Evaluation Design Report:
Millennium Challenge Corporation
Malawi Infrastructure Development and Power Sector Reform Projects

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Acronym List

DC	Double Circuit
D-E	Debt to Equity
DR	Debt Ratio
EIRR	Economic Internal Rate of Return
EMC	Evaluation Management Committee
ENRM	Environmental and Natural Resource Management Project
ERR	Economic Rate of Return
ESCOM	Electricity Supply Coordination of Malawi
FGD	Focus Group Discussions
FINOT	Financial and Operational Turnaround
GIS	Geographic Information System
GOM	Government of Malawi
GPS	Global Positioning System
GWh	Gigawatt Hour
IDP	Infrastructure Development Project
IHS	Integrated Health Survey
IRB	Institutional Review Board
IPP	Independent power producers
KII	Key Informant Interviews
kW	Kilowatt
kWh	Kilowatt Hour
kV	Kilovolts
kVA	Kilovolt-ampere
M&E	Monitoring and Evaluation
MCC	Millennium Challenge Corporation
MCA-M	Millennium Challenge Account-Malawi
MD	Maximum Demand
MERA	Malawi Energy Regulatory Authority
MIS	Management Information System
MOE	Ministry of Energy
MOU	Memorandum of Understanding
MWK	Malawian kwacha
O&M	Operations and Maintenance
OHL	Overhead Line
PSRP	Power Sector Reform Project
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control and Data Acquisition
SOW	Scope of Work

SSA	Sub-Saharan Africa
TOC	Theory of Change
TOR	Terms of Reference
WB	World Bank

I. Executive Summary

Introduction

On April 7, 2011, The Millennium Challenge Corporation (MCC) signed a five-year, USD 350.7 million Compact with the Government of Malawi (GOM) to address the structural, operational and financial inefficiencies of power subsector institutions, and the generation, transmission and distribution capacity constraints faced by the country's power subsector. The five-year implementation period began on September 20, 2013 and will run through September 19, 2018. The MCC Malawi Compact includes three projects: the Infrastructure Development Project (IDP, allocated $257.1 million), the Power Sector Reform Project (PSRP, allocated $25.7 million), and the Environmental and Natural Resource Management Project (ENRM, allocated $27.9 million). Social Impact's evaluation focuses on the IDP and PSRP. In this Design Report, Social Impact (SI) outlines a methodology for a mixed methods performance evaluation of the PSRP and IDP projects.

Compact Goals and Objectives

The Compact entails a wide array of activities designed to achieve the Compact's stated goal and objectives. The overarching goal of the Compact is to "reduce poverty through economic growth in Malawi." The Compact aims to attain this goal by working towards three primary objectives:

1) Reduce the cost of doing business in Malawi
2) Expand access to electricity for the Malawian people and businesses
3) Increase value-added production in Malawi

IDP and PSRP Activities

The Infrastructure Development Project (IDP) comprises four activities:

1. The Integrated Resource Plan Activity entails the development of an Integrated Resource Plan (IRP) that identifies a prioritized list of generation projects that will allow the GOM and ESCOM to meet the country's growing demand for power.
2. The Nkula A Refurbishment Activity involves the refurbishment of the Nkula A hydropower plant, which was originally constructed in 1966. The activity will extend the life of the facility of while adding generation capacity of approximately 6 MW.
3. The Transmission Network Upgrade Activity includes the installation of a 400 kV high voltage power line linking Lilongwe to power generation facilities in the south and the development of a 132 kV line to facilitate transmission in the north of the country around Mzuzu.
4. The Transmission and Distribution Network Upgrade, Expansion, and Rehabilitation Activity will occur in targeted locations throughout the country. It will include upgrading existing network connections, up-rating transformers, constructing new substations, and installing control and communications systems, among other actions.

The Power Sector Reform Project (PSRP) includes a wide array of activities designed to help address financial, operational, and governance challenges among power subsector institutions. The PSRP is divided into three main activities with several sub-activities:

1. The ESCOM Turnaround Activity includes a Finances Sub-Activity designed to develop a detailed financial plan, financial model and a management information system (MIS) for the Electrical Supply Corporation of Malawi (ESCOM). The Turnaround Activity also includes a Corporate Governance Sub-Activity to develop a Corporate Governance Benchmarking Study, and an Operations Sub-Activity, entailing a review of ESCOM's organizational structure, embedment of a financial and operational turnaround team, planned improvements to procurement processes, and the initiation of performance audits and a social and gender assessment.
2. The Regulatory Strengthening Activity also entails three sub-activities, including a Tariff Reform Sub-Activity that involves deployment of a tariff advisor to ESCOM and a regulatory advisor to Malawi Energy Regulatory Authority (MERA). A second sub-activity aims to build MERA's capacity through trainings, workshops, exchange visits, peer learning, and a benchmarking study. The third sub-activity, the Enabling Environment for Public and Private Sector Investment Sub-Activity, involves supporting a high-level energy advisor to the Ministry of Energy.
3. The Power Sector Reform Agenda Semi-Annual Review (SAR) offers a process for Compact stakeholders to jointly monitor the progress of power sector reform efforts and includes regular meetings to measure progress in achieving targets across 25 indicators.

Research Questions

Through a rigorous performance evaluation, the evaluation design aims to answer the following core evaluation questions and several complementary research questions:

1. What declines in poverty, increases in economic growth, reductions in the electricity related cost of doing business, increases in access to electricity, and increases in value added production are observed over the life of the Compact?
2. What were the results of the interventions – intended and unintended, positive or negative?
3. Are there differences in outcomes of interest by gender, age and income? Sex and income disaggregated information for businesses and households will be pursued to the extent possible.
4. What are the lessons learned and are they applicable to other similar projects?
5. What is the likelihood that the results of the Project will be sustained over time?
6. At the household level, the evaluations shall focus on the following program/project/activities impacts on household and individuals: income; expenditures, consumption and access to energy; individual time devoted to leisure and productive activities.
7. At the enterprise level, the evaluation shall focus on the potential impact of the program/project/activities on: business profitability and productivity; value added production and investment; employment and wage changes; energy consumption and sources of energy used; business losses.

8. At the regulatory, institutional and policy level, the evaluation shall explore the potential impacts of the program/project/activities on: utility operating costs and losses; financial sustainability; private investment, particularly in generation; expansion of electricity access for customers, particularly the poor.

Evaluation Design

To answer these evaluation questions, the evaluation design includes diverse research methodologies with different timelines for data collection. The evaluation design can be roughly broken into three overlapping parts:

- The IDP evaluation involving intensive metering complemented by focus groups with residents of beneficiary communities.
- The PSRP design incorporates five data collection activities, including: (1) quantitative indicators, (2) workflow analyses, (3) a series of largely qualitative research activities, (4) a proposed survey of ESCOM employees, and (5) a process evaluation that will compile lessons learned, and provide a qualitative context for interpreting monitoring data.
- A panel survey of business enterprises will be used to evaluate both the PSRP and the IDP.

I) Infrastructure Development Project

We propose that the IDP evaluation consist of two major parts: (1) intensive metering to determine technical benefits, and (2) focus group discussions with residents in beneficiary communities.

a) Technical Performance Monitoring

Improvements to transmission and distribution infrastructure are expected to result in: (i) higher capacity equipment and greater energy delivered; (ii) lower outage frequencies and durations; and (iii) lower levels of technical losses. MCA-M is currently laying the groundwork for an intensive metering initiative that will permit measurement of these three factors before and after the IDP supported investments.

b) Household focus groups

While the metering will offer a measure of technical benefits, Compact stakeholders are also interested in the effects on households in communities benefiting from IDP infrastructure investments. Because it will not be possible to rigorously measure these effects, a previously proposed household survey has been removed from the design. Nonetheless, the evaluation design includes a series of 24 focus groups stratified by beneficiary level, location, age and sex to complement the information provided by the technical benefits portion of the evaluation.

II) Power Sector Reform Project

The focus of the PSRP evaluation will be to measure financial, operational and governance changes within the power subsector over time through a combination of methods, and to qualitatively consider the extent to which any observed improvements can be attributed to Compact activities. Most data collection activities would occur in three phases: at baseline, midline, and at the end of the Compact and focus on the following:

a) Quantitative Indicators

Performance indicators for both ESCOM and MERA will provide quantitative measures of Compact outputs and outcomes over the life of the Compact. New data collection activities are not required to analyze the Compact's indicators since the MCC-MCA-M Monitoring and Evaluation (M&E) plan and MERA already track many key indicators. When possible, the evaluation team will compare indicators across several reference points, including prior to the initiation of the Compact, to better capture trends.

b) Workflow Studies

Using a methodology known as "metrics based process mapping," the evaluation team will explore a set of distinct tasks or processes expected to improve or become more efficient as a result of the Compact. These include tasks related to billing, procurement, finance, electricity outages, applications for new connections, customer service requests, the tariff approval process, and potentially others. This methodology will permit the evaluation to develop and track a series of quantifiable efficiency and effectiveness metrics over the course of the Compact while qualitatively identifying and exploring challenges in carrying out these processes.

c) Qualitative Research

As a complement to the workflow studies, additional key informant interviews and qualitative data collection activities will be conducted for each of the PSRP sub-activities. In addition, interviews and other qualitative research will include a gender component and will monitor compliance with and effectiveness of the social and gender integration plan.

d) ESCOM Survey

Pending a decision by the Evaluation Management Committee (EMC) to be taken after initial PSRP data collection, a survey of mid and senior level ESCOM employees is proposed to inform learning and provide complementary quantitative data to the otherwise largely qualitative PSRP evaluation. The survey would entail in-person and phone surveying. The survey would measure, at a minimum, employees' evaluations of aspects of ESCOM operations and HR policies and benefits. The survey instrument will be developed in consultation with MCC and MCA-M.

e) Process Evaluation

SI proposes to fold the midcourse process evaluation into existing PSRP data collection activities to be conducted at baseline and midline. Following a review of progress in meeting M&E targets for milestones and outputs, the evaluation team will use the workflow studies and qualitative data collection activities to explore lessons learned and to provide the qualitative context needed to interpret M&E data.

III. Enterprise Surveys

Two of the three main objectives of the Compact are related to businesses: to reduce the cost of doing business and to increase value added production. Achievement of these objectives and others can best be measured within the limits of a performance evaluation design through a survey of businesses before, during, and after realization of the Compact's benefits. The evaluation will use a panel survey of maximum demand and three-phase commercial customers in Compact beneficiary areas to identify changes in

electricity related indicators over time. The specifics of survey sampling and measurement will have to be further refined following additional scoping activities and discussions within MCC and other stakeholders. The survey will explore various topics including the costs of energy to businesses, responses to outages, perceptions of and responses to changes in energy supply and reliability, satisfaction with ESCOM, and consumer attitudes towards tariff rates for electricity.

II. Introduction

On April 7, 2011, The Millennium Challenge Corporation (MCC) signed a five-year, USD 350.7 million Compact with the Government of Malawi (GOM) to address the structural, operational and financial inefficiencies of power subsector institutions, and the generation, transmission and distribution capacity constraints faced by the country's power subsector. The five-year implementation period began on September 20, 2013 and will run through September 19, 2018. The MCC Malawi Compact includes three projects: the Infrastructure Development Project (IDP, allocated $257.1 million), the Power Sector Reform Project (PSRP, allocated $25.7 million), and the Environmental and Natural Resource Management Project (ENRM, allocated $27.9 million). Social Impact's evaluation focuses on the IDP and PSRP.

In the forthcoming sections of the Design Report, Social Impact (SI) outlines a methodology for a mixed methods performance evaluation of the PSRP and IDP projects. The Report begins with an overview of the project logic that illustrates how the inputs and outputs contribute to achieving the overall project and program objectives outlined in the first amendment to the Compact.[1] This overview is followed by a literature review which focuses on some of the commonly encountered challenges confronting the power sector in Malawi and Africa more generally, including tariff reform, corporate governance, and private sector involvement. The objective of this review is to explore both the history and best practices for overcoming these challenges in developing countries, with a primary focus on Sub-Saharan Africa.

The project logic, key findings from the literature review, and guidance from both MCC and MCA-Malawi, informed the IDP and PSRP evaluation designs. The IDP design focuses primarily on an intensive metering effort to measure the technical benefits of the project. This will be complemented by focus groups with residents of beneficiary communities. Some of the activities conducted as part of the PSRP evaluation, specifically work flow analyses of ESCOM response to outages, will also address IDP benefits made possible by the supervisory control and data acquisition (SCADA) systems. The PSRP design incorporates four data collection activities: (1) quantitative indicators from the M&E Plan and Malawi Energy Regulatory Authority (MERA) key performance indicators, (2) workflow analyses with relevant units, such as billing and procurement, (3) a series of largely qualitative research activities (with some mini-surveys included), and (4) a proposed survey of Electricity Supply Corporation of Malawi (ESCOM) employees. Finally, a panel survey of businesses will be used to evaluate both the PSRP and the IDP.

The PSRP and IDP designs are structured to answer the evaluation's core questions in addition to the research questions developed in cooperation with MCC and MCA-Malawi. The research questions and data sources for both evaluations can be found in Tables 2 and 3.

The later sections of this report include a risk analysis plan, Institutional Review Board (IRB) requirements, an overview of the evaluation team roles and responsibilities, protocols on data access, privacy and

[1] MCC. (2013). First Amendment to Millennium Challenge Compact Between the United States of America Acting Through The Millennium Challenge Corporation and The Republic of Malawi.
http://www.mcc.gov/documents/agreements/Malawi_First_Compact_Amendment_with_Annexes.pdf

documentation, and a dissemination plan. The data collection budget and detailed evaluation Work Plan are attached to this report.

III. Background and Literature Review

Electricity generation and access rates are extremely low in Malawi. The total installed capacity of the country's electrical utility ESCOM is about 351 MW, approximately 95% of which is generated by hydropower.[2] Almost all of ESCOM's hydropower generation is located in the southern region of Malawi along the Shire River, except for a 4.5 MW facility located in the Northern region on the Wovwe River. Electrical power is transmitted to all other parts of the country through an electricity network with inadequate transmission capacity and aging infrastructure, resulting in substantial losses of an estimated 20%-25% of the generated electrical energy.[3]

Prior to the commission of the Kapichira II hydropower plant in 2013, little generation capacity had been added to the network, and ESCOM and the GOM have not been able to meet the nation's growing demand for power. Clearly there is a need for greater investment in power generation; however, as Karekazi and Kimani (2002) note, there is a risk to focusing solely on generation. Without adequate transmission and distribution infrastructure, new generation capacity cannot reach end users. According to the 2010-2011 Integrated Household Survey (IHS), although 21% of households had an electricity grid within 100 meters from their dwellings, only 7% of households in Malawi had access to this electricity.[4] Further, while 33% of households in urban areas had electricity connections, only 2% of households in rural areas had access.[5]

To be sure, Malawi is not alone in Africa in failing to meet the energy needs of its citizens, and access remains low throughout Sub-Saharan Africa (SSA).[6] Many African power utilities suffer from poor financial and technical performance; insufficient managerial and technical skills; an inability to fund capital expansion or refurbishment projects; poor maintenance; non-cost reflective tariffs, and inadequate revenue collection mechanisms. These shortcomings ultimately result in poor quality of supply and service, an inability to meet growing electricity demand, difficulty in attracting credit, and a lack of private sector investment.

The costs of inadequate electrification are considerable. A large literature has identified the electricity sector as a driver of economic development.[7,8] In fact, low electricity access rates and unreliable supply for those with power connections have been identified as major obstacles to economic growth in Malawi

[2] Mhango, Lewis B. "New Emerging Issues in the Power Sector in Malawi." Presented at the Semi-Annual Review of the Millennium Challenge Compact. Ministry of Energy. (2014).
[3] Millennium Challenge Account-Malawi. "MCA-Malawi Progress Report." Presented at the Semi-Annual Review of the Millennium Challenge Compact. Millennium Challenge Account. (2014)
[4] National Statistical Office. Malawi Third Integrated Household Survey (IHS3). Zomba: National Statistical Office. (2012).
[5] *Ibid.* While the IHS is the most recent systematic measurement of electricity access, the Ministry of Energy estimates that as of 2014 9.8% of the population had access to electricity. Mhango, New Emerging Issues.
[6] International Finance Corporation. *From Gap to Opportunity: Business Models for Scaling Up Energy Access.* Washington: International Finance Corporation, 2012.
[7] Wamukonya, Njeri. "Power Sector Reform in Developing Countries: Mismatched Agendas." *Energy Policy* 31, no. 12 (2003): 1273-289.
[8] Ferguson, R., W. Wilkinson and R. Hill. "Electricity use and economic development." *Energy Policy*, no. 28 (2000): 923-934.

specifically.[9] In some cases, investments never occur due to the lack of reliable energy, and, in other cases, businesses must bear the high costs of finding private power solutions.[10]

Despite recognition of this problem, there has been less clarity on the solution. Since the 1990's, market-oriented electricity reforms have been promoted and adopted throughout SSA and the developing world, resulting in varying degrees of success and failure. Reforms have generally entailed establishing a cost-reflective tariff, corporatization of government run electrical utilities, changes in energy legislation, establishing an independent regulator, unbundling of generation, transmission, and distribution functions, and promotion of private sector involvement in generation and distribution - if not outright privatization.[11]

The starting point for reform initiatives has largely focused on tackling the challenges in financing. Without question, there is a need for greater infrastructure and increased investment, but electricity tariffs frequently fail to cover operation and maintenance costs much less permit capital investment. Instead, public utilities throughout SSA often rely on government or donor funding to make these investments. Using data from 2005-2009, Alleyne shows that only a handful of countries in SSA have cost-reflective tariffs, and the average tariff in SSA is only about 70% of the cost of power.[12] With electrical utilities selling electricity below cost, it becomes impossible to invest in the sector or even maintain existing infrastructure. As Alleyne states, "Low profitability leads to underinvestment and poor maintenance, and this in turn results in persistent shortages, reduced quality, and deteriorating infrastructure along the entire supply chain."[13]

Assuredly, increasing tariffs is politically difficult to do, particularly in low-income African countries. However, proponents of tariff reform point out that the *de facto* universal subsidizing of electricity benefits the wealthy and the middle class far more than it does the poor. In the case of fuel subsidies in Sub-Saharan Africa, Arze del Granado et al. find the top consumption quintile realized 44.2% of the benefits of fuel subsidies while the poorest quintile only received 7.8% of the benefit.[14] Regardless of who benefits, increasing tariff rates to cover costs either entails insulating utilities from reactionary public and political influence or convincing the public and political leaders that they will be better off with an electrical utility that is able to recover costs. The latter often requires public consultations, a more transparent regulatory process, and performance monitoring.

Malawi has not yet achieved a cost-reflective tariff; however, tariff rates have grown dramatically over the course of the last few years. In April 2014, the regulator MERA approved a gradual increase in the

[9] MCC. *Draft Final Analysis of Constraints to Economic Growth*. Washington D.C.: Millennium Challenge Account, 2009. Gamula, Gregory E. T. "An Overview of the Energy Sector in Malawi." *Energy and Power Engineering* 05, no 1 (2013): 8-17
[10] *Ibid.*
[11] [11] Williams, J.H. and R. Ghanadan. "Electricity Reform in Developing and Transition Countries: A Reappraisal." *Energy*. 31 (2006): 815-844.
[12] Alleyne, Trevor et al. *Energy Subsidy Reform in Sub-Saharan Africa*. Washington, D.C.: International Monetary Fund, 2013.
[13] *Ibid.* pg. 19.
[14] Arze del Granado, Javier, David Coady, and Robert Gillingham. "The Unequal Benefits of Fuel Subsidies: A Review of Evidence for Developing Countries." *World Development*. 40, no 11 (2012): 2234-2248.

average tariff of 37.28% over the course of the following four years, which will result in the increase of the average tariff from MWK 31.54 per KWh (US$.06) to 43.24 per KWh (US$.08).[15]

An additional step towards a more financially sound electrical utility is often corporatization, otherwise known as commercialization. This process entails transforming a publically-run utility into a limited liability corporate body, often with the government as the main shareholder. This reform aims to insulate technical and financial management of utilities from political pressures and encourage the development of an organization that operates more like a corporation. In a number of cases, including in Malawi at one point, management functions have even been contracted out to third party firms.[16]

Achieving a more efficient utility also requires a focus on how the utility and the electricity/energy sector are governed. The challenges confronting the sector have as much to do with governance challenges as they do with resources. For example, certain ownership and management factors can contribute to the proper functioning of power utilities. As Elfaki et al. write, these include "autonomy of decision making at the board level; clear separation of powers and responsibilities between the board and management; freedom from undue interference (whether by national political or private corporate interests) in the operations of utilities as self-contained organizations; clearly defined boundaries that sharply delimit the mandates and responsibilities of various actors in the energy sector; non-proliferation of mandates within one organization; functionally inspired rather than bureaucratically motivated co-ordination and linkages; adequate staffing by highly skilled and competent professionals, combined with further specialist training; and competitive terms of employment."[17] Furthermore, case studies have shown that the framework for promoting good performance should include stress management, good governance, and adequate management capacity.[18]

Malawi began a corporatization process in 1999, when the government-run Electricity Supply Commission of Malawi became the Electrical Supply Corporation of Malawi, operating under the auspices of the Companies Act with the government as the primary shareholder and with a Board of Directors appointed by the government. In 2004, Malawi followed another common reform recommendation and established the Malawi Energy Regulatory Authority under the Energy Regulatory Act No. 20 to "regulate the energy sector in Malawi in a fair, transparent, efficient and cost effective manner for the benefit of the consumers and operators."[19] In particular, MERA has responsibility for evaluating tariff rate applications from ESCOM and setting the rates that electricity consumers pay.

During this same time period, Malawi initially started to move towards another reform recommendation: unbundling. Vertical unbundling divides a vertically integrated utility into separate companies for generation, transmission, and distribution. (Horizontal unbundling, by contrast, divides a utility geographically.) By separating the natural monopolies of transmission and distribution from generation,

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[15] Malawi Energy Regulatory Authority. "Approved Electricity Tariff." *The Daily Times,* April 7, 2014.
[16] Syngellakis, K. et al. "Sustainable Energy Regulation and Policymaking for Africa." United Nations Industrial Development Organization. http://africa-toolkit.reeep.org/ 2006.
[17] Elfaki Ali, G., I.A. Algizouli, B.A. Okech, P.M. Nyoke, and Malur R. Bhagavan. *Energy Utilities in Africa.* St. Martin's Press.
[18] See for example Mkhwanazi, Xolani. "Power Sector Development in Africa." Presented at the Workshop for African Energy Experts on Operationalizing the NGPAD Energy Initiative. Senegal, 2003.
[19] Malawi Energy Regulatory Authority. (nd). "About Us." www.meramalawi.mw.

unbundling allows for competition in power generation.[20] Under such a scenario, an independent transmission company can purchase competitively generated electricity from both government power plants and independent power producers (IPPs). Uganda, for example, experienced a significant increase in private sector investment after unbundling.[21]

Advocates of unbundling argue that it increases the opportunities for competition, furthers the corporatization process, and leads to improved technical and financial performance.[22] While unbundling has been widely advocated for as a necessary mechanism to encourage private investment, Alleyne warns that it is no panacea.[23] Authors such as Besant-Jones have argued that unbundling appears less desirable in small, low-income countries with less developed institutional capacity.[24]

As a consequence of these counterarguments, the unbundling process was eventually halted in Malawi, and there is uncertainty as to whether or not it will resume or what form it may take. Regardless of the institutional structure, there are strong reasons to develop an enabling environment that encourages private sector investment in the electricity sector. In a context like Malawi, private sector investors offer a much-needed source of upfront capital. As of 2010 in Kenya, for example, five private IPPs accounted for about 25% of the country's installed generation capacity.[25] With demand for electricity far outweighing supply, independent power producers (IPPs) are becoming a major source for power generation in Africa and an attractive investment for the private sector.[26] However, IPPs can only be expected to invest provided a reasonable certainty that the endeavor will be profitable.

In summary, Malawi and many other countries in the region have been unable to fund, develop, and maintain adequate electricity infrastructure to provide more than a small percentage of their citizens with reliable access to electricity. As demand continues to outstrip supply, there has been a renewed interest in moving towards a cost-reflective tariff, further corporatizing ESCOM, improving governance of the electricity sector as a whole, and encouraging private sector investment in independent power production. The Compact represents a fundamental mechanism to further these objectives.

[20] Alleyne, Trevor et al. *Energy Subsidy Reform in Sub-Saharan Africa*. Washington, D.C.: International Monetary Fund, 2013.
[21] *Kapika, Joseph and Anton A. Eberhard. Power-Sector Reform and Regulation in Africa: Lessons from Kenya, Tanzania, Uganda, Zambia, Namibia, and Ghana. Cape Town: Human Sciences Research Council, 2013.*
[22] Syngellakis, K. et al. "Sustainable Energy Regulation and Policymaking for Africa." United Nations Industrial Development Organization. http://africa-toolkit.reeep.org/ 2006.
[23] Alleyne, Trevor et al. *Energy Subsidy Reform in Sub-Saharan Africa*. Washington, D.C.: International Monetary Fund, 2013
[24] Besant-Jones, John E. *Reforming Power Markets in Developing.* 2006.
[25] Alleyne, Trevor et al. *Energy Subsidy Reform in Sub-Saharan Africa*. Washington, D.C.: International Monetary Fund, 2013.
[26] Rennie, Matt. *Power Transactions and Trends: Global Power and Utilities Transactions Review.* Ernst and Young. Q3. 2013.

IV. Summary of Program Logic

The Compact entails a wide array of activities designed to achieve the Compact's stated goal and objectives. The overarching goal of the Compact is to "reduce poverty through economic growth in Malawi." The Compact aims to attain this goal by working towards three primary objectives:

1) Reduce the cost of doing business in Malawi
2) Expand access to electricity for the Malawian people and businesses
3) Increase value-added production in Malawi[27]

Figures 1 and 2 present the project logics reflected in the M&E plan linking the Compact activities to these higher-level outcomes. These illustrate how each project's activities are expected to affect outcomes related to each of the three Compact objectives. Understanding the linkages that are built into the theory of change (TOC) is fundamental in the evaluation design process. Clearly defined project logics will enable the evaluation team to consider the contribution of the Compact to observed outcomes, support the learning process, and enhance knowledge of the Compact's successes and possible shortfalls.

A. Infrastructure Development Project

Problem: The national electric grid in Malawi has one of the lowest generation capacities in Southern Africa, delivered by a woefully outdated transmission system, with a maximum transmission capacity of only 132 kV. The lack of adequate supply and transmission of electricity is exacerbated by high technical and non-technical losses. As a result, few Malawians have access to electricity and those that do experience frequent load shedding and blackouts.

Activities: The IDP project comprises four activities:[28]

1. The Integrated Resource Plan Activity entails the development of an Integrated Resource Plan (IRP) that identifies a prioritized list of generation projects that will allow the GoM and ESCOM to meet country's growing demand for power.
2. The Nkula A Refurbishment Activity involves the refurbishment of the Nkula A hydropower plant, which was originally constructed in 1966. The activity will extend the life of the facility of while adding generation capacity of approximately 6 MW.
3. The Transmission Network Upgrade Activity includes the installation of a 400 kV high voltage power line linking Lilongwe to power generation facilities in the south and the development of a 132 kV line to facilitate transmission in the north of the country around Mzuzu.
4. The Transmission and Distribution Network Upgrade, Expansion, and Rehabilitation Activity will occur in targeted locations throughout the country. It will include upgrading existing network connections, up-rating transformers, constructing new substations, and installing control and communications systems, among other actions.

[27] First Amendment to Millennium Challenge Compact Between the United States of America Acting Through The Millennium Challenge Corporation the Republic of Malawi. (2013): art. I, §1.1, 1.2.
[28] First Amendment to Millennium Challenge Compact.

Logic: Through increasing generation capacity, upgrading the transmission network, and improving transmission and distribution infrastructure, the IDP project aims to increase available power, reduce energy losses, reduce outages, and improve the quality of primary substations.[29] Lower energy losses, reduced outages, and improved quality of infrastructure should allow households and businesses to reduce their energy costs and increase value added production.[30] The bulk of funding for IDP activities focuses on improving the transmission system to handle added generation in the future. Furthermore, improvements to the transmission system, if coupled with adequate new generation capacity, may allow for the expansion of the distribution network to more households and businesses, increasing access to electricity.

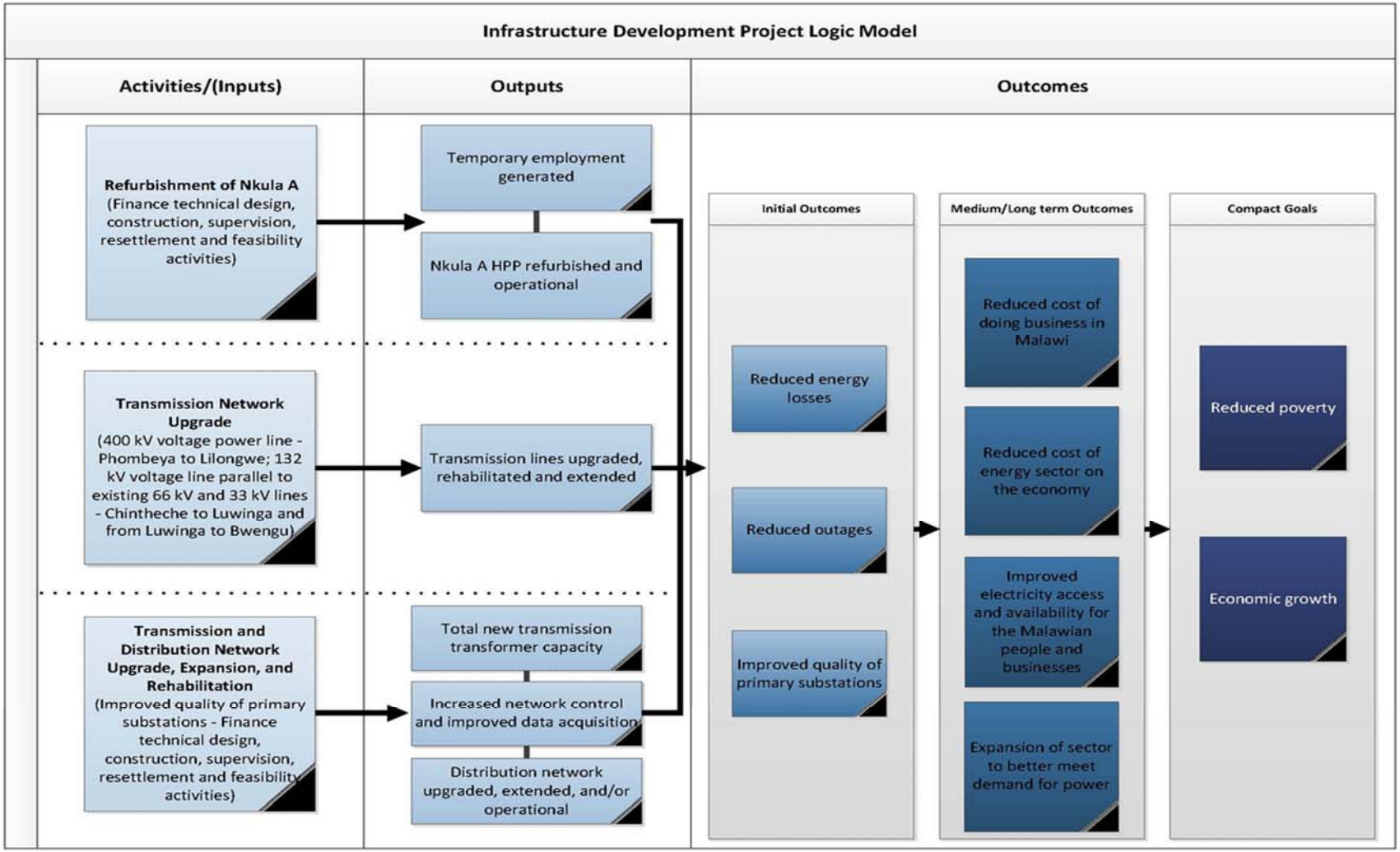
Assumptions and risks: Linking the Compact activities with the desired Compact objectives assumes that the gains in improved electricity supply, reliability and quality will be adequate to lead to a measurable improvement in electricity at the level of individual households and businesses such that total energy expenses can be reduced and time efficiencies gained. While the Compact's focus on transmission infrastructure is essential for the future development of the power sector, it means that the Compact will add minimal new generation capacity at a time when demand will continue to increase. MERA is currently developing targets for key performance indicators, which may require the electrical utility, ESCOM, to add up to 45,000 new customers each year for the next four years. Unless substantial new generation capacity is added, which is unlikely to occur during the life of the Compact, the reliability and quality of electricity might actually decrease for ESCOM customers in the short run.[31]

[29] Increasing available power is not included in the M&E logic model as an outcome; however, it is estimated that generation will increase by approximately 6 MW as a result of the Nkula rehabilitation.

[30] While increasing value added production is a Compact Objective, it is not included in the M&E plan. This is likely because the monitoring evaluation systems will not be able to measure this outcome. Nonetheless, the evaluation will be able to speak to this objective through the planned enterprise survey.

[31] The refurbishment of Nkula A is estimated to add up to 6 MW to the network. Reductions in losses might add a similar amount. The only additional generation that might be complete by the end of the Compact is the JICA funded rehabilitation to the Tedzani hydro-electric plant, which will lead to an additional 20 MW to be completed in mid-2018. Together, these improvements would represent an approximately 10% increase in generation capacity, which is far less than predicted increases in demand. To illustrate, there are currently only 118,565 domestic connections and 149,420 total connections, yet if the MERA targets are achieved, in four years there will be 180,000 connections added to the network. While the vast majority of these will be domestic connections that use a minimal amount of electricity, the increase in demand will certainly be above the 10% increase in capacity. Proposed coal power plants and the Mozambique interconnector could in theory be completed prior to the end of the Compact; however, these remain proposals.

Figure 1: IDP Logic Model



B. Power Sector Reform Project

Problem: In addition to infrastructure deficiencies, Malawi's power sector suffers from additional financial, operational, and governance challenges. The electrical utility, ESCOM, is financially and operationally unsustainable due to multiple factors including: low billing and collections rates, insufficient or incorrect customer information, and high technical and non- technical losses.[32] Partially as a result, inadequate investments are made in expanding generation, transmission, and distribution infrastructure or maintaining existing infrastructure. In addition, ESCOM suffers from a number of operational and governance challenges related to insufficient management capacity, unresponsive customer service, weak internal controls, political interference, and low transparency. Broader energy sector governance involving the regulator, MERA, and the Ministry of Energy (MoE) also confronts challenges as Malawi's regulators lack adequate operational cost data to inform tariff design and the sector does not effectively allow for meaningful private sector investment.

Activities: The PSRP entails a wide array of activities designed to help address these challenges and problems. The PSRP is divided into three activities with several sub-activities.

1. The ESCOM Turnaround Activity includes a Finances Sub-Activity that entails the development of a detailed financial plan and financial model, which will allow for financial planning over the five-year life of the Compact, and a management information systems (MIS), which will integrate existing information flows from diverse aspects of the utility into one comprehensive system. The Turnaround Activity also includes a Corporate Governance Sub-Activity that involves the development of a Corporate Governance Benchmarking Study and an Operations Sub-Activity, entailing a review of ESCOM's organization structure, embedment of a financial and operational turnaround team, planned improvements to procurement processes, and the initiation of performance audits and a social and gender assessment.[33]
2. The Regulatory Strengthening Activity also entails three sub-activities, including a Tariff Reform Sub-Activity that involves deployment of a tariff advisor to ESCOM and a regulatory advisor to MERA. This sub-activity will involve a cost of service study to accurately determine the cost of providing electricity to diverse customers. A second sub-activity aims to build MERA's capacity through trainings, workshops, exchange visits, peer learning, and a benchmarking study. The third sub-activity, the Enabling Environment for Public and Private Sector Investment Sub-Activity involves supporting a high-level energy advisor to the Ministry of Energy to assist the ministry in master planning, developing an integrated resource plan, and developing a legal and political environment that permits private sector investment in the power sector.
3. The Power Sector Reform Agenda Semi-Annual Review (SAR) offers a process for Compact stakeholders to jointly monitor the progress of power sector reform efforts and includes regular meetings to measure progress in achieving targets across 25 indicators.

[32] Annex IV of the MCA-M Monitoring and Evaluation Plan. 2013. Millennium Challenge Account-Malawi.

[33] There is some overlap across these sub-activities. For example, the financial and operational turnaround team listed under the Operations Sub-Activity will work to improve both financial management and corporate governance. Malawi Compact Power Sector Reform Project Description. (2014). Millennium Challenge Corporation.

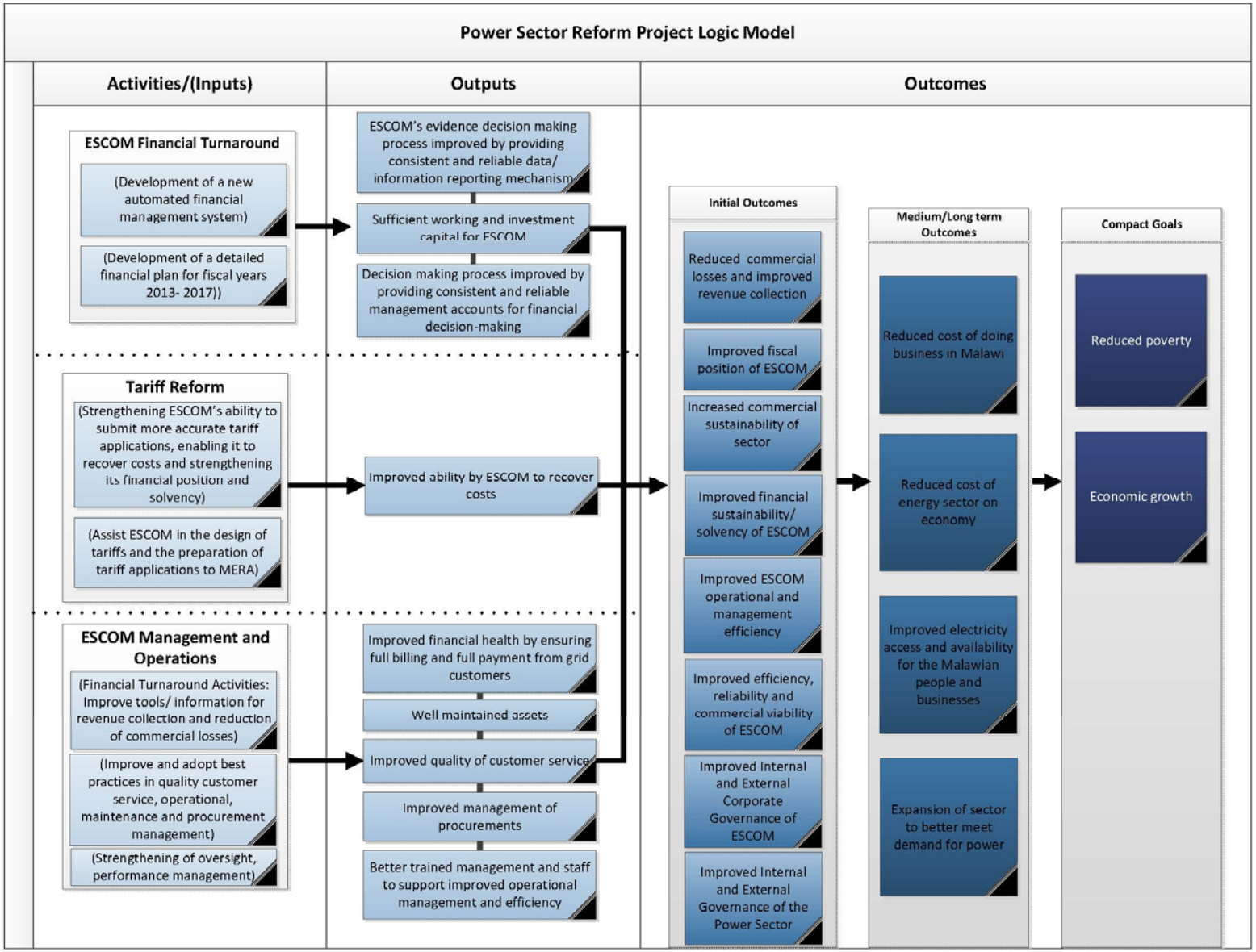
Logic: Through these activities, the PSRP aims to achieve several outcomes. These can roughly be summarized as: (i) improving the financial and operational health of ESCOM and rebuilding ESCOM into a strong, well-governed and well-managed utility, and (ii) developing a regulatory environment that supports private sector investment in generation at an affordable cost. These activities might, for example, result in a revision of the Energy Policy and Electricity Act and the development of a framework for independent power producers (IPPs). As such, the PSRP offers an essential complement to the IDP. While the IDP alone might not be able to yield reductions in the cost of doing business if the assumptions listed above do not hold, it is hoped that reforms fostered by the PSRP will produce an energy sector that is financially and operationally sustainable and that encourages continual investment into the future.

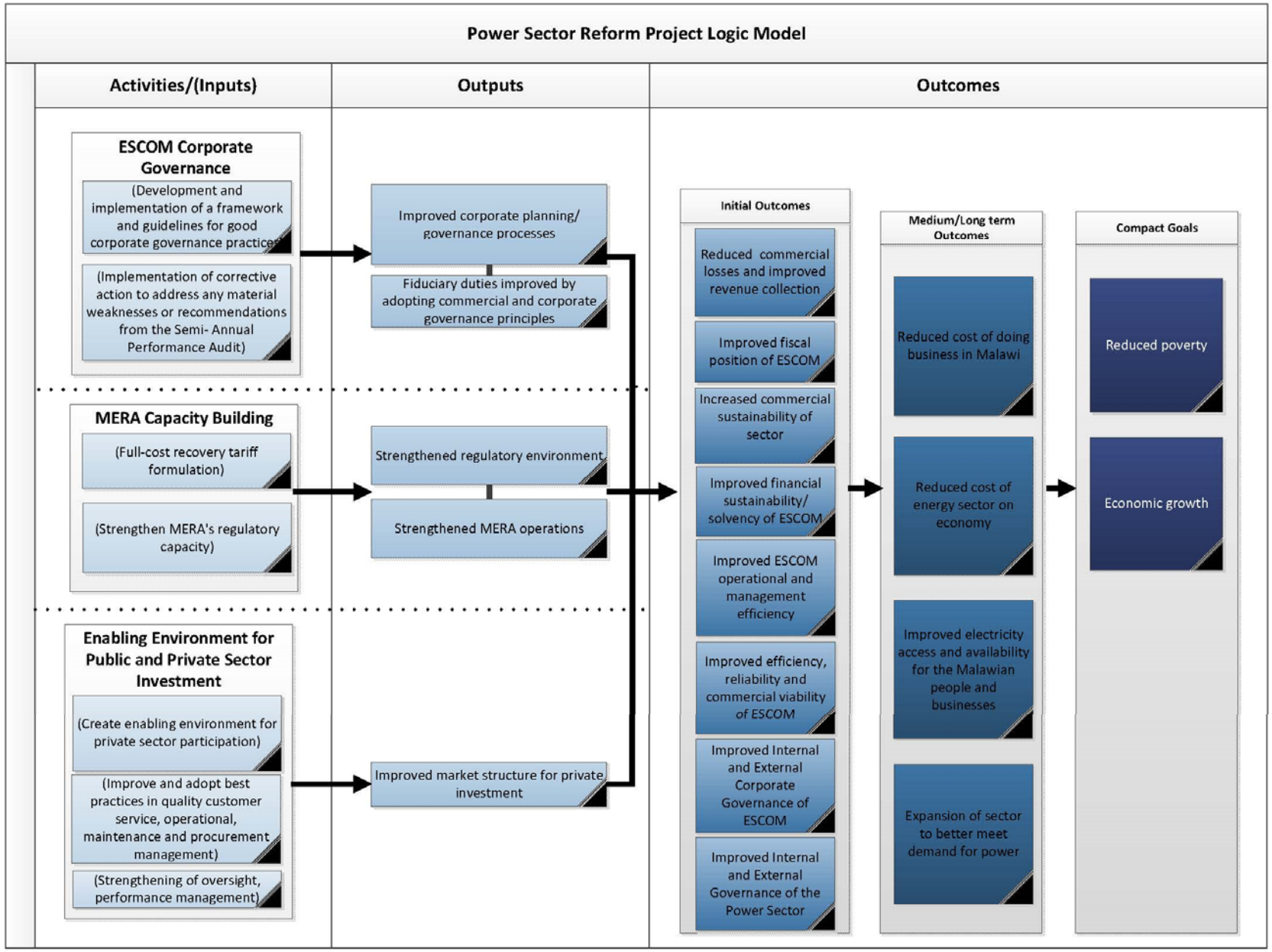
Assumptions: and risks: Annex IV to the MCA-M Monitoring and Evaluation Plan lists several assumptions underlying the PSRP. [34] The salient assumptions include:

- Political will exists to implement and sustain reforms, particularly in processes such as procurement.
- Political will exists to permit an increase in tariffs to cost-reflective levels.
- The ESCOM Board commits to new organizational structures and human resources (HR) practices.
- Technical staff turnover within ESCOM and MCA is minimized.
- Parliament approves necessary reforms that permit an enabling environment.

[34] Annex IV of the MCA-M Monitoring and Evaluation Plan.

Figure 2: PSRP Logic Model




Power Sector Reform Project Logic Model
Activities/(Inputs)
Outputs
Outcomes
ESCOM Corporate Governance
(Development and implementation of a framework and guidelines for good corporate governance practices)
(Implementation of corrective action to address any material weaknesses or recommendations from the Semi- Annual Performance Audit)
MERA Capacity Building
(Full-cost recovery tariff formulation)
(Strengthen MERA's regulatory capacity)
Enabling Environment for Public and Private Sector Investment
(Create enabling environment for private sector participation)
(Improve and adopt best practices in quality customer service, operational, maintenance and procurement management)
(Strengthening of oversight, performance management)
Improved corporate planning/ governance processes
Fiduciary duties improved by adopting commercial and corporate governance principles
Strengthened regulatory environment
Strengthened MERA operations
Improved market structure for private investment
Initial Outcomes
Reduced commercial losses and improved revenue collection
Improved fiscal position of ESCOM
Increased commercial sustainability of sector
Improved financial sustainability/ solvency of ESCOM
Improved ESCOM operational and management efficiency
Improved efficiency, reliability and commercial viability of ESCOM
Improved Internal and External Corporate Governance of ESCOM
Improved Internal and External Governance of the Power Sector
Medium/Long term Outcomes
Reduced cost of doing business in Malawi
Reduced cost of energy sector on economy
Improved electricity access and availability for the Malawian people and businesses
Expansion of sector to better meet demand for power
Compact Goals
Reduced poverty
Economic growth

V. Evaluation Type and Research Questions

Social Impact was contracted by MCC to develop and conduct an evaluation of the Malawi Compact. Specifically, SI has been tasked to "assess the program design and implementation to develop the most rigorous evaluation design feasible, whether it is a performance or impact evaluation, and identify the most appropriate evaluation methodology feasible given the context."[35]

An impact evaluation is defined as:

> A study that measures the changes in income and/or other aspects of well-being that are attributable to a defined intervention. Impact evaluations require a credible and rigorously defined counterfactual, which estimates what would have happened to the beneficiaries absent the project. Estimated impacts, when contrasted with total related costs, provide an assessment of the intervention's cost-effectiveness.[36]

A performance evaluation is defined as:

> A study that seeks to answer descriptive questions, such as: what were the objectives of a particular project or program, what the project or program has achieved; how it has been implemented; how it is perceived and valued; whether expected results are occurring and are sustainable; and other questions that are pertinent to program design, management and operational decision making. MCC's performance evaluations also address questions of program impact and cost-effectiveness.[37]

Efforts to identify a research design that would allow for a rigorously defined counterfactual were unsuccessful, and as a result this design document outlines plans for a rigorous performance evaluation that will aim to measure key outcome indicators early on in the Compact, midway through, and at the end of the Compact, as well as track changes over time. This evaluation is designed to address the core questions of the evaluation (Table 1) Since the proposed design is a performance evaluation, it is important to note that it may not be possible to state with confidence how the power sector in Malawi has changed (or not changed) as a result of the Compact, as it will not be possible to control for other potential causes of change. In some cases, however, it may be feasible to identify and potentially rule out alternative explanations.

The inability to define a counterfactual requires a reformulation of some of the initial evaluation questions originally proposed by MCC, including some core questions included in the SI-MCC contract. In addition, the Evaluation Assessment Report revealed that both SI and MCC had substantial concerns with regard to the original research questions proposed in Social Impact's contract.[38] This is natural given the way that

[35] Social Impact and The Millennium Challenge Corporation. Malawi Performance Evaluation of the Infrastructure Development and Power Sector Reform Projects – MCC-13-BPA-0017. March 2014. Section: C.4.4.1, pg.11.
[36] *Ibid,* C.2.3.1, pg. 5
[37] *Ibid.* C.2.3.2, pg. 5
[38] Evaluation Assessment Report: Millennium Challenge Corporation: Malawi Infrastructure Development and Power Sector Reform Projects. (2014). Social Impact.

interventions change over time, and that the proposed questions should be feasible to answer based on the data that can be collected as part of the evaluation. Based on SI's comprehensive desk review, information gathered during the scoping trip, and frequent communication with MCC and MCA-M, the SI evaluation team has developed research questions and research approaches for the PSRP and the IDP project components, as proposed in Tables 2 and 3**Error! Reference source not found.**, respectively. The original questions and the suggested modifications for each question are presented in the Appendix.

Table 1: Core evaluation questions

Core evaluation question	Approach
1. What declines in poverty, increases in economic growth, reductions in the electricity related cost of doing business, increases in access to electricity, and increases in value added production are observed over the life of the Compact?	KIIs, quantitative indicators, workflow analyses, ESCOM and enterprise surveys, focus groups, metering data
2. What were the results of the interventions – intended and unintended, positive or negative?	KIIs, quantitative indicators, workflow analyses, ESCOM and enterprise surveys, focus groups, metering data, ESCOM records
3. Are there differences in outcomes of interest by gender, age and income? Sex and income disaggregated information for businesses and households will be pursued to the extent possible.	KIIs, ESCOM and enterprise surveys enterprise survey
4. What are the lessons learned and are they applicable to other similar projects?	KIIs, workflow analysis
5. What is the likelihood that the results of the Project will be sustained over time?	Workflow analyses, KIIs
6. At the household level, the evaluations shall focus on the following program/project/activities impacts on household and individuals: income; expenditures, consumption and access to energy; individual time devoted to leisure and productive activities.[39]	Focus groups
7. At the enterprise level, the evaluation shall focus on the impact of the program/project/activities on: business profitability and productivity; value added production and investment; employment and wage changes; energy consumption and sources of energy used; business losses.	Enterprise survey
8. At the regulatory, institutional and policy level, the evaluation shall explore the potential impacts of the program/project/activities on: utility operating costs and losses; financial sustainability; private investment, particularly in generation; expansion of electricity access for customers, particularly the poor.	KIIs, financial data, workflow analyses

[39] There will be several challenges to identifying Compact impact on these items, and household surveys may be better used for learning purposes rather than for attributing impact.

Table 2: PSRP research questions and data sources

Activity	Research question	Data sources
Finance	1. Does the financial health of the utility stabilize over the life of the Compact? Are improvements driven primarily by tariff increases, or do efforts to improve collection efficiencies, reductions in losses, and reductions in administrative costs also contribute significantly to improved financial health? If there are no improvements or improvements are minimal, why?	Financial data, KIIs, ESCOM survey
	2. Does ESCOM realize improvements in effectiveness and efficiency over the five years of the Compact in financial planning and billing? To what extent can observed gains be attributed to the Compact? If there are no improvements or the improvements are minimal, why?	Workflow analyses, KIIs, performance audits
Corporate Governance	3. Is the ESCOM Board performing according to existing and any new statues, bylaws, Articles and Memoranda?	Performance audits
	4. Does ESCOM independence and the independence of the board increase over the life of the Compact? To what extent do Compact efforts to improve corporate governance explain increased independence? (Independence will be operationalized by examining the make-up of the board and the perceived ability of the board to act independently of government approval.) If there are no improvements or improvements are minimal, why?	KIIs, ESCOM survey
	5. What are the observed consequences if any (positive or negative) of any increases in independence?	KIIs, quantitative indicators
Operations	6. Does ESCOM realize improvements in effectiveness and efficiency over the five years of the Compact in procurement, outage response, processing new connections, and response to customer problems? To what extent can observed gains be attributed to the Compact? If there are no improvements or the improvements are minimal, why?	Workflow analyses, procurement audits, performance audits
	7. Is there a reduction in opportunities for corruption and/or a perception of corruption in procurement, service extension, and billing over the five years of the Compact? To what extent can observed gains be attributed to the Compact? If there are no gains or gains are minimal, why?	Workflow analyses, KIIs
	8. Does the quantity and quality of ESCOM communications with the public and the transparency of ESCOM increase over the life of the Compact? To what extent do Compact efforts to improve communications contribute to observed improvements? If there are no improvements or improvements were minimal, why?	KIIs, document review
	9. Do maintenance expenditures increase and maintenance procedures improve over the life of the Compact? To what extent do Compact efforts to improve maintenance systems contribute	Quantitative indicators, workflow analyses, KIIs

Activity	Research question	Data sources
	to any observed improvements? If there are no improvements or improvements are minimal, why?	
	10. If the mentoring program occurs, what specific learning can be attributed to the program? What are examples of experiences from other utilities that were incorporated into ESCOM operations? If there are no improvements or improvements are minimal, why?	KIIs, Mini-survey
Tariff Reform and MERA	11. Are tariffs cost reflective by the end of the Compact? If they are, to what extent did Compact efforts contribute? If they are not cost reflective, why not?	Financial data, KIIs, Cost of Service Study
	12. How do stakeholders regard the 2017 tariff process compared to the 2014 tariff process? What improvements can be attributed to the Compact? If there are not improvements, why not?	KIIs
	13. Are trainings of MERA personnel perceived to be useful by participants six months after training? What evidence do participants provide that they have put training into practice?	Mini-surveys
Enabling Environment for Public & Private Sector Investment	14. Do stakeholders (e.g., potential investors, technical experts, and consumer groups) consider there to be an appropriate environment to incentivize independent power producers at a fair price to Malawian consumers? Why or why not?	KIIs
	15. At the end of the Compact, have agreements been signed for independent power producers to enter the market? If yes, disaggregate by project and capacity.	MoE
Semi-Annual Review and quantitative indicators	16. Do stakeholders perceive the semi-annual review process to have contributed to progress on key reform milestones and broader reform project outcomes? If so, how?	KIIs, SAR Reports
	17. Is ESCOM meeting key performance indicator targets set as part of the Semi Annual Review? Why or why not?	Indicator Tracking Table, KIIs, SAR Reports
	18. Is ESCOM meeting key performance indicator targets set by MERA? Why or why not?	MERA records, KIIs
Cross-cutting survey based	19. Do ESCOM male and female employees' evaluations of various aspects of ESCOM's work, including generation, transmission, distribution, financial management, customer service, billing, procurement, management, maintenance, and strategic communications improve, decline, or stay the same?	ESCOM survey
	20. Do male and female employees' evaluations of various aspects of ESCOM's human resources policies, including salary, benefits, opportunities for advancement, educational opportunities, training (training needs), promotion processes, recognition of good performance, occupational	ESCOM survey[40]

[40] If MCC determines not to go forward with a survey of ESCOM employees, questions 20 and 21 would be removed from the evaluation.

Activity	Research question	Data sources
	health and safety, and advancement opportunities for women in ESCOM improve, decline, or stay the same?	
	21. Do male and female employees' satisfaction with ESCOM, the direction that ESCOM is heading, and the Compact, increase, decrease, or stay the same? What factors explain variation in employee satisfaction?	ESCOM survey
Additional	22. Do imbalances between the number of male and female staff within the composition of ESCOM staffing decline over the life of the Compact?	Human resources data
	23. How many new connections are added to the network? What percent are prepaid meters? What percent of existing connections are converted to prepaid metering? Disaggregated by year and connection type.	ESCOM, MCA-MW ITT, MERA

Table 3: IDP research questions and data sources

Research question	Data sources
1. As a result of the Compact, what are the changes in: (1) energy delivered, (2) technical losses, and (3) forced outages for each subproject?	Metering data, ESCOM records of load shedding and planned outages
2. What are beneficiary businesses' consumption/expenditures patterns for different types of energy? How do consumption/expenditure patterns change as a result of improved electricity?	Enterprise survey
3. Do beneficiary businesses change investments or alter their workforces following improvements in electricity reliability?	Enterprise survey
4. Does beneficiary male and female entrepreneurs' satisfaction with ESCOM improve over the life of the Compact? Do these entrepreneurs perceive an improvement in the quality of electricity over the life of the Compact? What factors explain variation in satisfaction with ESCOM?	Enterprise survey
5. Do the attitudes of beneficiary male and female entrepreneurs' towards cost-reflective tariffs improve over the life of the Compact? What factors explain variation in beneficiary male and female entrepreneurs' attitudes towards cost reflective tariffs?	Enterprise survey

VI. Evaluation Design

To answer these questions, the evaluation design will leverage diverse research methodologies with different timelines for data collection. The evaluation design can be broken into three main parts, albeit with some overlap:

- IDP evaluation: The IDP design focuses primarily on an intensive metering effort to measure the technical benefits of the project, including changes in energy delivered, outages, and quality. This will be complemented by focus groups with residents of beneficiary communities.
- PSRP evaluation: The PSRP design incorporates five data collection activities, including: (1) quantitative indicators from the M&E Plan and Malawi Energy Regulatory Authority (MERA) key performance indicators, (2) workflow analyses with relevant units, such as billing and procurement, (3) a series of largely qualitative research activities (with some mini-surveys included), (4) a proposed survey of Electricity Supply Corporation of Malawi (ESCOM) employees, and (5) the PSRP process evaluation, focused on implementation and achievement of implementation milestones and outputs will be folded into the PSRP data collection activities.
- Enterprise survey: A panel survey of businesses will be used to evaluate both the PSRP and the IDP.

A. IDP Evaluation Design

Design Overview

We propose that the IDP evaluation consist of two major parts: (1) intensive metering to determine technical benefits, and (2) focus group discussions with beneficiaries. In addition, some of the activities conducted as part of the PSRP evaluation - specifically work flow analyses of response to outages - will also address IDP benefits made possible by the supervisory control and data acquisition (SCADA) systems.

Technical Performance Monitoring

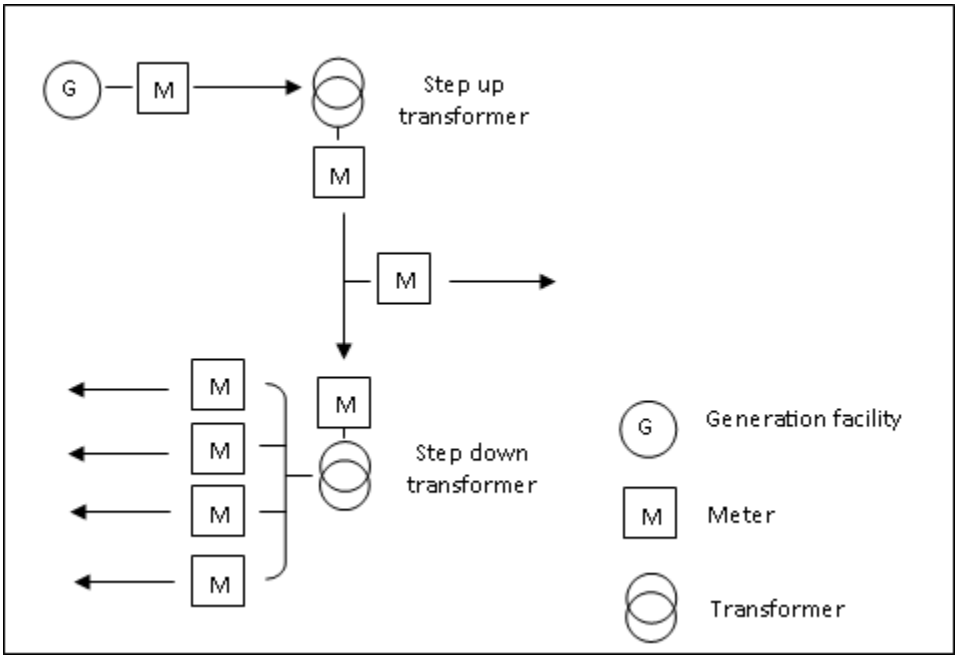
Most of the 48 individual sub-projects contained in the IDP will result in increased energy transmitted through the facilities covered by subprojects. The increased amount of energy will result from: (i) higher capacity equipment that will allow greater amounts of energy to be delivered over time; (ii) lower outage frequencies and durations; and (iii) lower levels of technical losses. These three factors may be derived from data acquired through metering systems that measure power going through the facilities at relatively small time intervals. Thus, a comparison of energy flow, outage indicators, and losses before and after the facilities are commissioned will provide an indication of the success of individual sub-projects.

Measuring these project benefits can only be accomplished with reliable baseline and end-line data. The recent Data Quality Review[41] and information collected during the scoping trip make it clear that reliable metering data are currently insufficient to create such a baseline. As such, MCA-M plans to use its M&E budget to locate metering at appropriate points along transmission lines and at substations that will

[41] MCA-Malawi/CRISIL Limited, 2014.

benefit from the project. Data collected with this metering equipment will be essential for the evaluation. Figure 3 provides a schematic explaining the metering methodology. Meters will be placed at any point of change in the network, including places where new generation is added and more commonly, where energy is diverted.

Figure 3: Schematic of metering



As the schematic suggests, metering will have to be strategically placed to measure the impact of the diverse Compact investments. To help inform the assessment of the metering needs across each sub-project, a map of Malawi, taken from ICF CORE's Rapid Due Diligence report and showing existing and planned power facilities, is presented in Figure 4.[42] Also, a relatively simple sketch of the existing transmission system of Malawi is provided in Figure 5 (from Annex 11 of the ICF-CORE 2011 feasibility study report).[43] In the discussion that follows, we consider metering requirements across the 48 infrastructure development Compact sub-projects. It is understood that slight changes have been made, and will continue to be made, as the project progresses. Appropriate modifications to the metering schemes, if needed, will be made when the sub-projects have been finalized.

[42] MCC, ICF International, CORE International, Inc. (2013). *Malawi Due Diligence and Appraisal - MCC Malawi Compact - Final Report.*

[43] MCC, ICF International, CORE International, Inc. (2011). *Revised Final Feasibility Study Report: Annex 11.*

Figure 4: Map showing IDP locations and existing power facilities

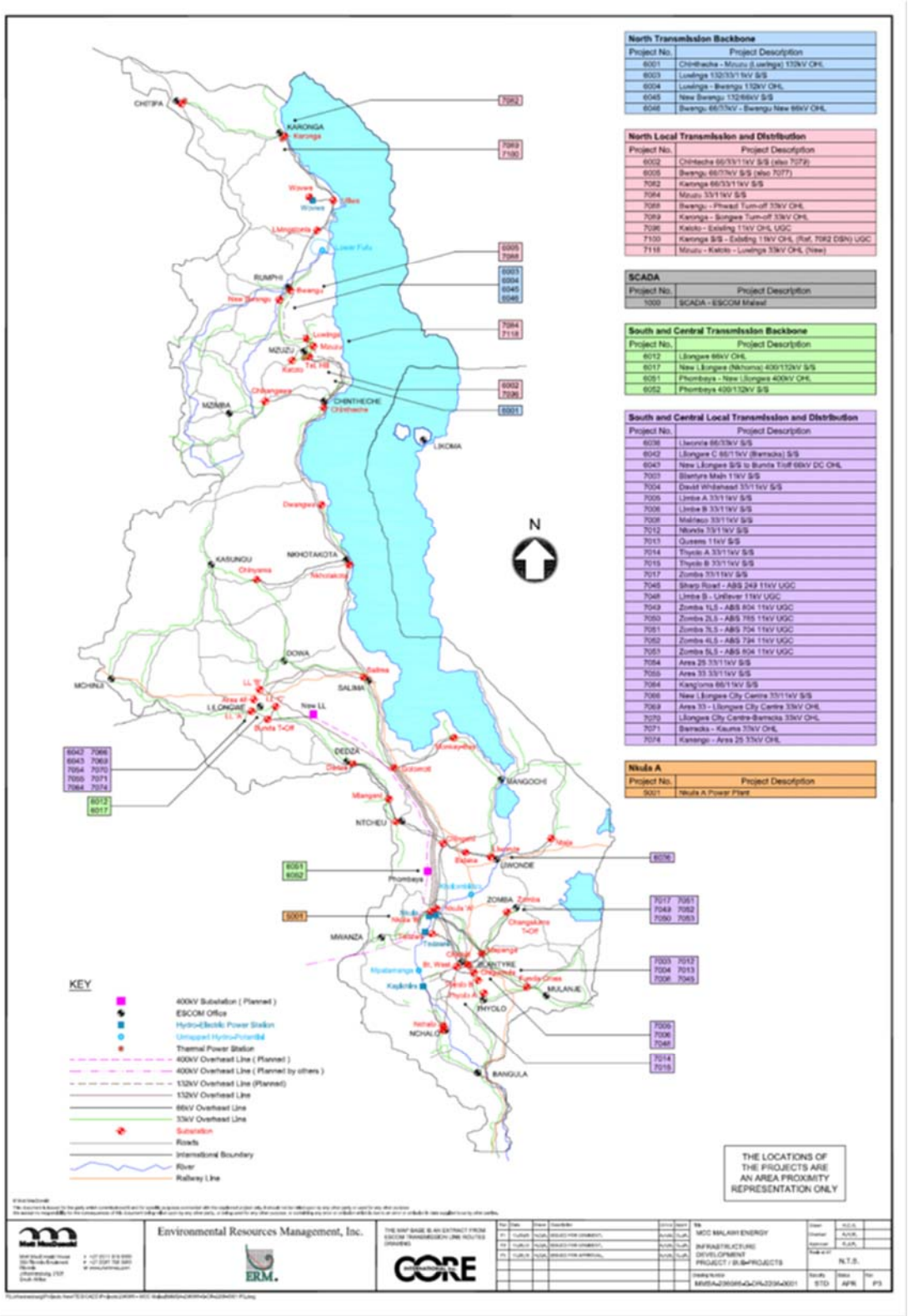
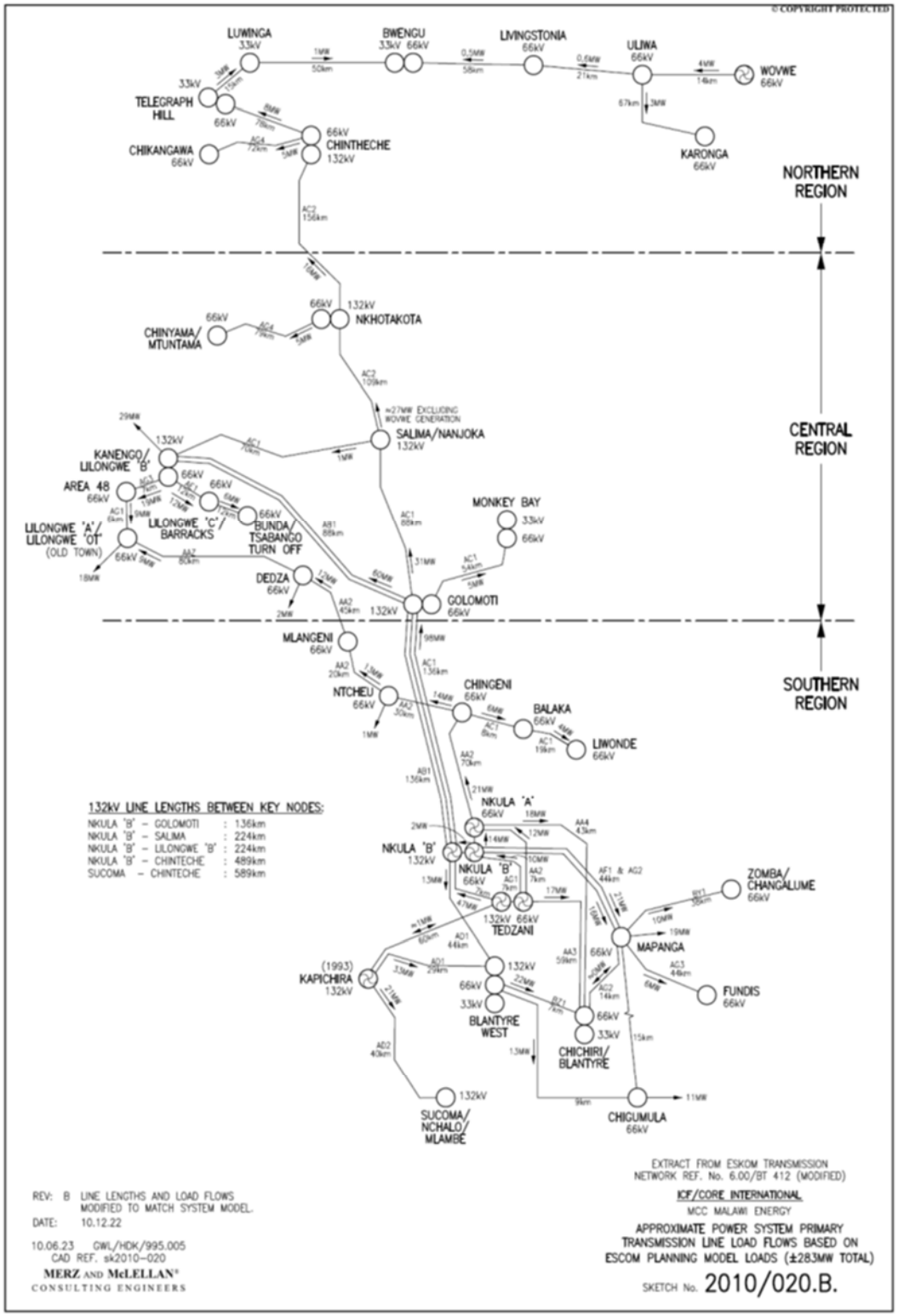


Figure 5: Sketch of the existing main transmission system of Malawi



South and Central Transmission Backbone Sub-Project

To capture the benefits of the south and central transmission backbone investments, a modified package of investments (for evaluation purposes) comprises the following:

- Phombeya – New Lilongwe 400 kV OHL (6051)
- Phombeya 132/ 400 kV Substation (6052)
- New Lilongwe (Nkhoma) 400/132 kV Substation (6017)
- New Lilongwe – Bunda Turnoff 66 kV DC[44] OHL (6043)

For the purpose of collecting baseline data, interval meters should be placed on all outgoing lines (i.e., on the low voltage side of the transformers) at the Lilongwe A and B substations and at the Bunda turn-off substation. Thus, all incoming power to Lilongwe, delivered to the 66 kV ring, will be measured, both before and after the 400 kV facilities are commissioned. This metering arrangement will capture loads at small intervals, and will record outages and corresponding times.

In Lilongwe at the 66 kV level, appropriate metering equipment will be needed along the 400 kV corridor to measure loads flowing into and out from the current path to Lilongwe (the locations are specified below). According to ESCOM's Transmission division, this equipment presently exists; however, the Data Quality Review identified problems with several meters. For these inputs, meters capable of measuring only monthly energy will be sufficient. However, given the relative size of the facilities, ESCOM probably already has, or is planning, installation of more sophisticated metering equipment. In any case, the locations of existing meters should be verified, as well as the condition of the meters and any faulty or insufficient meters replaced.

It is proposed that energy losses along the 400 kV corridor, before and after commissioning, will be derived on a monthly basis. The currently existing lines running to Lilongwe also include a series of substations from which power is tapped off for supply to other parts of the country. Therefore, the energy recording meters should be located on all the incoming and outgoing lines at each substation along the route. The relevant points for metering monthly energy include:

- The three outgoing 132 kV lines from the Nkula B generating plant to the Golomoti substation.
- The outgoing 66 kV line from the Nkula A generating plant to the Chingeni substation.
- The three incoming 132 kV lines at the Golomoti substation.
- The three outgoing 132 kV lines and the single outgoing 66 kV line from the Golomoti substation, as well as any lower voltage lines (33 kV and 11 kV) emanating from this substation.
- Similarly, all incoming and outgoing lines at the Salima/Nanjoka, Nkhotakota/Chinyama, Ntcheu, Mlangeni and Dedza substations.
- The incoming two 132 kV line at Lilongwe B and one 132 kV line outgoing.
- The two incoming 66 kV line at Lilongwe A.
- The single incoming 66 kV line from Kanengo to Kamuzu Barracks.

[44] DC means Double Circuit in this write-up (as opposed to Direct Current).

- The single incoming 66 kV line from Kamuzu Barracks to Bunda.

North Transmission Backbone

To measure the technical benefits of the north transmission backbone, metering will have to focus on the following sub-projects:

1) Chintheche – Luwinga 132 kV OHL (6001)
2) Luwinga 132/33/11 kV Substation (6003)
3) Luwinga – New Bwengu 132 kV OHL (6004)
4) New Bwengu 132/66 kV Substation (6045)
5) Bwengu – New Bwengu 66 kV OHL (6046)

As they appear to be serially aligned, projects 6004, 6045 and 6046 may be considered as one project that would take the load off the currently existing 33 kV line and 33/66 kV step-up facilities between Luwinga and Bwengu. The new Luwinga substation will merely replace the old one, while the Chintheche – Luwinga 132 kV line will bypass: (i) the existing 66 kV line between Chintheche and Telegraph Hill, (ii) the existing Telegraph Hill substation (66/33 kV) and (iii) the existing 33 kV line between Telegraph Hill and Luwinga.

For the purpose of collecting baseline data, interval meters should be placed at the following locations:

1) On the incoming 132 kV line to the Chintheche substation. The meter on the incoming 132 kV line should be located above the point that the new 132 kV tap off to Luwinga will be located.
2) On the two 66 kV outgoing lines of the Chintheche substation, as well as any other possible outgoing lines at lower voltage levels.
3) Interval meters should also be placed on the existing incoming 66 kV line to the Telegraph Hill substation, as well as on all outgoing lines.
4) All incoming and outgoing lines to/from the existing Luwinga substation should also be metered.
5) All incoming and outgoing lines at Uliwa substation should also be metered.

At Bwengu, the currently existing substation should be interval metered on all incoming and outgoing lines. At the time the 132 kV line from Luwinga is constructed, along with the New Bwengu 132/66 kV substation and the 66 kV line to Bwengu, only a single interval meter will be required just above the Bwengu substation, unless there is a takeoff point along the route.

Other requirements for the North Transmission Backbone package are about the same as for the South and Central Transmission package – i.e., software to aggregate interval data into a suitable format, a somewhat less complicated losses model, and ESCOM confirmation on the metering points. However, no elaborate retrieval and processing of metering data for the purpose of loss calculation will be required, as this information will be obtained from the metering equipment specified above.

Lilongwe 66 kV OHL (6012)

As this sub-project comprises the replacement of wood poles, metered data may not necessarily provide meaningful results, as the existing poles may be in place and may be in need of replacement, but will continue to supply electricity reliably until the point that they fall down. Some further discussion with MCA-Malawi and ESCOM will be necessary to determine whether the improved reliability arising from this investment can indeed be determined through metered data. While not anticipated, if the answer is yes, then interval meters may be installed at strategic points on the 66 kV system of Lilongwe.

New 33/11 kV and 66/11 kV substations (7054, 7064, 7066, 7012)

In cases where new substations will be serving new loads, the starting point will be zero and no baseline metering is necessary (or even possible). However, it is known that at least one of these substations will be relieving the load off an existing substation. In this case, baseline metering of that existing substation will be necessary and the two substations - existing and new - will need to be monitored together afterward. Some further discussion with MCA-Malawi and ESCOM will be necessary to determine the extent of interdependency between existing and new substations. In any case, all incoming and outgoing lines in each of the identified substations will be metered.

Upgrading of Transformers in existing 33/11 kV Substations (7004, 7005, 7006, 7008, 7014, 7017)

All incoming and outgoing lines in each of these substations will be metered. As with the new substations, any relief from loading on other existing substations will similarly need to be taken into account.

33/11 kV Substation Extensions for New Feeder Bays (6042, 7055, 6005, 7082, 7084)

These projects are scattered throughout the country and involve expansion of substations, although not of their transformers. Some further discussion with MCA-Malawi and ESCOM will be necessary to determine how much capacity through each substation may be gained through these investments. If judged significant, then interval meters will be required on all incoming and outgoing lines. As with the new substations, any relief from loading on other existing substations will similarly need to be taken into account.

Other work on existing 33/11 kV Substations (6036, 7003, 7013, 7015, 6002)

This work involves the upgrading of substation equipment that will not directly increase capacity, but there might be observed improvements in reliability. Subject to further discussion with MCA-Malawi and ESCOM, it will likely be worthwhile to install interval meters on all incoming and outgoing lines at these substations.

New 33 kV lines in Lilongwe and the Northern System (7069, 7070, 7071, 7074, 7088, 7089, 7118)

If the new 33 kV lines happen to be radial lines emanating from new or existing substations to serve new customers, the starting point will be zero and no baseline metering will be necessary. However, the lines are more likely an integral part of new capacity being installed to partly relieve loads on existing substations and lines. Further consultation with MCA-Malawi and ESCOM is required to learn how the pieces fit together before deciding where to put the meters.

Replacement of Existing Cables (7045, 7048, 7049, 7050, 7051, 7052, 7053, 7100, 7096)

Existing cables will presumably be replaced by cables with a higher capacity carrying capability. Meters may be placed at either end of each cable to measure both loads and losses, before and after replacement. However, this may be challenging as these projects are relatively high in number, the cables lengths are generally only a few hundred meters, and each individual sub-project is relatively small. A total of 18 interval meters would be required for the 9 relatively small sub-projects.

SCADA

One of the principal benefits of SCADA is greater reliability of supply. In this light, meters may be placed on each portion of the 132 kV and 66 kV transmission system (as well as the two 33 kV lines in the north that may be considered as part of the transmission system) to measure outage information before and after implementation of the new SCADA system. A possible problem here is that there may not be a clear date on which the system is actually commissioned, as in-service dates may occur in gradual pieces as work progresses. It appears that a total of about 50 meters may be required for this purpose, one on each line between the nodes of the transmission system. As about 30 of these locations have already been specified for other sub-projects, the incremental amount for SCADA evaluation purposes will be about 20 meters.

Possible Additional Sites for Metering

These sites include facilities where differences in metered data before and after commissioning may not be discernable and will be discussed with MCA-Malawi and ESCOM:

1) Lilongwe 66 kV wood pole replacement, at either end of the line (6012).
2) 33/11 kV substation extensions for new feeder bays (6042, 7055, 6005, 7082, 7084).
3) Replacement of existing cables (7045, 7048, 7049, 7050, 7051, 7052, 7053, 7100, 7096).

As certain reliance will be placed on ESCOM meters and recordings, it will be necessary to ensure that the meters are well functioning and that accurate data are being obtained. The monitoring of loads will require a system of metering that will measure and record loads (kW) at relatively short intervals – at least 15 minutes – at the entry points to each project facility and all outgoing points. Metering should measure (a) kW, (b) kVAs, (c) voltage and (d) amperes. The meters should be able to continuously monitor loads so that outage times can be recorded precisely; i.e., to the minute. Also, appropriate coordination with ESCOM will need to be established for obtaining the data. All meters should be compatible with the

Advanced Metering Infrastructure (AMI) system. Interval data will need to be aggregated and summarized in a suitable format for export into Excel spreadsheets. The meter manufacturer should supply appropriate software as part of the contract. This broad summary of metering requirements has been communicated to MCA for the purpose of engaging a consultant to develop precise metering requirements.

If done correctly, metering of loads at small intervals should be sufficient to capture: (i) energy over time, (ii) outages and (iii) losses across the facilities. As the Compact investments will yield improved generation and transmission capacity, one would expect to see greater energy flowing over the network. Improvements to transmission and distribution infrastructure should yield a decrease in forced outages. The metering will be able to capture outages across the network that can be used to measure common outage indicators, such as number of outages, duration of outages, system average interruption frequency index (SAIFI), and the system average interruption duration index (SAIDI). Certain measures such as SAIFI and SAIDI cannot presently be calculated, nor will their complete calculation be possible until a comprehensive SCADA system is installed at all voltage levels. However, appropriate metering at various points will permit SAIFI and SAIDI to be calculated across MCC-financed facilities. While this will only be possible at the 33/11 kV level and above, there are no Compact investments below 33/11 kV.

Outages occur for three distinct reasons: (i) load shedding, when demand for energy exceeds supply, (ii) planned outages, for example to conduct maintenance, and (iii) forced outages, from problems in the network or faulty equipment. Compact investments are expected to have the greatest impact on forced outages, as many of the current outages are the product of poor quality infrastructure in the transmission and distribution system. It is important to recognize that load shedding might actually increase over the life of the Compact if a dramatic increase in new users causes demand to outstrip supply. While the metering data will not be able to distinguish between load shedding and forced outages, ESCOM manually keeps track of all outage information. While this information is generally unreliable in the case of forced outages (ESCOM often does not know in real time when outages occur), manual tracking is fairly reliable for load shedding and planned outages. Either ESCOM's future M&E department or a data collection firm could compare and reconcile metered and manual outage data to distinguish load shedding, planned, and forced outages.[45]

Focus Groups with Households

The Compact posits that increased energy capacity and improved reliability will have effects at the household level on: (1) income, (2) energy expenditures, consumption, and access, and (3) use of time.[46] From a practical evaluation point of view, there are several challenges to testing these hypotheses. First and foremost, as mentioned above, it will not be possible to identify an adequate comparison group that could serve as a counterfactual. This is particularly problematic for measuring the benefits of the project on income. While it would be possible to measure household income at baseline and at end-line, given all the factors that help explain household income, it will be impossible to determine if any observed changes

[45] This is currently not included in SI's budget estimates for the evaluation.
[46] MCC. 2014. Malawi Performance Evaluation of the Infrastructure Development and Power Sector Reform Projects. MCC-13-BPA-00178. Millennium Challenge Corporation.

in income could be attributed to the project without a meaningful comparison group. Furthermore, as discussed above, electricity reliability might decline as new customers are added to the network.

As a result of these challenges and through consultation with MCC and Compact stakeholders, it was determined not to move forward with a previously proposed household survey. Instead, the metering and technical benefits portion of the evaluation will offer a more accurate approach to measure improvements in energy carried, reliability, and quality. Nonetheless, a focus on technical benefits alone would not allow the evaluation to speak to what IDP investments mean for households nor provide a strong understanding of energy challenges at the household level. As such, the evaluation proposes to conduct focus groups to complement the information provided by the technical benefits portion of the evaluation.

Focus groups are a useful research tool; however, they have significant limitations. Unlike a large-n survey of a representative, focus groups do not allow evaluation teams to make confident inferences about a population as a whole. There can be systematic biases in the types of people that participate in focus groups and what views are put forward in a group setting. Furthermore, far fewer individuals are consulted via focus groups than would be in a survey, introducing additional random error. As such, focus groups are best used to complement and help interpret other more systematic data collection activities. In this case, the focus groups will be used to complement the technical monitoring. As discussed below, the selection neighborhoods in which to conduct focus groups will be primarily based on the level of benefits expected from the IDP and the geographical location. The focus groups will also provide information relevant to the PSRP evaluation - for example, participants will be asked about their experiences with ESCOM and responses to power outages and maintenance requests - however, the primary objective will be to help provide qualitative context to the technical benefits of the IDP.

Focus group methodologies work best with relatively homogenous populations where participants feel comfortable speaking openly and where they speak from a common experience.[47] There are several variables that could be taken into account in stratifying and sampling for focus groups to ensure such commonalities, including electricity access, income, expected project benefits, sex, age, and, of course, geographic location. As the Compact is focused on electricity customers, the evaluation team will limit focus group recruitment to those that are current ESCOM customers. Electricity is of course used very differently across different income groups; however, in the Malawi case, electricity access is generally limited to the highest income quintile. As shown in Table 4, data from the Integrated Health Survey (n=22,532), suggests that 92.4% of electricity connections are limited to the highest quintile. As such, the focus groups will also be limited to this higher income group.

[47] Copsey, Nathaniel. "Focus groups and the political scientist." *European Research Working Paper Series.* No. 2 (2008). European Research Institute.

Table 4: Electricity access by income quintiles

	Electricity		No electricity		Total	
	Freq.	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
Lowest income quintile	-	0.0%	2,181	22.7%	2,181	20.2%
2nd lowest	2	0.2%	2,135	22.2%	2,137	19.8%
Middle income quintile	22	1.9%	2,158	22.5%	2,180	20.2%
2nd highest	48	4.1%	2,098	21.8%	2,146	19.9%
Highest income quintile	1,100	93.9%	1,036	10.8%	2,136	19.8%
Total	1,172	100%	9,608	100%	10,780	100%

Source: Third Integrated Household Survey, 2010-2011.

As a result, the focus groups will be convened and stratified based on beneficiary level, sex, and age. The technical benefits study will likely find that improvements vary across geographical location. Predicting which areas will realize greater benefits is not entirely obvious *a priori*; however, it stands to reason that one would be more likely to observe greater Compact benefits in areas where there is a large investment over a relatively small customer base. For example, one such neighborhood would be Area 25 in Lilongwe, a densely populated, new growth area poorly serviced by existing infrastructure that will benefit from both the installation of a new substation under the Compact and the new transmission line into Lilongwe.

Focus group respondents will be selected from "electrical communities," defined for the purposes of this evaluation as those serviced by the same substation feeder line. Two sets of these focus groups will be convened in selected electrical communities in Lilongwe, where the evaluation team expects to sample (1) from two communities that benefit from both the transmission line upgrade as well as upgrades in transformer capacity through improvements to local transmission and distribution infrastructure, and (2) from two communities that only benefit from the transmission line upgrade (See Table 5). As suggested above, in the first category, electrical communities will be selected downstream from sub-stations where a high level of IDP related benefits are expected. In the second category, electrical communities will be selected that exhibit similar characteristics at baseline (e.g. similar socio-economic status). By comparing focus group responses across these two categories and over time, the evaluation team hopes to be able to speak to the potential impact of varying levels of IDP benefits.

In the north and the south, communities will not benefit from both transmission line improvements and increased transformer capacity. As a result, just one community will be selected in each location from which focus group participants will be drawn. Communities will be selected to match those chosen in Lilongwe.

Focus groups will also be convened to ensure homogeneity in terms of sex and age. This will provide the evaluation team with a better understanding of how the benefits of the project might be different for men and women and for youth and adults while providing an environment where participants are more likely to feel comfortable speaking. As a result, four focus groups will be conducted in each electrical community, for a total of 24 focus groups.

Each focus group will include approximately 8 people, a commonly recommended number for focus groups, which is not too large that some participants' voices go unheard but large enough to ensure different points of view. Participants will be recruited by a recruitment team the day before the focus groups. Recruiters will randomly select households and household members for participation; however, they will utilize a screening instrument to screen for age, sex, income, electricity access, and level of knowledge about electricity in their household. Participants will be offered a small incentive to encourage invited participants to arrive at a predetermined site the day of the focus group. This will entail either a light meal or phone credit.

Table 5: Focus group stratification and selection

	New transmission line + increase in transformer capacity	**Only new transmission line or increased transformer capacity**
Lilongwe	Male young Female young Male adult Female adult	Male young Female young Male adult Female adult
Lilongwe	Male young Female young Male adult Female adult	Male young Female young Male adult Female adult
Mzuzu		Male young Female young Male adult Female adult
Blantyre/Zomba		Male young Female young Male adult Female adult

While the focus groups will not be able to accurately or reliably measure changes in income, energy costs, or time use, they will allow the evaluation team to explore a number of energy related issues, including:

- Sources of and expenditures on energy, including electricity, kerosene, paraffin, candles, and, for those with generators, the costs of generators, maintenance, and diesel.
- Reported experiences with electricity, including outages.
- Self-reported time spent on energy dependent activities (e.g., studying after sunset, household chores, television watching).
- Existence of in-house income generating activities.
- Attitudes towards energy, the Compact, government, and tariff rates.

- Satisfaction with ESCOM, experiences obtaining a connection, and customer service related experiences since becoming a customer.

Upon arrival at the focus group session, each participant will be asked to fill out a short mini-survey on the above mentioned topics. Responses to these questions will be used as a jumping off point for discussion and these responses can also be analyzed as a small non-representative survey of approximately 200 participants. In the focus groups, special attention will be paid to capturing the differential impacts on men and women. The results will be disaggregated by sex of the respondent, and by the sex of the household-head. It is expected that electricity access and reliability will affect men and women differently, and preferences and perceptions would also differ by sex. For example, women could accrue more time benefits due to greater access to electricity through several channels.

Timeline

The success of this evaluation methodology will depend on the comprehensiveness of the metering and timing. As mentioned above, MCA is contracting with a consultant to assist in developing specifications for the needed metering. The meters will need to be installed for an adequate time period prior to Compact IDP investments to ensure that an adequate baseline is established. Ideally, the metering would generate baseline data for the course of an entire year to account for seasonal variation in energy generation and use. As it is expected that the rehabilitation of Nkula A will begin in mid to late 2015, this will not be possible; nonetheless, it is important that baseline metering data be collected for as many months as possible before Compact related changes to the network occur.

Household focus group data collection will take place at three distinct points, estimated as February 2015, summer of 2017, and summer of 2019. These data collection activities will coincide with the enterprise survey discussed below and are meant to offer i) an early baseline, prior to any Compact related construction, ii) a later baseline, prior to the completion of the major Compact investments, and iii) an end-line, after the completion of the Compact.

A full evaluation work plan accompanies this Design Report. The detailed timeline includes the IDP evaluation deliverables and major activities from 2014 to 2018.

B. PSRP Evaluation Design

Design Overview

Social Impact proposes five data collection activities for the PSRP evaluation: (1) quantitative indicators from the M&E Plan and MERA key performance indicators, (2) workflow analyses with relevant units, (3) largely qualitative research activities (with some mini-surveys included), (4) a survey of current ESCOM employees, and (5) process evaluation. These activities will occur in three phases: at baseline (to be conducted as soon as possible), at midline, and at the end of the Compact. The evaluation will seek to identify changes over time and then consider the extent to which any observed improvements can be attributed to Compact activities.

An evaluation of the PSRP will confront several challenges that are worth addressing from the outset, including the absence of a counterfactual, the risk of impressionistic conclusions, and the need for stakeholder buy-in. Next, we explore each in turn.

Risks and Limitations

Lack of counterfactual

As the PSRP evaluation is a performance evaluation and not an impact evaluation, it will aim to measure changes in outcomes over time, as observed through quantitative indicators, workflow analyses, qualitative data, and survey data regardless of attribution. If no positive change is observed then the evaluation can conclude that the Compact did not have a positive effect, or did not have a sufficiently positive effect to overcome negative pressures. If a positive change is observed, then the evaluation team will attempt to qualitatively consider the extent to which the Compact activities played a role in these changes. The challenges in exploring the effect of Compact activities will differ by the type of activity. For example, the financial model and MIS systems are expected to produce substantial efficiency improvements observable through workflow analyses. In other cases, where rival explanations for improvements exist, additional methods will be employed to identify and explore these alternative hypotheses explaining change. For example, if private sector providers are entering the Malawi power market, stakeholders will be asked their perceptions of why this is so.

Risk of impressionistic conclusions

One of the criticisms of interview-based performance evaluations is that conclusions and subsequent recommendations are often highly subjective and based on a non-representative group of respondents. SI proposes two systematic data collection activities to mitigate this problem. The first of these is a survey of ESCOM employees at the level of supervisor or above. This will ensure that a diversity of opinions is taken into account and that the evaluation is not biased by an unrepresentative sample of a small number of interview respondents. It is important to note that the ESCOM survey is only included in the design as an option to be exercised by MCC's EMC and might be excluded from the evaluation. Second, SI proposes the use of workflow analyses to systematically track the number of steps, amount of time, costs, and challenges to accomplishing set tasks/processes.

Risk of inadequate buy-in

Interviews with MCC and MCA make clear that there is a concern of monopolizing ESCOM, MERA, and MOE time. There is a risk that the evaluation and evaluation activities will be viewed as an imposition. Stakeholder opposition to the evaluation would severely limit the evaluation team's ability to collect data. This is of particular concern with ESCOM, where the majority of PSRP activities will take place.

The evaluation team will seek to emphasize learning (in addition to accountability) in its design and develop data collection activities that will be useful to key stakeholders, particularly ESCOM. For example, by surveying ESCOM employees (an activity which has not been undertaken previously) the evaluation can generate information useful to ESCOM and human resources management. Similar benefits can be

expected for the workflow analyses activity. The evaluation team will also seek to limit the burden of data collection activities on Compact stakeholders by taking advantage of existing data, including monitoring and evaluation data collected by the MCA-M M&E team and the results of performance and procurement audits conducted by external consultants.

Through these efforts, the evaluation team hopes to mitigate the challenges to seeing through a successful evaluation of the PSRP. In the following sections, we explore each of the four data collection activities.

Quantitative Indicators

The first component of the PSRP evaluation will take advantage of several quantitative indicators already being collected as part of the MCC/MCA-M Monitoring and Evaluation (M&E) plan and the MERA key performance indicators. No new data collection activities by SI are anticipated as part of this component. Amongst the indicators laid out in the MCC/MCA M&E plan, the key quantitative indicators include the following.

A. Cost recovery ratios

The cost recovery ratio, equal to revenue divided by costs, gauges how well revenues recover costs. Costs may be defined as either: (i) operating expenses only, (ii) operating expenses plus capital replacement costs, or (iii) operating expenses plus capital replacement costs plus the cost of capital expansion. All three of these definitions are currently used and tracked for monitoring. Targets for 2018 as contained in the M&E plan for each of the above definitions are 1.50, 1.28 and 1.20, respectively. Reaching these specified targets assures ESCOM of profits and that a portion of capital spending requirements will be met through these profits. The indicated targets are probably sufficient.

B. Debt – Equity ratio

The Debt-Equity (D-E) ratio indicates the relative proportion of shareholders' equity and long-term debt used to finance ESCOM's assets. However, the Debt Ratio (DR), equal to total long-term debt divided by the total of debt and equity (or total capitalization), is a more commonly used and a generally more understandable variant of the MCA-M D-E ratio. A DR considered "optimum" in the power industry is in the 50% to 60% range. This would correspond to a D-E ratio of 50-50 (i.e., 1.00) or 60-40 (i.e., 1.50).

ESCOM's current D-E ratio is given as 20, (this corresponds to a DR of about 17%), which is rather low. The end-of-Compact target D-E ratio is 0.40 by 2018 (MCA-M, 2013), (or a DR of 29%). Some explanation is required as to how these numbers have been calculated, as a rather straightforward computation from the Balance Sheet of ESCOM's 2012 Annual Report, using end-of-year balances of "total long-term debt" and "total shareholder's equity" results in a 2012 D-E ratio of 0.47. This is actually a much more realistic D-E ratio than 20 or 9, which would suggest long-term debt levels that are commercially untenable. It has been suggested that the definition of this ratio may be revised in the next M&E Plan revision.

C. Gearing Ratio

The Gearing Ratio is one of MERA's key performance indicators, and is meant to capture the total of long-term and short-term debt. This ratio is calculated by adding long-term debt, short-term debt, and bank overdrafts, and then dividing this number by total equity. MERA has proposed a target of 0.66.

D. Acid or Quick test

The acid or quick test ratio measures the ability of a company to use its near cash or quick assets to extinguish or retire its current liabilities immediately. It is equal to the total of cash and any other current assets that can be quickly liquidated at their book value, all divided by total current liabilities. A quick ratio of less than one indicates that current liabilities cannot be fully paid at relatively short notice. ESCOM's current acid or quick ratio is 1.22, with a target of 1.00 throughout the period to 2018 (MCA-M, 2013). The value as of March 2014 was 7.20. It should be noted that this is not a commonly used financial indicator in the power industry, as there is generally no need for a utility to quickly provide cash to pay off short-term obligations.

E. Current ratio

The current ratio is simply equal to current assets divided by current liabilities. It differs from the acid or quick test ratio in that the acid or quick test ratio uses only Balance Sheet items that can be quickly converted to cash - e.g., cash itself, marketable securities, gold; not accounts receivable or prepaid expenses. The current ratio measures whether or not a firm has enough resources to pay its debts over the next twelve months and provides an indication of a firm's liquidity and ability to meet (short-term) creditor's demands. A ratio of over 1.00 means the firm is able to do this. ESCOM's latest officially stated current ratio was 3.83 (MCA-M, 2013), while it reached 15.47 as of March 2014. The target is 2.0 to 4.0 throughout the period to 2018 (MCA-M, 2013). In the power industry in developing countries, this ratio is often distorted by the inclusion of accounts receivable (which may not actually be very liquid) within current assets. This might explain the relatively high target of 2.0 to 4.0.

F. Billing/Collection Efficiency

The billing/collection efficiency ratio may be simply calculated as cash receipts from billed electricity consumption divided by the total amount billed. It measures the proportion of billings that are, in the end, actually paid by customers. The M&E Plan contains no information on the current level of collection efficiency within ESCOM due to lack of credible data as a result of an old billing system. The end-of-Compact target is 95%, which may be regarded as good. As ESCOM is transitioning to pre-paid meters, the focus of collection efficiency will remain on existing post-paid meters.

G. Quantities of electricity metered (by region)

The quantity of electricity metered by region is a performance indicator, insofar as it provides a measure of growth in the enterprise. The M&E Plan targets metered energy to grow at a compounded annual rate of about 9%.

H. Power system losses

Power system losses are defined as the difference between energy input to the system less the total energy billed. Losses are more commonly expressed in percentage terms by dividing these losses by total energy input. Losses may be distinguished as being technical or non-technical in nature. Technical losses arise from energy being lost in the form of heat as it travels through the power system, as well as a poor power factor, which arises mainly from the operation of induction motors that cause voltage and current to be out-of-phase. Non-technical losses arise from other sources within the distribution system - e.g., as the result of theft, faulty meters, or billing mistakes. It is generally difficult to measure the difference between technical and non-technical losses, but estimates may be made through technical analyses. An acceptable value for technical losses depends on the configuration of the power system - a system with a high degree of customer dispersion and long line lengths, as would occur in a rural area, would have higher losses than a power system that is primarily urban or has high concentrations of power consumption. Consequently, "optimum" levels of power system technical losses would range from about 6% to 12%. Thus, technical losses should generally not exceed the upper end of this range. Higher levels than this generally indicate that equipment needs to be upgraded. An ideal level for non-technical losses should be close to zero.

In the case of Malawi, current power system losses, technical and non-technical, are about 22%, with transmission losses accounting for 10% and distribution losses comprising 12%. The end-of-Compact target for transmission losses is 8.8% (a 1% decrease) and for distribution losses, it is 11% (a 1% decrease). Given the current power system, which is generally old and overloaded, technical losses might actually be as high as 20%, meaning that non-technical losses in this illustrative example, at 2%, would then be relatively low for a developing country. On the other hand, technical losses might be as low as 15%, meaning that non-technical losses would then be 7%. In the case of ESCOM, it has not been possible to estimate the split between technical and non-technical losses. In any case, the target as given in the M&E Plan appears reasonable.

I. Average collection period

The average collection period measures the average amount of time (in days) required for customers to pay their bills, and is calculated by first dividing accounts receivable by total annual billings (revenues) and then multiplying by 365. ESCOM's current average collection period is 54 days, with a target of 60 days throughout the period (MCA-M, 2013 – to be updated in September 2014). Sixty days is somewhat long; given that the current level is already at 54 days, the target will be revised by MCA-M in September 2014 to a more ambitious level such as 30-45 days.

J. Bad debt provision (%)

The bad debt provision measures the extent of bad debt that the firm is forced to expense on its profit and loss statement; i.e., there is little chance that the amount expensed will be recovered. In the case of ESCOM, the bad debt provision is calculated as the ratio of the total value of accounts receivables over 90 days divided by the total value of accounts receivable. The M&E Plan shows this percentage to be going down over the target period, from a current value of 20% to 2% by the end of the period. The precise

definition of this indicator is to be revised as part of MCA-M's planned revisions to the M&E plan in September 2014.

K. Average creditor days

This indicator measures the average number of days a company takes to pay its suppliers and is calculated by first dividing accounts payable by the total annual amount of purchases and then multiplying by 365. The current number of ESCOM's average creditor days is 77 as of December 2013, with a target of 45 days throughout the period (MCA-M, 2013). Latest evidence suggests that this value has declined further since 2013. From ESCOM's standpoint, the target of 45 days would seem reasonable, although creditors would probably prefer a number below 30 days. An improved cash flow from billings, as would be reflected by the expansion of prepaid metering as well as improvements in the average collection period and the bad debt provision, would help ESCOM in achieving a much lower creditor days ratio.

L. Average cost of electricity billed

This measure, defined as total expenses for generation, transmission, and distribution divided by total kWh billed, might be expected to decrease over time with operational improvements. However, given ESCOM's high projected growth rates and that the cost of incremental electricity supply is considerably higher than from existing sources, the value can only increase over time (and dramatically), which is the trend actually projected in the M&E Plan. This indicator could still measure operational efficiency within ESCOM. If the indicator exceeded the target of 0.05 by a significant amount, it would then be concluded that ESCOM was unable to maintain reasonable levels of operational efficiency.

M. Number of connections

The number of connections indicator is a measure of the number of new connections, disaggregated by connection type, which is important in assessing the speed at which the country is moving to increasing access to electricity. However, in the short term, given the lack of supporting infrastructure and increased generation capacity, it is possible that added electricity usage by new customers may harm ESCOM operationally and even financially.

N. ESCOM maintenance expenditures ratio to planned maintenance budget

The target value for this performance indicator is 1.00, which was presumably conceived due to the concern that ESCOM is not spending enough on maintenance. Whether the planned maintenance expenditures are sufficient is another issue that would require some analysis, especially as ESCOM has recently revised its own KPI of maintenance as the percent of operational expenditures from 40% to 15%. The justification for this was that the decrement of 25% is now being capitalized as opposed to being expensed. This issue is one that should be resolved by MERA, as there has been concern that ESCOM is not spending enough on routine maintenance.

O. Other possible indicators

The above indicators are comprehensive, although they do not quite capture an issue that has recently concerned some Malawi power sector stakeholders – i.e., ESCOM's insufficient level of capital expenditures, which may be partly addressed by the cost recovery ratios described above. However, it

might be worthwhile exploring other indicators that capture capital expenditures – which are particularly important in the power sector, since this is quite a capital-intensive industry.

One simple ratio might be to express capital expenditures in any year as a percentage of total invested capital, or total assets. However, as there are no known industry norms for such a ratio, it would be difficult to establish appropriate targets. A better measure for addressing capital expenditures would be to compare ESCOM's actual capital expenditures to the planned capital budget (similar to how maintenance expenditures are treated in the M&E Plan). Information on capital expenditures may be obtained through existing data in the detailed financial model or through Capex.

Another useful measure that addresses invested capital is the rate of return on net fixed assets. This is a measure of the efficiency of the use of operational assets or, alternatively, a measure of the return on invested capital. It is generally calculated by dividing net operating income by the current net value of fixed assets. This rather simple definition has often been used by development agencies in loan covenants with borrowers. Although the setting of an adequate rate of return performance indicator depends on a number of factors specific to the utility (e.g., capital structure, debt service, dividend requirements, taxation, growth rates), past rate of return targets as stipulated by development agencies in loan covenants, have generally been in the 8% to 12% range, in more or less real (inflation-free) terms. MERA actually does use a similar calculation to set an appropriate profit level for ESCOM. The current return level allowed by MERA is only 6%. This is significant from a capital expenditure standpoint because such a low allowed return on investment acts as a disincentive to capital spending. Given Malawi's relatively high inflation rate, this indicator should be well above 20%.

This performance indicator is quite similar to the return on regulatory asset base often used by regulators in the determination of reasonable profit. The regulatory approach, however, tends to be somewhat more sophisticated, with possible additional adjustments to the denominator for items such as work-in-progress, working capital, customer contributions and grants.

Therefore, it is proposed that two additional indicators be added to the PSRP set of indicators: (i) actual capital expenditures as a percentage of the planned capital budget, and (ii) rate of return on net fixed assets. This latter indicator is a difficult one for which to set a target, as MERA, by its own regulations, only allows a 6% return. To set a more appropriate target requires some analysis, which might be undertaken under the regulatory assistance to be provided under the PSRP (however, there is no expectation the current value of 6% will be changed). At this point in time, it can only be said that the 6% regulated return is much too low. The extent that this number changes over time towards a more appropriate number (still to be determined) will provide an indication of the extent of success in regulatory reform.

Workflow Studies

Using a methodology known as "metrics based process mapping," the evaluation team will explore a set of distinct tasks or processes expected to improve or become more efficient as a result of the Compact.[48] This methodology will permit the evaluation to develop and track a series of quantifiable efficiency and effectiveness metrics over the course of the Compact while qualitatively identifying and exploring

[48] Martin, Karen and Mike Osterling. 2012. *Metrics-Based Process Mapping: Identifying and Eliminating Waste in Office and Service Processes.* New York: Productivity Press.

challenges in carrying out these processes. In the discussion that follows, we first use billing and MIS as an illustrative example and then discuss other possible workflow analyses to be considered in the evaluation. The scenarios will be finalized with input from MCC, MCA, and other stakeholders.

a. **Billing and MIS:** Currently the billing process is slowed down by the lack of integration between information sources. The three separate regions assess the amount owed by post-paid users and then provide this information to ESCOM's billing department. This department then compiles this information and creates billing statements for post-paid customers. The development of the MIS is expected to dramatically improve the efficiency of this process. As such, the first proposed scenario will be the process for determining the amount owed by a post-paid maximum demand (MD) consumer, developing a billing statement, delivery of the bill, and collection.

In the first step of the mapping process, the evaluation team will review any existing workflow information: for example, information collected by the consultant responsible for developing the Financial MIS. The team will determine how to best utilize this information to prevent duplication of efforts. After this determination, the team will meet with a group of male and female individuals in the billing department for a group interview/focus group. Through the group interview, the evaluation team will seek to answer the following questions: what are all the steps in the process from beginning to end? Who are all the people involved? How long does each step take in total time and in employee hours? How long does the entire process take in total time and employee hours? What are the bottlenecks and challenges in completing the process? Having obtained group answers to these questions, the evaluation team will then conduct short one-on-one interviews with each of the participants in the process. These interviews will seek to confirm, revise, clarify, and amplify the data collected in the group interview. The team will be aware, during the interview process, if there are any emerging gender-based power dynamics between the participating men and women. If such dynamics do arise, as evidenced by a reluctance of participants of either sex (and not just one individual), then these dynamics will be explored further in one-on-one interviews. In either case, the facilitator will ensure that no one individual dominates the interview. At the end of the workflow analysis, the evaluation team aims to provide estimates of the following:

- The number of steps in the process.
- The total time to complete the process.
- The total number of employee hours required to complete the process.
- The total cost in labor to complete the process (determined by multiplying employee hours by labor category base salary rates).
- A qualitative summary of the strengths and weaknesses of the process, including documentation of any bottlenecks and challenges.

If the MIS and other efforts to improve billing are successful, we would expect to see improvements across all of these indicators in billing post-paid MD customers. The results of the workflow analysis will complement the other quantitative indicators discussed in the previous section, such as billings and collections efficiency rates. The methodology will also allow the evaluation team to explore additional outcomes specific to specific PSRP interventions. Other proposed scenarios would include the following:

b. **Procurement:** Procurement in ESCOM currently confronts a number of challenges. Scoping trip interviews suggest that there is often a disconnect between technical teams and the procurement office, which has resulted in substantial delays, and in some cases the purchase of equipment with the wrong specifications. Furthermore, there have been past incidences of inappropriate influence over procurement, resulting in the purchase of goods from politically favored providers. Finally, the procurement process for large items has been held up by government procurement rules despite approval from the ESCOM board. Procurement strengthening is a central part of the ESCOM operations sub-activity, and as such, we would expect to observe substantial improvements in the procurement process over the life of the Compact. The first scenario will be based on the purchase of a high volume order of the basic materials needed to connect a house to the ESCOM grid. The second scenario will be based on a high cost, relatively rare item, such as a substation transformer. In addition to qualitatively exploring bottlenecks, this particular workflow analysis will also examine opportunities for corruption and political influences.

   It is possible that consulting firms conducting procurement and performance audits as part of the Compact investment will utilize similar workflow methodologies and that duplication of these activities would create an unnecessary burden on ESCOM personnel. Once the procurement audit consulting team is selected, the evaluation team will review relevant documentation and conduct preliminary interviews with this team to learn more about their intended methodology. The evaluation team will seek to minimize duplication while ensuring that a systematic measurement approach can be applied and replicated.

c. **Finance:** The Compact includes investments for the development of a financial model, financial plan, and MIS, as well as capacity building for the finance team. As a result, the finance team should be able to project the future financial situation of ESCOM with greater accuracy and increased efficiency. As such, the workflow analysis will explore the processes involved in ESCOM's financial forecasting and planning (e.g., who is undertaking the financial forecast and how often, who is reviewing the results, what information is being provided to senior management, what actions have been undertaken as a result of analyzing financial forecast results). A scenario could be built around a specific financial planning task that is expected to benefit from the financial model. Alternatively, it might be possible to focus on the planning process for the tariff application, which occurred in 2014 and is scheduled to occur again in 2017.

d. **Outages**: The time it takes ESCOM to respond to forced outages should be reduced by investments in SCADA through the IDP and the financial and operational turnaround (FINOP) consultancy under PSRP. Furthermore, though not Compact supported, ESCOM plans to develop a distribution level SCADA system. These two investments in SCADA will allow the utility to transition from a manual process of responding to outages via "sectionalizing," to a centralized control system. The workflow analysis could either examine a scenario responding to an outage on the transmission system, which would be less common but more closely related to the Compact investments, or an outage in the distribution system, which is more common but less closely related to the Compact.

e. **New connections:** New connections are not directly funded by the MCC Compact; however, one of the major procedural deficiencies within ESCOM is responding to applications for service. While statutory requirements mandate that ESCOM establish connections within thirty days of application, anecdotal evidence suggests that some potential customers wait up to two years for a connection. As such, this workflow analysis will explore the process and timing of receiving an application and connecting a customer to the grid in a neighborhood already serviced by ESCOM. In addition to labor costs, this particular workflow analysis will also consider material costs of new connections.

f. **Customer service:** The operational turnaround and performance audits will seek to improve customer service, and in fact, customer service is one of the major complaints among consumers and is recognized as a weakness by ESCOM leadership. As such, the evaluation will explore the process for responding to a customer complaint about overbilling. In this particular case, the problem that the customer service team will have to identify and resolve is a defective meter.

g. **Tariff approval process:** A central focus of the PSRP is the tariff approval process. This workflow analysis will focus on MERA and its process for responding to ESCOM's application to increase the base tariff rate. MERA confronts considerable challenges in this process, as it must critically evaluate the utility's expressed need for higher rates. For example, MERA must issue clear guidelines and instructions for the type of data, analysis, and justification required for proposed tariff increases and be able to receive and critically analyze this information. This workflow analysis will differ from the others in that it will only occur retrospectively at baseline and at end-line and focus on the integrity of the process in addition to efficiency.

h. **Other analyses:** Other workflow analyses may be developed that may focus on the budget approval process by the ESCOM board, specific aspects of financial management, payroll, monitoring and evaluation, asset management, human resources, or other administrative processes. For example, it might be possible to explore the process that the soon to be created ESCOM M&E unit will take to conduct a data quality audit on a particular indicator. It is requested that MCC, MCA, and Compact stakeholders propose additional and specific scenarios that are: (1) relevant to the effective functioning of the energy sector, and (2) expected to be impacted by the Compact activities.

By focusing on specific scenarios, the evaluation team will be able to systematically measure improvements in performing key tasks over time. As such, the workflow analyses will serve as a key segment of the evaluation. While the focus of the workflow analyses will be to develop accurate and reliable metrics that can be compared over time, by identifying bottlenecks in the processes and by profiling these bottlenecks in the baseline report, this evaluation methodology may blur the line between evaluation and intervention. The data generated will result in a possible experimenter effect, as Compact participants might respond to the baseline study rather than the intervention itself. However, we feel that the learning objectives of the evaluation are a central part of the evaluation design. As such, to the extent that compact activities and participants can take advantage of the baseline data for learning purposes, we feel that this is not outside of the scope of evaluation activities.

In addition, while the goal is to obtain accurate and reliable metrics, there is the risk that error can be introduced into the measurement process. Both empirical direct observational and retrospective approaches to workflow analyses confront challenges. Direct observation of a given process from start to finish will be limited in number, perhaps to a single observation, raising the possibility that the observation will not be representative. Knowing that they are being observed, participants might work unusually hard to accomplish the task at hand far more efficiently than they would if they were not being studied, a problem known as the Hawthorne effect. This could be addressed by asking participants how much time certain tasks *typically* take; however, this approach also has drawbacks, as respondents might underestimate the time to appear more efficient. Furthermore, asking respondents to offer time estimates will, at a minimum, introduce random measurement error, as respondents will likely err in their recollection. In addition, over the course of the Compact, the respondent frame may change, and different respondents may offer different estimations of the same amount of time. Recall problems may be reduced by asking a group of respondents to arrive at a consensus; however, pressure from superiors or dominant individuals might lead to another source of bias. While each of these estimation techniques: direct observation, interviews, and group interviews, have some drawbacks, the evaluation will, to the extent possible, use all three methods to triangulate a best possible estimate of the number of steps, time required, and bottlenecks to each of the case scenarios.

Additional Qualitative Research

The greatest strength and primary weakness of the workflow analysis is its focus on very specific processes. While on the one hand, this specificity will allow the evaluation team to develop relatively precise measurement of time and costs, on the other hand, it will not allow the team to make more general observations about the PSRP activities and their outcomes. As such, additional qualitative research will be required to capture the full dimensions of the PSRP.

The evaluation will require a mini-qualitative design for each sub-activity of the PSRP. Qualitative research would be primarily based on personal interviews and/or group interviews with primary and secondary male and female informants for each sub-activity. The SI evaluation team will identify primary key informants for each activity or sub-activity and conduct semi-structured interviews with these individuals to better understand the status, progress to date, opportunities and challenges, and outcomes of the activity. This group of primary respondents for a given sub-activity would also serve as secondary respondents for other sub-activities. And each key interviewee will be asked a series of highly structured short answer or close-ended questions about sub-activities outside of their primary purview.

a. **Financial Directorate (Finances Sub-Activity and Financial and Operational Turnaround (FINOP) of the Operations Sub-Activity):** The finance directorate within ESCOM is a primary focus of the ESCOM Finances and Operations Sub-Activities under the PSRP ESCOM Turnaround Activity. The directorate is benefitting from the consulting services of Ernst & Young, which has finalized a financial plan for ESCOM and a financial model based on the assumptions in the financial plan. In addition, the Compact is funding a MIS, which will permit the integration of financial information across the utility and greatly facilitate the work of the finance department. Finally, the FINOP activities under the Operations Sub-Activity will entail a number of financial strengthening

activities. Given this strong focus, it is not surprising that many of the core quantitative indicators included in the M&E plan focus on the financial health of the utility. The qualitative research will complement this information. SI proposes to rely on an adaptation of the Asian Development Bank's Financial Management Assessment Questionnaire to assess the finance directorate at baseline, midline, and end-line and observe any changes over time. The questionnaire offers a comprehensive look at the qualitative aspects of good financial management and provides modules on the following items:

i. Staffing
ii. Accounting policies and procedures
iii. Segregation of duties
iv. Budgeting systems
v. Payments
vi. Policies and procedures
vii. Cash and bank
viii. Safeguards over assets
ix. Internal and external auditing
x. Reporting and monitoring
xi. Information systems

Given the focus of the financial turnaround consultancy, SI will pay particular attention to segments on budgeting systems and internal auditing. Key informants for the finance sub-activity include financial management consultants from Ernst & Young, the financial management expert from the yet to be contracted FINOP team, the ESCOM finance director, the heads of the revenue, expenditure, and projects and management accounting departments, other finance personnel also being interviewed for the workflow analyses, and finance personnel responsible for the financial model, financial plan, and MIS.

b. **Corporate Governance (corporate governance sub-activity and operations sub-activity)**: This activity has as its objective ensuring ESCOM's adherence to the various legal requirements including the Companies Act, the Public Financial Management Act, Public Audit Act, Energy Laws, Malawi Code II, and Sector Guidelines for Parastatal Organizations. Activities include funding a study on best practices and benchmarks for corporate governance in electrical utilities (under the corporate governance sub-activity) and contracting with a governance consultant under the FINOP sub-activity, who will assist the board in developing a code of conduct, clarifying roles and responsibilities, and reviewing the strategic planning process among other activities.

Scoping trip interviews raised two primary concerns with ESCOM's corporate governance at the initiation of the Compact. ESCOM's board consists of seven board members appointed by the President and three *ex-officio* members. The first concern raised by interviewees is that many of the board appointees are not ideal candidates for the board, with strong political affiliations and weak technical knowledge. The second concern is that while ESCOM is a Statutory Corporation, the GoM, is for all intents and purposes ESCOM's only shareholder, and it frequently asserts

authority over the board and undermines its independence. Changing these two features is perhaps beyond the scope of what can realistically be achieved by the Compact, and yet interviewees hope that the Compact's investments will lead to improved corporate governance and a more technically driven and independent board. While it is possible to track output indicators, such as whether or not a code of conduct was developed, the evaluation will attempt to qualitatively focus on the big picture objective of achieving a technically driven and independent board.

Another outcome of interest is that the board complies with relevant legislation. Legal compliance will not necessarily require new data collection, as the performance audits under the PSRP will include this information in their audits. Instead, baseline data collection activities will focus on better understanding current governance practices. This will include KIIs with the CEO, two appointed and two *ex-officio* members of the board, two former board members, personnel in the Office of the President and Cabinet's Statutory Corporations Office. Design of midline and end-line studies will likely need to be modified to track the recommendations in the benchmarking study.

c. **Operations** (operations sub-activity): The Operations Sub-Activity will involve the bulk of activities under the PSRP and will entail the organizational structural review and subsequent restructuring, the financial and operational turnaround, involving deployment of a 4-5 person expert team for a two year period to work on diverse financial and operational needs, procurement strengthening, performance audits, and an institutional social and gender assessment. The financial strengthening and corporate governance aspects of the Financial and Operational Turnaround have been discussed above.

    i. **Organizational review**: Several years ago, ESCOM was moving towards unbundling by dividing into separate generation, transmission, and distribution corporations. In this process, each division began to add additional staff to cover functions that were once addressed by the central office. This unbundling process was eventually arrested and functions recentralized; however, the new employees were maintained. As a result, ESCOM management notes that the organization is bloated. Therefore, under the Compact an assessment is being conducted to see how ESCOM should be reorganized. The evaluation team will monitor the extent of the reorganization and expected retrenchment and resultant labor cost savings.

    ii. **Procurement:** The Compact will entail support for a Procurement Oversight and Advisory Consultant to provide capacity building to the ESCOM procurement unit and an annual Procurement Performance Audit. As suggested above, procurement has been an area of ESCOM operations that suffers from a number of challenges. If procurement workflow analyses are undertaken, then the evaluation team will take advantage of process analysis interviews to ask additional questions regarding the procurement process, bottlenecks, problem areas, and incentives for abuse or corruption. Additional interviews will be

undertaken with the Procurement Oversight Advisory Consultant and the Procurement Performance Audit team. Furthermore, the evaluation team will review the reporting produced by the auditors.

iii. **Communications Strategy:** During the scoping trip, interviewees noted that ESCOM has poor customer relations and does a poor job of communicating with customers and the broader public. The FINOP team will include a Communication and Public Relations Specialist who will assist ESCOM in developing a communications and outreach strategy. Baseline data collection activities will consist of a review of existing communications strategies and publically available documentation and interviews with individuals involved in communications, including the communications consultant. The team will also examine any existing systems to track customer complaints and responses. At midline and end-line the evaluation will monitor qualitative changes in ESCOM's approach to communications as well as changes in transparency and monitoring and increases in the supply of publically available documentation.

iv. **Maintenance Systems:** As is common with cash strapped utilities, for many years ESCOM failed to invest adequately in proper maintenance. As the utility's financial situation improves, it will be in a better position to ensure the maintenance activities and planning. In addition, the FINOP team will include a Power Systems Operations Specialist with responsibility for assisting ESCOM in improving its maintenance systems and planning processes. Interviews will explore existing systems for monitoring assets, planning maintenance, and carrying out maintenance activities. Consideration will be given to variation in maintenance planning and operations across different directorates. To focus on evaluation activities, we will conduct an illustrative case study on maintenance planning for substation equipment. Interviews will be conducted with the Power Systems Operations Specialist as well as the appropriate male and female personnel within the transmission and distribution directorates responsible for maintenance. A visit will be planned to a substation not slated for rehabilitation to review equipment and maintenance plans for equipment at the substation. This same substation will be visited at midline and end-line to observe changes in ESCOM's approach to maintenance planning. This evaluation activity will be complemented by the above mentioned workflow analysis analyzing the budgeting of maintenance.

v. **Mentoring Program:** Many of ESCOM's mid and upper level leadership have spent their entire careers with ESCOM. While this continuity in personnel has many positive consequences, it also poses risks related to a lack of exposure and inadequate diversity of experiences. As such, a mentoring program is to be developed as part of the Compact to address this problem by pairing ESCOM management with respected managers from other utilities for a period of eight weeks over the course of a six-month period. It should be mentioned that there is some uncertainty whether this aspect of the project will go forward or not. If it does, SI plans to use a mini-survey with both mentors and mentees.

Open and close-ended questions will be utilized to measure perceptions of impacts or changes as a result of the mentorship program. Following review of the survey responses, follow-up interviews may be scheduled with specific mentor-mentee pairs. Throughout this activity, any aspects of personnel development relevant to gender equality will be examined, and questions addressing issues affecting advancement of women in the workforce will be included. The results will be disaggregated by sex for respondents. Baseline activities will entail short interviews with future mentees to gauge their expectations for the program. It is expected that most of these interviewees will be interviewed as part of other aspects of the PSRP evaluation.

vi. **Other**: The FINOP team will be expected to address other aspects of ESCOM operations including developing an energy efficiency and demand management roadmap, developing and carrying out a training program to improve occupational health and safety, providing technical guidance on system protection, and strengthening HR operations. The evaluation will be able to address occupational health, safety, and HR issues through the survey of ESCOM employees. The evaluation team would like to develop a qualitative component to focus on an aspect of human resource management likely to change as a result of the Compact; however, there is currently insufficient information to develop a targeted qualitative research agenda. SI will revisit this once the FINOP team is in place and has developed their work plan. No evaluation activities are expected to occur regarding demand management (outside of the communications strategy) or technical guidance on system protection.

d. **Tariff Reform and Regulatory Strengthening (Tariff Reform Sub-Activity and MERA Capacity Building Sub-Activity)**: Ensuring the financial health of ESCOM requires the ability to determine a tariff rate structure that will be adequate to recover costs for operation, maintenance, and capital expansion. Failure to do so will lead to a continuation of the financial problems experienced in the past, which have severely damaged the reliability and quality of electricity to existing customers and limited the expansion of electricity access to new customers. Nonetheless, it is important to recognize that ESCOM is a monopoly, and, as such, it requires an effective regulator to ensure that ESCOM is not overcharging for services that could be provided more efficiently. Malawi has a base rate tariff system, whereby ESCOM applies to its regulator MERA for a base tariff rate every four years. Following approval of the rate, a combined 5% shift in the exchange rate and the rate of inflation cause an automatic reconsideration of the rate and a possible increase or reduction.

MCA has contracted with one consulting firm providing two advisors, one housed in ESCOM and one in MERA, the former to assist ESCOM in calculating appropriate tariff rates and liaising with MERA and one in MERA to provide assistance in improving its regulatory functions. An additional consultant will be contracted to complete a cost of service study to learn the precise cost of providing services to different types of users. Qualitative research activities will focus on the tariff application process in 2014 and 2018. There are some challenges here in that the 2014 process is

already complete; however, baseline data collection activities will conduct an *ex post* analysis of the 2014 process, including interviews with key informants in ESCOM and MERA as well as external stakeholders that have participated in the process. The evaluation will then look for qualitative differences between the 2014 and 2018 processes. This approach will have to change somewhat if legislative reforms remove the base rate system and allow for greater flexibility in rate changes as some stakeholders have advocated.

It is also contemplated that the consultants to ESCOM and MERA will conduct an assessment of training needs and that subsequent trainings will be procured. At this time, the trainings have not been determined; however, ESCOM and MERA have developed their own wish lists of desired trainings. To the extent that such training lead to improvements in any of the other PSRP focused processes, then the effects of the training will be indirectly measured. Depending on the scope and reach of the trainings, it may also be possible to develop and implement mini-surveys to be conducted with course participants. Such surveys could be conducted at several different possible times, including immediately prior to the training, immediately after, and sometime after (e.g., 6 months later). The desirability of such mini-surveys will depend on the nature and reach of the trainings. For example, if trainings in MERA are heavily targeted toward a handful of personnel, then interviews might be more appropriate than mini-surveys.

e. **Future Capital Investment (Enabling Environment for Public and Private Sector Investment Sub-Activity)**: The GOM has the capital resources to address only a small portion of the electricity generation needs of the country. Donors will be essential in supplementing these resources; however, they too will be unable to meet the total demand. Provided a cost-reflective tariff and other prerequisites are in place, the environment may be conducive enough to attract private sector investors into the sector, with upfront capital to develop power plants. Unfortunately, the GOM is currently unable to provide adequate incentives for independent power providers to enter the Malawian market. For example, ESCOM is still required to charge a rate to consumers that would likely be below the rate charged by IPPs for independently generated power. Moreover, even when there is interest by the private sector, interviewees report that the Government of Malawi currently lacks the capacity to critically analyze proposals and ensure that they are a good deal for Malawian electricity consumers.

   To create an environment that will allow the GOM to effectively contract with IPPs, the Compact includes the development of a Power Market Restructuring Study and the assignment of a high-level energy advisor to the Ministry of Energy for a period of two years, with the possibility of an extension for another year. The long-term goal of the initiative will be the entry of IPPs into the Malawian energy market. However, the stated objective of the Compact is the creation of an "enabling environment." There is some disagreement on what such an environment would be. For some individuals interviewed during the scoping trip, an appropriate enabling environment will require the unbundling of ESCOM to ensure an independent buyer is able to impartially purchase electricity from public and private providers. For others opposed to ESCOM's unbundling, such an enabling environment could still be created with ESCOM in its current form.

For example, the development of clear and transparent regulations on tariffs, licensing, and technical performance standards might be adequate to create such an enabling environment. SI proposes to conduct interviews with the Energy Advisor, personnel from the Ministry of Energy, ESCOM, and MERA as well as leaders from any IPPs in the pipeline for approval. As of this writing, the GOM has signed an MOU with one such potential IPP, the Australian based IntraEnergy.

Survey of ESCOM Employees

SI has proposed that a survey of ESCOM male and female employees be included as a key component of the PSRP evaluation, and the EMC will determine if a survey is warranted following initial PSRP data collection and analysis. If the Compact achieves a financial and operation turnaround, then there should be corresponding and measurable changes in employee perceptions and attitudes. A survey would complement the depth provided in the workflow analyses and qualitative work. While qualitative research offers a powerful tool to understand complexity and nuance, it is limited by the relatively small number of interviewees reached. Qualitative research alone would not allow the evaluation team to know if the statements made by interviewees are particular to those individuals or representative of sentiments felt throughout the organization. This includes both positive and negative views. Surveying avoids this problem and will ensure that the evaluation captures a more complete understanding of the reach of the PSRP within ESCOM.

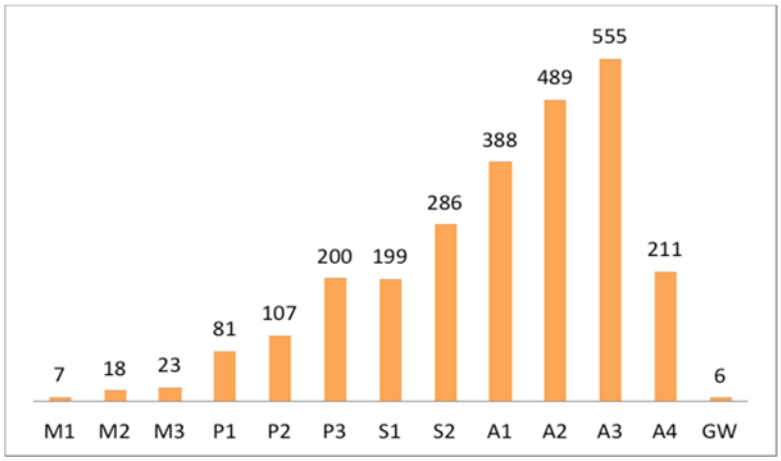
Survey respondents would be asked a range of issues both intended to inform the evaluation and provide valuable learning for ESCOM and MCA. The survey would measure, at a minimum, the following proposed indicators:

- Evaluation of the quality of various aspects of ESCOM's work: generation, transmission, distribution, financial management, customer service, billing, procurement, management, maintenance, strategic communications, etc.
- HR evaluation: salary, benefits, opportunities for advancement of male and female staff, educational opportunities, training (training needs), promotion processes, occupational health and safety, opportunities for women in ESCOM.

If, for example, the Compact investment achieves a financial and operational turnaround, then we would also expect to see statistically significant changes in the perceptions of ESCOM employees on key indicators, such as evaluations of financial management, billing, and procurement, and the workplace environment for males and females. Beyond evaluation purposes, the survey should also inform learning. According to scoping trip interviews, no systematic internal survey of ESCOM employees has ever been conducted.

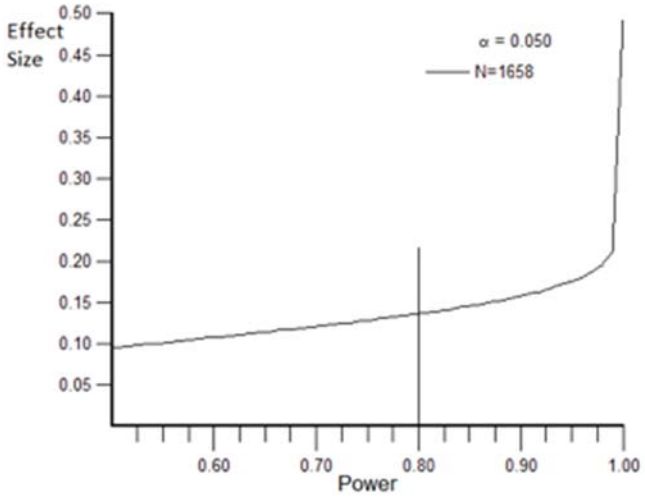
The evaluation team proposes to conduct a survey of a sample of ESCOM employees, which currently number 2,570 (Figure 6). While it would be possible to conduct a census of the population of ESCOM employees, the evaluation team will be able to make accurate inferences with a sample of employees.

Figure 6: Staff per grade[49]



Employees will be randomly selected for inclusion in the sample. Selected individuals will be surveyed in person if they are in the urban areas of Blantyre, Lilongwe, or Mzuzu and by phone if they are not. The ESCOM CEO has already expressed interest in the survey, and we hope that the ESCOM leadership will encourage a high response rate from within the ranks of the utility. We calculate that a sample of 829 will be necessary. As shown in Figure 7, at a standard of .80 power, the minimum detectible effect size for a comparison of waves of the survey is estimated at .14 standard deviations.

Figure 7: Power calculations for the ESCOM employee survey



In terms of sample proportions and assuming maximum variation (50%/50%), we would need to observe approximately a 4% difference between baseline and midline to be confident that a change occurred between these two time periods (see Equation 1). For example, if at baseline we observe that 65% of the

[49] *Note*: M= Manager, P=Professional, S=Supervisor, and A are base level employees. GW refers to another category of base level employees.

sampled ESCOM employees evaluated ESCOM customer service well and at midline this percentage rises to 69% of employees surveyed, then we could be confident that satisfaction had increased over time.

$$(1)\ \ Random\ error\ at\ 95\%\ confidence = .04 = 1.645\left(\sqrt{(.5 * .5/829)(.5 * .5/829)}\right)$$

Process Evaluation

As outlined in the contract, SI will undertake a midcourse process evaluation to "compile lessons learned, and provide a qualitative context for interpreting monitoring data."[50] SI proposes to fold the midcourse process evaluation into existing PSRP data collection activities to be conducted at baseline (fall 2014) and midline (summer 2016). As PSRP interventions are heavily front-loaded, several of the activities and sub-activities will actually be completed by the time initial data collection is conducted and many more will be completed by midterm. As such, there is a strong rationale for conducting process evaluation activities early on as well as at the midpoint of the Compact. Following a review of progress in meeting M&E targets for milestones and outputs, the evaluation team will use the workflow studies and qualitative data collection activities to explore lessons learned and to provide the qualitative context needed to interpret M&E data.

Timeline

As PRSP activities are frontloaded and some have already begun, there is urgency in initiating the PSRP baseline as soon as possible. Social Impact has submitted information for procuring data collection support services for the PSRP baseline. It is estimated that this process will take three months, which would allow for baseline data collection to begin in November. It is estimated that midline PSRP data collection would occur during summer 2016 and that end-line data collection would occur in the spring or summer of 2018. A full evaluation workplan accompanies the Design Report. The detailed timeline includes PSRP evaluation deliverables and major activities from 2014-2018.

C. Enterprise Survey

Two of the three main objectives of the Compact are related to businesses: to reduce the cost of doing business and to increase value added production. Achievement of these objectives and others can best be measured through a survey of businesses before, during, and after realization of the Compact's benefits. Unfortunately, measuring these benefits will be affected by the challenges discussed above. With benefits spread across consumers and diffused far into the future; without significant increases in generation; and provided the expansion of the customer base, it is not clear to what extent business customers will experience clear improvements in energy supply or reliability. Nonetheless, it may be possible to mitigate this challenge by focusing on high-energy-use businesses that are very dependent on electricity and can be expected to be highly sensitive to improvements in reliability. Maximum demand (MD) customers account for approximately 80% of ESCOM revenues and are the most likely to convert improved electricity into value added production. Anecdotal evidence suggests that many large businesses have held off on investments and expansions as a result of the poor energy situation. The Constraints Analysis developed by MCC offers several examples of manufacturing operations that either

[50] Malawi Performance Evaluation of the Infrastructure Development and Power Sector Reform Projects, C.7.9.1, pg. 28.

had to close their doors or opted not to invest as a result of unreliable energy supplies.[51] While several industrial zones are designated as priority areas exempted from load shedding, scoping trip interviews suggest that even these areas struggle with outages and poor quality supply. As a result, the evaluation will use a panel survey of maximum demand and three-phase commercial customers in Compact beneficiary areas to identify changes in electricity related indicators over time. As will be discussed below, the specifics of survey sampling and measurement will be further refined following additional scoping activities and discussions within MCC and other stakeholders.

Fortunately, a sampling frame of businesses can be easily developed from ESCOM's customer records. There are currently 832 MD customers in the ESCOM network. Of these, 448 customers are concentrated in the South; there are 310 customers in the Central region; and there are mere 66 in the North. Given the relatively low number of MD customers, it will be necessary to expand the population of interest to three-phase commercial connections, of which there are 5,389 in the ESCOM network.

The sampling strategy for the enterprise survey is yet to be finalized. Although all business consumers are identified as beneficiaries of the Compact, the benefits might vary across many of these businesses. To focus research efforts as per discussions with MCC and Compact stakeholders, non-businesses, such as government agencies, hospitals, and schools will be dropped from the sampling frame. This list may be further modified once an ongoing ESCOM customer verification program is complete which will yield a geo-referenced location for each enterprise customer. The survey will benefit enormously from this customer verification project.

Sampling could be based on a random sample from among this population; however, it might be desirable to oversample certain subgroups to ensure the evaluation's ability to generalize about sub-populations of interest and compare across these subgroups. The evaluation team initially proposed ensuring representative samples of the degree of expected Compact benefits; however, Compact stakeholders have raised concerns that it will be difficult to distinguish among beneficiaries. There are several additional variables that could be given priority in determining the evaluation's approach to sampling. These include:

- Geographical location: South, Central, North
- Industry type: manufacturing, agriculture, or services
- Electricity consumption at baseline: MD, three-phase customers
- Quality of service at baseline: industrial park customer, non-industrial park customer

A review of ESCOM customer data and further conversations between Compact stakeholders will inform further definition of the sampling strategy. The selection of the stratifying variable or variables will depend on a determination of whether it would be more useful for Compact stakeholders to compare changes across beneficiary type, geography, industry type, consumption, or quality of service. Obtaining and reviewing ESCOM customer records for both MD and three-phase commercial customers will be essential for making this determination. If possible, customer records should include the variables listed above.

[51] MCC. 2009. *Draft Final Analysis of Constraints to Economic Growth*. Washington D.C.: Millennium Challenge Account.

The development of survey instruments will also require additional scoping activities to better understand the energy-related challenges that businesses confront. Towards this end, the evaluation team plans to conduct focus groups or key informant interviews with distinct types of businesses in distinct locations in future visits to Malawi. It is, however, likely that the survey will explore the following energy related variables:

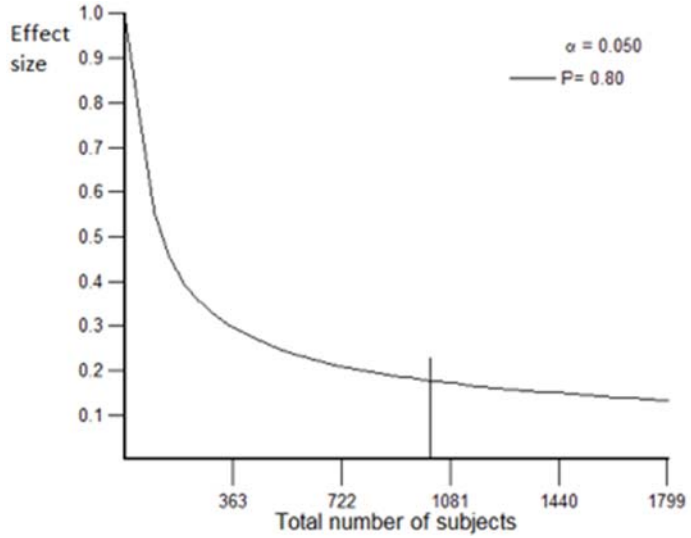
- **Costs** spent on generators, maintenance, diesel, electricity connections and infrastructure, and fixed and variable electricity fees. As many of those sampled will be large and medium businesses, a sizeable portion of the sample should be able to provide exact figures based on actual accounting records. It is expected that beneficiary firms will experience decreases in energy costs from non-ESCOM sources.
- **Reported outages and problems with energy quality**. Perceptive data will be collected on electricity reliability and quality. It is expected that perceptions of reliability will improve.
- **Time workers spend idle due to outages**. The survey will address how businesses respond to energy outages, particularly those that do not have their own generators.
- **Major new investments and expansion of employment**. It is hypothesized that businesses that experience more reliable electricity access will have the security needed to undertake additional power dependent investments and expansions.
- **Attitudes of business leaders** towards power, relevant government agencies, the Compact, tariffs, cross-subsidizing of household tariffs, views on private sector involvement in the power subsector, and perceptions of corruption and political influence in the energy sector.
- **Satisfaction** with ESCOM, experiences obtaining a connection, and customer service related experiences since becoming a customer.
- **Revenue and profit:** Experiences in other countries suggest that entrepreneurs are hesitant to provide accurate revenue and profit information. Such information is often considered sensitive and either results in a high non-response rate or false information. The evaluation team will explore the likelihood of obtaining valid and reliable financial data and consider alternative proxy variables during additional scoping activities.

Because the evaluation is designed as a performance evaluation, in the absence of a counterfactual, the survey is only designed to measure changes in these outcomes of interest over time and will not be able to attribute causality to the Compact itself. For example, if we observe changes in satisfaction with ESCOM over time, it will not be possible to determine if the changes are due to Compact activities or due to other factors.

Exact sample size calculations will be performed when the uncertainty about the sampling approach is resolved. However, if we assume that the evaluation will seek to make comparisons across two subgroups (e.g., high/low beneficiaries or higher/lower consumption), then the evaluation would require a survey of 1,000 enterprises across both these sub-groups in order to measure a minimum detectable effect size of 0.18 standard deviations. Given that this will be a panel study that will track the same businesses over nearly a five year time period, it is likely that there will be a high rate of attrition as businesses either fail or decline to participate in future iterations of the survey. As such, the evaluation team recommends

adjusting this estimate by an additional 25% to account for expected attrition from baseline to end-line, yielding a sample of 1,250 businesses. If the study aims to ensure comparisons across three sub-groups, then an additional 625 firms would need to be added to the sample. Alternatively, Figure 8 shows the tradeoff between the minimum detectable difference between sub-groups and the sample size. At higher minimum detectible differences, lower samples would be permitted. For budgetary purposes, in the attached budget we have estimated a sample of 1,250 businesses across Lilongwe, Mzuzu, and Blantyre, with a majority of sampling in Lilongwe, where most program beneficiaries will be located.

Figure 8: Power calculations for the enterprise survey



To further refine this design, the evaluation team would need to obtain and analyze: (1) existing customer data for all MD and three-phase commercial customers, and (2) forthcoming data from the customer verification project, including GPS data and information linking connections to specific substations. Furthermore, it will be necessary to conduct interviews or focus groups with diverse types of businesses in Blantyre, Lilongwe, and Mzuzu to better understand the energy challenges that they confront and how they respond to those challenges. Finally, in consultation with MCC and other Compact stakeholders, the evaluation team will finalize the sampling strategy.

While the survey design will not allow for a robust test of Compact impact, it will offer a clear picture of changes in key outcome variables overtime. This rich source of data will offer numerous learning opportunities to better improve energy sector operations and governance. This research will provide answers to a variety of questions, including how different types of businesses use energy, the costs that they incur, and entrepreneurs' attitudes towards diverse energy-related issues, including tariff rates. Moreover, statistical analysis will be able to answer specific research questions, such as what impact do diverse factors, including satisfaction with ESCOM, experiences with customer service, or perceptions of corruption and abuse have on attitudes towards higher tariffs? Or alternatively, what factors explain variation in satisfaction with ESCOM?

Timeline

It is anticipated that enterprise survey will be conducted at three points in time. An initial survey will be conducted in early 2015, a follow up survey will likely be conducted in the summer of 2017, and a final follow-up survey will likely be conducted after the completion of the Compact in mid-2019. The 2015 survey will offer a somewhat delayed baseline prior to the full realization of PSRP benefits and prior to construction of any IDP projects. The 2017 survey will offer something of a midline for possible PSRP benefits and a baseline for most IDP projects. The precise timing of this follow-up survey will be chosen to precede the completion of both transmission and distribution infrastructure. The 2019 survey will occur after the completion of IDP projects and with adequate time for businesses to realize the potential benefits of the IDP project. As such, the three surveys will provide a clear picture of changes in outcome variables of interest across three points in time. By timing the surveys appropriately, the evaluation team hopes to be able to speak to potential impacts of diverse aspects of the Compact within the limitation of a performance evaluation design. The evaluation work plan that accompanies this report provides additional detail on the timing of the various activities.

VII. Risks and Limitations

The limitations and risks to the evaluation have been discussed throughout the design document, presented within the section describing each planned data collection activity. This section summarizes these risks and limitations inherent in the proposed evaluation plan.

Overall risks and limitations

No counterfactual: As the proposed design represents a performance evaluation and not an impact evaluation, this evaluation does not offer an estimation of a counterfactual that would allow the evaluation team to make confident statements about the impacts directly attributable to the Compact.

Timing challenges: While the Compact officially began in the fall of 2013, many reforms were made as preconditions to the Compact. While in some cases it will be possible to use existing data to obtain baseline data from years prior to the compact, data collection activities by the evaluation team will not only occur after these precondition reforms but at least one year after the initiation of the Compact. Furthermore, many of the benefits will not be observable until after the official end of the Compact, making post-Compact evaluation activities essential.

Risk of decreasing electricity reliability: As a result of the commissioning of the Kapichira II hydropower plant, electricity supply is currently believed to be roughly equivalent to electricity demand; however, ESCOM plans to add more than 45,000 new connections per year (if MERA's targets are maintained). Without a corresponding increase in generation capacity, it is likely that service reliability will actually worsen for many existing customers over the life of the compact. While this is a risk of the Compact investment, it is also a risk to the evaluation as the evaluation team will not know what outcome indicators would have been in the absence of Compact. For example, the evaluation could be at risk of concluding that the Compact had no meaningful impact on power outages when in fact power outages would have been far worse in the absence of the Compact.

Technical benefits

The ability to measure technical benefits will depend on accurate and reliable metering throughout the system. For example, limitations in data collection, such as missing meters or error prone metering, will not permit an accurate measurement of losses in the system.

Challenges related to in ensuring rapid deployment of accurate and reliable metering will only permit a limited estimation of baseline prior to the initiation of Compact related construction.

Household focus groups

Focus groups offer a limited data collection tool in that participants will not be representative of a larger population and the sample size will be insufficient to make reliable generalizations.

Quantitative indicators

Data quality reviews reveal a number of concerns with many of the indicators included in the M&E Plan. While an action plan has been developed to address these issues, many challenges to ensuring high quality data in the future remain. Even if successfully resolved, it will be difficult to compare high quality end-line data with poor quality baseline data.

Workflow analyses

Workflow analyses confront numerous measurement challenges. While they aim to achieve objective, quantifiable indicators, measurements of time are particularly subject to recall biases and errors.

There is the potential for overlap between the workflow analyses and planned procurement and performance audits. While efforts will be made to ensure that the evaluation builds on these, there is a risk of either placing too large a burden on participants or on failing to achieve systematically collected data that can be compared over the life of the Compact.

Qualitative

The evaluation team will be limited in the number of qualitative research activities that it undertakes. With non-representative samples and a preference for depth over breadth, there is a risk of drawing incorrect conclusions based on insufficient or anecdotal evidence.

ESCOM survey

ESCOM employees might not believe assertions of confidentiality and may either misrepresent themselves in the survey or refuse to participate.

Enterprise survey

The primary limitations to the enterprise survey are lack of a counterfactual, timing, and potential for declining electricity reliability challenges discussed above.

There is also a risk of non-response sampling bias and measurement error.

VIII. Budget

The data collection budget accompanies this Design Report. Social Impact has provided inputs for PSRP and IDP data collection activities, and draft budgets for these activities have been provided by MCA-Malawi and a local data collection firm, Invest in Knowledge Initiative (IKI).

IX. Evaluation Team Roles and Responsibilities

Social Impact is responsible for the overall design, implementation, and dissemination of the evaluation, including the following responsibilities as outlined on page 11 of SI's contract with MCC:

- Develop a rigorous evaluation design given rules of implementation and feasibility of options
- Support MCC and MCA to build buy-in and ownership of evaluation
- Develop evaluation materials that are held to international standards
- Ensure appropriate review of evaluation materials and research protocols
- Manage the data collection firms
- Coordinate data collection
- Lead data cleaning, analysis, interpretation of results
- Produce evaluation reports
- Lead public dissemination efforts

The evaluation team is comprised of technical specialists who provide contributions in their areas of expertise, and headquarters-based staff who support the management and logistics of all aspects of the evaluation. The evaluation team and HQ staff, listed below, work in close collaboration with MCC and MCA-Malawi on all activities and deliverables.

Evaluation Team

Members of the core evaluation team are responsible for contributing to the evaluation design, design implementation, supporting the data collection efforts and in preparing documentation and reports. The Team Leader is responsible for overseeing and guiding the evaluation team's work to ensure it is of the highest quality, and for compiling and submitting all deliverables to SI HQ for quality assurance. The team's three sector experts provide input on issues in governance and institutional reform, the power sector, and social and gender issues. The In-Country Coordinator works directly with MCA-Malawi staff to confirm the team's meetings and interviews, and supports the team with data collection efforts when the team is in Malawi. The SI's evaluation team consists of the following members:

Team Leader: Dr. Olga Rostapshova
Governance, Institutional and Reform Expert: Dr. Daniel Sabet
Power Sector Expert: Arvid Kruze
Social and Gender Expert: Dr. Sarah Tisch
In-Country Coordinator: Aaron Mapondera

SI Headquarters Staff

The SI HQ staff support the evaluation team with any technical, managerial and administrative concerns, in response to any queries by the evaluation team or MCC. The program manager is responsible for

ensuring deliverables conform to MCC and MCA's expectations, and that they are submitted in a timely matter.

Senior Technical Advisor: Dr. Daniel Sabet
Program Manager and Qualitative Researcher: Michele Wehle
Program Assistant: Veronica Mazariegos

To best manage the design, planning and implementation of the contract, SI conducts bi-monthly conference calls with MCC's Program Officer to ensure objectives are jointly understood and any concerns or questions are fully discussed. SI also communicates with MCA-Malawi staff on a regular basis.

X. Institutional Review Board Requirements

All data collection protocols, survey instruments and consent forms for this evaluation will be submitted for ethical approval by the Social Impact Institutional Review Board. All SI research staff involved in the study will be trained and certified in ethical precautions for research with human subjects prior to the initiation of data collection and as a requirement for IRB approval.

Informed consent statements will be developed for diverse data collection activities including: (a) beneficiary focus groups, (b) workflow analyses and qualitative interviews, (c) the ESCOM survey, and (d) the enterprise survey. Informed written consent will be obtained for each respondent, documenting agreement to participate in the study and, in some cases, provide consent for the interview to be recorded.

The SI team will work closely with the data collection firm, MCA-M and MCC to obtain all necessary research clearances and permits. Approval from the Malawian National Commission for Science and Technology (NCST) of the survey tools and data collection protocols will be sought as necessary. SI will work with the selected data collection firm to ensure that the data collection methods are ethically sensitive and that all enumerators are instructed and trained to respect the rights of the respondents and to keep collected data in strict confidence. The use of electronic data collection will render privacy and confidentiality measures easier to implement.

XI. Data Access, Privacy and Documentation Plan

The privacy of all participants who take part in the data collection will be respected throughout the evaluation. To maintain confidentiality and to protect the rights and privacy of those who participate in the Enterprise and ESCOM surveys, data files will be free of identifiers that would permit linkages to individual research participants, and will exclude variables that could lead to deductive disclosure of the identity of individual subjects. Further, the qualitative research methods will be designed to protect subjects and guarantee confidentiality in order to maintain the integrity of the data collection among these groups while minimizing non-response. Transcripts and identifying information will be stored in password-protected folders and will not be made publically available.

Once data collection is complete for a given stage of the evaluation, SI will generate a final report and datasets. These materials will be shared with MCC and key stakeholders for review and comment before drafts are finalized. SI will present and share documents with MCC, MCA-M, and other stakeholders as outlined in the Dissemination Plan included below. Raw datasets provided will follow the MCC Data Documentation and Anonymization Requirements. Complementary Stata do files will also be provided to permit replication of SI's data analysis. Data will conform to the documentation requirements outlined in section J.3. of the contract.

In line with MCC's emphasis on transparency, the findings and data will be shared with the broader donor and development community, contributing to the global knowledge pool and amplifying the utility of the evaluation.

XII. Dissemination Plan

As outlined in SI's contract with MCC, SI is responsible for leading several dissemination-related activities, as described below.[52]

Lead public dissemination efforts: SI will lead public dissemination efforts facilitated by MCA and MCC (such as local workshops and conferences), and present at additional conferences and take advantage of other opportunities to publicly disseminate the results of the evaluation. SI will advise MCC on other public dissemination activities and collaborate as appropriate.

Disseminate baseline and final results: Once the baseline report and the final report are reviewed by the Evaluation Management Committee, SI will conduct the following dissemination activities:

- Present baseline and end-line results at MCC headquarters and at MCA/accountable entity headquarters. A presentation of initial PSRP baseline findings is estimated to occur in January/February 2015 and a subsequent presentation in Malawi for MCA-M and Compact stakeholders shortly thereafter. Results from subsequent rounds of data collection will also be presented to MCC and in public forums.
- SI will review any materials developed by MCC public relations for dissemination on the MCC website for quality assurance.
- If invited, SI will participate in other MCC-financed dissemination and training events, such as MCC M&E college and MCC Impact Evaluation Workshops.

In addition to these activities and as detailed above, SI will provide all presentation materials and raw data to MCC upon completion of the evaluation to support learning efforts.

[52] Malawi Performance Evaluation of the Infrastructure Development and Power Sector Reform Projects.

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Appendix: Original and revised research questions (PSRP and IDP)

Table A1: Core Evaluation question revisions

Original Question	Modified Questions
Were the Compact Goals and Outcomes, as outlined in the Compact document and M&E Plan, achieved? Why or why not?	What declines in poverty, increases in economic growth, reductions in the electricity related cost of doing business, increases in access to electricity, and increases in value added production are observed over the life of the Compact?
What were the results of the interventions – intended and unintended, positive or negative?	No Modification.
Was the Project cost effective, analyzed through re-estimated final economic rates of return, comparisons to original estimates, and assessment of differences?	Dropped.
Are there differences in the impact of the program by gender, age and income? Gender and income disaggregated information for businesses and households will be pursued to the extent possible.	Are there differences in outcomes of interest by gender, age and income? Sex and income disaggregated information for businesses and households will be pursued to the extent possible.
What are the lessons learned and are they applicable to other similar projects?	Not Modified.
What is the likelihood that the results of the Project will be sustained over time?	Not Modified.
At the household level, the evaluations shall focus on the following program/project/activities impacts on household and individuals: income; expenditures, consumption and access to energy; individual time devoted to leisure and productive activities.[53]	Not Modified.
At the enterprise level, the evaluation shall focus on the impact of the program/project/activities on: business profitability and productivity; value added production and investment; employment and wage changes; energy consumption and sources of energy used; business losses.	Not Modified.

[53] There will be several challenges to identifying Compact impact on these items, and household surveys may be better used for learning purposes rather than for attributing impact.

At the regulatory, institutional and policy level, the evaluation shall explore the impacts of the program/project/activities on: utility operating costs and losses; financial sustainability; private investment, particularly in generation; expansion of electricity access for customers, particularly the poor.	At the regulatory, institutional and policy level, the evaluation shall explore the potential impacts of the program/project/activities on: utility operating costs and losses; financial sustainability; private investment, particularly in generation; expansion of electricity access for customers, particularly the poor.

Table A2: PSRP research question revisions

Original question	Modified, dropped or newly proposed questions
Is the ESCOM Board performing according to existing and any new statues, bylaws, Articles and Memoranda?	**No change**: Is the ESCOM Board performing according to existing and any new statues, bylaws, Articles and Memoranda?
To what extent do training, twinning and other management support interventions improve the performance of the utility and the capacity of its employees?	**New question**: If the mentoring program occurs, what specific learning can be attributed to the program? What are examples of experiences from other utilities that were incorporated into ESCOM operations? If there are no improvements or improvements are minimal, why? (See survey questions related to trainings)
Does the financial management information system financed by the Compact help improve financial management and meet business requirements?	**New question**: Does ESCOM realize improvements in effectiveness and efficiency over the five years of the Compact in financial planning and billing? To what extent can observed gains be attributed to the Compact? If there are no improvements or the improvements are minimal, why? Note: Repeated question. Section on financial planning highlighted.
Which interventions are the most effective in reducing commercial losses? To the extent possible, the Contractor shall explore differences in results by customer type and region.	**Dropped**: Not clear what commercial loss activities will be conducted under the Compact provided ESCOM's existing customer verification and loss reduction program.

Original question	Modified, dropped or newly proposed questions
Is the utility meeting key performance targets set by the shareholder and/or regulator? Why/why not?	**Modified**: Is ESCOM meeting key performance indicator targets set by MERA? Why or why not? **Modified**: Is ESCOM meeting key performance indicator targets set as part of the Semi Annual Review? Why or why not?
Do the Compact activities improve the capacity of the regulator to independently regulate the sector and develop cost reflective tariffs?	**New question**: Are tariffs cost reflective by the end of the Compact? If they are, to what extent did Compact efforts contribute? If they are not cost reflective, why not? How do stakeholders regard the 2017 tariff process compared to the 2014 tariff process? What improvements can be attributed to the Compact? If there are not improvements, why not?
How does the semi-annual review process contribute to progress on key reform milestones and broader reform project outcomes?	**New question**: Do stakeholders perceive the semi-annual review process to have contributed to progress on key reform milestones and broader reform project outcomes? If so, how?
Outcome-level questions	
To what extent do improvements in sector governance and regulation lead to increased private investment, generation capacity and electricity coverage?	**New question**: Do stakeholders (e.g., potential investors, technical experts, and consumer groups) consider there to be an appropriate environment to incentivize independent power producers at a fair price to Malawian consumers? Why or why not? At the end of the Compact, have agreements been signed for independent power producers to enter the market? If yes, disaggregate by project and capacity.
Did a move toward cost-reflective tariff attract more investments in the generation sector?	Dropped: See questions above.

Original question	Modified, dropped or newly proposed questions
To what extent do improvements in sector governance and regulation lead to improvements in the quality of electricity supply?	**Dropped**: It is Difficult to link electricity quality to governance reforms given greater proportional dependence on infrastructure. MODIFIED: Does ESCOM realize improvements in effectiveness and efficiency over the five years of the Compact in financial planning and billing? To what extent can observed gains be attributed to the Compact? If there are no improvements or the improvements are minimal, why? Note: Repeated question. Relevant sections highlighted.
Did the program improve overall financial position of the utility?	**Modified**: Does the financial stability of the utility improve over the life of the Compact? Are improvements driven primarily by tariff increases, or do efforts to improve collection efficiencies, reductions in losses, and reductions in administrative costs also contribute significantly to improved financial health? If there are no improvements or improvements are minimal, why?
To what extent did improved policies and procedures for procurements and procurement audits lead to better financial and operational performance of the utility?	**New question**: Does ESCOM realize improvements in effectiveness and efficiency over the five years of the Compact in financial planning and billing? To what extent can observed gains be attributed to the Compact? If there are no improvements or the improvements are minimal, why? Is there a reduction in opportunities for corruption and/or a perception of corruption in procurement, service extension, and billing over the five years of the Compact? To what extent can observed gains be attributed to the Compact? If there are no gains or gains are minimal, why?
How do tariff increases affect consumption of electricity by different income groups, gender, customers and formal and informal firms?	**Modified**: How do tariff increases affect consumption of electricity by businesses surveyed in the enterprise survey?
To what extent have the activities improved operational efficiency and the cost of producing power?	**Dropped**. This is somewhat addressed through a question focused on maintenance. **New question**: Do maintenance expenditures increase and do maintenance procedures improve over the life of the Compact? To what extent do Compact efforts to improve

Original question	Modified, dropped or newly proposed questions
	maintenance systems contribute to any observed improvements? If there are no improvements or improvements are minimal, why?
To what extent do improvements in the regulator's independence and regulatory capacity result in improved operational and financial performance of the utility?	**New question**: Does ESCOM independence and the independence of the board increase over the life of the Compact? To what extent do Compact efforts to improve corporate governance explain increased independence? (Independence will be operationalized by examining the make-up of the board, the ability of the board to act independently of government approval, and perceptions of independence.) If there are no improvements or improvements are minimal, why? What are the observed consequences if any (positive or negative) of any increases in independence?
To what extent do improvements in regulatory independence and capacity attract more investments in the power sector?	**Dropped**: See questions above on enabling environment.
Impact-level questions	
Did public sector and regulatory reforms improve access to and consumption of power, particularly for the poor? If so, what components of the reform project – in particular, did the life line tariff- improve access and /or consumption of power for the poor?	**Modified:** Did public sector and regulatory reforms improve access to and consumption of power, particularly for the lowest two income quintiles in Malawi? Why or why not? For instance, sub-questions could include: Did employment rates for males and females increase within the expanded distribution area? Did the number of registrations of women- or men-owned small businesses increase? Is there a decrease in primary school drop-outs for boys and girls?
How did the change in tariff affect the profitability and productivity of businesses?	**Dropped**: Without baseline data or a counterfactual it will be difficult to meaningfully answer the question.

Additional questions
Does the quantity and quality of ESCOM communications with the public and the transparency of ESCOM increase over the life of the Compact? To what extent did the Compact efforts to improve communications contribute to observed improvements? If there are no improvements or improvements are minimal, why?
Do ESCOM male and female employees' evaluations of various aspects of ESCOM's work, including generation, transmission, distribution, financial management, customer service, billing, procurement, management, maintenance, and strategic communications improve, decline, or stay the same?
Do male and female employees' evaluations of various aspects of ESCOM's human resources policies, including salary, benefits, opportunities for advancement, educational opportunities, training (training needs), promotion processes, recognition of good performance, occupational health and safety, and advancement opportunities for women in ESCOM improve, decline, or stay the same?
Do imbalances between the number of male and female staff within the composition of ESCOM staffing decline over the life of the Compact?
How many new connections are added to the network? What percent are prepaid meters? What percent of existing connections are converted to prepaid metering? Disaggregated by year and connection type.
What are the observed consequences if any (positive or negative) of any increases in independence of ESCOM?
Are trainings of MERA personnel perceived to be useful by participants six months after training? What evidence do participants provide that they have put training into practice?

Table A3: IDP research question revisions

Original question	Modified, dropped, or newly proposed question
To what extent have the activities improved the operational efficiency and the cost of producing power?	See efficiency questions under PSRP
Did program interventions help attract private investment in the sector? What is the quality of this investment? Which aspects of the program were most effective in attracting private investment?	See PSRP question
To what extent have steps taken under the Compact and by the GOM improved measures of customer satisfaction?	**Modified**: Does beneficiary male and female entrepreneurs' satisfaction with ESCOM improve over the life of the Compact? Do these entrepreneurs perceive an improvement in the quality of electricity over the life of the Compact? What factors explain variation in satisfaction with ESCOM?
To what extent do small, medium, and large firms respond to more reliable, accessible, and/or higher quality power by expanding or intensifying production? Expanding employment? Investing in expanded plant or other fixed assets and/or different production technologies reliant on electricity?	**Modified**: Do beneficiary businesses change investments or alter their workforces following improvements in electricity reliability?
What is the program's overall impact on the profitability and productivity of enterprises? What are the mechanisms or channels through which these impacts do or do not occur?	**Dropped**: We are concerned about the feasibility of obtaining accurate and reliable profit data through surveys. We instead propose to focus on costs. How do energy expenditures change over the course of the Compact? How do improvements in electricity reduce or increase costs to business?
What is the likely magnitude of the impact of the program on wage and investment incomes? What are the mechanisms or channels through which these impacts do or do not occur? What is the income and/or skill distribution of individuals experiencing changes in wage and employment?	**Dropped**. Many factors influence wage and investment incomes and we do not anticipate being able to isolate the independent effects of electricity improvements.
What is the impact of the program on the diversification of the Malawian economy towards manufacturing, mining, tourism and higher value agriculture?	**Dropped**: Diversification is not expected within the evaluable time period.

What is the observed change in energy sources and consumption due to the program? How much of the observed changes is due to reliability and quality improvements in electricity versus the price (tariff) of electricity?	**Modified:** What are beneficiary businesses' consumption/expenditure patterns for different types of energy? How do consumption/expenditure patterns change as a result of improved electricity?
How do small, medium, and large firms respond to higher electricity tariffs?	**Dropped**: Sampling approach will not allow for an adequate sample of small businesses. Instead, businesses will be disaggregated by consumption.
What are the differential impacts of the program/project/activities on female-headed businesses and households, as well as other vulnerable groups?	**Dropped.**
To what extent do changes in the reliability of electricity impact female and children's time on non-household work and/or leisure?	**Dropped.**
What are the community-level impacts of improved power availability and quality on communities? How do project benefits accrue differently to households and/or businesses that are not connected to electricity grid but reside in communities with access to the grid?	**Dropped**.
Did the infrastructure improvements in generation, transmission and distribution lead to a reduction in technical losses and improve the quality of power? To what extent can these changes be attributed to the compact investments versus other investments or policy changes by the GoM?	**Modified**: As a result of the Compact, what are the changes in (1) energy delivered, (2) technical losses, and (3) forced outages for each subproject?

Did the infrastructure improvements result in increased power available to customers; reduce the frequency and duration of outages and load shedding?	**Same as above**: As a result of the Compact, what are the changes in (1) energy delivered, (2) technical losses, and (3) forced outages for each subproject? Does beneficiary male and female entrepreneurs' satisfaction with ESCOM improve over the life of the Compact? Do these entrepreneurs perceive an improvement in the quality of electricity over the life of the Compact? What factors explain variation in satisfaction with ESCOM?
Did the infrastructure interventions increase the capacity, efficiency and reliability of Nkula A?	**Same as above**: As a result of the Compact, what are the changes in (1) energy delivered, (2) technical losses, and (3) forced outages for each subproject?
Did infrastructure improvements in generation, transmission and distribution improve the operational and technical performance of the power utility?	**Same as above**: As a result of the Compact, what are the changes in (1) energy delivered, (2) technical losses, and (3) forced outages for each subproject? See PSRP question on response efficiencies to outages influenced by SCADA.
Did the infrastructure improvements contribute to greater cost savings and efficiency in the production and distribution of power?	**Dropped**.
Did the infrastructure improvements lead to better reliability and quality of power for consumers?	**Same as above**: As a result of the Compact, what are the changes in (1) energy delivered, (2) technical losses, and (3) forced outages for each subproject? Does beneficiary male and female entrepreneurs' satisfaction with ESCOM improve over the life of the Compact? Do these entrepreneurs perceive an improvement in the quality of electricity over the life of the Compact? What factors explain variation in satisfaction with ESCOM?

Additional questions
Do beneficiary male and female entrepreneurs' attitudes towards cost-reflective tariffs increase over the life of the Compact? What factors explain variation in attitudes towards cost-reflective tariffs?

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