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IMPLEMENTATION COMPLETION AND RESULTS REPORT

LOAN 8007

ON A

LOAN

IN THE AMOUNT OF US$15 MILLION

TO

JAMAICA

FOR THE

JAMAICA ENERGY SECURITY AND EFFICIENCY ENHANCEMENT PROJECT

June 20, 2018

Energy and Extractives Global Practice
Latin America and Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective June 5, 2018)

Currency Unit = Jamaican Dollar

1 JMD = US$0.0079

US$1 = JMD 127.38

FISCAL YEAR

April 1 - March 31

ABBREVIATIONS AND ACRONYMS

AFI	Approved Financial Institution
BOJ	Bank of Jamaica
BSJ	Bureau of Standards Jamaica
CPS	Country Partnership Strategy
DA	Designated Account
DBJ	Development Bank of Jamaica
DPL	Development Policy Loan
EMF	Environmental Management Framework
ESIA	Environmental and Social Impact Assessment
ESEEP	Energy Security and Efficiency Enhancement Project
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GoJ	Government of Jamaica
HFO	Heavy Fuel Oil
ICR	Implementation Competition and Results Report
IFR	Interim Financial Report
IMF	International Monetary Fund
IPP	Independent Power Producer
IRP	Integrated Resource Plan
IRPF	Involuntary Resettlement Policy Framework
ISR	Implementation Status and Results Report
JPS	Jamaica Public Service Company
LoC	Line of Credit for Energy Efficiency and Renewable Energy
LNG	Liquified Natural Gas
M&E	Monitoring and Evaluation
MEM	Ministry of Energy and Mining
MEM/MSTEM/MSET	Ministry of Energy and Mining/Ministry of Science, Technology, Energy, and Mining/Ministry of Science, Energy and Technology
MoF	Ministry of Finance
NEPA	National Environment and Planning Agency

OUR	Office of Utilities Regulation
PCJ	Petroleum Corporation of Jamaica
PDO	Project Development Objective
PIOJ	Planning Institute of Jamaica
PIU	Project Implementation Unit
PPA	Power Purchase Agreement
PPP	Public-Private Partnership
PV	Photovoltaic
RE	Renewable Energy
RFP	Request for Proposal
SMEs	Small and Medium Enterprises
TA	Technical Assistance

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DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P112780	Jamaica Energy Security and Efficiency Enhancement Project
Country	**Financing Instrument**
Jamaica	Investment Project Financing
Original EA Category	**Revised EA Category**
Partial Assessment (B)	Partial Assessment (B)

Organizations

Borrower	Implementing Agency
Government of Jamaica	Ministry of Science, Energy, and Technology

Project Development Objective (PDO)

Original PDO

The objective of the Project is to increase energy efficiency and security through the implementation of the Borrower'sNationalEnergy Policy.

FINANCING

	Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Financing			
IBRD-80070	15,000,000	14,478,575	14,478,575
Total	**15,000,000**	**14,478,575**	**14,478,575**
Non-World Bank Financing			
Borrower	0	0	0
Total	**0**	**0**	**0**
Total Project Cost	**15,000,000**	**14,478,575**	**14,478,575**

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
10-Mar-2011	16-Aug-2011	10-Jun-2013	31-Dec-2015	31-Oct-2017

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US$M)	Key Revisions
23-Dec-2015	9.92	Change in Results Framework Change in Components and Cost Change in Loan Closing Date(s) Reallocation between Disbursement Categories Change in Implementation Schedule

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Moderately Satisfactory	Satisfactory	Modest

RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	28-Jun-2011	Satisfactory	Satisfactory	0
02	14-Apr-2012	Satisfactory	Satisfactory	2.04
03	19-Nov-2012	Satisfactory	Satisfactory	3.95
04	12-Aug-2013	Satisfactory	Moderately Satisfactory	3.95
05	18-Mar-2014	Moderately Satisfactory	Moderately Satisfactory	5.38
06	24-Nov-2014	Moderately Satisfactory	Moderately Satisfactory	7.95
07	23-Jun-2015	Moderately Satisfactory	Moderately Satisfactory	8.79
08	17-Dec-2015	Moderately Unsatisfactory	Moderately Unsatisfactory	9.96
09	03-Jun-2016	Moderately Unsatisfactory	Moderately Unsatisfactory	11.18
10	21-Dec-2016	Moderately Satisfactory	Moderately Satisfactory	13.45
11	31-May-2017	Satisfactory	Moderately Satisfactory	13.70

SECTORS AND THEMES

Sectors

Major Sector/Sector	(%)
Financial Sector	**15**
Banking Institutions	15
Energy and Extractives	**85**
Public Administration - Energy and Extractives	69
Other Energy and Extractives	16

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3)	(%)

Private Sector Development	**14**
Jobs	4
Job Creation	4
Public Private Partnerships	10
Finance	**1**
Finance for Development	1
Disaster Risk Finance	1
Urban and Rural Development	**11**
Urban Development	4
Urban Infrastructure and Service Delivery	4
Rural Development	4
Rural Infrastructure and service delivery	4
Disaster Risk Management	3
Disaster Response and Recovery	1
Disaster Risk Reduction	1
Disaster Preparedness	1
Environment and Natural Resource Management	**87**
Climate change	49
Mitigation	49
Environmental policies and institutions	38

ADM STAFF

Role	At Approval	At ICR
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I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

1. Jamaica, the largest English-speaking island in the Caribbean Sea, had 2.7 million inhabitants with a per capita gross national income of US$4,326 in 2009.[1] Achieving higher growth and greater prosperity, reducing economic volatility, and providing greater social stability was urgent for Jamaica. The country developed Vision 2030, a 25-year strategy, and a Medium-Term Socioeconomic Policy Framework for 2009–2012. The latter was organized around six pillars: (a) a stable macro-economy, (b) greater security and safety, (c) effective governance, (d) world-class education, (e) strong economics, and (f) energy security through energy diversification and the promotion of energy efficiency. These objectives, however, had become more elusive in the face of the global economic crisis, which led to a contraction in foreign direct investment from the Organisation of Economic Co-operation and Development countries, a near collapse of the bauxite industry, an estimated 18 percent decline in 2008 in remittances from the approximately 3 million Jamaicans living abroad, and a tourism industry that had not grown in 2010.

2. As a result of the crisis, the Government of Jamaica (GoJ) approached the International Monetary Fund (IMF) and the World Bank for assistance. A Stand-By Arrangement to manage short-term difficulties and support the longer-term reform agenda was approved by the IMF in February 2010, in the amount of US$1.27 billion (or 15 percent of gross domestic product [GDP]), and the World Bank approved US$200 million for the First Programmatic Fiscal Sustainability Development Policy Loan (DPL) that built on the progress made under the World Bank's previous Fiscal and Debt Sustainability DPL (January 2009) to support the Government's reform program aimed at improving management of public finances and reducing the debt burden on the economy.

3. The World Bank Group Country Partnership Strategy (CPS)[2] for FY10–13 was discussed by the World Bank Group Board of Executive Directors on March 23, 2010, to support Government efforts to improve economic and social stability and achieve inclusive and accelerated growth with stronger governance and environment frameworks. The third pillar of the CPS aimed at promoting sustained growth by, among other objectives, strengthening non-labor competitiveness, increasing climate resilience, and reducing the debt burden on the economy.

4. The project built upon the assessment and conclusions of the Electricity Sector Note prepared by the World Bank in 2008.[3] Jamaica's energy sector was characterized by high energy costs, very high dependence on imported petroleum products (in 2008, 94 percent of all energy used was imported), relatively limited renewable energy resources, and a relatively small energy market.

[1] From 1990 to 2008, GDP growth averaged 1.4 percent and was −3.0 percent in 2009 as a result of the crisis. Public investment had been constrained by the servicing of a large debt stock, which stood at 115.7 percent of GDP end-FY08/09, and 129.4 percent in FY09/10.
[2] Country Partnership Strategy, Report No. 52849-JM.
[3] Additional information on Jamaica's energy sector is available in the project files.

5. The country's power generation capacity was adequate to cover demand. However, Jamaica's quasi-exclusive reliance on imported petroleum products (primarily diesel oil and Heavy Fuel Oil (HFO) for power generation), together with high levels of inefficiency in power generation and high transmission and distribution losses (23 percent in 2009),[4] led to very high electricity costs and tariffs. In 2009, the average electricity tariff and underlying cost was US¢27.5 per kWh. Furthermore, this dependence on petroleum exposed Jamaica to considerable vulnerability to oil price shocks. In 2008, Jamaica's overall oil bill amounted to US$2.7 billion or 18 percent of GDP,[5] of which 25 percent was used to generate electricity for the grid and 40 percent was used by bauxite refineries for generation of heat and off-grid power—factors that hampered the country's competitiveness.

6. Electricity demand was growing on average 3.8 percent per year between 2000 and 2010, with the industrial and tourism sectors representing approximately 45 percent of demand. The bauxite industry had become an important buyer of electricity provided by the grid, as industry self-generation decreased. While Jamaica did not face an energy supply crisis at the time, it was estimated that additional generation capacity of approximately 500 MW would have been needed over the following five years to meet anticipated increases in demand and the retirement of old and inefficient units.

7. **Institutional context.** Given the relatively small size of the energy sector in Jamaica, its structure was relatively complex and involved several private and public institutions, resulting in a complicated decision-making processes and challenges for coordination.

8. The most important challenges facing Jamaica's energy sector in 2010 were as follows:

(a) Reducing the cost of electricity and eventually lowering prices to improve the country's economic competitiveness and reduce the impact of energy consumption on households' budgets. This would be done by diversifying the sources of electricity generation away from expensive diesel oil, accelerating the replacement of highly inefficient generating plants, and reducing transmission and distribution losses.

(b) Lowering the sector's vulnerability to oil price fluctuations by reducing its reliance on imported petroleum products for electricity generation through (i) the development of renewable energy sources; (ii) diversification toward fuels with more stable prices, such as gas and renewable energy; and (iii) energy efficiency measures.

(c) Strengthening the sector regulatory framework by providing clear policy directions, regulations, and incentives to mobilize private sector investment, promote renewable energies, and increase energy efficiency at the level of utilities and end users.

(d) Mobilizing private sector financing for energy infrastructure as public finances would not be able to provide substantial financial resources directly or even through guarantees.

(e) Building institutional capacity to formulate, plan, and implement energy policies and

[4] This consists of 2 percent in transmission losses and 21 percent in distribution losses (of which 8 percent were technical losses and 13 percent were nontechnical losses).
[5] For 2009, the oil bill was approximately US$1.3 billion, which represented a decline of 50.8 percent compared to the previous year due, in part, to the downturn in the bauxite industry.

strategies and monitor and evaluate outcomes.

(f) Reducing greenhouse gas (GHG) emissions by switching to less polluting fuels (such as gas), developing renewable energy, and curbing energy consumption (and the underlying related generation) through energy efficiency measures.

9. The Jamaica National Energy Policy 2009–2030 (the 'National Energy Policy') approved by Parliament in November 2010 seeks to develop "A modern, efficient, diversified and environmentally sustainable energy sector, providing affordable and accessible energy supplies with long-term energy security and supported by informed public behavior in energy issues, and an appropriate policy, regulatory and institutional framework." Implementing the National Energy Policy and meeting the abovementioned challenges would require increased institutional capacity to formulate, plan, and implement the various energy programs and specific initiatives set out in the policy and to monitor progress and impacts.

10. **Improving energy security** through energy diversification was a critical part of the Government energy strategy. However, because of the country's borrowing and debt-servicing constraints and Government policies, such investments would be largely financed and managed by the private sector.

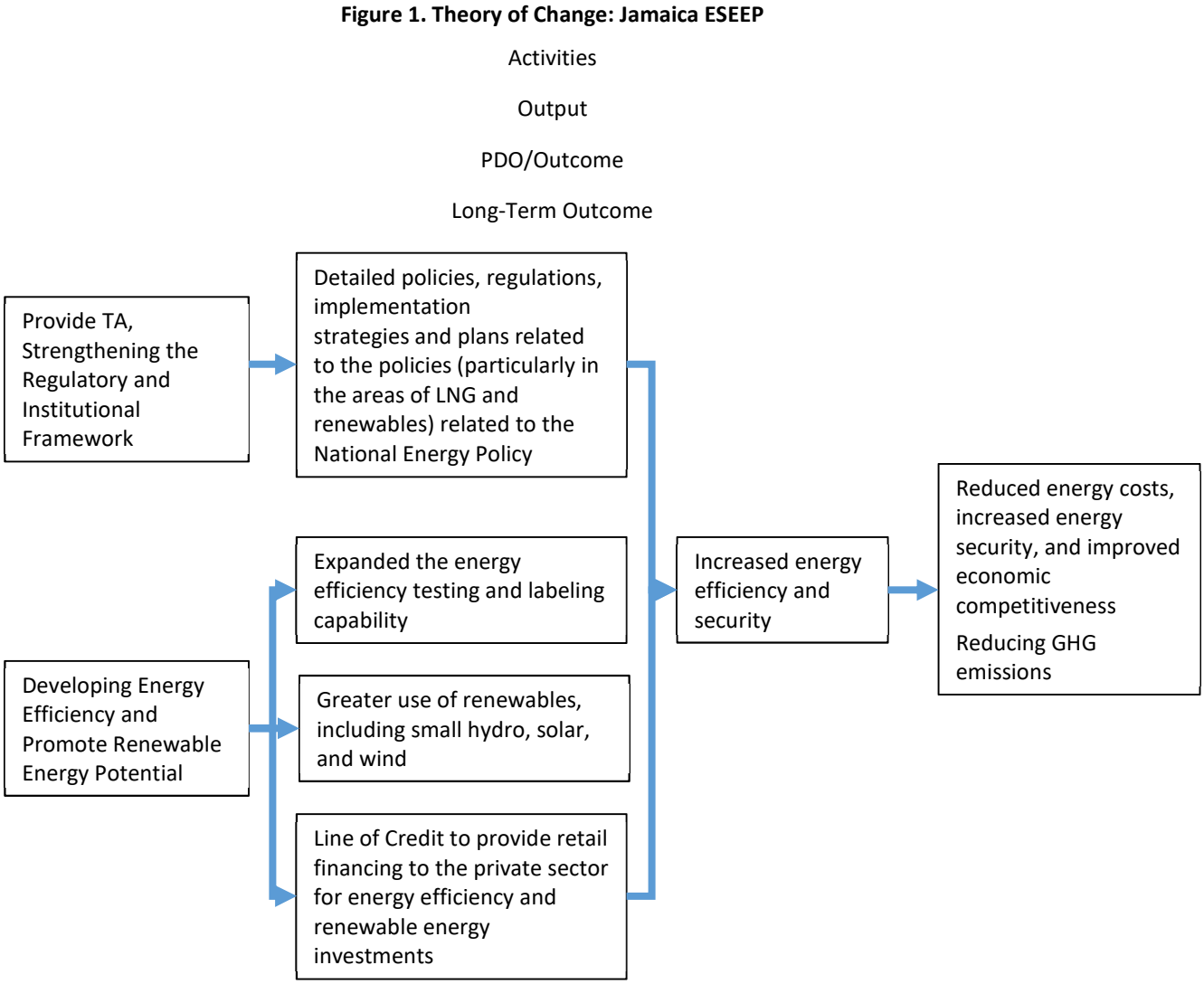
11. **Increasing sector efficiency.** Reducing energy costs was also a critical aspect of the Government's sector strategy because electricity and petroleum prices were high relative to Jamaica's main economic partners and competitors.

12. **Donors and private sector financing.** The Government partnered with a variety of International Development Partners in the development of Jamaica's energy sector.

13. The higher-level objectives of the project were to support the goals set out in Jamaica's National Energy Policy, particularly improving Jamaica's competitiveness by reducing end user energy costs, reducing the very high dependence on imported petroleum products, and mobilizing private sector financing. These objectives were also part of the World Bank Group CPS, in particular the third pillar of the CPS, promoting sustained growth, by strengthening nonlabor competitiveness, notably through a collaboration between the International Finance Corporation and the World Bank on energy programs and climate resilience, as well as vulnerability reduction.

Theory of Change (Results Chain)

Figure 1. Theory of Change: Jamaica ESEEP



Note: ESEEP = Energy Security and Efficiency Enhancement Project; LNG = Liquified natural gas; PDO = Project Development Objective; TA = Technical assistance.

Project Development Objectives (PDOs)

14. The objective of the project is to increase energy efficiency and security through the implementation of the Borrower's National Energy Policy.

Key Expected Outcomes and Outcome Indicators

15. The project was expected to contribute to reduced energy costs, increased energy security, and improved economic competitiveness. Furthermore, the project would contribute globally to reducing GHG emissions.

Components

16. The original components of the project are provided in the following paragraphs.

17. **Component 1:** Strengthening the Regulatory and Institutional Framework to Improve Sector Performance, Increase Private Investment and Transition to Cleaner Fuels (IBRD US$5.130 million). It included the following sub-components:

(a) **Sub-Component 1.1:** Provision of technical advisory services to, inter alia, develop: (a) detailed policies on renewable energy, in particular for hydro, wind resources and biomass, energy efficiency, and gas, and related regulations; and (b) implementation strategies and plans related to the policies on renewable energy referred to in subparagraph (a) immediately above (IBRD US$510,000; Implementation: MEM).

(b) **Sub-Component 1.2:** Strengthening the regulatory framework for private-public partnership monitoring capacity of the energy sector, including, inter alia, developing the capacity of the Office of Utilities Regulation (OUR) and Ministry of Energy and Mining (MEM) to: (a) develop regulations required for the development of renewable energy (including tariff setting methodologies), and a gas/Liquefied Natural Gas (LNG) program; (b) extend OUR oversight responsibilities to the gas, refinery and downstream petroleum sector; and (c) develop the monitoring and benchmarking instruments (IBRD US$1,160,000; Implementation: OUR).

(c) **Sub-component 1.3:** Accelerating the development of cost-effective privately financed generation in the power sector through the provision of technical advisory services to OUR and MEM, to: (a) prepare electricity non-Project investments; (b) facilitate effective interaction with the private developers; and (c) build their respective institutional capacity (IBRD US$1,610,000; Implementation: OUR).

(d) **Sub-Component 1.4:** Introducing the LNG program to support off-oil diversification, including the institutional strengthening of MEM and the relevant ministries, departments and agencies (MDAs), and provision of technical advisory services to enhance the technical, commercial, financial, and legal expertise required for developing a sound and sustainable LNG Program and related investments, stakeholders' information and consultation (IBRD US$1,650,000; Implementation: MEM).

(e) **Sub-Component 1.5:** Provision of technical advisory services to MEM and MDAs to harness the carbon credit potential created through the energy efficiency, renewable energy development and fuel substitution activities, respectively, under the Borrower's National Energy Policy (IBRD US$120,000; Implementation: MEM).

(f) **Sub-Component 1.6.** Implementing the National Energy Policy communication and information plan (IBRD US$80,000; Implementation: MEM).

18. **Component 2:** Developing Energy Efficiency and Renewable Energy Potential (IBRD US$9.08 million). It included the following sub-components.

(a) **Sub-Component 2.1:** Expanding the energy efficiency testing and labeling capability, and information program of the Bureau of Standards, including, inter alia, extending the testing chambers to test refrigerators, freezers, and air conditioners; and strengthening the related labeling and information program (IBRD US$1,550,000; Implementation: Bureau of Standards of Jamaica).

(b) **Sub-Component 2.2:** Carrying out investment promotion activities for identified small hydro sites, review the performance of the existing hydroelectric plants, and mobilizing investors and financiers, all in accordance with criteria acceptable to the Bank (IBRD US$2,760,000; Implementation: Centre of Excellence for Renewable Energy of PCJ).

(c) **Sub-Component 2.3:** Promoting solar and wind energy, including the dissemination of results of an on-shore wind resource assessment to potential investors, and promoting private sector investment in solar and wind energy (IBRD US$170,000; Implementation: Centre of Excellence for Renewable Energy of PCJ).

(d) **Sub-Component 2.4:** Provision of line of credit/revolving facility (Line of Credit) through the DBJ, to approved financial institutions (AFIs) to provide retail financing to the private sector (Eligible Investors) for energy efficiency and renewable energy investments (Subprojects) (US$4,600,000; Implementation: The Development Bank of Jamaica).

19. **Component 3:** Project Management, Monitoring and Evaluation (IBRD US$752,500). This component was to be managed by MEM and included the following subcomponents:

(a) **Sub-Component 3.1:** Strengthening the capacity of the MEM for Project management, procurement and financial management (IBRD US$662,500).

(b) **Sub-Component 3.2:** Provision of technical advisory services to define and implement the metrics/indicators and the monitoring and evaluation system required to monitor and assess the progress in Project implementation and the related actions under the National Energy Policy (IBRD US$90,000).

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION (IF APPLICABLE)

Revised PDOs and Outcome Targets

20. The PDOs were not revised.

Revised PDO Indicators

21. During the project's restructuring in December 2015, two PDO indicators were dropped. The PDO indicator tied to (a) 'a reduction in electricity costs for generation', was dropped as the results would be outside the scope and control of the project, and (b) 'a reduction in energy costs for SMEs' was also dropped as energy cost reductions were viewed as not a good proxy for energy consumption reductions through efficiency and diversification (with renewables) measures.

Revised Components

22. The Jamaican Parliament passed a new Electricity Act in 2015. This included a change of responsibilities for OUR. Previously, OUR was responsible for sector planning and also sector regulation. With the Act, the sector planning responsibilities moved from OUR to the ministry, to avoid possible future conflicts of interest. Due to this change in OUR responsibility, during the project's restructuring, the scope of Subcomponent 1.2: 'strengthening the regulatory framework and PPP monitoring capacity of the energy sector', Subcomponent 1.3: 'accelerating the development of cost-effective privately financed generation in the power sector', and Subcomponent 1.4: 'introduction of LNG in the borrower's energy matrix to support off-oil diversification', which were under OUR, was reduced.

23. Furthermore, the Act reduced the scope of the previous actors involved in promoting private sector investments in renewable energy (the Ministry of Science, Technology, Energy, and Mining [MSTEM] and Petroleum Corporation of Jamaica [PCJ]) and placed the responsibility with a new transitional entity 'Electricity Sector Enterprise Team', which was not an implementing entity under this project. Therefore, while the MSTEM continued working on streamlining procedures for private investment, it no longer actively supported feasibility studies for future investments. As a result, US$238,368 from Subcomponents 2.2 and 2.3 was reallocated.

24. Following competitive solicitation and market condition analysis, it was seen that the equipment being procured under Subcomponent 2.1 was considerably more expensive than anticipated, and funds made available through the reduction in scope were reallocated to fund the shortfall.

25. Significant demand for the Line of Credit (LOC) under Subcomponent 2.4 resulted in an additional US$1,000,000 being allocated to it.

Other Changes

26. The project was extended by 22 months due to delays in implementation of Subcomponent 2.1 (extending the testing chambers) as well as PIU turnover, with significant delays in hiring a new Project Manager and Procurement Officer.

27. The Electricity Act also changed the implementation arrangements for the project. The MEM became the MSTEM and became responsible for the energy sector planning. As a result of MSTEM and OUR's modified responsibilities under the Electricity Act, MSTEM became the lead implementing agency for the project.

Rationale for Changes and Their Implication on the Original Theory of Change

28. The changes were a result of the new Electricity Act that modernized the sector (the previous one was 125 years old) and did not materially change the objectives or outputs of the project, as they were still in line with the Government's overall National Energy Policy. Furthermore, the reallocation of funds within the project, through a restructuring, was directly to other activities that also contributed to increased energy efficiency and security. Even though OUR had a modified mandate through the Act, a number of outputs had already been produced, including reports for the Electricity Policy, Electric Lighting

Act, draft Power Purchase Agreement templates, feed-in tariff assessments, a smart-grid road map, and a grid impact and assessment for increased penetration of renewable energy.

II. OUTCOME

A. RELEVANCE OF PDOs

Assessment of Relevance of PDOs and Rating

29. The project is fully consistent with the current CPS 2014–2017, presented to the Board on April 29, 2014. The CPS focused on the World Bank strategy to be a program that was supporting the GoJ reform agenda "…accompanied by technical assistance in critical reform areas to build capacity…" whereby "…reforms that are being undertaken aim at addressing supply side bottlenecks to growth…." One of the main areas the CPS is focused on is growth, for which the Country Economic Memorandum had pointed to the country's low productivity as the main cause. Among the reasons for low productivity are inadequate business environment and poor and inefficient infrastructure, both of which are dealt with in the ESEEP.

30. Furthermore, the CPS recognizes that high debt ratios experienced by the country reduce space and limit the Government's ability to invest in infrastructure and improve public services that could support growth. Thus, by addressing the bottlenecks, which allows for greater private sector involvement in the energy sector, the project directly addresses the issues related to growth, thereby enabling investment in the sector.

31. The CPS also highlights Jamaica's low ranking in investment climate in the Doing Business report, whereby a key weakness is the high retail tariff for energy, at the time among the highest in the Caribbean, and low access to finance (at the time private credit to GDP at 27 percent, well below the upper-middle-income group average of 48 percent). The project focused on promoting energy efficiency and diversifying the energy matrix, to contribute to the reduction in cost of energy, while reducing vulnerability to external shocks, and increased access to finance—particularly in the energy sector. As such, the relevance of the project can be rated High.

B. ACHIEVEMENT OF PDOs (EFFICACY)

Assessment of Achievement of Each Objective/Outcome

Objective: Greater energy security

32. The outcome of this objective is rated as Substantial. In terms of indicators, the project initially linked security to a reduction in energy costs. As the restructuring correctly assessed, costs alone could not adequately be used for attribution, nor could it account for externalities—such as a drop in the price of oil. However, the project's other indicator based security on the diversification of the energy matrix of the country away from oil. The dependency on oil decreased from 95 percent (2010) to 71 percent (2017) and is expected to fall further to approximately 50 percent by the end of 2019. Given the absence of other indicators, a general look at the achievements of the project is used to support the satisfactory rating.

33. Critical to energy security was TA provided to enable updating of the 125-year-old Electric Lighting Act of 1890 with the modernized Electricity Act in 2015. This is a comprehensive energy strategy, which, prior to the project Jamaica lacked. The new Electricity Act now took into account issues such as renewable energy, biofuels, energy from waste, energy consumption and efficiency, and carbon trading. It included the creation of market conditions and evolution of private sector involvement in the sector. As a result of establishing these market conditions, the Electricity Act is leading to the development of an Integrated Resource Plan (IRP) to guide the development of a modern energy sector in Jamaica. The IRP, to be completed in 2018, will project electricity demand over a 20-year period and thus will aid in determining the generation capacity and technologies to be used to satisfy demand over this period. Technical assistance provided through the project also helped the realignment of energy sector agencies in Jamaica, allowing for better definition of roles and responsibilities and coordination among them, as well as the creation of two new entities: the Generation Procurement Entity and the Government Electrical Regulator. This has enabled a much-improved working relationship between MSTEM (now called MSET – Ministry of Science, Energy and Technology), OUR, and the power operator, Jamaica Public Service Company (JPS), in line with international best practice.

34. At the project concept stage, LNG was not a big focus, but during implementation it was considered a critical component in the diversification of the matrix. Specific assistance provided for planning and regulation of the gas sector, which included the development of regulatory and legislative policy frameworks for the introduction of natural gas, the development of National Petroleum Codes (including a Code for Liquified Petroleum Products), TA to evaluate the bids of new generating capacity on a build-own-operate basis, assistance to create structures for LNG (and hydro) projects to benefit from carbon credits to improve their financial and economic feasibility, and stakeholder engagement activities, all of which enabled more than US$1 billion of private sector investments in the LNG sector. This includes a 120 MW plant installed in the country's north coast, and an additional 190 MW plant, with the necessary infrastructure, which will become operational in 2019, replacing outdated oil plants.

35. Studies under the project determined that the country's grid could absorb increased renewable energy sources. Furthermore, the project developed new regulations, market mechanisms, and tariff options for renewable energy and alternative energy sources. As a result, together with the country's strategy to increase diversification, renewable energy generation almost doubled from 9 percent at the start of the project to 17 percent (of which 15.4 percent were large plants), by the end of 2017. The new renewable energy generation investments (including the photovoltaic (PV) solar to be installed by 2019) amounted to US$290 million for 374 MWh of generation potential. Furthermore, the results of the hydro feasibility studies, under Component 2, show six of the ten sites could lead to generation plants, a new solar PV plant will be commissioned by 2019, and the GoJ intends to install energy storage. These potential investments identified indicate that it is likely that even more renewables will come on line in the coming years. While biomass is one of the options to be considered, during implementation it was not considered cost-effective, but the Government is still interested in possible future uses.

36. The cost of energy lowered from US$0.39 per kWh (2012) to US$0.23 per kWh (2017). While much of this reduction was a result of the drop in oil prices, the diversification in the generation of energy, which includes cheaper LNG and renewables, also contributed to this reduction. Specific TA for the evaluation of bids for energy supply enabled the GoJ to receive proposals with costs as low as US$0.08 per kWh. Further aiding in the reduction of costs, the expected cost of energy produced by the six hydro sites for which feasibility studies were completed is around US$0.10–0.15 per MW. The OUR conducted an analysis

for the contribution of the diversification of the matrix to lowering the tariff, whereby they replicated the 2012 generation costs, but with the 2018 generation matrix. The original 2012 generation cost was US$0.188 per kWh, with the current matrix the tariff would have been US$0.1318 per kWh. Furthermore, the projected generation portion of the tariff for 2020 is US$0.1253. Thus, the addition of LNG and renewables has contributed to, and will continue to contribute, to lower energy costs in Jamaica. Furthermore, it should be highlighted that the World Bank's Performance and Learning Review of the Country Partnership Strategy for Jamaica (FY14-17) mentions that the diversification of the energy matrix was a notable advancement in the ease of doing business in Jamaica.

37. Other outcomes that will aid in enhancing energy security include additional measures, such as: the development of micro-grids or renewable energy solutions for rural electrification; smart grid road map for Jamaica; regulations for net billing, auxiliary connections and power wheeling; electricity sector grid codes (generation, transmission, distribution, dispatch, and supply); and petroleum codes, as well as an investor guide and a TA framework for new investments in the energy sector.

Objective: Increased energy efficiency

38. This subcomponent is rated as Modest. Unfortunately, the project did not identify an appropriate energy efficiency PDO indicator, as the one identified in the PAD did not consider the fact that the cost of energy of small and medium enterprises (SMEs) alone would not demonstrate energy efficiency. Further complicating the assessment, the testing chambers of the Bureau of Standards Jamaica (BSJ) were not fully operational at the time of project closure. However, several actions taken under the project have contributed toward improving energy efficiency, and the full outcomes will only be realistically visible well after the project has closed, due to the time lag needed to reflect its impact.

39. Under the provision of the LoC, through the Development Bank of Jamaica (DBJ), 55 loans, totaling US$5.38 million, were disbursed for energy efficiency projects, with two entities obtaining repeat loans. This subcomponent proved to be satisfactory, as there was much demand for energy efficiency loans, as reflected by the need to augment the funds available to this subcomponent during the restructuring, where the amount originally allocated to it was US$4.6 million. The projects ranged from US$8,000 to US$340,000, including energy efficient lighting to grid-tied solar PV systems. In fact, 2.8 MW of solar PV systems were installed under the LoC scheme, amounting to 2,505.48 barrels of oil equivalent/2,943 MCO_2 avoided annually.

40. It is noted, however, that the impact of the LoC was actually greater than the project's objective of just the World Bank loan of US$5.38 million. This was the country's first energy efficiency LoC, and it catalyzed the market, whereby other lenders also moved into this line of business. By the end of 2017, the DBJ had actually approved JMD 3 billion (approximately US$24 million) in energy loans for over 270 projects, through 13 lenders.

41. While the BSJ's testing chambers were practically fully completed by project closure, they were not operational by the project's closing date due to a series of events, one of which was beyond the control of the implementation unit. However, at the time of the ICR preparation, the BSJ had taken steps to complete the chambers and trained their staff to operate them, and it is anticipated that they will become operational by July 2018. These testing chambers have more than doubled the BSJ's capacity to test appliances (namely refrigerators and freezers), expanded their capability to include air conditioning

units, and halved the time it takes to test them. Furthermore, the testing chambers have been fitted to accommodate both 50 Hz and 60 Hz equipment, lending itself to be a testing hub for the Caribbean region.

42. The development of energy efficiency standards under the project will also have a significant impact. The activities supported under the project includes developing a policy regarding energy efficiency that did not exist previously, and inefficient appliances will be prohibited from entering the country. Furthermore, the standards developed will be applied to energy use labels (prepared by the testing chambers) and placed on the tested equipment, enabling consumers to have a choice regarding energy efficiency. In the past without these standards and greater testing capability, the country had no energy efficiency standards, and any appliances—no matter how poorly they were operated—could legally be imported, sold, and used in the country.

43. Unfortunately, at the time of closure, the project did not have any measures on the full amount of energy saved due to its activities, nor an exact projection of the possible savings in the years to come—leading to the Moderately Unsatisfactory rating for this subcomponent. However, anecdotal evidence (the appetite for energy efficiency funds disbursed under LoCs, fact that energy efficiency is now part of the law, and energy efficiency standards, which previously were nonexistent and will as of July 2018 be applicable to major home devices, and equally prevent the importation of poor energy efficient appliances) suggests energy efficiency is, and will continue, improving as a result of the project's activities.

Justification of Overall Efficacy Rating

44. The overall efficacy of the project is rated Substantial, as the project achieved its objectives of improving energy security, through the diversification of its matrix, which contributes, and will continue to contribute, to lowering energy prices. Furthermore, although not all of the energy efficiency activities were completed by project closure, they are very likely to be completely shortly and produce the intended results of improved energy efficiency.

C. EFFICIENCY

Assessment of Efficiency and Rating

45. An economic rate of return/internal rate of return was not calculated for this ICR due to insufficient data, particularly in energy efficiency, where, as mentioned later in the assessment of monitoring and evaluation (M&E), the necessary data were not collected, and thus a true meaningful value could not be obtained. However, the efficiency of this project is rated High. The project disbursed US$14.5 million out of the US$15 million (96.5 percent) loan. Savings (approximately US$1 million) were obtained due to the change in Government policy toward LNG, as well as in the procurement of the testing chambers. These funds were reallocated during the restructuring to increase the available funds for the LoC, under the DBJ, given the high demand that subcomponent was attaining from the market. It should be noted that the project was originally designed to be a US$25 million operation, but due to macro/fiscal constraints, it was downsized to US$15 million.

46. The high rating is based on the leverage the project had in attracting private sector investment to the sector. The change in Government policy, whereby investments—particularly in the LNG sector—were to be private sector led (as opposed to Government-led at appraisal), brought in significant investments

to the sector. As mentioned earlier, in the LNG sector alone, US$1 billion was invested in the country. The project also facilitated local investors in renewable energy where, for example, the Eight Rivers 37 MW PV plant has 50 percent local ownership. Furthermore, the testing chambers in the BSJ will not only serve Jamaica, as initially intended, but will also be a regional hub, whereby other Caribbean countries can purchase their services for energy efficiency testing and labeling, thus creating an additional stream of income for the agency.

47. In terms of implementation, the project spent US$0.738 million for project management, monitoring, and evaluation to provide US$13.74 million worth of goods, services, and consultancy, with an administrative efficiency of 5.1 percent of direct investment expenditure. However, it is noted that capacity (that is, staffing) in the Ministry of Science, Energy, and Technology (MSET) proved to be a bottleneck for agility in reviewing and responding to the project needs (for example, reviewing terms of reference). This was compounded by delays in fully staffing the Project Implementation Unit (PIU) at the beginning of the project, as well as delays in replacing staff during the life of the loan.

D. JUSTIFICATION OF OVERALL OUTCOME RATING

48. The overall outcome rating of the project is Moderately Satisfactory. While the project was able to fully achieve the objective of improving the energy security of Jamaica, aiding in the implementation of the National Energy Policy, leading to diversification of its matrix, and in doing so, enabling the leverage of significant private sector funding, the shortfall in its second objective undercuts the possibility of a full satisfactory implementation rating. While anecdotally, and conceptually, it is understood there should be energy efficiency gains from projects financed under the LoC, there are no data to support these assumptions. The main issue is that SMEs could use the savings from energy efficiency to use more energy—thus undercutting the objective of overall reduced energy consumption. Furthermore, there is the shortcoming that the test chambers were not operational by project closure, thus the intermediate indicators for this subcomponent could not be fully achieved. This shortcoming will be corrected, however, as the BSJ has made efforts, with its own resources, to finalize their implementation, and the test chambers will be operational by July 2018.

E. OTHER OUTCOMES AND IMPACTS (IF ANY)

Gender

49. The project did not have a gender aspect to it. However, Jamaica has been a good example of gender balance in the workforce, and this is reflected in the project. In terms of authority, the ministry's Permanent Secretary, Chief Technical Director, and Project Coordinator were all women, as well as other key Government and counterpart staff, including the Deputy Director General of External Cooperation Management of the Planning Institute of Jamaica, the Deputy Financial Secretary of the Ministry of Planning and Finance, and the head of the country's utility, JPS. Furthermore, other key project staff (for example, procurement officer) were also women.

50. During implementation, the project strongly encouraged gender balance during trainings and representation in bidding. As an example of the latter, the consortium that was awarded the tender for the 37 MW PV plant is owned by a woman.

Institutional Strengthening

51. The project contributed to strengthening the capacities of OUR and the MSET. The OUR Act itself was updated, to reflect the modern conditions of the sector. A benchmarking instrument was developed that allowed OUR to establish an M&E protocol. Furthermore, its capacity was enhanced enabling OUR to conduct comprehensive power system analyses, improving its forecasting needs and modifying the power systems to achieve optimal operation with the addition of new generating capacity. These tools increased OUR's overall grid knowledge, enabling it to verify that the grid could accommodate an expansion of renewable energy. OUR's procurement and negotiating capacity was also strengthened, which enabled the awarding of generation contracts for as low as US$0.085 per kWh. Furthermore, tools were developed to improve OUR's monitoring and benchmarking capabilities, and its modeling capabilities are now more robust, allowing for greater acceptance from other partners and stakeholders.

52. The project also contributed to improving OUR's capacity to analyze JPS' (the sole distributer of electricity in Jamaica) rate adjustment requests, in the context of the JPS Electricity License of 2016, through the construction of suitable long-term demand forecasting models. Furthermore, OUR and JPS are able to synchronize their data, facilitating interaction and sharing of models.

53. The improvement in the MSET's capacity is viewed through its ability to deliver the Electricity Act of 2015, as well as its implementation, combined with the greater diversification of the energy mix, as noted earlier. This includes an improved ability to negotiate new contracts (for example, LNG and renewable energy), which contribute to lowering overall energy costs. In addition, the MSET has been critical in clarifying and coordinating the roles of all energy sector actors.

Mobilizing Private Sector Financing

54. The project had a significant impact in mobilizing the private sector. This is reflected in investments made in energy generation. At the close of the project, 623 MW of new capacity was either added or is under construction for commissioning by the end of 2019. This includes three projects in LNG, representing approximately US$1 billion. The new capacity also includes three wind farms, two solar farms, and one hydro plant, all coming on line with private sector investment.

55. The project also has an indirect positive effect on the private sector through the energy efficiency loans made through the DBJ. The ESEEP subcomponent alone enabled funding for 53 firms, through 55 loans (amounting to US$5.3 million), for energy efficiency measures. Beyond this loan, the subcomponent catalyzed the market with the funds onlended being supplemented by 12 other lenders, enabling extending a total of JMD 3.08 billion (approximately US$28 million), to support energy efficiency projects in SMEs. Although exact figures are not known, there is anecdotal evidence that some of the SMEs used the savings provided by the energy efficiency actions, to reinvest in themselves, either through expanding their operations or using additional energy to boost productivity.[6]

[6] This reason is discussed in the project restructuring, which invalidated the PDO indicator used to measure increased energy efficiency in SMEs.

Poverty Reduction and Shared Prosperity

56. The project aids in the overall World Bank objectives of ending extreme poverty and boosting shared prosperity by: (a) providing greater energy security, through the diversification of the energy matrix by reducing the reliance of the country on imported oil; (b) reducing energy costs to the Jamaican population, where the average tariff has fallen from US$0.40 per kWh to around US$23 per kWh; (c) reducing the energy cost burden for SMEs through energy efficiency measures; and (d) providing options for improved energy efficiency appliances to the overall population.

Other Unintended Outcomes and Impacts

57. The original project was designed with a GoJ administration that envisioned the development of LNG, LNG architecture, and infrastructure to be all Government led. The change in government, due to the elections, resulted in a changed policy. This new policy was for the project to focus on the regulatory framework, and let the private sector come in to develop the generation aspect. The unintended outcome was the significant private sector investment (mentioned earlier), where even local institutions played a major role; for example, the 190 MW LNG (plant and related infrastructure) came mostly from local institutions. It is expected that the next tranche of investments will also come from the private sector. In addition to investments, involving the private sector in generation has led to a change in energy dispatch to the grid, improving efficiency and lowering the cost of energy for the end users.

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

58. During project design, there was significant coordination with other donors to address issues in the sector. From the World Bank's perspective, it was originally envisioned to be a US$25 million operation, at a time when there was an even greater emphasis on hydropower development in the country. However, due to the macroeconomic situation the country faced at the time, specifically the country's debt ceiling constraint, the project was reduced in scope to be the US$15 million project. This resulted in a narrower scope of interventions.

B. KEY FACTORS DURING IMPLEMENTATION

59. There were three main factors that affected project implementation. The first was a result of the DBJ bearing the exchange rate risk at the beginning of the project. During the design phase, the DBJ reluctantly accepted the risk, whereby it borrowed from the Government in U.S. dollars and then onlent in Jamaican dollars. After the first year of implementation, there was a significant drop in exchange rate, whereby the DBJ was losing significant funds. As a result, this component came to a halt for approximately two years, between 2012 and 2014, whereby the Government, the World Bank, and the DBJ renegotiated so that the onlending agreement from the Government to DBJ was changed to Jamaican dollars. This proved to be effective, in that, despite the delay, the program ended up disbursing the available funding very quickly once this issue was resolved and was even oversubscribed. As such, during restructuring, the ceiling for the onlending was raised.

60. The second was a change in Government policy regarding the LNG sector, due to elections, whereby it changed from a Government/publicly led to a market-based system. Thus, Government now concentrated on enabling factors and regulation and allowed the private sector to invest in the gas infrastructure. This led to a slowdown in the findings, studies, and recommendations related to this aspect of the project, as they needed to reflect the new policy.

61. The third key factor was related to the construction and refurbishment of the testing chambers in the BSJ, where there should have been closer project management oversight. The subcomponent experienced delays in the refurbishing of the existing labs (which ultimately delayed the whole project), in particular two chamber fans, which needed to be custom made, and only arrived near the end of the project. Then, upon arrival, they were stolen, had to be reordered, and were installed only after project closure. Furthermore, software incompatibility also delayed the final commissioning of the testing chambers. With these issues being resolved, the fans were installed during the preparation of this ICR, and the new and refurbished testing chambers are expected to be operational by July 2018.

62. As a result of delays in implementation due to the abovementioned factors, the project faced an additional constraint, given the tight fiscal policy (and space) the country was facing. The project's budget allocation from the Government for disbursing for each year was based on projections and experience. With each delay, the project would disburse less than planned, which in turn reduced the allocated amount for the subsequent year. This reduced amount thus capped the disbursements—even if more was required—leading to the deferment of payments or further delays due to the postponement of procuring certain contracts and disbursement of the LoC funding to accommodate the allowable fiscal space. The issue was resolved through improved planning, execution, and communication between the MSET, the Planning Institute of Jamaica, and the Ministry of Finance (MoF).

63. It should also be highlighted that the existing macroeconomic picture of the country has changed since project effectiveness. As the World Bank's Performance and Learning Review of the Country Partnership Strategy for Jamaica (FY14-17) mentions, Jamaica has made commendable progress in fiscal consolidation where primary fiscal balance is maintained between 7.0 to 7.5 percent of GDP, debt to GDP fell by 25 percentage points from 146 and growth rates have improved. Furthermore, the GoJ continues to be focused on private sector-led growth and public-sector modernization.

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

A. QUALITY OF MONITORING AND EVALUATION (M&E)

M&E Design

64. The M&E design was Moderately Unsatisfactory. While the intermediate indicators were useful at tracking the project's progress in implementation, the PDO indicators were not adequate to fully monitor the project's achievements. This is reflected by the discontinuation of two of the three indicators at the project's restructuring ('reduction of electricity costs for generation' and 'reduction of energy costs for SMEs'). The two indicators were simplistic and did not take into account all external factors that could significantly affect them—the main instance here being the cost of oil. Furthermore, the project lacked an appropriate indicator to assess the increase in energy efficiency. The indicator used for the SMEs also did

not take into account that the entities using the energy efficiency loans would in turn use the savings for greater energy-consuming activities to increase productivity, thus further nullifying the use of the indicator.

65. Conversely, the second indicator (Increase in energy security) was quite appropriate showing the change in energy generation matrix, and this was a good measure for the project's success related to the objective of the indicator.

M&E Implementation

66. The M&E framework provided a good set of intermediate indicators to track the project's progress with respect to diversifying generation, following the 'theory of change'.

67. The MSET would consistently include updated indicator tables in their Project Manager Reports, which were produced quarterly, and the data reflected in the World Bank's regular Implementation Status and Results Reports (ISRs), 11 of which were prepared. These reports collected qualitative information on the status of implementation of each indicator (for example, the status of the procurement or contract execution) and details of the outputs (for example, not just listing the number of reports, but describing which ones were produced).

68. The shortfall, as mentioned earlier, was in properly monitoring the project outcomes. By the end of the project, both the GoJ and the World Bank were trying to utilize other indicators to measure the success of the project. While this was possible in the diversification of the matrix, there were shortcomings in measuring the effectiveness of energy efficiency. There are two reasons for the shortfall in measuring energy efficiency: (a) BSJ's test chambers were not completed, and thus, no forward-looking estimation on energy efficiency could be calculated, and (b) the DBJ did not have any funds allocated for M&E of its approved projects. For such an analysis, the DBJ would have had to conduct site visits to the beneficiaries of its loans and conduct technical audits to monitor their progress and energy savings. Unfortunately, funds were not assigned, and the DBJ did not have the in-house expertise to conduct such an analysis—even though the Operational Manual highlighted the issue.

M&E Utilization

69. The project was proactive and consistent in using the intermediate indicators to monitor the progress of implementation. The Project Management Reports, referenced earlier, were the basis of the supervision discussions with the World Bank, whereby the indicator tables were the up front and usually the first topic discussed, thus playing a useful role in overall project management.

70. In particular for the last year of implementation, and soon after the restructuring, the World Bank and the PIU team did engage in discussions to measure the overall effectiveness of the project, but as described in the above section, the outcomes of the energy efficiency measures were not able to be measured for an accurate assessment given financial and capacity constraints and project delays.

Justification of Overall Rating of Quality of M&E

71. The overall rating of the M&E is Modest. This is based on the shortcomings of the design, where two of the three indicators were significantly inaccurate to consider external factors, and therefore at the restructuring, although they were correctly removed, substitute indicators were not added. Furthermore, measuring energy efficiency was hindered by having no specific budget allocation for the DBJ to hire an energy/M&E expert to measure their results. Given these PDO shortcomings, from an output standpoint, the intermediate indicators were useful and greatly used to monitor and manage the project's progress.

B. ENVIRONMENTAL SOCIAL AND FIDUCIARY COMPLIANCE

72. **Safeguards.** As identified in the PAD, the project was classified as risk Category B, and an Environmental Management Framework (EMF) and Resettlement Policy Framework were prepared to guide safeguards compliance during implementation. In addition to Environmental Assessment (OP/BP 4.01), the following policies were triggered largely as precautions: Natural Habitats (OP/BP 4.04), Forests (OP/BP 4.36), Pest Management (OP 4.09), Involuntary Resettlement (OP/BP 4.12), and Safety of Dams (OP/BP 4.37). The main environmental and social risks were related to the private sector investments in energy efficiency and renewable energy subprojects financed through the energy efficiency/renewable energy LoC, the investment preparation studies (including those related to hydroelectric project feasibility studies), and regulatory and legal studies (mainly related to LNG) that the Project would finance.

73. Each of the six completed hydroelectric feasibility studies included Environmental and Social Impact Assessment (ESIA) documents that identified the relevant environmental and social risks, including land acquisition, natural habitat impacts, and weir design for dam safety questions. Permitting aspects were also addressed by acknowledging that National Environment and Planning Agency (NEPA) licenses would be required of all the hydroelectric projects. The feasibility study ESIAs will serve as valuable guidelines and references going forward if any of these projects are pursued in the future, and thus serve as scoping studies for environmental and social safeguards aspects.

74. Environmental aspects of the LoC for private sector investments were managed by the DBJ. There were 55 energy loans supported from energy efficient lighting to grid-tied solar PV systems, which presented minimal to negligible environmental or social impacts. However, the experience gained by the DBJ using the EMF allowed for its subsequent adaptation and application to other World Bank Group projects managing environmental and social aspects of SME LoCs, credit guarantees, and other financial products, not only through the DBJ but through other lenders, thus helping improve environmental management systems for Financial Intermediaries throughout the country.

75. Plans for more comprehensive regulatory reform were reduced in scope as the lead role in LNG shifted to the private sector. The preparation of LNG guidelines and planning standards resulted in a 2015 set of simplified safety and technical standards for gas pipelines and metering stations, LNG satellite plants, and regasification terminals, which lay out basic industry standards. The NEPA's Environmental Impact Statement (EIS) process continues to govern the mitigation of environmental and social impacts but was assisted by the new guidelines and planning standards for several new LNG plants and the regasification terminal in Portland Bight. In the future, more comprehensive regulations may draw from the guidelines for developing a natural gas regulatory framework, also issued in 2015.

76. In sum the project performance was moderately satisfactory for safeguards. There were no safeguards non-compliance issues detected as part of the ICR review, but safeguards aspects were not methodically integrated during the implementation phase. The project supported basic advances in environmental protection for hydroelectric, LNG and SME alternative energy loans, and contributed to the country's shift to cleaner energy and reduced emissions. However, more rigorous TORs and additional time for safeguards review of the hydroelectric ESIAs would have enhanced investment readiness for other, future multilateral lenders and for in-country National Environmental and Planning Agency (NEPA) permitting, particularly regarding costs for land acquisition, baseline data in sensitive areas, and dam safety questions. For the Line of Credit component, earlier integration of the EMF into DBJ's operations would have resulted in more effective environmental management, dissemination of environmental information to borrowers, and improvement of environmental practices. The LNG regulations cover some basic safety aspects, but could have reference ASMEB31.8 or other more comprehensive international safety standards for the industry, as well as referring to best management practices for civil works associated with construction of LNG related facilities.

77. **Procurement.** Procurement implementation was consistently rated Satisfactory and the fiduciary risk was considered low throughout the life of the project. The project started off with the PIU operating with high efficiency, effectively preparing and processing a large number of TA contracts. This pace was kept up for the initial years of the project, but the turnover of PIU staff in 2015 affected somewhat its implementation progress until the hiring of a new project procurement officer in mid-2015, when the procurement capacity of the project was reestablished. Some contract implementation delays and issuance of new contracts in 2016 were reportedly due to the PIU's technical capacity challenges and bottlenecks in decision making as well as the disbursement limitations set by Ministry of Finance given the country's fiscal space constraints.

78. Most of the project contracts were subject to prior review by the World Bank, and as a result, the World Bank carried out only two post reviews for the project in 2015 and 2017. The first post review revealed that the procurement processes were carried out in accordance with the agreed provisions, while the second post review revealed that the World Bank provided 'no objection' to the use of national procurement methods for consulting services. There was no misprocurement under the project.

79. **Financial Management.** Throughout implementation, the ESEEP was compliant with the relevant requirements of the Financing Agreement. Despite the inconsistencies in timely submission of interim financial reports, the team produced quality financial information on implementation. All audit reports were provided to the World Bank on time and deemed to be of acceptable quality. There were no significant financial management deficiencies noted, and hence, the project maintained a financial management ISR rating of Satisfactory.

C.BANK PERFORMANCE

Quality at Entry

80. Quality at Entry is rated Moderately Satisfactory. Given the overall macroeconomic constraints that Jamaica was facing, the project was strategic and very relevant to addressing the issues faced—especially the cost of energy and the heavy toll oil had on the country's expenditures. With relatively small funding, the project ended up leveraging significant financing to the sector through its targeted

interventions in LNG, hydro, and other renewable energy and was worked in coordination with other multilaterals, namely, the Inter-American Development Bank, for a broad and effective sector approach. The project was consistent with the CPS, as well as the overall Government National Energy Policy.

81. However, given that the project was small, it was complex for Jamaica, in that it addressed energy planning, policy, generation, and efficiency, as well as onlending financing and refurbishment and expansion of small infrastructure. This complexity is reflected in over 40 separate activities, requiring a diverse set of skills and involving many different stakeholders from the GoJ, which was challenging to them, and led to a lack of overall focus. However, the design was equally flexible so that even with a change in government, and thus changing approach to addressing the sector issues, the project did not require any major changes during restructuring.

82. With regard to implementation, the design was sound, with appropriate fiduciary and safeguard arrangements. There were two shortfalls that could have been addressed at the design stage: (a) as mentioned in the M&E section, the PDO indicators were not adequate, and (b) the project did not effectively assess/mitigate the exchange rate risk that arose with the DBJ during implementation that delayed the component and thus the project.

Quality of Supervision

83. Quality of Supervision is rated Satisfactory. The World Bank's team conducted missions, at least twice a year, to supervise the project, and adequately reported on the performance of implementation in a candid manner in the 11 ISRs produced. The project was downgraded in December 2015 due to slow disbursements and a delay in re-staffing the PIU, given a turnover in key positions, including the overall project coordinator and procurement officer. Following the restructuring, the project was upgraded again to Moderately Satisfactory in December 2016, after which the ratings remained unchanged until project closure.

84. The Bank focused its efforts on achieving results and aiding the government. This is particularly illustrated with the support provided for the LNG policy change, whereby the Bank provided support in refocusing the government's role to that of a sector enabler and regulator, rather than participant. The Bank was particularly commended by the Government for its close support in the final two years of implementation, providing timely support to enable the completion of almost all contracts and achieving 97 percent disbursements. The only flaw during supervision was the insufficient analysis to formally identify and substitute the PDO indicators dropped at restructuring.

Justification of Overall Rating of Bank Performance

85. The overall rating for World Bank performance is Satisfactory. The project was strategic in nature and able to transform the electricity sector in Jamaica, in a positive way, and significantly contribute to diversifying the energy matrix, despite modest funding. Furthermore, the World Bank was able to adjust to new political realities, be flexible, and be supportive to achieve the country's goals. The minor shortcoming was assigning and revising PDO Indicators.

D.RISK TO DEVELOPMENT OUTCOME

86. Moving forward, the risk to the development outcome is low. The objectives of the project led to the creation of the Electricity Act and contributed to the drafting of the IRP, which should be issued in 2018. These are major sector policies that are guiding the Government and enabling unprecedented coordination between the Government's energy agencies. As referenced in Section II.B, the energy matrix at project closure now had 71 percent oil. A year after project completion, this figure is expected to lower to around 50 percent, with a potential of lowering further as new auctions take place for LNG and hydro plants (for which the feasibility studies are ready). In energy efficiency, as noted earlier, the BSJ completed its testing chambers with its own resources and has trained its staff to operate them, enabling long-term energy efficiency gains.

V. LESSONS AND RECOMMENDATIONS

87. PDO indicators that can trace the attribution of the project's activities should be used. During preparation it was not clear whether sufficient attention was given to identifying the proper indicators and respective targets. While the indicators chosen reflected the broader goals of the energy sector, such as reduction in electricity costs at a macro (country) and a micro (SME) level, they failed to take into account externalities, such as the cost of oil or an increase in energy use, over which the project has no control, and thus were not good measures of progress.

88. A relatively small, but targeted TA intervention can ultimately change, in a short time, the energy matrix of a small country. This is exemplified in this project through the impact of specific reports and studies that led to improved laws and regulations, which attracted and leveraged private sector investment in the necessary areas.

89. In designing TA projects, it is essential to keep the design flexible to accommodate a change in the sectoral approach (for example, the LNG sector in Jamaica, which was initially to be led by the Government, halfway through became private sector-led sector), without restructuring the design or objectives of the project.

90. When providing onlending through banks for activities aligned with the overall project objectives (for example, onlending for energy efficiency and renewable energy in a project with an energy efficiency PDO) where a technical audit is part of M&E , it is important to ensure resources (either funding or technical know-how/capacity) are available to conduct such audits.

91. When onlending funds through a local development bank to another financial entity, there should be a mechanism that is similar to the subsidiary agreement between the ministry and the development bank (in this case the DBJ) for the receiver of the funds and the development bank (DBJ). This would enable the development bank (DBJ) to respond to project needs and keep abreast of the impact of the project, such as energy efficiency savings.

92. The ultimate success of the onlending LoC for energy efficiency and renewable energy was due to having a dedicated window to attract borrowers in this area with lower interest rates.

93. In particular for Jamaica, it is important to ensure fiscal space is provided for the project to disburse against all planned activities in a year. This also entails continuous monitoring, re-estimation of expected disbursements, and constant communication with the MoF.

94. In designing a project with implementing entities whose parent ministry is different from that of the executing agency (and possibly self-financing), it is suggested they cofinance the project to achieve buy-in and thus ensure necessary implementation oversight.

95. An ICR workshop was conducted, bringing all the implementing agencies together to review the results of the project, as well as provide specific lessons learned regarding the project, which go beyond this section of the ICR. The findings are presented in annex 6.

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Increase in Energy Security	Percentage	95.00 31-Dec-2010	68.00 31-Dec-2015	73.00 31-Oct-2017	72.00 31-Oct-2017
Comments (achievements against targets):					

A.2 Intermediate Results Indicators

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
New Energy Sector Regulations Under Preparation or Approved	Number	0.00 31-Dec-2010	12.00 31-Dec-2015	12.00 31-Oct-2017	18.00 31-Oct-2017
Comments (achievements against targets): The Project directly or indirectly contributed to 18 new energy sector regulations, including the Electricity Act					

2015, 5 petroleum codes, standards for testing energy efficiency of appliances, electricity sector grid codes, and regulations for Government Electrical Regulator.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
New electricity generating capacity assigned, negotiated or under construction/installed	Megawatt	0.00 31-Dec-2010	520.00 31-Dec-2015	267.00 31-Oct-2017	623.00 23-May-2017

Comments (achievements against targets): 623 MW of new capacity has been added or is under construction, including 3 LNG facilities, 3 wind farms, 2 solar farms and 1 hydropower plant.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Implementation of the natural gas/LNG program	Text	- 31-Dec-2010	FSRU and pipelines completed 31-Dec-2015	LNG import and regasification facilities under construction 31-Oct-2017	LNG import and regasification facilities: one completed and one under construction. 31-Oct-2017

Comments (achievements against targets): 114 MW LNG facility has been completed at Bogue, and a 190 MW facility is under construction in Old Harbour. A third facility (100 MW at Jamalco) is scheduled to come online in 2019.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Information/Communication Activities (Project and National Energy Programme)	Number	0.00 31-Dec-2010	18.00 31-Dec-2015	18.00 31-Oct-2017	20.00 31-Oct-2017

Comments (achievements against targets): Activities completed include radio, television and social media campaigns executed; posters, banners and brochures printed and distributed; workshops and sensitization sessions held.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Appliances tested	Number	0.00 31-Dec-2010	8500.00 31-Dec-2015	250.00 31-Oct-2017	0.00 31-Oct-2017

Comments (achievements against targets): Laboratories were not completed in time to start testing within the project implementation period.

Laboratory staff underwent training in April 2018, funded by the Caribbean Regional Organisation for Standards and Quality (CROSQ) to build capacity for testing appliances for the Caribbean region, in preparation for the Energy Efficiency Laboratory becoming a regional testing facility.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised	Actual Achieved at

				Target	Completion
Prefeasibility, feasibility and other investments studies underway or completed on Renewable Energy (Hydros, Wind, Solar)	Number	0.00 31-Dec-2010	10.00 31-Dec-2015	10.00 31-Oct-2017	21.00 31-Oct-2017

Comments (achievements against targets): 11 prefeasibility and 10 feasibility studies were completed.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Commitments and Disbursements on the Line of Credit	Number	0.00 31-Dec-2010	5.00 31-Dec-2015	5.60 31-Oct-2017	5.38 31-Oct-2017

Comments (achievements against targets): All the funds issued to DBJ were on lent (funds given to DBJ were restricted due to a lack of fiscal space). 55 loans were disbursed.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Investment commitments to Electricity Sector	Number	0.00 31-Dec-2010	625.00 31-Dec-2015	625.00 31-Oct-2017	1109.00 31-Oct-2017

Comments (achievements against targets): Actual and planned investments in the energy sector included 3 LNG plants, 2 wind farms, 2 solar plants and a hydro plant.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Personnel Assigned to Project	Text	0 31-Dec-2010	3 31-Dec-2015	3 30-Jun-2015	4 31-Oct-2017

Comments (achievements against targets):

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Capacity building activities regarding Project Management, Financial Management and Procurement	Number	0.00 31-Dec-2010	12.00 31-Dec-2015	12.00 31-Oct-2017	9.00 31-Oct-2017

Comments (achievements against targets): All opportunities that arose were utilized.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Financial management, procurement, Safeguards, internal and external audits	Number	0.00 31-Dec-2010	12.00 31-Dec-2015	12.00 31-Oct-2017	22.00 31-Oct-2017
Comments (achievements against targets): These include annual external and internal audits, and semi-annual Interim Financial Reports (IFRs).					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Reporting on the implementation of the National Energy Policy (number of reports submitted)	Number	0.00 31-Dec-2010	9.00 31-Dec-2015	9.00 31-Oct-2017	10.00 31-Oct-2017
Comments (achievements against targets):					

B. KEY OUTPUTS BY COMPONENT

Objective/Outcome 1 – Increased Energy Security	
Outcome Indicators	1. Increase in Energy Security (reduction in the dependency on fuel oil)
Intermediate Results Indicators	1. New energy sector regulations under preparation or approved 2. New generating capacity assigned, negotiated, or under construction/installed 3. Implementation of the natural gas/LNG program 4. Information/communication activities (ESEEP and NEP) 5. Prefeasibility, feasibility, and other investment studies underway or completed on renewable energy (hydros, wind, solar) 6. New investment commitments to the electricity sector
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	1. The project directly or indirectly contributed to 18 new energy sector regulations, including the Electricity Act 2015, 5 petroleum codes, standards for testing energy efficiency of appliances, electricity sector grid codes, and regulations for Government Electrical Regulator 2. 623 MW of new capacity has been added or is under construction, including 3 LNG facilities, 3 wind farms, 2 solar farms, and 1 hydropower plant 3. 11 prefeasibility and 10 feasibility studies for hydro dams were done
Objective/Outcome 2 – Increased Energy Efficiency	
Outcome Indicators	1. Not available. Indicator cancelled at restructuring
Intermediate Results Indicators	1. Electrical appliances labeled; Information/awareness campaigns 2. Electrical appliances tested; 3. Commitment and Disbursement on the Line of Credit
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	1. Laboratories were not completed in time to start testing within the project implementation period. However, laboratory staff underwent training in April 2018, funded by the Caribbean Regional Organisation for Standards and Quality (CROSQ) to build capacity for testing appliances for the Caribbean region, in preparation for the Energy Efficiency Laboratory becoming a regional testing facility. The laboratory is

	expected to be fully operational by July 2018. 2. All the funds issued to the DBJ were onlent (funds given to the DBJ were restricted due to a lack of fiscal space). 55 loans were disbursed. 39 of these included installation of solar PV, for a total amount of 2.8 MW, 2,505.48 barrels of oil equivalent/2,943 MCO_2 avoided annually.

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Supervision/ICR	
Mark Stephen Lambrides	Task Team Leader(s)
Luciano Wuerzius	Procurement Specialist(s)
Shonell Jodian Robinson	Financial Management Specialist
John R. Butler	Social Safeguards Specialist
Luisa F. Pacheco de Vincenzo	Team Member
James Victor Pannett	Team Member
Laura Wendell Berman	Team Member
Michael J. Darr	Environmental Safeguards Specialist
Nora Elizabeth Sanchez Guzman	Team Member

B. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US$ (including travel and consultant costs)
Preparation		
FY09	11.654	78,477.24
FY10	45.763	226,917.78
FY11	69.035	352,844.25
FY12	.525	1,387.05
Total	**126.98**	**659,626.32**
Supervision/ICR		
FY11	0	4,524.79
FY12	15.896	89,384.59

FY13	19.235	147,078.46
FY14	14.450	151,654.42
FY15	32.835	269,643.90
FY16	21.571	111,490.95
FY17	25.872	119,739.34
FY18	16.326	130,666.17
Total	**146.19**	**1,024,182.62**

ANNEX 3. PROJECT COST BY COMPONENT

Components	Amount at Approval (US$M)	Actual at Project Closing (US$M)	Percentage of Approval (US$M)
Component 1: Strengthening the Regulatory and Institutional Framework to Improve Sector Performance, Increase Private Investment and Transition to Cleaner Fuels	0	3.27	0
Component 2: Developing Energy Efficiency and Renewable Energy Potential	0	10.82	0
Component 3: Project Management, Monitoring and Evaluation	0	0.87	0
Total	**0**	**14.96**	**0**

ANNEX 4. EFFICIENCY ANALYSIS

N/A

ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS

MINISTRY OF SCIENCE, ENERGY AND TECHNOLOGY

IMPLEMENTATION COMPLETION AND RESULTS REPORT

Energy Security and Efficiency Enhancement Project

May 2018

Currency Equivalents

(Exchange Rates Effective May 19, 2011 and October 31, 2017)

Currency Unit = Jamaican Dollar (J$)
World Bank Board Approval: US$ 1.00 = J$85.83
Closing Date: US$1.00 = J$127.29

Abbreviations and Acronyms

AFI	**Approved Financial Institution**	**MSTEM**	**Ministry of Science, Technology, Energy and Mining**
BP	**Bank Procedures**	**NEP**	**National Energy Policy**
BSJ	**Bureau of Standard Jamaica**	**NEPA**	**National Environment and Planning Agency**
CERE	**Centre of Excellence for Renewable Energy**	**OP**	**Operational Policies**
CESED	**Centre of Excellence for Sustainable Energy Development**	**OUR**	**Office of Utilities Regulation**
DA	**Designated Account**	**PDO**	**Project Development Objective**
DBJ	**Development Bank of Jamaica**	**PCJ**	**Petroleum Corporation of Jamaica**
EE	**Energy Efficiency**	**PAD**	**Project Appraisal Document**
EMF	**Environmental Management Framework**	**PSMD**	**Public Sector Modernization Division**
EOI	**Expression of Interest**	**POM**	**Project Operational Manual**
ESCO	**Energy Service Company**	**PSC**	**Project Steering Committee**
FERC	**Federal Energy Regulatory Commission**	**PIU**	**Project Implementing Entity**
FIDIC	**International Federation of Consulting Engineers**	**RE**	**Renewable Energy**
FM	**Financial Management**	**RFP**	**Project Implementing Unit**
GEF	**Global Environmental Facility**	**SLR**	**Request for Proposal**
GoJ	**Government of Jamaica**	**TER**	**Shortlisting Report**
IFB	**Invitation To Bid**	**TER**	**Technical Evaluation Report**
IFR	**Interim Financial Report**	**TOR**	**Terms of Reference**
ISR	**Implementation Status and Results (Report)**	**TTL**	**Task Team Leader**
LoC	**Line of Credit**	**UNDB**	**United Nation Development Business**
MDA	**Ministries, Departments and Agencies**	**WB**	**World Bank**
MSET	**Ministry of Science, Energy and Technology**		

Government of Jamaica
Energy Security and Efficiency Enhancement Project

CONTENTS

TABLES

FIGURES

Data Sheet

A. Basic Information			
Country:	Jamaica	Project Name:	Energy Security and Efficiency Enhancement Project
Project ID:	P112780	Borrower:	JAMAICA
Lending Instrument:	SIL		
Original Total Commitment:	USD 15.00M	Disbursed Amount:	USD 14.49M
Environmental Category: B			
Implementing Agencies: Petroleum Corporation of Jamaica, Bureau of Standards Jamaica, Office of Utilities Regulation, Development Bank of Jamaica, Ministry of Energy			

B. Key Dates				
Process	Date	Process	Original Date	Revised / Actual Date(s)
Concept Review:	11/24/2009	Mid-term Review:	6/30/2013	6/10/2013
Approval:	3/10/2011	Closing:	12/31/2015	10/31/2017
Effectiveness:	8/16/2011			
Restructuring(s):	12/23/2015			

C. Results Framework Analysis

Project Development Objective
The objective of the Project was to increase energy efficiency and security through the implementation of the Borrower's National Energy Policy.

Revised Project Development Objective
Objective was not revised.

Results Framework Analysis

Project Development Objective (PDO): The objective is to increase energy efficiency and security through the implementation of the National Energy Policy

Status	Intermediate Results Indicator	Description	Unit of Measure	Baseline 2010	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion	Date Achieved
Deleted	**Indicator #1:** Reduction in Electricity Costs (per unit of energy) for generation	Average annual electricity generation costs	US$/MWh	200	120	------	------	Oct 31, 2017
Comments (incl. % achievement)	This indicator was deleted because it was recognized that there are many factors outside of the control of Jamaica that affect the cost of electricity.							
Revised	**Indicator # 2:** Increase in Energy Security (reduction on the dependency of fuel oil)	Source of energy (oil as a % of the total fuel source)	% reduction in the depen-dency on oil	91%	67%	73% (End target date revised to align with extended project closing date)	72%	
Comments (incl. % achievement)	**105.6% achievement:** This significant reduction in the percentage of oil in the energy mix (signifying a corresponding increase in energy security) can be attributed mainly to the introduction of natural gas to Jamaica in 2016. Liquefied Natural Gas (LNG) now makes up 12% of the energy mix. During the corresponding period solar energy has also been introduced into the energy mix (currently at 3.5%), while wind energy has increased from 3.4% to 10.3%.							
Deleted	**Indicator # 3:** Reduction in Energy Costs of SMEs		Reduction from business-as-usual scenario	100	80	------	------	
Comments	This indicator was removed because of the difficulty in accurately calculating the reduction in cost attributable to loan funds.							

(incl. % achievement)	

Component 1: Strengthening the Regulatory and Institutional Framework to Improve Sector Performance, Increase Private Sector Investments and Transition to Cleaner Fuels.								
Status	**Intermediate Results Indicator**	**Description**	**Unit of Measure**	**Baseline 2010**	**Original Target Values (from approval documents)**	**Formally Revised Target Values**	**Actual Value Achieved at Completion**	**Date Achieved**
Unchanged	**Indicator #1:** New energy sector regulations under preparation or approved	Number of new regulations under preparation or approved (cumulative)	# of Regula-tions	------	12	(End target date revised to align with extended project closing date)	18	
Comments (incl. % achievement)	**150% achievement**: The Project directly or indirectly contributed to 18 new energy sector regulations, including the Electricity Act 2015, 5 petroleum codes, standards for testing energy efficiency of appliances, electricity sector grid codes, and regulations for Government Electrical Regulator.							
Revised	**Indicator #2**: New Generating capacity assigned, negotiated or under construction / installed.	New MWs of generating capacity by source including renewables	Genera-ting Capacity (MW)	**-------**	520 (FO/Gas: 460, RE: 40)	267 (FO/Gas) (End target date revised to align with extended project closing date)	623	
Comments (incl. % achievement)	**233% achievement:** 623 MW of new capacity has been added or is under construction, including 3 LNG facilities, 3 wind farms, 2 solar farms and 1 hydropower plant.							

Component 1: Strengthening the Regulatory and Institutional Framework to Improve Sector Performance, Increase Private Sector Investments and Transition to Cleaner Fuels.								
Status	**Intermediate Results Indicator**	**Description**	**Unit of Measure**	**Baseline 2010**	**Original Target Values (from approval documents)**	**Formally Revised Target Values**	**Actual Value Achieved at Completion**	**Date Achieved**
Revised	**Indicator #3:** Implementation of the Natural Gas/LNG Programme.	Key Milestones: A. Selection of investor for terminal; B. Negotiations completed; C. Financial close.	Milestones	-------	FSRU & pipelines completed	LNG import and regasification facilities under construction (End target date revised to align with extended project closing date)	LNG import and regasification facilities: one completed and one under construction .	
Comments (incl. % achievement)	**200% achieved**: a 114 MW LNG facility has been completed at Bogue, and a 190 MW facility is under construction in Old Harbour. A third facility (100 MW at Jamalco) is scheduled to come online in 2019.							
Unchanged	**Indicator #4**: Information/ Communication activities (ESEEP & NEP)	Number of workshops held, advertisements sponsored, publications distributed	Cumulative Number	-------	18	(End target date revised to align with extended project closing date)	20	
Comments (incl. % achievement)	**111% achieved:** activities completed include radio, television and social media campaigns executed; posters, banners and brochures printed and distributed; workshops and sensitization sessions held.							

Component 2: Developing Energy Efficiency (EE) and Renewable Energy Potential								
Status	**Intermediate Results Indicator**	**Description**	**Unit of Measure**	**Baseline 2010**	**Original Target Values (from approval documents)**	**Formally Revised Target Values**	**Actual Value Achieved at Completion**	**Date Achieved**
Deleted	**Indicator # 1:** Electrical appliances labeled; Information/awareness campaigns	# of electrical appliances labeled # of information/awareness campaigns	Number of labels Number of campaigns	3000 -------	8500 10	------	------	
Comments (incl. % achievement)	Indicator was deleted as "labeling" appliances is outside the project scope.							
Added	**Indicator # 1:** Electrical appliances tested;	# of electrical appliances tested	Number of appliances tested	-------	------	250 (End target date revised to align with extended project closing date)	0	
Comments (incl. % achievement)	**Not achieved:** Laboratories were not completed in time to start testing within the project implementation period. Laboratory staff underwent training in April 2018, funded by the Caribbean Regional Organisation for Standards and Quality (CROSQ) to build capacity for testing appliances for the Caribbean region, in preparation for the Energy Efficiency Laboratory becoming a regional testing facility.							

Component 2: Developing Energy Efficiency (EE) and Renewable Energy Potential								
Status	**Intermediate Results Indicator**	**Description**	**Unit of Measure**	**Baseline 2010**	**Original Target Values (from approval documents)**	**Formally Revised Target Values**	**Actual Value Achieved at Completion**	**Date Achieved**
Unchanged	**Indicator #2:** Prefeasibility, Feasibility and other investment studies underway or completed on Renewable Energy (Hydros, Wind, Solar)	Number and status of investments studies	Cumula-tive Number	---------	10	(End target date revised to align with extended project closing date)	21	
Comments (incl. % achievement)	**210% achieved:** 11 prefeasibility and 10 feasibility studies were done.							

Revised	**Indicator #3:** Commitment and Disbursement on the Line of Credit	Number of sub-projects and $ value approved by DBJ (and sub-projects presented by AFIs)	# of Sub-projects & Value (Cum)	------- -------	35 $5m	------- $5.6m (End target date revised to align with extended project closing date)	$5.38M	
Comments (incl. % achievement)	**96% achieved:** All the funds issued to DBJ were onlent (funds given to DBJ were restricted due to a lack of fiscal space). 55 loans were disbursed.							
Unchanged	**Indicator # 4:** New investment commitments to the Electricity Sector	New commitments by type of investment (generation, gas, energy efficiency, etc.)	US$ million	------	625m	(End target date revised to align with extended project closing date)	1,109m	

Comments (incl. % achievement)	**177% achieved:** actual and planned investments in the energy sector included 3 LNG plants, 2 wind farms, 2 solar plants and a hydro plant.

Component 3: Project Management and Monitoring and Evaluation (M& E)								
Status	**Intermediate Results Indicator**	**Description**	**Unit of Measure**	**Baseline 2010**	**Original Target Values (from approval documents)**	**Formally Revised Target Values**	**Actual Value Achieved at Completion**	**Date Achieved**
Unchanged	**Indicator #1:** Key project personnel assigned to project (Project Manager, Financial Management Specialist & Procurement Officer)	Monitoring of retention of Project Manager, Financial Management and Procurement experts and external auditors	Personnel assigned to project	------	PM, FM, PS	(End target date revised to align with extended project closing date)	PM, FM, PS	
Comments (incl. % achievement)	**100% achieved:** Staff who resigned during the period were replaced.							
Unchanged	**Indicator #2:** Capacity building efforts regarding project management, project financial management and procurement.		Number of sessions	-------	12	(End target date revised to align with extended project closing date)	9	
Comments (incl. % achievement)	**75% achieved.** All opportunities that arose were utilised.							

Component 3: Project Management and Monitoring and Evaluation (M& E)								
Status	**Intermediate Results Indicator**	**Description**	**Unit of Measure**	**Baseline 2010**	**Original Target Values (from approval documents)**	**Formally Revised Target Values**	**Actual Value Achieved at Completion**	**Date Achieved**
Unchanged	**Indicator #3**:Financial management, procurement, safeguards, internal & external audits	Monitoring of delivery of reports	Number & types of reports submitted	-----	12	(End target date revised to align with extended project closing date)	22	
Comments (incl. % achievement)	**183% achieved:** annual external and internal audits, and semi-annual Interim Financial Reports (IFRs).							
Unchanged	**Indicator #4:** Reporting on the implementation of the National Energy Policy		Number & types of reports submitted	-----	9	(End target date revised to align with extended project closing date)	10	
Comments (incl. % achievement)	**111% achieved.**							

D. Ratings of Project Performance in ISRs

No.	Date ISR Archived	PDO	IP	Actual Disbursements (USD millions)
1	June 16, 2011	Satisfactory	Satisfactory	0.00
2	April 14, 2012	Satisfactory	Satisfactory	2.04
3	November 19, 2012	Satisfactory	Satisfactory	3.95
4	August 12, 2013	Satisfactory	Moderately Satisfactory	3.95
5	March 18, 2014	Moderately Satisfactory	Moderately Satisfactory	5.38
6	November 24, 2014	Moderately Satisfactory	Moderately Satisfactory	7.95
7	June 23, 2015	Moderately Satisfactory	Moderately Satisfactory	8.79
8	December 17, 2015	Moderately Unsatisfactory	Moderately Unsatisfactory	9.96
9	June 3, 2016	Moderately Unsatisfactory	Moderately Unsatisfactory	11.18
10	December 21, 2016	Moderately Satisfactory	Moderately Satisfactory	13.45
11	May 31, 2017	Satisfactory	Moderately Satisfactory	13.70
12				

Jamaica Energy Security and Efficiency Enhancement Project (P112780)
Implementation Completion Report

Borrower's Assessment

The following is the Government of Jamaica's assessment of the design, implementation and achievements of Project P112780. The lessons learned throughout the implementation of the project will be highlighted.

1. Project's Context

1.1. In 2008, the year in which project design began, Jamaica's energy sector was characterized by high energy costs and an extremely high dependence on imported petroleum products, with 94% of all energy used coming from imports. Renewable energy sources were few.

1.2. While there was adequate capacity to cover the demand for power generation at the time, electricity costs and tariffs were very high, as a result of (i) the almost exclusive reliance on imported petroleum products, (ii) highly inefficient power generation, and (iii) high transmission and distribution losses (23% in 2009). In 2009, the average electricity tariff was 27.5 USc/kWh. Its dependence on imported fuel also meant that Jamaica was very vulnerable to oil price shocks. Jamaica's competitiveness suffered as a result.

1.3. Although Jamaica's energy supply was adequate in 2009, an anticipated increase in demand, and the retirement of old and inefficient power plants, meant that over the ensuing five-year period Jamaica would need additional generation capacity estimated at approximately 500 MW.

2. Project's Relevance at the Time of Design

2.1. In November 2010, the Jamaican Parliament approved the Jamaica National Energy Policy 2009-2030 (NEP). The goal of the NEP is to develop "a modern, efficient, diversified and environmentally sustainable energy sector, providing affordable and accessible energy supplies with long-term energy security and supported by informed public behaviour on energy issues, and an appropriate policy, regulatory and institutional framework." The NEP in turn supports the National Development Plan – Vision 2030 Jamaica (2009), in particular the national strategies to (i) diversify the energy supply and (ii) promote energy efficiency and conservation.

2.2. The Project was therefore very relevant at the time of design, as it was designed to operationalize the newly-crafted and approved NEP. It would assist the Ministry of Energy and Mining (as it was designated at the time) to ensure that it was actively pursuing the goals of Energy Vision 2030, while building institutional capacity to formulate, plan and implement energy policies and strategies and monitor and evaluate outcomes.

2.3. The components of the Project addressed the following identified needs:

a) Strengthening the sector regulatory framework by providing clear policy directions, regulations and incentives in order to mobilize private sector investment, promote renewable energies and increase energy efficiency at the level of utilities and end-users.

b) Building institutional capacity to formulate, plan and implement energy policies and strategies and monitor and evaluate outcomes.

c) Mobilizing private sector financing for energy infrastructure as public finances will not be able to provide substantial financial resources directly or even through guarantees.

d) Reducing the cost of electricity and eventually lowering prices to improve the country's economic competitiveness and reduce the impact of energy consumption on households' budgets. This required diversifying the sources of electricity generation away from expensive diesel oil to natural gas (through LNG) and heavy fuel oil, accelerating the replacement of highly inefficient generating plants and reducing transmission and distribution losses.

e) Lowering the sector's vulnerability to oil price fluctuations by reducing its reliance on imported petroleum products for electricity generation through: (i) the development of renewable energy sources; (ii) diversification toward fuels with more stable prices, such as gas and renewable energy; and (iii) energy efficiency measures.

f) Reducing GHG emissions by switching to less polluting fuels (such as gas), developing renewable energy, and curbing energy consumption (and the underlying related generation) through energy efficiency measures.

3. Project's Design (PDO, Components)

3.1. The ESEEP was designed to provide comprehensive support to the implementation of the NEP covering the 2009 through 2030 period. The Project's design supported all of the key goals of the NEP: (a) increase Jamaica's energy security by diversifying the energy matrix; (b) enhance Jamaica's economic competitiveness and performance by improving the efficiency of the energy sector, and minimizing end-users energy costs; (c) reduce Green House Gas (GHG) emissions from the energy sector; and (d) delineate and implement well defined institutional, and regulatory frameworks. .

3.2. The Project Development Objective and the three components of the Project are shown in the table below.

Table 1: PDO and Components

Project Development Objective: Increase energy efficiency and security through the implementation of the Borrower's National Energy Policy	
Component 1:	Strengthening the Regulatory and Institutional Framework to Improve Sector Performance, Increase Private Investment and Transition to

	Cleaner Fuels
Component 2:	Developing the Energy Efficiency and Renewable Energy Potential
Component 3:	Project Management, Monitoring and Evaluation

3.3. As shown above, the Project was structured with three components, each with subcomponent activities reflected in the indicators and aligned to the PDO. The components and sub-components were adequate and comprehensive, and were clear in content, organized, and implementable. The Project was designed to be implemented by the Ministry of Energy, the Petroleum Corporation of Jamaica (PCJ), the Office of Utilities Regulation (OUR), and the Development Bank of Jamaica – all key players in the energy sector.

3.4. The sub-components of the Project directly addressed the development of a modernized regulatory framework for the energy sector; the increase of energy security and diversification; development of renewable and alternative energy sources; the promotion of energy efficiency and conservation, and building institutional capacity for the Ministry and the OUR.

3.5. The design also included a communication and information campaign. This was important because the general public plays an important part in achieving the goals of the NEP, as these were to be supported by informed public behaviour on energy issues. As the attitude of the general public towards energy conservation and efficiency is brought in line with the goals of the NEP, therefore influencing their behavior, the objectives can be more easily met.

3.6. The provision of a line of credit to facilitate energy efficiency and conservation projects in the private sector (specifically for small and medium enterprises) was very useful in promoting these concepts in that sector. The public sector was already being served via the Energy Efficiency and Conservation Programme, so this sub-component filled the void.

3.7. Component 1: Strengthening the Regulatory and Institutional Framework to Improve Sector Performance, Increase Private Investment and Transition to Cleaner Fuels

3.7.1. Component 1 was implemented by the Ministry of Science, Energy and Technology (formerly the Ministry of Energy and Mining and the Ministry of Science, Technology, Energy and Mining) and the Office of Utilities Regulation (OUR). The component aimed at (i) operationalizing the new energy policy; (ii) reinforcing the energy sector regulations for mobilizing and implementing energy investment and for cost optimization; and (iii) accelerating the development of energy efficiency and renewable energy initiatives.

3.7.2. The activities employed to address the needs identified in Section 2.3 above are outlined below.

3.7.2.1. <u>Strengthening the Energy Sector Regulatory Framework</u>

Goal 5 of the NEP is for Jamaica to have "a well-defined and established governance, institutional, legal and regulatory framework for the energy sector that facilitates stakeholder involvement and engagement". The aim is to "remove policy inconsistencies and provide a coherent policy and regulatory framework to facilitate competition in the energy supply system, enable the introduction of diverse sources of energy into the system, and provide integrated monitoring and enforcement of regulations, all overseen by agencies and organizations with the capacity and tools to guide the energy sector." This Project thus provided for review of existing regulatory and legislative documents, such as the outdated Electricity Act, as well as development of a framework for regulating newer energy sources, including gas, solar and hydro.

3.7.2.1.1. <u>Modernization of the Electricity Lighting Act</u>

A consultant was engaged to develop the electric power sector policy strategy and to modernize the Electricity Lighting Act, while consolidating the policy and legislation governing the electric power sector in Jamaica. The Electricity Policy and the Electricity Act 2015 which were developed as a result of this consultancy took into account the objectives of the National Energy Policy and the sub policies for renewable Energy, Biofuels, Energy from Waste, Energy Conservation and Efficiency and Carbon Trading; the draft Electric Power Sector Policy and Strategy; and the draft Legislation for the Electricity sector. The policy and the act were designed to be in harmony with the OUR Act.

3.7.2.1.2. <u>Development of Regulatory Frameworks for Renewable Energy and Alternative Energy Sources</u>

The NEP states that as part of the energy diversification strategy "*In the short to medium term, natural gas would be the fuel of choice for generation of electricity and production of alumina. This diversification will require an enabling regulatory and legislative environment and development of institutional capacity*". Renewable energy sources such as solar and hydro were also identified as being part of the thrust for diversification.

Given the urgency for the acquisition of electricity generation capacity and the modernization imperatives, the GOJ desired that a Liquefied Natural Gas (LNG) receiving terminal and natural gas distribution system be commissioned in Jamaica no later than 2014. LNG floating storage and re-gasification unit (FSRU) technology was contemplated as the preferred means of accomplishing the introduction of natural gas into Jamaica's energy mix in the desired timeframe.

Consultants were engaged to:

- develop the regulatory and legislative policy framework needed for the successful introduction and operation of natural gas as the next generation fuel in Jamaica;
- support the preparation of new regulations, market mechanisms and tariff options for renewable energy and alternative energy sources;
- identify the most cost-effective energy efficiency and demand-side programmes to achieve policy and legislative objectives under a revenue cap regime.

3.7.2.1.3. Development of National Petroleum Codes (NPC)

The GoJ, through the Ministry of Energy, is committed to the modernization of the petroleum sector as well as ensuring that petroleum supplies are safely and reliably transported to homes, communities and the productive sector. To this end, the GoJ is committed to the development of petroleum standards especially in relation to health, safety and the environment, which are also supported by other legislative and regulatory frameworks such as the Factories Act and the Weights and Measures Act.

Under the ESEEP National Petroleum Codes (NPC) were developed for the regulation of all stakeholders within the petroleum sector, with specific reference to refining, importation, wholesaling, distribution and retailing. The NPC established a comprehensive framework with minimum requirements for health, safety and the environment, as well as informed the legislation which is required to support the implementation of the Codes.

The specific codes developed are:

- JS 341 - Code for Liquid Petroleum Products.
- JS 342 - Code for Liquefied Petroleum Products.
- JS 343 - Code for Petroleum Based Lubricants.
- JS 344 - Code for Product Chain of Custody.
- JS 345 - Code for Biofuels

3.7.2.2. Building Institutional Capacity

Development of institutional capacity was identified in the NEP as being key to achieving its goals. Activities were carried out to strengthen the institutional capacity of both the OUR and MSET.

3.7.2.2.1. Evaluation of Bids for the Supply of 480MW of Base Load Generating Capacity on a BOO Basis

A Consultant was hired to evaluate bids received for the provision of 480 MW of new generating capacity on a Build Own and Operate (BOO) basis. This new capacity would replace approximately 292 MW of inefficient aged plants, and provide for load growth.

The Consultant provided an evaluation document that ranked the proposals according to evaluation criteria, supported by the analysis of each item. While the procurement was not carried through, the evaluation document provided a framework for the OUR to use in its evaluation of other proposals such as the 190 MW LNG plant and the battery storage system purchased by JPS, and has

proved to be an invaluable resource.

3.7.2.2.2. Provision of Power System Analysis And Planning Software Package

In April 2014 the OUR was provided with a comprehensive power system analysis and planning software package that enhanced its ability to (i) plan and design the power system to meet forecasted needs, and (ii) facilitate the modification of the power system to achieve optimal operation with the addition of new generating capacity.

However, pursuant to the new Electricity Act published in 2015, the MSET was given the responsibility for power sector planning and specifically - in line with the new JPS licence - for the preparation of the Integrated Resource Plan for the electricity grid in Jamaica. The process was started for the MSET to be given access to the software package previously supplied to the OUR, and to have this package, as well as the newly acquired PLEXOS Integrated Energy Model, incorporated within the infrastructure and operations of MSET. Unfortunately this activity was not completed under the ESEEP because the required inputs needed by the consultant were not available in time.

The OUR continues to use the software to perform studies of the JPS transmission system, to ensure that it is being operated in a safe and reliable manner and within the design limits. JPS has also purchased the software for its own use.

3.7.2.2.3. Enhancement of OUR's Monitoring And Benchmarking Capabilities

An evaluation of the OUR's monitoring and benchmarking capabilities was carried out. The firm reviewed and commented on the existing regulatory monitoring activities and systems of the OUR and determined their adequacy and the extent to which these activities/systems effectively and accurately monitored and measured the performance of the regulated service providers. A benchmarking instrument was developed that allowed the OUR to establish a Monitoring and Evaluation protocol.

3.7.2.2.4. OUR's Capacity To Analyse JPS Rate Adjustments

The new *JPS Electricity Licence 2016* (which is an indirect outcome of this Project) has resulted in a replacement of a price cap tariff regime with a revenue cap methodology for setting retail prices for electricity. This is a forward-looking approach to tariff setting, as opposed to the previous econometric models used which relied heavily on historical data. The new approach will therefore rely heavily on a long-term demand forecast.

The *JPS Electricity Licence 2016* also allows for electricity rates to be set having

regard to the return on equity to be provided to the Licensee.

The OUR's institutional capacity to analyse rate adjustments requested by JPS was therefore enhanced by the following:

- Construction of a suitable long-term demand forecasting model that will be used by the OUR and other stakeholders in the energy sector for planning, operation and rate-setting purposes. Importantly, the major stakeholders – OUR, JPS and MSET – all participated in this consultancy (evaluation of bids and approval of deliverables), so that, rather than the various entities using different forecast methodologies, there is now agreement on the methodology to be used.

- An analysis of the methodological options available for computation of the return on equity which would allow the JPS the opportunity to earn a return sufficient to provide for the requirements of consumers and acquire new investments at competitive cost. The most suitable methodology, based on the specific characteristics of the Jamaican economy and electricity industry was identified. As required by the JPS Licence, the Bank of Jamaica (BOJ) provided guidance on the methodology.

3.7.2.2.5. Update of OUR's Electronic Filing System

An electronic filing system was developed for the OUR to provide current and timely information in an interactive, user-friendly manner. The information can be uploaded to an internal database for reporting and analysis.

3.7.2.2.6. Mobilization of Carbon Credits for the LNG and Hydro Projects

The objective of this activity was the development and mobilization of Carbon Credits for the fuel diversification strategy being pursued by the GoJ. A consultant was engaged to recommend appropriate structures for the LNG and hydro projects to benefit from Carbon Credits in order to improve their financial and economic feasibility. The outputs of this consultancy assisted in structuring negotiations with the off-takers of the LNG project to support the successful introduction of LNG in Jamaica, and specifically, the monetization of the Carbon Credit potential. With regards to the development of the hydropower sub-sector, activities were focussed on coaching staff of the Ministry and the JPS through the validation and registration process of the Programme of Activities and Design Document for the Clean Development Mechanism.

3.7.2.2.7. Project Monitoring and Evaluation Tool

Implementing the NEP necessitates a range of infrastructure development within the energy sector, led by private sector investment. A project analysis, evaluation, monitoring and implementation system, administered by MSET, is needed for tracking energy projects and evaluating new energy proposals. This tool will assist in the review of project concepts; analysis of project proposals for technical, financial, and economic pre-feasibilities and feasibilities; as well as assist with the project implementation monitoring, evaluating and reporting processes.

The project monitoring and evaluation system which was developed facilitates variance analyses (comparing actual versus forecasted impact and timing of implementation).

3.7.2.3. Development of Gas and Renewable Energy Sectors

Diversification of the fuel source for electricity generation serves to both reduce the cost of energy and provide increased energy security. The Project therefore aimed to facilitate the introduction of additional renewable energy as well as other alternative energy sources into Jamaica. Activities were carried out to increase stakeholder knowledge of new and emerging areas for non-conventional fuel sources, as well as build capacity to plan and regulate these areas. A key issue here was investigation of the impact that renewable energy sources would have on the electricity network, and determination of the tariffs related to these newer technologies.

3.7.2.3.1. Liquefied Natural Gas (LNG) Workshops

Prior to the introduction of LNG in Jamaica, an LNG Gas Workshop was held in 2012 to provide a basic introductory course for stakeholders, treating generally with issues such as regulation, pricing, and the physical LNG value chain. Shortly after the introduction of LNG to Jamaica in 2016 it was thought prudent to convene another workshop to inform stakeholders in more specific terms about the industry, and to support the MSET in developing stakeholders in Jamaica's emerging LNG value chain. The training in May 2017 was customized to fit the Jamaican realities and requirements. Participants included the Petroleum Corporation of Jamaica, power companies, universities, MSET and other ministries.

3.7.2.3.2. Assessment of Tariffs for Renewable Energy and Generation Avoided Costs

To support the development of renewable energy in Jamaica, a consultant was engaged to develop a tariff proposal and a transparent and fair tariff methodology,

including the methodology to estimate avoided costs[7]. Recommendations were made with respect to the following:

- The Feed-In Tariff[8] for different renewable energies available in Jamaica (in particular small hydros, solar, wind, bagasse);
- Considerations for a Feed-In Tariff Policy;
- Considerations for a Net Metering[9] Policy;
- Considerations for a Cogeneration[10] Policy.

3.7.2.3.3. Grid Impact and Assessment and Smart Grid Roadmap

There are issues concomitant with the integration of renewable energy sources into electric power systems (electricity grids), primarily based on the intermittency of the energy produced by these sources, as well as the variability in voltage. The consultancy for *Grid Impact Analysis and Assessment for Increased Penetration of Renewable Energy into the Jamaican Electricity Grid* was designed to study these issues with respect to the Jamaican situation. Various renewable energy technologies were studied, these being:

- Waste to Energy
- Biomass / bagasse cogeneration
- Wind
- Solar PV – distributed and large scale
- Hydro

The main objectives of this consultancy were to:

a) Assess the level of renewable energy that can be supported with the current grid configuration as well as specify the points in the grid where renewable energy could be added;

b) Propose specific upgrades to accommodate the level of renewable energy contemplated in the Vision 2030 (20%), including a high level budget for the

[7] Avoided cost is cost saved by a public utility by purchasing energy from another source. Tariffs for renewable energy may be determined on the basis of avoided cost.

[8] A payment made to households or businesses generating their own electricity through the use of methods that do not contribute to the depletion of natural resources, proportional to the amount of power generated.

[9] Net metering allows consumers who generate some or all of their own electricity to use that electricity anytime, instead of when it is generated. This is particularly important with renewable energy sources like wind and solar, which are non-dispatchable (when not coupled to storage).

[10] The generation of electricity and useful heat jointly; the utilization of the steam left over from electricity generation.

cost of such upgrades. The extent and cost of the required additional transmission network development to accommodate the renewable development should be studied.

One of the recommendations coming out of the Grid Impact study was for a Smart Grid Roadmap to be developed; however the need for such a tool had been anticipated and formed the basis of another consultancy.

A smart grid is an electricity network that uses digital and advanced technologies to monitor and manage the transport of electricity from all generation sources efficiently by minimizing costs and environmental impacts while maximizing system reliability, resilience and stability. A Smart Grid Roadmap was developed which identifies, defines, and sequences smart grid initiatives to address Jamaica's priorities and support Jamaica's National Energy Policy. In addition, subject matter expertise was provided to advance the discussions around the other priority areas, namely, smarter buildings, water, and energy efficiency and customer conservation programs.

The Smart Grid Roadmap was devised to meet Jamaica's short- and long-term goals. Short-term initiatives were designed to address high electricity costs and reliability issues while developing the foundation for Jamaica's long-term energy independence and sustainability goals. As the fuel cost reduction benefits of Jamaica's generation expansion program are realized, longer-term initiatives will enhance Jamaica's ability to adjust the energy supply mix while continuing to achieve performance and efficiency objectives.

3.7.2.3.4. An Investor Guide and Technical Assistance Framework for New Investments in the Energy Sector

Energy projects involving developments in generation, transmission and distribution systems, as well as other energy solutions, are key to achieving the energy sector targets. These projects, as stated in the NEP, are envisaged as being led primarily by private investment. However, experience has shown that it is still a major challenge for the private sector to get involved with investing in the energy sector. A simplified, transparent and comprehensive investors' guide would make it easier to attract qualified investors to the various investment opportunities and to, hopefully, successfully complete energy sector projects.

An Investor Guide was developed to provide an overview of the energy sector in Jamaica, and provide information to prospective investors regarding:

- the opportunities available in the energy sector and the information available to investors on those opportunities;
  - the regulations that control investments in the energy sector;
  - the processes for investing in the various areas of opportunities;
  - the financial and non-financial incentives available; and

- key contacts for investors.

3.7.2.4. Implementing the National Energy Policy communication and information plan

3.7.2.4.1. The goals of the NEP communication and information plan were two-fold:

- Jamaicans will not only be informed about Energy Vision 2030, but will genuinely feel connected and part of the vision. Additionally, at least 30% of Jamaicans will be able to describe the main goals of the Jamaica Energy Policy 2009-2030 and name key activities that they and the GoJ are implementing towards Energy Vision 2030.
- Key groups of the Jamaican population use energy wisely and pursue opportunities for conservation and efficiency.

This sub-component was executed in two parts: design of a communication and information programme supporting the objectives of the NEP, followed by implementation of aspects of the programme.

3.7.2.4.2. For the implementation phase, communication campaigns for the Bureau of Standards Jamaica (BSJ) and the Energy Efficiency and Conservation Programme (EECP) were incorporated:

- A public information campaign was designed for the BSJ, focusing on its enhanced capacity for testing the energy efficiency of refrigerators, freezers, wine coolers and air conditioning units and the new energy labels which would indicate to the public the energy efficiency rating of the units. Because of delays in completion of the test chambers, which delayed the start of appliance testing, execution of the campaign has been postponed until the appropriate time.
- An information and awareness-raising campaign was executed for the EECP, promoting its Energy Efficiency and Energy Conservation initiatives within the public sector.

3.7.2.4.3. The following are some of the activities carried out under this sub-component:

- Television and radio advertisement campaigns
- Social media campaigns
- Design and printing of posters, brochures and banner
- Execution of “Energy Champion” and “Energy Matters” competitions
- Execution of awareness and information sessions

3.8. Component 2: Developing the Energy Efficiency and Renewable Energy Potential

3.8.1. Component 2 was implemented by the Bureau of Standards Jamaica (BSJ), the Development Bank of Jamaica (DBJ), and the PCJ (Renewable Energy and Energy Efficiency Department). It financed: (i) the expansion of the appliance labeling and consumer awareness program of the Bureau of Standards of Jamaica; (ii) a line of credit (revolving facility) managed by DBJ to finance private sector energy efficiency and renewable energy investments; and (iii) instruments for the mobilization of private sector financing for eleven small hydroelectric projects.

3.8.2. The specific activities are outlined below:

3.8.2.1. **Expanding the energy efficiency testing and labeling capacity and the information program of the Bureau of Standards Jamaica (BSJ)**

This subcomponent aimed to incentivize Jamaican households and commercial entities to purchase highly energy efficient appliances (in particular refrigerators and freezers, and air conditioning units). This will reduce energy costs to end-users and investment requirements in generation, transmission and distribution of electricity to meet the peak demand of the interconnected electricity system (by up to 20 percent), and also lower greenhouse gas (GHG) emissions.

3.8.2.1.1. Overhaul of Capacity of BSJ to Test the Energy Efficiency Rating of Appliances

The overhaul of the testing capacity included:

- Significant expansion of the testing capacity, from 6 to 22 testing stations through the addition of two new chambers:
  - i. a new ten-test station chamber for refrigerators, freezers, refrigerator-freezers, and wine coolers . This test chamber has the capacity for performing tests at 50 Hz and 60 Hz supply frequency;
  - ii. a new six-test station chamber to provide new capacity for testing air conditioning units.
- Upgrade of the existing test chamber. The commissioning of this chamber was not completed because:
  - **i. Blower fans and motors, which were in stock, were found to be incorrect. These were replaced but some were stolen.**
  - **ii. A control valve was discovered to be rusty and leaking.**
  - **iii. The Data Acquisition (DAQ) cards in the existing test chamber were found to be incompatible with the new software.**

- Increase in the staff assigned to the program on a full time basis (including training); one new full-time staff was added.

The Energy Efficiency Laboratory will become the testing facility for the Caricom region. Laboratory staff underwent training in April 2018, funded by the Caribbean Regional Organisation for Standards and Quality (CROSQ) to build capacity for testing appliances for the region.

3.8.2.1.2. Review of existing standards (BSJ)

Two revised standards were produced establishing test methods which may be applied for measuring energy and other performance characteristics of any brand or model of (i) household refrigerators, refrigerator-freezers, freezers and wine chillers, and (ii) room air conditioners. The standards prescribed the testing environment, testing equipment and test procedures to be employed, which will allow performance comparisons to be made within and across the various types and brands of household appliances treated with.

Each standard includes a table of minimum energy efficiency consumption allowed for each type of appliance. Appliances that do not meet the minimum energy efficiency requirement will be refused entry to the island or removed from the market. This is a new development for Jamaica which will greatly aid in achieving energy efficiency.

A third revised standard was produced defining the terms and conditions under which major household appliances and other energy consuming products shall be energy labeled. It identifies the information which consumers must receive on the energy operating cost and energy consumption (or efficiency) of major household appliances.

The standard included a label design which provides a highly visible indication of energy efficiency. Mock-up diagrams of the revised labels have been created.

3.8.2.1.3. Public awareness campaign /Promotion of BSJ's labeling and certification program

A public awareness campaign was designed to highlight the benefits of energy efficient appliances and increase awareness about the energy efficiency labels, in parallel with the expansion of the BSJ's certification and labeling program. The design of this campaign was incorporated into a broader public education program on energy efficiency carried out through this Project. The BSJ public awareness campaign has not yet been executed because of delays in commissioning the test chambers, which delayed the commencement of testing of appliances.

3.8.2.2. Investment promotion activities for identified small hydro sites

The Renewable Energy and Efficiency Department of the PCJ performed the implementing role for this sub-component: carrying out investment promotion activities for identified small hydro sites, aimed at mobilizing investors and financiers. The successfully implemented activities are outlined below; however, the following two activities were not done:

- review of the performance and evaluation of issues with respect to the eight existing hydro sites. JPS did not agree to give access to the relevant data because the PCJ was viewed as a competitor with respect to hydropower developments;
- dissemination to potential investors of the results of an on-shore wind resource assessment and promoting private sector investment in wind energy – there were insufficient resources to complete this activity.

3.8.2.2.1. Pre-Feasibility & Feasibility Studies for Small Scale Hydropower Projects

Hydroelectric power plants have been exploited in Jamaica to supply the public electricity grid since 1945. There are currently eight (8) such plants in use in Jamaica, all owned by JPS. It is believed that there is significant potential for other hydroelectric plants to be developed to supply the grid. Hydropower is therefore one form of renewable energy that can help to satisfy the NEP objectives of a sustainable and diversified energy supply.

In order to ensure that technically, environmentally, socially and financially viable hydropower developments could be identified for recommendation for financing, private sector involvement and connection to the national grid, pre-feasibility studies were commissioned for eleven (11) identified sites in Jamaica, in the parishes of St. Catherine, Portland, St. Thomas, and Trelawny. These studies determined the following:

- the expected output, costs, technical, economic and financial viability of the site;
- the environmental and social impacts of developing the site; and
- the implementation and operational risks.

Ten of the eleven sites were found to be suitable to be studied for full scale feasibility (see Table 2 below). For these sites, all of which were found to be feasible, the following were provided:

- a detailed description of the facility (civil works, mechanical and electrical installations, interconnection requirements);

- description of the expected output (MWs, MWh/year with base case and high and low scenarios);
- detailed cost estimates for main component and for operation and maintenance of the facility;
- capital structure and financing arrangements, construction and drawdown schedules and revenue requirements;
- environmental and social impact assessment and corresponding management plans;
- requirements for permits and licences;
- suggested organizational arrangements, and risk analysis.

Table 2: Hydropower Feasibility - Summary of Sites

#	HPP Site	Est. Capacity (MW)	Est. Annual Generation (MWh)	Est. Annual Barrels of Oil Equiv.	Est. Annual CO2 Reduction
					(M Tonnes)
1	Martha Brae	4.4	16,700	9,824	11,540
2	Spanish River	7.8	18,000	10,588	12,438
3	Negro River	2.3	7,000	4,118	4,837
4	Swift River	2.9	8,300	4,882	5,735
5	Green River	2.7	8,700	5,118	6,012
6	Rio Grande 1	0.9	2,900	1,706	2,004
7	Rio Grande 2	0.8	2,700	1,588	1,866
8	Wild Cane	1.9	6,800	4,000	4,699
9	Rio Cobre (NIC)	1	2,300	1,353	1,589
10	Rio Cobre (Bog Walk)	1.3	4,900	2,882	3,386
	Totals:	**26**	**78,300**	**46,059**	**54,105**

3.8.2.2.2. Technical Assistance and Capacity Building for the Promotion and Development of Cost Effective Small Hydro-Power Projects

A consultant was engaged to provide technical assistance and guidance to key stakeholder agencies in the administration of hydropower developments. Specifically, the consultant provided technical assistance in hydropower promotion, financial analyses and project evaluation, as well as provided institutional capacity strengthening.

The support provided included, *inter alia*, the following:

- Definition of a streamlined licensing process for small hydro-sector developers and operators.
- Drafting of Financial Model Documents.
- Development of model documents to support regulation and monitoring of sector operators, including Hydropower Power Purchase Agreement (PPA) and simplified environmental and social permits
- Recommendation for the establishment of an Office of Hydropower Development
- Submission of promotional materials, including website structure
- Preparation of a draft Request for Proposal as well as a draft Expression of Interest to be used for the development of hydro-power projects under public/private partnerships.
- Provision of a list of prospective investors.
- Performance of capacity building and training exercises.

3.8.2.3. Survey of Renewable Energy Penetration throughout Jamaica, with a view to Facilitate Policy Assessment, Evaluation and Development

3.8.2.3.1. One objective of the NEP is that of improving the country's energy independence and increasing renewable energy penetration to about 20% by the year 2030. The NEP also states that a regular review of the energy policy framework should take place to test its effectiveness and suggest, where necessary, adjustment to reach its 2030 Vision. In keeping with these sentiments, an assessment of the progress made so far was done by performing a survey of renewable energy penetration throughout Jamaica, with a view to determine the numbers, types and contribution of renewable energy in the country's energy matrix. This information would in turn facilitate policy assessment, evaluation and development.

3.8.2.3.2. In performing the survey, the consultants analysed the roadblocks to increasing the use of renewables, as well as suggested policy initiatives that could be used to increase penetration.

3.8.2.3.3. A website was designed to publish the data generated from the RE penetration survey (see summary below in Table 3), with a link provided from the MSET website. The contents will include but may not be limited to:

- The RE penetration Report
- Issues from RE penetration users

- Contact information of Suppliers and Installers of RE products
- Numbers and types of RE systems by parish
- Pictures of RE systems

The site can be accessed through the link: http://www.mset.gov.jm/renewable

Table 3: Estimates of Electricity Generation from RE Sources 2016-2017

Renewable Energy System	Production(MWh)		
	2016 (Jan - Dec)	2017 (Jan-Jun)	2017 (July only)
Solar	220,265	111,891	18,111
Wind	263,751	144,832	35,282
Hydro	114,929	66,839	13,932
Biomass	Neg.	Neg.	Neg
Sub- Total	598,945	323,562	67,325
Total Electricity Produced[11] (Renewable + non-renewable)	4,349,278	2,121,802	394,047
Renewable Energy Penetration[12] (%)	13.8	15.2	17.1

3.8.2.4. Line of credit/revolving facility for Private Sector

3.8.2.4.1. This sub-component financed an initial endowment for a Line of Credit/revolving facility (LoC) aimed at promoting energy efficiency and renewable energy investments in the private sector – small and medium enterprises (SMEs) in particular. Retail financing to SMEs for energy efficiency and renewable energy projects was provided by selected local financial institutions (Approved Financial Institutions – AFIs) working with DBJ and drawing from the line of credit. The LoC also benefitted from a partial guarantee instrument set-up by DBJ to allow the AFIs to lend for EE and RE without full collateral for the loans.

3.8.2.4.2. 55 loans for a total of USD 5.38 M were disbursed, for projects ranging from installation of energy-efficient lighting and appliances (e.g. LED bulbs, inverter air conditioning units and refrigerators) to grid-tied solar photovoltaic systems. 18 partial credit guarantees of JMD 112M were provided.

4. Risks

4.1. The overall risk rating as outlined in the ESEEP PAD was Medium I[13]. Two critical risks were identified: implementing agency risks, and project financial management and procurement risks, which both hinged on the fact that the Ministry of Energy and Mining (MEM) was not experienced with World Bank-financed project implementation, procurement and financial management requirements. Mitigations measures put in place included the following:

[11] Source: Jamaica Public Service Company Ltd

[12] The Renewable Energy (RE) penetration is the ratio of Renewable Energy produced during a given period, to the Total Energy produced during the same period, expressed as a percentage.

[13] Medium I: Medium risk driven by potential Impact on achievement of the Project Development Objective.

- Support of the Public Sector Modernization Division (PSMD) of the Cabinet Office of the Prime Minister (until the hiring of suitable Project staff).
- Hiring of experienced project staff (Project Manager, Financial Management Specialist and Procurement Officer) to support Project implementation. While staff turnover was experienced, suitable replacements were made.
- Creation of a Project Steering Committee which included PIOJ and principals of the implementing entities. This was more active in the earlier, more critical years of the Project.
- Annual audits of Project accounts by the Auditor General, and annual audits of the DBJ LoC accounts by an external auditor acceptable to the Bank.

4.2. A Project Stakeholder risk which did materialize was the issue of the country having all the fiscal space to carry out the project. While this risk was recognized at design, the decision was taken to retain the loan at US $15M because of the potential benefits of the Project to Jamaica. The Project was usually not able to get all the funds requested for a particular fiscal year, which resulted in a delay in implementation of activities. The BSJ sub-component was particularly impacted by this. The extension of the Project during restructuring in 2015 allowed more time to complete the Project activities.

4.3. Another risk identified was that there would not be sufficient demand for energy efficiency and renewable energy investments to utilize the LoC. This did not materialize – in fact additional funds were allocated to the LoC, and all the funds given to the DBJ were disbursed.

4.4. With regards to Procurement Risk, while lengthy procurement processes were a factor in the Project's implementation, an even greater issue was a lack of response or unresponsiveness to procurement requests. This was somewhat mitigated where appropriate by conducting pre-bid meetings for prospective bidders, to advise them on the requirements for submitting responsive bids.

5. Project's Implementation

5.1. Factors that contributed to successful implementation are outlined below:

5.1.1. The restructuring of the Project in 2015 contributed to its successful implementation. Restructuring was necessary because the lack of fiscal space in previous years meant that the pace of implementation was slower than required for the funds to be utilised in the four years allotted. In addition, with the advent of the Electricity Act 2015, the MSET was given the remit for planning for the Energy Sector, necessitating a change in the focus of some of the remaining consultancies to (i) equip the Ministry with the tools and resources to competently perform its new function, and (ii) modify some of the regulatory framework documents to reflect the new realities. This ensured that the Project remained relevant to the needs of the country.

5.1.2. After restructuring, there were nine (9) consultancies to be contracted, with terms of references (TORs) to be drafted and approved, prior to procurement processes being executed for hiring of consultants. Because of the relatively limited time to execute these activities, consultant Jaap Smink was hired to assist with the drafting of TORs and approval of deliverables.

5.1.3. The use of the virement process to shift funds from delayed activities to others where funding was initially deficient was crucial to fully utilising the funds allocated, thus putting the Project in a better position to be allocated the funds required for the following period.

5.1.4. Approaching the end of Project implementation, close monitoring of activities necessary for the completion of all the newly-contracted consultancies (as well as the BSJ sub-component), and prompt review of deliverables contributed to the success in completing the activities.

5.1.5. The professionalism of the consultants, in adhering closely to the strict timelines imposed on them (particularly coming to the close of implementation of the Project), helped considerably in its success.

5.2. The main factors that contributed to delays in Project implementation are outlined below.

5.2.1. The Bureau of Standards sub-component of the Project was the most challenging, for the following reasons, *inter alia*:

5.2.1.1. In 2014, the bidders for the new test chambers were allowed to bid on test chambers with similar specifications to the existing test chamber, or to propose different specifications as an option. The successful bidder's proposal for different specifications was accepted. This would have necessitated modification to the scope of works for the building modification contractor, which was not done. This, exacerbated by the fact that the development of the test chambers is a unique activity in Jamaica, has led to the need for several variations.

5.2.1.2. This sub-component includes refurbishing of an existing test chamber, and, as is customary for refurbishments, there were some unanticipated situations that had to be worked around. These caused lengthy delays.

5.2.1.3. There have been constant disagreements on specifications for works between the Project Engineer and the architectural team (unrelated to the specifications for the test chambers), resulting in the building contractor being unclear on what to do, or not getting clear instructions as to what was required of him, in some instances. Despite it being made clear that the Project Engineer had the final say with regards to the building contract (as prescribed by the FIDIC contract), the building contractor was reliant on the drawings to be presented by the architectural team.

5.2.1.4. Payment and variation claims presented by the building contractor have been tardy and fraught with inaccuracies, duplications, and overpricing, which have resulted in many hours being taken by the Project Engineer, the architectural team and the PIU to make adjustments and get sign-off by the relevant parties.

5.2.1.5. There was reluctance by the Project Engineer to deal formally with the tardiness of the building contractor in executing several activities, even those that were a part of his original contract, and despite several requests for the contractor to proceed with the works.

5.2.1.6. While the retrofitting of the refurbished laboratory has been completed, testing and commissioning was not accomplished before the close of implementation of the Project because of defective/incorrect/stolen parts which have to be replaced. The testing and commissioning of the refurbished laboratory will be completed by the BSJ on receipt of the replacement parts.

5.2.1.7. The BSJ sub-component also suffered from a lack of ownership on the part of the BSJ Management which included the assignment of adequate resources to oversee the Project.

5.2.2. The Project was not given the required fiscal space to execute in a timely manner. This affected implementation (both before and after the restructuring). Oftentimes a decision had to be taken as to which activities to proceed with, and which activities to delay. Fortunately, the Project was given the required support in the months just prior to the close of implementation to complete the remaining activities.

5.2.3. Staff turnover affected progress on activities. Over the life of the Project the Project Manager, the Financial Management Specialist, and the Project Coordinator were changed once, and the Procurement Officer was changed twice. There were usually long delays in replacing staff. In one instance the Project was without a Project Manager for almost one year, and during this time the Procurement Officer post was also vacant. The Project Coordinator post was also vacant for the better part of a year.

5.2.4. The Energy Division, as the subject matter experts, were required to support the Project, particularly in preparing and approving terms of references, and in reviewing and approving deliverables. The Division was severely challenged to provide this support in a timely manner, because of a shortage of staff. As a result, many of consultancies to be engaged after restructuring came alarmingly close to running out of time for execution, and had to be accomplished in a reduced timeline to ensure completion prior to the closure of Project implementation.

5.2.5. The inputs for the consultancy for Integration of Modern Power Sector Planning Instruments for MSET were not received in time for the consultants to execute the work for the consultancy. The required inputs were the Integrated Resource Plan (IRP), and the PLEXOS licence. The IRP still has not been completed (though it is scheduled to be completed within a few months). The PLEXOS licence was received November 1, 2017.

5.2.6. The procedure in the Ministry for approval of procurement activities and payments is too multi-layered and acts against the smooth and timely execution of these activities.

6. Monitoring & Evaluation

6.1. In accordance with the ESEEP Project Appraisal Document (PAD), Monitoring and Evaluation (M&E) was the responsibility of MEM, as the Project coordination entity. This included the monitoring of performance and intermediate indicators. The Energy Division of the Ministry gathered electricity generation information from JPS, as well as information on energy projects (both conventional, renewable energy and alternative energy). This information was, however, not always up-to-date, and was not always in a form that easily related to the Project indicators.

6.2. M&E was also facilitated by the following:

(a) Quarterly progress reports and Interim Financial Reports (IFRs);

(b) Annual audits of the Project Accounts and of the LoC Accounts;

(c) Regular World Bank supervision missions;

(d) Project midterm review of implementation progress held in June, 2013.

6.3. During restructuring, some indicators were removed, while others were modified. The indicator regarding reduction in energy cost was deleted because it was recognized that there were many factors outside of the control of Jamaica that affected the cost of electricity. In fact, during the period a primary reason for the reduction in the cost of energy was the reduction in the price of oil on the international market. Ascertaining the reduction in energy cost due to activities in the Jamaican energy sector would have been difficult.

6.4. The indicator “Reduction in Energy Costs of SMEs” was removed because of the difficulty in accurately calculating the reduction in cost attributable to loan funds. Calculation of cost reductions were to be based on energy savings as provided in the business plans/feasibility studies developed under the Line of Credit; however, it was necessary to determine what aspects of the plans were actually executed. Because of additional energy-consuming investments done by entities receiving loans, often with savings made from reduced energy consumption, a simple comparison of energy consumption before and after the original investment could not be used in calculating the reduction in energy costs. Based on the Project Operational Manual, DBJ was to have been responsible for the following monitoring activities:

- Conducting periodic site visits for every sub-project financed from the LoC to ensure that sub-projects were duly implemented and compliant

- Contracting energy auditors to monitor annual progress in energy savings, GHG reductions, as well as, financial results under the individual sub-projects

However, DBJ claimed that it did not have the funds to carry out these activities.

6.5. Delays in completing the test chambers at the BSJ resulted in non-achievement of the indicators for "Electrical appliances labeled" up to the point of the restructuring of the Project. This indicator was removed in restructuring and replaced with "Electrical appliances tested".

7. Project's Outcome

7.1. Rating: Highly Satisfactory

7.2. The project was very much relevant to both the GoJ and wider Jamaican interests at the time of completion.

7.3. The project was effective in its outcomes. The PDO "Increase in energy security" was met and exceeded, and will continue to be increased beyond the life of the Project.

7.4. The efficiency of the project can be measured in terms of implementation efficiency, through the ratio of administrative to subproject expenditure. As at February 20, 2018 the Project had spent USD 738,000.00 for Project management, monitoring and evaluation to provide USD 13.74M in goods and services towards energy efficiency and security. This suggests high administrative efficiency of 5.1% of direct investment expenditure.

8. Additional Impacts

8.1. Increase in Energy Security (Diversifying the Energy Matrix)

8.1.1. The percentage of oil in the energy mix for electricity generation declined from 91% to 72% from 2010 (when the ESEEP Project was designed), to 2017 (close of implementation of ESEEP). This reduction, signifying a corresponding increase in energy security, can be attributed to the introduction of natural gas to Jamaica in 2016, and the increased use of renewable energy sources. LNG now makes up approximately 12% of the installed capacity for electricity generation, and renewables increased from 7% to 17% over the corresponding period.

8.1.2. LNG was introduced to Jamaica in October 2016, when the 114 MW JPS-owned facility at Bogue in St. James received its first shipment of LNG. Two additional plants, at Old Harbour in St. Catherine (190 MW) and the Jamaica Aluminium Company (Jamalco) in Clarendon (100 MW), are under construction and expected to be in operation by 2019, when LNG is expected make up 45% of the energy mix. Conventional fuel would therefore be reduced to less than 50% of installed capacity, from a high of 91% a decade before.

8.1.3. The development of a regulatory and legislative policy framework for LNG, as well as a draft gas act (completed by the Project in 2013), in addition to a LNG Workshop which took place in 2012, contributed to the discussion of LNG nationally which led to the introduction of LNG in 2016. The legal and regulatory framework for LNG will be incorporated into the broader documents for the regulation of petroleum, viz. the Petroleum (Downstream Activities) Act and the Petroleum (Downstream Activities) Regulation, which will give additional structure to the sector.

8.1.4. On the environmental side, the ESEEP has supported the introduction of LNG by strengthening the capacity of the National Environment and Planning Agency to do environmental assessment and regulation of the natural gas sector.

8.1.5. With regards to the increase of renewables in the energy mix, the analysis of the impact of introducing renewables to the electricity grid (grid impact assessment) facilitated by the Project has provided guidance to the Ministry as well as the JPS on the amount of renewables that can be added to the grid. It assured stakeholders, contrary to the opinion of some, that the grid could in fact support the addition of renewables. A roadmap for the development of a smart grid was recommended, and has been developed. The use of this information by the JPS has guided them in the introduction of additional renewable energy to the grid, and has supported their decision to procure a hybrid energy storage solution, which is the first of its kind in the Caribbean. This innovation will help to secure grid stability and reliability, in the face of increasing intermittent renewable energy. It will allow JPS to provide a high speed response when the output from renewables is suddenly reduced, to mitigate stability and power quality issues that cause outages to customers. It will also provide a much faster, cost effective and environmentally friendly spinning reserve (or back-up) as an alternative to traditional generation spinning reserve.

8.2. Reduction in Electricity Costs

8.2.1. Concomitant with the diversification of the energy matrix is the reduction in the cost of electricity. While a major driver of the decrease in cost over the life of the Project was the price of oil internationally, which fell from approximately USD 80.00 to USD 50.00 (Phillips, 2018), the introduction of LNG into the energy matrix is anticipated to generate fuel savings of between 15 and 30 per cent annually. Renewables, priced at significantly less than the average cost of electricity (as low as 12.90 US cents per kWh currently, compared to 23 US cents per kWh for average production), have also had a downward influence on this cost, and will continue to do so as more renewables are added to the matrix at even lower prices (as low as 8.54 US cents per kWh for solar energy).

8.3. New Energy Sector Regulations

8.3.1. An important and far-reaching outcome of the Project was the updating of the 125-year old Electric Lighting Act of 1890 with the modernised Electricity Act 2015. Some of the outcomes of this revised Act are the following:

- Redefining of the roles and responsibilities of entities in the electricity sector, thereby creating two new entities, viz. the Generation Procurement Entity (GPE), and the Government Electrical Regulator (GER), with the result that the planning and regulation of the energy sector is now more orderly and streamlined, and in line with international best practices. This has also resulted in a more harmonious working relationship between the Ministry, the OUR and JPS, which is unprecedented. The redefined roles in the Energy Sector are as follows:
    - The Minister of Energy is responsible for planning the electrical system and issuing licences.
    - The GPE is responsible for managing the replacement of existing electricity generation capacity and the procurement of new capacity.
    - The GER is responsible for the regulation of the electrical inspection processes, the licensing of electricians and electrical inspectors and the monitoring of work done by the electrical inspectors. It will also recommend the renewal and revocation of licences of both electricians and electrical inspectors.
    - The Office of Utilities Regulation is responsible for regulating the electricity sector generally.
- Negotiation and crafting of a new JPS Licence.
- Updating of the OUR Act.
- Development of an Integrated Resource Plan (IRP) to guide the development of a modern energy sector in Jamaica. The IRP will establish the projected electricity demand over a 20-year period; determine the generation capacity and technologies to be used to satisfy the demand over this period; and establish agreements on the transmission and distribution infrastructure required to generate and deliver the needed electricity, and the resulting tariffs.
- Provision for the development of micro-grids or renewable energy solutions for rural electrification.
- Guidelines for the replacement/addition of generating capacity, which specify that the replacement cost of new generating capacity cannot exceed the generation avoided cost.

8.3.2. Other Energy Sector regulations prepared/approved included the following:

- Legal and Regulatory Framework for the Gas Sector (mentioned above)

- Grid Impact Analysis and Assessment of Increased Penetration of Renewable Energy
- Smart Grid Roadmap for Jamaica
- Tariff for Renewable Energy Study
- Regulations for Net Billing, Auxiliary Connections and Power Wheeling
- Electricity Sector Grid Codes (Generation, Transmission, Distribution, Dispatch and Supply)
- Regulations for Government Electrical Regulators (GER)
- BSJ Standards:
    - JS 1 - The labelling of commodities Part 21: Energy labelling of appliances and products
    - JS 178: 2016 Jamaican Standard Specification for the Determination of Energy Consumption and Other Performance Characteristics of Household Refrigerators, Freezers, Refrigerator-freezers and Wine Chillers
    - JS 179: 2016 Jamaican Standard Specification for Room Air Conditioner Energy and Other Performance Testing
- Petroleum Codes:
    - JS 341 - Code for Liquid Petroleum Products.
    - JS 342 - Code for Liquefied Petroleum Products.
    - JS 343 - Code for Petroleum Based Lubricants.
    - JS 344 - Code for Product Chain of Custody.
    - JS 345 - Code for Biofuels
    - Code for Solid Carbonaceous Fuels

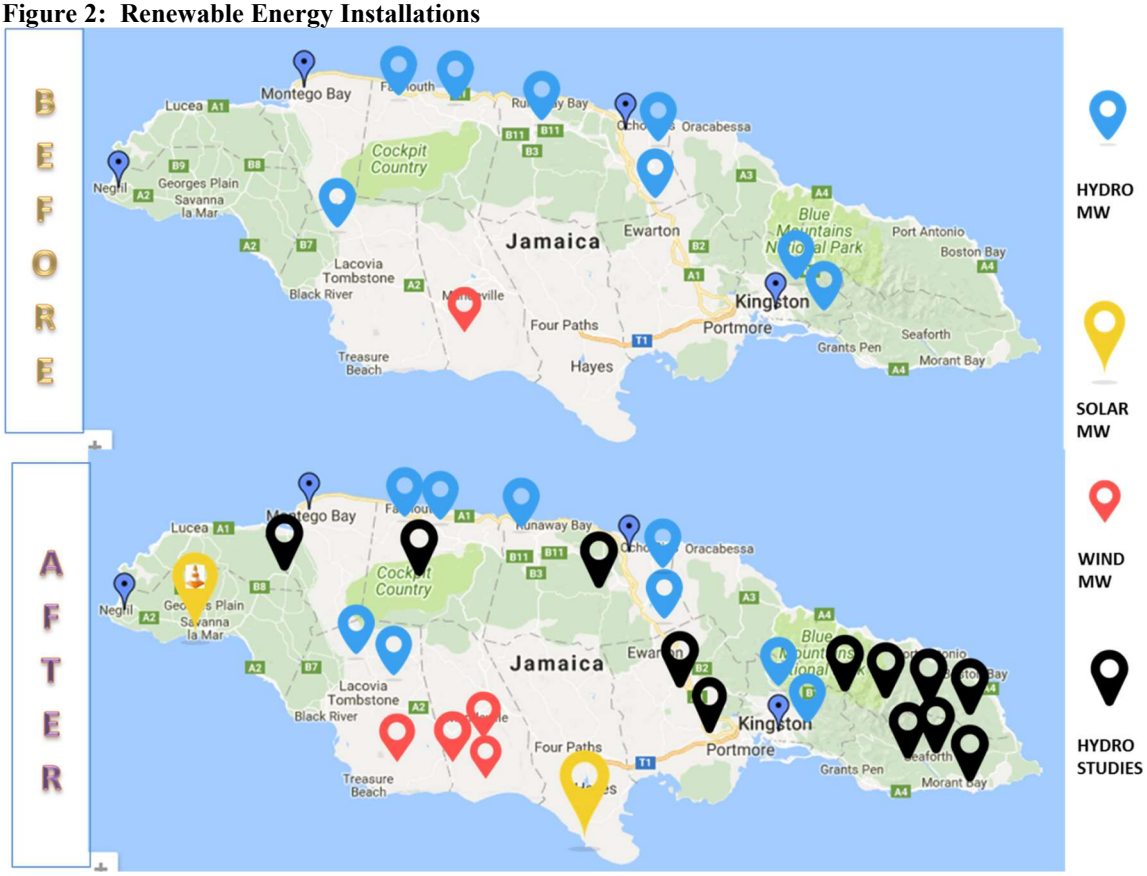
8.4. New Electricity Generating Capacity

8.4.1. The Project indirectly contributed to the installation of approximately 280 MW of new electricity capacity, with another 340 MW being negotiated or under construction, for a total of 620 MW (see Figure 1 below). The total cost of the investment in these plants is approximately USD 1.1 B.

- LNG: 114 MW of LNG was introduced into the energy mix. An additional 290 MW is to be added by 2019.
- Solar: A 20 MW solar energy plant has been installed, with another 37 MW coming online in 2018. In addition, owners of 636 privately-owned solar photovoltaic plants with potential generating capacity of 14.6 MW have agreements to supply excess energy to the JPS.

- Wind: 60 MW of wind power has been added from three facilities.
- Hydro: A 6.3 MW run-of-the-river hydro plant was established at Maggotty in 2014.

Figure 2: Renewable Energy Installations



8.4.2. The contribution of the Project to the introduction of LNG is outlined above in clauses 8.1.3 and 8.1.4, and to the introduction of renewables in clause 8.1.5. In addition, the recrafting of the roles and responsibilities within and between the governmental entities in the energy sector, occasioned by the changes made pursuant to the new Electricity Act 2015, has resulted in the creation of a transparent, sustainable modern energy sector, which gives investors the necessary confidence to make significant investments in the sector.

8.4.3. The ten feasibility studies for potential hydro power sites developed by the Project, as well as the draft documents for soliciting expressions of interest and requests for proposals from potential investors, have given the Government a good start in seeking to develop additional hydropower plants, which can potentially add another 26 MW to the energy mix.

8.5. Increase in Energy Efficiency and Conservation in SMEs

8.5.1. The line of credit disbursed to SMEs through the Development Bank of Jamaica provided 55 loans totalling USD 5.38M. Investments were made for energy conservation (renewable energy - solar photovoltaic generating plants) and energy efficiency (LED bulbs, solar film, energy-efficient air conditioning units, etc.).

8.5.2. Loan recipients experienced reductions in energy usage of 25% – 80%. Some were able to expand their businesses (by as much as 40%) or add infrastructure (e.g. additional cold rooms and buildings) while still seeing a reduction in energy consumption compared to the period before making the investment.

8.5.3. The solar photovoltaic systems purchased through the DBJ line of credit are capable of providing 4,259 MWh of electricity annually[14], which would result in 2,506 barrels of oil equivalent avoided, and reduced carbon dioxide emissions of 2,943 metric tonnes.

8.6. Results of NEP Communication and Information Campaign

8.6.1. Prior to and following the communication and information campaign (see Section 3.7.4) a poll was conducted to measure the results (though the campaigns were limited in duration). The following was achieved:

- **the number of persons who were aware of what Energy Vision 2030 was almost doubled;**
- **50% of respondents knew that most of the electricity used in Jamaica was generated from imported oil, as opposed to 30% prior to the campaign;**
- **63% of persons stated that they had changed their behaviour with respect to energy consumption within the past 6 months; 35% of these said that they had been influenced by radio and tv advertisements and public service announcements.**

9. Sustainability – Risk to Development Outcome

9.1. Rating: Highly Satisfactory

The Project has placed Jamaica on a trajectory on which it will continue to reap the benefits of the Project and see (i) continued improvement in energy security through diversification of the energy matrix; (ii) enhanced economic competitiveness and performance through improvements in the efficiency of the energy sector; (iii) minimization of end-users' energy costs; (iv) reduced GHG emissions from the energy sector; and (v) well-defined institutional and regulatory frameworks.

- By 2019 conventional fuel will make up less than 50% of the energy matrix (from a high of 95% a decade ago and 72% currently);
- LNG and renewables as a part of the energy matrix will continue to be increased (thanks, *inter alia*, to the IRP which arose from the Electricity Act 2015, and the hydro feasibility studies);

[14] Based on 6 hours per day for 251 days (week days less holidays per year).

- The regulatory framework documents for renewable and alternative energy, as well as the new petroleum codes will inform the development of new regulations and policies for the energy sector. The Petroleum Act and Regulation (which will include LNG) are currently being drafted.
- The clear definition of roles and responsibilities in the energy sector, as outlined in the Electricity Act, will continue to redound to the benefit of the sector:
    - the harmonious working relationship that now exists between the major players in the sector, augurs well for their future dealings;
    - the transparency and good order in the sector will continue to attract investors in energy infrastructure.

10. Rating of the Bank at Design

10.1. Rating: Satisfactory

10.2. The Project was well designed to support the goals of the National Energy Policy.

10.3. While the Project comprised several sub-components, these were shared amongst a number of implementing entities, who, if they had continued to be well-organised to implement their sub-components (as at the beginning of the Project), and if buy-in to the objectives had continued through personnel changes, would have made the work more manageable for the PIU than it eventually turned out to be. The fact that the sub-components by and large were successfully implemented and have contributed or will contribute to the achievement of the goals of the NEP justifies the design.

11. Rating of the Bank During Supervision

11.1. Rating: Highly Satisfactory

11.2. The Bank was very supportive during the implementation of the Project. The regular implementation support missions helped to maintain the visibility of the Project to the PIOJ and Ministry of Finance, as well as to the management at the Ministry, and were useful in highlighting issues (such as fiscal space) that needed to be raised.

11.3. The Bank was also very supportive with respect to those aspects of implementation that needed its input, such as requests for no objections, virement requests, and advice as to entities to be requested for proposals. Responses were received in a timely manner. At the latter part of the Project these timely responses were critical to the success of the activities.

11.4. The Bank was very supportive during the restructuring exercise.

12. Rating of the GoJ

12.1. Rating: Moderately Satisfactory

12.2. While the GoJ was clear on the value of the Project to Jamaica, it was constrained by macro-economic considerations to provide the Project with the necessary fiscal support at all times. This led to delays in implementation which, *inter alia*, necessitated a restructuring of the Project.

12.3. Approaching the close of implementation of the Project, the necessary support was given to successfully complete the remaining sub-components.

13. Rating of MSET

13.1. Rating: Moderately Satisfactory

13.2. The Ministry housed the Project Implementation Unit and outfitted it with the necessary tools and resources to get the work done. The Ministry also made the necessary representations in attempting to get the appropriate funds for the Project to accomplish its tasks, both in the primary as well as the supplementary budgets.

13.3. The Ministry provided a Project Coordinator to work with the Project. As the Project Coordinator was part of the Public Service Establishment in the Ministry, this would also assist in building capacity in the Ministry.

13.4. The Ministry's support to the Project was, however, affected by a lack of resources in the Energy Division (which was short-staffed); in particular, there was a lack of personnel to support the Project as subject-matter experts. These were required to prepare and approve terms of references for Consultants, and review and approve deliverables. The Ministry assisted in the procurement of consultants to give support in this regard.

14. Lessons Learned

14.1. In designing a project, caution must be exercised when designating as implementing entities those whose parent ministry is different from that of the executing agency, as it might be difficult to ensure buy-in and the allocation of resources throughout the life of the project. One way of mitigating this issue, however, would be to have the entity co-finance the project, particularly in a case where that entity is self-financing.

14.2. If a project is to be completed on time, it must be given the fiscal space required. To do otherwise is to guarantee that the project will have to be restructured. It is,

however, acknowledged that the policy with regards to fiscal space must take into consideration the macroeconomic realities of the country.

14.3. It is critical to the timely achievement of project objectives that periods during which staff posts are vacant are limited as much as possible. There is usually lean staffing on projects, and the staff have very specific responsibilities, which are all critical to the successful implementation of the project. The timely recruitment of replacements must be a priority.

14.4. The unit within the Ministry under which the Project falls must be given the required resources to adequately support the Project. The support required must be determined at the outset and be a part of the discussion in the design stage with firm commitments being given.

14.5. Approval processes should be made more agile and less cumbersome, so as to remove unnecessary delays. Particularly in a Project with numerous sub-components, these delays have a multiplication effect. Where the Government has sought to facilitate greater efficiencies by increasing approval limits, for example, it is often the case that MDAs are reluctant to follow suit. Every effort must be taken to be as efficient as possible within the existing strictures.

14.6. As noted earlier, the Development Bank of Jamaica had the responsibility to monitor the Line of Credit offered to SMEs. The monitoring required was quite extensive, as it involved (i) conducting periodic site visits for every sub-project financed from the LoC, to ensure that sub-projects were duly implemented and compliant, and (ii) contracting energy auditors to monitor annual progress in energy savings, GHG reductions, as well as financial results under the individual sub-projects. This would have been a very costly exercise, and it was perhaps not reasonable to expect the DBJ to fund this from their own resources. A better approach would have been to carve out some of the loan funds to be used for the monitoring activities.

14.7. The onlending of funds from the LoC was delayed for approximately one year because of an issue as to who should bear the foreign exchange risk on the loan. This was eventually solved by the acceptance of the risk by the Ministry of Finance. This issue would have been better settled at the outset.

14.8. As evidenced by the BSJ sub-component, proper diligence must be exercised for refurbishing projects, which have inherent potential pitfalls not present in greenfield projects. There are unknown factors in refurbishing projects that can cause significant budget and time overruns. Proper checks, as far as possible, must be done, and assumptions verified.

Annex A: List of Supporting Documents

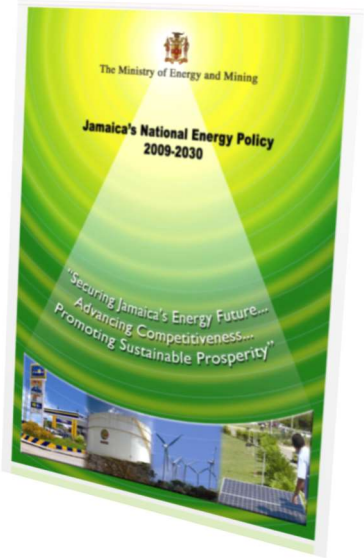
"Project Appraisal Document on a Proposed Loan in the Amount of US$15 Million to Jamaica for an Energy Security and Efficiency Enhancement Project" – February 3, 2011

Annex B: References

Bogue plant to deliver cheaper energy soon. (2016, April 27). Retrieved May 2018, from Jamaica Observer: http://www.jamaicaobserver.com/news/Bogue-plant-to-deliver-cheaper-energy-soon

Phillips, J. C. (2018, January 22). *Historical Oil Prices Chart*. Retrieved May 2018, from Forecast-Chart.com: http://www.forecast-chart.com/chart-crude-oil.html

ANNEX 6. SUPPORTING DOCUMENTS (IF ANY)



ESEEP ICR Workshop

Kingston, Jamaica
April 16-20, 2018

Contents

Introduction

1. **The World Bank (Bank) and the Government of Jamaica (GoJ) held a week long mission from April 16-20, 2018, in Kingston, Jamaica, to review the finding of the Energy Security and Efficiency Enhancement Project – P112780 (ESEEP), to aid in the preparation of their respective Implementation Completion Reports (ICRs). The World Bank team included Mark Lambrides (Senior Energy Specialist, GEEDR, Task Team Leader), Jimmy Pannett (Energy Specialist, GEEDR), and Shonell Robinson (Financial Management Specialist, GGOLF). Mr. Luciano Wuerzius (Sr. Procurement Specialist, GGOPL) also joined via video conferencing. The mission was coordinated by the Government's Project Coordinator, Judy Marshall, together with the Ministry of Science, Energy and Technology (MSET). The teams met with the Petroleum Corporation of Jamaica (PCJ), Development Bank of Jamaica (DBJ), the Bureau of Standards Jamaica (BSJ), and the Office of Utilities Regulation (OUR). The mission wishes to thank the participating institutions for their availability and the high quality of the exchanges.**

Objective

2. **The objectives of the mission were to gather all necessary data required for the evaluation of the ESEEP project. This included general background information, performance of each project component and subcomponents, project indicators and outcomes (both regularly monitored, as well as supplementary to support the project's ratings), and both internal and exogenous factors which might have influenced the design, performance and outcome of the project.**

3. **The ESEEP project was approved on March 10, 2011, and closed on October 31, 2017, having disbursed US$ 14.48 million of the approved US$ 15 million loan.**

4. **This Aide Memoire is structured to summarize the outputs and discussions with each implementing agency, and will be attached to the Bank's ICR document.**

MSET

5. **MSET was tasked with the overall implementation of the project, as well as specific subcomponents. Their tasks involved the implementation of Component 1: Strengthening the Regulatory and Institutional Framework to Improve Sector Performance, Increase Private Investment and Transition to Cleaner Fuels.**

6. **Sub-component 1.3: Accelerating the development of cost-effective privately financed generation in the power sector, through the provision of technical advisory services to OUR and MEM [MSET] to: (a) prepare electricity non-Project investments (that are not financed by the Project); (b) facilitate effective interaction with the private developers. This will include:**

    a. **Provision to OUR and MEM [MSET] of expertise needed for the preparation of new projects and to assess the compliance of these projects with sector policy, and with regulatory and licensing requirements;**
    b. **(ii) training of OUR and MEM [MSET] staff in the preparation and execution of tenders for new power generating capacity;**

7. **Sub-Component 1.4: Introducing the LNG program to support off-oil diversification, including the institutional strengthening of MEM [MSET] and the relevant ministries, departments and agencies (MDAs), and provision of technical advisory services to enhance the technical, commercial, financial and legal expertise required for developing a sound and sustainable LNG Program, and related investments, stakeholders' information and consultation.**

8. **The natural gas/LNG program will include several components that need to be developed in parallel. First, the development of gas sector regulations; Second, the development, financing and management by the private sector of the infrastructure required with respect to the LNG to be imported, re-gasified, stored and delivered to the gas off-takers (initially through pipelines). This activity is currently managed through the Office of the Prime Minister and is assisted financially by the PetroCaribe Development Fund. Third, the promotion of the use of natural gas, including the delineation of a gas market and of a gas industry structure, and the capacity to monitor the gas sector. Project support to MEM [MSET] will include:**

9. **a. Developing a sound industry structure, and delineating the institutions and the modus operandi required to expand the market for natural gas in Jamaica, and ensure an efficient management of the gas sector.**
   b. **Defining the actions required to effectively maximize the availability of gas in Jamaica and to optimize the use of the existing import infrastructure;**
   c. **Acquiring technical, commercial, financial, regulatory and legal advisors;**
   d. **Developing the national capacities to assess and manage the environmental and social aspects associated with the natural gas/LNG program, and to communicate with the stakeholders and the public. This activity will be carried out jointly by MEM [MSET] and National Environment and Planning Agency (NEPA);**
   e. **Informing and consulting regularly with the stakeholders and potential natural gas users (power sector, bauxite industry, transportation sector and others.) and drawing lessons from comparable natural gas/LNG programs. This will include workshops, and promotion activities.**

10. **Sub-Component 1.5: Provision of technical advisory services to MEM [MSET] and MDAs to harness the carbon credit potential created through the energy efficiency and renewable energy programs and the fuel substitution activities under the Borrower's National Energy Policy.**

11. **Sub-component 1.6: Implementing the National Energy Policy communication and information plan. This sub-component will provide resources to implement the Project communication and information plan, as well as the National Energy Policy communication plan.**

Outputs and Results

12. **The most important result achieved by the project was the contribution, through TA, to the new Electricity Act in 2015, whereby the previous one was from 1890. The objectives of the Act are to: provide for a modern system of regulation of the generation, transmission, distribution, supply, dispatch and use of electricity; promote transparency in the sector; provide clarity of roles; and promote energy efficiency, among others.**

13. **The expansion of LNG into the generation matrix of Jamaica, where since 2011 almost US$ 1 Billion have been invested in the sector. This investment includes 120 MW installed on the north coast,**

and an additional 190MW plant (and infrastructure), mostly from local institutions, is coming online in 2019, replacing old oil plants.

14. **Renewable penetration studies demonstrated the system could absorb more, and now RE accounts for 17% of the energy matrix (15.4% from large plants).**

15. **Clarity and alignment of roles to each of the energy sector entities, removing bottlenecks from the system, which previously relied on central players (for example, the Minister would be the one to provide licenses). Furthermore, relationships between the respective agencies is better, and decisions are more expedited.**

16. **An Investor Guide was created to provide an overview of the Jamaican energy sector, and provide information for prospective investors regarding opportunities, regulatory requirements, processes for investing, availability of financial incentives and contact information.**

17. **Structures for LNG and hydro projects to benefit from Carbon Credits, in order to improve their financial and economic feasibility were created.**

Issues Affecting Implementation

18. **The change in government, due to elections in early 2016, delayed the country's energy security target by two years. In particular, this was due to the change in approach to LNG, whereby at the start of the project, LNG investments were to be Government led. The new Government changed the approach to being Private Sector led. This resulted in delays to accommodate the necessary adjustments to the project to cover these new regulatory and structural needs.**

19. **Furthermore, the delay created a fiscal imbalance within the Ministry, whereby as a result of the decision on to change the LNG approach, the Ministry was unable to spend their initially estimated budget. As a consequence, the MoF did not allocate sufficient budget the following year, preventing timely project implementation.**

20. **Another issue was related to the capacity of MSET to take on the necessary work encompassed by the project. There was a personnel deficiency, which ultimately resulted in bottle-necks whereby decision making was centralized on, many times, one person – either due to authority or due to lack of additional qualified personnel within the Ministry. Furthermore, when there was a vacancy opening within the PIU, the replacement process would be very lengthy timewise.**

PCJ

21. **PCJ was tasked with the implementation of Subcomponent 2.2: Carrying out investment promotion activities for identified small hydro sites, review the performance of the existing hydro-electric plants, and mobilize investors and financiers, all in accordance with criteria acceptable to the Bank.**

22. **PCJ was also tasked with the implementation of Subcomponent 2.3: Promoting solar and wind energy, including the dissemination to potential investors of the results of an on-shore wind resource assessment, and promoting private sector investment in solar and wind energy.**

23. The outputs of their components are as follows:

ACHIEVEMENTS

Item	Description	Consultant	Budget (US$)	Contract Amounts (USD)	Contract Duration (months)	Status
2.2a	Conduct Pre-Feasibility & Feasibility Studies for five hydropower sites.	Studio Pietrangeli Ing. (Italy)	1,100,000	1,151,185	18	✓
2.2a.1	Conduct Pre-Feasibility & Feasibility Studies for six hydropower sites.	Studio Pietrangeli Ing. (Italy)	1,100,000	1,159,665	24	✓
2.2 b & 2.2c	Technical Assistance and Capacity Building for the Promotion and Development of Cost-Effective Small Hydropower Projects.	HydroScience (USA) & BA Energy Solutions (Argentina)	480,000	407,648	18	✓
2.2d	Review of the Performance of Existing hydropower sites owned by JPSCo.	n/a	30,000	0	0	✗
2.2e	Streamlining access by Investors to Permitting and Licencing of Hydropower Projects.	US Federal Energy Regulatory Commission (USA)	50,000	7,257	1	✓
2.3	Promote wind energy.	n/a	170,000	0	0	✗
	TOTAL		**$2,930,000**	**$2,725,755**		

Results

24. Specific results have been achieved by the work performed by PCJ to allow for greater diversification in the energy matrix, in particular with renewables. These include:

- **125MW of installed capacity were added as a direct result the project's promotion. The addition of these renewables accounts for avoiding 258,100 TCO_2 annually while providing electricity to 177,000 average size homes.**

Increase Hydropower, Wind and Solar Investments (US$ millions)

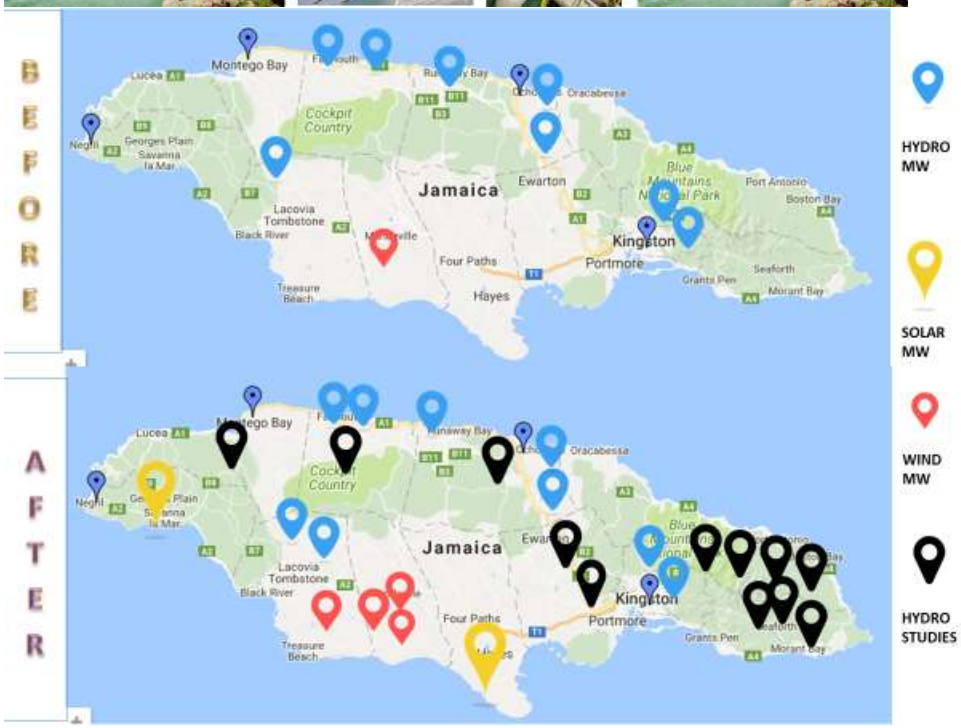
RE Project	Investment in US$ millions	MW Capacity	MWh Generation Potential	Barrels of Oil equivalent Avoided	Reduced Emissions of CO_2 (M Tonne)
Wigton Windfarm Limited Phase III Commissioned June 2, 2016	US$45	24.0	63,072	37,101	43,583
Blue Mountain Renewables Wind farm Commissioned August 2016	US$89.7	36.8	95,514	56,184	66,000
Content Solar PV Plant Commissioned 2016	US$62	20.0	62,050	36,500	42,876
Maggotty Hydropower Plant B Commissioned 2016	US$34	7.2	38,278	22,516	26,450
Eight Rivers Energy Company Solar PV Plant Commissioning date set for 2019 Under construction	~US$60	37.0	114,700	67,444	79,230
TOTALS	$290.7	125	373,614	219,745	258,139

- **26MW of potential hydro to be explored, with 10 feasibility studies completed (see table below). In addition to these, two other additional feasibility studies were prepared with other donor financing**
    - **It is expected that these hydros will be executed through PPP arrangements, where the estimated capital costs for 12 sites is US$113 million, and the production cost is estimated to be between 10-15c/kWh;**
    - **This RE source represents a reduction of 54,100 TCO_2 annually (equivalent to supply 41,400 average homes)**

FEASIBILITY STUDY RESULTS

Hydropower Feasibility Study Summary of Sites

#	HPP Site	Est. Capacity (MW)	Est. Annual Generation (MWh)	Est. Annual Barrels of Oil Equiv.	Est. Annual CO_2 Reduction (M Tonnes)
1	Martha Brae	4.4	16,700	9,824	11,540
2	Spanish River	7.8	18,000	10,588	12,438
3	Negro River	2.3	7,000	4,118	4,837
4	Swift River	2.9	8,300	4,882	5,735
5	Green River	2.7	8,700	5,118	6,012
6	Rio Grande 1	0.9	2,900	1,706	2,004
7	Rio Grande 2	0.8	2,700	1,588	1,866
8	Wild Cane	1.9	6,800	4,000	4,699
9	Rio Cobre (NIC)	1.0	2,300	1,353	1,589
10	Rio Cobre (Bog Walk)	1.3	4,900	2,882	3,386
	Totals:	**26.0**	**78,300**	**46,059**	**54,105**



25. **The project further developed hydro policy and procedures which aided in the streamlining of procedures. Through the project, PCJ worked with the US Federal Energy Regulation Commission (FERC) to develop more disciplined/streamlining procedures to improve the procedures to increase renewables. Having more streamlined procedures enabled additional RE sources (in this case wind) to be added to the matrix, although these were done outside project, in some instance and with Inter-American Development Bank (IDB) financing.**

Implementation

26. **PCJ highlighted how the hydro sector was more complex to develop than other sources of energy, as it requires great coordination with the various regulators (for example water).**

Issues Affecting Implementation

27. **The following issues were highlighted as affecting the implementation of PCJ's components:**
    - **Change management at PCJ impacted the human resource allocation during project execution;**
    - **Regulatory and legislative changes, such as the new Electricity Act 2015, delayed aspects of the Project, such as Hydropower Investment Promotion;**

Lessons

28. **PCJ highlighted the following lessons learned by the project, which include:**
    - **The project unit within PCJ was not always aligned with the corporate objectives;**
    - **Fiduciary training and the coordination of fiscal planning were critical factors in achieving the Project's goals. (MSET's PEU, MoFP, PCJ). Furthermore, the training was considered excellent and well timed;**
    - **By interlacing the GoJ and IBRD procurement procedures, MSET's PEU and PCJ were able to identify a critical approval pathway for large value procurement;**
    - **PCJ, Water Resources Authority (WRA), Jamaica Promotions Corporation (JAMPRO), MSET and National Irrigations Committee (NIC) put significant effort into evaluating International bids to ensure effective contract management;**
    - **Land Acquisition Plan needs a more transparent process, in particular since land owners were wanting early gratification;**
    - **Some amount of risk mitigation regarding hydrology has to be taken into account early on to mitigate climate change issues, causing hydrological uncertainties, in particular with run-of-the-river hydroplants;**

Next Steps

29. **PCJ advised that their presence is being sought by potential investors, particularly for their expertise and technical assistance in dealing with social and environmental issues, when there is a need to engage communities, and understand the environmental and land acquisition regulations.**

30. **Also moving forward, PCJ will be engaging in transaction advisory services with the Dominican Republic and other countries to help bring the hydros to fruition.**

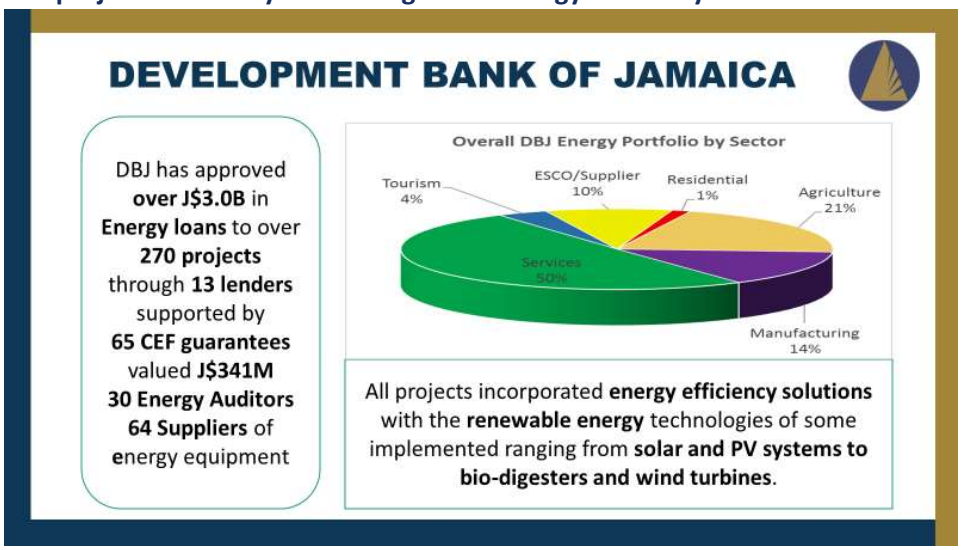
DBJ

31. **DBJ was tasked with the implementation of Subcomponent 2.4: Provision of line of credit/revolving facility (Line of Credit) through the DBJ, to approved financial institutions (AFIs) to provide retail financing to the private sector (Eligible Investors) for energy efficiency and renewable energy investments (Subprojects). This subcomponent will finance an initial endowment for an Energy Efficiency (EE) and Renewable Energy (RE) Line of Credit/revolving facility aimed at promoting EE**

and RE private sector investments. The investment for this subcomponent was originally US$ 4.6 million, but during restructuring the funds available were increased to US$ 5.6 million.

32. The outputs and results of their component are as follows:

- 55 loans for US$ 5.3 million loaned for energy efficiency projects to SMEs, with the average sub-loan in the area of US$ 150-200K;
    - The loans were disbursed through 7 approved financial institutions, supported by 18 CEF Partial Credit Guarantees of J$112M 19 Energy Auditors and 30 Suppliers of Energy Equipment;
    - Two companies had repeat loans;
- 39 of the 55 included, installation of solar PV, for a total amount of 2.8MW, 2,505.48 Barrels of Oil Equivalent/2,943 MCO_2 avoided annually;
- The project also catalyzed lending in the energy efficiency area of DBJ such that:



33. As noted during the discussions, prior to these lines being established, energy was not an area to be discussed as an option for lending by institutions. Now it is seen as a line to target to clients. Several institutions are now publishing funding for energy projects, showing a competitive market base has been created.

Implementation

34. DBJ had a team that liaised with MSET. Their team consisted of a Project Steering Committee Representative – Managing Director / General Manager (alternate), Project Leader – General Manager, Deputy Project Leader – Manager, Project Coordinator – Account Executive, and a Financial Management – General Manager, Finance & Treasury.

35. Unfortunately, while a technical auditor was contemplated during the design of the project, this never materialized due to no specific allocation for this. Thus, during the project evaluation, exact

figures on project savings were not calculated. It was noted, however, that for subsequent projects, e.g. for environment, line item to cover costs were included in the design.

Issues Affecting Implementation

36. One of the main factors affecting the implementation of ESEEP was related to DBJ. During the design phase DBJ was to bear the foreign exchange risk (Most borrowers from the LOC demanded local currency loans, while repayment to the World Bank was in US dollars.). The design was the desire of the MoF. During the first two years of project implementation, there was a significant devaluation of the JM$ vis-à-vis the US$, thus DBJ was losing significant funding. This is reflected in the fact that between 2012-14 no sub-loans were awarded. This problem was eventually resolved, as DBJ and the MoF developed a risk aversion strategy that would allow them to mitigate the foreign exchange risks. The demand of the on lending was such, that the restructuring raised the amount of funds available.

Lessons

37. When lending funds for purposes like this, there should be mechanism to, in the same way there is a subsidiary agreement with DBJ, there should be one where the receiver to DBJ should respond to needs there, to keep abreast of impact.

BSJ

38. BSJ implemented part of Component 2: Developing Energy Efficiency and Renewable Energy Potential. Specifically, BSJ was responsible for Sub-Component 2.1: Expanding the energy efficiency testing and labeling capacity and the information program of the Bureau of Standards (BSJ), including, inter alia, extending the testing chambers to test refrigerators, freezers, and air conditioners, and strengthening the related labeling and information program. The activities to be carried out include: (a) an overhaul of BSJ's electrical appliances testing capacity including adding testing chambers within BSJ's premises in Kingston. The loan financed: (a) modifications in the existing BSJ facilities; (b) the purchase of the equipment; (c) a review of the existing standards and of the labeling strategy; (d) strengthening the enforcement capacity, in particular regarding appliances screening at entry points; and (e) the delineation and launching of a comprehensive energy efficiency promotion campaign aimed at the household, commercial and industrial sectors, and a new consumer awareness program. This was the only component of the project implementing civil works.

39. The outputs for the component are as follows:

- Dated 6- test station chamber for the testing of refrigerators/ freezers was refurbished and new test software installed;
- New 10-test station chamber was installed for the testing of refrigerators/ freezers/wine chiller;
- The 10-test station chamber is capable of performing tests at 50Hz or 60Hz supply frequency;

- **Balance calorimeter for the testing of room air conditioners was installed. This is a new service for which, prior to ESEEP, BSJ did not have the capacity or physical installations for such testing;**
- **Jamaican Standard Specification for Determination of energy consumption and other performance characteristics of household refrigerators, freezers, wine chillers and refrigerator-freezers, JS 178:2016**
- **Jamaican Standard Specification for Room air conditioners energy and other performance testing, JS179:2016**
- **Jamaican Standard Specification for Labelling of commodities Part 21:Energy Labelling of appliances and products, JS1 Part 21:2015**

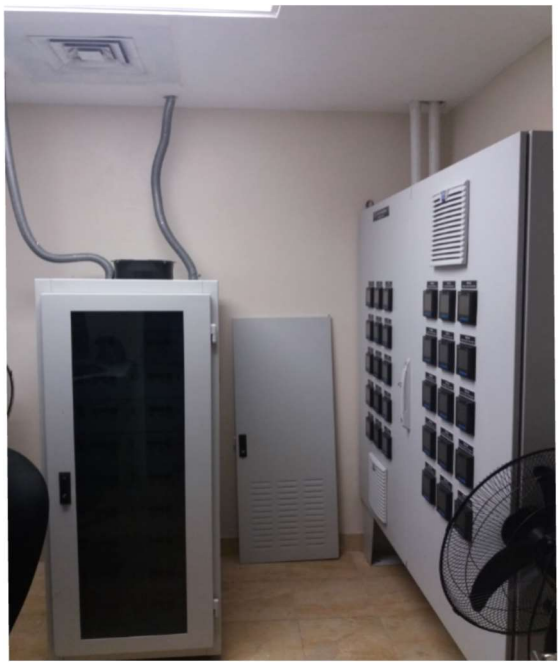


Figure 1: 50/60 Hz Supply Control

Results

40. **This subcomponent was just shy of full completion at the time of project closure, whereby a few extra months were needed to install minor equipment, for which then the technician's training could take place. Delays in obtaining equipment, as well as equipment theft (see section below on Issues Affecting Implementation) prevented the site from being operational by October 2017. However, since project closure, the Government has been finalizing the outstanding tasks. Staff training took place in April, 2018 and the testing chambers will be operational as of July 2018.**

41. **Although not yet operational at the time of the ICR report, this component will be shortly providing results in energy efficiency for Jamaica. The test chambers are doubling the testing capacity of equipment in Jamaica, and the actual testing time of equipment has been cut in half. Furthermore, the chambers will allow the GoJ to enforce new energy standards, also developed under ESEEP, whereby Energy Efficiency Limits are now included, which would govern the entry of the respective**

equipment into the country. Through the new standards, inefficient models would be prevented from being imported, and through the issuance of labels, consumers will have a choice when purchasing refrigerators, ACs etc, to see which are the more energy saving models. The collective gain from this should reduce the country's energy bill as consumers purchase more energy efficient products. It was noted by MSET that the cost of energy to GDP is now 8%, where it once stood at 33%.

Figure 2: Sample energy label

Issues Affecting Implementation

42. As mentioned above, this component experienced delays and the testing chambers, while working, were not operational at the close of the Bank's loan. Specific implementation issues were:
    - Challenges with the software during commissioning, with incompatible cards causing technical issues;
    - The need to purchase customized fans for the refurbished labs, which was executed late in implementation, and took longer than anticipated to complete;
    - These same fans were stolen soon after receipt, requiring the need to re-order a new pair for installation.

43. In addition to these events, it was noted that closer oversight from BSJ management to on-the-ground activities, as opposed to an independent consultant, could have improved the construction and refurbishing activities. This would have also aided in the oversight of the contractor billing process, which required thorough reviews during implementation.

Lessons

44. Ownership of the project wasn't quite embraced by BSJ, particularly since they were an income taking entity – it was difficult to understand why they were taking in funds from the Bank, as opposed of using their own budget. As such, the project did not receive the necessary oversight for smooth and complete implementation. It was recommended that cofinancing with the entity to give them greater ownership, and hence, the attention needed.

Next Steps

45. **With the staff training, conducted in Mexico, completed in April 2018, final adjustments are being made, but the expectation is that the testing labs become fully operational by June/July 2018. In addition to testing equipment for Jamaica, the testing chambers were built to test both 50 and 60 cycle equipment, thus BSJ will also serve as a testing hub for other islands in the Caribbean.**

OUR

46. **OUR was tasked with the implementation of Component 1: Strengthening the Regulatory and Institutional Framework to Improve Sector Performance, Increase Private Investment and Transition to Cleaner Fuels.**

47. **Component 1 will be implemented by the Ministry of Energy and Mining (MEM) and by the Office of Utilities Regulation (OUR). The component aimed at: (i) operationalizing the new energy policy; (ii) reinforcing the energy sector regulations for mobilizing and implementing energy investment and for cost optimization; and (iii) accelerating the development of EE and RE initiatives. It includes the following sub-components.**

48. **1.2.d - Strengthening OUR's regulatory and monitoring capacity of the power sector. As a result of the increasing complexity of supervising JPS, of the entry of new IPPs and of the fuel sourcing strategy, the regulator needs more sophisticated regulatory instruments and timely monitoring. In order to meet this challenge, OUR will need to:**
    - **Acquire modern sector planning instruments, and train its staff to use the new planning instruments.**
    - **Reinforce its capacity to monitor the activities of the main utility and of the IPPs with the support of a sector financial model and of a dispatch model to monitor the optimality of the dispatch carried out by JPS.**
    - **Develop a regulatory data base for performance benchmarking purposes.**

49. **Sub-component 1.3: Accelerating the development of cost-effective privately financed generation in the power sector, through the provision of technical advisory services to OUR and MEM to: (a) prepare electricity non-Project investments (that are not financed by the Project); (b) facilitate effective interaction with the private developers; and (c) build their respective institutional capacity; Implementation: OUR). This will include:**

    - **a. Provision to OUR and MEM of expertise needed for the preparation of new projects and to assess the compliance of these projects with sector policy, and with regulatory and licensing requirements.**

    - **b. Provision to OUR of expertise required to successfully interact with IPP developers, in particular to implement the generating capacity replacement program. OUR's latest least cost power sector investment plan shows that several new dual-fuel generation projects (representing a total of 480 MW) will have to be developed quickly to replace old, inefficient and high-cost generating units. Successful and effective preparation of these projects requires specialized skills within OUR and access to the expert services with international experience in power projects development and project financing. The Project therefore**

supports: (i) the provision of expert services – financial, technical, legal and marketing – required for the preparation of Power Purchase Agreements (PPAs) and for the development of wind capacity under private financing; and (ii) training of OUR and MEM staff in the preparation and execution of tenders for new power generating capacity.

50. Restructuring Paper - Given the modified responsibilities under the new Electricity Act, the OUR was no longer be responsible for procuring new renewable energy or natural gas capacity. The installation of new capacity in Jamaica was to be private sector led and at the time the Government authority responsible for interacting with these private generators to promote expansion of generation capacity had not been defined under the new law. As such, the scope of subcomponent 1.2 "Strengthening the Regulatory Framework and PPP Monitoring Capacity of the Energy Sector", 1.3 "accelerating the development of cost-effective privately financed generation in the power sector", and subcomponent 1.4 "introduction of LNG in the borrower's energy matrix to support off-oil diversification" were reduced.

51. The outputs for the component are as follows:

OUR OFFICE OF UTILITIES REGULATION

Outputs

OUR OFFICE OF UTILITIES REGULATION

Report on OUR Projects completed under ESEEP contracts as of 2017 October 31

No	Project Description	Background	Output	Challenges	Outcomes	Benefits/Impacts	Lessons Learnt	Sustainability
1	**Development of a Regulatory Database for performance benchmarking**	It was envisaged that OUR was to have a regulatory database where all the regulated entities' data could be stored and retrieved using a multi-variable database.	Database.	Varying ideas about how the database should work and the requirement for external entities to use the database securely and efficiently.	The database for the collection of regulatory filing information was designed, developed and delivered. However, the solution did not cover the following: 1. submission of the filings; 2. timetable of the filing; and 3. measurement of adherence to OUR Directives or Decisions. These items are required in order to successfully implement the database. Currently these modules are being developed in house.	The database assisted in the framework to design and develop the additional modules.	The approach to development of the solution should have been from the beginning of the regulatory process and not from a stage midway through the process to allow for proper development, implementation and use.	Database is still work in progress. When completed sustainability is likely.
2	**Identification and Implementation of Monitoring & Benchmarking Instruments**	Based on the formation of a monitoring department, the OUR sought assistance in establishing the identification and Implementation of Monitoring & Benchmarking	Report of recommendations for monitoring regulated utilities.		Report included recommended structure of monitoring framework, selection of sector specific data sets, reporting methodology and sample forms etc. All of the recommendations in the consultant's report have not been accepted by the OUR. Stemming from an internal review project there has been specific approvals for the provisions of sector reports on specific KPIs and also a report on the status of compliance with regulatory decisions. The Office has also approved that each issued decision is to indicate clearly the regulatory decisions that are to be monitored with the milestones.	Useful information on how regulatory monitoring is carried out in other jurisdictions and how it could be applied locally.	Without a proper framework both the regulator and the regulated will have challenges in the improvement of the services provided. Recommendations should be implemented as soon as possible to see maximum gains.	The consultation provided useful information to assist the OUR in developing a robust monitoring system. Sustainability is likely when fully developed and implemented.
3	**Acquisition of Power System Analysis Software**	The OUR saw the need to do advanced power system analysis as it had oversight for the performance of electric utilities; to be able to review proposals, carry out outage and other system investigations.	Recommendation of a software sufficient to the needs of analysing the Jamaican power system along with training to use the software.		Purchase of a powerful software called DIgSILENT with both network and individual licences. Two (2) weeks of training for OUR and Ministry staff.	Ability to do advanced analysis of the Jamaican power system. Projects completed with the use of DigSILENT are: 1. Transmission System Rapid assessment Plan. 2. Transmission System 2014 – 2033 Expansion Plan. 3. Bid Evaluation for 37 MW of Renewable Energy Power Generating Plant. 4. 2016 April 17th System Separation and Widespread Power Outages. 5. 2016 August 27th, Power System Collapse. 6. JPPC Generation Contract Extension. 7. JPS Battery Storage System.	Due to the specialized nature of the software, fewer access keys were needed. However, additional modules were subsequently bought to augment the ability to do stability and other analyses.	The software has a maintenance programme that allows it to be updated as necessary. Sustainability is likely.

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Outputs

Report on OUR Projects completed under ESEEP contracts as of 2017 October 31

No	Project Description	Background	Output	Challenges	Outcomes	Benefits/Impacts	Lessons Learnt	Sustainability
4	**Evaluation of Bids for the Supply of 480MW of Base Load generation Capacity on a BOO Basis**	To address the aged and inefficient generators on the system, OUR sought to replace the generation plants as well as create room for growth with an RFP for procurement of 480MW in a tranche of 360 MW and 120 MW using natural gas to be provided by another procurement led by the GOJ.	Report and recommendations.	Not enough bids to facilitate competition as only the incumbent's bid was reviewed. The separation of fuel procurement from generation supply pose coordination challenges due to the high inter-dependence between the two procurements.	The evaluation of the bid indicated there were significant challenges with the bid however in a facilitation by the contracts committee JPS was given 45 days to address the matters appropriately. This was done and JPS was awarded the contract to build a 360MW plant.	Selection of preferred bidder and award of contract.	Procurement of generating plants should be done as a complete procurement where possible (i.e. fuel procurement combined with generation capacity).	**The procurement process was aborted.** Although the process was aborted it laid the foundation for the JPS 190MW and the Jamalco 100MW plants that have since been approved to run on natural gas as fuel. This addition of generation capacity will result in a more diversified fuel mix to the energy sector and in the long run lowering of electricity prices to end users.
5	**Development of Long-Term Demand Forecast Model for the Jamaica Electricity Sector**	Legislative prerequisites to OUR for the JPS 2019 Tariff Review. Inadequate in-house expertise at OUR to take on the regime change from "Price Cap" to "Revenue Cap".	Reports and Workshops/Training	Compressed Timelines, Data Collection Process, Workshop Scheduling/Logistics	Demand Forecast Model	Efficient and transparent tariff review process. Acceleration of energy access, affordable supply of electricity, increase RE penetration etc.	Robust TOR/RFP is necessary. Data collection process should be carefully managed. Workshop essential in order to gain stakeholders buy-in.	**Sustainability is likely.** Fair and efficient tariff process undertaken by the OUR. The process is participatory and is supported by rigorous analytical work.
6	**Expert Advice on the Methodology and Computation of Return on Equity for the JPS Co. Ltd.**	As above	Reports and Workshops/Training	As above	Guidance received from the BOJ. NERA endorsed CAPM. OUR will be guided by NERA's general approach to derive ROE estimate.	As above	As above.	**As above**

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Results

52. The specific results achieved by OUR include:

- **Enabled the new license for JPS to be the energy distributor in Jamaica;**
- **Improved capacity to analyze energy proposals and their effects on the system as a whole, reflected in new analysis and move towards using storage to provide grid stability[15];**
- **With JPS utilizing similar software, OUR and JPS can synchronize data and facilitate in the sharing of models;**
- **The analysis for the additional 480 MW baseload generation enabled proper evaluation that led to supply bids coming in at 8c/MW;**
- **Further energy biddings are coming in at lower prices than before, contributing to a lower cost of energy;[16]**
- **OUR forecasting models are seen as more robust, and thus accepted by all partners, and are being used for the new IRP under preparation;**

[15] JPS is in the process of installing 23MW of, combined, Flywheel and battery storage.

[16] One of the main contributing factors to the current lower cost of energy, when compared to appraisal, is the lower cost of oil. However, the cost of the more diverse sources of generation (in particular gas and RE) coming online are at a lower cost, thus further contributing to lower energy prices, which currently stand at US$0.23/kWh.

Outcomes

1. **Expert Advice on the Methodology and Computation of ROE for JPS**
   - ✓ NERA Economic Consulting has endorsed the Capital Asset Pricing Model (CAPM), which is currently the choice of model employed by the OUR in estimating the ROE for regulated entities.
   - ✓ The OUR received guidance on the ROE from the Bank of Jamaica (BOJ), which is a requirement of the JPS Licence.
   - ✓ For the 2019 JPS Tariff Review the OUR will be guided by NERA's general approach to derive the ROE estimate.
   - ✓ Exposure to the technical staff & the Office to the workings of the CAPM & forecasting techniques.
2. **Development of Long-Term Demand Forecast Model for the Jamaican Electricity Sector**
   - ✓ The Demand Forecast Model that was developed by MHI to forecast electricity demand will adopted by the major stakeholders (MSET, OUR & JPS) in Jamaica's Electricity Sector.

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53. Further benefits are envisioned:

Benefits

For the 2019–2023 Electricity Tariff Review, the OUR is embarking on an efficient and transparent process, which is driven and supported by policy initiatives. The benefits to be realized from this process include among other things:

- New modes of energy access, [***Charges for Use of the System or Top-up or Standby Supplies and Electricity Power Wheeling***]
- Affordable supply of electricity,
- Increase renewable energy penetration,
- Improvement in energy efficiency,
- Implementation of the Smart Streetlight Program a policy initiative of the government of Jamaica.

The forward looking **revenue cap principle** intends to make affordable the funding for initiatives contained in the JPS business plan and should avoid any potential overcharging of consumers.

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Lessons

54. Given the number of stakeholders involved, there was a need to have an upfront, clearly defined process to prepare the complex ToRs.

55. Good project management procedures/culture can help avoid the problems experienced, including: time management, whereby in the end it became a challenge; better oversight of activities whereby the managers understand the expected processes; and monitoring indicators, in particular data gathering.

56. Stakeholder engagement is key for data collection, and critical for buy-in, particularly if conducted as a workshop.

Conclusion

57. The MSET and the Bank hosted a Stakeholder workshop on April 20, for which Minister Dr. the Hon. Andrew Wheatley, expressed his satisfaction with the outcomes of ESEEP, and its importance towards the implementation of Jamaica's National Energy Policy.

58. The Permanent Secretary of MSET, Mrs. Hillary Alexander highlighted the importance of the partnership and thanked the Bank for its continued support to the sector. Mark Lambrides, Task Team Leader of the project, on behalf of the Bank, also commented on the good working relations between Jamaica and the Bank, thanked all entities for their support and effort during the project's lifetime, and hope for continued collaboration in the energy sector.

59. Below is the summary of the project achievements as presented during the workshop:

WHAT DID THE PROJECT ACTUALLY DO/ACCOMPLISH?

- Policies and Regulation
- Capacity building for implementation of the National Energy Policy
- Investments in RE/EE SMEs
- Refurbishment and new EE testing chambers, Standards, and Labeling system
- Hydropower feasibility studies
- RE promotion
- Natural gas market stimulation

7 Energy Security and Efficiency Enhancement Project (ESEEP)

WORLD BANK GROUP