allowed for small power producers to implement EE/RE projects amounting to 2MW of installed RE capacity and over 900MWh per year of energy savings.

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17 ELPA was passed in parliament in December 2013, amended in April 2015 and became official on May 2015. It initially allows for independent power producers interested in supplying electricity to apply for and be issued with a license to generate and supply up to a total of 20MW of utility solar PV and 15MW of utility wind capacity. A power purchase agreement price is to be negotiated with BL&P and approved by FTC. Once a license is issued, BL&P will facilitate grid interconnection.

18 Barbados Intended Nationally Determined Contribution, 2015.

19 Initially formulated so all kWh sold to the grid were credited at 1.6 times the Fuel Clause Adjustment and accessible to suppliers up to a maximum capacity of 150kW. However, as per the FTC's decision on April, 2016, temporary RER credit is set at 0.416US$/kWh for solar PV and 0.315US$/kWh for wind until such time as a permanent rate may be established and the limit increased to 500kW.

20 In August 2013, there were approximately 200 customers on the RER representing approximately 2.1MW.

1.11 Installed RE capacity in Barbados has come a long way increased five-fold from 1.6MW in 2013 to over 9MW in 2015 mostly due to the RER. In terms of utility-scale RE, BL&P has developed a 10MW solar farm with 44,000 PV panels at Trents, St. Lucy and is analyzing the feasibility of building a similar facility.[21] Similarly, BL&P is considering a 10MW wind farm at Lambert's Plantation in St. Lucy. With RE penetration reaching approximately 12% (19MW) by the end of 2015,[22] a successful and ongoing RER, and several private sector-led utility-scale RE projects in various stages of development, Barbados is approaching the threshold for RE penetration[23] that the grid allows without additional mitigation measures. For additional RE development, Barbados would need to consider energy storage and/or smart grid technologies. While costs have reduced significantly, the levelized cost of these technologies remain higher than baseload alternatives to manage RE intermittency.[24] Hence, Barbados is looking to NG as a baseload energy source for the power sector that could further reduce carbon emissions[25], reduce electricity tariffs and provide an alternative to switch away from HFO in the short-term.

1.12 GOB is working on developing a comprehensive energy policy to implement the ELPA by promoting the generation of electricity from RE at utility scale, increasing energy security and reliability of electricity supply, and reducing the sector's GHG emissions. To this end, and with IDB support,[26] the policy will not only address the use of RE but also consider options for diversifying the energy portfolio. In the short term, the country is looking to meet local demand in the RC&I sectors by importing NG in the form of LNG. In the medium term, Barbados is exploring NG as a baseload fuel that can enable a transition towards greater RE generation to achieve INDC commitments. Accordingly, NPC/BNOCL have already begun working towards ensuring NG service continuity and preparing for the expansion in NG use in RC&I sectors but also, potentially, in the power sector. Upgrading the existing NG infrastructure is essential to meet NG demand, to expand NPC's customer base, to ensure a reliable and safe service to customers and also to prepare the country for a switch from LFF to NG for power production. This means replacing old NG pipelines and infrastructure as well as improving the measuring and monitoring of NG flow and usage, all critical elements in the logical path towards a fuel switch in power generation.

1.13 There is a need to expand capacity of the Micro LNG Plant (¶1.5) in order to satisfy total demand of up to 2 mmcfpd, taking advantage of a larger supply of NG in the Region (¶1.16), and avoiding costly NG shortages while also enabling NPC to diversify its sources of supply thus improving energy security. There is also an opportunity to upgrade existing NG infrastructure; 10 kilometers of pipeline will need to be replaced in the next 6 years. Remote monitoring and

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21 http://www.caribflame.com/2016/05/barbados-light-power-company-looking-to-construct-another-solar-plant/.

22 Contributing to achieving 41% of the Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS) goals of having a 29% RE penetration by 2029.

23 The indicative threshold for intermittent RE penetration is 20%. Therefore theoretical upper limit of solar would be 36MW.

24 Intermittent RE resources present reliability and stability challenges for small island grids which lack the interconnections and grid characteristics typical of utilities on continents.

25 As much as 48% of the reductions envisioned by 2021 and as much as 30% of the reductions envisioned by 2030 in the INDC could be obtained by implementing the PPP LNG project and the RE investments financed by this loan.

26 Through technical cooperation ATN/KK-14950-BA and ATN/OC-14951-BA.

control needs to be strengthened to ensure that in a context of NG supply restrictions, NPC is making the best use of NG across the entire supply chain. Finally, quality management certification processes could improve quality and environmental management in preparation for implementing a Public-Private Partnership (PPP) project.

1.14 NPC is studying the prospect of establishing a PPP to import LNG for the power sector to shift away from using HFO in some of the existing generation facilities. In order to support this process, the IDB will follow a dual approach by strengthening institutional capacity in NPC/BNOCL to undertake significant expansion of LNG and NG operations while also providing support in the process by which NPC/BNOCL would choose a partner to form a PPP. The latter will be possible through an intensive collaboration with IDB's private sector arm, the Inter-American Investment Corporation (IIC). IDB will finance consultancies, studies and training to strengthen NPC/BNOCL in key areas (¶1.27). The IIC will provide guidance to the governmental entities in their preparation and review of the bidding documents to be developed under Component 3 to ensure the bankability of the PPP project. The IIC has been expanding its operations in Latin America for LNG infrastructure to contribute in the expansion of clean energy fuels as NG in the energy matrix in lieu of other fossil fuels. This is the case through the project PN-L1123 (Costa Norte Gas-fired Thermal Power Plant and LNG Terminal Project) in Panama and the project 1946/OC-PE (an LNG Project) in Peru to exploit its extensive gas reserves through limited exports of LNG and related products.

1.15 **Bank Experience in the Sector and Lessons Learned.** The IDB has played an active role in supporting the energy sector transformation in Barbados since 2009 (¶1.10). Through two Policy Based Loans (2410/OC-BA and 2609/OC/BA), the Bank assisted the process of drafting and enacting policy and regulation to promote EE/RE that resulted in the ELPA being enacted. It also led to the identification, under an IDB-financed study titled 'Sustainable Energy Framework for Barbados', of viable investments in EE/RE. As a result, the Bank subsequently approved two investment loans, the Energy Smart Fund (2485/OC-BA) and the Public Sector Smart Energy Project (2748/OC-BA). The former developed financial instruments to support Small and Medium Enterprises adoption of RE and the latter allows for the retrofitting with EE/RE technologies of public buildings and street lights. Based on experience implementing investment loans in Barbados, the project team has incorporated early training in IDB procurement policies for NPC. Training sessions have taken place during project preparation in order to avoid delays in procurement processes once execution begins. The Bank has supported NG related projects in Uruguay through the technical cooperation ATN/OC-10741-RG and investment loan UR-L1102 (studies for LNG regasification plant), and 2894/OC-UR;2894/OC-UR-1;2894/OC-UR-2 (sovereign guaranteed financing for Punta del Tigre gas-fired combined cycle power plant). These experiences demonstrated the importance of the technical, environmental and market studies in the conceptualization of the projects and to facilitate private sector participation.

1.16 **LNG regional context**. NG is the cleanest-burning fuel for thermoelectric plants as emissions from its combustion are much lower than with oil products.[27] The IDB has been involved in studying the feasibility of NG as a baseload solution for countries in the Caribbean. In 2014-2015 the IDB financed a regional LNG study to assess LNG options in the Caribbean. The study shows promising results for the Caribbean Region (see figure 2) and particularly for Barbados (see figure 3), indicating that replacing HFO with NG for power generation may generate cost savings between 15-30% even at currently low oil prices. Elsewhere in the region NG terminals have been built or are being considered. The conclusions of the study have been used both in Jamaica and Barbados to develop LNG regasification plants. It is expected that NG supply in the region will increase and the Dominican Republic, Florida (USA), Panama and/or Jamaica may serve as a regional hub for distribution of NG contributing to economic integration via the establishment of a regional LNG supply chain. Both the study and the Bank´s support has contributed to develop the demand for LNG as shown by Barbados, and exploring interest in countries such as Suriname, Guyana, and The Bahamas. As a result, the Bank has strongly contributed to the development of a regional LNG supply chain.

1.17 **Barbados LNG context**. As a consequence of the latter (¶1.16), Barbados could increase the number of suppliers from one as it currently stands to 2 or more, increasing the competitiveness in LNG prices. Not only is achieving competitive prices important but also increasing the volume of NG to be purchased. A potential of 110MW (almost half of total installed capacity) could be converted to use NG,[28] resulting in an increased demand of this fuel of approximately 18mmcfpd and reduced power generation costs. The most economical and cost-effective way to import NG to Barbados is in the form of LNG. LNG facilities vary from a regasification capacity of less than 15mmcfpd (micro) to nearly 5.5 billion cubic feet per day (bcfpd). The transport mechanism depends on the volume of LNG considered. Iso-containers transported in regular vessels are appropriate for volumes lower than 15mmcfpd, small LNG vessels are recommended for volumes between 15 and 100mmcfpd, and regular LNG vessels for larger volumes (see Table 1). In order to meet Barbados' demand and required storage capacity of 0.067mmcf, the appropriate solution according to international best practices is a Micro LNG Plant using iso-containers. If in the future Barbados starts importing LNG to supply power generation needs, the use of a Small LNG Vessel and a Very Small (VS) LNG Plant could be justified.

Table 1: LNG Transportation and Regasification Capacity[29]

	Micro	VS	Small	Medium	Large
Regasification capacity (NG)	< 15 mmcfpd	15 -100 mmcfpd	100-500 mmcfpd	0.5-1.0 bcfpd	>1.0 bcfpd
Storage capacity (LNG)	< 1 mmcf	1 – 2.0mmcf	2 – 10 mmcf	10 – 50 mmcf	>50 mmcf
Transport mechanism	Iso-container	Iso-Container/ Small LNG Vessel	LNG Vessel	LNG Vessel	LNG Vessel

[27] NG emits 1.22lbs. CO_2/kWh while HFO and Diesel emit 1.76 and 1.64 respectively. https://www.eia.gov.
[28] Related investment costs would be assumed by BL&P in around US$20 million.
[29] Source: International Group of LNG Importers, The LNG Industry 2014 http://www.giignl.org/.

1.18 **Program design.** The program will support Barbados in transitioning to a cleaner energy future and meet its current NG demand while contributing to the creation of a regional LNG supply chain. The program has been designed in such a way that it will seek to strengthen the entities developing NG in the country (NPC/BNOCL) to prepare them for undertaking a LNG PPP project to supply the power sector. It will then address the barrier of high capital costs by providing access to capital. In parallel, the program provides support to invest in RE technologies, as the companies seek to enhance their capacity and knowledge about these technologies and provides support for improving EE as they move to green their facilities. This project is a priority for NPC/BNOCL as well as for the GOB which requested IDB assistance through the ETD.

1.19 **Strategic alignment.** The program is consistent with the updated Institutional Strategy 2010-2020 (AB-3008) and is strategically aligned with the development challenge of: (i) productivity and innovation by reducing energy costs for commercial and industrial customers and with the use of cutting edge RE technologies combined with NG;[30] and (ii) economic and regional integration, by contributing to the establishment a regional LNG supply chain (¶1.21).[31] The program is also aligned with the cross-cutting theme of climate change and environmental sustainability, by reducing carbon emissions. According to the joint Multilateral Development Bank approach on climate finance tracking, an estimated 16% of total IDB funding of this project is invested in climate change mitigation activities. This contributes to the IDB Group´s climate finance goal of 30% of combined IDB and IIC operational approvals by year's end 2020. The program is also aligned with cross-cutting theme of institutional capacity and the rule of law, by strengthening NPC's capacity to engage in a partnership with the private sector. Additionally, the program will contribute to Corporate Results Framework 2016-2019 (GN-2727-6) indicators: (i) reduction of emissions with support of IDB financing (annual million tons CO_2 equivalent), by promoting a switch to a less carbon intensive fuel for power generation; (ii) installed power generation from RE sources (%), by increasing RE capacity in NPC/BNOCL facilities; and (iii) government agencies benefited by projects that strengthen technological and managerial tools to improve public service delivery (#), by strengthening NPC's institutional capacity through training programs. Finally, the project is in line with the Sustainable Infrastructure for Competitiveness and Inclusive Growth IDB Infrastructure Strategy (GN-2710-5); specifically with the priority areas of: (i) promoting access to infrastructure services, by expanding NG service coverage; and (ii) supporting infrastructure for regional integration, by supporting the establishment of a regional LNG supply chain (¶1.21). The project is included in the Operations Program Report for 2016 (GN-2849), and aligned with the country development goals[32] established in the IDB Country Strategy with Barbados 2015-2018 (GN-2812) in which energy is a priority sector. The project is consistent with the Bank's Climate Change Sector Framework Document (GN-2835-3) as it was designed with climate change considerations in

[30] The program will contribute to the reduction of the electricity tariff. It is expected that electricity tariffs will decrease from a 2015 average of 0.28 to 0.25 US$/kWh.

[31] The program will contribute to increasing the number of LNG suppliers to Barbados improving conditions for the establishment of a regional LNG supply chain.

[32] See the Barbados Country Strategy Matrix; the country development goal for the energy sector is reducing dependency on LFF by promoting RE, EE and the efficient use of fossil fuels (including NG) for power generation.

mind and will reduce CO_2 emissions; also, this project promotes financial structures that enable coordination between the public and private sectors, and capacity strengthening to address climate change issues (¶1.27).

1.20 **Consistency with the Energy Sector Framework Document (GN-2830-3).** The project is consistent with all 4 Bank goals and principles in the energy sector: (i) to develop economical and sustainable energy access, by encouraging the efficient and cost-effective expansion of energy services and power generation systems using appropriate technologies; (ii) to promote EE, RE and cleaner fuels for sustainable energy**,** by financing EE/RE investments in NPC/BNOCL facilities and promoting the use of NG for power generation;[33] (iii) to stimulate energy security, by promoting the establishment of an LNG regional supply chain (¶1.22); and (iv) to promote good governance by providing NPC with technical advisory services and training to increase its capacity.

1.21 **Consistency with the Sector Strategy to Support Competitive Global and Regional Integration (GN-2565-4)**.[34] The strategy indicates that regional integration operations will be identified according to four non-mutually exclusive indicative criteria. The project is aligned with the criteria of cross-country focus and national subsidiarity. Components 1 and 3 contribute to a greater regional insertion of countries by improving domestic policies and national investment priorities, with cross-border impacts (energy imports particularly LNG). Component 1 specifically finances investments that will improve energy exchanges in the region contributing to the expansion of a regional LNG supply chain in the Caribbean (See Integration Annex).This operation has been developed within the regional effort supported by IDB through a technical cooperation (ATN/OC-13800-RG) in order to study the potential for establishing an LNG regional supply chain in the Caribbean. Participating countries include Barbados, Belize, The Bahamas, Dominican Republic, Guyana, Haiti, Jamaica, T&T, and Suriname.

1.22 **Compliance with the Public Utilities Policy (PUP) (GN-2716-6)**. The project complies with the conditions of economic viability and financial sustainability established in the Public Utilities Policy. The program's economic viability was analyzed based on the Bank's CBA methodology concluding that the project is both financially and economically viable (¶1.31). The project is also financially sustainable (¶2.10) because the cost of service related to the investments financed (supplying NG to final users) is covered by the NG tariffs. Tariffs provide NPC with sufficient funds to meet its financial commitments and Operational & Maintenance (O&M) expenses of the systems related to the operation. Moreover, fiscal benefits in the form of additional tax receipts are enough to cover the financial cost of this loan from the government's perspective (¶2.11). (See Analysis of Compliance with the PUP).

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[33] The IDB's Energy Sector Framework Document (2015) states that: "A priority will be given to cleaner sources of energy, while considering in a case by case basis fossil fuel technologies, when the investments are necessary and make sense from an economic standpoint (taking externalities into account), for example: in the rehabilitation of existing plants, substitution of solid or LFF with cleaner gaseous fossil fuels; or to meet the demand for energy services".

[34] See the Results Matrix of this operation which includes the indicators that are related to the project's alignment to the development challenge of Economic and Regional Integration.

1.23 **Gender additionality**. Occupational segregation is a reality in Barbados: (i) women's labor participation rate is still lower than men's;[35] (ii) women earn between 14% and 27% less than men;[36] and (iii) they are highly concentrated in sectors that have lower salaries and fewer benefits. In fact, women represent only 34% of the Barbadian electricity sector, but represent over 65% of the employees of the hotel and tourism sectors. Taking this into account, the project will try to improve and expand economic opportunities for women currently working at NPC/BNOCL by ensuring their participation in trainings financed by the project under Sub-component 3.1 (Gender Annex).

B. Objective, Components and Cost

1.24 The objective of this project is to enhance Barbados' energy security and sustainability by diversifying its energy matrix through promoting the use of cleaner fuels for power generation, and increasing the use of RE sources. Specific objectives include: to (i) upgrade existing NG infrastructure to ensure NG service continuity; (ii) increase EE/RE applications within NPC's and BNOCL's operations to reduce GHG emissions; (iii) enable implementation of a PPP project to import and supply LNG for power generation; and (iv) provide technical support to NPC/BNOCL to foster organizational and operational efficiency.

1.25 **Component 1. NG Infrastructure (US$25.02 million)** - will finance activities to upgrade existing NG infrastructure and information systems under **Sub-component 1.1 (US$17.48 million)** – NG Infrastructure upgrade: (i) develop a geographic information system of NPC's network; (ii) update the Supervisory Control and Data Acquisition of NG processing and distribution; (iii) meter replacement/upgrade plan and automated meter infrastructure; (iv) modernization of on-road distribution fleet; and (v) replacement, realignment and installation of NG pipelines for transmission and distribution and upgrade of distribution stations; and to develop new infrastructure under **Sub-component 1.2 (US$7.54 million)** – Expansion of Micro LNG Facility at Woodbourne, including: (i) LNG unloading facility for iso-container reception (up to 2mmcfpd); (ii) cryogenic LNG storage tank and related equipment; (iii) emergency equipment; and (iv) gas buffering system.

1.26 **Component 2. Smart Energy Solutions (US$3.35 million)-** will finance solutions to increase EE and the use of RE in NPC-BNOCL facilities including: (i) installation of PV (at least 300kW) and smart systems in NPC-BNOCL operational facilities; (ii) conversion of compressors from NG to solar PV plus plant retrofits; (iii) installation of at least 850kW of wind power or additional solar PV; and (iv) installation of EE and/or RE equipment in administrative buildings.

1.27 **Component 3. Technical Advisory Services (US$4.05 million)**- **Sub-component 3.1 – Institutional Strengthening (US$2.05 million)**: will finance consultancy services: (i) to provide training for NPC/BNOCL in areas including: (a) negotiating and entering into PPP contracts; (b) large infrastructure project design, execution, and management; and (c) quantification of gross and

[35] Women labor participation is 62% versus 72% of men in 2013 (source: ILO (2013). ILOSTAT Database: Caribbean.

[36] Bellony, Annelle; Hoyos, Alejandro; and Nopo, Hugo (2010). Gender Earning Gaps in the Caribbean: Evidence from Barbados and Jamaica. IDB: Washington DC.

net GHG emissions of projects; and (ii) to develop studies[37] for improving: (a) corporate governance, environmental, legal and regulatory functions; (b) quality management systems;[38] and (c) information technology applications to monitor and control the NG supply chain. **Sub-component 3.2 (US$2 million) – establishing a PPP for the construction of a VS LNG Plant:** will finance consulting services to facilitate the establishment of a PPP for the construction of facilities to import LNG for power generation[39] including: (i) supporting the procurement and negotiation process to select a private sector partner and enter into a PPP to build and operate the VS LNG Plant;[40] (ii) supporting the procurement and negotiation process to secure at least 18 mmcfpd supply of LNG using a PPP scheme; and (iii) capacity building for structuring and managing the PPP contract.

1.28 The cost of the program is estimated at US$34,000,000 and will be financed by the Bank´s Ordinary Capital (OC) resources. Table 2 shows the costs of the project by component.

Table 2: Project Cost by Component

Component	IDB (OC loan)
Component 1. NG Infrastructure	25,025,000
Component 2. Smart Energy Solutions	3,350,000
Component 3. Technical Advisory Services	4,050,000
Program Evaluation	75,000
Project Management and Monitoring[41]	1,500,000
Total	**34,000,000**

C. Key Results Indicators

1.29 **Intended beneficiary population.** This project, and particularly Component 1, will benefit 2,018 households, 7 businesses and 2 industrial customers[42] that will be able to connect to the NG grid and start using a cleaner and more affordable fuel that is also a continuous and reliable source of energy. Component 2 will benefit NPC/BNOCL by increasing their uptake of EE/RE thus improving their operational efficiency while contributing to the country's goal to increase overall RE penetration and reduce carbon emissions. Finally, Sub-component 3.1 will benefit NPC/BNOCL by providing technical advisory services required to improve operational efficiency, and Sub-component 3.2 will benefit all electricity users in Barbados, which amount to 125,991, by supporting efforts to diversify the energy matrix.

1.30 **Expected results.** As indicated in the Results Matrix, the expected results are: (i) ensuring continuity of NG service to customers; (ii) increasing the number of LNG suppliers to Barbados thus enhancing energy security; (iii) carbon emission

[37] Studies may include fiduciary and operational audits.
[38] Including relevant quality and/or environmental management certifications (e.g ISO9001/ISO1400).
[39] The availability of LNG for power generation will displace HFO-based power generation.
[40] The IIC will provide support by overseeing consultancy services under this sub-component.
[41] Project management costs include the cost of individual consultants to set up and bolster capacity of the PEU during project implementation as well as the cost of monitoring and reporting activities including data collection.
[42] Equivalent to additional NG consumption of 0.3mmcfpd assuming that average daily consumption is 23cfpd/residential, 0.023mmcfpd/commercial and 0.040mmcfpd/industrial users, respectively.

reductions from NPC/BNOCL operational and administrative facilities; increased operational efficiency in NPC's transmission and distribution activities; and (iv) private sector participation in a PPP to build and operate the VS LNG Plant. Expected long-term impacts include a reduction in the electricity tariff that contributes to one of the goals in the Barbados Country Strategy and GHG emissions reductions from power generation.

1.31 **Project CBA.** For the purpose of conducting the program's CBA the investments financed by this operation were grouped into sub-projects as follows: (i) a sub-project comprised of the existing NG infrastructure updates and the expansion of the Micro LNG Facility at Woodbourne (financed under Sub-components 1.1 and 1.2 respectively); and (ii) a sub-project comprised by the planned investments in Smart Energy solutions (financed under Component 2) which include: (a) an 850kW wind turbine to supply electricity to NG compressors; and (b) a 300kW PV system for NPC's own power consumption. A 12% discount rate and a 25 year projection period were used for the calculations.

1.32 For the NG infrastructure updates and Micro LNG Facility expansion benefits were quantified in terms of: (i) avoided economic losses to RC&I customers from NG shortages; and (ii) savings in electricity consumption by the new users connected to the grid as they switch from other fuels to NG. Smart Energy solutions benefits were quantified in terms of: (i) savings in electricity generation costs for NPC derived from using RE (wind, solar) instead of LFF; and (ii) the monetary value of the reduction in GHG emissions. The aggregate results are presented below. For details see the CBA Report.

1.33 All the sub-projects evaluated are financially and economically viable.[43] The program has an aggregate Economic Net Present Value (ENPV) of approximately US$9.8 million, an Economic Internal Rate of Return (EIRR) of 25%. A sensitivity analysis shows that the program and its sub-projects are still economically viable even in a "worst case" scenario.[44] The program's EIRR falls from the base case of 25% to 22% and the ENPV falls from US$9.8 million in the base case to US$6.9 million.

1.34 **PPP CBA.** Although the investments in a PPP project to import and supply LNG for power generation won't be financed by this operation, a financial analysis was conducted for the PPP for VS LNG Plant. If the VS LNG terminal is included in the analysis, the aggregate ENPV in the Base Case is US$89 million and the

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[43] The "Base Case" scenario was defined as one in which: (i) the price of CO_2 is set at 10US$/ton based on the average price over the last 5 years which 11.3US$/ton; (ii) the price of oil is defined by the price of WTI which ranges between 49 and 138US$/barrel based on the EIA 2015 Annual Energy Outlook (AEO) Reference Case; (iii) the price of NG is defined by the price of Henry Hub which ranges between 2.62 and 7.99US$ per million BTU based on the EIA 2015 AEO Reference Case; (iv) the wind turbine capacity factor is set at 31% based on information provided by NPC and the system vendor; and (v) the solar PV system capacity factor is set at 20% based on information provided by NPC and the system vendor.

[44] The "Worst Case" scenario was defined as one in which: (i) the price of CO_2 is set at the lowest recorded annual average price of 6US$/ton; (ii) the price of oil is defined by the price of WTI which ranges between 30 and 67US$/barrel based on the EIA 2015 AEO Low Oil Price Case; (iii) the price of NG is defined by the price of Henry Hub which ranges between 2.62 and 7.28US$ per million BTU based on the EIA 2016 AEO Low Oil Price Case; (iv) the wind turbine capacity factor is set as 28%; and (v) the solar PV system capacity factor is set at 18%.

EIRR is 28%.[45] Economic benefits will stem from savings on liquid fuel expenditures, and the monetary value of avoided GHG emissions related to the displaced consumption of liquid fuels for electricity generation.

II. FINANCING STRUCTURE AND MAIN RISKS

A. Financing Instruments

2.1 This is a specific investment project that will be financed through an investment loan of up to US$34 million from the Bank´s OC resources.

2.2 **Disbursement period.** It is expected that the loan financed with resources from IBD OC will have a 6 year disbursement period. Loan resources are to be fully disbursed within 72 months from the effective date of the loan agreement. Table 3 shows the indicative disbursement projection of IDB OC resources.

Table 3: Projected Disbursements in US$ millions

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Total
IDB (OC) - annual disbursement	5.1	5.1	6.8	6.8	5.1	5.1	**34.0**
Percentage (disbursed / total)	15%	15%	20%	20%	15%	15%	**100%**

2.3 **Disbursement restrictions.** Pursuant to Document AB-2990, Bank disbursement of loan financing will be subject to maximum limits: (i) up to 15% in the first 12 months; (ii) up to 30% in the first 24 months; and (iii) up to 50% in the first 36 months. All of these periods will be counted from the time the loan operation is approved by the Board of Executive Directors. These limits may be rendered inapplicable if the requirements set forth in the Bank's policy regarding said limitations have been fulfilled, provided that the Borrower has been notified of the same in writing.

B. Environmental and Social Safeguard Risks

2.4 The program has been classified as Category "B" under IDB´s Environment Safeguards Compliance Policy (OP-703) considering that expected negative environmental and social impacts will be local, short-term, not significant and manageable through the implementation of already available mitigation measures. In general, it is expected that the program will not have significant negative environmental impacts that could put at risk the natural and/or social environment. The works to be financed present moderate and low environmental and social aspects to prevent mitigate and/or compensate the potential negative impacts.

2.5 The environmental and social due diligence determined that the program is in compliance with the applicable police directives of OP-703 and with the relevant provisions of other key policies. Specific key IDB Policies and Directives applicable to the program include OP-703 especially B.5 (environmental

[45] In a "Worst Case" scenario, the aggregate ENPV would be US$46.6 million and the EIRR would be 22%.

assessment requirements), B.6 (Consultation), B.7 (Supervision and Compliance), B.10. (Hazardous Materials), B.11 (pollution prevention and abatement), and Access to Information Policy (OP-102). The OP-710 for Involuntary Resettlement does not apply since the need for physical resettlement has not been identified for the project. The NG pipeline will be upgraded upon its current route, and there is no need for additional rights of way. The project is not expected to result in any major adverse impact and only two are considered minor impacts (i.e. vapor release from the potential rupture of the storage and iso-container tanks and fire hazard as well as increased noise levels due to the NG compressors operation). The rest of the potential impacts are expected to be negligible. To further mitigate the risks of a LNG accident, BNOCL has developed an emergency response plan to handle and mitigate any emergency at the plant or during the transportation of the iso-containers from the port to the plant. BNOCL has also conducted a fire risk analysis to evaluate the risks of fire at the plant. The negligible to minor impacts will be mitigated and managed with the application of industry-standard best practices according to the Environmental and Social Management Plan (ESMP) prepared for the project.

2.6 In compliance with the OP-703, a detailed Environmental and Social Assessment (ESA) was carried out for the interventions proposed under the program, including an outline ESMP. The ESA has been disclosed according to OP-102, and two public consultation meetings were conducted on July 21 and October 27, 2016. Both public consultation meetings were properly advertised and documented and are in compliance with IDB's E&S Safeguards. As special contractual condition of execution prior to the bidding of works financed under Components 1 and 2, the EA shall provide evidence that the final ESMP has been finalized and the OM has been updated with the final ESMP version annexed. For more details, please refer to the ESMR.

C. Fiduciary Risk

2.7 The overall fiduciary risk of the project is deemed to be low. Notwithstanding the latter, a few risks deemed medium are: (i) limited availability of reliable and timely financial information for decision making to be mitigated by customizing the current financial management information system (Innoprise) so that it facilitates project accounting and reporting; (ii) lack of awareness of IDB Procurement and Disbursements and Financial Reporting Procedures to be mitigated by providing training to the Project Execution Unit (PEU) on IDB's procurement and financial management procedures and requirements; and (iii) limitations in the capacity to manage procurement documentation to be mitigated by establishing guidelines for document management including roles and responsibilities. As a result of the impending amalgamation between NPC/BNOCL, a medium risk related to delays in the establishment and implementation of fiduciary arrangements of the project was also noted. This risk will be mitigated by continuous monitoring of the amalgamation process with emphasis on internal controls, financial reporting, and general organizational roles of the fiduciary area (please refer to Annex III).

2.8 An Institutional Assessment of NPC, carried out in preparation for this project, evaluated the following aspects: (i) planning systems; (ii) administrative systems; (iii) personnel management systems; (iv) goods and services management systems; (v) financial management systems; (vi) internal control systems; and

(vii) external control systems. The assessment concludes NPC has robust policies and procedures in place and fosters a culture of implementing established procedures when managing critical business processes. The assessment found that while NPC has adequate planning and administrative management practices in place, and has operated in accordance with its reported processes and procedures, the company has documented its practices in moderate detail scoring medium in both development and risk in the IDBs ranking system. To mitigate this risk Component 3 provides institutional strengthening for NPC/BNOCL including processes and procedures documentation.

D. Other Key Issues and Risks

2.9 Risks classified as medium or high are the following: (i) changes in the supply of LNG in the region could make it difficult for NPC to find and access LNG in the market at appropriate conditions. This risk will be mitigated by having at least 2 suppliers of LNG and contracts with them to meet domestic demand; (ii) changes in the global price of NG could affect NPC's finances, however, this risk will be mitigated by linking NG tariffs to the cost of NG supply; (iii) limited experience of the EA using IDB policies could cause execution delays. To mitigate this risk, the Bank will provide training in its procurement processes early during project execution[46] and establish clear lines of communication between NPC leadership and IDB project team; (iv) lack of regulatory framework for PPP and limited experience in structuring PPP in Barbados in general and NPC in particular which will be mitigated by providing NPC with technical assistance and training in structuring PPP funded under Component 1. Also, the PPP contract will contain elements and conditions that make up for the lack of a legal framework; (v) risk of having NG investments become stranded assets if and when energy storage and/or smart grids technologies become more competitive than NG-based generation. This risk will be mitigated by having expansion planning done considering these new technologies; and (vi) impacts due to the NPC/BNOCL amalgamation[47] which will be mitigated by NPC-&-BNOCL entering into an agreement to maintain the PEU (¶3.2) in place throughout the potential organizational transition either entirely under NPC's or under the merged entity's general management structure.

2.10 **Finance sustainability**. Financial sustainability will be achieved without the need for government contributions or subsidies. The project is financially and economically viable under current NG tariffs which provide the revenue streams to cover the cost of providing the services related to investments financed by this loan and the ongoing services provided by NPC to its customers. This includes O&M costs to keep NPC's infrastructure and equipment in optimal conditions to operate according to established quality standards and best practices. NG tariffs are reflective of costs and provide incentive to expanding service coverage. It is due to the limited availability of NG that NPC has not been able to connect new customers to its existing grid or extend its grid to reach new users.

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[46] Training for NPC in IDB's procurement policies and processes has started during project preparation.

[47] Should the amalgamation of NPC/BNOCL be delayed, the structuring of the PPP can go ahead with NPC as the participating entity.

2.11 **Fiscal impact.** This operation has positive macroeconomic impacts[48] for Barbados owing to the fact that NG is less expensive than LFF and that it enables increased economic activity. The net present value of net tax impacts and net balance of payment impacts over the next 25 years is US$3.3 million and US$30.9 million respectively.[49] This positive effect is dominated by the avoided tax losses to the government and is also due to additional business for NPC as well as across the manufacturing and tourism sectors.

III. IMPLEMENTATION AND MANAGEMENT PLAN

A. Summary of Implementation Arrangements

3.1 **Borrower and Executing Agency (EA).** The Borrower will be the GOB and the EA, responsible for the execution of the project, will be NPC. Because efforts to amalgamate NPC/BNOCL are underway, in case the amalgamation between these organizations into one single entity takes place, the single entity will be the EA.[50] **As a special condition prior to first disbursement of the loan the Borrower shall submit to the Bank signed correspondence by the EA for the purposes of transferring the loan resources and the execution obligations of the project from the Borrower to the EA.**

3.2 **PEU.** A PEU will be established and comprised of at least the following professionals who will fulfill requirements and have qualifications acceptable to the Bank: (i) a Project Manager; (ii) a Project Accountant; (iii) a Procurement Officer; (iv) a Project Administrator; (v) a Project Engineer; and (vi) a Quality Assurance Officer. **As a special condition prior to first disbursement of the loan the EA will provide evidence that the PEU staff has been selected or assigned a Project manager, Project accountant, Procurement officer, Project administrator, Project engineer, and Quality assurance officer in accordance to the terms of reference agreed with the Bank and included as annex to the OM.** As special execution condition, the Borrower by itself, or through the EA, agrees to maintain the PEU in place and operational throughout the implementation of the project, including all its staff positions as indicated in the loan contract.

3.3 **Strategic and Coordination Committee (SCC).** The SCC will be composed by a representative of the MFE through its Public Investment Unit, the BNOCL Manager or its representative, the NPC Manager or its representative (or manager or representative of the merged institution), and it will be chaired by the Permanent Secretary responsible for Energy or its representative. The SCC will discuss and provide guidance on strategic and coordination issues of the

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[48] This operation would increase public debt by around 2% of GDP; however, energy savings estimated at US$20-30 million per year account for approximately 1% of GDP per year.

[49] If the price of oil decreases by 10% and the price of natural gas increases by 10%, the net tax and balance of payments benefits are reduced to US$3.5 million and US$26 million respectively.

[50] In case a new legal entity is created as a result of the amalgamation and becomes the EA of the program, a change in the EA will be processed and approved by the Bank, and an amendatory loan agreement signed between the GOB and the Bank as well as an amendatory agreement of the execution agreement between the Ministry of Finance and the NPC, after the Bank conducts an analysis of the institutional capacity of the new entity.

project that would then be implemented by the PEU. The SCC will meet on a semiannual basis.

3.4 The General Manager of NPC, through the PEU, will be responsible for the administration of loan resources and procurement processes. PEU responsibilities include at a minimum: (i) preparing and presenting semi-annual progress reports (¶3.13) required by the Bank; (ii) preparing and implementing the Annual Operation Plan (AOP), the Pluriannual Execution Plan (PEP) (¶3.11) and the Procurement Plan (¶3.7); (iii) establishment of adequate internal controls and effective financial administration of the program according to accepted accounting principles; (iv) preparing and presenting Audited Financial Statements (AFS) (¶3.9); (v) ensuring the quality and efficacy of procurement processes and their compliance with both the policies of the Bank and those of the GOB; (vi) ensuring the consistent alignment of expected project results with day-to-day program implementation; (vii) compiling, storing, and keeping with it all information, indicators, and parameters needed to measure the indicators included in the Results Matrix, prepare the midterm and final evaluations, the project completion report, and any other program evaluation that may prove necessary (¶3.14); and (viii) being program liaison with the Bank.

3.5 **Program's Operations Manual (OM).** Details of all execution arrangements as well as the roles and responsibilities of the PEU and its members will be elaborated in the OM.[51] **As a special condition prior to first disbursement of the loan the EA will provide evidence that the OM has been approved by the EA pursuant to the terms previously agreed with the Bank and has entered into effect, including the principles and requirements from the ESMP draft.** As special condition of execution prior to the bidding of works under Component 1 and 2, the EA shall provide evidence that the final engineering designs of the infrastructure to be financed have been finalized as previously agreed with the Bank.

3.6 **Procurement.** Procurement of works, goods, and non-consulting services for the project will follow the Policies for the procurement of goods and works financed by the IDB (GN-2349-9) and the engagement of consultants will follow the Policies for Selecting and Contracting Consultant financed by the IDB (GN-2350-9). Procurement thresholds as well as other arrangements are included in Annex III.

3.7 **Procurement plan.** The Procurement Plan includes details on project procurement for the first 12 months of execution. Activities may be amended accordingly, by agreement between the EA and the Bank. The EA will update the Procurement Plan at least once every 12 months. The procurement supervision method will be determined by the Bank for each selection process and, will start

[51] The OM defines all administrative, financial, procurement, and execution rules and procedures required for the Project's implementation and management and shall include, at a minimum, the following elements: (i) a detailed description of the implementation of each component; (ii) roles and responsibilities of the agencies involved in the implementation of the project; (iii) criteria and procedures to select and contract goods, services and works; (iv) criteria and procedures for management and financial control of the project; (v) monitoring and evaluation arrangements; and (vi) the roles, responsibilities and composition of the SCC referred to in ¶3.3.

as ex-ante. Once ex-post review is viable, they will be performed as indicated in Annex III.

3.8 **Advance contracting and retroactive financing.** The EA may choose to proceed with procurement activities before the signature of the Loan Agreement. In such case, all procurement procedures, including advertising, shall be in accordance with Bank Procurement Policies in order for such contracts to be eligible for loan financing. NPC undertakes such advance contracting at its own risk. The Bank may retroactively finance such eligible expenses up to US$5.1 million (15% of the loan amount) provided that all procurement procedures are substantially similar to those set out in the loan agreement. These expenses must have been incurred on or after 21 July 2016 (approval date of the Project Profile), and cannot have been incurred more than 18 months prior to the loan date approval. Such eligible expenses include works, goods and services related to the development of infrastructure financed under Components 1, 2, and 3. The amount of retroactive financing will be subject to the limitations on disbursements stated in ¶2.3 and footnote (c) of the project summary.

3.9 **External control and reporting.** The external audit of the program will be done by independent public accountants acceptable to the Bank and will follow the guidelines set forth in the Bank's Financial Management Guidelines OP-273-6 and Financial Reports and External Audits Handbook for Bank financed operations. Standard financial reporting requirements of the Bank will apply including: (i) AFS of the project which will be submitted to the Bank within 120 days following the end of each fiscal year of the EA; and (ii) a final AFS of the project which will be submitted within 120 days following the date of the last disbursement of the loan. The costs for the audits will be financed from resources of the loan as indicated in the procurement plan.

B. Summary of Arrangements for Monitoring Results

3.10 The program has a Monitoring and Evaluation Plan (M&EP) which includes monitoring and reporting requirements as well as project evaluation mechanisms. Administrative monitoring and control will focus on the fulfillment of procedural regulations governing administrative, financial, accounting, and legal matters, in accordance with national guidelines, those of the Bank, and those specified in the project's OM.

3.11 **AOP and PEP.** Every year during the implementation of the project, the PEU will present an AOP to the Bank for its non-objection. The AOP will detail the project's progress and execution of activities including goals, results, budget, and implementation schedule for the year ahead. The PEP will detail the project's progress and implementation schedule for the outstanding years of the loan. An initial AOP and PEP were prepared for the first 12 months of project execution.

3.12 The IDB project team will conduct semiannual technical visits to the EA in order to review progress of works and make adjustments based on execution. Fiduciary oversight visits will be conducted once a year. External audits of accounting and operations are planned to validate the use of the loan proceeds and the operational internal controls and processes to be implemented by the executing agency. The information compiled will be analyzed every 6 months.

3.13 **Semi-annual progress reports.** The EA, through the PEU, will send the Bank semi-annual progress reports to be submitted no later than 60 days after the end of each semester as described in the M&EP. Semi-annual progress reports will explain the degree of fulfillment of the output indicators and progress toward the outcomes of the Results Matrix making it possible for the Bank to monitor these indicators using the Bank's Project Monitoring Report tool. Semi-annual reports for the second semester of each year will also include a report on the status of the works and equipment included in the project and an annual maintenance plan for the following year. Semi-annual, intermediate evaluation and ex-post evaluation progress reports will also include the PEP, AOP and Procurement Plan.

3.14 **Project evaluation.** As detailed in the M&EP, the PEU will select and contract external consulting services in consultation with the Bank according to terms of reference agreed with the Bank, to undertake: (i) a midterm evaluation once 50% of the financing has been disbursed and justified, or after 3 years from the date of the first disbursement, whichever happens first. This evaluation will focus on analyzing progress achieved, aspects of coordination and execution, and recommendations to attain the proposed targets and investment sustainability; and (ii) a final evaluation to be submitted to the Bank no later than 120 days after the final disbursement justification. This evaluation will include: (a) the degree of fulfillment of the targets specified in the Results Matrix; (b) an ex-post CBA; (c) an assessment of the performance of the EA; (d) factors affecting implementation; and (e) lessons learned and recommendations for the design of future operations. The final evaluation will allow the Bank to finalize the Project Completion Report.

Development Effectiveness Matrix			
Summary			
I. Strategic Alignment			
1. IDB Strategic Development Objectives	**Aligned**		
Development Challenges & Cross-cutting Themes	**-Productivity and Innovation -Economic Integration -Climate Change and Environmental Sustainability -Institutional Capacity and the Rule of Law**		
Regional Context Indicators	**-Greenhouse gas emissions (kg of CO2 e per $1 GDP (PPP))**		
Country Development Results Indicators	**-Reduction of emissions with support of IDBG financing (annual million tons CO2 e) -Installed power generation from renewable energy sources (%) -Regional, sub-regional and extra-regional integration agreements and cooperation initiatives supported (#) -Government agencies benefited by projects that strengthen technological and managerial tools to improve public service delivery (#)**		
2. Country Strategy Development Objectives	**Aligned**		
Country Strategy Results Matrix	**GN-2812**	**Increase the percentage of renewable energy in the energy matrix and increase energy efficiency.**	
Country Program Results Matrix	**GN-2849**	**The intervention is included in the 2016 Operational Program.**	
Relevance of this project to country development challenges (If not aligned to country strategy or country program)			
II. Development Outcomes - Evaluability	**Evaluable**	**Weight**	**Maximum Score**
	8.6		**10**
3. Evidence-based Assessment & Solution	**8.4**	**33.33%**	**10**
3.1 Program Diagnosis	**3.0**		
3.2 Proposed Interventions or Solutions	**2.4**		
3.3 Results Matrix Quality	**3.0**		
4. Ex ante Economic Analysis	**10.0**	**33.33%**	**10**
4.1 The program has an ERR/NPV, a Cost-Effectiveness Analysis or a General Economic Analysis	**4.0**		
4.2 Identified and Quantified Benefits	**1.5**		
4.3 Identified and Quantified Costs	**1.5**		
4.4 Reasonable Assumptions	**1.5**		
4.5 Sensitivity Analysis	**1.5**		
5. Monitoring and Evaluation	**7.5**	**33.33%**	**10**
5.1 Monitoring Mechanisms	**2.5**		
5.2 Evaluation Plan	**5.0**		
III. Risks & Mitigation Monitoring Matrix			
Overall risks rate = magnitude of risks*likelihood	**Medium**		
Identified risks have been rated for magnitude and likelihood	**Yes**		
Mitigation measures have been identified for major risks	**Yes**		
Mitigation measures have indicators for tracking their implementation	**Yes**		
Environmental & social risk classification	**B**		
IV. IDB´s Role - Additionality			
The project relies on the use of country systems			
Fiduciary (VPC/FMP Criteria)	**Yes**	**Financial Management: Budget, Accounting and Reporting, External control, Internal Audit.**	
Non-Fiduciary			
The IDB's involvement promotes additional improvements of the intended beneficiaries and/or public sector entity in the following dimensions:			
Gender Equality	**Yes**	**The project will promote women's participation in management and technical roles within NPC or the amalgamated entity.**	
Labor			
Environment			
Additional (to project preparation) technical assistance was provided to the public sector entity prior to approval to increase the likelihood of success of the project			
The ex-post impact evaluation of the project will produce evidence to close knowledge gaps in the sector that were identified in the project document and/or in the evaluation plan			

Note: (*) Indicates contribution to the corresponding CRF's Country Development Results Indicator.

The objective of this project is to enhance Barbados' energy security and sustainability by diversifying its energy matrix through promoting the use of cleaner fuels for power generation, and increasing the use of Renewable Energy (RE) sources. Specific objectives include: (i) upgrade existing natural gas (NG) infrastructure to ensure NG service continuity; (ii) increase Energy Efficiency (EE) and RE applications within the National Petroleum Corporation (NPC)'s and Barbados National Oil Company Limited (BNOCL)'s operations to reduce Greenhouse Gas (GHG) emissions; (iii) enable implementation of a Public Private Partnership project to import and supply liquefied natural gas (LNG) for power generation; and (iv) provide technical support to NPC/BNOCL to foster organizational and operational efficiency.

The POD presents a solid diagnosis of the problems to be addressed by the project and its dimensions. The interventions proposed are linked to the problems identified and the beneficiaries of the project are identified. Although the POD mentions valuable lessons learned from previous interventions and makes reference to a feasibility study in the region that quantifies the potential impacts on reducing electricity costs and emissions, the POD does not present evidence based on previous evaluations of similar interventions that can show the effectiveness in achieving all of the results proposed for this operation, such as increasing international and regional LNG suppliers, increasing operational efficiency or promoting private sector participation through PPPs.

The results matrix has a clear vertical logic and the indicators presented are SMART, have baselines, targets, and means of verification. The project presents a solid cost-benefit analysis. The main economic benefits quantified are avoided economic losses due to natural has shortages, avoided costs of importing liquid fuels or savings in generating costs, and reductions in CO2 emissions. The results show a positive net present value and an internal rate of return greater than 12%. The profitability of the entire project is maintained under multiple scenarios of sensitivity, and only when the solar panel sub-project is analyzed independently it shows to be not economically viable under a worst case scenario, where all variables tested are assumed to behave in a negative way.

The monitoring plan is solid, details all monitoring instruments that will be used, and presents the total and annual costs for all outputs identified in the results matrix. The evaluation plan is based on an ex-post economic analysis and a before-and-after methodology.

RESULTS MATRIX

Project Objective	The objective of this project is to enhance Barbados' energy security and sustainability by diversifying its energy matrix through promoting the use of cleaner fuels for power generation, and increasing the use of Renewable Energy (RE) sources. Specific objectives include: to (i) upgrade existing Natural Gas (NG) infrastructure to ensure NG service continuity; (ii) increase Energy Efficiency (EE) and RE applications within the National Petroleum Corporation (NPC)'s and Barbados National Oil Company Limited (BNOCL)'s operations to reduce Greenhouse Gas (GHG) emissions; (iii) enable implementation of a Public-Private Partnership (PPP) project to import and supply liquefied natural gas for power generation; and (iv) provide technical support to NPC and BNOCL to foster organizational and operational efficiency.

Impact Indicators	Units	Base Level (2015)	Final Target (EOP)	Means of Verification	Comments
Total GHG emissions resulting from power generation in Barbados	Million tons CO_2 equivalent/year	2	1.5	Reports Intended Nationally Determined Contribution (INDC) compliance	Official reporting to UNFCCC regarding Barbados compliance with INDC.
Average national electricity tariff in Barbados	US$/KWh	0.28	0.25	Reports from Barbados Light and Power (BL&P)	BL&P publication of tariffs (average of residential, commercial and industrial sectors).

Component 1: NG Infrastructure Results Indicators	Units	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Final Target (EOP)	Source of Verification/ Comments
Expected Result 1: Ensure NG service continuity										
Annual NG sales by NPC to residential, commercial and industrial clients	Million cubic feet (mmcf)	565	565	600	675	675	675	675	675	Semi-annual reports (SAR) from NPC/BNOCL.
Expected Results 2: Increase the number of LNG suppliers to Barbados to enhance energy security										
Number of international/regional Liquefied Natural Gas (LNG) suppliers to Barbados	# LNG suppliers	1	2	2	2	2	2	2	2	SAR from NPC/BNOCL.

Component 1: NG Infrastructure Output Indicators	Units	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Final Target (EOP)	Source of Verification/ Comments
Monitoring and control systems upgraded/replaced	# of systems	0	0	1	0	1	0	1	3	SAR from NPC/BNOCL. Systems may include upgraded mapping (Geographic Information System), automated data gathering systems, and improved meters for commercial / industrial customers.
Pipelines for transmission and distribution replaced, realigned and/or installed	Km of pipeline	0	2	4	4	0	0	0	10	SAR from NPC/BNOCL.

Component 1: NG Infrastructure Output Indicators	Units	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Final Target (EOP)	Source of Verification/ Comments
NG distribution stations upgraded	# stations	0	1	0	0	0	0	0	1	SAR from NPC/BNOCL.
On-road NG distribution fleet acquired or modernized	# vehicles	0	7	0	0	0	0	0	7	SAR from NPC/BNOCL. Can include conversion of existing vehicles to use compressed NG as fuel.
Micro LNG Plant at Woodbourne expanded	Binary (No/Yes)	0	0	0	1	0	0	0	1	SAR from NPC/BNOCL. Capacity added should be at least 0.3 mmcfpd.

Component 2: Smart Energy Solutions Indicators	Units	Base	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Final Target (EOP)	Source of Verification/ Comments
Expected Result 3: Reduce CO2 emission reductions from NPC/BNOCL operational and administrative facilities										
Annual CO_2 emission reductions from implementing smart energy solutions in NPC/BNOCL operational and administrative facilities	Tons CO_2 equivalent /year	0	0	0	0	1752	1752	6716	10,220	SAR from NPC/BNOCL. Calculated based on EE saved, RE installed and accepted carbon emission reduction methodologies. Smart energy solutions includes RE and EE.
Outputs (Expected Result 3)										
RE capacity installed in NPC/BNOCL/newly created entity facilities	kW	0	0	0	0	300	0	850	1,150	SAR from NPC/BNOCL indicating RE capacity installed which may include RE sources in NPC-BNOCL facilities: solar photovoltaic or wind turbine.
EE and/or RE equipment installed in NPC/BNOCL/newly created entity's operational and administrative facilities	Binary (no/yes)	0	0	0	0	0	0	1	1	SAR from NPC/BNOCL indicating the EE measures implemented in NPC-BNOCL facilities.

Component 3 Technical Advisory Services	Units	Base (2015)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Final Target (EOP)	Source of Verification/ Comments
Expected Result 4: Increased operational efficiency in NG transmission and distribution										
NPC's Annual Operational cost per customer	US$/ customer	5.2						4.3	4.3	SAR from NPC/BNOCL. The operational cost per customer will take into account only transmission and distribution of NG which is NPC's main responsibility.
Expected Result 5: Increase private sector participation to develop an LNG project										
Number of private sector partners with a contract awarded to implement the VS G Plant under a PPP scheme	# of private sector partners	0	0	0	0	0	0	1	1	Contract with winning proponent which will be attached to the Semi-annual reports from NPC/BNOCL.
Outputs (Expected Result 4)										
Studies developed to improve NPC/BNOCL/newly created entity's corporate governance, environmental, legal and regulatory functions, quality management systems, and information technology	# studies	0	0	1	2	1	0	0	4	SAR from NPC/BNOCL and final reports of the studies. Studies to improve corporate governance, environmental, legal and regulatory functions; quality management systems and information technology applications to monitor and control the NG supply chain.
NPC/BNOCL/newly created entity personnel trained in technical and management areas to support NG expansion	# of men	0	4	4	5	5	0	0	18	SAR from NPC/BNOCL. Technical and management personnel will be trained in PPP contracts; NG expansion planning and operation, estimating CO2 emission reductions, quality management systems/certification (minimum of 7 women will be
	# of women	0	2	2	2	1	0	0	7	

Component 3 Technical Advisory Services	Units	Base (2015)	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Final Target (EOP)	Source of Verification/ Comments
										trained).
Outputs (Expected Result 5)										
Bidding documents developed to secure 18 mmcfpd supply of LNG using a PPP scheme	Bidding documents package	0	0	0	0	1	0	0	1	Bidding documents which will be attached to the SAR from NPC/BNOCL.
Bidding documents developed to select a private sector partner for a PPP LNG project	Bidding documents package	0	0	0	1	0	0	0	1	Bidding document which will be attached to the SAR from NPC/BNOCL.

NOTES:

(1) Further details on how to calculate each of the indicators are provided in Appendix A of the Monitoring and Evaluation Plan.

(2) The targets in the results matrix are targets for each year, as opposed to cumulative targets up to the year.

DOCUMENT OF THE INTER-AMERICAN DEVELOPMENT BANK

PROPOSED RESOLUTION DE-__/16

Barbados. Loan ____/OC-BA to the Government of Barbados
Deployment of Cleaner Fuels and Renewable
Energies in Barbados

The Board of Executive Directors

RESOLVES:

That the President of the Bank, or such representative as he shall designate, is authorized, in the name and on behalf of the Bank, to enter into such contract or contracts as may be necessary with the Government of Barbados, as Borrower, for the purpose of granting it a financing to cooperate in the execution of a program for the deployment of cleaner fuels and renewable energies in Barbados. Such financing will be for the amount of up to US$34,000,000 from the resources of the Bank's Ordinary Capital, and will be subject to the Financial Terms and Conditions and the Special Contractual Conditions of the Project Summary of the Loan Proposal.

(Adopted on _____ 2016)

LEG/SGO/CCB/IDBDOCS#40697582
BA-L1012