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Report No: PAD1410

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED CREDIT

IN THE AMOUNT OF SDR 286.9 MILLION
(US$400 MILLION EQUIVALENT)

TO THE

REPUBLIC OF THE UNION OF MYANMAR

FOR A

NATIONAL ELECTRIFICATION PROJECT

P152936

August 25, 2015

Energy and Extractives Global Practice
East Asia and Pacific Region

CURRENCY EQUIVALENTS
as of July 31, 2015

1,232.5 Myanmar Kyat = 1 United States Dollar (USD)
1.3947 USD = 1 Special Drawing Right

MYANMAR FISCAL YEAR
April 1 – March 31

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
CER	contingent emergency response (Component 4 of the Project)
CERIP	Contingent Emergency Response Implementation Plan
CO2e	carbon dioxide equivalent
CPF	Country Partnership Framework
CQS	Selection Based on Consultants' Qualifications (CQS)
CSO	civil society organization
DA	Designated Account
DC	direct current
DRD	Department of Rural Development (within MLFRD)
EBITDA	earnings before interest, taxes, depreciation and amortization
EIRR	economic internal rate of return
ENPV	economic net present value
ESE	Electricity Supply Enterprise (covering States/Regions other than Yangon)
ESIA	Environmental and Social Impact Assessment
ESMF	Environment and Social Management Framework
ESMP	Environment and Social Management Plan
FGD	focus group discussion
FNPV	financial net present value
FY	Fiscal Year
GAD	General Administration Department
GDP	gross domestic product
GIS	geographic information system
GRS	grievance redress service
HV	high voltage
IBRD	International Bank for Reconstruction and Development
ICB	International Competitive Bidding
IDA	International Development Association
IDCOL	Infrastructure Development Company Limited (Bangladesh)
JICA	Japan International Cooperation Agency
JIP	Joint Implementation Plan (of the World Bank Group, for electricity
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
IHLCA	Integrated Household Living Conditions Assessment Survey
IRM	Immediate Response Mechanism
JICA	Japan International Cooperation Agency
JIP	Joint Implementation Plan (of the World Bank Group, for electricity access in Myanmar)
KII	key informant interview
kV	Kilovolt

kWh	kilowatt-hour
LED	light-emitting diode
LTA	local technical advisors
LV	low voltage
M&E	monitoring and evaluation
MEPE	Myanmar Electricity Power Enterprise
MESC	Mandalay Electricity Supply Corporation
MFI	microfinance institution
MLFRD	Ministry of Livestock, Fisheries and Rural Development
MMK	Myanmar Kyat
MOE	Ministry of Energy
MOEP	Ministry of Electric Power
MV	medium voltage
MVA	megavolt-ampere (unit of electric power equivalent to megawatt)
MW	megawatt (one million or 10^6 watts)
NCB	National Competitive Bidding
NEEC	National Electrification Executive Committee
O&M	operation and maintenance
P2P	'Power to the poor' scheme
PAD	Project Appraisal Document
PMO	Project Management Office
PSIA	Poverty and Social Impact Assessment
PV	photovoltaic
QA	quality assurance
QBS	Quality-based Selection
QCBS	Quality and Cost-based Selection
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework (part of the safeguard documents)
SDR	Special Drawing Rights
SHS	Solar home system
SME	small and medium enterprises
SRE	self-reliant electrification
SSS	single-source selection
t	metric ton
TA	technical assistance
TSU	Technical Support Unit
TWh	terawatt-hour (one trillion or 10^{12} watt-hours)
TV	television
USD	United States Dollar
VA	Village Administrator
VEC	Village Electrification Committee
VSC	Village Supporting Committee
WBG	World Bank Group
Wp	watt-peak (unit of nominal power of photovoltaic devices)
WTP	willingness to pay
YESC	Yangon Electricity Supply Corporation

Regional Vice President:	Axel van Trotsenburg
Country Director:	Ulrich Zachau
Global Practice Senior Director:	Anita Marangoly George
Practice Manager:	Julia M. Fraser
Task Team Leader:	Dejan R. Ostojic
Co-Task Team Leader:	Xiaoping Wang

TABLE OF CONTENTS

DATA SHEET

Report No.: PAD1410

Basic Information		
Project ID: P152936	Environmental Assessment Category: B - Partial Assessment	Team Leader(s): Dejan R. Ostojic, Xiaoping Wang
Lending Instrument: Investment Project Financing		Fragile and/or Capacity Constraints [ ]
		Financial Intermediaries [ ]
		Series of Projects [ ]
Project Implementation Start Date: 15-Sep-2015		Project Implementation End Date: 31-Mar-2021
Expected Effectiveness Date: 16-Dec-2015		Expected Closing Date: 30-Sep-2021
Joint IFC: Yes	Joint Level: Complementary or Interdependent project requiring active coordination	

Practice Manager	Senior Global Practice Director	Country Director	Regional Vice President
Julia M. Fraser	Anita Marangoly George	Ulrich Zachau	Axel van Trotsenburg

Borrower: Republic of the Union of Myanmar			
Responsible Agency: Ministry of Electric Power			
Contact:	His Excellency U Aung Than Oo	Title:	Deputy Minister
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Responsible Agency: Ministry of Livestock, Fisheries and Rural Development			
Contact:	U Khant Zaw	Title:	Director General
Telephone:	95-67-401109	Email:	kzaw.dda@gmail.com

Project Financing Data(in USD Million)			
[ ] Loan	[ ] IDA Grant	[ ] Guarantee	
[X] Credit	[ ] Grant	[ ] Other	

Total Project Cost:	567.00	Total Bank Financing:	400.00
Financing Gap:	0.00		

Financing Source	Amount
BORROWER/RECIPIENT	60.00
International Development Association (IDA)	400.00
Local Communities	107.00
Total	567.00

Expected Disbursements (in USD Million)

Fiscal Year	2016	2017	2018	2019	2020	2021	2022
Annual	6	40	66	78	83	79	48
Cumulative	6	46	112	190	273	352	400

Institutional Data

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

Climate Change, Gender, Governance, Social, Urban, Rural and Resilience Global Practice

Cross Cutting Topics

[X] Climate Change
[ ] Fragile, Conflict & Violence
[X] Gender
[ ] Jobs
[ ] Public Private Partnership

Sectors / Climate Change

Sector (Maximum 5 and total % must equal 100)

Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Energy and mining	Transmission and Distribution of Electricity	100		88

☐ I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.

Themes

Theme (Maximum 5 and total % must equal 100)

Major theme	Theme	%
Rural development	Rural services and infrastructure	100

Project Development Objective

To help increase access to electricity in Myanmar.

Components	**Cost (USD Millions)**
1. Grid extension	375.00
2. Off-grid electrification	172.00
3. Technical assistance and project management	20.00
4. Contingent emergency response	0.00

Systematic Operations Risk- Rating Tool

Risk Category	**Rating**
1. Political and Governance	High
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	High

4. Technical Design of Project or Program	High
5. Institutional Capacity for Implementation and Sustainability	High
6. Fiduciary	High
7. Environment and Social	Substantial
8. Stakeholders	Substantial
OVERALL	High

Compliance

Policy

Does the project depart from the Country Partnership Framework in content or in other significant respects?	Yes [ ]	No [X]
Does the project require any waivers of Bank policies?	Yes [ ]	No [X]
Have these been approved by Bank management?	Yes [ ]	No [ ]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	No [ ]

Safeguard Policies Triggered by the Project	**Yes**	**No**
Environmental Assessment OP/BP 4.01	**X**	
Natural Habitats OP/BP 4.04	**X**	
Forests OP/BP 4.36		**X**
Pest Management OP 4.09		**X**
Physical Cultural Resources OP/BP 4.11	**X**	
Indigenous Peoples OP/BP 4.10	**X**	
Involuntary Resettlement OP/BP 4.12	**X**	
Safety of Dams OP/BP 4.37	**X**	
Projects on International Waterways OP/BP 7.50		**X**
Projects in Disputed Areas OP/BP 7.60		**X**

Legal Covenants

Name	**Recurrent**	**Due Date**	**Frequency**
Project Management Offices fully staffed		01-Dec-2015	

Description of Covenant

Each PMO shall include at minimum a head of the PMO, financial management specialist, procurement specialist, environmental specialist, social specialist, planning specialist, engineer, monitoring and evaluation specialist and, as needed, an independent verification consultant.

Name	**Recurrent**	**Due Date**	**Frequency**

Project Operation Manuals	**X**		Continuous

Description of Covenant

The Ministry of Electric Power and Department for Rural Development shall implement the Project in accordance with the Project Operation Manuals.

Name	**Recurrent**	**Due Date**	**Frequency**
Annual work plans and budgets	**X**		Yearly

Description of Covenant

Due two months before the beginning of each Fiscal Year during the implementation of the Project (i.e. February 1) or such later date as the Association may agree.

Name	**Recurrent**	**Due Date**	**Frequency**
Mid-term review		16-Apr-2018	

Description of Covenant

Due 28 months after effectiveness

Conditions

Source Of Fund	**Name**	**Type**
IDA	Contingent Emergency Response Implementation Plan	Disbursement

Description of Condition

The Recipient shall adopt a satisfactory Contingent Emergency Response Implementation Plan for Component 4 of the Project and, in the event of an eligible crisis or emergency, ensure that the activities under said component are carried out in accordance with such plan and all relevant safeguard requirements.

Team Composition

Bank Staff

Name	**Role**	**Title**	**Unit**
Dejan R. Ostojic	Team Leader (ADM Responsible)	Lead Energy Specialist	GEEDR
Wang Xiaoping	Team Leader	Senior Energy Specialist	GEEES
Alan D. Lee	Team Member	Energy Specialist	GEEDR
Frank Van Woerden	Safeguards Specialist	Senior Environmental Engineer	GENDR
Frederick Yankey	Financial Management Specialist	Senior Financial Management Specialist	GGODR
Helene Bertaud	Counsel	Senior Counsel	LEGES
Manush Hristov	Counsel	Senior Counsel	LEGES
Hien Minh Vu	Team Member	Program Assistant	GEEDR
Li Zijun	Team Member	Carbon Finance Specialist	GCCCF
Liu Zhentu	Team Member	Senior Procurement Specialist	GGODR

Myat Kay Khine	Team Member	Procurement Specialist	GGODR
Panos Vlahakis	Team Member	Senior Operations Officer	CASEF
Patricia Maria Fernandes	Team Member	Senior Social Development Specialist	GSURR
Rome Chavapricha	Team Member	Senior Energy Specialist	GEEDR
Shen Chau-Ching	Team Member	Senior Finance Officer	WFALN
Sirirat Sirijaratwong	Procurement Specialist	Procurement Specialist	GGODR
Theingi Min	Team Member	Operations Analyst	EACMM
Thida Aung	Team Member	Program Assistant	EACMM

Extended team

Name	Title
Ajith Kumar	Mini-hydro Consultant
Alex Sundakov	Institutional Consultant
Anil Cabraal	Renewable Energy Consultant
Anna Nunez Sanchez	Environment Specialist
Arun Sanghvi	Electrification Consultant
Charlotte Bisley	Social Safeguards Specialist
Chawsu Devi	Team Assistant
Christopher Greacen	Off-Grid Consultant
Daw Phyu Aye	Environment Specialist
Edwin Adkins	Geospatial Planning Consultant
Ian Holbrook	Intern
Istvan Dobozi	Consultant
Li Yan	Consultant
Svend Jensby	Senior Social Safeguards Specialist
Vijay Modi	Electrification Planning Consultant
Voravate Tuntivate	Monitoring and Evaluation Consultant

Locations

Country	First Administrative Division (State/Region)	Location	Planned	Actual	Comments
Myanmar	Kachin		X		
	Kayar		X		
	Kayin		X		
	Chin		X		

	Mon		X		
	Rakhine		X		
	Shan		X		
	Sagaing		X		
	Mandalay		X		
	Magway		X		
	Bago		X		
	Ayyarwaddy		X		
	Tanintharyi		X		
	Naypyitaw		X		
	Yangon		X		

I. STRATEGIC CONTEXT

A. Country Context

1. Myanmar is the largest country in mainland Southeast Asia, located between Bangladesh, China, India, Lao People's Democratic Republic (PDR), and Thailand, and with more than 2,800 miles of coastline. It is well positioned to be a regional trading hub and supplier of minerals, natural gas and electric power given its geographic advantage and natural resources.

2. Despite its potential, Myanmar is one of the least developed countries in Southeast Asia, with a legacy of conflict, isolation, and ineffective policies. Its population of 51.4 million had a gross domestic product (GDP) of $1,105[1] per person in 2013/14. According to the best available data, some 26% to 38% of Myanmar people were in absolute poverty in 2010. At least 70% of the poor live in rural areas, depending primarily on agriculture.[2]

3. Major political and economic reforms since 2011 have significantly increased civil liberties and removed many constraints to commerce, investments and enterprise. Overall macroeconomic performance has strengthened. The economy grew around 8.5% in 2014, inflation was 5.7% in 2013/14, and external debt 19% of GDP in 2013/14. Growth is expected to remain relatively strong over the medium term, but remaining major obstacles include an underdeveloped financial sector, deep infrastructure gaps and limited capacities to manage external shocks.[3]

4. The Government of Myanmar is pursuing efforts to bring an end to the multiple and long-lasting conflicts in various ethnic areas. Parliamentary elections are scheduled for late 2015, and the coming years offer opportunities to deepen reforms further. A key challenge will be to ensure that political, economic and peacemaking transformation gives voice to the whole population, benefits those most in need and vulnerable to exclusion, and develops the non-state sector to support broad-based economic growth.

B. Sectoral and Institutional Context

5. **Myanmar's energy consumption is among the lowest in the world.** Average annual consumption per person of around 160 kilowatt-hours (kWh) is twenty times less than the world average. About 70% of the population, and 84% of rural households, lacked grid electricity access in 2014. Off-grid schemes are rare and typically provide high cost, low reliability power service for a few hours per day. Also, access to modern fuels for cooking (such as liquefied petroleum gas) is limited to urban areas. Consequently, traditional biomass (wood and animal dung) is widely used and accounts for about two-thirds of primary energy consumption.

6. **Electricity consumption is growing fast.** Peak load demand reached 2,100 megawatts (MW) in 2014, growing at an average 14% per year over the past five years.[4] During this period, the

[1] $ denotes United States Dollars throughout this document.
[2] World Bank Group Myanmar Country Partnership Framework FY 2015-17 (Report No. 95183-MM) discussed by Executive Directors on April 23, 2015.
[3] http://documents.worldbank.org/curated/en/2015/01/23978308/myanmar-investment-climate-assessment-sustaining-reforms-time-transition#
[4] Peak load demand is estimated at about 2,400 MW, but due to load shedding the realized peak is 2,100 MW.

electricity supplied by the national grid grew about 15% per year and reached 9.6 terawatt-hours (TWh) in 2013. Hydropower currently accounts for around 68% (3,151 MW)[5], natural gas 29% (1,329 MW), and a small coal-fired power plant 3% (120 MW) of total installed capacity (4,600 MW) on the grid. Small off-grid diesel and mini-hydropower units dispersed across the country have an estimated total installed capacity of about 114 MW.[6] Due to heavy reliance on extremely seasonal hydropower with low firm capacity, the existing power generation system cannot meet the peak demand during the dry season.

7. **Electricity shortages and supply disruptions are a major concern.** Accumulated delays in investments in power infrastructure, over-reliance on seasonal hydropower production, together with a rapid increase in electricity demand (which tripled over the last decade), resulted in large electricity shortages, which peaked at about 30% of power demand in 2012-2013. Despite a significant recent increase in gas-fired power generation (about 400 MW was commissioned in 2014) load shedding, blackouts and generally low reliability of power supply remain prevalent.

8. **The energy sector's institutional and regulatory framework has been fragmented, particularly in rural electrification.** The Ministry of Energy (MOE) is responsible for overall energy policy, while the Ministry of Electric Power (MOEP) leads power sector development. Within MOEP, the Myanmar Electric Power Enterprise (MEPE) is responsible for gas-fired power generation, operates the high-voltage power grid and acts as the single buyer of electricity and power market operator. Three government-owned distribution utilities report to MOEP: Yangon Electricity Supply Corporation (YESC) and Mandalay Electricity Supply Corporation (MESC), which cover Myanmar's two most populous and urbanized Regions,[7] and the Electricity Supply Enterprise (ESE) for the rest of the country. The Government limits the role of these distribution utilities to medium voltage (MV) primary distribution, leaving low voltage (LV) secondary distribution open for private sector participation including through village initiatives and direct private investments. In rural areas, the Department of Rural Development (DRD) in the Ministry of Livestock, Fisheries and Rural Development (MLFRD) is responsible for off-grid electrification. In addition to the national (Union level) ministries, the seven States and seven Regions each has their own energy ministry that plans and implements sub-national power projects below 30 MW capacity. The Government is transferring part of the 2015-2016 Union electrification budget to State/Region ministries as a part of broader decentralization efforts.

9. **The main challenge facing the power sector is to scale-up access to electricity in reliable, efficient, affordable and sustainable manner**. Near-term challenges include to: (a) increase capacity and efficiency of power generation; and (b) reduce losses in transmission and distribution networks, which are currently about 20%, in order to reduce electricity shortages. The main medium-term challenges are sector reforms, particularly corporatization of power sector enterprises and pricing reform to reflect economic cost of electricity supply, while protecting consumers with low incomes (or vulnerable to exclusion) through well-targeted and fiscally

[5] Including Joint Venture hydropower projects which exported about 2 TWh to China in 2013/2014.
[6] MOEP Presentation to Greater Mekong Subregion Regional Power Trade Coordination Committee, June 9, 2015.
[7] YESC (formerly YESB) and MESC came into effect April 1, 2015 by order of MOEP Notifications No. 94/2015 and 95/2015 dated March 30, 2015, approved by Parliament July 10, 2015.

affordable subsidies.[8] The Government's long-term objective is universal electricity access by 2030 with secure reliable, affordable, as well as environmentally and socially sustainable energy supply to all consumers.

10. **The Government is supporting strategic development and reforms in the power sector.** The 2013 National Energy Policy[9] is based on guiding principles in the 2012 National Framework of Economic and Social Reforms. These include: energy mix diversification; greater energy productivity through energy conservation and efficiency measures; and energy pricing policies that reflect economic costs for both suppliers and users in the domestic energy market. The 2014 Electricity Law provides for an independent energy regulatory agency that, once established, should catalyze further sector reforms and private sector participation.

11. **The Government's National Electrification Plan aims to electrify 7.2 million households and achieve universal access to electricity by 2030**. The Plan calls for investments of $5.8 billion over the next 15 years to extend the distribution grid and electrify off-grid areas. The Plan was developed with World Bank technical assistance (TA) of $1.5 million funded by the Sustainable Energy for All initiative. The Government has developed a complementary Energy Master Plan (for primary energy sources) with Asian Development Bank (ADB) assistance, and a Power Sector Master Plan (for generation and transmission sub-sectors) with Japan International Cooperation Agency (JICA) assistance.

12. **The World Bank Group (WBG) Joint Implementation Plan (JIP) in Myanmar supports public and private efforts to increase electricity access and alleviate acute electricity shortages.** The WBG JIP first stage (2013-2015) focuses on increasing gas-fired power generation capacity and efficiency, and lays the foundation for national electrification. The $140 million International Development Association (IDA) Credit for the Myanmar Electric Power Project (MEPP) includes finance to increase the capacity and efficiency of a gas-fired power plant in Thaton, Mon State. The International Finance Corporation (IFC) and Multilateral Investment Guarantee Agency (MIGA) have supported MOEP to conduct Myanmar's first competitive bidding for an Independent Power Producer, for a new 240 MW gas-fired plant in Myingyan, Mandalay Region.

13. **Scaling-up access to electricity requires sector reforms and increasing private sector participation.** The Government and its development partners recognize that the next stage of sector development will require further reforms, institutional development and increasing private sector participation. With help from IFC, the Government already initiated corporatization in the power distribution sector (April 2014) which will create conditions for private sector investments in distribution utilities being corporatized. Also, a proposed IFC-led 'Lighting Myanmar' initiative would support the private sector to develop a commercial market for solar devices and kits, as an integral part of national electrification efforts. In addition to financing support, the WBG will continue to provide TA and policy advice on power sector financial viability, electricity tariffs and subsidies review, institutional capacity building for environmental and social due diligence, procurement and financial management in MOEP and other sector entities.

[8] In April 2014, the Parliament approved a new block tariff system with higher rates for higher consumption levels, while keeping a 'life-line' tariff of 35 Kyats/kWh for residential consumers.
[9] http://www.myanmarpresidentoffice.info/en/?q=issues/energy/id-4827

14. **Universal electricity access by 2030 requires more than doubling the current annual rate of connections.** In 2013, Myanmar's distribution utilities added about 200,000 residential customers. At this rate, it would take nearly 40 years to achieve universal access and connect 7.2 million Myanmar households presently without electricity. The National Electrification Plan calls for a more than doubling of the electrification rate and reaching about 500,000 new connections per year from 2020 onward. Clearly, the investment requirements will need to more than double, as the cost of connections per household continues to rise with increasing grid penetration towards less populated areas. In order to maximize the number of connections with the limited financing resources available, the Plan uses a geospatial least-cost approach to identify an optimal combination of grid and off-grid solutions, and a sector-wide approach for implementation.

15. **The National Electrification Project will support the Government in implementing the Plan in coordination with all development partners and the private sector.** The Project will establish the basis for a sustained engagement of the WBG in supporting public and private sector investments needed to achieve universal access to electricity by 2030, as well as to strengthen the Government's institutional capacities. In addition to working with the public and private sector investors, the joint WBG energy team will collaborate closely with all development partners active in Myanmar (ADB, Japan, Germany, United Kingdom, Norway, Australia, etc.). The Plan requires finance beyond the Project's contribution, and is open for other development partners and the private sector to participate. Also, the Project will seek to leverage climate and carbon finance, such as the Green Climate Fund, and other possible sources of multilateral and bilateral financing.

C. Higher Level Objectives to which the Project Contributes

16. The Myanmar Country Partnership Framework (CPF) for 2015-17,[10] the WBG's first full strategy for the country since 1984, identifies three focal areas: (i) reducing rural poverty; (ii) investing in people and effective institutions for people; and (iii) supporting a dynamic private sector to create jobs. Activities in these areas also integrate four important cross-cutting issues: gender, conflict, governance and climate change/disaster risk.

17. The Project helps reduce rural poverty through CPF Objective 1.1: 'Improved power generation and access to electricity'. Better access to electricity is critical to improve well-being, reduce vulnerability to poverty, promote income-generating opportunities, and lower the inter-generational perpetuation of poverty. Electrification improves access to basic services including health, education, security, finance, and information and communication technologies.

18. The Project also contributes to other CPF priorities. It will help improve national capacity for sustainable environmental management (Objective 1.4) through TA for MOEP and MLFRD. It indirectly supports private sector to create jobs in newly electrified areas across the country, given that inadequate and unreliable electricity supply is a particularly critical constraint to existing and potential business activities in Myanmar.

[10] World Bank Group Myanmar Country Partnership Framework FY 2015-17 (Report No. 95183-MM) discussed by Executive Directors on April 23, 2015. It draws on lessons learned since the WBG and Myanmar re-engaged in 2012, findings of a Systematic Country Diagnostic in 2014 and extensive public consultations.

II. PROJECT DEVELOPMENT OBJECTIVE

A. Project Development Objective

19. The Project's objective is to help increase access to electricity in Myanmar.

B. Project Beneficiaries

20. The Project is expected to benefit around 6 million people with new electricity connections by 2021. The beneficiaries will span rural and urban areas in all of Myanmar's seven States and seven Regions. The IDA support in off-grid areas will especially target communities in locations the grid is unlikely to reach in the next 10 or more years (remote areas where social and/or ethnic tensions are often present).[11]

21. People living in areas electrified under the Project are expected to benefit from: (i) reduced costs of electricity; (ii) enhanced well-being through electricity for lighting, telecommunications and entertainment; and (iii) job creation and opportunities to boost incomes and economic productivity. To maximize developmental impacts including health, education and social benefits, the Project will prioritize connections for health clinics, schools, religious and other community buildings.[12] The Project will benefit groups vulnerable to social exclusion, such as low-income and female-headed households, people with disabilities, students, and people of different ethnic groups and religious beliefs. The Project is also expected to strengthen the capacity of village committees and improve the participation of community members, especially women, in decision-making for electrification.

22. Finally, the Government and private sector participants of the Project will benefit from TA and support for institutional development, capacity building, and gender-sensitive training for grid and off-grid electrification activities.

C. PDO Level Results Indicators

23. Table 1 below summarizes results indicators for the Project's objective, all of which are core sector indicators except for public lighting. The Project will measure the number of direct beneficiaries in the form of people with access to electricity by household connections. Given the large number and national distribution of beneficiaries, the female percentage is assumed to be practically equivalent to the national average.[13] Gender and social inclusion is a focus of safeguards, TA, consultations and impact evaluation as discussed in the Appraisal Summary (page 20).

24. CPF Objective Indicator 1 sets a target of WBG helping to provide 3 million people with new or improved electricity service by 2017 (from a baseline of zero in 2014). The Project is expected

[11] In parallel, IFC expects approximately 4 million people in central Myanmar would benefit from better access to market-based solar PV devices and kits under its proposed Lighting Myanmar program (described on page 7).
[12] Religious buildings are frequently used for communal functions, village level planning, as well as education.
[13] 51.8% according to the *Population and Housing Census of Myanmar 2014*. www.dop.gov.mm or http://myanmar.unfpa.org/census

to achieve 859,000 connections by 2017 (from zero in 2015).[14] Annex 1 details annual results targets.

Table 1: Results Indicators

Indicator name	Cumulative target by Dec-2021 (compared to a baseline of zero in Dec-2015)
1. People provided with access to electricity under the project by household connections, *of which:*	**6,210,000 people** (1,242,000 households)[15]
Grid	*3,750,000 people (750,000 households)*
Off-grid solar	*2,282,500 people (456,500 households)*
Mini-grid	*177,500 people (35,500 households)*
2. Community electricity connections under the project, *of which:*	**23,000 connections**
Grid	*11,600 connections*
Off-grid / Mini-grid	*11,400 connections*
3. Public lighting, *of which:*	**151,000 lights**
Grid	*132,000 lights*
Off-grid /Mini grid	*19,000 lights*

25. CPF Objective 1.1 includes a Supplementary Progress Indicator for the National Electrification Executive Committee (NEEC) Secretariat to be adequately staffed and functional by 2016 (from a baseline of establishment in 2014). This is an intermediate result indicator of the Project.

III. PROJECT DESCRIPTION

A. Overall Project Approach

26. The IDA Credit of $400 million will finance activities which combine investment and capacity building in grid and off-grid electrification, as a major contribution to realize the first phase of Myanmar's National Electrification Plan. Explicitly designed to bridge public and private service provision, the Project complements IFC activities as part of the overall, integrated WBG JIP. The Project has three main components plus a contingent emergency response component, summarized below. Annex 2 describes the three main components in detail. IFC's Lighting Myanmar proposal is included here to highlight its complementarity with IDA support for off-grid electrification.

[14] At the time of CPF preparation, the Project was expected to connect around 1 million people by 2017. The revised estimate of 859,000 takes into account a later start date. Other WBG JIP projects will contribute to the CPF target.
[15] The World Bank December 2014 Core Sector Indicators and Definitions provides that the number of people with electricity connections is estimated by multiplying the actual number of household connections with an estimate of the average household size. The 2014 Census recorded on average 4.4 persons per household in Myanmar, varying by State/Region though with little difference between urban and rural areas. This Project assumes five people per household for simplicity and on the basis that target areas may have larger households than the national average.

B. Project Components

27. **Component 1: Grid extension (Total $375 million, of which IDA $300 million)**. This component will support the distribution utilities to extend distribution networks and connect communities and households to the national power grid, including through the provision of goods and materials for: (i) the expansion of existing medium voltage ("MV") substations and construction of new MV substations, (ii) the construction of new MV lines, low voltage ("LV") lines and MV/LV transformers; and (iii) household and community connections, and public lights. IDA will finance the cost of goods and materials (transformers, poles, conductors, insulators, switchgear, materials, etc.) for this component. The utilities will support installation, with private (community level) contributions at a rate set by the Government, and possible private sector participation.

28. **Component 2: Off-grid electrification (Total $172 million, of which IDA $80 million)**. About 5.5 million households are estimated to remain without access to national grid by 2021. Of these, 1.3 million are in the remote Chin, Kachin, Kayin, Shan, Rakhine, Taninthayi and Sagaing States/Regions. The Project's off-grid component targets communities in these areas, located far beyond the existing national grid and unlikely to receive grid access in the next 10 or more years, and where private sector is not active due to relatively high operating costs and low ability to pay. IDA finance will cover partial costs of goods and services for: (i) solar photovoltaic devices or systems for a target of 456,500 households; (ii) mini-grids to serve some 35,500 households; (iii) electricity connections for 11,400 health clinics, schools and other community buildings; and (iv) installation of 19,000 public street lights. Villages, and the Government (with grant finance from other sources), will share the balance of related costs. IDA finance will disburse after installation and required services are delivered and field-verified in accordance with criteria to be detailed in Department of Rural Development's (DRD) Project Operation Manual.[16] Mini-grid and community electrification will be 'technology neutral' and may include solar PV, mini-hydropower, wind, diesel, or a hybrid (e.g. diesel and solar), depending on assessment of each community.

29. **IFC's proposed Lighting Myanmar program.** By targeting remote areas, the IDA off-grid component is designed to complement and coordinate with IFC's proposed Lighting Myanmar program. The IFC program would provide advisory services to help develop commercial market solutions for solar photovoltaic devices and kits in central Myanmar. This approach recognizes the market segmentation between central regions and remote border areas, which require different solutions. The scope of IFC's proposed program includes: (i) consumer profiling and segmentation, service demands, willingness and ability to pay, and other market intelligence; (ii) quality assurance including products certification, enabling participation of Lighting Global quality assured products in price-competitive procurement, building local capacity to assure quality, and field performance testing; (iii) consumer awareness and education on selection and quality and acquisition channels of PV products as well as qualified service delivery agents; (iv) business to business (B2B) support, including targeted business development services, facilitating B2B connections, etc.; and (v) access to finance for the supply chain, including support to local distributors to assess working capital needs and access to financing, identifying solutions to provide funds to the micro-finance institutions (MFI) sector and providing linkages on the potential

[16] MOEP and DRD will each have a separate Project Operation Manual for their respective parts of the Project.

pipeline to MFI clients. The IFC program may also consider complementary support for mini-grid market development, including support on business models to get to scale (for example, telecom tower as a base customer with community power), geographic market intelligence identifying areas suitable for mini-grids scale up, as well as market intelligence on pricing/ regulations. Its total cost is estimated to be in the order of $4 million, financed with donor's trust fund and fees from IFC clients. The proposed IFC program would provide such services separately and in parallel to the National Electrification Project, both as part of the overall integrated WBG JIP.

30. **Component 3: Technical assistance and project management (Total $20 million, of which IDA $20 million).** This component provides support to MOEP and MLFRD to: (i) strengthen institutional capacity to implement the National Electrification Plan; (ii) improve the policy and regulatory framework related to electrification and renewable energy; (iii) develop an integrated framework to plan electrification, monitor result and evaluate impacts; (iv) secure technical advice and consulting services, including on standards, technology assessment and technical design, economic and financial analysis, environmental and social impact management, procurement and financial management; and (v) improve Project management.

31. **Component 4: Contingent emergency response (CER) ($0)**. This component, with an initial allocation of zero dollars, is part of IDA's support to an Immediate Response Mechanism (IRM) in Myanmar. The IRM allows reallocation of a portion of undisbursed balances of IDA-financed investment projects for recovery and reconstruction support following a formal Government request in the event of an eligible emergency. With IDA's support, Myanmar is developing its Contingent Emergency Response Implementation Plan (CERIP) which will specify eligible uses, implementation arrangements and operational procedures for the IRM. The CERIP is a condition prior to disbursement of any funds reallocated to this component, and will also serve as the component's operation manual. If the IRM component is activated, the IDA Management will, where necessary, amend the Project Development Objective to reflect the provision of immediate and effective response to the eligible emergency. IDA Management will approve such amendment to the Project Development Objective in order to enable the Project's Contingent Emergency Response Component to be activated without delay.

C. Project Cost and Financing

32. Overall project cost is estimated at $567 million, of which IDA Investment Project Financing covers $400 million (71%).[17] As in Table 2, the Project's non-IDA finance includes an estimated $75 million of community contributions for Component 1, $32 million of community contributions for Component 2, and $60 million from the Government budget for Component 2. The shares of Component 2 subproject contributions will vary from contract to contract, as detailed in Annex 2.

[17] IFC's proposed 'Lighting Myanmar' program is not included in the cost and finance figures of this Project.

Table 2: Estimated project cost and financing requirement by component

Component	Project cost ($ million)	Source of finance $ million *(Share of Project cost)*					
		IDA credit		Government		Local Communities[18]	
1. Grid extension	375	300	*(80%)*	-	-	75	*(20%)*
2. Off-grid electrification	172	80	*(47%)*	60	*(35%)*	32	*(18%)*
3. TA and project management	20	20	*(100%)*	-	-	-	-
4. Contingent emergency response	-	-	-	-	-	-	-
Total Project Costs	567	**400**	***(71%)***	60	*(11%)*	107	*(18%)*

D. Lessons Learned and Reflected in the Project Design

33. The Project design reflects extensive lessons from past and recent WBG electricity access activities, especially in Lighting Africa (now Lighting Global) program, Rwanda, Ethiopia, Vietnam, Lao PDR and Bangladesh, as well as the WBG Independent Evaluation Group's 2015 global assessment of WBG support to electricity access.[19]

34. **General lessons and principles of successful national electrification include:**

a. With sustained government commitment, a transition from low access (as in Myanmar today) to high or universal access can be made within two decades, as Lao PDR and Vietnam have recently accomplished.

b. WBG can help Myanmar electrify rapidly at an early stage by establishing an enabling framework, building capacity and providing finance, as well as leveraging overall investment finance required on an ongoing basis.

c. Planning the rollout of national electricity access needs to be comprehensive and synchronized, integrating grid and off-grid solutions and bringing development partners together on a platform of 'many partners, one team and one plan'.

d. A national push for universal access provision primarily depends upon the pursuit of a least-cost path for grid expansion backed by appropriate sector policies and complemented by off-grid electricity in the interim or for the long-term as needed.

e. Affordability, equity and inclusion need to be addressed upfront by targeting low-income households and those in remote and inaccessible areas.

[18] It includes contributions from villagers, local governments, other donors, and private sector, as applicable, for village electrification.

[19] "World Bank Group Support to Electricity Access, FY2000-FY2014," draft IEG report dated April 20, 2015; Istvan Dobozi, "Global and World Bank Experiences with Off-grid Rural Electrification: Selected Policy and Operational Aspects," IEG draft report, November 2014.

f. A sector-wide approach and sustained engagement with the Government and key sector entities are crucial to a rapid and sustainable scale-up of access to electricity.

g. Adequate institutional capacity and program management across the entire value chain are essential for timely and efficient implementation and sustainability. A number of cases – such as the sector-wide approach in Rwanda and the Universal Electrification Access Program in Ethiopia – demonstrate that institutional capacity development throughout the value chain, including the utilities and sector institutions, as well as local contractors, is critical to organize and mobilize the work teams all the way to regional and village levels.

h. In a rapidly evolving sector environment, a flexible approach to national electrification should be adopted to accommodate changing priorities and on-the-ground developments. Even if the changing situation could not be foreseen at design stage, such an approach enables more smooth and effective implementation.

35. **General lessons and principles of successful off-grid electrification include:**

a. Recent rapid technological innovations, significant cost reductions, performance improvements, financing model innovations and the climate change agenda have greatly increased the attractiveness of off-grid solutions based on renewable energy sources.

b. There are important emerging good practices in off-grid electrification such as the WBG-supported solar home systems program in Bangladesh, which installed and successfully serviced 3 million systems in the past decade. These programs are largely driven by the private sector, enabled by government regulation within the framework of public-private partnership.

c. The right policy framework is a requirement for any successful off-grid program. The fact that a large share of the un-electrified rural households is located in low-income, remote and isolated areas, underpins the importance of developing a dedicated off-grid policy framework.

d. Subsidies can be an important part of a well-designed off-grid policy framework given that off-grid schemes are usually more expensive than grid electricity, and off-grid communities tend to have the lowest incomes. The sustainability of the subsidy scheme requires a well-defined source of financing, preferably on a declining scale as the commercial market matures. A sustainable long-run off-grid electrification market requires maximizing private investment while minimizing subsidies.

e. There is no one superior business model to accomplish off-grid electrification. Specific country conditions are important determinants of the model choice. For Myanmar, a transition from government-led off-grid electrification to a more commercially oriented one, along the lines of Bangladesh's IDCOL model, will take time, depending chiefly on availability of access to financing.[20]

[20] IDCOL is the Infrastructure Development Company Limited, established by the Government of Bangladesh and licensed by Bangladesh Bank as a 'non-bank financial institution'. It promotes and finances infrastructure and renewable energy projects, including off-grid electrification. IDCOL has been the central actor in managing and

f. WBG's Lighting programs have supported commercial non-subsidized markets in nine countries. In these markets, over 47 million people gained access to improved energy services from Lighting Global quality verified products delivered through commercial businesses. Allowing a non-subsidized, commercial private sector market to develop with a range of quality-assured products addresses multiple market segments and helps meet an array of energy service needs.

g. Most countries have far less capacity for off-grid electrification than grid extension. Given this, the simplest delivery or business model should apply to match local realities. Capacity building and training to develop local skills in design, implementation, management and operation and maintenance (O&M) is essential for off-grid rural electrification to succeed.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

36. The National Electrification Executive Committee (NEEC), established in 2014,[21] provides strategic direction and guidance for the Project. NEEC's Patron is one of Myanmar's two Vice Presidents; the Minister of Electric Power is Chair, and Minister of Livestock, Fisheries and Rural Development is Co-Chair. Deputy Ministers of MOEP and MLFRD jointly head the NEEC's Secretariat.

37. MOEP, and MLFRD's Department for Rural Development (DRD), have each established a Project Management Office (PMO) for grid and off-grid electrification, respectively. MOEP's PMO will oversee Component 1 through Myanmar's distribution utilities, and will be directly responsible for the grid-related TA activities under Component 3. DRD's PMO will implement Component 2, including budget and physical planning, in close cooperation with sub-national bodies, and will be directly responsible for the off-grid TA activities under Component 3. Each PMO has a Manager and staff positions for planning, engineering, procurement, financial management, environmental and social management, as well as monitoring and evaluation (M&E). Annex 3 provides details. Both PMOs will prepare, budget and implement annual work plans and manage project funds in line with eligibility guidelines. They will also operate the respective Designated Accounts, disburse project funds, reconcile bank accounts and apply for withdrawals, consolidate annual work plans, plan budgets, arrange annual audits, reports and conduct M&E.

38. At the sub-national level (State/Region, district and township levels), joint PMOs headed by staff from the distribution utilities and DRD will coordinate and manage the Project at their jurisdiction. The sub-national PMOs will work with the development committees for infrastructure projects composed of public, private sector and civil society representatives, staff of distribution utilities, and DRD.

39. Many villages organize their own electricity access through Village Electrification Committees (VECs) or Village Supporting Committees (VSCs). Village committees are currently responsible for most new grid connections in Myanmar. Distribution utilities are constrained in their ability to

funding Bangladesh's highly successful off-grid electrification in the past 15 years with considerable World Bank support.

[21] Established by notification No. 59/2014 of the President's Office, dated August 27, 2014.

extend LV lines and household connections due to lack of funding. Committee responsibilities vary from village to village and, for the grid component, can include: mobilizing finance from villagers and external sources for project design; capital investments; collecting villager contributions; hiring contractors for construction; and transferring works to distribution utilities. After commissioning, the distribution assets are transferred to distribution utilities to operate and maintain. Such roles of village committees will continue in the project target areas during implementation.

40. To allow flexibility during implementation, DRD's Project Operation Manual (rather than the Financing Agreement) will describe implementation arrangements for the off-grid component in more detail.

B. Results Monitoring and Evaluation

41. M&E is essential to inform corrective actions during implementation. Both PMOs will monitor and evaluate the Project and report every six months in accordance against indicators listed in Annex 1. They will collect and assess data and statistics on project outputs and outcomes to include in half-yearly progress reports to the WBG. They are also expected to use Geographic Information System (GIS) to plan and monitor Project outputs and outcomes for both grid and off-grid electrification. Since the PMOs have low capacity for M&E, TA under Component 3 will help PMOs develop the M&E framework, acquire GIS tools, train staff, and combine traditional implementation progress reporting with state-of-the-art mapping.

42. The Project will evaluate the impacts of grid and off-grid electrification activities with surveys before (for baseline), during, and after project implementation, including gender impacts.

C. Sustainability

43. The WBG envisages a programmatic engagement to support the implementation of the National Electrification Plan, with the proposed Project constituting the first operation. The sustainability of the Project's benefits will mainly depend on effective institutions, financial viability of distribution utilities, affordability of electricity to low-income people, and technical service support for off-grid systems.

44. **Effective institutions.** Implementation of the National Electrification Plan, including this project, requires transformation of institutions at the strategic, program coordination, planning and project implementation levels. The strong commitment evidenced by the establishment of NEEC, its Secretariat and PMOs, is an important first step. Equally important is to make these entities fully functional with clearly defined responsibilities and adequate human resources and institutional support. The Project will provide TA to this end. Furthermore, the Bank will sustain its engagement and policy dialogue with the Government to fulfill its commitment to universal electrification and power sector development.

45. **Financial viability of distribution utilities.** Distribution is the main source of revenue in the power sector value chain. Investments in adequate power generation, transmission, distribution and supply, as well as O&M of power assets, critically depend on the financial viability of distribution utilities. The Bank is helping MOEP prepare a Financial Viability Action Plan (FVAP)

for the power sector, as a legal covenant under the Myanmar Electric Power Project. Furthermore, the WBG JIP includes TA for strengthening power sector policy and regulation, focusing on corporatization and commercialization of distribution utilities, and introduction of 'performance-based regulation' for power distribution.

46. **Affordability.** The Poverty and Social Impact Assessment (PSIA) conducted during Project preparation shows that grid electricity tariffs are currently affordable to most residential users. However, high capital investment costs, including connection charges, prevent a sizeable number of households from connecting to the grid. As a result, low-income households are likely to remain unconnected even after the electrification of their village. Field investigations suggest some un-electrified households spend as little as $3-5 per month on non-electric lighting. Building on experiences in other countries (e.g. Lao PDR), the Project will help the Government develop and introduce a financing scheme to electrify households most vulnerable to exclusion[22], taking into account the current level of their energy spending.

47. To bridge the affordability gap, the Government will use IDA funds and its funds from other sources to finance grid connection goods and materials as Annex 2 details. The Government is also committed to provide additional finance to help the lowest-income households pay installation costs and connection charges. For off-grid systems, the Government will provide subsidies to cover the financing gap between total costs of the systems and users' contributions, and reduce initial costs for users to a level commensurate with their current energy expenditures. The Government will finance the subsidies in part with its own budget and with IDA funds. IDA-supported off-grid electrification will be limited to the geographically remote sections of the country where the IFC proposed Lighting Myanmar program would not be able to reach users. Subsidies to off-grid electrification in remote areas is expected to phase out gradually as access to commercial micro-finance increases over time. The lowest-income households will have a choice to opt also for small solar home systems (SHS) or solar kits. Subsidies to be provided with IDA funds for off-grid systems will be transparent, targeted, and minimized through appropriate bidding mechanisms. This cost-sharing scheme will be designed in a way to minimize market distortions and leakages of subsidized products from border areas to the central part of the country where the Lighting Myanmar Program will support commercial market development. Furthermore, direct government subsidies will be accompanied by market development measures, such as training to providers and users, as well as promotion and awareness campaigns. Subsidy levels and method of allocation will depend on the choice of technology, ability to pay of users, and availability of local service providers.

48. **Provision of technical service for off-grid systems** can be crippled by the remoteness of system locations, lack of local technical skills and high operating costs by non-local service providers. A fraction of the subsidies will be disbursed against performance results, including service quality after the installation. The selected suppliers will be obliged to train the users on basic O&M. Users will be made aware of their rights and responsibilities and proper channels for requesting service support. To localize the service support and minimize the operating costs, the

[22] Households vulnerable to exclusion includes those of low-income, those headed by females, and those which have persons with a disability.

project will also provide training to local technicians who the village committees can recommend and who will keep a stock of key parts and provide in-time service support for a fee by users.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks.

49. The overall risk rating of the Project is high due to the following factors.

50. *Political and Governance risks.* Overarching political and governance risks include the fragility of the reform process and the limited government experience with development partners such as the WBG in the last two decades. More generally, capacity is limited and institutional mechanisms relatively weak to deliver ambitious reforms. Constraints include capacities for policy making and economic regulation, least-cost planning, procurement and governance, financial management, and environmental and social impacts management.

51. *Sector Strategies and Policies.* Institutional fragmentation and overlapping responsibilities for electrification can increase the risks of delays, poor coordination and inaction in the Government. Changes in the legal framework, such as establishment of the electricity regulatory agency, restructuring and corporatization in the power distribution sector, may initially slow down the electrification rate, but later on are expected to boost its implementation through new pricing policies, efficiency gains, and better design of subsidy mechanisms. To facilitate the reform process and help mitigate sector risks, the Project will provide significant TA to MOEP and sector entities.

52. The risk of inadequate generation capacity to serve newly connected consumers still presents a threat in some areas depending on the evolution of electricity supply and demand balance. The WBG JIP and support from other development partners will help mitigate this risk through improvements of policy and regulatory environment for private sector investments, as well as through direct financing support for power generation.

53. *Technical Design of Project*. The main project risk is related to the establishment of institutional arrangements for implementation country-wide and mobilization of contributions from the Government budget and beneficiaries. Finding a right balance between the public and private sector participation in the electrification program will be important for program implementation, but even more for sustainability of new electricity services provided under the Project. For example, there are cases where off-grid systems and over-extended distribution lines were abandoned due to lack of adequate O&M and access to technical services or spare parts in remote areas. IFC's proposed Lighting Myanmar program faces considerable risk should the Government decide to move beyond the more remote areas with its off-grid solar subsidy program, and crowd out private companies in areas where private companies have sought to invest.

54. *Institutional Capacity for Implementation and Sustainability.* MOEP and MLFRD capacities are low for all aspects of electrification: policy making, planning, design, implementation and supervision. In the last couple of years, MOEP has seen a declining role (and budget support) for the electrification activities and will need a strong support (TA, training etc.) to strengthen its capacity as a focal agency for implementation. Also, the distribution utilities will need to be

significantly strengthened to cope with the electrification plan's envisaged doubling of the electrification rate. The low institutional capacity of Myanmar entities and the lack of knowledge of international best practices will be mitigated through capacity building, use of in-house advisors, training and knowledge sharing on best practices, and strong implementation support by the WBG team. The project will also include capacity building at State/Region, District and Township levels.

55. *Environmental and Social.* Consultations are an important part of preparation and implementation with regional/state and local authorities, Civil Society Organizations (CSOs) and the general public in the project areas. This is necessary to mitigate environmental and social risks and to consider affordability, social inclusion and other factors that can affect households and communities. The Project design integrates results of the Poverty and Social Impact Assessment (PSIA) to maximize the extension of project benefits to households vulnerable to poverty or exclusion and help mitigate potential negative impacts during implementation.

56. Implementation of off-grid solutions in some regions/states where social/ethnic tensions are persistent will present significant challenges and require additional capacity building support for the implementing agencies. Gender-sensitive public consultations with different ethnic and religious groups will be particularly important in conflict-affected communities during the preparation of electrification plans.

57. IDA funds for off-grid component are expected to be disbursed as the last payment for provision of services after the construction/installation is completed and verified, a potential risk in delayed disbursement. It will be important for DRD to put in place an effective field verification protocol and prompt payment processing. In addition, there is risk of un-sustained government budget over the project life to co-finance the off-grid component. However such risk is small since DRD is expected to receive contributions for electrification from several donors, which would offset any shortfall in government budget for this purpose.

58. *Fiduciary*. The overall financial management and procurement risks are substantial and high. The main risks that will need to be addressed include lack of comprehensive fiduciary procedures, expertise and staff with experience in World Bank procurement guidelines and procedures. Detailed assessments of implementing agency capacity have been carried out during appraisal and risk mitigation measures were agreed with the Government. These will include requirements that both PMOs have staff with knowledge of Bank or international good practice. The Bank will provide training to PMO staff on procurement and financial management. More details are seen in Section VI. C and D as well as Annex 3.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analyses

Economic analysis

59. Expected quantifiable economic benefits of the Project can be measured in terms of the avoided costs for un-electrified household activities, such as lighting, radio listening and TV viewing, for which electricity from project-enabled (grid or off-grid) sources will replace kerosene lamps, batteries or small diesel generators to offer better services at a lower cost. Additional economic benefits from electrification are commonly recognized albeit difficult to quantify. These include

improved health services and education, improved communications and connectivity, electric water pumping, improved lifestyle, reduced gap in the quality of life between city and rural dwellers, improved conditions of study for students, potentially more business and income-generating opportunities, more local jobs, improved public security, etc.

Grid component

60. At a 10% social discount rate, the Economic Net Present Value (ENPV) of grid electrification is $288 million and the benefit-cost ratio is 1.33. The economic internal rate of return (EIRR) is estimated at 25%. The discounted payback period is nine years. As shown in Annex 6, the Project EIRR is robust to key variables, including the cost per connection and willingness to pay. The switching value for the project EIRR corresponds to the doubling of the cost per connection and a 32% decrease in the willingness to pay.

Mini-grid component

61. Village-scale micro-hydro systems in Myanmar generally have installed capacities ranging from 5 to 100 kW, serving up to a few hundreds of village households through distribution networks within the service area. The analysis covers a typical village-scale micro-hydro system with an installed capacity of 50 kW to serve 200 households over 15 years.

62. *Service level.* Due to seasonality, hydro power plants in Myanmar generally operate between eight and ten months a year and staying idle for the remaining months. The analysis assumes that the village-scale micro-hydro system operates for nine months a year, during which all connected households are able to carry out the essential power-consuming activities, such as lighting, radio listening, TV viewing and 25% of the households are able to use electricity for rice cooking.

63. *Costs.* Total investment costs of the 50 kW micro-hydro power plant and the distribution system were estimated at $150,000 or $3,000 per kW. O&M cost was assumed at 6% of the total investment or $9,000 per year.

64. At 10% social discount rate, the levelized cost of electricity (LCOE) from village-scale micro-hydro power supply is estimated at $0.16 per kWh, while the average willingness to pay (WTP) is estimated at $0.21 per kWh. The investment's economic internal rate of return is 17.0% and Economic Net Present Value is U$58,160. The discounted payback period is nine years.

Solar home system

65. The analysis covered the economic viability of a reference 60 Watt peak (Wp) solar home system capable of meeting a typical household's basic needs: lighting, phone battery charging and radio or TV.

66. *Costs.* The cost of the system was estimated at $260 per system along with periodic replacement costs of batteries and lights every two years. Annual O&M cost was assumed at 5% of the system upfront investment.

67. At a 10% social discount rate for a project life of 10 years, LCOE of a 60W SHS is estimated at $1.10 per kWh, whereas the average WTP is estimated at $1.53 per kWh (or $11.15 per month), translating to a benefit-cost ratio of 1.39. The investment will yield an estimated EIRR of 52.3% and ENPV of $229 per system. The discounted economic payback period is three years.

Financial Analysis

68. A financial analysis of the Project's grid extension component was carried out from ESE's and YESC's perspectives.[23] The IDA credit of $300 million finances the goods component of grid investments at a service charge of 0.75% per year. Finance of $75 million for works is assumed to come from community contributions (equivalent to $100 average charge per connection for 750,000 customers). ESE and YESC revenues come from two main sources: (i) electricity sales from both residential and non-residential customers; and (ii) the connection charge. The return on equity was assumed at 14%. With the weighted average cost of capital (WACC) at 3.4%, ESE will have a Financial Net Present Value (FNPV) loss of $140.5 million and a financial internal rate of return (FIRR) of negative 2.9%; YESC will have an FNPV loss of $24.5 million and an FIRR of negative 4.1%. The negative FIRR is due primarily to the low residential tariff which currently stands at about 33% and 50% below the marginal costs of supply of ESE and YESC, respectively.

B. Technical

Grid extension

69. The power distribution network in Myanmar comprises about 15,500 miles of MV lines, 14,000 miles of LV lines and 30,308 distribution transformers with a combined capacity of 7,452 MVA. The Project will extend the existing grid by 7,100 miles of MV lines and 5,800 miles of LV lines, and install 772 MVA of new distribution transformers in more than 6,300 locations across the country to connect 750,000 households to the grid over the Project period (2016-2021).

70. Newly connected consumers under the Project will add an estimated 300 MW to the power system load demand by 2020. The incremental electricity demand associated with the Project is a relatively small share (about 15%) of the total increase of electricity demand in Myanmar over the next five years, which is estimated at 1,800 MW (low case) to 2,300 MW (high case) by 2020.[24]

71. The Government is committed to attract significant public and private investments in power generation to meet the fast growing electricity demand. More than 400 MW of new capacity was added to the power system in the past two years. The WBG actively supports the generation expansion program in Myanmar. Two gas-fired power generation projects – the 120 MW Thaton CCGT power plant and the 240 MW Myingyan Independent Power Producer – supported by the WBG are expected to come on-line in 2017-2018, and future support may also include hydropower.

72. The distribution utilities' current electrification program suffers from inadequate funding, lack of systemic approach to grid roll-out and inadequate technical standards, particularly for electrification of rural areas. The overall capital expenditures in power distribution sector increased

[23] At the time of the analysis, MESC had not been established; Mandalay was assumed to be covered by ESE.
[24] MOEP load forecast used for the Power Sector Master Plan supported by JICA.

from about 69 billion Kyats in 2012 to 99 billion Kyats in 2014. However, this was barely enough to cover investment needs for the existing MV grid. The utilities have therefore made very slow progress expanding the MV grid to date, and villages essentially self-finance investments in the LV network and new connections. As a result, the expansion of the LV grid and connections has suffered from the lack of systematic planning and uneven application of technical standards. Furthermore, such approach has contributed to increased cost per connection because low-cost options and optimization techniques were not used in planning and implementing new connections.

73. The Project will help address the above weaknesses and support the electrification program through (a) financing of distribution system equipment and materials to buy down the investment cost and, therefore, reduce the average cost per connection; and (b) TA to introduce geospatial least-cost planning, modernize technical standards and specifications, and develop a state-of-the-art distribution grid code. Particular attention will be given to possible cost savings through the application of low-cost electrification solutions, as well as longer-term grid optimization, including a gradual shift from 11 kV to 22 kV for primary distribution.

74. O&M of the expanded distribution grid will need significant improvements to meet modern standards and ensure adequate reliability and quality of power supply to existing and future consumers.[25] Over the last five years, the distribution utilities have made significant progress in reducing overall distribution losses from 22% in 2009 to 16% in 2014. However, there is a still large room for loss reduction and improvement of operating performance of the power distribution networks. This will require both investments in modernization and upgrading of distribution facilities as well as organizational measures, including commercialization/corporatization of distribution utilities and increased private sector participation in distribution. The proposed Project will support investments in strengthening MV and LV networks as well as TA for strengthening the institutional capacity of MOEP to develop and implement policies and regulations required for the above-mentioned sector reforms.

Off-grid electrification

75. The technical design of the off-grid electrification component draws on the current practice in Myanmar, global experiences and lessons learned on similar projects around the world, as well as expert judgment. The Project will employ mini-grids and solar technologies proven and commonly used in other countries, although still at an early stage of development in Myanmar.

76. A phased and segmented approach proposed for the off-grid component is based on an extensive review of DRD's current off-grid program, and international experiences, as well as broad stakeholder consultations. Analysis of the Government's existing off-grid program and the enabling environment shows that: (i) the current government-led, subsidy-driven off-grid electrification framework is not sustainable; and (ii) the current constraints for sustainable scale-up of off-grid electrification – such as the weak banking sector and the virtual lack of micro-credit culture and infrastructure – may ease over the medium-term, thus allowing a progressive shift to a more sustainable and largely commercially-oriented off-grid market.

[25] Currently, ESE and YSEB serve about 2.9 million consumers and the proposed project will add about 0.75 million household connections by 2020.

77. The proposed off-grid component includes parallel and complementary IDA and IFC support. In Phase 1, the sustainability-focused IDA support will target populations in the remote, low-income areas which often face special social and ethnic challenges. These comprise primarily Chin, Kachin, Kayin, Shan, Rakhine, Taninthayi and Sagaing States/ Regions. The IFC-led commercially-focused *Lighting Myanmar* program serves more commercially viable areas of central Myanmar. Phase 2 involves a nationwide commercial-oriented approach for off-grid electrification. Given the weak state of the financial sector in Myanmar and rapidly changing institutional and political environment, it is necessary to allow flexibility in time for transition from Phase 1 to Phase 2. Nevertheless, the Project will start building foundations for Phase 2 from its outset through TA support to the Government and close collaboration with the WBG assistance to financial institutions which aims to improve access to financing (for consumers and suppliers alike) and address institutional weaknesses in the financial sector which are the main hurdles for development of commercially viable off-grid electrification market.

78. With a focus to improve sustainability, the IDA support will: (i) expand off-grid target areas based on the geospatial, least-cost electrification plan; (ii) set and enforce quality standards; (iii) build capabilities of companies, train staff, and require them to adhere to good practices; (iv) provide strong management oversight to ensure that consumers obtain good quality products and responsive services; (v) begin the transition to a more commercially oriented model; and (vi) require consumers to contribute to the cost of off-grid electrification services and enhance affordability by buying down the remaining cost with grants from DRD and IDA.

79. The complementary IFC Lighting Myanmar Program is proposed to introduce a commercial approach in Central Myanmar where the market conditions are more appealing to the private sector. The geographic areas of the IDA-supported program and IFC-supported program, as well as the grid rollout, will be properly identified in line with the geospatial least cost electrification plan. There is a risk that subsidized systems under the IDA-supported program might be exploited and resold at the second-hand market. However, the potential for such 'leakage' to cause damage to the commercial market in Central Myanmar is rather limited due to the market size in border areas (much smaller than the central market) and market decoupling which makes systems/devices more likely to be resold in the higher-price border areas, i.e. in the proximity of their origin, rather than in the lower-price areas in central Myanmar. Furthermore, the IDA off-grid component includes the following risk mitigation measures to minimize the leakage: (i) IDA funds will be disbursed only upon installation and verification of the services delivered in line with requirements; and (ii) self-policing by the Village Electrification Committees (for example, households reported with leakage would be no longer eligible for other public support and their villages would be negatively affected under other development assistance programs).

C. Financial Management

80. Each PMO will include finance staff with qualification and experience acceptable to IDA. The MOEP PMO's finance staff are expected to come from the distribution utilities. These arrangements will allow financial management support to be effectively targeted. The PMOs will manage finances centrally for their respective components. The flow of funds will align with implementation arrangements as detailed in Annex 3. The MOEP PMO will facilitate and liaise with the distribution utilities to manage finances for grid extension activities including payments, accounting recordings and reporting. The DRD PMO will liaise with participating States/Regions

to manage finances for off-grid electrification activities including payment, accounting recording and reporting.

81. The overall financial management risk is substantial. The main risks that will need to be addressed are: i) inadequate documentation of policies and procedures (although the systems of internal control themselves are reasonably strong); ii) lack of experience in managing and implementing donor-funded projects; iii) all financial management recording and reporting are manually carried out, which are prone to errors and delays; and iv) likely delays in submission of financial reports.

82. To mitigate these risks, the Government, with World Bank support, will: (i) ensure each PMO has targeted support; (ii) identify financial staff with qualifications and experience acceptable to IDA; (iii) provide timely training to staff prior to start of implementation; (iv) ensure the Project Operation Manuals fully document agreed procedures and guidance on all financial management arrangements; (v) recruit a qualified financial management consultant to support the finance staff within each PMO, particularly during initial implementation; and (vi) have the Office of the Auditor General of the Union conduct an annual, independent external audit of project financial statements.

83. The financial management arrangements will be deemed acceptable and meet the requirements of OP 10.00 when the proposed mitigation measures have been implemented.

D. Procurement

84. MOEP's PMO will manage procurement activities for grid extension goods and materials under Component 1 and related TA under Component 3. The distribution utilities will provide technical inputs and manage ensuing contracts. DRD's PMO will manage procurement activities under Component 2, in close cooperation with sub-national bodies, and directly procure off-grid TA activities under Component 3.

85. The Project's overall procurement risk is high. An initial assessment of procuring entities in December 2014 found no centralized procurement legal framework. Apart from a general arrangement to exercise open competitive tendering as a default method, MOEP and MLFRD have delegated powers to make their own arrangements. Both Ministries lack comprehensive procurement procedures, procurement expertise and staff with experience in World Bank procurement guidelines and procedures. Detailed assessments of markets and implementing agency capacity have been carried out during appraisal and risk mitigation measures agreed with Government. These will include requirements that both PMOs have staff with knowledge of Bank or international procurement expertise, the Bank will train PMO staff, and Bank Procurement and Consultant Guidelines will apply to all procurement activities.

E. Social (including safeguards and gender)

86. Project benefits include: reduced costs of electricity (e.g. by reducing connection costs); enhanced well-being by providing electricity for lighting and other household needs, street lighting, telecommunications and entertainment; improved cooking practices and indoor environment (through reduced use of charcoal and firewood for cooking); and enhanced income-generation opportunities and productivity. To maximize developmental impacts, both the grid and

off-grid components will target connections for health clinics and schools, and areas with low-income or vulnerable to exclusion. The Project is expected to improve the participation of community members in decision-making processes concerning electricity provision and strengthen the capacity of village committees.

87. The Poverty and Social Impact Assessment (PSIA) conducted in two phases (February to June 2014, and January to April 2015) has informed the Project design. The PSIA assessed the key issues and constraints concerning electricity access (barriers to access in rural and urban areas and for low-income and marginalized households in particular), electricity uses, service quality, tariff affordability, and consumer understanding of these tariffs and related maintenance and other charges. The PSIA highlighted in particular: (i) the importance of subsidizing connections to villages/communities as the high cost of these connections constitute one of the key barriers to access to electricity in rural areas; and (ii) the importance of off-grid solutions for more remote areas and communities further away from the grid infrastructure. The analysis conducted under the PSIA will further inform future tariff structures and subsidy schemes for the power sector.

88. The PSIA reviewed the current Self-Reliant Electrification (SRE) process to assess community level decision making practices (including gender and ethnicity issues), the distribution of benefits during village electrification and risk of exclusion of vulnerable and marginalized households (including female-headed households). Data on the membership of VECs, issues of exclusion based on income, gender and ethnicity collected by the PSIA will be used to support the implementation of grid and off-grid solutions at local level (including the capacity building activities targeting township level officials, the preparation of village level electrification plans and the preparation of safeguard instruments).

Gender

89. The PSIA included separate consultations with men and women and key informants interviews were undertaken with vulnerable and marginalized households, including female-headed households. For the implementation of household questionnaires researchers ensured the presence of both male and female household members to collect data on uses of electricity, assessment of quality, demand and affordability. Female respondents highlighted challenges with the quality of electricity supply which meant that firewood (and charcoal in poorer urban wards) remained the primary source of fuel for cooking. There was high demand among female respondents for electricity supply that would allow them to use electric rice-cookers and reduce the amount of time (and money) spent on fire-wood collection. In addition, access to electric water pumps and access to lighting in the evenings so that children could more easily complete school work was also frequently mentioned by women. Vulnerable and marginalized households interviewed, including female headed households, had systematically no access to electricity and spent a significant amount of their income on candles, kerosene for lighting. Overall, the key barrier to access among these households was: (i) the high costs of the connection to the village or urban ward itself; and (ii) the cost of connection/electricity installation to the home. The Project's design takes into account these constraints by putting in place a mechanism to subsidize village/ward connections and by seeking to reduce the connection costs for households. Finally, women were found to be systematically excluded from participating in VECs. Training for District and Township officials will include topics such as village committee membership and the importance of gender balance therein.

90. The PSIA has pointed out some of the key gender issues in electrification, and has influenced Project design to reduce social inequalities by considering the affordability of wide range of people in both grid and off-grid areas including vulnerable, low-income and female-headed households. Electricity provides great contribution in enhancing women's participation in economic, social and political life especially at the local level. It also can contribute to enhance community safety, literacy and other social programs.

91. To mainstream gender aspects, the Project will: (i) integrate gender aspects in the preparation of subprojects; (ii) integrate gender aspects in the project public consultations; (iii) improve gender knowledge; (iv) enhance women's participation in village committees; and (v) strengthen data and research on gender. The baseline survey and the impact evaluation of grid and off-grid electrification activities will also integrate gender aspects. Monitoring and evaluation will pay close attention to vulnerable women and female-headed households, and how electricity has contributed to or enabled women to participate more in economic, social and political life.

Safeguards

92. The PSIA also assessed potential social impacts and risks in accordance with World Bank safeguard policies (OP 4.01, 4.10 and 4.12), and informed preparation of the Project's Environmental and Social Management Framework (ESMF). This part of the PSIA and ESMF preparation included consultations with 360 stakeholders from the private sector, government at state/region, district, and township levels, CSOs (international, national and local), ethnic minority organizations, and local communities. The PSIA and project consultations/field visits included ethnic minority communities in Chin, Shan, Mon, Rakhine, and Kayin States.

93. The Project triggers Indigenous Peoples (OP 4.10) and Involuntary Resettlement (OP 4.12) safeguard policies. Ethnic minorities covered by OP 4.10 are present in most areas of Myanmar, but concentrated in the Kayah, Kayin, Kachin, Chin, Mon, Rakhine, and Shan States. Ethnic minorities would benefit from Project activities as described above, however, the Project also presents risks and challenges to ensure that ethnic minorities benefit from electrification activities. In some conflict or post-conflict areas, ethnic minority organizations provide independent social services and community infrastructure. To mitigate such risks the Project includes a community engagement process and an Indigenous Peoples Planning Framework (embedded in the ESMF) with a screening and consultation process.

94. Using a least-cost approach, the Project has identified initial target areas for both the grid and off-grid components. Based on the initial lists, MOEP and MLFRD will identify priority investments needed. In addition to the least cost principle, the proposed priorities at the local level will take into account other criteria, such as imminent risk of power shortage and potential congestion of the upstream substation in supplying more residential customers, and environmental and social criteria such as the presence of health and education facilities, affordability and the inclusion of ethnic minorities, vulnerable and poor people through explicit selection criteria. The priority investments will be aggregated at the Union level after consultations with the local authorities to ensure a strong support and ownership of the electrification program at all levels. Off-grid subprojects will be demand-driven and will only take place where community members wish and support such subprojects, which will involve some upfront cash contributions, agreement to receive training and willingness to take responsibility for O&M. Criteria for selecting

participating villages will also involve equity concerns among different types of infrastructure projects with government support (i.e. one village receiving roads this year may not receive support for electrification or water supply), etc. The ESMF describes these selection criteria and the Project Operation Manuals will provide additional details.

95. The type of investments supported by the Project generally have small footprints, normally follow existing right-of-way, and flexibility in terms of specific location to avoid land acquisition. However, some land acquisition or loss of assets such as trees and standing crops, cannot be ruled out, for instance in relation to expansion of existing and construction of new MV substations, new MV and LV lines, and mini-hydro systems.

96. Since specific project sites will not be identified during project preparation, specific safeguard impacts cannot be determined until project implementation. For this reason, the Project adopts an ESMF which screens for and addresses safeguard issues for specific investments and subprojects. The ESMF includes an Indigenous Peoples Planning Framework and a Resettlement Policy Framework to address OP 4.10 and 4.12 requirements, respectively, with provisions for preparing site-specific Resettlement Plans and Indigenous Peoples Plans as needed. The Project's TA component includes capacity building for safeguard and the ESMF includes a capacity building plan (see section VI.B below).

97. The Project will prioritize electrification for Thaton District, Mon State including villages near the power station being upgraded through the IDA-supported Myanmar Electric Power Project. The upgrade is scheduled to be completed by the end of 2017. Electrification planning in the area will only be prepared during implementation once the power station has been upgraded, including the development of an Indigenous Peoples Plan following the requirements of the ESMF and its Indigenous Peoples Planning Framework.

98. The draft ESMF and PSIA were disclosed in-country in English and Myanmar language on May 5, 2015 (on MLFRD's website) and May 7, 2015 (on MOEP's website), and hard copies were available upon request at the ministries' offices. Public consultations on the draft ESMF took place in Mandalay, Taunggyi (Shan State), and Yangon on May 14, 16, and 18, 2015, respectively, and were attended by local, national and International NGOs and CSOs, and state and local government officials, etc.). The updated ESMF and PSIA were disclosed in-country and at the Bank's website on May 29, 2015.

F. Environment (including Safeguards)

Environmental safeguards

99. The Project triggers the Environmental Assessment (OP 4.01), Natural Habitats (OP 4.04), Physical Cultural Resources (OP 4.11), and Safety of Dams (OP 4.37) policies in addition to OP 4.12 and OP 4.10 discussed above. The project will invest substantially in grid roll-out through the purchase of equipment including for MV substations (expansion of existing substations and construction of new ones), MV/LV transformers, MV and LV lines, household connections, and off-grid systems, the latter including solar PV devices and systems, mini-hydro power, wind, diesel, and hybrid systems. The Project will work nation-wide but will be implemented in the form of local subprojects that are limited in size. Environmental impacts for grid extensions are related

to works at substations and the installation of power lines, which may require safe disposal of construction, old equipment and other waste and clearance of vegetation. Substations under the grid extension subprojects are small and impacts are expected to be limited. Off-grid investments could include systems based on solar, diesel generators, wind turbines and small-scale hydropower expected not to exceed 1 MW and which would only include small water diversion structures in line with requirements for small dams under OP4.37. Possible impacts related, for instance, to fuel usage and installation of turbines in water streams would require environmental control measures. Investments will not go beyond village level schemes (typically less than 1 MW) and potential impacts are expected to be limited. In view of this, the World Bank has classified the Project as Category B under OP4.01.

100. The ESMF as referred to in the Social section above presents procedures and measures to address OP 4.01, 4.04, 4.10, 4.11, 4.12 and 4.37. This ESMF provides for screening subproject applications to both assess significance of potential impacts (i.e. no impacts that could qualify for a Category A regime since such would not be in the anticipated scope of subprojects with IDA finance contributions of $40,000-50,000 on average per subproject and since capacity would not be present with implementing agencies to manage such impacts under the Project) and identify which safeguards instruments are required to further investigate potential impacts, identify mitigation measures, conduct consultations and prepare environmental management and monitoring requirements as needed. The ESMF for environmental impacts differentiates– depending on significance of potential impacts—for subprojects between full Environmental and Social Impact Assessment (ESIA), Environmental and Social Management Plan (ESMP) or application of the standardized Environmental Code of Practice. The ESMF includes the Environmental Code of Practice as an annex, presenting a standardized set of environmental control measures of construction and operation of subprojects for which all potential impacts are insignificant. The ESMF also includes procedures to monitor subprojects' compliance with the safeguards instruments.

101. The institutional capacity of MOEP and MLFRD is low for all aspects of the electrification program, including capacity to implement and monitor safeguard requirements. Capacity building at the state/regional/district/township levels is necessary as well, since they will have important roles in project implementation and monitoring. Currently, government offices at these levels have no capacity to coordinate electrification activities and have no experience concerning safeguards. Both the MOEP and DRD PMOs have assigned human resources for carrying out safeguard and operational standards-related activities at a national level. However, the background and experience of government staff is mostly focused on engineering and needs to be expanded to environmental and social management. Basic training on regulatory requirements, environmental and social impacts, environmental and social assessment and management has started during project preparation. This will be further extended to improve the capability of relevant Government engineers and experts in carrying out their responsibilities under the Project.

102. The PMO safeguard staff has received on-the-job training during the preparation of the ESMF from international and national safeguard consultants and Bank staff. The Project's TA component includes capacity building to implement the Bank's safeguard policies and the ESMF includes a capacity building plan. The capacity building will draw lessons from the on-going WBG projects including the Myanmar Electric Power Project (with MOEP) and Community-Driven

Development project (with DRD). In addition, experts will provide technical assistance to the PMOs in safeguard document preparation, review and monitoring.

103. For off-grid subprojects it is possible that private investors will initiate or participate in subproject development and implementation. The Bank safeguard policies, and the ESMF, will fully apply to these subprojects. IFC financing in the sector is not part of the IDA-financed Project and safeguards for IFC's proposed Lighting Myanmar program will therefore be addressed separately.

Greenhouse gas accounting

104. The Project will support the scale-up of low carbon energy through grid connections and renewable or hybrid energy for village-scale mini-grids and off-grid solar home systems to replace current fossil fuel sources of electricity and lighting including diesel and kerosene.

105. The Project's grid extension component will reduce greenhouse gas emissions by an estimated net total of 8.3 Mt CO_2e over 30 years (2016-2045), or 0.5 t CO_2e per household per year, compared to a scenario of continued diesel use in the absence of grid extension. This estimate is based on assumed: (i) 750,000 household connections by 2021; (ii) a minimum service level of 529 kWh/year per household[26]; (iii) gross emissions associated with additional grid connections of 84 kt CO_2e/year from generation and associated distribution loss[27]; and (iv) avoidance of diesel-based generator emissions of 10.8 Mt CO_2e over 30 years, which are assumed would occur without grid extension.

106. Project-supported solar home systems are estimated to avoid 1.5 Mt CO_2e over 10 years, or 0.4 t CO_2e/year per household. This assumes: (i) 460,925 households; (ii) 60 Watt-peak rated capacity of solar panels per household; (iii) 16.7% availability (equivalent to 4 hours of operation per day).

107. Mini-grid connections are projected to result in net greenhouse gas reductions of 0.2 Mt CO_2e over 15 years, or 0.6 t CO_2e per household per year. This assumes: (i) 31,418 households served by hydro-based mini-grids; and (ii) average household electricity consumption of 250 kWh/year. Given the foreseen small volume of diesel-based power generation under the off-grid component, and with the majority of renewable energy-based power generation capacity likely to result in a reduction of fuel consumption for power generation, net greenhouse gas emissions from diesel-based mini grids are expected to remain at insignificant levels over the Project's lifetime.

108. The Green Climate Fund and other instruments to finance greenhouse gas emission reductions are expected to become available during Project implementation to provide additional

[26] To assess the extent of the additional generating capacity required to achieve universal access, rural households are assumed to consume at least 250 kWh per year and urban households 500 kWh per year according to *Promoting Energy Access Projects under the Clean Development Mechanism* (World Bank 2011). Grid-based electricity for lighting, radio, TV and a rice cooker in Myanmar is estimated at 529 kWh/year/household.

[27] Grid-related emissions is based on a national grid emission factor of 0.196 t CO_2e/MWh reflecting the 2009-2011 energy source mix for power generation (primarily hydropower and natural gas). Though likely to change over the next 30 years, the emissions factor is assumed constant for this analysis.

financing support, particularly for the application of renewable energy technologies for electrification.

Table 3: Greenhouse gas impact over project lifetime

Component	Period of impact	Emissions avoided
Grid extension	2016-2045	8.3 Mt CO_2e
Solar home systems	2016-2025	1.4 Mt CO_2e
Mini-grid component	2016-2030	0.2 Mt CO_2e

Climate and disaster risk screening

109. The Project was screened to assess potential risks from climate change. The results suggest a moderate to high risk to the Project Development Objective. Potential risks relate to expected changes in precipitation causing increased frequency and intensity of floods and droughts. These two factors might damage or reduce the effectiveness of grid distribution and off-grid electrification infrastructure.

110. Temperatures in Myanmar have increased on average by about 0.08°C per decade since 1950, most notably in the northern and central regions. The temperature increase is projected to reach at least 0.4ºC across Myanmar by 2020, and up to 0.7ºC in the Yangon Delta region. The frequency of flooding events has increased mostly during the 6-month-long monsoon (rainy) season from May to October. Rainfall during the monsoon season totals more than 500 cm in upper Myanmar and over 250 cm in lower Myanmar and Yangon.[28]

111. Grid and off-grid power infrastructure generally has a long lifespan. The major risks for Project investments are: (i) flood-related physical damage to the distribution infrastructure and village-scale mini-grids; and (ii) reduced effectiveness of off-grid power supply due to floods or droughts. Sensitive technical design and implementation should mitigate these climate and disaster risks.

E. World Bank Grievance Redress

112. Communities and individuals who believe that they are adversely affected by a World Bank-supported project may submit complaints to existing project-level grievance redress mechanisms or the World Bank's Grievance Redress Service. The Grievance Redress Service ensures that complaints received are promptly reviewed in order to address project-related concerns. Project-affected communities and individuals may submit their complaint to the World Bank's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of World Bank non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service, visit

[28] Data from Myanmar's National Adaptation Plan of Action and World Bank Climate Portal.

http://www.worldbank.org/GRS. Information on how to submit complaints to the World Bank Inspection Panel is available at www.inspectionpanel.org.

Annex 1: Results Framework and Monitoring

Note: *For all indicators, the frequency of data collection is 6 months, and the data source is Project Progress Reports.*

Project Development Objective: to help increase access to electricity in Myanmar

Table A1-1: Project Development Objective Indicators

Indicator Name	Core	Unit of Measure	Base-line	Cumulative Target Values (Calendar years)						Responsibility of Data Collection[29]
				2016	2017	2018	2019	2020	2021	
1. People provided with electricity access by household connections.[30] Of which:	Core	Number	0	**200,000**	**859,000**	**1,790,000**	**3,179,000**	**4,653,000**	**6,210,000**	N/A
1.1. Grid	Core	Number	0	0	375,000	938,000	1,875,000	2,813,000	3,750,000	N/A
1.2. Off-grid/mini-grid–only renewable sources	Core	Number	0	198,000	476,500	826,000	1,242,000	1,724,000	2,282,500	N/A
1.3. Off-grid/mini-grid–Any sources except only renewable	Core	Number	0	2,000	7,500	26,000	62,000	115,500	177,500	N.A
1.4. Female beneficiaries[31]	Core	Number	0	103,000	445,000	927,000	1,646,000	2,410,000	3,216,000	N/A
2. Community electricity connections.[32] Of which:	Core	Number	0	**990**	**3,540**	**7,020**	**12,000**	**17,300**	**23,000**	N/A
2.1 Grid	Core	Number	0	0	1,160	2,900	5,800	8,700	11,600	MOEP PMO
2.2 Off-grid/mini-grid–only renewable sources	Core	Number	0	990	2,380	4,120	6,200	8,600	11,400	DRD PMO
3. Public lighting. Of which:	-	Number	0	**1,600**	**16,900**	**39,800**	**76,300**	**113,300**	**151,000**	N/A
3.1 Grid	-	Number	0	0	13,000	33,000	66,000	99,000	132,000	MOEP PMO
3.2 Off-grid/mini-grid	-	Number	0	1,600	3,900	6,800	10,300	14,300	19,000	DRD PMO

[29] 'N/A' denotes an indicator which does not require new data collection since it is derived from data shown in subsequent rows.
[30] The Project assumes five people/household as explained in footnote 15.
[31] The proportion of female beneficiaries is assumed to be practically equivalent to the national average (51.8%, based on the 2014 Census), given the large number and national distribution of grid and off-grid beneficiaries. The indicator is derived from the grid and off-grid beneficiaries (1.1, 1.2, and 1.3).
[32] Electricity services provided to health clinics, schools, community centers or other establishments that provide services to a larger pool of people than a household.

Table A1-2: Intermediate Results Indicators

Indicator Name	Core	Unit of Measure	Base-line	Cumulative Target Values (Calendar years)						Responsibility of Data Collection
				2016	2017	2018	2019	2020	2021	
Component 1: Grid extension										
4. Distribution lines constructed	Core	Kilometers	0	0	2,100	5,200	10,300	15,600	20,700	MOEP PMO
5. Transformers installed	-	kVA	0	0	77,000	193,000	386,000	579,000	772,000	MOEP PMO
6. Households connected to grid electricity	-	Number	0	0	75,000	187,500	375,000	562,500	750,000	MOEP PMO
7. Greenhouse gas reductions (grid)[33]	-	kt CO_2e	0	0	31	76	153	229	305	N/A
Component 2: Off-grid electrification										
8. Households served with solar	-	Number	0	39,600	95,200	165,200	248,400	344,800	456,500	DRD PMO
9. Households connect to mini-grid	-	Number	0	400	1,500	5,200	12,400	23,100	35,500	DRD PMO
10. Greenhouse gas reductions (solar home systems)[33]	-	kt CO_2e	0	16	40	69	104	144	190	N/A
Component 3: Technical Assistance and Project Management										
11. National Electrification Executive Secretariat adequately staffed and functional	-	Percent	0	100	100	100	100	100	100	MOEP and DRD PMOs
12. People trained[34] – Grid	-	Number	0	0	1,650	4,125	8,250	12,375	16,500	MOEP PMO
13. People trained[34] – Off-grid	-	Number	0	320	760	1,360	2,140	2,970	3,900	DRD PMO
Citizen Engagement[35]										
14. Villages or wards where at least one public consultation is held – Grid	-	Number	0	0	530	1,320	2,650	3,970	5,300	MOEP PMO
15. Villages where at least one public consultation is held – Off-grid	-	Number	0	320	740	1,330	2,090	2,890	3,800	DRD PMO

[33] Greenhouse gas reductions, expressed in metric kilotons of carbon dioxide equivalents over the lifetime of the infrastructure built under the project (assumed to be 30 years for distribution network and 15 years for solar home systems), are inferred from the number of households connected.
[34] Relevant government staff (at all levels including Union, Region/State, Township through to villages), village committee members as well as private sector individuals who receive at least one training pertaining to the Project.
[35] Public consultations will be conducted in all project villages.

Annex 2: Detailed Project Description

National Electrification Plan

1. **The Government is committed to achieving universal electricity access by 2030.** MOEP and MLFRD, with World Bank assistance, developed the National Electrification Plan. It aims to electrify 7.2 million households to achieve universal electricity access by 2030. The Plan calls for investments of $5.8 billion over the next 15 years to extend the distribution grid and electrify off-grid areas. Alongside this Plan, the Government has developed an Energy Master Plan for primary energy sources with ADB assistance, and Power Sector Master Plan for generation and transmission with JICA assistance.

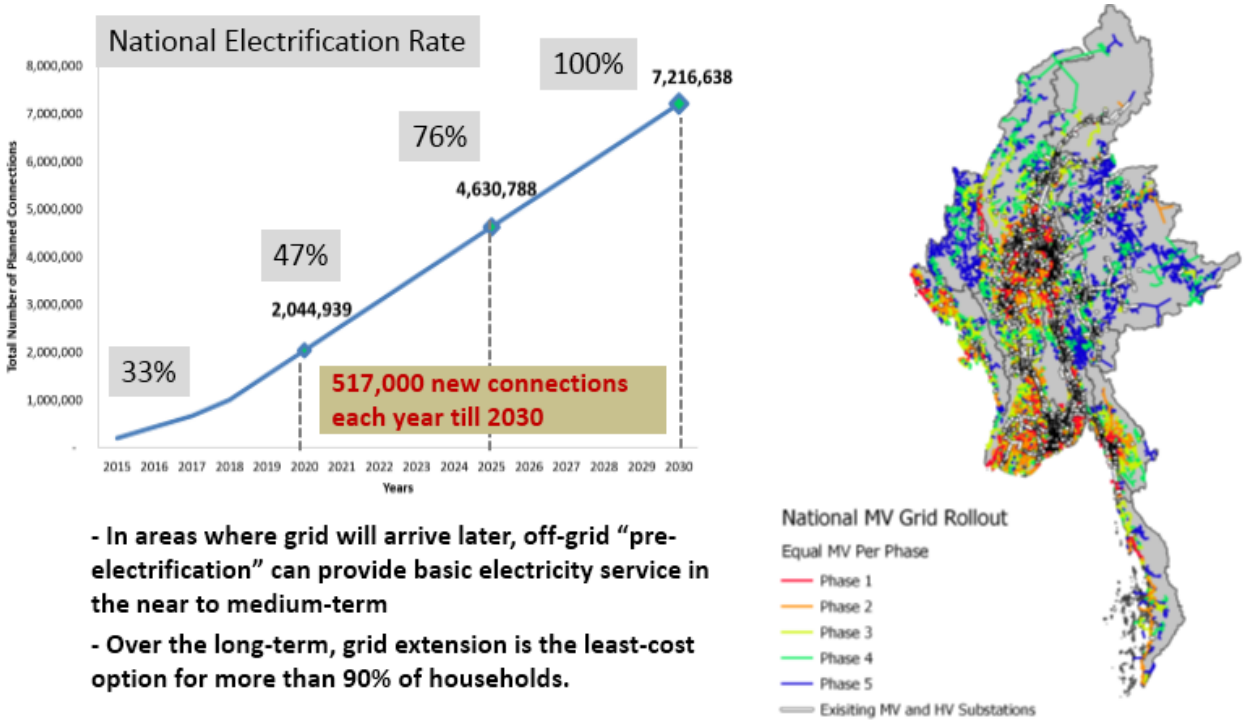
2. **The National Electrification Plan proposes a two-pronged approach based on complementary use of grid and off-grid solutions for electrification.** To achieve its objective in a timely and least-cost manner, the Plan proposes coordinated application of grid-rollout and off-grid (pre)electrification. The analysis under the Plan shows that the grid alone cannot achieve universal access to electricity in an optimal manner, particularly outside the central plains of Myanmar. For example, in Shan, Kayah and Chin states, settlements are sparse and the investment requirements for grid-rollout (per household) are much higher than in the central part of the country. Therefore, the off-grid program should proceed in parallel with the grid rollout focusing on villages which are unlikely to connect to the grid in the next 10 or more years.

3. **The Plan proposes a phased and segmented approach to ensure timeliness and accountability for grid rollout and off-grid programs.** Figure A2-1 shows the main phases and intermediate milestones for implementation of the Plan to 2030. The Plan will need regular updating and adjustments to reflect emerging new information (e.g., the recently completed population census) and the changing patterns in settlements, population and electricity demand. According to the Plan, the first five years of implementation require total investments and TA of about $700 million to electrify around 2 million households (or about 10 million people) by 2020.

4. **Implementation of the Plan will require sector reforms to overcome institutional and financing constraints**. It is unlikely that the existing sector institutions—in their current state—will have the capacity needed to implement the program efficiently and at sufficient speed. The 2014 Electricity Law creates the foundation for further sector reforms, including establishment of an electricity regulatory agency. In April 2015 the Government corporatized the distribution utilities for Yangon and Mandalay "to commercialize…in line with the system of market economy".[36] The corporatization and commercialization of distribution utilities will go a long way in overcoming institutional and financial constraints in the sector, and will help attract more private sector participation, including in the electrification program. The reforms expected in the financial sector are also important for the electrification program. Specifically, institutional strengthening in the currently weak financial sector would allow a transition from the current grant-funded off-grid program to a more commercialized and private sector-driven program.

[36]Notification No. 094/2015 dated March 30, 2015.

Figure A2-1: Overview of National Electrification Plan



5. **To build institutional capacity and implement sector reforms, the Government will need to sustain a long term commitment to the Plan**. A key step in this direction was the establishment of a National Electrification Executive Committee under the patronage of the Vice President, and chaired by Minister of MOEP and MLFRD. Through its permanent Secretariat, headed by Deputy Ministers of MOEP and MLFRD, the NEEC will guide the Plan implementation, ensure effective strategy and management, and coordinate development partner support. The NEEC Secretariat has established PMOs in MOEP and MLFRD, and is in the process of establishing counterpart staff at State/Region and District levels. The Plan estimates a need for $23.8 million of TA to support implementation and build institutional capacity over the next 5 years. Of this, the Project will provide $20 million.

6. **Financing and institutional development to implement the Plan requires close collaboration and support across Myanmar society, development partners, central and local governments, consumers, and the private sector.** Neither the Government, nor any single development organization, can fund implementation of the Plan alone. Concessional financing and grants from all sources for meeting investment and technical assistance needs are key to the viability and sustainability of the Plan.

Component 1: *Grid Extension*
(including Component 3(a) of TA related to grid extension)

7. The grid extension component will support the distribution utilities to extend distribution networks and connect communities and households to the national power grid, including through the provision of goods and materials for: (i) the expansion of existing medium voltage ("MV")

substations and construction of new MV substations, (ii) the construction of new MV lines, low voltage ("LV") lines and MV/LV transformers; and (iii) household and community connections, and public lights. IDA will finance the cost of goods and materials (transformers, poles, conductors, insulators, switchgear, materials, etc.) for this component. The utilities will support installation, with private (community level) contributions at a rate set by the Government, and possible private sector participation.

A. Current Situation[37]

8. The power distribution network in Myanmar comprises about 15,500 miles of MV lines, 14,000 miles of LV lines and 30,308 distribution transformers with a combined capacity of 7,452 MVA. The MV network uses a two-tier distribution system with the primary distribution at 33 kV and the 11 kV distribution feeders supplying MV/LV transformers. As of early 2015, about 86% of MV and 75% of LV network was operated by ESE, with the remainder operated by YESC. However, ESE accounts for only 53% of installed transformer capacity showing the low level of grid density outside Yangon Region. Furthermore, the average installed transformer capacity is only 2.1 kVA per consumer in ESE, which compares to 3.4 kVA per consumer in YESC. The average age of YESC's distribution network is more than twice the age of ESE's which was mostly developed in the last 10-15 years.

9. The number of existing household consumers served by ESE (1.88 million) and YESC (1.03 million) indicate an electrification rate of about 20% in the ESE and 65% in the YESC service areas. The average electricity consumption per residential connection in Yangon (2,011 kWh) was about twice the average consumption in ESE (953 kWh) in 2013/2014.

10. In spite of its comparatively unfavorable technical characteristics, ESE has made significant progress in reducing distribution losses from around 23% in FY2009 to 13.7% in FY2014. Last year alone, the losses were reduced by 3.2% through a strong focus on eradication of commercial losses. YESC also made progress in reducing distribution losses to about 15.6% in 2013/2014. While a significant room for reduction of commercial losses still exists, it will be increasingly difficult to continue the loss reduction program without significant investments to modernize the existing power distribution system, reduce overloading and improve the metering system.

11. The number of new connections have steadily increased from 90,000 to about 150,000 in ESE over the last five years. During this period, the number of new connections for YESC increased from 30,000 to 54,000. In 2014, however, the number of new connections showed a steep increase to about 204,000 in ESE and 76,000 in YESC, as electrification has become a Government priority.

B. Main Issues and Challenges

12. The main challenges facing the on-going grid roll-out include (i) adequacy of the power grid to meet incremental electricity demand in a reliable and sustainable manner; (ii) large investments required for the extension of the distribution networks; (iii) weak institutional capacity for O&M

[37] References to ESE in this Annex effectively include the Mandalay Region service area, since MESC had not yet been formed at the time of preparation, and separate data for Mandalay was not available.

of the fast expanding distribution system; and (iv) affordability of electricity services by final consumers, particularly in the poor rural areas.

13. **Adequacy of Power Grid**. Geospatial analysis carried out by the Earth Institute[38] estimates that about 80% of Myanmar's population lives within 50 km of the existing HV network. The planned expansion of the HV network is expected to increase the share of population living close to the power grid to more than 90% by 2030. This implies that MV distribution lines can cost-effectively reach almost all major settlements and more than 90% of the population by 2030. Therefore, the National Electrification Plan envisages the grid roll-out as the main vehicle for scaling-up access to electricity.

14. The new connections will add to the fast growing electricity demand. Assuming service levels of 1,000 kWh per household per year, the power grid will need about 2.5–3 GW of generation capacity to meet the incremental electricity demand of 7.2 million households which are expected to connect to the grid by 2030. This is equivalent to a doubling of the total current electricity demand (2.4 GW in 2014). This is less than a third of forecasted electricity demand in 2030 at 9.1 GW, according to the 'low case' scenario in the Power Sector Master Plan.[39] Clearly, a major expansion of the power generation and transmission system will be required to meet the fast growing electricity demand, including that from newly electrified consumers.

15. To ensure adequacy of the future power grid to provide reliable and sustainable service to all consumers, the proposed Project is integrated in the Government's program for power sector development outlined in the Power Sector Master Plan. The WBG is already contributing to the expansion of power generation system through its support for the upgrade of the gas-fired Thaton power plant under the Myanmar Electric Power Project. Furthermore, the WBG is considering support for new gas-fired and hydropower generation across the country, which would significantly contribute to the adequacy of power grid to meet future electricity demand.

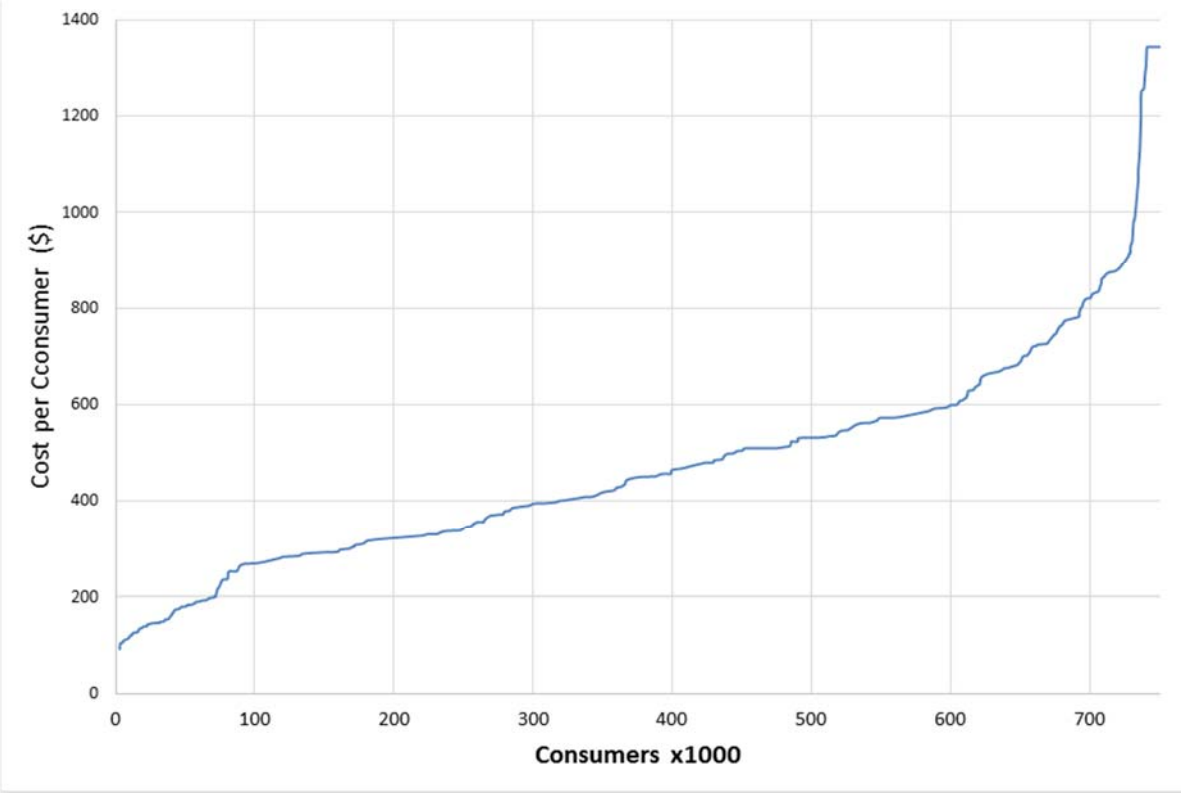
16. **Investments in power distribution and grid-based electrification**. The recent increase in the Government's support for investments in power distribution comes after many years of under-investments and cannot meet the ambitious targets set in the National Electrification Plan to achieve universal access by 2030. Over the last three years (2012-2014), capital expenditures in ESE increased from 40.7 billion Kyats to 55.8 billion Kyats (about $55 million) which led to an increase in the number of new household connections from 135,508 in 2012 to 200,817 in 2014. At the same time, YESC increased investments from 28.6 billion Kyats to 43.1 billion Kyats (about $43 million) connecting 57,227 households in 2012 and 73,412 households in 2014. At the current pace of grid-based electrification, it would take more than 26 years to reach universal access to electricity in Myanmar. Therefore, the Plan calls for doubling the rate of grid-based electrification in order to achieve universal electricity access by 2030.

17. One of the main barriers to grid-based electrification is large investment needs for MV and LV networks. The average cost per connection under the Project is estimated at about $500, though it varies significantly across the country. This cost includes the extension of MV (typically 11 kV)

[38] Myanmar National Electrification Plan: Least Cost Geospatial Electrification Planning Results, Earth Institute, Columbia University, 2014.
[39] The Project for Formulation of the National Electricity Master Plan in the Republic of the Union of Myanmar, JICA, 2014.

overhead line, step-down transformer (MV/LV), LV (0.4 kV) lines, service drop and electricity meter. It does not include the cost of internal (household) wiring. Depending on the distance from the existing grid, terrain and village density, large variations in the connection cost are possible, as illustrated in Figure A2-2 below.

Figure A2-2: Cost per consumer from meter to medium-voltage line



18. Due to the high connection cost and slow extension of the ESE and YESC distribution network, the private sector, led by self-organized village committees, emerged as the driving force for the grid-based electrification in Myanmar. Committees are self-organized by relatively higher-income villagers willing to pay the cost and able to mobilize funding for village electrification. Committee responsibilities vary from village to village, but typically they include mobilization of financing from villagers and external sources, obtaining approval for project design from the relevant district utility, hiring contractors for construction, assisting the utilities to connect households and commissioning of the new distribution facilities. After commissioning, the distribution assets are transferred to the relevant distribution utility for O&M.

19. The connection cost is also a significant barrier for poor households even in villages which are already electrified. Currently, the connection cost includes (i) the electricity meter; (ii) service drop cable; and (iii) installation works. The charge is about 65,000 Kyat (about $65) for the analogue meter and 90,000 Kyat ($90) for the electronic meter. The service drop is charged based on the actual length and cable size/type, but on average it costs about $50 per household. The distribution utilities charge and collect the connection cost.

20. The Project will reduce the above barriers by financing extension of the grid. With IDA finance, the Government will procure goods and materials to construct MV and LV lines and connect households. This will buy down the overall connection cost and practically double the electrification rate from about 274,000 connections per year (2014) to at least 500,000 connections per year in 2020. This will require IDA investment for the construction of 7,100 miles of MV lines, 5,800 miles of LV lines and installation of 772 MVA of transformer capacity in more than 6,300 locations across the country. The total cost for the grid-based component of the proposed project is estimated at $375 million. The cost breakdown for the grid-based electrification component is shown in Table A2-1. IDA's $300 million Credit will finance only procurement and supply of goods and materials (transformers, poles, conductors, etc.). Installation and connection of IDA-financed goods and materials are estimated at $75 million, representing an average $100 'connection charge' for 750,000 households. The Government will determine the optimum amount that the utilities will charge customers for connection, and potential sources of finance for installation other than customer contributions. Possible sources of finance include: (i) Union budget (from sources other than the Project's IDA Credit); (ii) State/Region government funds; (iii) Customers; and (iv) Distribution utilities' funds from other sources (e.g. private equity).

Table A2-1: Cost breakdown of grid-based electrification ($ million)

Grid Components	Total Project cost	Material cost: financed with IDA credit	Installation cost: financed by other sources
1. MV Lines	138	111	27
2. Transformers (ML/LV)	126	100	26
3. LV Lines	49	39	10
4. Household Connections	62	50	12
Total Project Costs	375	300	75

21. MOEP and the distribution utilities will manage transport, storage and delivery to communities of IDA-financed goods and materials.[40] MOEP's Project Operations Manual will detail these responsibilities. The utilities will receive goods and materials at stores in corresponding States and Regions, and manage the distribution of materials to the installers. MOEP's PMO and the utilities have already demonstrated themselves capable of this, having operated stores to connect more consumers than under this Project. However, an international consultant hired under Component 3 will further strengthen their capacities in this area, including to handle connections of around 500,000 consumers per year.

22. **Operation and maintenance (O&M) of distribution system**. The distribution utilities (YESC, MESC and ESE) operate and maintain Myanmar's power distribution network. The grid extension under the Project will increase O&M costs, particularly for ESE. Underinvestment, low level of O&M expenditure, and suboptimal O&M practices, have resulted in poor system condition, poor reliability and high losses. Although over the last 5 years YESC increased O&M

[40] National and local governments will determine the amount of finance required to oversee installation, and seek its appropriation through usual budget processes. It is possible they will also charge a nominal fee for such service. The cost is expected to be minimal.

from about $4 to $10 per consumer per year, and ESE remained at about $7 per consumer per year, these figures are relatively low compared to international standards. The Project will provide TA to strengthen institutional capacity in the distribution sector, and ensure optimal organization and adequate level of O&M as the system expands, while developing power distribution at least cost.

23. The Project will provide comprehensive TA to MOEP and the distribution utilities to develop their institutions and build capacity in policy making, system planning, technical standards, procurement, financial management, project management, environmental and social safeguards, and M&E. Table A2-2 describes the main TA components.

Table A2-2: Technical assistance for the grid component (total $10m)

TA Component (cost estimate in $ million)	**Brief Description**
1. Policy making and regulations for rural electrification ($1m)	Support MOEP to develop policies and regulations for rural electrification, including design of "power to poor" scheme for electrification of poor households, corporatization and commercialization of the distribution sector and introduction of performance-based regulation in power distribution.
2. Geospatial Least Cost Planning for distribution system expansion ($1m)	Support MOEP PMO and subnational PMOs introduce and adopt least-cost geospatial planning for grid extension.
3. Development of technical standards and specifications ($1m)	Support MOEP PMO develop and adopt state-of-the-art technical standards, including a distribution grid code. Support the PMO to prepare standard technical specifications for key grid-extension components, including ML and LV distribution lines and transformers.
4. Procurement advisors ($0.5m)	Support MOEP PMO to procure goods, works and consultants for the Project, and build general procurement capacity in the utilities.
5. Financial management advisors ($0.5m)	Support MOEP PMO manage Project finances, and build general financial management capacity in the utilities, including billing and collection systems.
6. E&S safeguard advisors ($0.5m)	Support MOEP PMO implement Project safeguards instruments, and build the utilities' capacity to manage environmental and social impacts.
7. Project management and implementation support ($5m)	Support to MOEP PMO and the utilities in overall project management and implementation, including management of inventories of goods supplied for rural electrification, scheduling and commissioning of distribution assets and verification of results on the ground.
8. Monitoring and impact evaluation ($0.5m)	Support MOEP PMO to monitor, evaluate and report on progress in implementation, including evaluation of project impacts in newly electrified areas.

24. Revenue collection from newly electrified areas will stretch the already thin institutional capacity in the utilities to perform meter reading, billing and collections. In fact, the utilities already started outsourcing these functions to private sector operators under distribution franchises covering townships in more densely populated urban (and peri-urban) areas in Yangon, Mandalay and other cities. Therefore, the proposed project is expected to help improve the utilities' financial management systems and establish foundations for the development of a Management Information System which can be funded under subsequent phases of electrification activities.

25. The Project will support MOEP and distribution utilities to develop policies and regulations required to facilitate private sector participation including public private partnerships. Initially, this may take the form of concessions and management contracts for selected distribution areas, but it is expected that the commercialization and corporatization of distribution enterprises will lead to other forms of private sector participation. While such reforms will take time to prepare and implement, they are eventually the best way to strengthen sustainability of the distribution sector, increase its efficiency and improve operating performance.

26. **Poverty reduction and affordability of electricity services**. Access to electricity is important, not only to improve well-being (e.g., lighting, communications, entertainment), but also to reduce vulnerability to poverty by creating income-generating opportunities (e.g., in agriculture and services). However, affordability of electricity services by the poor is a major barrier to the achievement of these benefits of access to electricity.

27. As evident from experience in the neighboring countries (e.g., Lao PDR and Cambodia), connection charges of about $80 resulted in about 60% connection rates in the rural areas because about half of villagers could not afford such charges. However, they can afford to spend about $5-10 for kerosene and candles a month. In Lao PDR, a "Power to the Poor" (P2P) scheme was introduced for the poor who could not afford the initial connection charge, by providing an interest free loan (payable up to 5 years) and for at least two years after the village electrification, to finance the connection charge and internal household wiring. This helped increase access to another 20-30% of the poor consumers, bringing the electrification rates to around 90% in 2-3 years after the village electrification.

28. The proposed project will build on this positive experience and help MOEP develop and introduce P2P scheme in Myanmar. The main elements of P2P scheme will be designed drawing on the TA component and piloted under the project. Subject to its successful verification, the P2P scheme will be rolled-out to help achieve universal access to electricity in villages included in the Project.

Component 2: *Off-grid Electrification*
(including Component 3(b) of TA related to off-grid)

29. The off-grid electrification component targets communities in areas located far beyond the existing national grid and unlikely to receive grid access in the next 10 or more years, and where private sector is not active due to relatively high operating costs and low ability to pay. IDA finance will cover partial costs of goods and services for: (i) solar photovoltaic devices or systems for a target of 456,500 households; (ii) mini-grids to serve some 35,500 households; (iii) electricity connections for 11,400 health clinics, schools and other community buildings; and (iv) installation

of 19,000 public street lights. Villages, and the Government (with grant finance from other sources), will share the balance of related costs. IDA finance will disburse after installation and required services are delivered and field-verified in accordance with criteria to be detailed in DRD's Project Operation Manual. Mini-grid and community electrification will be 'technology neutral' and may include solar PV, mini-hydropower, wind, diesel, or a hybrid (e.g. diesel and solar), depending on assessment of each community.

C. Current Situation

30. Approximately two-thirds of Myanmar's population have no access to the national grid and depend on limited services from private/communal supply, own generators, batteries or have no electricity services of any form. During the recent UNDP household survey (IHLCA-II)[41] carried out from 2009-2010, 15% of households reported that they purchase electricity from private suppliers, 5% use communal or private generator, and 7% use batteries for lighting. Some grid-connected users also resort to private (off-grid) supply to compensate the often unreliable and inadequate services by the national grid, although the exact number is unknown. Those with no electricity services mostly rely on candles, kerosene and diesel oil lamps for lighting.

31. In the off-grid space, there are many institutions responsible for policy and implementation. MOEP is responsible for issuing permits to private distribution service providers. From 2002 to 2013, it issued 21 permits, including isolated grids with power imported from Thailand, own diesel generators or hydro generation. In all but one case (a private company), the permit holders are township electrification committees. At the same time, many private or community service providers are known to be active with no permit. There seems to be no permit enforcement mechanism in place. ESE has constructed and operated 32 mini-hydro stations with a total installed capacity of 34 MW, mostly in the 1980s and 1990s, and recently transferred the ownership and responsibility for O&M to State/Region governments.

32. MLFRD, as chair of the Rural Electrification and Potable Water Resource Committee established in 2013 by Presidential Decree, is mandated to promote renewable energy for rural electrification and has received a sizable government budget to this effect. Since 2012, DRD has run an off-grid lighting program, giving away solar home systems to end users with a 100% subsidy. It supported 17,616 solar home systems in FY2013, 18,342 in FY2014 and 179,163 in FY2015, as well as more than one hundred mini-grids during the same period. The Government budget for FY2015 amounted to about $37 million, representing a ten-fold scale-up from previous years. The budget for FY2016 is expected to be around $36 million (36.298 billion Kyats).

33. The Ministry of Industry is responsible for promoting renewable energy and implemented a number of pilot renewable energy-based electrification projects with donor support before the transfer of its rural electrification mandate to MLFRD. It also owns a solar PV panel assembly plant. The Ministry of Science and Technology is responsible for technology transfer and capacity building and has a national training center for renewable energy. It has also built community-based and family-sized fixed dome-type biogas digester plants in nearly 200 villages, mainly in the

[41] The Integrated Household Living Conditions Assessment Survey II in Myanmar (IHLCA) included a nationwide representative sample of 18,660 households.

central region (Mandalay, Sagaing and Magway Regions), for cooking, lighting and other electricity uses.

34. Beyond DRD's lighting program, stakeholder consultations and field investigations revealed that the community organizations and private developers have played a significant role in installing numerous "self-help" electrification systems in rural areas. "Self-help" approaches are widespread, reaching thousands[42] of villages and hundreds of thousands of households. The technologies include pico-, micro- and mini-hydro[43], biomass gasification, diesel generator-based mini-grids, and solar home systems. These systems are usually financed by small entrepreneurs, township/village committees or the households themselves with almost no public financial or technical support, provide electricity for lights, entertainment and limited productive use equipment that the users would not have otherwise. However, power quality and reliability are generally low. Micro-hydropower turbines are typically manufactured in local metal shops or imported from China; biomass gasifiers are manufactured in Myanmar. Inexpensive solar electric equipment imported from China is widely available in the township markets in rural areas, though with no quality control. Self-installed solar home systems using these components are commonly seen in middle- and higher-income rural homes.[44]

35. The IHLCA-II survey and the World Bank's recent PSIA[45] indicate that a substantial number of (public electricity) households in Myanmar consume below the lifeline-tariff bloc (currently set at 100 kWh/month). In urban areas, 30% of households consumed 50 kWh/month or less and 66% consumed 100 kWh/month or less. In rural areas, 53% of households consumed 50 kWh/month or less and 88% consumed 100 kWh/month or less. Overall, current life-line tariffs at 35 Kyats/kWh are moderate and electricity remains affordable to most households which currently have access to the power grid. Only about 40% of the households in the PSIA-visited villages are connected, representing the relatively well-off part of the households.

36. In contrast, more than 50% of the off-grid hydropower beneficiaries consume less than 15 kWh per month, constraining power consumption to two or three light bulbs and occasionally TV. It costs about 2,000 Kyats per month on average, equivalent to nearly 60 kWh monthly consumption for national grid consumers.[46] Clearly, off-grid customers tend to pay significantly more for lower level of services than grid-connected users. This is particularly the case where off-grid service is provided by diesel-based generation which costs up to 600-700 Kyats/kWh or 20 times more than the life-line tariff for grid consumers.

37. Savings in household energy expenditures resulting from these off-grid systems are significant, as long as the mini-hydro or DRD-supported solar home systems remain functional. Prior to installation of the SHS, villagers in 20 households queried by the field investigation team paid

[42] Comprehensive data on deployment of "self-help" off-grid rural electrification is lacking. The estimate of "thousands" is from knowledgeable Myanmar individuals who travel frequently to rural sites.
[43] ADB guidelines define the size thresholds for hydropower systems typically used for off-grid rural electrification as follows: 100-1,000 kW for mini-, 5-99 kW for micro- and up to 5 kW for pico-hydropower plants.
[44] For detailed outcome of consultations and field investigations, see:
https://energypedia.info/wiki/Achieving_Universal_Access_to_Electricity_in_Myanmar
[45] The PSIA report can be found at:
https://energypedia.info/wiki/Achieving_Universal_Access_to_Electricity_in_Myanmar
[46] Based on field investigations of the mini-hydro sector in Myanmar, carried out by the World Bank, MOEP and MLFRD in November-December 2014.

between 2,600 and 50,000 kyat per month for non-heat energy, with an average expenditure of 13,400 Kyats/month for candles (about 100 Kyats per night), diesel/kerosene lamp oil (a 0.66 liter bottle costs about 700 Kyats and lasts 2-3 days). Diesel-based household generators or shared community diesel generators were particularly expensive. After installation of the solar home system, most households' non-fuel energy expenses were negligible. For mini-hydro users, a monthly average energy cost of 2,000 Kyats also means financial savings and better quality of lighting than before.

D. Issues and challenges in off-grid electrification

38. The needs for off-grid electrification are large. It is estimated that under the least-cost electrification plan, about 5.5 million households will remain without grid electricity in 2020, with 1.3 million of them in the remote parts of Chin, Kachin, Kayin, Shan, Rakhine, Taninthayi and Sagaing states/regions. In addition, many of the existing off-grid systems would benefit from rehabilitation and technology upgrade at a modest cost in order to augment the quantity and quality of service.

39. The Government is committed to provide basic electricity services for lighting and information and communication technology (so-called 'pre-electrification')[47] in a sustainable, participatory manner to those households which will connect to the national grid only in the later phases of its extension. The affected households are likely to have lower incomes and face higher operating costs to access electricity services given their remote locations, thus not favored by the private sector in absence of proper financial incentives. However, the Government's budgetary resources and limited technical and institutional capacity provide serious constraints. Achieving the ambitious goals set for off-grid electrification requires engaging a broader set of stakeholders, including multilateral/bilateral development organizations, financial institutions, private companies, local governments at the state/region/district/township level as well as village communities.

40. Myanmar has accumulated a significant amount of practical experience over the years which will help implement off-grid electrification, including:

a. **Involvement of local governments and communities in identification of priority villages and project implementation.** DRD has extensive staff presence in each state/region, district and township throughout the country. They work closely with local governments and township-level Development Committees in selection of villages through a consultative process, aggregating demands from lower levels, tendering and contracting private companies for service delivery if applicable and signing off payments based on field validation of installations.

b. **Local knowledge and a cadre of local practitioners specialized in various off-grid technologies:** along with the deployment of hundreds of thousands of solar home systems and thousands of mini-grids of various technology type, a cadre of home-grown entrepreneurs, project developers, service providers, technical specialists, shop owners and villagers have acquired hands-on experience in and exposure to technology, engineering

[47] This definition also aligns with tier-2 of the multi-tier access measurement framework that the UN Sustainable Energy for All initiative has endorsed.

design, project identification, planning and financing, as well as O&M. Partial knowledge of off-grid electrification technologies is widely dispersed in rural areas. Local practitioners consulted by the project team are eager to learn and improve their skills and capability with World Bank support.

41. In order for the Government to fulfill the ambitious off-grid commitment, a number of additional challenges need to be overcome, including:

a. **Untested business models:** DRD's lighting program and self-help systems use two polarized approaches (fully public or fully private sector-driven), neither of which are sustainable in the long term. The 100% give-away policy under the DRD program misses the opportunity to leverage other resources and is not conducive to creating ownership of the systems by users. Vague specifications and a price-capped tendering procedure do not lend themselves to obtaining the best products at the most competitive price. Systems installed under the existing DRD procurement program do not include provisions for maintenance and repairs. To the extent that maintenance and repairs occur, they are conducted in an ad hoc fashion by users themselves with little understanding of proper maintenance procedures. On the other hand, the self-help approach oftentimes leaves the poor behind, involves inefficient use of limited resources, and damages consumers' confidence in quality off-grid products. Both approaches hinder the market development in the long run.

b. **Lack of institutional capacity:** Since its inauguration, DRD's lighting program has focused on project implementation using government budgetary resources. The Project requires DRD to take on a strategic role in planning, coordination and policy-making functions in off-grid electrification. This alone is a daunting task and requires significant amount of capacity building. As it gears up for this, DRD would be too stretched to continue deeply involved in implementation, and would present a potential risk and conflict of interest. The institutional capacity of local governments and village committees are also lacking for off-grid electrification. Financial institutions in Myanmar are in a feeble state and have no appetite or existing capability in appraising or financing electrification projects.

c. **High cost of quality solar home system equipment and mini-grid systems relative to ability to pay of the users**: Despite the technology advance and related cost reduction in off-grid electrification technologies, the high capital costs of solar home and mini-grid systems are beyond the means of many rural households in the pre-grid electrification target areas. The ability of households to pay for solar equipment or mini-grid systems is better viewed through the lens of financed monthly payments for such systems no more than the monthly expenditures that the household currently pays for non-heat energy services. Provided that such consumer micro-financing is available (see point (e) below), a preliminary analysis shows that some poor households will not be able to make the estimated monthly payments for pre-grid electrification services (lighting and information and communication technologies) which are more than their current non-heat energy

spending.[48] In addition, currently, solar installation companies are largely based in Yangon with little sales and service presence in remote rural areas. To expand their business to village households in pre-grid electrification areas will incur additional operating costs, which increases costs to consumers.

d. **Lack of quality improvement and assurance for equipment and installations**: Suppliers have limited knowledge of, and access to, better quality products. Consumers do not have any information to differentiate good quality from poor quality. DRD staff and other implementing agencies do not have necessary knowledge and skills to inspect the performance of the systems and quality of installation. Local manufactures of mini-hydro equipment and certain solar components lack access to knowledge and technical assistance for improving quality and efficiency.

e. **Poor access to finance**: Companies installing off-grid systems lack investment capital and working capital including access to trade finance. Consumers have no access to financing for electrification which are considered as consumptive activities. Overall, Myanmar's banking sector is severely constrained, with limited products, services, and outreach. The sector is largely confined to fixed deposits and one-year fixed-rate loans with collateral requirements. While over 100 micro-finance license holders (of 236 licenses in total) are active in the country, they primarily focus on easier-to-access peri-urban and dry-zone areas. Myanmar's 2011 legal framework for microfinance institutions (MFIs) has several challenges, including limited differentiation between deposit and non-deposit MFIs, low capital requirements for deposit-taking institutions, and an interest rate ceiling of 30% per year.[49] Micro-finance for off-grid electricity systems is in embryonic stages with only one company, Proximity Designs, offering micro-financing in limited areas for solar lanterns.

f. **Lack of awareness of consumers**: there is general lack of consumer's awareness of government electrification plans, technology options, quality assurance, rights to obtain user training and warranty services. There is also lack of knowledge among villagers of their options when equipment breaks.

E. Proposed approach

42. The Project proposes a phased and segmented approach for off-grid electrification, which reflects the fact that: (i) the current government-led, subsidy-driven off-grid electrification framework in Myanmar is unsustainable; and (ii) existing constraints--such as the weak banking sector and the virtual lack of micro-credit culture and infrastructure--may ease over the medium-term, thus allowing a progressive shift and nationwide convergence to a more sustainable and largely commercially based off-grid market.

[48] See background paper titled "Are buy-down grants justified for Myanmar SHS and pico-solar products? If so, what level?", project file, last accessed April 10, 2015.

[49] IFC and the Consultative Group to Assist the Poor (CGAP) completed the first comprehensive publicly available assessment of the microfinance landscape in Myanmar since the enactment of country's microfinance law in late 2011. See Eric Duflos, Paul Luchtenburg, Li Ren, and Li Yan Chen. 2013. *Microfinance in Myanmar Sector Assessment*, IFC Advisory Services in East Asia and the Pacific, January. (cgap.org/publications/microfinance-myanmar-sector-assessment).

43. The phased approach will allow a transformation of the DRD's current wholly grant funded SHS and mini-grid program into a more sustainable program with better quality and larger scale to serve the most remote areas and those with social challenges, while IFC takes the lead in fostering a commercial market in Central Myanmar in Phase 1, and eventually create a nationwide commercial-oriented model such as the Bangladesh IDCOL model in Phase 2.

44. The segmented approach will enable the private sector to play a significant role in bringing quality services to off-grid target population in Central plains of Myanmar where the market conditions are more conducive to the private sector, while ensuring that under-privileged populations in the most remote areas, and those with social challenges, receive basic electricity services through necessary public support. Segmentation of the target off-grid population allows the use of two different approaches in parallel and with little interference, maximizing the results on the ground.

45. The IDA portion of the off-grid component Phase 1 aims to improve the sustainability and expand penetration of modern electricity services in the most remote, low-income areas which also often face social challenges. It will: (i) expand off-grid target areas based on the geospatial, least-cost electrification plan; (ii) set and enforce quality standards; (iii) build capabilities of companies, train staff, and require them to adhere to good practices; (iv) provide strong management oversight to ensure that consumers obtain good quality products and responsive services; (v) begin the transition to a more commercially oriented model; (vi) adopt a community-driven approach such that consumers will elect to contribute to the cost of off-grid electrification services and choose the level of services; and (vii) enhance affordability by buying down the remaining cost with grants from DRD through IDA and other budget funding. DRD will disburse the IDA credit last, after verifying that the contractor has delivered the specified services. DRD's Project Operation Manual will detail the guidelines for verification.

46. The parallel, complementary initiative of the proposed IFC Lighting Myanmar Program in Phase 1 has a primary focus on off-grid solar services market development through solar devices and kits in central Myanmar, complementing the geographic focus of the grid and off-grid components of the IDA-financed Project. The scope of activities include: (i) market intelligence including consumer profiling and segmentation, service demands, willingness and ability to pay, etc.; (ii) quality assurance including products certification, enabling participation of Lighting Global quality assured products in price-competitive procurement, building local capacity to assure quality, and field performance testing; (iii) consumer awareness and education on selection and quality and acquisition channels of PV products as well as qualified service delivery agents; (iv) business to business (B2B) support, including targeted business development services, facilitating B2B connections, etc.; and (v) access to finance for the supply chain, including support to local distributors to assess working capital needs and access to financing, identifying solutions to provide funds to the MFI sector with potential future IFC/IDA funding and providing linkages on the potential pipeline to the MFI clients. The IFC program may also consider complementary support for mini-grid market development, including support on business models to get to scale (e.g. using telecom towers as a base for community power supply), geographic market intelligence identifying areas suitable for mini-grids scale up, as well as market intelligence on pricing/ regulations (working in parallel with the Government-led program).

Box A2-1: Myanmar Off-grid Electrification: the case for subsidies

There is a strong rationale for Government financial support for off grid electrification. The Government has committed to achieve universal access to electricity by 2030. The national electrification plan concluded that for consumers in remote dispersed communities, off-grid electrification options such as solar PV and mini-hydro mini-grids are the least cost solutions or enable electricity services sooner.

Increased electricity access in these remote regions supports equitable national development. Equity demands that the justification for subsidizing grid electrification is applied to off-grid electrification. That is, society-wide economic benefits significantly outweigh the costs – so long as off-grid electrification is the least economic cost option for realizing these benefits.

Access to electricity brings significant externality benefits. These include vastly improved lighting services, increased children's study time, enhanced women's empowerment, enhanced security especially for women and children; greater connectivity, greater national integration, and greater health benefits through switching from oil lamps and battery use. These benefits can only be unlocked if households can afford these off-grid electricity systems, which can only happen initially with subsidies in these remote regions due to market failures.

Despite off-grid electrification being economically justified, market failures prevent consumers in these communities from obtaining electricity services. These market failures include, low cash incomes, limited to no savings, high cost and risk of serving remote areas, private sector preferring to serve commercial markets in easier to access central areas, and lack of access to financing.

The proposed financing scheme for IDA-supported off-grid electrification in remote areas of Myanmar will ensure effectiveness, efficiency and sustainability by (i) offering consumers a choice of service levels; (ii) obtaining a share of costs from the users so they have a sense of ownership with a greater share from those demanding larger more expensive systems, (iii) gradually reducing grant subsidy levels, (iv) switching from grant subsidy to financing when the financing access is improved, (v) competitively selecting suppliers; (vi) enforcing quality and performance standards; and (vii) ensuring long term sustainability by supporting township level service centers.

In the absence of access to financing in Myanmar, the subsidy level was set by considering consumers ability to pay. The share of costs for consumers to bear is assumed to be about 10-20% on average in the first years of the project, and is expected to increase over time.[50]

Such subsidy shall be designed in a manner to leverage contributions from the communities and private sector, and not to crowd out greater private sector participation, in particular in Central Myanmar where the private sector is already active in electrification.

[50] Surveys found that households paid from $2.60 to $12 per month (average of $6.28) for fuel-based lighting. Off-grid households with TVs paid from $16-$50 per month (average $30.20, median $25) for lighting, TV and DVD. Empirical data suggests poor consumers have high discount rates (the IFC/CGAP study reports informal interest rates of 10-30%/month in rural areas). Assuming a poorer household wishes to recover its cost in 3 months they would be willing to pay about 15% of the cost of a small PV system (2 lights, cell phone charger), and assuming a non-poor household would recover its costs in 6 months, would be willing to pay about 30% towards a larger system that provides several lights, cell phone charging and TV viewing.

47. In the course of Project implementation, WBG and DRD will assess progress on a regular basis and make adjustments as appropriate toward the goals of electricity access, quality improvement of products and services, business maturity of the companies, and customer satisfaction, as well as lessons learnt from IFC's proposed Lighting Myanmar program. In due course, the WBG will also assess the suitability of MFIs to become on-lenders for off-grid electrification, and to identify partner MFIs willing and capable to serve customers in off-grid areas. The WBG will undertake due diligence to ensure that it can accept the Government's selection of an institution to act as a financial intermediary using the proceeds of a line of credit from the WBG. Assuming that market conditions are then suitable, and participating MFIs and credit institution selected, Phase 2 of the nationwide off-grid electrification component, on a commercial basis, will be launched, covering as many segments of the un-electrified population as possible. Given the weak state of the financial sector in Myanmar and rapidly changing institutional and political environment, it is necessary to allow flexibility in time for such transition from Phase 1 to Phase 2.

48. Phase 1 and Phase 2 together are expected to address the major challenges of off-grid electrification as Table A2-3 details. The measures will be taken in Phase 1 unless indicated otherwise.

Table A2-3: Off-grid component challenges and mitigation measures

Challenges	Mitigation Measures
1. Lack of awareness	• Promotional program • Training programs
2. Lack of access to financing	• Select and strengthen capacity of participating credit institution and MFIs (Phases 1 and 2) • Capitalize a credit line (Phase 2) • On-lend to: solar home system companies for working capital, mini-grids for investment, or MFIs for on-lending to SHS customers (Phase 2)
3. Untested business models	• Public-private partnership enterprise model with the ultimate goal of commercialization • Presence of multiple program partners ensures healthy competition (Phase 2) • Phased reduction of grants (Phases 1 and 2) • Training for program partners in enterprise and financial management
4. Lack of institutional capacity	• Institutional development grant • Long-term concessionary credit (Phase 2) • Staff training program
5. High cost of quality SHS equipment and mini-grids	• Capital buy-down grant • Concessionary credit facility (Phase 2) • Consumer in-kind or cash equity • Increased volume of business

Challenges	Mitigation Measures
6. Lack of quality assurance	• Technical Standards • Design assistance services • Quality control by the Program Manager • Training to Participant Organizations in good practices in design, installation and service

F. Description of IDA-supported off-grid activities

49. IDA support for off-grid electrification comprises: (a) $80 million for investment (Component 2); and (b) $10 million for TA (Component 3b). It targets less than half of the "very late to electrify" households in the remote villages as identified under the geospatial least-cost plan. Specifically, the investment seeks to serve approximately 492,000 households (456,500 with solar home devices/systems, and 35,500 with mini-grid connections), plus 11,000 rural public institutions (including schools, clinics and religious buildings), and 19,000 public street lights. The TA and advisory services will build the technical and business capacity of key government, private sector, and local development partners.

F.1 IDA-supported off-grid activities: investment component

50. **Mini-grids.** IDA finance of $7 million will support community micro-hydropower projects, as well as other technologies such as biomass, biogas, solar and wind. Hybrid systems that include a backup diesel generator are also eligible. Mini-grids up to 1 MW in capacity[51] are eligible for support under the program.

51. Mini-grids require certain site conditions (clustered housing, presence of nearby stream of sufficient water flow and head in case of mini-hydropower, opportunities for productive-use loads), more specialized engineering skills to deploy and cohesive community with effective village committee. Because these conditions are expected to be met in only a portion of villages, this analysis conservatively assumes that only 1% of households in the program will be served by mini-grids installed in the first year, rising to 10% in year six.

52. The average mini-grid cost is assumed to be $4,000/kW or $800 per household for an average load of 200 W per household.[52] It is expected to be co-financed by users and DRD budget from IDA and other sources. With available access to commercial financing in the future, the users' contribution would increase from the initial 20% to more than 50%, and the grant portion would decrease accordingly. DRD will cover the funding gap using IDA finance and Government budget from other sources.

53. **Solar devices/systems.** IDA finance of $53 million will support solar technologies assumed to include best available, price-competitive pico-photovoltaic units and solar kits up to large solar home systems of 100 watts peak (Wp). These can cater for basic needs (e.g. three light points, cell phone charging) up to larger systems that include the ability to power televisions for several hours, direct current (DC) fans and other small appliances. The most basic systems, or a combination of

[51] In hybrid mini-grids, capacity is defined as that of the largest contributing technology. For example, the capacity of a project with 600 kW solar array and two diesel generators each 450 kW is 2 x 450 kW = 900 kW.

[52] Costs of mini-grid schemes vary greatly by technology and may change over time. Detailed cost information will be available in the feasibility study.

systems, kits and devices for basic needs, are heavily subsidized to ensure universal access (equivalent in concept to lifeline tariffs for grid electricity customers), with larger systems requiring greater user contributions. In the first years, 99% of households are assumed to be served by SHS, with this portion declining to 90% by the fifth year as mini-grids ramp up. It is not the intention for the Project to develop SHS testing structure in Myanmar. Rather, the Project will develop technical specifications, taking into account certified products that are quality verified to *Lighting Global* standards, products approved and used in the World Bank-supported Bangladesh Rural Electrification and Renewable Energy Development Project, and products that are independently tested to be in compliance with relevant IEC specifications, etc. The list of approved products will be updated regularly, as is done in Bangladesh and in Lighting Global, as new systems and products become commercially available.

54. The assumed average cost per SHS of an average size of 50/60 Wp as a reference is $360. It is expected to be co-financed by users, DRD budget from IDA and other sources. With available access to commercial financing in the future, the users' contribution would increase from the initial 10% to more than 20%, and the grant portion would decrease accordingly. DRD will cover the funding gap using IDA finance and Government budget from other sources.

55. **The public institutions portion of the off-grid component** [IDA: $20 million] provides 100% IDA finance disbursed as grants for schools, clinics, religious buildings and street lighting to villages under the Project. For planning purposes, each affected village is assumed to have one school, one clinic, one religious building and five street lights. These systems will be solar or mini-grid-based depending on the technology selected for households of the concerned village, and will be acquired together with the residential systems in the same tender. DRD data for FY2015 suggests an average village size of 128 households. Costs and quantities of these systems are estimated in Table A2-4.

Table A2-4: Public institution equipment costs

Connection type	System quantity	Cost per system	Equipment cost
Total	**30,400**	**N/A**	**$20 million**
Schools	3,800	$1,000	$4 million
Religious buildings	3,800	$1,000	$4 million
Health clinics	3,800	$2,000	$8 million
Public (street) lights	19,000	$250	$5 million

F.2 IDA-supported off-grid activities: Technical Assistance and Project Management

56. TA and Project Management includes support for the Technical Support Unit (TSU) and local technical advisors (LTA), training for DRD, businesses, CSOs, and cost-sharing on pre-feasibility and feasibility studies. These activities address gaps in capacity that are crucial to fill to ensure the Project is successful in meeting its off-grid targets. The budget for this subcomponent is estimated at $10 million for the Project period. The scope of TA activities includes the following.

57. The Technical Support Unit (TSU) located at the Union level requires resident international expertise and short-term consultants for the following TSU activities:

a. Support preparation and implementation of Rural Electrification Law and policy and regulations related to renewable energy development;
b. Development of mini-grid/small-power producer regulatory framework including tariff-setting mechanism;
c. Capacity building/training to NEEC, local technical advisors, DRD, community VECs, Township Development Committee, financial institutions, local consultants, CSOs and participating renewable energy companies (cost-shared);
d. Geospatial electrification planning: update and new data collection;
e. Development of model contracts, specifications and procurement procedures;
f. Development/adaptation of technical specifications and service performance requirements for off-grid solar products/systems;
g. Approval of certified products including certification process for Myanmar-made products on a cost-sharing basis between the project and applicants;
h. Approval of participating companies (suppliers, installation companies, feasibility study consultants, etc.);
i. Cost-shared funding of feasibility and other studies;
j. TA for improving access to financing in order to provide investment and working capital loans to electrification service providers and micro-credits to consumers;
k. Outreach and information campaign to the public concerning how to benefit from the Project's off-grid component, how to identify quality products, and how to maintain and operate solar home systems;
l. TA to implement the Project's Environmental and Social Management Framework;
m. Monitoring and evaluation; and
n. Management support.

58. Local technical advisors operate at State/Region, District and Township levels, and receive training as required by TSU or other contracted training programs so that they can effectively provide:

a. Advisory services for technology options;
b. Guidance on designs and specifications;
c. Contracting and implementation support, including advice during contractor/product selection;
d. Management of the Environmental and Social Management Framework;
e. Installation inspection;
f. Support on O&M procedures and simple repairs; and
g. Cost-sharing, oversight and approval of feasibility and other studies, especially for mini-grids.

G. Description of proposed IFC-supported Lighting Myanmar program

59. The proposed IFC-supported Lighting Myanmar program aims to enable modern energy access to approximately 4 million people in Myanmar by 2020 through a market-based approach. Working with global and local companies, in collaboration with the Bank team and in consultation with appropriate Myanmar government agencies, Lighting Myanmar would address barriers to commercial delivery at scale of high quality solar energy services in Myanmar. The objective of

the program is to build a vibrant commercial market to deliver an ever-expanding array of solar energy devices and systems which are affordable across multiple segments of the Myanmar market on sustainable commercial terms. The proposed IFC-led project is envisioned as a key element of the National Electrification Plan, addressing the central Myanmar provinces where commercial enterprises are well suited to invest and build a commercial sustainable market.

60. The proposed Lighting Myanmar program would be based on feedback provided by private solar services and device companies who have been active, or are positioning themselves to enter, the Myanmar market, as well as IFC's assessment of the dynamics, market segments, and barriers to scaling currently in Myanmar. What IFC found was an organic private sector off-grid market defined by a substantial lead-acid battery sales and charging industry, complemented by a large informal solar panel market where price and size is the basis for competition. This market is constrained by a lack of consumer education and a distinct lack of quality indicators upon which consumers can differentiate products based on service and value. This results in poor quality product proliferating and a lack of credible brand-oriented competition. Systems are not optimized, resulting in poor performance, which limits demand and reduces consumer value.

61. The Lighting Myanmar program would respond to the market impediments directly, and complement the investments private firms are prepared to make in developing supply chains and selling quality products. Lighting Myanmar would be based on the WBG's portfolio of off-grid solar services market development programs (presently operated in more than 10 countries by World Bank and IFC teams through Lighting Africa and Lighting Asia) which are supported under the WBG Lighting Global program platform. The underpinning of this portfolio of country-based market support programs is Lighting Global's Quality Assurance framework which presently includes more than 50 Lighting Global Quality Verified products manufactured by more than 25 companies, and extends from single light point solar lanterns up to integrated solar kits of less than 100 watts which deliver a range of energy services through use of super-efficient direct current (DC) appliances. The Lighting Global quality assurance standards have now been adopted globally as the standard for off grid solar by the International Electrotechnical Commission (IEC).

62. The Lighting Myanmar program would operate as part of the global network of WBG off-grid solar services programs, supported by WBG's global management, expertise and knowledge. IFC would manage program operations directly with a small program team based in Yangon. The program design, to be refined during IFC's Pre-Implementation period, would be based on WBG experience under Lighting Global, and informed by IFC's market scoping work in Myanmar. The program would draw upon the following toolkit of market support activities, continuously recalibrated and adapted to changing market dynamics over an expected four year program life.

63. **Primary focus of the Lighting Myanmar Toolkit: Off-grid solar services market development through solar devices and kits, including:**

a. Market Intelligence

- Demonstrate the viability of the market to companies and investors through market intelligence research and reporting on market size and characteristics, consumer preferences and behavior, through testing of a variety of business models, and by leveraging information gained through the Bank-supported Project.

- Map multiple distribution channels.
- Identify potential market segments and geographies for off-grid solar services.
- Map the different market segments with substantial consumer profiling.
- Working with the Government and World Bank teams, disseminate grid extension information to inform the marketing strategies for off-grid solar products.

b. Quality Assurance

- Improve the enabling environment for the sector by developing a quality assurance market infrastructure by supporting the quality-assured certified products (recently expanded to plug and play systems up to 100W).
- Where the Government proceeds with its own program in outlying geographic regions of the country, work with them through the World Bank-financed program to ensure that procurement will utilize the Lighting Global Quality Assurance methodology.
- Together with the Government, explore the potential to set up an independent institution whose purpose it is to administer QA and potentially channel finance to MFIs or companies in the supply chain.
- In cooperation with Government, undertake market check testing to ensure that products deployed in the market perform according to promised performance consistent with the Lighting Global Quality Assurance protocol.

c. Consumer Awareness

- Educate consumers about quality products and how to acquire them.
- Focus on the framework of energy service delivery, including addressing local issues relating to PV size/ wattage for both the consumers and the retailors.
- Educate consumers and IFC clients about the economics of low quality systems (including two or three battery changes in a two year period) vs. a quality assured, guaranteed product.
- Conduct consumer education campaign to educate consumers about quality solar products versus other alternatives so that consumers understand the choices while procuring these products.
- Leverage promotional activities of quality verified product companies through integrated program/associate marketing campaigns.

d. Business-to-Business Support

- Support the scale up and replication of successful Myanmar solar services businesses by providing targeted business development services.
- Help catalyze development of effective distribution networks and product supply chains by facilitating B2B connections.
- Facilitate B2B interactions through hands-on engagement and support to locally active companies, acting as the market connective tissue and sector expert. This work will be complemented, as appropriate, with conferences, workshops and a dedicated web-platform.

64. **Access to finance for the supply chain.** A key impediment to the market's development is the lack of finance across the supply chain, including working capital debt for manufacturers, distributors and retailers. One response has been IFC's investment in the Responsibility Working Capital Debt Fund which addresses the need for short term working capital debt by global manufacturers. In order to complement this global facility, the IDA-financed Project would support the channeling of IDA Credit to financial intermediaries supporting companies operating in Myanmar and work with the local IFC investment team to work with local private financial institutions to develop financing products for local retailers and the distributors. This includes potential: (i) IFC parallel investment in MFIs; (ii) IFC parallel investment in Myanmar private financial intermediaries, including leasing companies and banks; and (iii) IFC parallel investment in solar service providers to enable consumer finance through a variety of models, including pay-as-you-go solar kits.

65. **Complementary support for mini-grid market development** will include work with developers to assess market for potential mini-grid options. This includes: (i) support on business models to get to scale ex. telecom tower as a base customer with community power; (ii) geographic market intelligence identifying areas suitable for mini-grids scale up; and (iii) market intelligence on pricing/ regulations (working in parallel with the Government led program).

66. **Next Steps for Lighting Myanmar.** Critical to the development of Lighting Myanmar will be getting comfort that the enabling environment in Myanmar will support private sector investment in the sector. Therefore, next steps to enable implementation of the program are as follows.

a. The Project clearly identifies the geographic region where private companies will be allowed to operate commercially without threat of government control or solar product subsidies.
b. IFC will enter into additional consultations with private companies to gauge their appetite for investment in the market in the conditions implied by the Plan. A key focus of the consultations will be the:
    - geographic focus of the Government's solar subsidy-based program;
    - envisaged subsidy levels and mechanisms; and
    - potential market risks associated with the Project and projected impacts.
c. Second stage market assessment upon which a Lighting Myanmar Implementation Plan will be developed, based on the toolkit and above principals.
d. Approval by IFC management of the Program Implementation Plan.
e. Appropriate level of donor support and private company commitments to enable implementation of Lighting Myanmar by an IFC team in Myanmar.

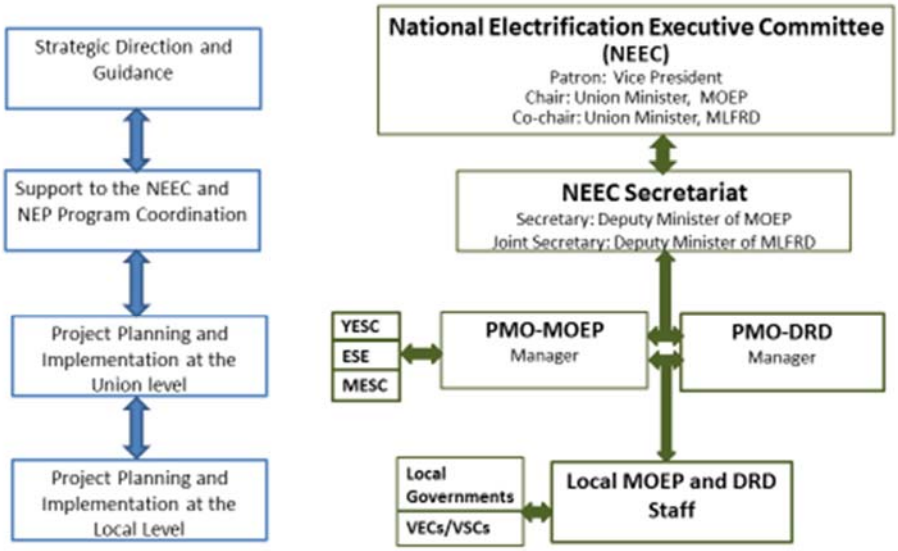
Annex 3: Implementation Arrangements

Project Institutional and Implementation Arrangements

Project administration mechanisms

1. MOEP and MLFRD are the two implementing agencies for the National Electrification Plan, and this Project, under the overall guidance of the National Electrification Executive Committee (NEEC). NEEC was established under the patronage of the Vice President, through Presidential decree on August 27, 2014. The Minister of Electric Power is Chair and Minister of Livestock, Fisheries and Rural Development is Co-Chair. The National Electrification Executive Secretariat, established in MOEP and MLFRD, oversees PMOs at the Union and local levels responsible for electrification activities including for this Project. Figure A3-1 shows the institutional implementation framework and responsibilities allocated to each level.

Figure A3-1: Institutional Framework for National Electrification Plan and Project



Grid component

2. The PMO in MOEP is responsible for implementing component 1 and the part of component 3 related to grid extension. It is under the direct supervision of the MOEP Deputy Minister and coordinates closely with the utilities, as well as local governments to develop prioritizing criteria for village selection, technical specifications, co-financing packages, bidding documents, and supervise contract execution. It will also monitor the installation by the village committees or the private sector to ensure quality and effectiveness. It will be adequately staffed with at least 18 full-time employees during the project life and assistance of national and international advisors on an as-needed basis.

3. For grid extension activities, the utilities (YESC, MESC and ESE) will be responsible for building, owning and managing new or rehabilitated MV lines and in some cases building the LV lines and household connections and otherwise providing technical support and quality control, inspecting and accepting the LV lines and households connections by the private sector.

4. The utilities will implement grid component works under the management of the MOEP PMO. The PMO in consultation with the utilities will be responsible for coordinating and establishing the scope of works and any modifications henceforth. The PMO will have the responsibility of project implementation supervision and financial management. It will be staffed with personnel from the utilities as well as hiring external staff to meet the requirements.

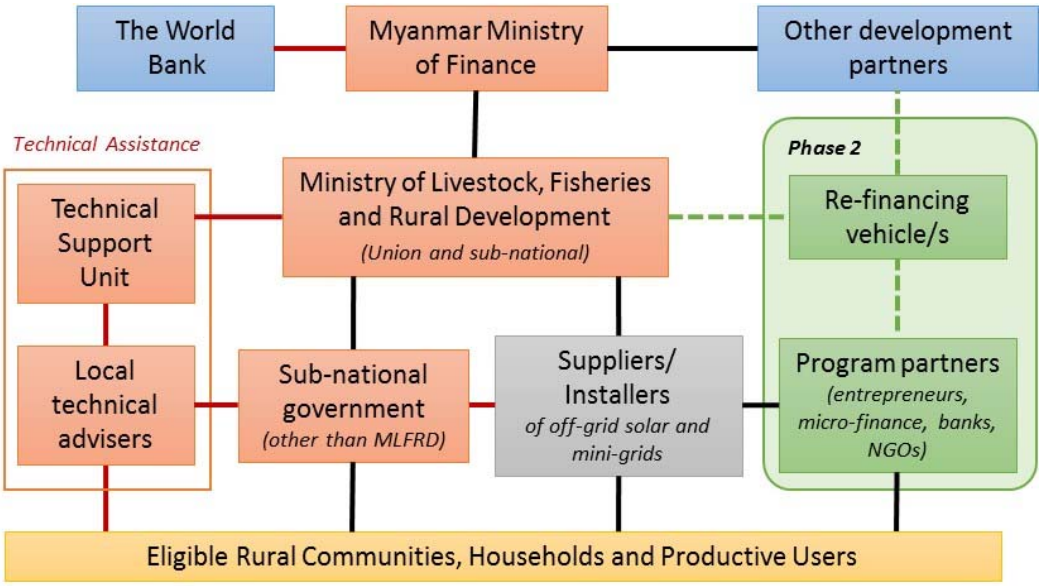
5. Once the lines and transformers are installed, they are handed over to the power distribution utilities, which are then responsible for O&M of the assets.

Off-grid component

6. The DRD PMO implements component 2 and part of component 3 related to off-grid electrification. It builds on the existing DRD lighting program, and will hire additional staff as its responsibility expands under the Project. As with the current practice, the PMO will engage local governments at the State/Region, District, and Township level through its local staff in selecting priority villages and ensure alignment of target villages with the national geospatial, least-cost electrification plan. A Technical Support Unit (TSU) will manage TA and capacity building for the public and private institutions involved.

7. Figure A3-2 shows the relationship between key organizations/partners and their roles and responsibilities as well as a transition between the proposed two phases for the off-grid component. Funding from IDA and other development partners flows to the MLFRD via the Ministry of Finance. In Phase 1, the funds are primarily used to complement end-user contributions, leveraging quality for solar home systems and mini-grids.

Figure A3-2: Myanmar Electrification Program Off-grid Component Design



8. **Technical Support Unit (TSU)** at the Union level with international and national expertise will provide technical backstopping to the local technical advisors, as well as support policy and regulatory development. The TSU will assist the financial sector to adopt or adapt mechanisms for consumer and supplier financing and provide trainings to improve their capacity to assess the credit-worthiness of off-grid electrification projects. For state DRD offices, the TSU will develop and disseminate streamlined contracting and procurement processes, support DRD in consumer information campaigns, M&E, and assist in program management. The TSU will assist private sector equipment suppliers and installation companies through capacity building and training on technical as well as business development topics.

9. **Local technical advisers:** The Project provides substantial TA to overcome limitations in access to knowledge and technology, inadequate capabilities of businesses and government, poor quality of products and services, and low consumer awareness. At the township and village level Local Technical Advisors (LTAs) comprise local CSOs and consultants collaborating with local governments (especially but not exclusively DRD staff). LTAs provide necessary guidance to village communities and townships in selecting and developing appropriate off-grid electrification solutions. Mini-grids require certain site conditions (clustered housing, presence of nearby stream of sufficient flow and head in case of hydropower, opportunities for productive-use loads), more specialized engineering skills to deploy, and cohesive community with an effective village committee. In the case of mini-grids, individual VECs have ownership and control of the development process with guidance from the LTA. The TSU/LTA share costs on pre-feasibility and feasibility studies from approved consultants as well as assistance in selecting approved contractors. Villages contribute labor and local materials as well as cash.

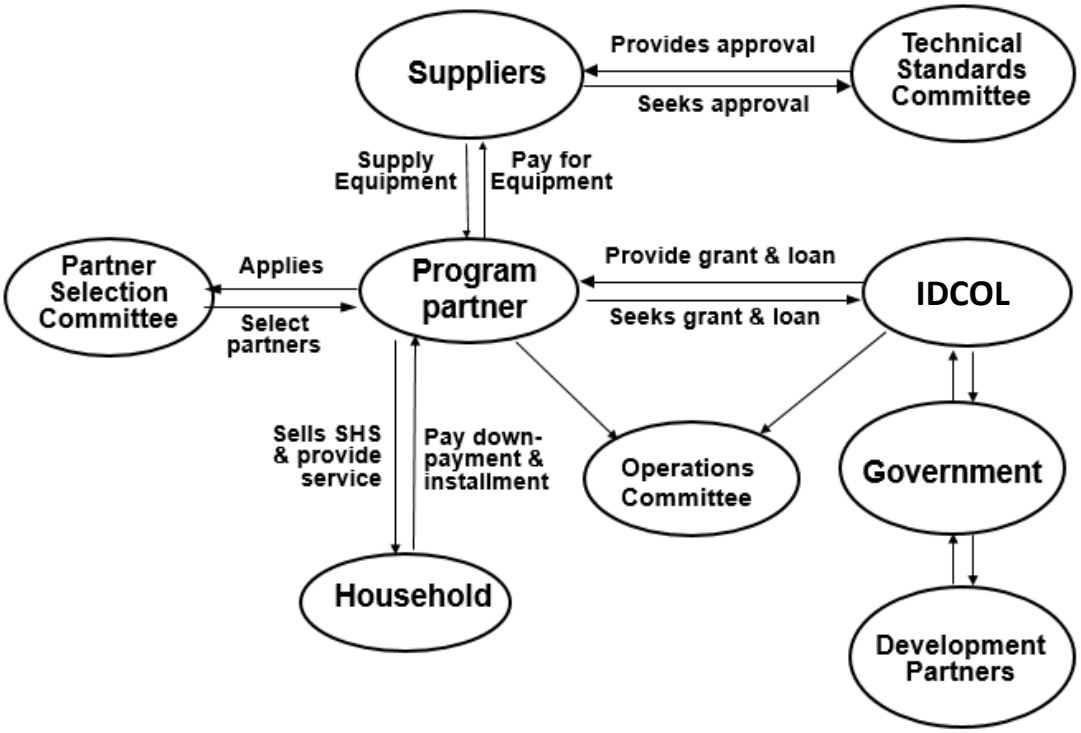
10. **Subnational Governments:** will work closely with local DRD staff in identifying priority villages, aggregating demands, participating in tender as applicable, and provide additional financing support to villagers.

11. **Suppliers and Installers:** At present, direct sales of individual solar devices/systems are not practical due to the remote location of targeted villages. Off-grid solar requests from multiple villages will be aggregated to a procurement process that DRD will carry out at Union level. The TSU/LTA provides expertise throughout the procurement process to ensure competitive and transparent selection of suppliers and supervision services to ensure that suppliers meet their contractual obligations including establishing a presence in the area to address future repairs.

Phase 2 of off-grid electrification

12. Phase 2 builds on successful global experiences with off-grid electrification, especially on Bangladesh's IDCOL model (illustrated in Figure A3-3), which the WBG consider a best practice sustainable financing structure for solar-based off-grid programs. The concrete model should be developed and designed in detail during project implementation in close cooperation with the Government.

Figure A3-3: IDCOL model for off grid electrification



13. Generally, key elements of the best practice include:

a. Public-private partnerships to implement a phased long-term national off-grid program at scale.
b. Existence of a strong commercially oriented, well-managed and well-capitalized Program Manager.
c. Delivering off-grid products and services through program partners that use quality products, offer effective services, honor warranties, adopt a competitive sales and service model, and follow responsible financial management practices.
d. Access to reasonably priced financing and availability of grant assistance to increase affordability and to ensure the program partners have adequate capital for investing and operating the off-grid service infrastructure, and consumers can pay for their off-grid investments over time.
e. Social acceptability and confidence in the program partners at the community level and the existence of a micro-credit culture in rural areas resulting in customer readiness to try the off-grid systems.
f. Risk sharing between the PM and program partners, proper customer selection and attention by both the Program Manager and the program partners to collection efficiencies.
g. The ability to achieve low costs through economies of scale, competitive procurement and competitive sales, and offering and honoring multi-year warranty for batteries and maintenance.

h. Customer training imparted by the program partners enabling the customers to carry out regular, simple maintenance work themselves to enhance reliability, availability and customer satisfaction – crucial requirement to ensure loans are repaid.
i. Sense of ownership by consumers resulting in proper system care.
j. Large customer base in relatively densely populated areas.
k. Setting technical standards and enforcing the standards through strong supervision and monitoring by the PM.

14. Flow of funds and the specific roles of the World Bank, donors, the Government, PM, program partners, suppliers and households are as follows:

a. World Bank/Donors: provide grant, concessionary loans and policy advice to the Government.
b. Government: provides grant and soft loans to the PM, credit institutions as well as policy support.
c. Program Manager: (i) identifies target areas for focus of SHS sales and mini-grids in line with the electrification plan; (ii) selects and qualifies program partners; (iii) provides grants to reduce SHS and mini-grid cost and for capacity building; (iv) provides training and promotional support; (v) monitors and oversees program partners to ensure that they adhere to program requirements, and that MFIs and other lenders comply with financial performance requirements.
d. Credit institutions: (i) refinance program partners' micro-credits to households; and (ii) finance mini-grid investments on slightly concessionary terms using credit line funds.
e. Program partners: (i) identify and pool potential customers or mini-grid opportunities in off-grid areas; (ii) install SHS or mini-grids; and (iii) provide after-sales services for SHS and management and operation of the mini-grids.
f. MFIs: extends micro-credit using own financing and refinancing by the credit institutions.
g. Suppliers: supply SHS and mini-grid equipment, as well as design and installation services that are in compliance with standards issued by the Technical Standards Committee under the program.

Financial Management, Disbursements and Procurement

Financial Management

15. The overall financial management risk is substantial. The main risks that will need to be addressed are: (i) inadequate documentation of policies and procedures (although the systems of internal control themselves are reasonably strong); (ii) inexperience of staff in managing and implementing donor funded projects; (iii) all financial management recording and reporting are manually carried out, which are prone to errors and delays; and (iv) likely delays in submission of financial reports.

16. These risks will be mitigated by: (i) setting up PMOs to ensure targeted support; (ii) identifying staff with qualifications and experience acceptable to IDA; (iii) provide timely training to staff prior to implementation; (iv) ensuring the Project Operation Manuals document fully agreed

procedures and guidance on all financial management arrangements; (v) recruiting a qualified financial management consultant to support the finance staff within the PMOs, particularly during initial project implementation phase; and (vi) have the Project financial statements subject to an independent external audit annually by the Office of the Auditor General of the Union.

17. The financial management arrangements will be deemed acceptable and meet the requirements of OP 10.00 when the proposed mitigation measures have been implemented.

18. **Staffing.** Each PMO will include finance staff with qualification and experience acceptable to IDA. The MOEP PMO's finance staff are expected to come from the utilities, seconded full time when Project implementation is fully underway. However their time may be split between PMO and their home agency at the initial stages since activities under the Project will be minimal. DRD is currently implementing a World Bank-financed CDD project, with support from an international accounting firm, and so has built some knowledge. There may however be the need to support the team with an additional local consultant for a period, given the coverage and size of the activities within this component. The seconded staff will be required to be a post-graduate, have attended at least three training sessions organized by the Union Auditor General. In addition, the Project will recruit a qualified financial consultant with international CPA to support and train PMO staff for at least one year and help them set up systems and train other staff.

19. **Budgeting.** The Government's current budgeting process appears to be adequate for Project budgeting purposes. Therefore, the Project will follow the existing Government budgeting system and timetable to obtain Parliamentary approval. The Government budget is prepared on a cash basis. Project budgeting and financial reporting will also be on a cash basis. The PMO's finance staff will ensure that the Project budget is communicated to their respective agencies for incorporation into their budget for purposes of seeking budget approval from Parliament.

20. Each PMO's approved annual budget will be broken down into six monthly budget allocations based on the timing envisaged for implementation of Project activities. In the subsequent financial reporting, explanations of variances between actual versus budgeted expenditure will be provided as part of the interim unaudited financial report each six months.

21. The budget for the initial period from Project effectiveness (expected December 2015) should be included in the Government budget for Fiscal Year 2015-16. The Government will review and if necessary revise the budget each six months through its supplementary budget process. MOEP and DRD will inform the World Bank prior to making or allowing to be made any change to the annual work plans and budgets. The Project Operation Manuals will detail budgeting process, and timing and review of execution.

22. **Accounting Policies and Procedures.** The Project will use the cash basis of accounting for preparation of interim unaudited financial reports and annual financial statements. The Project Operation Manuals will include agreed, appropriate accounting policies and financial reporting procedures. The financial management consultant will provide support and assist the PMOs to draft these. The consultant will review the current policies and procedures and the detailed systems of internal control and determine if the Project activities require any additional control measures. The Project Operation Manuals, including provisions for financial management, will be subject to review and acceptance by the World Bank and translation into the Myanmar language.

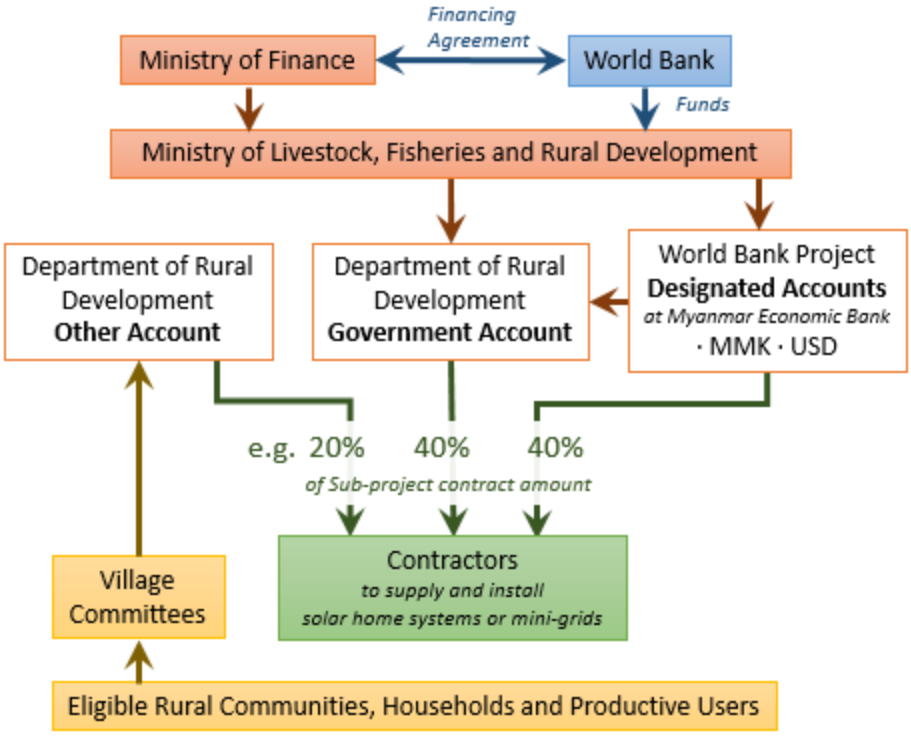
23. **Internal controls.** The Project will use the existing systems of internal control, which the Project Operation Manuals will document. Given the high level of soft expenditures expected, specific controls will be put in place for training, workshops, study tours, travel and accommodation, Controls over commitments and monitoring of work in progress will also be implemented. The Project Operation Manuals will detail policies and procedures for accounting, financial authorities and delegation levels, segregation of duties for incompatible functions, reconciliations and policies on safeguarding of assets.

24. **Fund flows.** The project will have four Designated Accounts: two for each PMO, in USD and Myanmar Kyat respectively. The Designated Accounts will be at the Myanmar Economic Bank to receive the project funds for their respective components. The World Bank will pay directly for all the internationally competitive bids (ICBs) and large packages of contracts at the Government's request, in particular large lump sum contracts and contracts designated in foreign currencies. In broad terms, the PMOs will centralize fund flows. In some cases under the DRD component, funds will be provided to States/Regions for some operating cost activities as outlined below, and which the Project Operation Manuals will further document.

25. **Fund flows for the grid extension component.** Under this component, the MOEP PMO, with the distribution utilities, will ensure that all activities are carried out in line with MOEP's Project Operation Manual. They will process request and make payments on their behalf upon the technical certification of completion of work by the distribution utilities. MOEP PMO will send quarterly financial reports to the distribution utilities and National Electrification Executive Committee. They will also prepare timely withdrawal applications and submit these to the Bank in line with the Disbursement Letter, submit project financial reports to the World Bank each six months, and submit annual financial statements for audit purposes. MOEP's Project Operation Manual will detail further arrangements.

26. Fund flows and disbursements for IDA support to the off-grid component is depicted in Figure A3-4 below. IDA financing for the off-grid component include two main categories, i.e. solar home systems and mini grids, and there is a wide range of products under each of the two categories – the former ranging from solar devices, kits and assembled systems; the latter including different technologies (mini-hydro, solar, biomass, etc.), different sizes in terms of kW capacity and different technical designs. *For solar home systems,* IDA will split with DRD the funding gap which is the difference between the total costs of delivering the system and users' cash contributions (about 10%). Part of the funding gap is due to the higher cost of delivering a system/product in remote areas than in Yangon. IDA funds will be used to finance such cost differential. The cost differential may vary from one system product to the other, but on average IDA's share of the funding gap is estimated to amount to about 40-45% of system cost at the beginning of the project implementation. The IDA share is expected to decrease over time as the demand in the remote areas increases and the cost differentials decrease. DRD will sign supply/service agreements with qualified suppliers, which will clearly state the 'funding gap' for different types of products. DRD's Project Operation Manual will indicate IDA's exact share of solar system cost.

Figure A3-4: Offgrid electrification component funds flow



27. For mini grids, the feasibility study and subsequently the supply/service agreement to be signed among DRD, village committee and qualified contractors will stipulate the design of the mini-grid, materials or parts required, installation and commissioning and financing plan. Similar to the solar systems, IDA will share with DRD funding gap under mini grid sub-component, and IDA's share may come to about 30-40% of the grid cost. DRD's Project Operation Manual, and the supply/service agreements, will specify IDA's exact share for each mini grid to be built.

28. Funds flow and disbursements are expected to follow closely the DRD funds flow for its own budget. DRD budget is already providing support to off-grid activities, and a large part of DRD budget is expected to be directed to project activities in the target areas on a cost-sharing basis. In line with this, the flow of funds for solar home systems and mini grids will be structured into three stages of payments including beneficiary contributions, as summarized here:

a. On meeting the criteria set for off-grid schemes in DRD's Project Operation Manual, there will be a contract (or supply/service agreement) between DRD, village committees (as applies to the mini-grids) and the contractor who will provide the services. The contract will stipulate exact financing amounts including the share of IDA finance.
b. Beneficiaries will make the first payment, from 10% to 20% of the contract amount. The amount will depend on the type of off-grid solution selected. DRD will open a separate bank account (i.e. 'Other Account') to receive beneficiaries' contributions. DRD will transfer the beneficiaries' contributions to contractors, as the first payment upon contract signing.

c. DRD will make the second payment from its budget using its current procedures. It will represent from 40% to 45% of contract amount, depending on type of off-grid solution. The second payment will be made to the contractors upon DRD's acceptance of goods/parts/equipment.
d. DRD will make the last and final payment after full installation of the system by the contractor, and inspection and validation by DRD or an independent third party. The DRD PMO will make the payment from IDA financing to the contractor. The payment will amount to 40% to 45% of contract amount, depending on the off-grid solution selected.

29. DRD's Operations Manual will further detail funds flow steps and documentation requirements.

30. **Financial Reporting.** Each PMO Manager will be responsible for all reporting, including financial reporting. Finance staff seconded to the PMOs will support the Managers, and accurately record all financial transactions in a timely manner in the Project's primary books. The finance staff will be responsible for preparing semi-annually unaudited interim financial statements for the whole project. Each PMO will submit unaudited interim financial statements to the Bank within 45 days after each six month period to which it relates. The PMOs will use Government existing manual records and accounting system to record the Project's financial transactions on a cash basis. Excel spreadsheet may also be used to aid the recording of transactions.

31. **Audit arrangements.** The Union Office of the Auditor General will be the external auditor of the Project based on Terms of Reference acceptable to the World Bank. The PMO Managers will agree Terms of Reference with the Office of the Auditor General within three months of Project effectiveness. The PMOs will submit audited financial statements and management letters to the World Bank no later than six months after each fiscal year. The World Bank Policy on Access to Information requires the audit report and audited financial statements to be publicly disclosed. The Ministries will disclose them on their websites.

32. The Project includes the agreed financial management actions in Table A3-1.

Table A3-1: Financial management actions

	Required Actions	**Responsible officer**	**Expected completion date**
1	Nominate and second qualified financial management staff from the distribution utilities to MOEP PMO	General Manager for accounts at the distribution utilities	December 1, 2015
2	Agree draft Terms of Reference for audit with the World Bank	PMO Managers	March 30, 2016
3	Review financial management components of Operations Manuals	PMO Managers	one month after effectiveness
4	Recruit international financial management consultant/s to support implementation	PMO Manager	June 30, 2016

	Required Actions	Responsible officer	Expected completion date
5	Recruit local financial management consultant/s to support implementation	PMO Manager	January 30, 2016
6	Agreed interim unaudited financial reports with the Bank	PMO Manager	45 days after the end of the covered period

Disbursements arrangements

33. **Allocation of IDA credit proceeds.** IDA finance includes taxes and disbursement categories will be as in table A3-2.

Table A3-2: IDA Finance Disbursement Categories

Disbursement Category	Financing Allocated ($ million)	Percentage of Expenditures to be Financed (inclusive of Taxes)
1. Goods for Components 1; and goods, consultants' services, non-consulting services, Training and Operating Costs for sub-component 3(a) of the Project.	310	100%
2. Goods, works, consultants' services, non-consulting services, Training and Operating Costs for Components 2 and 3(b) of the Project, including those financed through Sub-Financing if any.[53]	90	• 100% of Final Payment(s) under Component 2 • 100% of amount disbursed for Sub-Financing under Component 2 • 100% of Expenditures to be Financed under Component 3(b)
3. Emergency Expenditures for Component 4	0	100%
TOTAL AMOUNT	400	

34. Counterpart contributions of $167 million, including contributions from beneficiaries, will finance expenditures other than goods under component 1 (which IDA will finance) and the first and second payments under Component 2 for solar systems and mini grids.

35. Retroactive financing of up to $1.0 million (i.e. $500,000 each for MOEP and DRD parts) will be provided for payments made against Disbursement Categories 1 and 2 for expenditures to be incurred from August 4, 2015, to the signing date of the Project's Financing Agreement, provided that the expenditures are incurred in line with the Bank's relevant procurement guidelines.

36. The primary disbursement methods will be Advances and Direct Payments. Ceilings of advance will vary based on six-monthly forecasts of expenditures and cash needs for the components. Supporting documentation required for eligible expenditures paid from the Designed Accounts includes Summary Sheets with Records and Statement of Expenditures. Documentation of expenditures paid from the Designated Account shall be made monthly or for a period no longer

[53] Sub-Financing refers to the financing mechanism under the Project's Component 2 (off-grid).

than three months. Records such as invoice, receipts, etc. will be required to support Direct Payments. Reimbursement and Special Commitment disbursement methods will also be available. The Minimum Application Size for Reimbursements, Special Commitments and Direct Payments will be $50,000 equivalent.

37. The Project's Disbursement Deadline Date will be four months after the credit Closing Date. The Disbursement Deadline Date is the final date on which the World Bank will accept applications for withdrawal from the IDA credit Recipient or documentation on the use of this credit proceeds already advanced by the World Bank. The four-month 'grace period' is granted to permit orderly project completion and closure of the Credit account via submission of applications and supporting documentation, for expenditures incurred on or before the Closing Date. Expenditures incurred between the Closing Date and the Disbursement Deadline Date are not eligible for disbursement.

38. All documentation for expenditure submitted for disbursements will be retained by the PMOs, and made available to external auditors for their annual and interim audits, and to the World Bank and its representatives if requested.

Procurement

39. Procurable items under the project will include power distribution goods and materials (transformers, poles, conductors, insulators, switchgear, materials etc.) and technical assistance services for project management and planning studies among others. The Project will also support the financing of off grid electrification interventions for target communities.

40. The Project's procurement risk is high. The World Bank's December 2014 initial assessment in implementing entities identified the following major procurement risks which could arise during project implementation, and suggested appropriate measures to mitigate these risks.

a. **Lack of legal framework for public procurement.** Myanmar has no comprehensive written legal framework for public procurement. Existing rules include: (i) two instructions from the President's Office in 2011, one for change from "close tender" to "open tender" and another for decentralizing procurement to line ministries; (ii) a tender directive issued by the President's Office in April 2013 for addressing some issues in processing open tenders; and (iii) another directive issued by the President's Office in January 2014 for procurement of civil works. MOEP and MLFRD have no relevant written procedures. During project implementation, there may be confusion regarding procedures and rules to be followed. To address this risk, implementing agencies agree that the project shall strictly follow the World Bank Procurement/Consultant Guidelines.

b. **Price negotiation.** The practice of price negotiations shall not be used for the contracts financed by the proposed project.

c. **Limited capacity and experience with procurement**. The procurement experiences of all implementing agencies are very limited. This will be the first time for YESC, MESC and ESE to conduct procurement in accordance with World Bank procedures. For implementation of the proposed project, an International Procurement Consultant shall be

employed to assist both PMOs, transfer knowledge to and build capacity of designated procurement staff. Both PMOs should assign at least one full time officer to work with the procurement consultant. The World Bank will train the implementing agencies' staff to familiarize them with World Bank procurement policy and procedures.

d. **Inadequate technical specifications and use of brand names.** The International Consultant will be needed to help prepare technical specifications following international practice.

e. **Possible lengthy process of procurement**. Major milestones for each contract will be identified and strictly supervised. The World Bank team will closely monitor the Procurement Plan.

f. **Procurement through national competitive bidding (NCB)**. Subject to availability of qualified and eligible bidders from the national market, some contracts may be procured through NCB. This will be the first time for MOEP and MLFRD to conduct NCB following World Bank Procurement Guidelines. The World Bank will assist them to prepare acceptable NCB bidding documents as needed. Additionally, the International Procurement Consultant will guide their procurement through NCB.

g. The Project Operation Manuals will describe procedures and responsibility of each step for Government procurement of grid electrification equipment installation services, and procurement of off-grid goods and services. According to these arrangements, MOEP and DRD will hire an International Verification Consultant to randomly check the quality of work by private firms that the implementing agencies hire.

41. It was noted from the capacity assessment and discussion with Borrower that the use of Borrower's own equipment and labor may be the most efficient way for certain procurement (e.g. installation of solar home systems and mini grids in rural and remote areas due to the scattered and isolated nature of the installations). Under such circumstances, the Borrower may use Force Account subject to prior review by the Bank on the incremental costs for carrying out these works/installations.[54]

42. **Applicable Guidelines**. Procurement for the Project will be carried out in accordance with the Bank "Guidelines: Procurement of Goods, Works and Non-consulting Services under International Bank for Reconstruction and Development (IBRD) Loans and IDA Credits and Grants by World Bank Borrowers" dated January 2011 (revised July 2014)[55]; "Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits and Grants by World Bank Borrowers" dated January 2011 (revised July 2014)[56]; and the provisions stipulated in the Financing Agreement. Bank standard documents for procurement of goods, works or non-

[54] A Force Account (otherwise known as "direct labor", "departmental forces", or "direct work") refers to works such as construction and installation of equipment and non-consulting services carried out by a government department of the Borrower's country using its own personnel and equipment. Refer Guidelines cited in footnote 55.
[55] http://siteresources.worldbank.org/INTPROCUREMENT/Resources/278019-1308067833011/Procurement_GLs_English_Final_Jan2011.pdf
[56] http://siteresources.worldbank.org/INTPROCUREMENT/Resources/278019-1308067833011/Consultant_GLs_English_Final_Jan2011.pdf

consultancy services shall be used for all ICB contracts and Bank standard request for proposals shall be used for all consultancy assignments requiring international competition. Bank standard documents modified as appropriate will be used for all NCB contracts taking into account the country situation and exceptions as detailed in paragraph 40 above. Bank will work with implementing agencies to prepare and agree on a prototype NCB document for use under the Project.

43. Procurement post reviews will be conducted at least annually by the Bank or by its consultants or auditors acceptable to the Bank. The sampling ratio for procurement post review will be at least one in five contracts.

Procurement Plan

44. The World Bank and implementation agencies agreed on the Procurement Plan (dated August 4, 2015) for the first 18 months of implementation. MOEP and DRD shall update their respective parts of the plan throughout the Project's duration, at least annually, or as required, to reflect actual implementation needs and improvements in institutional capacity. The Bank will publish online the agreed initial Procurement Plan and all subsequent updates.

Table A3-3: Procurement methods for goods, works, and non-consulting services

Row	**Procurement Method**	**Contract Value Threshold (USD)**	**Prior Review Threshold (USD)**
1	ICB (Goods)	>200,000	All contracts
2	NCB (Goods)	≤200,000	First contract
3	Shopping (Goods)	≤50,000	No prior review
4	ICB (Works)	>300,000	All contracts
5	NCB (Works)	≤300,000	First contract
6	Shopping (Works)	<100,000	First contract
7	Direct Contracting	-	>5,000
8	Procurement from UN Agencies	-	>10,000
9	Community Participation in Procurement (*)	-	No prior review
10	Commercial Practice (*)	-	No prior review
11	Framework Agreement	-	First contract
12	Force account (*)	-	Prior review

(*) Detailed procedures in the Project Operation Manuals acceptable to the Bank.

Table A3-4: Summary of procurement packages planned in first 18 months after Project effectiveness

Ref.	Contract Description	Cost Estimate	Packages	Review by Bank (Prior/Post)	Domestic Preference	Comments
C1	Component 1 packages summary	$100m	12	Prior	Yes	56 lots
C2	Component 2 packages summary	$65m[57]	15	Prior	Yes	Multiple lots

Table A3-5: Selection of Consultants

Selection Method	Prior Review Threshold	Method Threshold
Quality and Cost-based Selection (QCBS) / Quality-based Selection (QBS) (Firms)	Over $100,000	>$300,000
Selection Based on Consultants' Qualifications (CQS) (Firms)	First contract and all over $100,000	≤$300,000
Single Source Selection (SSS) (Firms/Individuals)	All over $10,000	-
Individual Consultant (IC)	First contract; Single source selection contract over $10,000; and all fiduciary positions	-

Table A3-6: Consultancy Assignments with Selection Methods and Time Schedule

Ref.	Summary of number of contracts that will be let under:	Cost estimate	Packages	Review by Bank (Prior / Post)
1	QCBS	$9,300,000	5	Prior and Post
2.	CQS	$100,000	2	Prior
3.	IC	$5,525,000	11	Prior and Post

[57] Subject to Government decision including on the share of community contribution and Parliamentary approval of DRD's Budget.

Environmental and Social (including safeguards)

45. The two implementing agencies' PMOs will be responsible for the environmental and social performance of the Project and subprojects, staffed for this purpose with one dedicated environmental and social safeguards officers in each PMO. For each subproject, once identified, the responsible PMO (MOEP or DRD) will clarify tasks and responsibilities regarding implementation of the specific subproject (e.g. operators, utilities or villages) following requirements and procedures of the Environmental and Social Management Framework (EMSF). The PMOs will prepare a screening report and draft TOR for ESMP or ESIA and requirements to prepare a Resettlement Action Plan (RAP) and/or Indigenous Peoples Plan for each subproject, as needed. They will consult the public and stakeholders as required on the resulting ESMP or ESIA, RAP and/or Indigenous Peoples Plan, and submit these for World Bank review. The PMOs are also responsible for submitting monitoring reports to the World Bank as the ESMF and the Project Operation Manuals prescribe. The PMOs will draw upon assistance from a consultancy firm to support the preparation and review of safeguard documents and safeguards monitoring of subprojects under implementation.

46. In addition, the NEEC Secretariat will be informed and engaged regularly in the implementation of the ESMF as part of general reporting of Project implementation. The central PMOs will be adequately staffed for this purpose with environmental and social safeguards officers. These staff do not yet have adequate capacity and experience implementing World Bank safeguard policies. They will therefore be supported by TA/consultant teams that will help implement ESMF requirements while building staff capacity to address safeguard issues. For this reason, institutional strengthening and implementation support together with structured capacity building are required. The ESMF includes details of these.

47. The two PMOs will be responsible to monitor implementation of the ESMF and subproject safeguard instruments. They will regularly inform the NEEC Secretariat and the Bank on the status of ESMF implementation and provide an overview report of the implementation of sub-project environmental and social safeguards instruments. The PMOs will prepare semi-annual and annual reports on the key steps, outputs and results of the environmental and social management actions taken to support the implementation of the ESMF and the sub-projects. The PMOs will report on any shortcomings in the implementation of the ESMF and of any circumstances or occurrences that could have a materially adverse impact on the environmental and social performance of the project that go beyond the impacts envisioned and managed through the processes outlined within this ESMF. The PMOs will be supported by TA/Consultant team and will solicit assistance from local NGOs as needed. The ESMF includes a Grievance Redress Mechanism. The subproject safeguard instruments will describe implementation, monitoring and grievance redress arrangements for each subproject.

48. A budget of $1.8 million is estimated for ESMF implementation, including for TA/Consultants to help PMOs at Union and local levels prepare subproject safeguard instruments. The Government will finance compensation for land acquisition or lost assets. Given the varied character and implementing entities for the different types of subprojects, the source and arrangements of funding would vary. In most cases, funding will come from the State/Region under the auspices of the State/Region Land Acquisition Committee, which includes the State/Region General Administration Department (GAD), MOEP/DRD, District and Township level GADs and other

relevant entities. Funding will flow from the State/Region – or other entity determined to provide the source of land acquisition financing – to the District GAD, who will be responsible for compensation payment to affected people. The subproject RAP will describe these arrangements in detail.

Monitoring & Evaluation

49. M&E is essential to provide necessary information for corrective actions during implementation. Both PMOs will have designated staff to monitor and evaluate the project. The team will be allocated with sufficient resources and funding and is expected to be responsible for project M&E as well as preparation of the required progress reports.

50. Although both PMOs have limited capacity for M&E, consultants (for Component 3 TA activities) will assist both PMOs to increase their capacity to create project M&E framework. In addition, consultants specialized in GIS will provide additional support to enable PMO staff from both offices to combine traditional project M&E framework and reporting with state-of-the-art GIS. Given the new technology, it is expected that both PMOs will be able to closely monitor implementation progress and provide project management teams with appropriate and timely information necessary take corrective measures during implementation. In addition, project outputs and results can be visually displayed via the internet.

51. For grid electricity connection, citizen engagement is institutionalized. This means that project engineers/staff either at the township level or from PMO hold public consultation in every project village. In this respect, project engineer/staff will be able to make final determination whether the plan fits geographical and spatial location of the village and has support of the village. After construction of distribution network and house connections is completed, PMO will send engineers to inspect the works. This is to ensure that all works performed meet the required technical standards. PMO will also provide training to VEC members on all key aspects of electrification (depending on the level of involvement of VEC in electricity provision/services) and simple maintenance (such as, trimming tree branches) in all project villages. Trained VEC members are expected to assist PMO monitor progress and provide direct feedback from the field to township engineers and PMO.

52. With regard to off-grid component, the design of solar sub-component which allows consumers to provide feedback, report any problems of the system and file complaint which is critical for improving quality of the emerging solar market in Myanmar. Creation of a dedicated DRD hotline to be established to receive calls and written messages (mail, email, SMS and social media) on problems and complaints from customers will be another useful tools for the M&E team. The main purpose is to make sure that solar systems/products sold to consumers are of high quality, companies provide quality and timely after-sale services and honor warranty. For example, according to the rules for program participants, a company shall be responsible for repairs within two weeks if three or more systems in the same village are in need of repair. Once repairs are completed, company informs the DRD using an online tracking database. DRD keeps record of company performance. Poor performance including delays in responding to repairs calls, and failure to provide adequate support to fix problems can result in losing qualification to participate in the program. In order to assure quality in installations in the field, a portion of installed off-grid systems are randomly selected for verification and inspection by DRD or a qualified third party.

53. A final aspect of M&E is the audits which will provide an independent periodic review of all aspects of the program to ensure that the program is operating as designed, efficiently, corruption free, and is deployed at sufficient scale to meet targets.

54. WBG, MOEP and MLFRD will annually review the progress in the Project implementation and agree any actions that may be required to facilitate the achievement of Project results. WBG, MOEP and MLFRD will review the Project's mid-term status against key performance indicators within 36 months after the effectiveness date. MOEP and MLFRD's mid-term report will cover: (i) the overall implementation progress; (ii) data against the results framework (as in Annex 1) and impact evaluation; (iii) progress on procurement, disbursement and financial management; (iv) progress on implementation of the Environmental and Social Management Framework (ESMF) and other safeguards measures; (v) implementation arrangements; and (vi) needs for any adjustments or funds reallocation to improve performance. The Ministries and WBG will help PMOs identify and take measures as required.

Annex 4: Implementation Support Plan

Strategy and Approach for Implementation Support

1. Implementation is expected to begin in October 2015, following Board approval. The first disbursement is expected by March 2016 subject to agreement effectiveness by December 2015. Implementation support will begin as early as possible to prepare the Government and the implementing agencies ahead of first disbursement.

Implementation Support Plan

2. Implementation support will be flexible and focus on mitigating risks defined in Section V. Bank team members for procurement, financial management, and safeguards will be mostly based in regional offices (Yangon, Bangkok, and Vientiane) to ensure timely support to the client. Formal supervision and field visits will be carried out at least twice a year.

3. **Financial management** implementation support will be frequent in the first year of implementation, and thereafter at least each 6 months, depending on the updated project financial management risk assessment and progress to build financial management capacity. Missions for this purpose will integrate with procurement reviews and determine continued adequacy of the financial management arrangements.

4. **Procurement support**. The Bank will support procurement implementation through a mission every four months during the first year of operation. Later on, the frequency of implementation support for procurement will depend on the progress of capacity building in the implementing agencies. Procurement post-reviews will be conducted at least annually by the Bank or by its consultants or auditors acceptable to the Bank. The sampling ratio for procurement post-review will be at least one in five contracts.

Table A4-1: Implementation support for first two years

Time	***Focus***	***Skills Needed***	***Resource Estimates (Staff cost and travel)***
First twelve months	• Build capacity for procurement, financial management, and safeguards • Market research to design appropriate procurement packages • Oversee first tranche of grid extension equipment procurements • Set quality standards for off-grid equipment • Institutionalize citizen engagement • Establish baseline to evaluate impact • Oversee pre-feasibility and feasibility studies	• Procurement • Financial management • Engineers (electrical, solar) • Social and environment safeguards • Policy and communications • Evaluation specialists	$150,000, including $35,000 of travels.

Time	*Focus*	*Skills Needed*	*Resource Estimates (Staff cost and travel)*
12-48 months	• Localized geospatial planning. • Improved technical specification and design of the second tranche of grid equipment procurement packages. • Support for tariff reform and rural electrification policy (e.g. grid to mini-grid connection arrangements). • Build capacity of participating companies, civil society organizations involved in program implementation. • Begin transition to more commercial model for off-grid electrification	• Geospatial specialists • Engineers • Economists • Policy analysts • Financial specialists • Social and environment safeguards	$140,000 per year, including $25,000 of travels.

Table A4-2: Staff Skills Mix Required

Skills Needed	*Number of Staff Weeks/Year*	*Number of Trips/Year*	*Comments*
Overall supervision	6	4	
Engineers (electrical, power, civil, mini-hydro)	4	2	
Geospatial specialist	4	2	
Finance specialist	3	2	
Procurement specialist	6	3	
Environment specialist	3	2	
Social specialist	3	2	
Evaluation specialist	3	2	

Annex 5: Poverty and Social Impact Assessment[58]

1. The PSIA supported Project design by providing information on: (i) the institutional context in which development and implementation of the Project takes place; (ii) energy and electricity consumption patterns with a focus on energy poverty; (iii) perception of affordability of electricity connections and recurrent charges with a particular focus on the new tariffs introduced in April 2014 and how these have affected different groups of consumers; and (iv) consumers' perspectives on the quality of services and understanding of electricity pricing. The PSIA used a mixed methods approach and included a quantitative and a qualitative module to collect information on the issues outlined above.[59]

2. In parallel with the PSIA, an assessment of potential social impacts and risks were undertaken during January–March 2015 in accordance with the World Bank safeguard policies (OP 4.01, 4.10 and 4.12) and to inform the Project's ESMF. An international consultant based in Yangon led this work with MOEP and DRD Social Safeguards counterparts and guidance from the World Bank.

3. The selection of field sites took into account the importance of understanding the different contexts, conditions of access to electricity and perceptions of consumers in rural and in urban areas. For rural areas, 13 villages were targeted to collect information from areas with different types of access to electricity in different Regions/States and "agro-ecological zones" in Phase I. 11 were new sites.

4. In rural areas, data collection included a total of 127 focus group discussions (FGDs) and 120 key informant interviews (KIIs). In addition, a short questionnaire assessed affordability and financing gaps to access the government-run grid connection with a total of 35 rural households interviewed by per site (a total of 525 interviews conducted). In urban areas, 300 KIIs and six FGDs[60] were conducted in Yangon and Mandalay as well as Hakha (capital of Chin State). An additional 315 household interviews were conducted in urban areas to assess affordability and financing gap in accessing government-run grid connection.[61] The PSIA and project consultations included ethnic minority communities in Chin, Shan, Mon, Rakhine, and Kayin States.

5. The PSIA drew on the results of a "deep-dive" into the 2009 IHLCA data focusing on access to electricity, reliability of supply and affordability. In addition, qualitative analysis was conducted in two phases (Phase I, in February/March 2014 and Phase II in February/March 2015).[62]

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[58] This Annex summarizes the full draft PSIA to inform the ESMF which the Government disclosed in April 2015 before consultations on safeguards. The full draft is available at the following address: http://www.worldbank.org/content/dam/Worldbank/document/EAP/Myanmar/Myanmar_NEP-DRAFT_Preliminary_PSIA_to_Inform_ESMF-Full_Document-English-April_30_2015.pdf

[59] A paper by Kozel and Kim (forthcoming) will present quantitative analysis based on 2009 Living Standards Survey (IHLCA).

[60] KII were the preferred means of data collection in urban areas.

[61] KIIs were the preferred means of data collection with 25 KIIs conducted per site. In addition, FGDs were conducted with Electricity Committees in Industrial Zones and Township Electricity Departments where relevant. Urban areas were purposefully selected to collect information from: (i) areas where negative feedback to the announcement of new electricity tariffs in November 2013 had been the strongest (Yangon and Mandalay); and (ii) smaller urban areas where access to electricity remains limited and challenges with the quality of supply are an important issue (Hakha was selected as it exemplifies some of the challenges common in a number of state capitals).

[62] Analysis of PSIA Phase II data is ongoing to inform the TA components of MEPP and this Project. Two of the three villages with access to the national grid identified in Phase I were also covered to collect additional information on the community organization approach followed.

Barriers to access and main uses of electricity

6. **The IHLCA data indicates that overall, 28% of households in Myanmar were connected to the public grid in 2010 with marked differences between rural and urban areas: 77% of urban households were connected to the grid compared to only 10% of rural households**. An additional 15% reported that they purchased electricity from private suppliers (9% of urban households, 18% of rural households). Another 5% indicated that they used communal or private generators, and 7% reported using batteries for lighting. Overall, the IHLCA data indicates that there were substantial gaps in access to reliable electricity and that households and communities developed innovative alternatives to secure access to electricity albeit without ensuring reliable supply.

7. **Overall, households with public connections were much more likely to live in urban areas and were wealthier than households with private or communal connections.** Access to electricity was highly correlated with income. Better-off households were much more likely to use electricity (particularly the public grid) than poorer households.

8. **According to the IHLCA data, households connected to the public grid reported spending 1.4% of total expenditures on electricity, and the share of spending was fairly constant across the income distribution (for poor as well as rich households).** Households accessing electricity from private suppliers reported spending 2.2% of total consumer expenditures on electricity, which was also consistent across the income distribution. Low spending is the result of low tariffs and a generous lifeline tariff, coupled with low electricity consumption. A substantial number of (public electricity) households consume below the lifeline tariff (currently set at 100 kWh/month): in urban areas, 30% of households consumed 50 kWh/month or less, and 66% consumed 100 kWh/month or less. In rural areas, 53% of households consumed 50 kWh/month or less, and 88% consumed 100 kWh/month or less. Overall, current tariffs are moderate and electricity remains affordable to those who have access.

9. **Importantly, not all households within electrified villages and wards were connected to electricity services.** Electrification rates for urban wards/rural villages were substantially higher than electrification rates for individual households. According to the IHLCA, 41% of wards or villages were connected to the public grid, 13% reported communal electricity sources, and 50% had households that used electricity from a private supplier. Overall, 78% of urban wards and rural villages had some type of electricity supply available (viz. public, private or communal). In 40% of electrified wards/villages, nearly all households were electrified. But private connection rates were highly variable in the remaining 60% of wards/villages.

10. **Very few households had electricity available on a continuous basis. Surprisingly, there was no strong relationship between the reliability of electricity supply (measured in average hours available per day) and household income.** Households connected to the public grid reported an average availability of 12 hours/day, households connected to private suppliers reported an average availability of 10-11 hours/day.

11. **IHLCA tabulations, augmented by some additional simulations, do not suggest that electricity affordability is currently a concern for households connected to electricity services in Myanmar.** It is important to understand this finding in a context where better-off households are currently much more likely than poorer households to be connected to the grid. In addition,

this finding was not reflected in the qualitative analysis and warrants additional study. Qualitative analysis further indicated that in rural areas electricity committees and private companies do charge rates significantly above those set by MOEP. Further analysis will be particularly relevant as the National Electrification Plan envisages a steep increase in the number of households to be covered by electricity services and an outreach to poor and marginalized households currently not connected.

Barriers to access in rural and urban areas

12. **In the current "Self-Reliant Electrification Approach" (SRE), communities raise their own funds to connect to the Government's electricity grid, with no other financial support.** Access to electricity in rural areas is limited, therefore, by the current coverage of the grid but also by the fact that villages must cover the costs of the connection from the main transmission line to the village itself.

13. **Limited technical support is provided by the township departments of the electricity companies responsible for overseeing the SRE and there is little regulation of the role of electricity committees that oversee SRE at the village level.** Composition and selection of electricity committee members, their functions and roles, segregation of duties, procedures for FM and procurement, disclosure of information, community mobilization and planning procedures as well as the rates to be charged are left to the discretion of the committees themselves. This creates a number of organizational and governance challenges and often results in electricity tariffs significantly above those set by Government.

14. **Within villages connected to the grid (or with access to electricity through community initiatives), a significant proportion of the population (middle and lower income households) remain without access.** These households cannot afford the fees to connect the village to the grid. Village leaders/elites systematically exclude them from the planning stages on this basis and do not invite them for discussions.[63] No instances of cross-subsidization were observed (where the village itself put in place a mechanism to facilitate access to lower-income households).

15. **All Village Electrification Committee (VECs) in targeted villages had close linkages to local government and administration. Village Administrators (VA) are systematically involved in the establishment and functioning of the committee.** Village Administrators were members of the VEC in all but one instance. Religious leaders and wealthier households within the community were less systematically involved but often played an influential role linking villages with contractors and influential local or national government figures who can significantly accelerate the process of connection to the electricity service by fast-tracking applications, providing access to discretionary funding, facilitating access to loans and TA.

16. **The exclusion of low-income and marginalized households noted during PSIA Phase I was confirmed by the analysis carried out under Phase II.** None of the VECs in the targeted villages included participation by low-income households given the nature of the SRE and lack of guidance for targeted support to low-income households. All VECs in the study areas made a

[63] In this regard it is important to note that qualitative analysis was undertaken in 13 villages only and that further work will be conducted under the PSIA Phase II to understand possible social dimensions of exclusion within villages with greater depth.

decision early on in the process about the households who could not afford to buy into the scheme. Those who can afford to contribute to the connection were invariably the better off households. In addition, women were systematically excluded from participating in the VECs, with the exception of one village in the sample. In all other instances, village leaders did not consider women eligible for participation.

17. **No significant variation was noted in terms of social inclusion and community participation across regions/ethnic groups in sample villages, though one case was observed.** Elite capture of the process and limited communication with the community was the overall trend observed. The PSIA Phase II villages included two mixed villages (Village 17 in Mon and Village 6 in Shan). In the Mon case, the village is made up of Palong (20%), Burma (45%) and Kayin (35%) farmers with all groups being represented in the VEC and in the planning of village electrification. Burma and Kayin tended to dominate local government institutions which did not affect the distribution of benefits from the electricity scheme. There was no ethnic dimension to the exclusion of poor households in this case. What determined household ability to access electricity was exclusively household income. In the case of Village 6 in Shan electricity was provided by a large private company (hydro). The village is predominantly Shan with a minority (20%) Palong households. Livelihoods and household welfare tend to be divided along ethnic lines with Palong households living in the outskirts of the village and being predominantly landless farmers and daily laborers. Palong households were therefore at an economic disadvantage in terms of joining the electricity service. In this case, the private company, linked to the village administration (Shan dominated), provided better conditions of access for Shan households – namely initial credit and the ability to pay connection fees in installments. No such flexibility was provided to Palong households with the result that all those in the village currently excluded from accessing electricity are Palong.

18. **Barriers to access (inability to connect to the service) were less relevant in the main urban centers but significant for smaller cities (Hakha) and for informal settlers in poorer wards (Yangon and Mandalay).** Overall access was not the key concern in the major urban centers of Yangon and Mandalay and issues of quality of service and affordability were more frequently highlighted by respondents across all wards visited. There were, however, noteworthy issues of access particularly by informal settlers in Yangon (namely in the poorer ward visited, YGN-3)[64]. While the costs of the connection were indicated as a barrier to access by a small minority the most commonly mentioned reason for using these "better than nothing at all" services in Yangon was the inability to secure the necessary documentation (including household and land registration as well as approval of the application by the ward leader) to apply for a connection.

19. **Informal connections to small-scale local providers of electricity (using diesel generators) were observed across all cities and were particularly important in Hakha.** This was noted given the limitations of the coverage by government-provided electricity services (only a few hours every other day). In Mandalay, all neighborhoods visited had connections to electricity provided by similar small-scale operators. This was conveyed as a "back-up" option given the widespread black-outs experienced until recently in the city. In Yangon the research team found a different

[64] Informal settlers in Yangon (YGN 3) are not included in wards records and therefore not officially "counted" in data on access to electricity (please see Table 9)

scenario where only the poorest groups (informal settlers) relied on the services of these small local private providers given their inability to access the grid as highlighted above.

20. **The cost of connections for households and industrial/commercial consumers varied across sites but did not constitute a barrier for the majority of respondents in urban areas as it did in rural areas.** However, as noted above, the poorest and marginalized households in low income wards could not afford the connection fee and used informal electricity providers instead. In addition, interviews conducted with households from the wealthiest quintiles and businesses in industrial zones in Mandalay and Yangon indicated that a significant portion of the connection cost had been shouldered by the households and/or by businesses themselves at the time of establishment.

Uses and quality of service

21. **The qualitative analysis indicated that uses of electricity were very consistent across research sites in rural areas. Household use was primarily for lighting and TV across all sites visited.** For lower middle income households (among those with an electricity connection) lighting was often **the** only use found. Diesel was the primary source of energy for livelihood activities for the vast majority of households and small businesses interviewed. Overall, the cost of diesel (and fluctuations in cost) were a significant constraint to their profitability and there was high demand among rural Small and Medium Enterprises for grid-based electricity services.

22. **While current usage of electricity was limited, households across all rural research sites (with and without access to the Government grid) highlighted the importance of an electricity connection to *"be linked up to the outside world"*** particularly through a TV. There was a sense in village with no electricity connections that they were left behind in terms of the "modernization" process (particularly where better-off villages in the vicinity were connected to the grid). Furthermore, there was high demand for more reliable electricity services so children could study at night and electricity could be used for livelihood activities (in the areas visited this consisted of pottery making in the evenings, lighting in small village shops and more generally agricultural activities given the very high perceived cost of diesel).

23. **Agricultural tasks for large/medium/small farmer were systematically carried out with diesel generators**. These were owned for large/medium farmers and rented out for small farmers. Better-off households in villages with reliable electricity supply used electricity for water pumping and limited irrigation. In the areas surveyed, fishermen mainly relied on diesel generators for productive activities (i.e., for lighting to sort fish in the evenings).

24. **Unlike in rural areas, uses at household level in urban areas varied more markedly across wards/income groups and cities.** Urban households with generally better access to reliable electricity used significantly more appliances. Beyond lighting and TV, electricity was commonly used to run refrigerators, stoves, kettles and rice-cookers. Air-conditioning was an important use among higher income households and found exceptionally only in middle-income households. The use of electricity for cooking was observed in better-off wards but was much less prevalent in middle-income neighborhoods and non-existent in the poorer wards. Issues of quality of service were stressed in poorer wards more strongly (across all three cities) both in terms of the availability, reliability of the supply and speed/cost of repairs.

25. **With the exception of Hakha, which has significant limitations in the actual availability of service, respondents in Yangon were the most critical regarding the quality of the service** (particularly in the middle-income ward visited). In Mandalay the overall perception across sites was that privatization had improved the quality of service and customer relations. There were some variations, within cities in terms of quality of service with poorer wards highlighting more power fluctuations and difficulties in getting repairs done. Interestingly, better off **households** reported good service for repairs with no informal charges. These were more frequently mentioned in middle income wards. Poorer households tended not to call the service provider (as this would take too long) but instead to call upon private electricians (sometimes employed by the electricity companies but doing these small repair jobs "on the side" for additional income).

Affordability of the new tariffs: perceptions

Rural areas

26. **In rural areas, there was an overall lack of knowledge on the part of households about the electricity tariffs charged by Government and the increase taking effect in April 2014.**[65] Across all 13 villages visited, only a very limited number of respondents had heard about the tariff **increases**. These were: (i) the members of the Electricity Committees at village level and; (ii) occasionally small business owners who had heard the announcements on TV.

27. **Standard government rates were applied only in two of the four villages where electricity services were provided either by government or a private company (per kWh/hour).** In the other two sites, tariffs collected were much higher than government rates at 200 Kyats/kWh and 50 Kyats/kWh and were set by the electricity committee. As noted earlier, the functioning of the electricity committee is largely unregulated and while these committees are responsible for the maintenance of the village's system there is no guidance provided on what amounts to charge for the service. In addition, the level of detail provided in the bill does not allow households to fully understand the tariffs, additional meter rental charges or other maintenance charges that may be added. Overall, where social capital was high and there was trust between the electricity committee and the villagers the amounts charged were not questioned.

Urban areas

28. **Analysis in urban areas was conducted in April and May 2014 once new tariffs were already in place and the first bill with the increases had been paid by households.** Compared to rural areas, there was a generally good understanding of the new tariffs charged and greater clarity in terms of the different charges that make up the electricity bill.

29. Given the limited supply of electricity in Hakha (number of hours/day), the city was in an exceptional situation in that the increase in rates were not considered relevant for all respondents across wards (including the poorest). There were high expectations regarding the expansion of Government electricity services. A common concern for better off/middle income households and small businesses in Hakha was the high cost of fuel for diesel generators. There

[65] It is important to note that field work in rural areas was conducted in March 2014. This was following the announcement of the increase in rates but before the tariffs were reflected in the new bills.

was significant hope that improved access to electricity would eventually result in savings. As in rural areas, the use of solar panels as an alternative to diesel (for lighting) was frequently observed for households that were able to afford the upfront investment. Overall rates charged were considered affordable although respondents resented having to pay "maintenance fees" for meters 500 kyats/meter/month (in fact meter rental fees) as they reported receiving "no maintenance services".

30. **The situation was significantly different in Yangon and Mandalay where particular segments of participants in the study reported being "very affected" by the increase, namely middle-income households and some categories of SMEs.** As noted earlier it is important to highlight that the findings reported here focus on households and businesses perceptions of impact. In the case of middle-income wards, where feedback on tariffs was strongly negative, there were, in fact, no negative coping strategies reported. Respondents in this case linked their dissatisfaction with the tariff increases with the lack of improvements in the quality of services.

Feedback from poor and marginalized households

31. **Pre-existing difficulties to pay were noted for the most vulnerable households interviewed, although this segment of interviewees did not see their electricity tariff increase.** Households considered vulnerable/marginalized within the poorer wards themselves reported challenges with making monthly electricity payments (both for grid connection and for small scale distributors). Overall, the main coping strategies noted were delays in payment and borrowing from neighbors. Borrowing was done without interest charged but with the idea that the favor will be reciprocated if needed, indicating significantly high levels of social cohesion/social capital in these wards. Payments were never more than a month late for grid connection and a few days late for small-scale providers.

32. **As noted earlier, in a small number of cases (among the households interviewed) the cost of the connection to the household was a barrier for the poor in urban areas.** This was true in wards where government service does not yet provide full coverage and connection to some blocks in the ward may require a significant investment. Respondents in this category in Mandalay[66] use the services of informal providers instead. They indicated that given the opportunity to connect they would prefer to pay government tariffs considered overall affordable and as better value for money if the cost of connection could be subsidized.

Respondents in middle class wards

33. **Respondents in middle class ward had mostly moderate overall increases but had strong negative feedback on the additional cost particularly in Yangon.** These participants in the study **highlighted** that increases in tariffs were not accompanied by improvements in the quality of the service. Given the level of consumption/types of uses, this segment of respondents reported it would be difficult for them to further reduce electricity consumption. The most frequently mentioned savings item was to reduce air-conditioning use[67] and switching off lights during the

[66] As in Chin respondents saw little value in getting a connection to the grid given the limited supply
[67] For a minority of households in the middle-income wards covered

day. No significant delays in bill payment, instance of borrowing money or reduction of other types of expenditure were however, reported.

34. **Significant increases were noted for the better-off households (particularly in Yangon) and savings were planned to cope with new rates.** The items households indicated they would most likely cut were: (i) lighting in garden/security lights; (ii) air-conditioning; and (iii) lighting during the day/unused rooms. While there was negative feedback on the increases, this was less strong than in middle-class areas with an overall sense that electricity supply was of good quality.

Small and Medium Enterprises (SMEs) in Yangon and Mandalay

35. **The study covered three groups of SMEs in Yangon and Mandalay, defined in terms of their electricity consumption**. Feedback on the tariff increases and coping strategies adopted varied depending on the new tariff band in which they now found themselves in.

Table A5-1: Different types of businesses surveyed (Yangon and Mandalay):

Cities	Number of SMEs by consumption (Units kWh)		
	1-500	501-10,000	10,001-20,000
Yangon	8	17	0
Mandalay	13	10	2
Total	21	27	2

36. **Very small, family run businesses and business requiring unskilled labor reported not being affected by changes in tariffs.** These made up a significant proportion of the businesses surveyed and included small-scale food production and packaging companies and mechanics. Overall the rates were considered affordable and no particular negative coping strategies were observed among this group.

37. **Medium-sized businesses (in the second and third group) were the most affected among those surveyed.**[68] The second group of businesses includes mold making, printing and purified water companies, now required to pay 25 additional kyats per unit (or 30% increase in relation to the previous tariff structure). These businesses consider themselves hard hit by the increases particularly as they have to shoulder the additional electricity costs together with diesel costs. Generators are still needed to address gaps in electricity supply (fluctuations in capacity and brief black-outs). The third group of businesses was found only in the Mandalay industrial zone surveyed. These were two smelting businesses (iron rods and construction materials), which fell under the second tariff block with an additional 50 kyats to be paid per unit (i.e., two-thirds increase in their bill compared to the previous tariff). Using generators for these businesses is extremely expensive and they rely heavily on the grid connection having invested significantly in setting up the necessary infrastructure in the Industrial Zone.

[68] It'sIt is important to note that the analysis did not cover individual discussions with large-scale companies although the Myanmar Chamber of Commerce and the Management Committee of Industrial Zones in Mandalay and Yangon were consulted on the overall quality of the electricity supply and on their perspectives regarding tariff increases.

38. The most common coping strategy reported was to increase prices for the consumer when this was possible (in some instances pre-existing contract commitments meant that businesses incurred losses). Medium businesses in the second group coped by laying off some staff, reducing production **and** no longer holding stocks (i.e. producing only when they had a specific order). Larger businesses in the third group reported that they had some time to prepare (around three months) and find cheaper suppliers and re-negotiate prices and in spite of a higher increase were in a comparatively better situation.

39. **However, even among the second group of businesses (most affected) feedback focused on improvement in quality of service rather than in reduction of the tariffs**. The main recommendation made by **all** the three groups was to reduce power fluctuations, increase voltage capacity and ensure a 24-hour steady supply. With these conditions met, business owners would be able to drastically reduce their expenditures with diesel, which were considered more burdensome than electricity prices. Overall 85% of businesses interviewed regularly use generators (100% of those in Chin).

Grievances regarding electricity services

40. **The analysis of Grievance Redress Systems in PSIA Phases I and II indicated that the presence and use of these for government electricity services was extremely rare in rural areas although more present/used in the urban areas visited.** For the roll-out of the National Electrification Plan there is limited capacity in the current system to effectively handle grievances. Those respondents that indicated having reached out to service providers did so in urban areas and for issues of service maintenance and billing. In spite of the lack of clarity often mentioned by respondents during the study regarding the financial management of the SRE by the VEC there were no instances where villages/participating households had lodged a grievance with either the VEC or Village or Township Administration.

41. **Of the eight sites in rural areas, only one VEC (Village 17 in Mon) had established a dedicated grievance redress system to receive queries and complaints**. The other seven villages with access to government electricity services in the sample did not have systems in place and issues regarding billing and service were informally resolved through the VEC and VA. No significant disputes or tensions over the provision of electricity were observed in the targeted sites.

42. **Confirming the trend observed during the Phase I of the PSIA, in villages with access to government, respondents were on the whole satisfied with the quality of the electricity service provide**d**.** However, issues with slow repairs and low capacity of the power supply were noted in four of the eight sites. FGD discussions with women in particular indicated a strong demand for better capacity services to reduce time/money spent on collecting/purchasing firewood for cooking. In addition, households had queries on billing in two of the rural sites visited where maintenance/operation charges collected were unclear. The division of units "lost" (difference in charges from village meter and individual household meters) was unclear in these cases. While levels of social capital/trust were overall high (and there was an overall perception that the VEC was charging the correct amount) consumers did fully understand the rationale behind the additional amounts collected.

43. **In the new urban areas visited under PSIA Phase II there was more widespread awareness of how to reach the service provider with request for information, maintenance and queries about bills.** Numbers for TED were provided in bills in Thaton although not in Sittwe. In Sittwe, the TED was in the process of disseminating the new information/complaints hotline and had printed new pamphlets. Complaints were mostly related to errors with bills and were either communicated directly to the township or through bill collectors. There was an overall perception among households interviewed that these were acted upon (with errors in bills adjusted in the next month's bill) although with some delays.

Potential Social Impacts and Risks of the Project

44. **The Bank's Indigenous Peoples (OP 4.10) and Involuntary Resettlement (OP 4.12) safeguard policies are triggered to the Project.** The Project is country-wide and covers all States and Regions; ethnic minorities covered by OP 4.10 are present in most areas of Myanmar, but concentrated in the Kayah, Kayin, Kachin, Chin, Mon, Rakhine, and Shan States. Ethnic minority communities would benefit from project activities through improved access to electricity including in many remote areas currently not covered by the grid and with few off-grid electrification schemes. Along with other beneficiaries, ethnic minorities will benefit from: reduced costs of electricity for households (e.g., by reducing connection costs); enhanced well-being by providing electricity for lighting in houses and streets, telecommunications and entertainment; improved cooking practices and indoor environment (through reduced use of charcoal and firewood for cooking); and enhanced income-generation opportunities. To maximize developmental impacts, the Project's grid component will prioritize connections for health clinics and schools, particularly in poor and vulnerable areas, and the off-grid component will directly benefit the poor and vulnerable households by targeting those who reside outside the reach of the power grid. The Project is also expected to improve the participation of community members in decision-making concerning electricity and strengthen the capacity of Village Electrification Committees.

45. **The Project, however, also presents risks and challenges, particularly in terms of ensuring that ethnic minorities participate in and benefit from project investments.** Investing in electrification in conflict or post-conflict areas where ethnic minority organizations provide parallel social services and community infrastructure also poses risks that require a good consultation and project management approach. The PSIA finds that rural villages are most often partially electrified commonly due to some villagers' lack of ability to fund the costs of the initial connection. The high connection costs has also led to significant debts for some villages. Without measures to address such constraints, project support may weaken the social cohesion within a community, particularly in villages with mixed ethnicity and/or with households having moved to the village because of conflict or natural calamities.

46. **Construction and operations activities associated with the Project may present possible triggers for grievances or conflict.** Particular triggers may include: the use of companies and/or laborers sourced from a different ethnic group and from outside the area of project implementation; inadequate stakeholder consultation and engagement, including in local languages and with insufficient advance notice and consultation; lack of awareness of land use and ownership structures within the community; low awareness of the cultural value of community forests; and community safety concerns, especially of women and children.

47. **Limited, if any, land acquisition is expected as the type of investments supported by the Project generally have small footprints, normally follow existing right-of-way and have some flexibility in terms of specific location to avoid land acquisition.** However, some land acquisition or loss of assets such as trees and standing crops, cannot be ruled out, for instance in relation to expansion of existing and construction of new MV substations, construction of new MV lines, LV lines, and off-grid investments such as mini-hydro systems. The PSIA and social assessment found that there are seldom accurate records of what constitutes "common village land" used for infrastructure purposes and while voluntary land donations are practiced these are rarely documented.

48. **Since specific project sites will not be identified during project preparation, specific safeguard impacts cannot be determined until project implementation. An ESMF has been prepared to screen for and address any safeguard issues for specific investments and subprojects.** The ESMF includes an Indigenous Peoples Planning Framework and a Resettlement Policy Framework (RPF) to address OP 4.10 and 4.12 requirements respectively, including provisions for preparing site-specific Resettlement Plans and Indigenous Peoples Plans when needed. The RPF includes a protocol for voluntary land donations.

Social Impacts, Risks and Safeguards

49. **To mitigate potential risk of equity, transparency and accountability, it will be critical for the Project to embrace a broad-based and inclusive community-based planning process, to have a sound and nuanced understanding of the community context ahead of subproject implementation at village level, and to integrate a conflict-screening process in the ESMF**. Targeting and sequencing of project activities, both grid and off-grid, underpinned by a transparent and broadly communicated rationale will be important. Furthermore, it will be critical for the Project to implement a conflict-sensitive approach underpinned by thoughtfully designed, inclusive and well-executed consultation and engagement strategies. Regular and transparent monitoring, including third party monitoring with community involvement, can play a valuable role in managing perceptions of transparency and accountability.

50. **Providing electricity services and infrastructure within a diverse cultural and linguistic context such as Myanmar will require specific consideration for project design and the ESMF.** This includes language use and preparation of consultation and engagement materials that effectively communicate with potential project beneficiaries and other stakeholders who are not literate in Burmese; participatory monitoring and evaluation activities; and engagement with ethnic minority representatives at village, district, regional/state and national levels.

51. **While Project activities mainly have minor safeguard impacts and risks, the Project should be prepared and implemented in such a way that they minimize any potentially negative social and environmental impacts.** Natural resources and the environment are key to the cultural identity of ethnic minorities and play a significant role in their livelihoods, and potential impacts and risks on community forest and streams should be identified, avoided, minimized or mitigated through the screening and safeguard procedures of the ESMF. The ESMF should also identify criteria for site selection that take into consideration potential risks for landslide, flooding or medium to long-term impacts from climate change.

52. Site-specific project activities (subprojects) should provide consistent documentation regarding land acquisition or loss of assets, including for any voluntary land donations that may be implemented. Currently documentation of such arrangements is highly variable across sites and often lacking, and there is very limited experience implementing World Bank safeguard policies, including for involuntary resettlement.

53. Capacity building is needed for implementing agencies and relevant parties (e.g. private sector, Village Electrification Committees and community members), including concerning safeguards.

Annex 6: Economic and Financial Analyses of the Project

1. The economic and financial analyses of the Project includes: (i) economic analysis of grid extension component; (ii) financial analysis of grid extension component; (iii) economic analysis of mini-grids; and (iii) economic analysis of solar home systems.

I. Grid component

2. The investment cost is estimated based on the National Electrification Plan Roadmap (August 2014), as updated by ESE.

Table A6-1: Grid Component: Investments Costs and Connections

Investment ($ million)			Number of Households Connected			$/ household
Goods	Works	Total	ESE	YESC	Total	
300.0	**75.0**	**375.0**	**650,083**	**99,917**	**750,000**	**500**

Economic analysis

3. ***Costs.*** Project costs comprise three parts: (i) the above-mentioned investment costs; (ii) the cost of electricity supply; and (iii) the cost of O&M.

- *Investment costs.* The total investment cost is estimated at $375 million, including $300 million in goods and $75 million in works.
- *Cost of electricity supply.* After accounting for losses, the long-run marginal cost of supply from transmission is estimated at $0.108 per kWh based on the National Electrification Plan.
- *O&M costs.* The annual O&M cost of the distribution system is assumed at 2% of the system investment plus an additional $5.00 per connection for meter reading.
- *The lifetime of new distribution networks is assumed to be 30 years.*

4. ***Benefits.*** Expected quantifiable economic benefits can be measured in terms of the avoided costs for non-electrified households of the essential power-consuming activities, such as lighting, radio listening and TV viewing, for which grid electricity will replace kerosene lamps, batteries or small diesel generators to offer better services at a lower life-cycle cost.

5. ***Willingness-to-pay (WTP)*** for grid-based electricity was assumed for two types of activities: (i) for lighting, radio and TV, where grid electricity will replace existing sources, such as kerosene lamps, car batteries, dry cells, etc.; and (ii) for new (productive) activities to be enabled by grid electricity.

6. *WTP for lighting, radio and TV* is typically assessed based on responses from end-user consumption surveys, which are not yet available in Myanmar. Thus, data from a survey among non-electrified households in Lao PDR (2006) was used as a reasonable proxy for the analysis. With inflation adjustment, the total WTP for lighting, radio and TV combined was estimated to be

$14.62 per month among non-electrified households in 2006[69] Based on the same survey, household consumption of grid-based electricity for all three purposes was estimated at 21.6 kWh per month.

7. This approach in estimating WTP for grid-based power supply provides only the lower bound of the actual benefits of grid-based power supply, which, *inter alia*, include increased educational (e.g., longer study time) and health benefits (e.g., reduced burn injuries from kerosene lamps and reduced air pollution from diesel generators), time savings (e.g., avoiding trips for battery charging), new business and income-generating opportunities, more local jobs and improved public safety. These benefits are difficult to quantify in monetary terms. Nevertheless, they represent a significant part of the overall benefits of electrification. A World Bank study[70] on the electrification programs worldwide suggests that including these benefits would raise total consumer benefits of electrification for an average household consuming 30–40 kWh a month to about $60 a month.

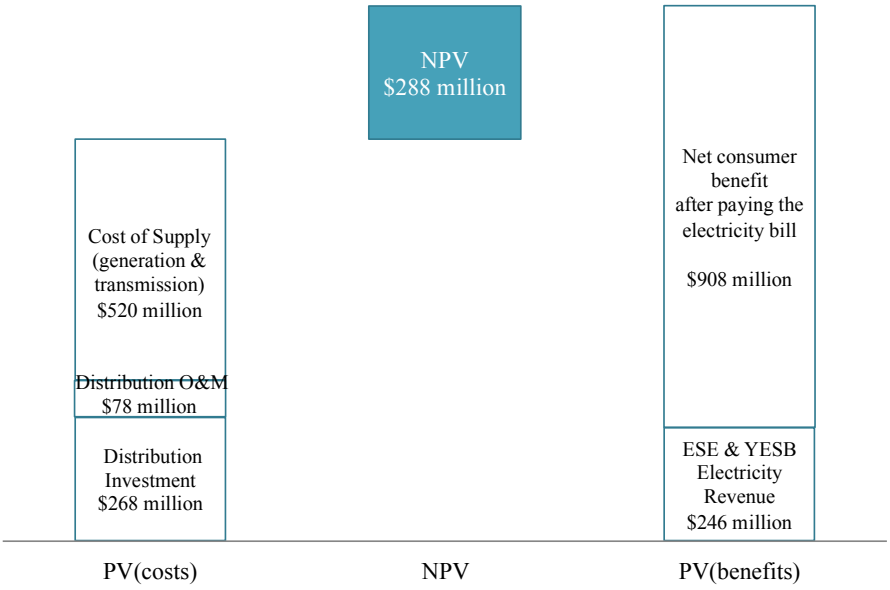
8. ***Results.*** At a 10% social discount rate, the Economic Net Present Value (ENPV) of grid electrification is $288 million and the benefit-cost ratio is 1.33. The Economic Internal Rate of Return (EIRR) is estimated at 25%. The discounted payback period is 9 years.

Table A6-2: Results of Economic Analysis for the Grid Component

	Economic internal rate of return	Benefit/ Cost Ratio	Economic Net Present Value
Grid component	25%	1.33	$288 million

[69] Adjusted for US dollar inflation.
[70] The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits. An IEG Impact Evaluation, Washington, 2008.

Figure A6-1: Present value of the costs and benefits of the grid investment



9. ***Sensitivity analysis.*** This was carried out to assess the impact of the (i) average cost per household; and (ii) WTP for the essential activities, such as lighting, radio and TV on of the EIRR of the grid investment. As Figure A6-2 shows, the EIRR is sensitive to the cost per household. The switching value of cost per household was estimated at $950, above which the investment would not be economically viable. As Figure A6-3 shows, EIRR is sensitive to the WTP for the essential activities. The switching value of WTP for these activities was estimated at $10.0 per month, below which the investment would not be economically viable.

Figure A6-2: EIRR Sensitivity to Average Cost Per Connection

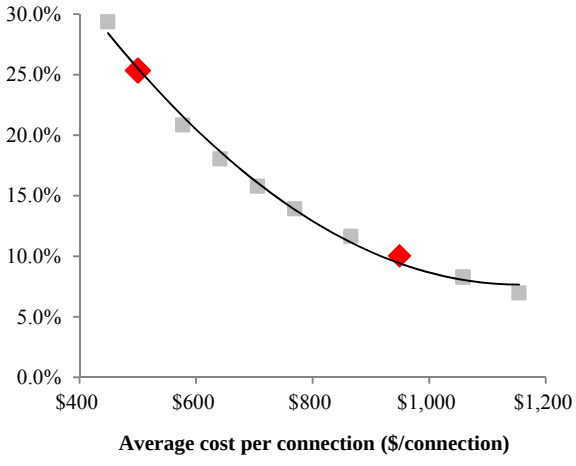
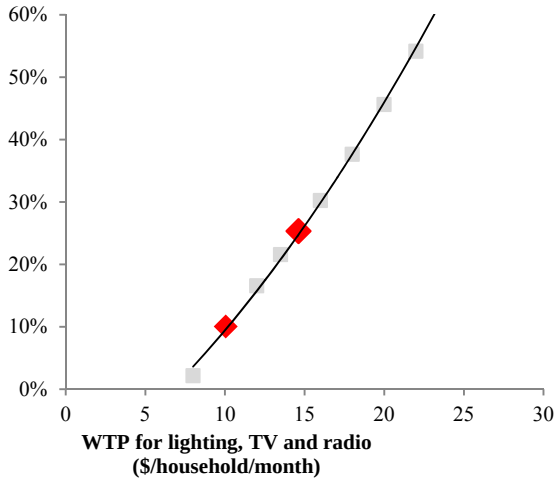


Figure A6-3: EIRR Sensitivity to WTP for Lighing, TV and Radio



Financial analysis

10. The World Bank carried out a financial analysis of the Project's grid extension component from ESE's and YESC's perspectives.[71]

11. ***Financing.*** An IDA credit of $300 million will finance the goods component of grid investments. It has a tenure of 38 years and a grace period of 6 years with no interest; it includes a 0.75% per year service charge.[72] The remaining $75 million of the investment will be for works to be financed from the distribution utilities' own funds with an expected return on equity of 14%. Thus, the weighted average cost of capital is 3.4%.

12. ***Cost of electricity supply.*** Starting April 1, 2014, the bulk tariff from the transmission company, Myanmar Electricity Power Enterprise (MEPE), to distribution was 52 kyat/kWh (or 5.2 US cent/kWh equivalent) to ESE and 57 kyat/kWh at (5.7 US cent/kWh) to YESC. After accounting for the distribution loss of 13.7% (ESE) and 18.3% (YESC), the implied cost of electricity sold was 60 kyat/kWh (6.0 US cent/kWh) for ESE and 70 kyat/kWh (7.0 US cent/kWh) in 2014. The analysis assumed the same cost of supply in 2016, then growing at an average US dollar inflation rate of 3% throughout the 30-year project life.

13. ***Revenues.*** The revenues of ESE and YESC are from two main sources: (i) electricity sales from both residential and non-residential customers; and (ii) connection charges. The analysis assumes a consumption ratio of 1:1 between residential and non-residential segments in the new areas to be connected.[73]

14. ***Retail tariff.*** The analysis assumes residential tariff starts from the current (April 2015) average level of 40 kyat/kWh (5.2 cents/kWh) for ESE and 45 kyat/kWh (5.7 cents/kWh) for YESC, then grows at the average US dollar inflation rate of 3% over the 30-year project life. Non-residential tariff was assumed at the current average of 105 kyat/kWh (10.5 cents/kWh),[74] growing at an average annual rate of 3%.

15. ***Connection charge*** was assumed at $100 per household. A sensitivity analysis was carried out to assess the impact of connection charge on the FIRR of the grid investment.

16. ***Results***. With a weighted average cost of capital at 3.4%, ESE will have a financial net present value (FNPV) loss of $140.5 million, and a financial internal rate of return (FIRR) of negative 2.9%; YESC will have an FNPV loss of $24.5 million and FIRR of negative 4.1%. The negative FIRR is due primarily to the low residential tariff which currently stands 33% and 50% below the marginal costs of supply of ESE and YESC, respectively.

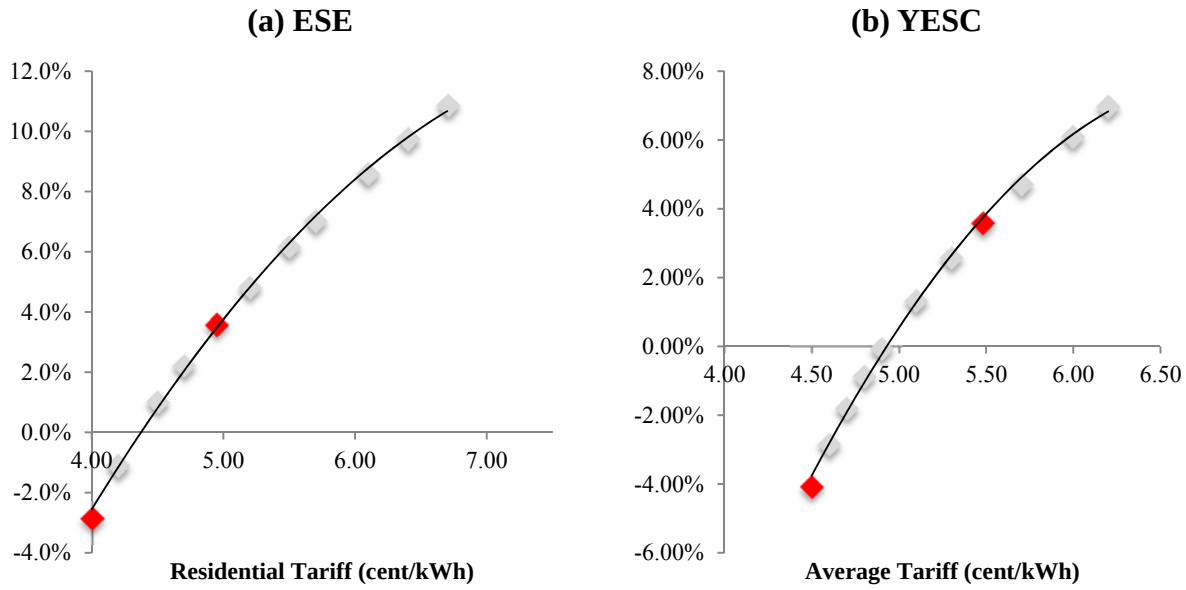
[71] At the time of the analysis, MESC had not been established; Mandalay was assumed to be covered by ESE.
[72] Effective as of January 1, 2015.
[73] In 2013, the consumption ratio between residential and non-residential customers was around 1:1 in the service area of YESC and 1:2 in that of ESE.
[74] A set of non-residential tariffs became effective in April 2014.

Table A6-3: Results of Financial Analysis for the Grid Component

	Benefit-Cost Ratio	Financial Net Present Value	Financial Internal Rate of Return
ESE	0.95	- $140.5 million	-2.9%
YESC	0.95	- $24.5 million	-4.1%

17. ***Sensitivity analysis.*** This was carried out to assess the impact of residential tariff on the FIRR of ESE and YESC. Figure A6-4 shows that the FIRR is sensitive to the residential tariff. The switching value of residential tariff for ESE was estimated at 5.0 US cent per kWh (compared with the current level of 4.0 US cent per kWh); and 5.5 US cent per kWh for YESC (compared with the current level at 4.5 US cent per kWh).

Figure A6-4: Financial Internal Rate of Return Sensitivity to Tariff



II. Off-grid

Economic analysis of the mini-grid subcomponent

18. Village-scale micro-hydro systems have been installed in Myanmar with capacities ranging from 5 kW to 100 kW, serving up to a few hundreds of village households through distribution networks within 5 km radius from the power source. The analysis covers a typical village-scale micro-hydro system with an installed capacity of 50 kW to serve 200 households over 15 years.

19. ***Costs.*** Total investment costs of the hydropower plant and the distribution system were estimated by the World Bank team at $150,000 or $3,000 per kW. O&M cost was assumed at 6% of the total investment or $9,000 per year.

20. ***Benefits.*** The economic benefits of the micro-hydro system can be measured in terms of the avoided costs for non-electrified households of the essential power-consuming activities, such as lighting, radio listening, phone charging and TV viewing, for which hydropower-based electricity

will replace kerosene lamps, dry cells and car batteries. This approach provides only the lower bound of the actual benefits, which, *inter alia*, include increased educational (e.g., longer study time) and health benefits (e.g., reduced burn injuries from kerosene lamps and reduced air pollution from diesel generators) and time savings (e.g., avoiding trips for battery charging). These benefits are difficult to quantify in monetary terms. Nevertheless, they represent a significant part of the overall benefits of off-grid electrification. Furthermore, the economic analysis does not take account of the positive environmental externalities associated with hydropower-based electricity supply, such as the greenhouse gas emission reduction.

21. ***WTP*** was assessed for different types of activities. For lack of reliable data for Myanmar, the usage level and WTP for essential power-consuming activities, such as lighting, radio listening and TV viewing, was estimated based on a survey response among rural households, pre- and post-grid electrification in Lao PDR (2006). The combined WTP for all three activities was estimated at $14.62 per month for non-electrified households in 2006. Based on the same survey, household consumption of grid electricity for all three purposes was estimated at 21.6 kWh per month, implying a WTP of $0.677 per kWh for lighting, radio and TV. Some households will switch to rice-cooker once connected to sufficient power supply. The WTP for power consumption on rice cooking was assumed at $0.30 per day or $0.40 per kWh. For all other purposes, the WTP was conservatively assumed at $0.05 per kWh.

Table A6-4: Electricity consumption and WTP among mini-grid connected households

	Consumption from mini-grid			WTP		
	Hours /day	kWh/month	kWh/year	$/kWh	$/month	$/year
Lighting (1 x 50W)	7.25	10.88	130.6	0.78	8.49	101.83
Radio (1 x 18W)	4.13	2.23	26.8	1.15	2.56	30.77
TV (1 x 80W)	3.53	8.48	101.8	0.42	3.57	42.74
Rice cooker (1 x 750W)	1.00	22.5	270.0	0.40	11.25	135.00
All other purposes				0.05		

22. ***Service level.*** Due to seasonality, hydropower plants in Myanmar generally operate between eight and ten months a year, staying idle for the remaining months. The analysis assumes that the village-scale micro-hydro system operates nine months a year, during which all connected households are able to carry out the essential power-consuming activities, such as lighting, radio listening and TV viewing. Due to the system load profile and capacity constraint, it was conservatively assumed that only 25% of the households would be able to use rice-cooker. Figure A6-5 below illustrates a typical load profile of a village-scale micro-hydro system. The load factor of the system was assumed at 50%.

23. ***Results.*** At 10% social discount rate, the Levelized Cost of Electricity (LCOE) from village-scale micro-hydro power supply was estimated at $0.16 per kWh, while the average WTP was estimated at $0.21 per kWh. ***The*** EIRR of the investment is 17.0%, and the ENPV is U$58,160 as Figure A6-6 illustrates. The discounted payback period is nine years.

Table A6-5: Results of Economic Analysis for the Mini-grid Sub-Component

	EIRR	ENPV
50 kW micro-hydro serving 200 households	17.0%	$58,160

Figure A6-5: Typical load profile of a village-scale micro-hydro during months of operation

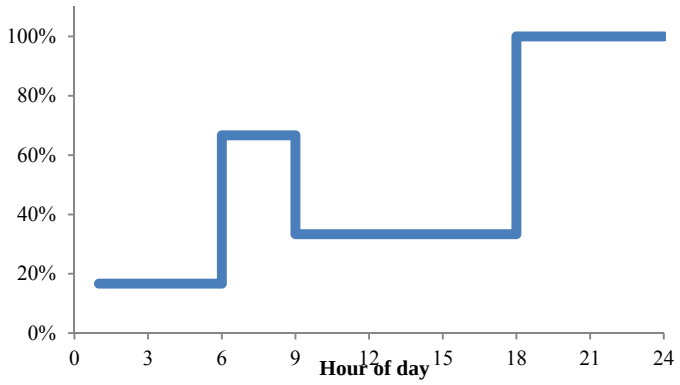
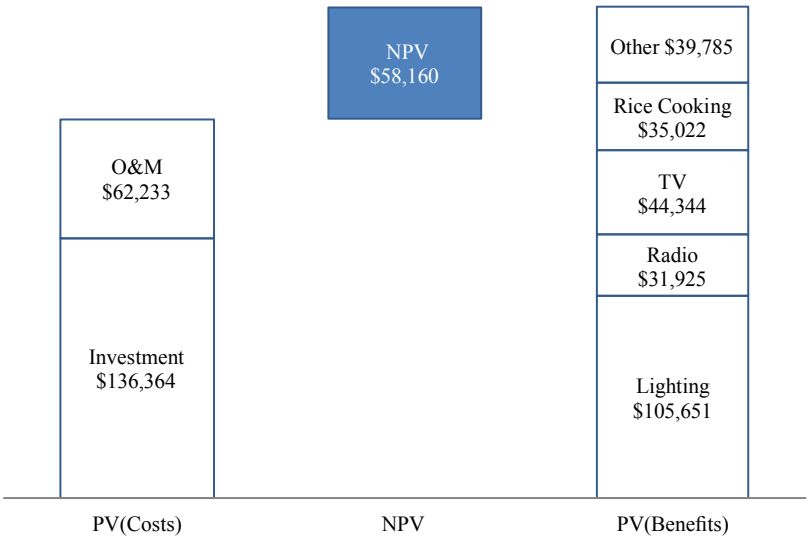


Figure A6-6: Estimated present value of costs and benefits of a 50kW micro-hydro system



24. ***Sensitivity analysis.*** This was carried out to assess the impact of the (i) availability factor; and (ii) investment cost on the economic viability of village-scale micro-hydro system. As Figure A6-7 shows, the EIRR ***is*** sensitive to the number of months the micro-hydro system is available. The switching value of system availability was estimated at 6.5 months, below which the investment would not be economically viable. Figure A6-8 reveals that EIRR is sensitive to the investment cost of the micro-hydro system. The switching value of investment cost of the 50 kW system was estimated at $194,000, above which the investment would not be economically viable.

Figure A6-7:
EIRR sensitivity to hydro-power plant availability

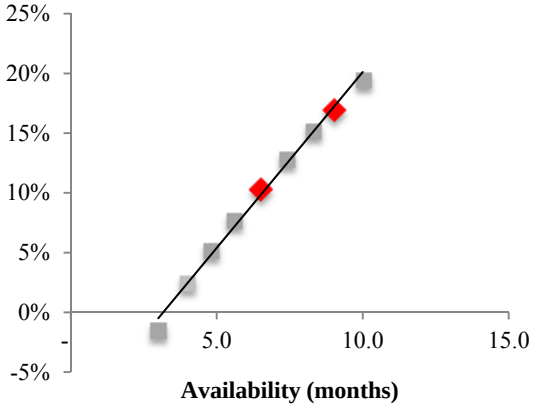
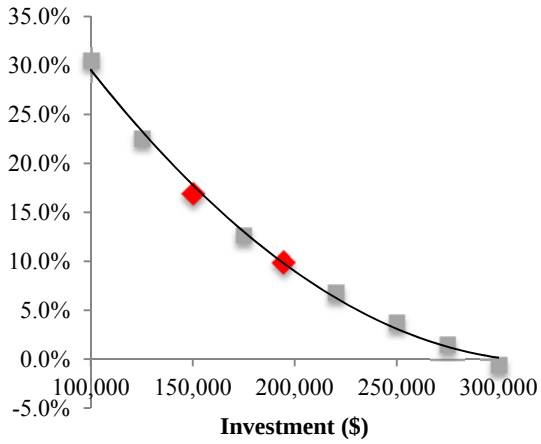


Figure A6-8:
EIRR sensitivity to investment cost



Economic analysis of the solar home system subcomponent

25. The analysis covered the economic viability of a 60 Wp SHS that is capable to meet a typical household's basic needs for lighting, radio listening, phone battery charging and TV viewing.[75] DRD's off-grid program is designed to adopt prospectively a sustainable commercial approach by offering a ***range*** of capacity-size options based on household needs and affordability. Table A6-6 summarizes key specifications and associated costs of the SHS.

Table A6-6. Key specifications and costs of a 60 Wp SHS

	Cost ($)	Lifetime (years)
Solar panel	75.0	10
Solar battery	85.0	2
Small lights 3 W x 2	15.0	2
LED light 9 W x 1	15.0	2
Wiring	15.0	10
Support	15.0	
Transport and installation	20.0	
Controller	20.0	5
Total	**260.0**	
Annual O&M @ 5%	13.0	
Hours of usage (hours per day)	4.0	

26. ***Benefits.*** The economic benefits of SHSs can be measured in terms of the avoided costs for non-electrified households of the essential power-consuming activities, such as lighting, radio listening, phone charging and TV viewing, for which SHS-based electricity will replace kerosene lamps, dry cells and car ***batteries***. This approach provides only the lower bound of the actual benefits of SHS-based power supply, which, *inter alia*, include increased educational (e.g., longer

[75] DRD's current off-grid electrification program supports systems with capacities ranging from 80 Wp to 90 Wp. Technical review carried out by the World Bank team suggests that the currently installed systems are oversized. With a budget of $38.5 million, DRD plans to electrify 170,248 HHs in fiscal year 2014-15. With the same budget, higher quality systems with more advanced specifications can be procured.

study time) and health benefits (e.g., reduced burn injuries from kerosene lamps and reduced air pollution from diesel generators) and time savings (e.g., avoiding trips for battery charging). These benefits are difficult to quantify in monetary terms. Nevertheless, they represent a significant part of the overall benefits of off-grid electrification. Furthermore, the economic analysis does not take account of the positive environmental externalities associated with solar-power-based electricity supply, such as the greenhouse gas emission reduction.

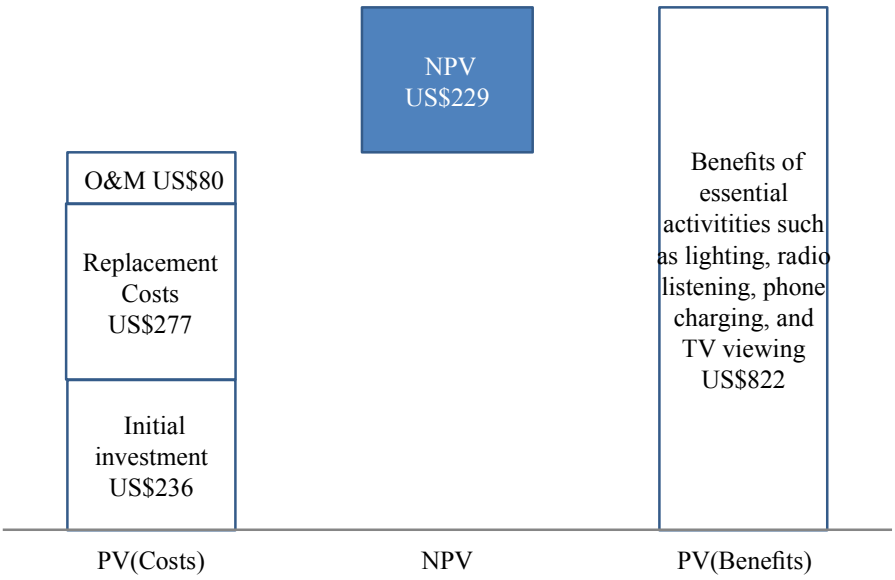
27. ***WTP.*** A 60 Wp SHS operating four hours a day generates 0.24 kWh a day or 7.2 kWh a month to support lighting, radio listening and phone battery charging, or alternatively, TV viewing. Surveys among un-electrified households in Myanmar indicate that rural households spend between $2 and $13 a month on kerosene, dry cells, car battery, etc. for activities that can be served by electricity from a 60 Wp SHS. Based on a household survey for pre- and post-SHS end-users in Lao PDR, the WTP for the power supply from a 50 Wp SHS was estimated at $11.15 per month. To be conservative, the same monthly WTP value is assumed for a 60 Wp SHS in Myanmar.

28. ***Results***. At a 10% social discount rate for a project life of 10 years, LCOE of a 60W SHS is estimated at $1.10 per kWh whereas the average WTP is estimated at $1.53 per kWh (or $11.15 per month), translating to a benefit-cost ratio of 1.39. The investment will yield an estimated EIRR of 52.3% and ***ENPV*** of $229 per system, as Figure A6-9 shows. The discounted payback period is three years.

Table A6-7: Results of Economic Analysis for the Solar Sub-Component

	Economic internal rate of return	Economic Net Present Value
1 x 60 Wp solar home system	52.3%	$229

Figure A6-9: Estimated present value of costs and benefits



29. ***Sensitivity Analysis.*** This was carried out to assess the impact of (i) the investment cost; and (ii) WTP on the economic ***viability*** of the 60 Wp system. As Figure A6-10 shows, the EIRR is sensitive to the system cost. However, there is considerable headroom for cost increases for the SHS investment to remain economically viable. The switching value of the system cost was estimated at $406, above which the investment would not be economically viable. Figure A6-11 shows that EIRR is sensitive to WTP. The switching value of monthly WTP was estimated at $5.83 per month, below which the investment would not be economically viable.

Figure A6-10
EIRR Sensitivity to System Cost

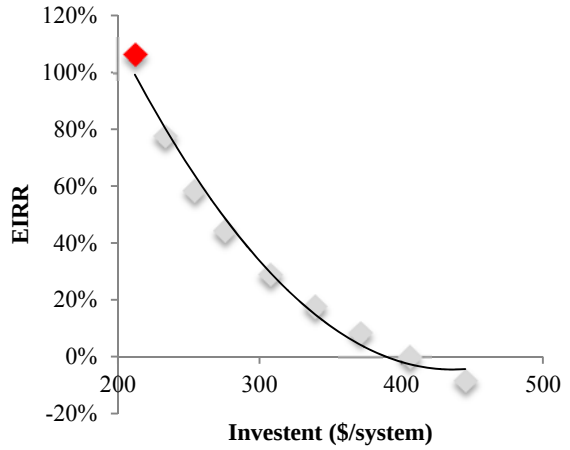
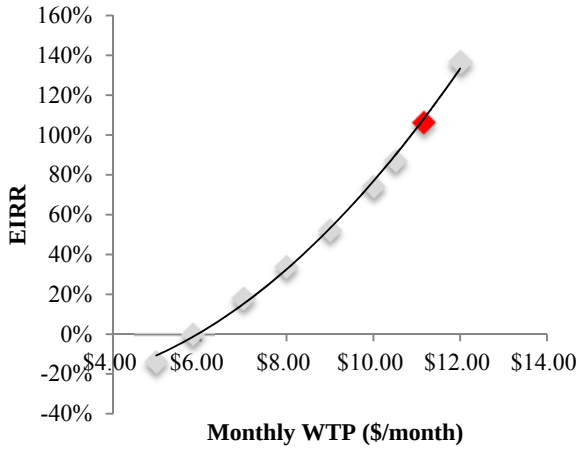


Figure A6-11
EIRR Sensitivity to WTP



Annex 7: Financial Analyses of Distribution Utilities

A. Overview of Myanmar Electricity Supply Sector

1. The Ministry of Electric Power (MOEP) is the main agency responsible for the electricity supply business in Myanmar. MOEP carries out its mandate largely through state economic enterprises that include: (i) Myanmar Electric Power Enterprise (MEPE) for gas-based electricity generation, wholesale buyer/seller of electricity, and as the operator of the electricity transmission network; (ii) Hydro Power Generation Enterprise for hydro and coal-based electricity generation; (iii) Yangon Electricity Service Corporation (YESC) for distribution in Yangon Region; (iv) Mandalay Electricity Service Corporation (MESC) in Mandalay Region; and (iv) Electricity Supply Enterprise (ESE) for distribution in the rest of the country.

2. Following the devaluation of the Myanmar kyat during FY2013, the cost of electricity supply has increased due to higher cost of US dollar-denominated natural gas for power generation. Electricity generated from natural gas accounted for about 25-30% of electric energy supplied to the national power grid. The Myanmar authorities responded to the increased cost by raising electricity tariffs in January 2012 and again in April 2014.

3. The Government is subsidizing the cost of electricity supply by absorbing the tariff gap at MEPE's level. In the past two fiscal years (FY2013 and FY2014), MEPE incurred financial deficits of -35 billion and -39 billion Kyats, respectively (or about 9% of MEPE revenue or 0.07% of GDP). The deficits arose from absorbing the tariff gaps between (i) the cost of power generation and transmission (including transmission losses); and (ii) the wholesale tariffs from MEPE to the distribution utilities. Under the on-going IDA-funded Myanmar Electric Power Project (MEPP), a power sector Financial Viability Action Plan (FVAP) will be prepared to address financial gaps/subsidies requirement of the Myanmar power sector, which is contained at the wholesale level by MEPE.

4. The three distribution utilities (YESC, MESC and ESE) are responsible for implementing the distribution grid component of the Project. The following analysis reviews recent financial situation of ESE and YESC, and carries out a forward-looking assessment of their financial outlook and their ability to implement the Project. As MESC was only established in April 2015, prior to this analysis, Mandalay is therefore assumed to be covered by ESE for the purpose of this Annex.

B. **Financial Analysis of ESE and YESC**

5. The financial risk of the implementing agencies is considered moderate to high because of the upcoming large investment program, supportive electricity tariff policies and limited debt financing at present. The financial analysis shows that both ESE and YESC are in a position to satisfactorily implement the Project under assumptions presented below.

6. Myanmar's electricity tariff policies have supported profitable operations for both ESE and YESC in the past five years. For end-customers of ESE and YESC, electricity tariffs are uniform across the country and there are cross-subsidies among different customer groups. The regulated purchase tariff from wholesaler/transmission entity MEPE is lower for ESE than for YESC to take account of the wider geographic area and the higher cost of distribution services. Both enterprises are allowed to generate an adequate distribution margin to cover their operating cost and financing

cost. This policy is continuing with the most recent tariff adjustment of April 2014. *As long as this tariff adequacy is maintained, both utilities are well positioned to have sustainable financial performance to implement distribution grid improvement and expansion, including Project activities*.

7. The electricity tariff structure for end-users effective from April 2014 provides three tariff blocks for residential, small and medium-sized customers, as well as public sector customers: 0-100 kWh/month at 35 kyats/kWh, 101-200 kWh/month at 40 kyats and over 201 kWh/month at 50 kyats/kWh. For industrial and large customers, there are six tariff blocks with tariffs range of 75-150 kyats/kWh. Effectively, the first group of customers are cross-subsidized by industrial and large commercial customers since their new tariffs (35-50 kyats/kWh) are below the average cost of supply. All electricity tariffs are uniform at the retail level all over the country.

Table A7-1: Electricity Tariffs (established in April 2014 and current as of April 2015)
(Source: MOEP)

Residential, small-medium commercial, public buildings, street lightings

Consumption (kWh/month)	Kyats / kWh
0-100	35
101-200	40
201++	50

Industrial and large commercial

Consumption (kWh/month)	Kyats / kWh
0-500	75
501-10,000	100
10,001-50,000	125
50,001-200,000	150
200,001-300,000	125
300,001 ++	100

8. Despite the imbalance of end-user tariffs between residential and non-residential uses, the overall tariffs have been adequate to cover the cost of services provided by ESE and YESC as a whole. However, this unbalanced end-use tariff structure is not sustainable in the long term. Under the IDA-funded MEPP, an electricity tariff review study and a poverty and social impact assessment will be carried out to inform decision-makers of further tariff rationalization options.

9. For the next 5–10 years, the main financial risks for both ESE and YESC arise from the expected step-increase in capital expenditures for distribution network improvement and expansion. This follows limited new investment in recent past. Both enterprises will have to prepare to manage new debt and equity financing to finance upcoming capital expenditures, including for the Project. As of end-FY2013/14, both ESE and YESC have no long-term debt financing. Both enterprises have depended on tariff revenue to cover operating costs and on MOEP budget for capital expenditures. For the next few years, debt repayment obligations will be limited by the grace-period of new loans, which helps manage financial liquidity risk for them.

10. Both ESE and YESC will need to carefully manage its debt and owners' equity composition to guard against financial shocks. The enterprises will also need to proactively manage their cash flow to meet future financial obligations. And, the grid improvement and expansion program will soon generate significant cost saving from reducing distribution losses, which is financially beneficial for the two utilities.

Overview of ESE Financial Performance

11. ESE's total assets reached 446 billion kyats ($446 million) in FY2013/14. The fixed assets were around 181 billion kyats ($181 million). All fixed assets were financed by government contributions, ESE's equity, without any debt financing.

12. During FY2014, the selling tariff of ESE averaged 49.8 kyats/kWh, while total expenses averaged 49.4 kyats/kWh, resulting in a net profit margin of 2%. ESE purchased most (98%) of its electricity from MEPE and generated a small amount from small hydro and diesel units. In FY2013/14, ESE sold 5,366 million kWh to its customers. The general purpose category (mostly regular residential customers) accounted for 32% of the electricity sale while industrial consumption, bulk sale and franchise sale accounted for about 67%. The total power purchase cost was 225.5 billion kyats ($225 million), while the total revenue in the same period was 270.4 billion kyats ($270million). Income before taxes was 7.0 billion kyats ($7 million) and net income after taxes was 5.3 billion kyats ($5 million), a net profit margin of 2%.

13. In terms of cash flow, net operating cash flow was -5.3 billion kyats, declining from positive operating cash flow in the preceding two years of 31.6 billion kyats and 7 billion kyats, respectively. Capital spending was 55.8 billion kyats, continuing to increase from previous years. Cash support from the government budget of 92 billion kyats was made to ESE to meet the cash funding gap.

14. In terms of working capital management, ESE manages this aspect quite well with good collection rate from customers and no legacy of significant unpaid obligations to suppliers. However, it appears that the level of inventory on-hand (mostly for distribution equipment) is quite high, averaging 46% of gross fixed assets. In FY2013/14, ESE had an outstanding account receivables from customers of 24 billion kyats, plus 22 billion kyats of prepaid receivables. Customer receivables averaged about one month of sales, suggesting good bill collection performance. On the other hand, ESE's payables account (mostly to MEPE) totaled around 41 billion kyats or about two months of the cost of purchased electricity in that year.

Overview of YESC Financial Performance

15. YESC's total assets reached 302 billion kyats in FY2013/14 ($302 million). The fixed assets were around 132 billion kyats ($132 million). Total liabilities reached 91 billion kyats ($135 million) and total equity reached 211 billion kyats ($211 million). All fixed assets were financed by government contribution, YESC's equity, without any debt financing.

16. In FY2013/14, the selling tariff of YESC averaged 57 kyats/kWh, while total expenses averaged 54 kyats/kWh, resulting in a net profit margin of 3.8%. YESC's electric power purchased from MEPE was 5,197 million kWh, while the amount of power sold in the same period was 4,245 million kWh, resulting in 18% electricity loss. Residential and non-industrial consumption

accounted for about 50% of total sales, while industrial consumption and bulk sales accounted for the balance. The total electricity purchase cost from MEPE was 208 billion kyats ($208 million), while the total revenue was 244 billion kyats ($244 million). The net profit for the year was 9.2 billion kyats ($9 million), a net profit margin of 3.8%.

17. YESC also manages working capital well with good collection rate from customers—averaging one month of sales—and no significant unpaid obligations to suppliers. The level of inventory on-hand increased to 32% of gross fixed assets. In FY2012/13, YESC had outstanding account receivables from customers of 17 billion kyats. YESC's payables account with MEPE was around 24 billion kyats ($24 million), averaging about 1.5-month worth of electricity purchased from MEPE. YESC had a large current liability of 31 billion kyats ($31 million) for separate and concrete pole plant.

Financial Outlook

ESE

18. A medium-term financial projection has been carried out for ESE. Its financial performance is sensitive to the average selling tariff, the average purchasing tariff, level of capital expenditures, financing expenses and the level of distribution losses. The projection shows declining profitability in the next ten years due to rising operating cost and financing cost. ESE's financial performance may improve further with a decline in distribution losses below the assumed 13%. The projection suggests that ESE's indebtedness will continue to increase, exceeding two times its equity by FY2020/21, compared with no debt in FY2013/14. In terms of cash flow, ESE can generate positive operating cash flow during the projection period, which will complement debt financing for capital expenditures. The projection assumes average bill collection period of 45 days, slightly longer than the actual average of about 30 days in recent years, to take account of increasing electrification in the ESE service area. On the payables side, the projection assumes an average payment period of 60 days.

The tables below show summary income, cash flow, balance sheet projections for the two utilities to FY2020.

19. ESE's fixed assets are projected to increase sharply—from 181b kyats to more than 1,000b Kyats—due to the expansion of the distribution network, including under the Project. Building on existing ESE equity (book value of 282 billion by end-FY2014), the projection assumes new capital expenditures can be mostly debt-financed, including the IDA credit for the Project. ESE is projected to start debt repayment in FY2020/21. The initial debt service capacity is adequate and supported by relatively long repayment period of IDA credit and other concessional loans.

YESC

20. For YESC, the financial performance is also sensitive to the average selling tariff, the average purchasing tariff, level of capital expenditures, financing expenses and the level of distribution losses. The projection shows initial increases in profitability in the next five years, followed by a decline in the outer years due to rising operating costs and financing costs. YESC's financial performance may also improve further with a decline in distribution losses below the assumed 14-17%. The projection suggests that YESC's indebtedness will gradually increase, approaching 0.4

times its equity by FY2020/21, compared with no debt in FY2013/14. In terms of cash flow, YESC can generate positive operating cash flow during the projection period, which will complement debt financing for capital expenditures. The projection maintains an average bill collection period of around 35 days similar to recent years. On the payables side, the projection assumes an average payment period of 30 days.

21. YESC's fixed assets are projected to increase substantially from 302 billion kyats to more than 1,000 billion kyats due to the expansion of the distribution network, including under the Project. Building on existing YESC equity (book value of 211 billion by end-FY2014), the projection assumes a combination of debt and equity financing for new capital expenditures consistent with YESC's corporatization program. The utility is projected to start debt repayment in FY2019/20; the initial debt-service capacity is adequate and supported by the relatively long repayment period of the IDA credit and other concessional loans.

Table A7-2: ESE Summary Income Statement

Summary Income Statement	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats
	Actual	Actual	Actual	Estimates	Projected	Projected	Projected	Projected	Projected	Projected
Income										
Electricity sales	167,933	236,359	267,315	409,434	459,672	516,074	579,396	650,488	730,303	819,911
Other income	2,680	3,390	3,064	3,217	3,378	3,547	3,725	3,911	4,106	4,312
Total income	170,613	239,749	270,379	412,652	463,050	519,621	583,121	654,399	734,409	824,223
Expenses										
Electricity purchases	99,574	193,735	225,511	346,453	388,963	436,689	490,270	550,427	617,964	693,788
Fuel	4,433	5,581	6,312	6,501	6,696	6,897	7,104	7,317	7,536	7,763
Salaries, wages	5,551	5,960	7,685	8,069	8,473	8,896	9,341	9,808	10,298	10,813
Maintenance, repairs	10,184	11,433	11,002	11,552	12,130	12,736	13,373	14,041	14,744	15,481
Depreciation	3,681	6,593	9,062	11,310	12,362	14,468	17,633	23,185	32,395	41,605
Commercial taxes	4,462	3,591	1,924	2,936	3,295	3,698	4,149	4,657	5,226	5,865
Interest expenses	-	-	-	-	379	1,616	3,692	6,924	12,136	18,301
Total Expenses	129,312	228,552	263,345	386,822	432,677	486,230	548,005	620,803	707,925	804,177
Taxes	12,390	2,799	1,759	6,458	7,593	8,348	8,779	8,399	6,621	5,011
Net income (after taxes)	28,910	8,397	5,276	19,373	22,780	25,044	26,337	25,197	19,864	15,034

Table A7-3: ESE Summary Cash Flow Statement

Summary Cash Flow Statement	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats
Operations										
Changes in non-cash working capital	25,101	(1,258)	(16,174)	(58,317)	(16,056)	(16,231)	(16,667)	(14,832)	(10,881)	(14,403)
Operating cash flow, net	31,636	7,000	(5,263)	(27,634)	19,086	23,660	28,533	35,993	45,822	49,862
Investing										
Capital spending	(40,665)	(34,258)	(55,778)	(60,000)	(26,300)	(52,640)	(79,120)	(138,820)	(230,240)	(230,240)
Financing										
Loan disbursement & adjustment	0	0	0	0	25,289	56,381	79,570	130,994	207,615	213,928
Loan repayment	0	0	0	0	0	0	0	0	0	(25,799)
Fund from State budget	9,025	113,094	92,010	0	0	0	0	0	0	0
Change in cash flow for the year	(3)	85,835	30,968	(92,801)	(4,705)	2,357	2,646	2,970	3,334	3,742
Beginning cash balance	(1)	(4)	85,831	116,800	23,999	19,294	21,651	24,297	27,267	30,600
Ending cash balance	(4)	85,831	116,800	23,999	19,294	21,651	24,297	27,267	30,600	34,343

Table A7-4: ESE Summary Balance Sheet

Summary Balance Sheet	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats	Mil. Kyats
	Actual	Actual	Actual	Estimates	Projected	Projected	Projected	Projected	Projected	Projected
Current assets, of which	103,849	205,118	264,532	251,872	272,283	302,831	337,121	375,612	418,818	467,318
Cash	- *4*	*85,831*	*116,800*	*23,999*	*19,294*	*21,651*	*24,297*	*27,267*	*30,600*	*34,343*
Consumer's accounts	*17,533*	*20,110*	*24,094*	*50,875*	*57,088*	*64,063*	*71,892*	*80,679*	*90,544*	*101,617*
Non-current assets	110,536	136,536	181,404	230,094	244,031	282,204	343,691	459,326	657,170	845,806
Total assets	214,385	341,654	445,936	481,966	516,314	585,035	680,812	834,937	1,075,989	1,313,124
Current liabilities, of which	31,675	45,850	58,122	79,946	89,005	100,965	115,942	136,631	191,421	231,710
Current-portion of long-term loans	0	0	0	0	0	0	0	0	25,799	35,733
Non-current liabilities, of which	107,992	107,779	105,367	105,367	130,655	187,416	268,216	401,653	587,914	773,734
Loans	-	-	-	-	25,289	82,049	162,849	296,286	482,547	668,368
Total liabilities	139,668	153,630	163,489	185,312	219,660	288,381	384,158	538,284	779,335	1,005,445
Total equity	74,717	188,024	282,447	296,654	296,654	296,654	296,654	296,654	296,654	307,679
Total Liabilities and Equity	214,385	341,654	445,936	481,966	516,314	585,035	680,812	834,937	1,075,989	1,313,124

Table A7-5: ESE Financial Indicators

Financial & Other Indicators	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
	Actual	Actual	Actual	Estimates	Projected	Projected	Projected	Projected	Projected	Projected
Electricity sales per kWh sold, kyat/kWh	40.1	52.5	49.8	70.0	72.1	74.3	76.5	78.8	81.1	83.6
Total expenses per kWh sold	33.8	51.4	49.4	67.2	69.1	71.2	73.5	76.2	79.4	82.5
Profitability										
EBITDA margin	26.4%	7.4%	6.0%	9.0%	9.4%	9.8%	10.1%	10.4%	10.7%	11.0%
Net margin	16.9%	3.5%	2.0%	4.7%	4.9%	4.8%	4.5%	3.9%	2.7%	1.8%
Return on equity	38.7%	4.5%	1.9%	6.5%	7.7%	8.4%	8.9%	8.5%	6.7%	4.9%
Return on assets	13.5%	2.5%	1.2%	4.0%	4.4%	4.3%	3.9%	3.0%	1.8%	1.1%
Effective tax rate, %	30%	25%	25%	25%	25%	25%	25%	25%	25%	25%
Average depreciation rate, % of fixed assets	4%	5%	5%	4%	4%	4%	4%	4%	4%	4%
Cashflow										
Debt service coverage	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	4.8	1.5
Self finance	78%	20%	-9%	-46%	74%	45%	36%	26%	20%	10%
Liquidity and leverage										
Current ratio	3.3	4.5	4.6	3.2	3.1	3.0	2.9	2.7	2.2	2.0
Receivable outstanding, # day of revenue	37.5	30.6	32.5	45	45	45	45	45	45	45
Payables outstanding, # day of external cost	79.5	60.8	66.1	60	60	60	60	60	60	60
Inventory level, % of fixed assets	48%	46%	46%	55%	56%	54%	50%	42%	34%	30%
Long-term debt to equity, times	-	-	-	-	0.1	0.3	0.5	1.0	1.6	2.2
Cash balance (# month of revenue)	(0.0)	4.3	5.2	0.7	0.5	0.5	0.5	0.5	0.5	0.5
Technical										
ESE GWh sold	4,192	4,503	5,366	5,849	6,375	6,949	7,575	8,256	9,000	9,809
ESE distribution losses, GWh	863	907	843	910	983	1,063	1,150	1,245	1,348	1,461
Distribution loss rates, %	-17%	-17%	-14%	-13%	-13%	-13%	-13%	-13%	-13%	-13%
Tariff changes, % from prior year	7%	31%	-5%	41%	3%	3%	3%	3%	3%	3%
GWh sold changes, % from prior year	23%	7%	19%	9%	9%	9%	9%	9%	9%	9%

Table A7-6: YESC Summary Income Statement

Summary Income Statement	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat
	Actual	Actual	Actual	Estimates	Projected	Projected	Projected	Projected	Projected	Projected
Income										
Electricity sales	148,256	213,404	240,544	391,475	401,262	411,293	421,576	481,137	555,726	650,619
Other income	2,042	3,118	3,669	3,880	4,102	4,338	4,587	4,851	5,129	5,424
Total income	150,298	216,522	244,213	395,355	405,364	415,631	426,163	485,988	560,855	656,043
Expenses										
Electricity purchases	87,303	177,314	207,880	304,939	299,738	298,397	313,067	352,152	422,142	499,210
Fuel	126	112	141	0	0	0	0	0	0	0
Salaries, wages	2,549	2,846	5,513	5,788	6,656	7,655	8,803	10,124	11,642	12,806
Maintenance, repairs	3,048	5,132	4,776	5,104	5,046	4,792	4,993	5,975	7,242	8,475
Depreciation	4,283	4,742	7,553	10,281	11,456	12,459	15,193	21,372	25,903	30,316
Commercial taxes	3,858	3,144	1,619	19,574	20,063	20,565	21,079	24,057	27,786	32,531
Interest expenses	-	-	-	1,121	1,549	1,884	2,162	4,179	6,888	9,100
Total Expenses	101,167	193,290	227,481	346,807	344,509	345,752	365,297	417,858	501,604	592,438
Taxes	14,739	5,808	4,183	12,137	15,214	17,470	15,216	17,032	14,813	15,901
Net income (after taxes)	2,131	12,777	9,203	36,411	45,641	52,410	45,649	51,097	44,438	47,703

Table A7-7: YESC Summary Cash Flow Statement

Summary Cash Flow Statement	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021
	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat
Operations										
Changes in non-cash working capital				(39,268)	514	860	2,230	(1,151)	(946)	(2,171)
Operating cash flow, net				7,424	57,611	65,729	63,072	71,318	69,396	75,848
Investing										
Capital spending				(30,472)	(21,893)	(18,698)	(50,951)	(115,170)	(84,448)	(82,237)
Financing										
Loan disbursement & adjustment				51,822	16,598	14,110	35,416	82,491	59,686	59,262
Loan repayment				0	0	0	0	0	(2,986)	(5,160)
Fund from State budget/Equity				9,142	6,568	5,609	15,285	34,551	25,334	24,671
Change in cash flow for the year	(18,104)	64,754	33,067	37,916	58,884	66,751	62,822	73,191	66,983	72,385
Beginning cash balance	21,422	3,318	68,072	101,139	139,055	197,939	264,690	327,513	400,703	467,686
Ending cash balance	3,318	68,072	101,139	139,055	197,939	264,690	327,513	400,703	467,686	540,070

Table A7-8: YESC Summary Balance Sheet

Summary Balance Sheet	**2011-2012**	**2012-2013**	**2013-2014**	**2014-2015**	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**2020-2021**
	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat	Mil. Kyat
Current assets, of which										
Cash	3,318	68,072	101,139	139,055	197,939	264,690	327,513	400,703	467,686	540,070
Consumer's accounts and others	31,244	56,388	68,296	41,847	40,839	39,935	38,911	43,274	49,878	58,478
Non-current assets	86,347	96,930	132,371	152,562	162,999	169,238	204,996	298,793	357,338	409,260
Total assets	120,909	221,390	301,806	333,464	401,777	473,863	571,419	742,771	874,902	1,007,808
Current liabilities, of which	49,933	67,279	90,780	55,555	56,333	57,312	58,268	63,353	69,583	77,709
Short-term loans	-	-	-	*30,492*	*31,765*	*32,786*	*32,536*	*34,409*	*34,981*	*36,678*
Non-current liabilities, of which										
Loans	-	-	-	21,331	36,656	49,745	85,410	166,029	222,157	274,563
Total liabilities	49,933	67,279	90,780	76,886	92,990	107,056	143,678	229,382	291,740	352,272
Total equity	70,976	154,111	211,026	256,578	308,788	366,807	427,741	513,389	583,162	655,536
Total Liabilities and Equity	120,909	221,390	301,806	333,464	401,777	473,863	571,419	742,771	874,902	1,007,808

Table A7-9: YESC Financial Indicators

Financial & Other Indicators	2011-2012 Actual	2012-2013 Actual	2013-2014 Actual	2014-2015 Estimates	2015-2016 Projected	2016-2017 Projected	2017-2018 Projected	2018-2019 Projected	2019-2020 Projected	2020-2021 Projected
Electricity sales per kWh sold, kyat/kWh	42	57	57	89	89	89	89	89	90	93
Total expenses per kWh sold	29	52	54	79	77	75	77	77	81	84
Profitability										
EBITDA margin	35.5%	12.9%	9.9%	15.2%	18.2%	20.3%	18.4%	19.3%	16.4%	15.7%
Net margin	1.4%	5.9%	3.8%	9.2%	11.3%	12.6%	10.7%	10.5%	7.9%	7.3%
Return on equity	3.0%	8.3%	4.4%	14.2%	14.8%	14.3%	10.7%	10.0%	7.6%	7.3%
Return on assets	1.8%	5.8%	3.0%	10.9%	11.4%	11.1%	8.0%	6.9%	5.1%	4.7%
Effective tax rate, %	30%	25%	25%	25%	25%	25%	25%	25%	25%	25%
Average depreciation rate, % of fixed assets	4%	4%	5%	5%	5%	5%	5%	5%	5%	5%
Cashflow										
Debt service coverage	n/a	n/a	n/a	7.6	38.2	35.9	30.2	18.1	7.7	6.0
Self finance	n/a	n/a	n/a	28%	270%	362%	128%	66%	87%	97%
Liquidity and leverage										
Current ratio	0.7	1.8	1.9	3.3	4.2	5.3	6.3	7.0	7.4	7.7
Receivable outstanding, # day of revenue	44	32	n/a	39	37	35	33	33	32	33
Payables outstanding, # day of external costs	66	50	n/a	30	30	30	30	30	30	30
Long-term debt to equity, times	-	-	-	0.1	0.1	0.1	0.2	0.3	0.4	0.4
Cash balance (# month of revenue)	0.3	3.8	5.0	4.2	5.9	7.6	9.2	9.9	10.0	9.9
Technical										
YESB GWh sold	3,525	3,752	4,245	4,389	4,499	4,611	4,726	5,394	6,156	7,026
YESB distribution losses, GWh	840	860	952	917	901	885	868	931	1,020	1,116
Distribution loss rates, %	-19%	-19%	-18%	-17%	-17%	-16%	-16%	-15%	-14%	-14%
Tariff changes, % from prior year	11.2%	35.2%	-0.4%	57.4%	0.0%	0.0%	0.0%	0.0%	1.2%	2.6%
GWh sold changes, % from prior year	21.8%	6.5%	13.1%	3.4%	2.5%	2.5%	2.5%	14.1%	14.1%	14.1%

Annex 8: Map of Myanmar