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Liberia Energy Project: Findings from the Final Evaluation of the Liberia Electricity Corporation Training Activity

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Abbreviations

CLSG	Cote D'Ivoire, Liberia, Sierra Leone, Guinea
MCHPP	Mount Coffee Hydro Power Plant
MHI	Manitoba Hydro International
MSC	Management Services contractor
IMT	Interim Management Team
NORAD	Norwegian Agency for Development Cooperation
EIB	European Investment Bank
KfW	German Development Bank (Kreditanstalt für Wiederaufbau)
OMT	Operations, Maintenance, and Training
HOI	Hydro Operations International
UTC	Utility Training Consultant
WB	World Bank

Executive Summary

Program overview

The $257 million Compact ($238 million disbursed) between the Government of Liberia (GoL) and the Millennium Challenge Corporation (MCC), which ended in January 2021, included energy investments to "provide access to more reliable and affordable electricity." The Liberia Energy Project comprises the Mount Coffee Power Hydropower Plant (MCHPP) Rehabilitation Activity; Capacity Building and Sector Reform, the MCHPP Support Activity; and the Liberian Electricity Corporation (LEC) Training Activity. This report presents the evaluation of the LEC Training Activity, which aimed to improve the technical capacity of the energy sector workforce through improved training for LEC staff and technicians.

In this report, we first introduce the Training Activity and describe the context of the Liberia Energy Sector and LEC, which is important background to understand the challenge of human resource capacity building in Liberia. Next, we describe the Training Activity design, program logic, and implementation as well as a brief review of literature on training for staff at utility companies in developing countries. Then, we present the evaluation methodology, data sources, evaluation questions, and analyses. Finally, we present implementation outcomes compared to the program logic and conclude with main findings and recommendations.

Evaluation

MCC commissioned Mathematica to conduct a qualitative performance evaluation of the LEC Training Activity to provide an in-depth assessment of evaluation questions and program logic. MCC's evaluation questions for the Training Activity include:

- 1a. How did the LEC Training Activity function in practice?
- 1b. How effective was the Training Activity at training LEC staff?
- 2. To what extent did the LEC Training Activity meet needs, including the number of people trained and the quality and relevance of skills provided?
- 3. How sustainable is the LEC Training Activity? Do LEC staff have the time, capacity, and budget to operate the training program? Are new LEC staff offered training and how does LEC maintain continuity of skills and capacity within the workforce?

To answer these questions, we reviewed documents and training videos, conducted interviews with LEC employees (both trainers and trainees), and led key informant interviews with LEC management, MCC, Millennium Challenge Account Liberia (MCA-Liberia), and Tata Power Company Limited (Tata). Guided by evaluation questions and expected outcomes, we analyzed data and triangulated findings across data sources. Finally, we situate findings in the context of Liberia, LEC, and the broader Liberian energy sector, which is critical to interpreting results and offering realistic recommendations for future investments.

Key findings

We present evaluation questions and summarize key findings that emerged from our analyses:

Evaluation Question 1a: How did the LEC Training Activity function in practice?

- The original scope and budget of the LEC Training Activity was reduced despite LEC's critical gaps in human resource capabilities. The original plan for the more robust Activity included the construction of an on-the-job, fully equipped training center, ample training of trainers (ToT) across departments, and an ongoing schedule of trainings. The scope was reduced to a one-time training of trainers, one-time training for a third of LEC staff, and construction of an outdoor training facility.[1] MCC cited multiple reasons for this change in scope: LEC's failure to comply with its contract obligations for the OMT at MCHPP, the lack of a viable business plan for the training center proposed by the design consultant, a completion risk given the late start to the Activity, concern about LEC's ability to operate and maintain a training center, and the desire to promote hands-on and on-the-job training rather than classroom training.
- After the scope of the training activity was reduced, the COVID-19 pandemic caused closures, interrupted global travel, and negatively affected the activity. Tata (the company contracted to provide the trainings to LEC staff), was flexible and adapted given the constraints. Tata reduced travel to Liberia to plan for training and modified the training schedule, format, and content. Tata quickly transitioned to a mostly virtual training with limited in-person ToT instruction, and was able to complete the planned trainings prior to the compact end date.
- Stakeholders reported that Tata produced high-quality deliverables, was highly collaborative with the LEC Training and Development Department, and accurately identified the major training needs at LEC. Modifying the training to a virtual format was necessary but respondents reported that it resulted in a less-effective training experience. Unreliable internet connections caused frequent interruptions, poor quality audio exacerbated language differences between Tata trainers and LEC trainees, and one-on-one interactions were limited.
- The Outdoor Training Center (OTC) was constructed but has been underutilized due to equipment shortages. As of May 2022, plans for the installation and construction of additional training equipment and lodging for trainees were on hold due to LEC's financial shortfall.

Evaluation Questions 1b and 2: How effective was the LEC Training Activity? To what extent did the LEC Training Activity meet skill needs at LEC (number of staff trained and the quality and relevance of skills)?

- According to Tata's post-training assessments, the trainings—delivered to about 300 LEC staff members—exceeded the targets for learner satisfaction, course completion, and knowledge transfer. Average learner satisfaction was 4.19 on a five-point scale, above the target of 4. The course completion rate was 80 percent against a target of 60 percent.
- While program targets were met, there were mixed reports on the relevance of training content and format. For example:

[1] MCC redirected Training Activity funds to support another component of the Compact, the Operations, Maintenance and Training (OMT) contractor at MCHPP. The OMT was needed to bolster training specific to the hydropower plant and avoid catastrophic failure.

  - Tata implemented a ToT model for LEC staff to conduct on-the-job training. This training was generally well received but there was insufficient in-person time and feedback. ToT respondents reported significant barriers to implementing ongoing training.
  - Respondents across all departments reported that safety training was important, however it highlighted LEC's critical lack of safety equipment.
  - Commercial Department staff felt trainings were useful and highly relevant, especially topics related to customer service and metering.
  - Technical staff in generation and T&D departments reported that training did not fully meet needs. They reported the subject matter was relevant, but the level of detail and lack of hands-on practice was insufficient to address the complicated infrastructure and equipment challenges they face. Staff want to observe experts in person, practice on actual LEC assets, and receive immediate feedback on their performance. MCHPP staff reported that the training utilized equipment not used at MCHPP. LEC reported that they cannot repair transformer failures or fix metering issues, skills which they feel are essential to avoiding outages and reducing power theft.

Evaluation question 3. How sustainable is the LEC Training Activity? Do LEC staff have the time, capacity, and budget to operate the training program? Are new LEC staff offered training and how does LEC maintain continuity of skills and capacity within the workforce?

- The LEC Training Activity has serious risks to sustainability given LEC's financial situation and reliance on external partners for funding. LEC management and donors reiterated that more training is needed and expressed concern about LEC's ability to operate independently and maintain critical infrastructure including MCHPP and thermal generators. LEC training staff also felt that construction of a permanent training center and procurement of additional training tools and equipment were critical to the sustainability of the Activity. The Activity's inability to meet interim objectives suggest essential human resource capacity building and training is unlikely to be sustained without major institutional reform and donor coordination and support.
- Many staff do not have the time or resources to conduct ongoing on-the-job or classroom training despite LEC's need to maintain critical infrastructure and assets. Since the Tata trainings, respondents reported that on-the-job training has been implemented inconsistently. While two thirds of on-the-job trainers reported implementing at least some on-the-job training, it was generally brief or lacked structure because of LEC's limited financial and material resources. LEC staff worry that insufficient administrative support and equipment shortages are a barrier to permanently applying the best practices learned during the training.
- LEC staff recognize that training must be a continuous process of skill development, expansion, and reinforcement, rather than a one-time event. Respondents agree that training on additional topics and refresher trainings are essential to gain more depth and hands-on practice with specific equipment or technologies. While it would not replace hands-on learning, respondents suggested that LEC support continuous learning through access to computers, internet, and other resources for self-study. LEC training staff also noted that the Training and Development Department should be upgraded to a Division at LEC in order to have a seat at the LEC Executive Management meeting.

Key takeaways

The LEC Training Activity, although reduced in scope and modified given the Covid-19 pandemic, was an important contribution to utility training efforts in 2020. However, LEC's growing patchwork of

electricity assets and infrastructure require that LEC staff receive sustained, intensive training and continuous capacity building to instill the skills needed to operate and maintain complex infrastructure. This study shows that one-time and piecemeal trainings, implemented and funded by different organizations, have been insufficient to yield the knowledge and expertise needed for staff to operate and maintain LEC's assets, equipment, and infrastructure.

Overall, LEC has made notable progress since 2018 including establishing the Training and Development Department, developing a Training Policy and in-house trainings, and partnering with organizations to support training. However, the utility's financial crisis and lack of financial support from the GoL requires that the LEC Training and Development Department rely heavily on external partners for funding and training. While all stakeholders understand the importance of training to LEC's performance and ability to overcome critical risks and threats—such as loss of assets, equipment, and life, and excessive technical and commercial losses—training still lacks adequate funding and prioritization. Given that funding is inconsistent, intentional, planned training is difficult and scheduled trainings are often delayed, canceled, or modified. Moving forward, the GoL must take steps to improve LEC's financial position and LEC and donors—in a strategic and coordinated manner—must invest in human capacity development to improve utility operations and ensure the sustainability of infrastructure and assets.

Excerpt from Master and Strategic Plan, February 2020

"For every power utility, continuous improvement in its training standards, approach and methodology is very critical to meet the ever-changing customer demands, regulatory interventions, technological upgrades and business operations. Developing a competent, skilled and high-performing workforce is imperative to maintain and improve workplace safety, optimize business performance, ensure compliance and maximize stakeholder value. A substantial investment in human resources - an organization's most important asset—is critical to maximizing workforce potential and driving business results" (Tata 2020a).

A fully detailed account of these findings is provided in Section III of the report.

I. LEC Training Activity Overview

The Liberia Electricity Corporation (LEC), the state-run utility company, ceased operations during the country's civil war. The war, lasting from 1989 to 2003, resulted in the destruction of the generation, transmission, and distribution (T&D) network across Monrovia, Liberia's capital city where LEC assets and infrastructure were located. With poles and wires looted and main streets in darkness, LEC staff were unpaid and let go. LEC operations ceased in 1990 and remained closed for 15 years. Consequently, LEC lost human resource capacity and the consistent on-the-job practice, training, and professional development required for a power utility's "continuous improvement in its training standards, approach and methodology" to meet "ever-changing customer demands, regulatory interventions, technological upgrades, and business operations" (Tata 2020a).

Post-war, in 2005, with a new government and $40 million in donor investments for temporary diesel generators, LEC resumed operations, reaching 2,500 customers in Monrovia by 2010. As LEC began to rebuild, the utility faced acute shortages of technical and management capacity given the lack of operations, war, and diaspora. Liberia has received assistance and donations from the African Development Bank, European Investment Bank, European Union, World Bank, and China, France, Germany, Ghana, Japan, Norway, the United Kingdom, and the United States through the U.S. Agency for International Development and the Millennium Challenge Corporation (MCC) to help rebuild the power sector. However, assistance and investments have prioritized generation and T&D infrastructure, without donor and government coordination or a coherent strategy to ensure maintenance and sustainability. Meanwhile, human capacity development has not kept pace with the technical complexity of the system caused by piecemeal, discordant, and non-optimized donations.

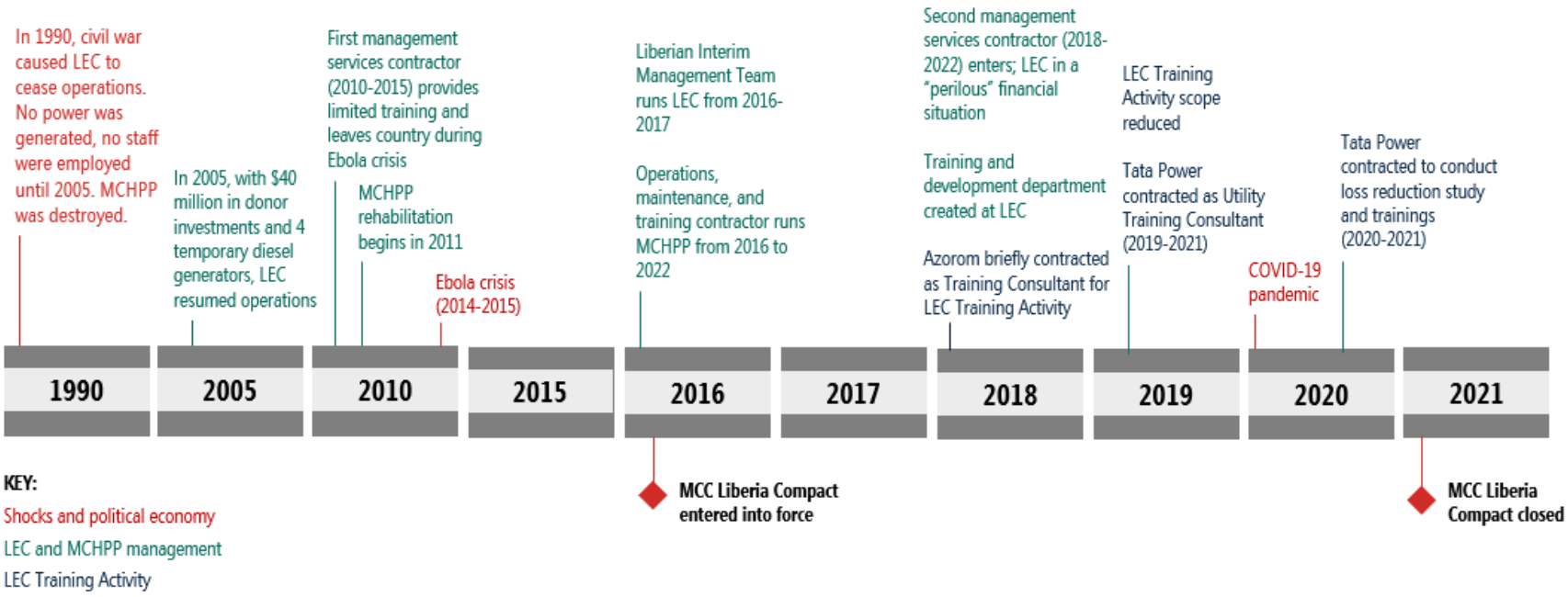
In 2015, MCC and the Government of Liberia (GoL) signed the Liberia Compact, having identified inadequate power as a key constraint to poverty reduction and economic growth. The Compact was entered into force with the goal of increasing access and improving electricity quality and reliability. The $202 million Liberia Energy Project funded the Mt. Coffee Power Hydropower Plant (MCHPP) Rehabilitation Activity; Capacity Building and Sector Reform; the MCHPP Support Activity; and the LEC Training Activity.

In 2017, MCC contracted Mathematica to evaluate its investments in the Liberia Energy sector. This report focuses on the evaluation of the LEC Training Activity, which aimed to improve the technical capacity of the energy sector workforce through improved training for LEC staff.

A. Liberian Electricity Corporation

Corporations must ensure that human resource capabilities are commensurate with the responsibilities that an organization has for successfully maintaining and sustaining operations. For an electricity corporation, management must ensure that staff have the skills and knowledge to handle the utility's generation, transmission, distribution, and commercial operations in a safe, efficient, and effective manner. While building human resource capabilities requires an organization to engage in long-term strategic planning and continuity, LEC's management has changed numerous times in the past decade (Figure I.1). From 2010 to the present, LEC has had three separate management structures, including two different management services contractors and a Liberian-led Interim Management Team (IMT). In July 2022 Liberian-led staff will assume LEC management. Next, we describe the relevant history and context given its importance for interpreting the evaluation findings and making future recommendations.

Figure I.1. Timeline of LEC management and training



Manitoba Hydro International (MHI) as Management Services Contractor (MSC) 2010-2015

In July 2010, MHI became the first management services contractor post-war. At the time, LEC generated 9.6 megawatts of electricity, served 2,500 customers, and had a goal of improving technical and commercial performance. With a $14 million contract, MHI's training budget was minimal while the amount of generated power and the customer base increased. MHI ended operations in 2015, after the Ebola Virus Disease (EVD) crisis led to MHI staff evacuations. In 2015, LEC generated 22 megawatts, served approximately 27,000 customers, and maintained a monthly operating loss of $0.6 to $1.3 million.

Liberian Interim Management Team 2016-2017

The Liberian IMT managed LEC from 2016 through 2017. During these two years, Liberia's generated power supply grew to 70 megawatts, serving approximately 44,000 customers. The IMT increased staffing dramatically and raised salaries by 30 percent. With more electricity available, power theft became rampant, causing combined technical and commercial losses to balloon from 37 to 61 percent. When the IMT ceased operations in 2017, LEC had no training department, minimal inventory, burnt records, debt exceeding $21 million, and it operated at a monthly loss of $1.2 million.

Mount Coffee Hydro Power Plant rehabilitation, 2011-2018

With LEC's human resource capabilities diminished from the EVD crisis and IMT management, the utility's responsibilities were growing with the rehabilitation of MCHPP, the cornerstone of rebuilding Liberia's electricity supply. In 2016 MCC joined the field of donors (the Norwegian Development Agency, European Investment Bank, and German Development Agency) and the GoL in the $357 million rehabilitation of MCHPP, which became LEC's largest and most important asset, capable of generating 88 megawatts of renewable power during the wet season. Operation and maintenance of MCHPP would require specialized knowledge and skills that exceeded LEC's existing capacity. The MCHPP project implementation unit (PIU), MHI, implemented limited operations and maintenance training. More investment was necessary before LEC could realistically manage the MCHPP.

Hydro Operations International as Operations, Maintenance, and Training Contractor 2016-2022

In August 2016, with Unit 1 of MCHPP commissioned, Hydro Operations International (HOI) was identified as the plant's Operations, Maintenance, and Training (OMT) contractor for a five-year period following commissioning of the turbines. The OMT contractor was considered critical to ensuring overall plant operations and sustainability given the loss of Liberian technical expertise during the nearly two decades without hydropower operations (Miller et al. 2020). However, while the OMT work was critical to avoiding plant outages, failures, and even loss of property and life, HOI was chronically underpaid by LEC's IMT, repeatedly submitted "notice of stop work orders," and had its staff count reduced from 18 to 11. In 2019, stakeholders predicted catastrophic failure at MCHPP without greater investment in the OMT and better stewardship by LEC (Miller et al. 2020). LEC training staff additionally noted that HOI provided limited cooperation with LEC's Training and Development Department until 2020/2021.

Concerns about MCHPP sustainability

"The sustainability of MCHPP is at risk due to under investment in the OMT. The OMT contract lacks adequate funds for staffing, equipment, parts, and materials. LEC staff can manage preventive maintenance but are not fully trained to problem solve. Stakeholders described that, "[The] plant is forgiving, robust in the first year. In 2 years, if no maintenance then problem, none of units will be operational. They will cannibalize a unit [when a part is needed]. Capacity will go from 4 units to 3 units. This is exactly what happened at Bushrod from 16 MW (had these 1 MW generators) and then down to 1; it is the same issue as other thermal plants. JICA is doing a major refurbishment" (Miller et al. 2020).

Electricity Supply Board International (ESBI) as second MSC, 2018-2022

In 2018, as Units 2 and 3 of MCHPP were commissioned, the GoL selected ESBI to serve as LEC's second MSC. MCC funded ESBI's $11.7 million three-year (plus two option years) contract. An external audit conducted in 2018 revealed that LEC's financial crisis was existential with "chronic illiquidity, an operating deficit, accumulating losses, and inability to fund necessities" (Azorom 2019). LEC lacked cash and the basic materials to maintain its infrastructure and assets, such as feeders, transformers, and meters. The poor quality, low voltage network was heavily strained by inordinate levels of power theft. In addition, the size and complexity of LEC's network was about to grow given new construction of $200 million in donor-funded infrastructure.

In this context, one of the main requirements of the MSC was to "build capacity of the local staff to a level where they can independently run the utility at the end of the Compact." (LEC and ESBI 2017) However, in 2018, LEC had no training department. While LEC's main infrastructure was physically located across Monrovia—rather than spread across the country—the low quality, patchwork of assets, lack of an inventory or mapping of assets, and insufficient vehicles, tools, and equipment made the human resource capacity and training requirements more complicated compared to other countries with compatible and sufficient quality infrastructure and assets.

ESBI establishes the Training and Development Department, 2018

From 2018 to 2020, ESBI faced a constant deluge of operational, financial, political, human resource, technical, commercial, safety, and other challenges operating LEC. Still, there was training-related progress: First, the LEC Training and Development Department was established in August 2018 (LEC 2019). With stakeholder input, the department wrote and LEC adopted a corporate training policy. The department completed a training assessment and gap analysis and began organizing ad hoc trainings, such as the West African Power Pool training and the Association of Power Utilities of Africa (APUA) training. Additionally, the department submitted a Tandem Management Program and Training Plan in August 2018, which outlined training for non-executive staff and creation of the LEC Training Center. The department also received training accreditation from the Ministry of Education, allowing LEC to run in-house training programs and issue certifications to trainees. LEC's 2019–2023 Business Plan emphasized the need for training and development of senior management and technical staff. Specifically, the Business Plan proposed improved human resources; information, communication, and technology (ICT) systems; and safety.

ESBI established the Training and Development Department while operating under the assumption that the MCC-funded Training Activity would provide significant resources to bolster training efforts.

Currently, guided by the draft Master and Strategic Plan[2], the Training and Development Department builds monthly and annual training calendars and has conducted trainings on topics such as safety, customer relationship management, basics of metering, billing, tariff structure, revenue cycle management, overview of power systems, substation operations and maintenance, streetlighting, and other topics. While there has been progress, the department chronically lacks funding, space, equipment, materials, and prioritization given LEC's ongoing financial crisis.

ESBI's term as the management services contractor ended in July 2022.

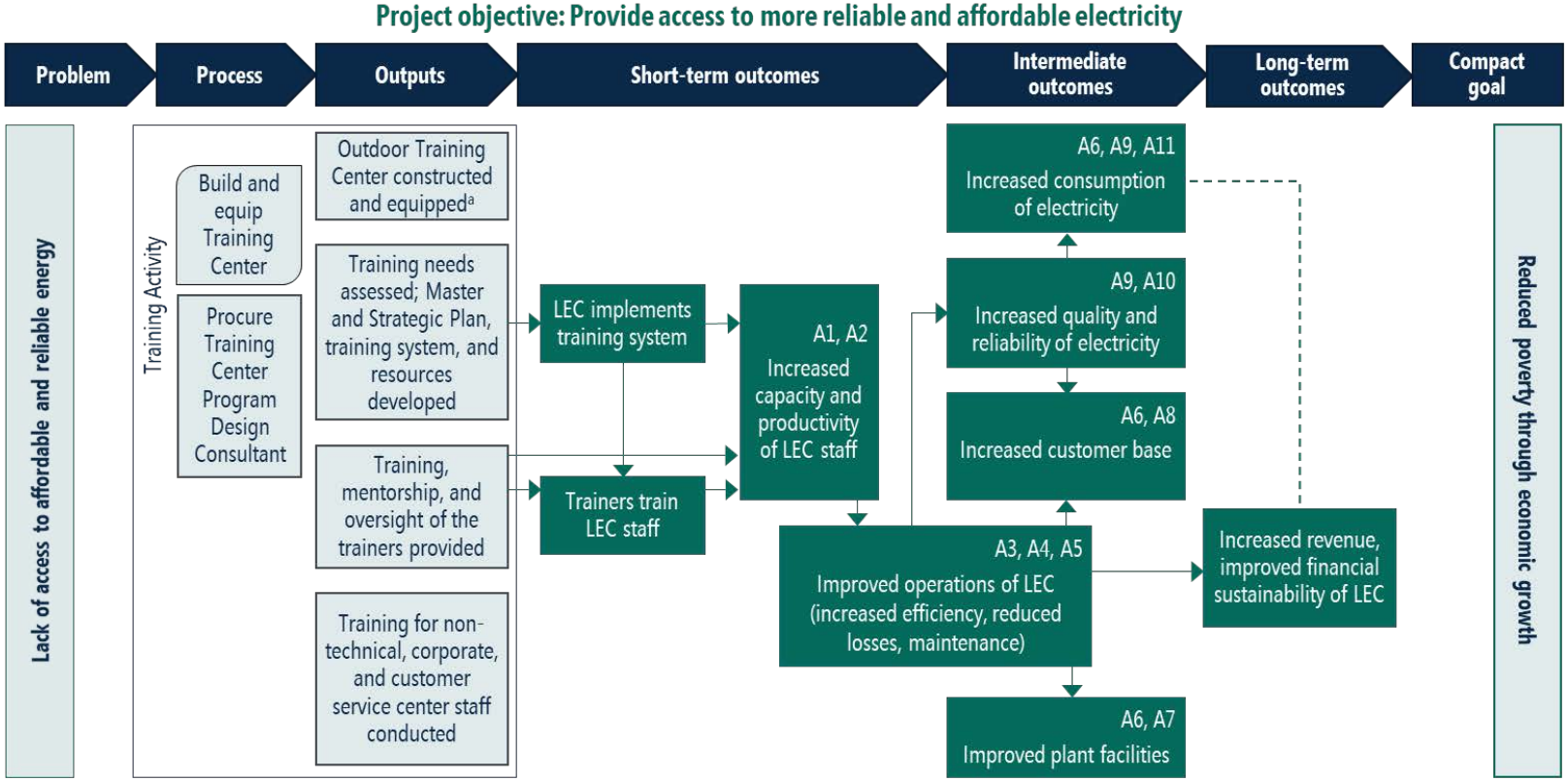
B. Program logic

The LEC Training Activity aims to bolster LEC's technical, operational, and commercial skills to improve utility operations. The Training Activity's program logic, shown in Figure I.2, illustrates the expected path from the program's immediate outputs and outcomes to the short-term outcome of increased skills and capacity among the LEC workforce. A better-trained workforce is expected to improve utility operations and performance across multiple measures. In the long term, these outputs could increase revenue and bolster LEC's financial sustainability.

The program logic has inherent assumptions about the functionality of LEC, the broader energy sector, and the overall political economy in Liberia, and it assumes these factors will not undermine the Training Activity. LEC's current fiscal constraints might interfere with the Training Activity. For example, the reduction in LEC staff salaries could undermine enthusiasm for training or LEC may not have the equipment necessary to perform certain job functions. Further, in the broader energy sector, competing demands for resources and skilled staff could weaken the Training Activity if trained staff are hired by contractors for other donor-funded projects. Finally, morale among public sector employees in Liberia in general and at LEC is low given high rates of corruption, unpaid or delayed salaries, and lack of essential equipment and parts. These issues could all further destabilize the LEC Training Activity.

[2] The MCC-funded Utility Training Consultant, Tata Power Company Limited (Tata) (*described in more detail in the next section)* drafted the Master and Strategic Plan (Tata 2020a).

Figure I.2. LEC Training Activity program logic



A1-There is sufficient staff capacity and continuity in order to accomplish MSC capacity building objectives. Increased capacity is sustained after MSC ends.
A2-Training of trainers system is effective.
A3-LEC has the capacity and resources to manage it operations effectively and efficiently, including reducing losses, increasing collections, and performing routing maintenance; LERC standards are effective.
A4-Project outputs will result in appreciable improvement in customer service practices; LEC is willing and able to address customer complaints. Customer willingness to pay increases.
A5-The MSC is able to effect long-term change in LEC operations and stakeholders with interest and influence support these changes.
A6-LEC increases ability to make customer connections. New customers can afford to pay for electricity; LEC can accommodate increased energy demand during dry season.
A7-Increased generation capacity and the planned T&D investments are capable of increasing the quality and reliability of electricity.
A8-LEC has sufficient manpower, skill, materials, and operational capacity to respond to user requests for connections.
A9-The tariff-setting process will adhere to LERC's regulations as stipulated in Section 13.3 of the 2015 Electricity Law and will be insulated from political interference.
A10-LEC has the ability and resources to ensure compliance.
A11-Customers pay for the electricity they consume.

C. Literature review

Utility companies in low-income countries often lack adequate human resource capacity to effectively manage operations, maintain assets and infrastructure, and provide adequate customer service and cost recovery. While public utility companies may be viewed by political leaders as steady income generators, utility performance is hampered because there is often limited funding allocated to training and capacity development (McCulloch et al. 2017, 2018). Utilities often manage with severe resource shortages as tariffs do not adequately cover costs of basic operations, never mind the costs of ongoing training and capacity development (Bacon 2018).

Further, public utilities can become large employers, particularly in countries with high unemployment and few economic opportunities. Overstaffing, without prioritizing requisite education, skills, and experience occurs as part of a system of patronage (Gómez-Ibáñez 2007, McCulloch et al. 2017, 2018).

Given government's inability or inaction to adequately support utility companies, bilateral and international donors have incorporated training and technical assistance to strengthen utilities' technical capacity. Despite the popularity of these investments, there still has been limited evaluation of their effect on utility performance.

We found some evidence that technical assistance for public utilities can improve performance. Studies from Tanzania and Kenya showed that training was associated with self-reported measures of employee performance (Karia et al. 2016; Mensah 2014). In a review of case studies of public water utilities, researchers found that training can boost productivity, but this effect is mediated by the presence (or absence) of internal accountability measures (for example, performance reviews and performance incentives) (Baietti et al. 2006). While measuring trainees' retention of information and skills is relatively easy, it is more difficult to measure training impacts on job performance, problem solving, and decision making.

Gómez-Ibáñez (2007) discusses pitfalls to avoid when implementing a training program at a public utility in a developing country. They observe that technical trainings usually fail to achieve objectives unless accompanied by efforts to address structural and organizational inefficiencies. They also find that training curricula adapted from developed countries often fail because they do not properly account for cultural norms around individual and group

Desk Review of Enterprise-Based Utility Training Centers*

Case studies of utility training centers in Nigeria, Zambia, Ghana, and Kenya highlight six dimensions of utility training strategy and implementation: vision and mission statement, organizational structure, faculty composition, strategic approach, training facilities, and training courses offered. Below are recommendations for LEC:

- LEC should ensure they have an experienced training director, with an external advisor from the National Power Training Institute of Nigeria.
- Training should be tailored to the specific needs and job descriptions of the trainees and should include a strategy for measuring improvements in relevant competencies and workplace outcomes.
- Trainees' achievements should be recognized with award ceremonies and other events attended by senior management.
- The Training Department should maintain high visibility by marketing its trainings, events, and outcomes company-wide (Azorom 2018).

* In 2018, MCC contracted Azorom, an energy contractor to conduct case studies of utility training centers.

responsibility or understand the relationship between politicians and civil servants. This is a risk in Liberia, given that LEC has severe organizational and operational challenges, the legacy of civil war, loss of generational skills and knowledge, the EVD crisis, changes in management, political interference, macroeconomic challenges, and chronic underfunding.

This evaluation is a case study describing the benefits and limitations of donor investments in a resource-poor electricity company situated in a fragile, post-war country. Our findings contribute to the evidence base on the effects of training at a public utility company and can help LEC management, policymakers, and donors better understand the utility's training achievements and ongoing needs. Additionally, the evaluation provides actionable recommendations to inform future MCC support for training activities to improve the sustainability of infrastructure investments.

D. Design and implementation of the LEC Training Activity

MCC funded the Training Activity to help build LEC's technical, operational, financial, and administrative capacity (MCC 2015). The original design included plans to construct, equip, and staff the LEC Training Center and develop a training curriculum in five core areas: transmission and distribution, electrical, mechanical, hydro-electric, and other specialized training. However, in 2019 MCC determined that construction of a training center was not feasible and redirected funds from the LEC Training Activity to pay for the OMT contract at MCHPP. The revised Training Activity design no longer included full Training Center construction but rather focused on development and implementation of an on-the-job, train-the-trainer model and construction of an outdoor training center for lineworker training. MCC cited multiple reasons for this change in scope: LEC's failure to comply with its contract obligations for the OMT at MCHPP, the lack of a viable business plan for the training center proposed by the design consultant, a completion risk given the late start to the Activity, concern about LEC's ability to operate and maintain a training center, and the desire to promote hands-on and on-the-job training rather than classroom training. However, LEC training staff felt that the reduction in scope – specifically, the removal of the LEC Training Center - was a major setback to LEC's overall training program.

The original budget for the LEC Training Activity was $5.5 million. The revised budget, reflecting the reduced scope of Training Activity, was $2.2 million. The actual expenditures and associated activities by year are shown in Table I.1 (MCA-Liberia 2021b).

Table I.1. LEC Training Activity costs

	2018	2019	2020	2021	Grand Total
Expenditures U.S. $	$452,760	-	$508,628	$1,264,011	$2,225,399
Activities	Program Design Consultant Contract (Azorom)		Utility Training Consultant (Tata Power)	• Final UTC deliverables (Tata Power) • Capacity Building for System Loss Reduction (Tata Power)	

Source: MCC disbursement data for Liberia Compact. Expenditures for the UTC were split across 2020 and 2021; therefore, the 2021 expenditure value equals the full amount of the loss reduction contract plus part of the UTC contract amount.

The LEC Training Activity was implemented from 2018 to 2021.

In 2018, MCA-Liberia contracted the Ireland-based energy consulting firm Azorom as the Program Design Consultant. The $452,760 contract was for March to September 2018. Azorom produced several deliverables, listed in Table I.2, which MCC thought were not adequately tailored to LEC.

In 2019, with the scope and budget reduced, Tata received a $972,170 contract to serve as the Utility Training Consultant (UTC) (MCA-Liberia 2021b). Tata began providing technical assistance and capacity strengthening to establish and implement the on-the-job training model. Tata also designed the Outdoor Training Center (OTC), supervised its construction, and trained lineworkers at the OTC. Between January 2020 and January 2021, Tata produced key deliverables and conducted multiple training of trainers (ToT) who would conduct on-the-job training, and trained LEC staff (Table I.2).

Table I.2. LEC Training Activity consultant deliverables

Azorom major deliverables	Tata major deliverables
✓ Inception report	✓ Inception report and work plan
✓ Work Plan and Site Condition Assessment Report	✓ Master and Strategic Plan for Training and Human Capacity Development at LEC
✓ Desk Review of Enterprise-Based Utility Training Centers	✓ Training Needs and Skills Assessment Report
✓ Training Needs Analysis	✓ Curriculum, training manuals, and assessment materials
✓ Training Program Scope Report	✓ Specifications for tools and equipment
✓ Curriculum, training manuals, and assessment materials	✓ Crosswalk between LEC job roles and their associated skills and competencies
✓ Final report	✓ Training reports
	✓ Final report

Note: The deliverables listed for Tata Power are those associated with the UTC contract. We have not listed the deliverables for the Capacity Building for System Loss Reduction contract because the scope of that contract was wider than just training.

Near the end of the Compact, in December 2020, MCA-Liberia contracted Tata to conduct Capacity Building for System Loss Reduction, which included training on system loss reduction and current transformer operated metering systems. A separate Tata team conducted this work in December 2020 and January 2021 under a contract totaling $742,500 (MCA-Liberia 2021b).

Tata's activities comprise the bulk of the activities under the LEC Training Activity and are the focus of this evaluation.

E. Summary of implementation

Tata conducted a ToT to prepare 35 individuals to provide regular on-the-job training to staff in their departments. They also provided lineworker training to 58 T&D staff; classroom training on commercial,

Key findings

- Under the LEC Training Activity redesign, Tata, the Utility Training Consultant, developed a master and strategic plan for training, provided training to over 300 LEC employees, trained 35 on-the-job trainers, and supervised construction of the OTC.
- The Training Activity far exceeded the Compact's target for employees trained but only trained about half of the on-the-job trainers expected.

ICT, and safety topics to 299 staff (under the UTC contract); and loss reduction training to 33 staff (under the Capacity Building for System Loss Reduction contract)[3]. These trainings, conducted over the course of five months, reached over one-third of LEC's approximately 930 total staff in 2020 (Tata 2020a, 2021a, 2021b). Stakeholders noted that the trainings were conducted on an extremely compressed timeline and were impressed by what Tata was able to accomplish before the compact end date. In Table I.3 we show the topics covered in each training.

Table I.3. Training topics

Training	Training topics	Number of participants[a]	Percent female
Training of trainers	• Hydropower operations and maintenance • Thermal operations and maintenance • Substation operations and maintenance • Distribution operations and maintenance • Transformer repair	36	6%
Commercial	• Customer relationship management • Basics of metering, billing, and tariff structure • Revenue cycle management • Revenue mobilization and protection • Overview of power systems for non-technical staff	71	43%
ICT	• Using Microsoft Word, Excel, PowerPoint, and Outlook	79	45%
Safety	• Safety for generation (hydropower and thermal) • Safety for transmission and distribution • Driver safety • Office safety	105	10%

[3] These numbers reflect the number of participants reported by Tata in its reports to MCA-Liberia. The numbers do not match those reported in the Compact Indicator Tracking Table, nor do they match the number of participants in the training roster LEC provided to Mathematica.

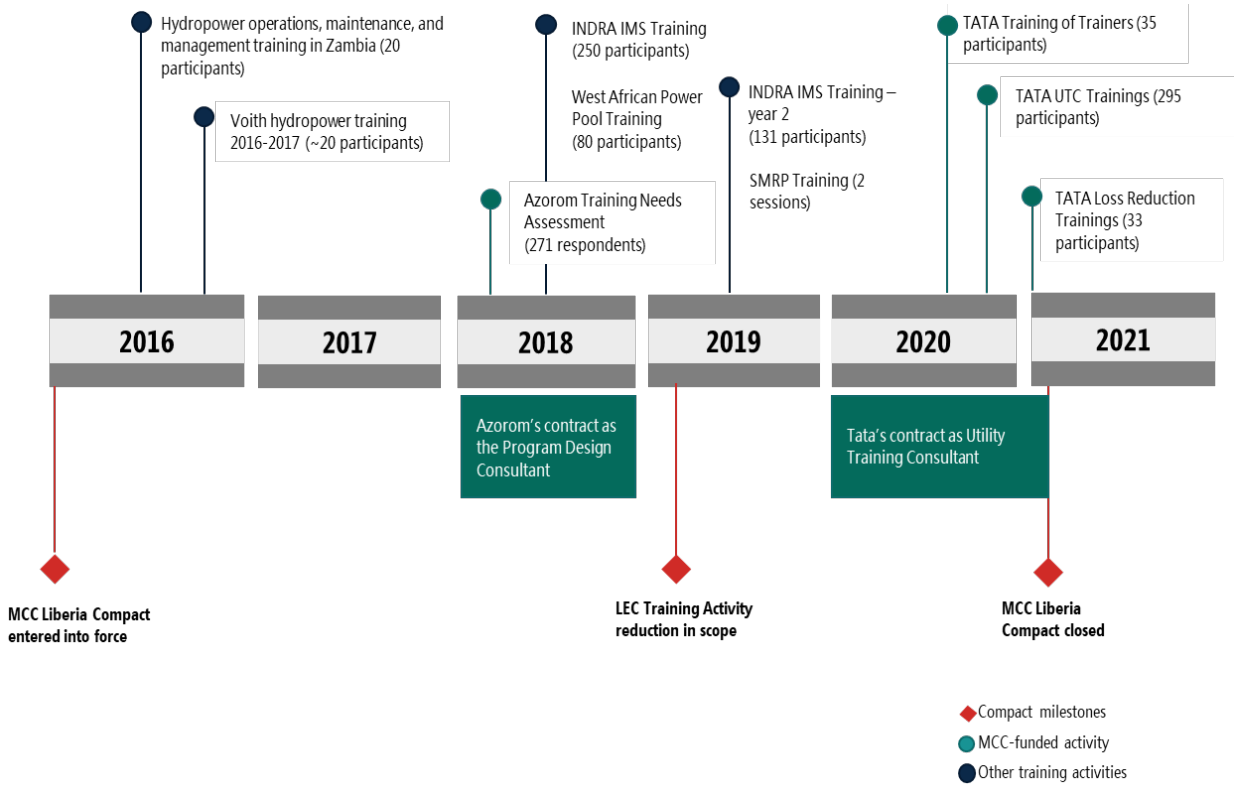
Training	Training topics	Number of participants[a]	Percent female
Lineworker	• Protection and testing • Supervisory control and data acquisition (SCADA) • Cable jointing • Street lighting • Construction of the Outdoor Training Center • Maintenance of distribution lines	75	6%
Loss reduction	• Revenue maintenance and loss reduction • Pilferages in distribution system, energy audit • Big data analytics • Revenue mobilization/revenue protection and electrical inspectorate	57	24%

Source: Tata training participant list provided by LEC Training and Development Department.

[a] These numbers reflect the number of individual participants who participated in each training topic. Some participants attended more than one training, which is why these numbers do not total to the numbers presented in the text above this table.

The Tata trainings funded by MCC were part of broader efforts to jumpstart training and staff development at LEC during the Compact period (2016–2021). In Figure I.3, we summarize the trainings that occurred at LEC during the Compact.

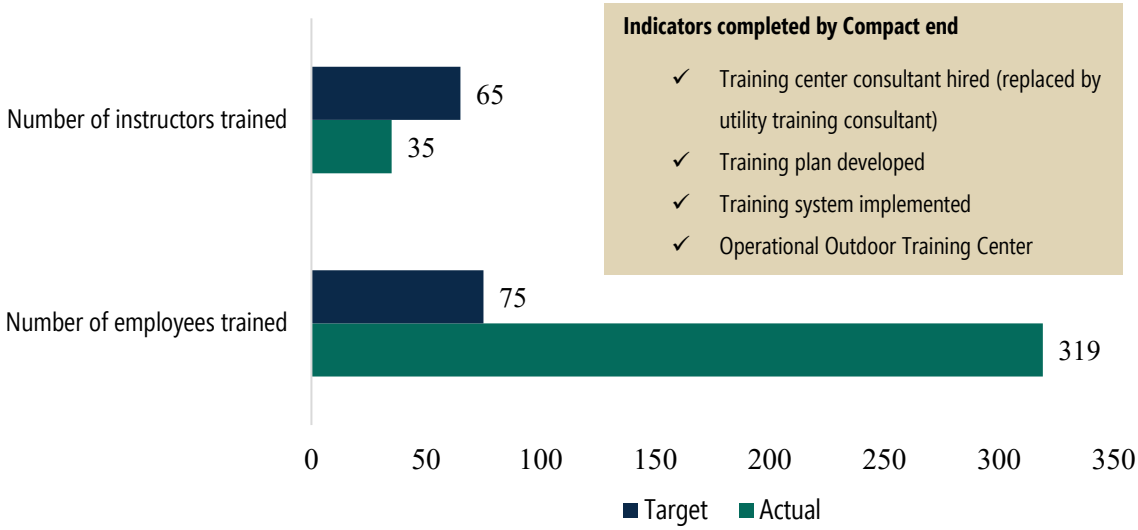
Figure I.3. Timeline of training opportunities at LEC during the Compact



Source: LEC 2019; MCA-Liberia 2021b; Tata 2021a; Tata 2021b.

By the end of the Compact, the LEC Training Activity had achieved most of the implementation targets in the indicator tracking table (Figure I.3). As the UTC, Tata built the OTC, developed a training plan, and implemented a training system. Tata far exceeded the target for employees trained but only trained about half the expected number of on-the-job trainers. Figure I.4 summarizes the status of the LEC Training Activity implementation indicators at the end of the Compact.

Figure I.4. LEC Training Activity indicators



Source: MCA-Liberia 2021a.

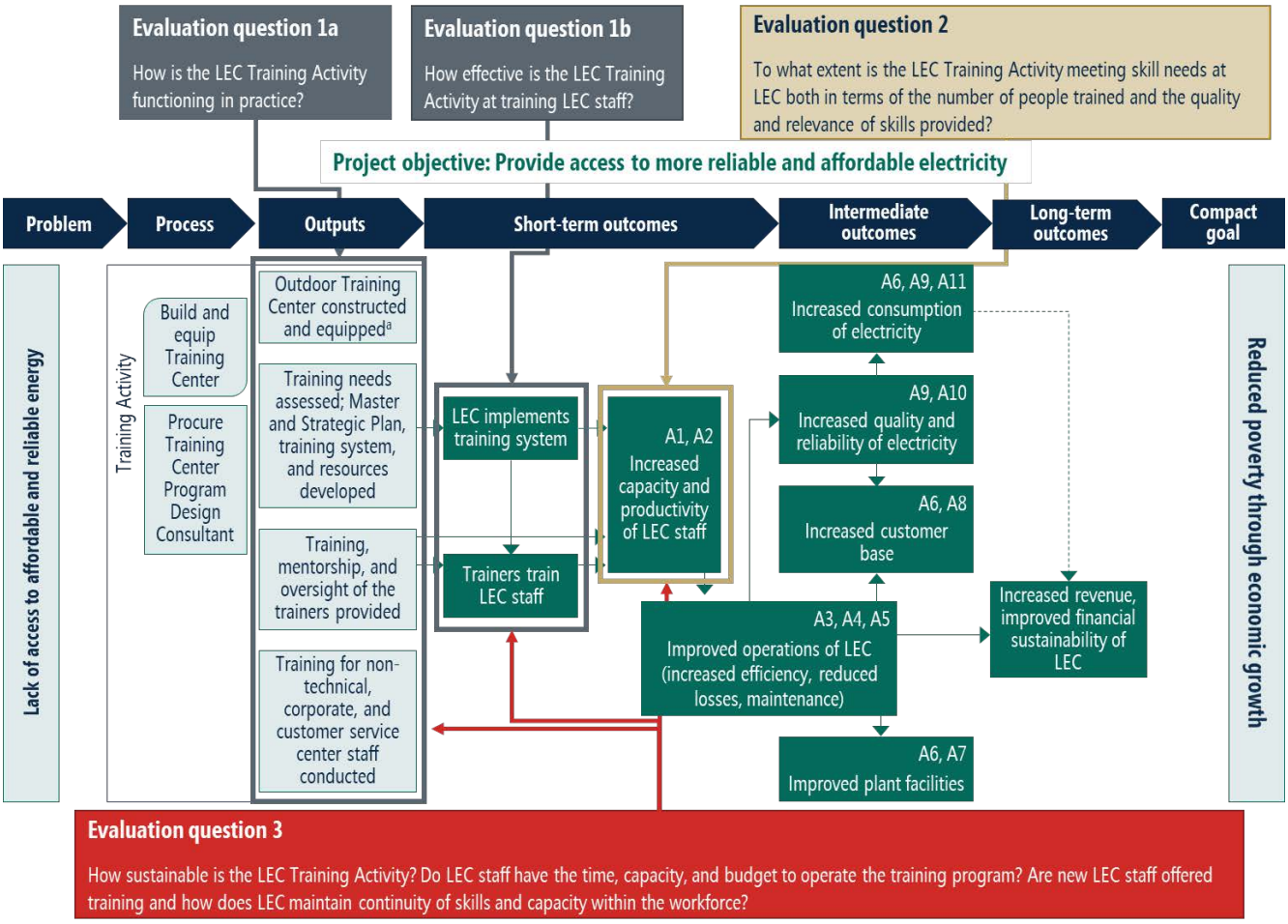
Notes: The number of employees trained reported in the Indicator Tracking Table (ITT) does not match the number reported in the UTC Final Report (Tata 2021a). The ITT considers only the UTC (the ToT and direct trainings), not the loss reduction training that was under a separate Tata contract.

II. Methodology and Data Sources

A. Evaluation questions and methodology

The evaluation of LEC Training Activity aimed to assess evaluation questions related to implementation, knowledge and relevance of skills gained, and sustainability. These evaluation questions (1a, 1b, 2, and 3) are closely tied to the program logic, as shown in Figure II.1.

Figure II.1. Evaluation questions mapped to program logic



We conducted a qualitative performance evaluation (specifically, an ex-post thematic analysis[4]) to assess implementation and performance. The original design included data collection in 2021 to assess short-term outcomes (evaluation questions 1, 2, and 3 in Figure 3) and a sustainability check in 2024 (evaluation question 3 in Figure 3). MCC later determined that the main data collection in 2021-2022 and resulting report would be sufficient to fulfill the Compact's learning objectives, and the sustainability check in 2024 was canceled.

[4] According to MCC's Evaluation Management Guidance, an ex-post thematic analysis includes "retrospective evaluations that draw conclusions about results solely on post-program data."

B. Data sources

As described in the Evaluation Design Report, the 2021 data collection included collecting project documentation, site visits to observe training, and conducting key informant interviews (KIIs) and focus group discussions with stakeholders, trainers, and trainees. Because of the COVID-19 pandemic, which disrupted travel from March 2020 until early 2022, our U.S.-based team conducted virtual interviews with key stakeholders in mid-2021 and in-person interviews in early 2022 once travel was approved. The team reviewed Tata's training videos rather than observed in-person training. Additionally, Mathematica's Liberia-based data collection partner The Khana Group (TKG) conducted KIIs with LEC trainees, rather than focus group discussions, to maintain appropriate physical distancing. Table II.1 provides an overview of questions, methodology, and sources.

Table II.1. Overview of evaluation questions, evaluation methodology, and data sources

Evaluation questions	**1a**. How did the LEC Training Activity functioning in practice? **1b**. How effective was the LEC Training Activity at training LEC staff? **2.** To what extent did the LEC Training Activity meet needs, including the number of people trained and the quality and relevance of skills provided? **3.** How sustainable is the LEC Training Activity? Do LEC staff have the time, capacity, and budget to operate the training program? Are new LEC staff offered training and how does LEC maintain continuity of skills and capacity within the workforce?
Evaluation methodology	Performance evaluation in the form of a qualitative study to assess implementation and performance over time
Data sources	• Document review • Site visit to observe training operations • Key informant interview (KIIs) with MCC, MCA-Liberia, training consultants, LEC management, LEC trainers, and other LEC staff • KIIs with LEC staff trainees
Exposure period	LEC staff trained as trainers should acquire skills within three months of training and LEC trainees should acquire skills within three to six months of training. Training processes should be sustained post-Compact. The Mathematica data collection occurred a little over a year after the ToT and just under a year after the completion of the other Tata trainings.

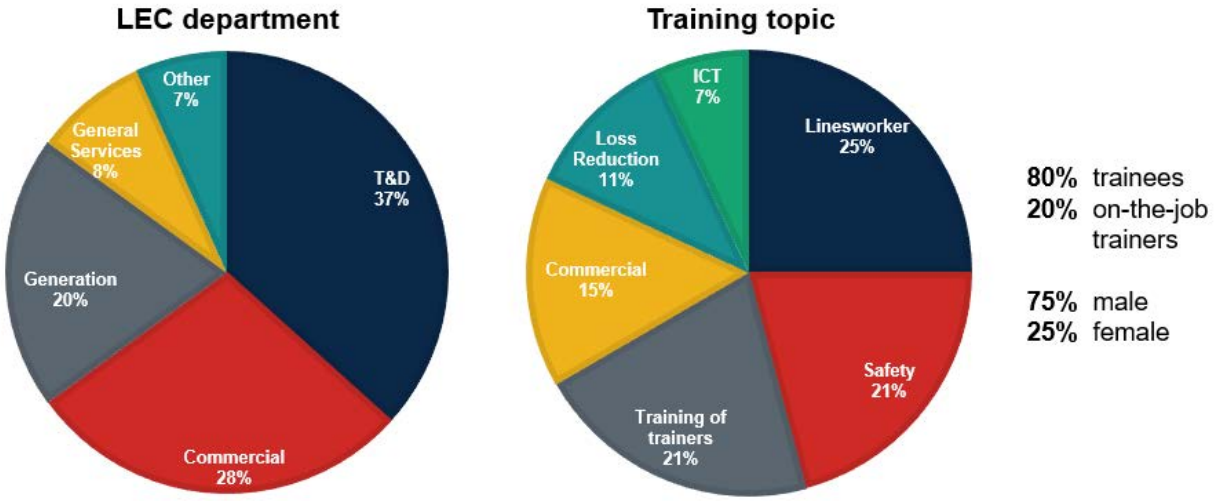
Source: Abarcar et al 2021

We received a list of all training participants from LEC and randomly selected a sample of 60 (48 trainees and 12 on-the-job trainers) from the full list of LEC employees that participated in the Tata trainings, stratifying by the training content. Mathematica and TKG conducted a thorough training process to ensure that interviewers had mastered the protocols, understood LEC operations, and could effectively obtain LEC staff cooperation. Mathematica first conducted a ToT for TKG staff. TKG then trained a small group of interviewers who administered a pre-test by telephone.

The pre-test experience demonstrated that we could not obtain high-quality data over the phone because of poor audio quality and respondent reluctance to speak openly over the phone. With MCC's approval, Mathematica converted to in-person data collection with stringent COVID-19 protocols. TKG trained the full group of interviewers, who then conducted an in-person pilot exercise.

At each stage, Mathematica listened to the audio files, reviewed the transcripts, and provided comments to TKG. In addition, Mathematica hired the former MCA-Liberia Director of Energy to train interviewers on the Compact activities and LEC operations, organizational structure, and job functions. After a final pilot exercise, TKG conducted the qualitative interviews with LEC staff in November and December 2021, approximately one year after the ToT and 9–12 months after the lineworker and classroom trainings. The characteristics of the interviewed sample are shown in Figure II.2.

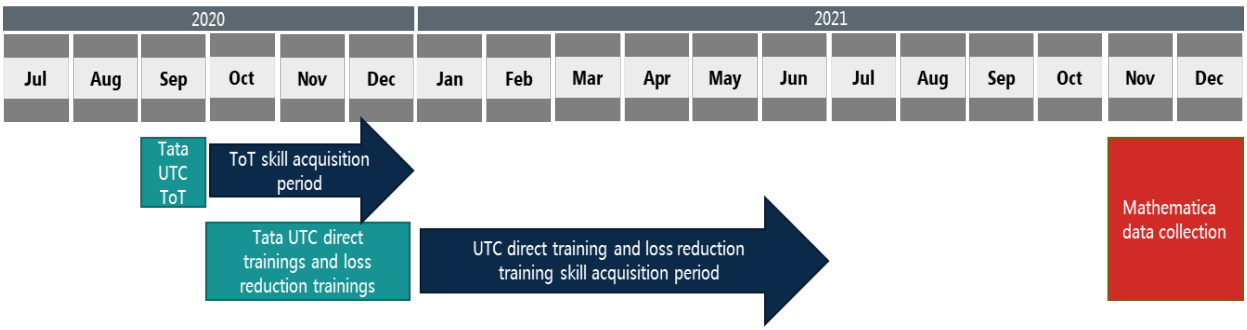
Figure II.2. Sample characteristics of key informant respondents



Source: Tata training participant list provided by LEC Training and Development Department.

In the Evaluation Design Report, we estimated that LEC staff trained as on-the-job trainers should acquire skills within three months of training and that LEC trainees should acquire skills within three to six months of general capacity building and on-the-job training. MCC did not articulate an expected timeframe for results, nor were the LEC Training Activity's expected benefits modeled in a cost-benefit analysis. Therefore, this exposure period is based on the evaluator's review of the literature and the Activity's design. The program logic also assumes that training would be sustained post- Compact. The timing of the data collection, approximately one year after training completion and 10 months post-Compact End Date, allows a test of these assumptions, as shown in Figure II.3.

Figure II.3. Timeline of implementation, expected exposure period, and data collection



C. Analysis

We analyzed each data source (documents, KIIs) and triangulated findings to answer the evaluation questions. For example, we systematically organized, screened, and categorized documents and materials by source and topic. We reviewed Tata's training needs assessment, master and strategic plan, and training materials and videos. We also reviewed contracts, Azorom's reports, LEC, and reports from the Contract Monitoring Consultant (the organization that monitored ESBI's performance). This enabled us to assess implementation and LEC performance metrics to identify emerging themes.

We analyzed transcripts from interviews with MCC and MCA-Liberia staff and program implementers to understand stakeholder perspectives on implementation of the LEC Training Activity, the quality and relevance of the training provided, and its sustainability. We also coded and analyzed transcripts from interviews with 60 LEC staff to understand training needs and skill gaps at LEC, the quality and relevance of the training provided, the application of skills learned to their role, and barriers to applying the training. To develop the coding scheme, we read pilot transcripts to understand respondents' experiences and key themes emerging from the data. We also mapped the interview protocols to the evaluation questions and the program logic to structure the coding scheme around the key outputs and outcomes. We used NVivo to code the transcripts and then reviewed and organized the resulting codes into themes that mapped to the program logic and were present across multiple respondents. We compared themes and codes by respondent type and training content to identify consistent and differing themes across respondent groups.

Once we analyzed each data source, we triangulated findings to identify trends and relationships, confirm patterns or findings, and detect discrepancies or disparate experiences. We also drew on our understanding of LEC operations and developments in the energy sector in Liberia to contextualize our findings on the performance and sustainability of the trainings.

III. Findings

A. Project implementation

Evaluation Question 1a: How did the LEC Training Activity function in practice?

Overall, we found that Tata produced high quality deliverables, collaborated well with LEC, and adequately identified LEC's training needs. The training schedule, format, and content were negatively affected by the Covid-19 pandemic, but Tata was flexible and adapted given the constraints. The Outdoor Training Center was constructed, however LEC struggles to keep it fully equipped due to supply shortages at LEC and it has not been consistently utilized.

Implementation summary and key outputs	Assessment of program logic
Training consultant deliverables	
(+) Tata delivered a training needs assessment, master and strategic plan, and training materials that met expectations.	(+) All training outputs from the program logic were realized
(+) LEC and Tata respondents praised the level of collaboration among training stakeholders.	(−) The OTC has been constructed but not fully equipped due to supply shortages at LEC; this output has not been fully achieved.
Training of trainers	
(+) LEC selected on-the-job trainers from departments of generation and T&D who were motivated to train others.	
(−) Technical expertise among LEC on-the-job trainers varied by department; some trainers need additional training to be effective.	
Training of LEC staff	
(+) Tata successfully conducted a large-scale training program for LEC staff prior to the Compact end date	
(−) COVID-19 travel restrictions and closures reduced the amount of training and required a mostly remote format	
Outdoor Training Center	
(+) The Outdoor Training Center (OTC) was designed and constructed	
(−) Equipping the OTC is an ongoing challenge	

(+) = positive finding, (−) = negative finding

Tata produced deliverables that met LEC and MCA-Liberia's expectations. MCC stakeholders noted several contextual factors that posed challenges to successful implementation of the Training Activity, including a rapid compact entry into force and late engagement with MCC's human capacity development team, low prioritization of the Training Activity, weak deliverables from the design consultant, and implementation delays given the rescoping. Despite initial concerns that Tata would not be able to complete all work before the Compact end date – given the compressed timeline for the Training Activity as a whole –, the Tata team successfully produced a training needs assessment, master and strategic plan, and training materials including videos and job cards[5]. LEC appreciated that Tata surveyed staff at all levels of the organization to develop the training needs assessment and overall felt that Tata accurately identified the training needs within LEC.

Collaboration among Tata, LEC, ESBI, MCA-Liberia, and MCC was generally strong, though Bushrod Island Generation Station staff were often too busy to fully participate. Tata and the LEC Training and Development Department met weekly to discuss training needs and plans. Both Tata and LEC reported that stakeholders were aligned on the objective to increase staff capacity to operate the utility without a management contractor. LEC appreciated that Tata was open to feedback, and Tata appreciated that LEC was engaged and willing to learn. However, Tata also reported that participation varied by department and they sometimes had to seek inputs from ESBI when they could not get information from specific LEC departments. Tata reported that leadership at the Bushrod Station was often too busy with their work to fully engage and was not fully invested in improving safety.

Findings from Tata's needs assessment and our interviews with LEC staff were mostly consistent. The training needs at LEC are wide-ranging and varied little between Tata's training needs assessment and Mathematica's interviews with LEC staff, as shown in Figure III.1. The biggest difference is that the Tata assessment did not sufficiently identify LEC staff needs for basic computer competency in the non-commercial departments. This was a need expressed frequently by respondents in the evaluation sample. LEC training staff also noted that Tata did not adequately communicate plans for the MS Office training to LEC in advance.

COVID-19 affected nearly all aspects of the training program. The March 2020 onset of the COVID-19 pandemic delayed the training and reduced Tata's time in Liberia. Tata was unable to make several data gathering trips and had to conduct the trainings remotely, with some in-person follow-up for the ToT. Stakeholders agreed that the remote approach was necessary but reduced the overall training effectiveness. Further, the in-person ToT follow-up was inconsistent: most on-the-job trainers said there was no in-person observation of their training skills after completion of the classroom training.

[5] The job cards developed by Tata define the standard operating procedures associated with specific jobs.

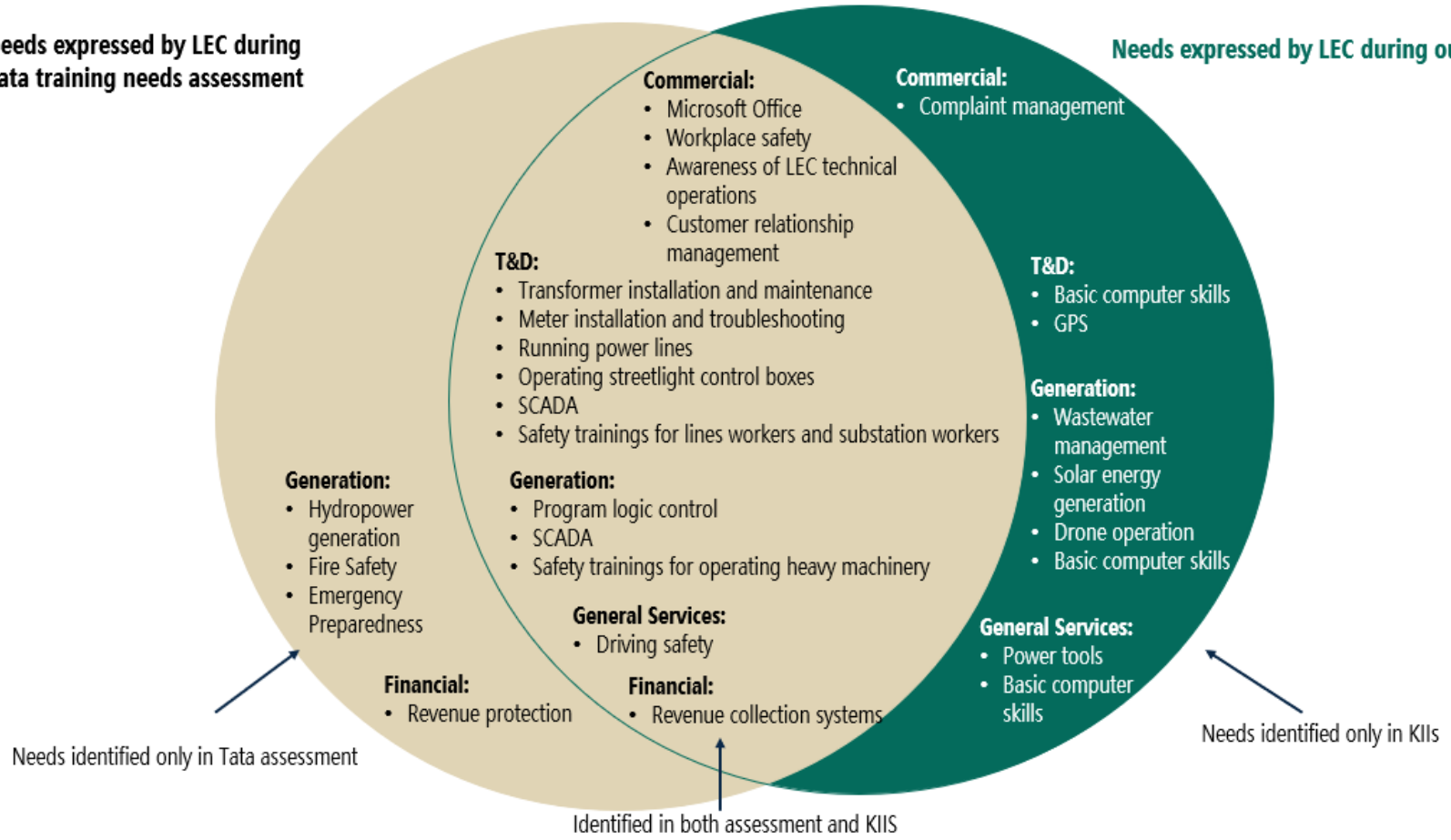
Within the constraints imposed by COVID-19, Tata fulfilled its commitment to delivering a ToT and LEC staff training. As described by LEC stakeholders, the purpose of Tata's contract was to establish a basic level of competency within LEC, implement a consistent approach to training, and outline standard operating procedures for some roles. Tata largely achieved those goals through training 35 on-the-job trainers, providing direct training to over 300 LEC staff, and developing job cards for key staff roles.

The selection process for on-the-job trainers (who participated in the ToT) worked well, although capacity varied by department. LEC and Tata worked collaboratively to solicit nominations from staff and select participants based on their competencies, availability, and aptitude to share information. LEC stakeholders felt that they mostly identified the right staff as trainers. According to Tata, on-the-job trainers from MCHPP were excellent and took initiative to modify the job cards. In contrast, they were less satisfied with trainers staff at the Bushrod Generation Island Station.

LEC staff reported their motivations for being an on-the-job trainer

- Sense of duty to share skills and knowledge with younger generation
- Experience with or interest in teaching
- Address specific skill gaps in department
- Improve safety practices
- Reduce system losses

Figure III.1. Comparison of Tata needs assessment with LEC staff and evaluation key informant interviews with LEC staff



Most of the on-the-job trainers reported they appreciated being nominated, although they were not always sure why they were selected. Some noted that they were already fulfilling a training role in their department, while others felt that they were recognized as, or had the potential to be, a strong performer. Respondents cited multiple motivations for becoming an on-the-job trainer. Only one respondent reported displeasure that they were volunteered, rather than asked to be a trainer.

> ***"I took interest in helping to [move] the minds of younger ones and people who have limited skills that I can impact one way or the other."*** – On-the-job trainer

The Outdoor Training Center was designed and constructed; however, fully equipping it to maximize its utility has been challenging. Building on Azorom's work, Tata provided advisory services during construction of the OTC and specified tools and equipment needed. MCA-Liberia procured some of the OTC equipment prior to Compact end, but it was hard to retain these items given LEC's pressing field needs to use equipment to service the rapidly increasing number of actual customers. In addition, the generation, transmission, and distribution equipment in Liberia comes from different countries and manufacturers, increasing the complexity of the needed equipment. In 2022, LEC reported that they had constructed wire fencing at the OTC (to secure equipment), had plans to construct a cafeteria and lodging (so that staff could participate in multi-day trainings), and install additional simulation equipment (to expand training offerings). Plans were on hold until after the dry season given financial shortages[6]. Given these limitations, the OTC's functionality is limited. This shortfall in achieving the basic outputs in the program logic will negatively affect its ability to achieve utility level outcomes in capacity development.

> ***"Most of the OTC training requires materials and equipment… LEC management may not have the money to procure that equipment in the future. We are struggling with having materials in the field. We took about ten poles and two transformers from there. So the guys in the field say when push comes to reality, we're going to take that transformer back from you."*** – LEC stakeholder

LEC's Outdoor Training Center

[6] Under ESBI, LEC approved a 3-phased approach to modernizing the OTC. Phase 1 has been completed while phases 2 and 3 are pending due to lack of funding.

B. Project effectiveness

Evaluation Questions 1b and 2: How effective was the LEC Training Activity? To what extent did the LEC Training Activity meet skill needs at LEC (number of staff trained and the quality and relevance of skills)?

The LEC Training Activity met program targets though the training content and format did not fully meet needs, particularly for technical staff in generation and T&D who require advanced skills to adequately maintain and repair LEC assets and infrastructure. LEC cannot repair transformer failures or fix metering issues to reduce power theft without adequate skills and knowledge. Tata implemented a ToT model for LEC staff to conduct on-the-job training but significant barriers to implementation persist.

Key findings	Assessment of program logic
Training achievements and effectiveness	
(+) Tata training exceeded learning targets and established baseline competency in core topic areas for more than 30 percent of LEC staff.	(+) LEC has achieved the short-term outcome of implementing a training system.
Training format and content	
(+) The virtual training worked well for soft skills training but was not adequate for technical skill building which required hands-on demonstration, practice, and feedback.	(−) LEC has not fully realized the outcome "trainers train LEC staff" because not all on-the-job trainers are training LEC staff.
(+) Commercial and Finance Department staff reported that customer service, metering, and other technical training improved their productivity and customer interactions.	(+) The training increased the self-reported capacity and productivity (a short-term outcome) of some staff, but not all.
(−) Generation and T&D Department staff said the training topics were relevant, but the content was too theoretical and not specific to LEC equipment. Thus, training did not affect their job performance.	(−) Assumption 2 (the ToT system is effective) is flawed because not all trainers are training LEC staff.
Training of on-the-job trainers	
(+) Most on-the-job trainers felt confident in their ability to train other staff, though they reported limited instruction on pedagogical practices and feedback about their competency as trainers.	
(−) Implementation of on-the-job training has been inconsistent and appears to rely on the motivation and position of the individual on-the-job trainer.	

(+) = positive finding, (−) = negative finding,

Training achievements and effectiveness

The training reached over 300 staff across all major departments, representing one-third of LEC's 900+ staff. Additionally, several trainees (not on-the-job trainers) said they have shared key learnings and best practices with colleagues who were not trained. However, some respondents raised concerns that there was an unfair selection process for training participation. Some women and younger employees expressed that their groups were excluded from participating.

> ***"Many times, we as females, we feel marginalized because we are not selected to go on most of LEC trainings."*** - LEC trainee

Tata exceeded all learning targets from MCA-Liberia's indicator tracking table. Tata reported on several learning indicators, including post-training self-reported learner satisfaction, the course completion rate, and knowledge (measured as the change in test scores from pre- to post-training). Tata exceeded targets for each indicator, as shown in Table III.1.

Table III.1. Knowledge gain indicators (averaged across all trainings)

Indicator	Target	Achieved
Learner satisfaction	4.0/5.0	4.19/5.0
Course completion rate	60%	80%
Change in test scores (pre-post)	25%	33%

Source: MCA-Liberia indicator tracking table (MCA-Liberia 2021a).

Note: These scores are for the UTC training and do not include the loss reduction training.

These scores provide respondents' perceptions of training immediately following the training. We conducted interviews about one year following training once respondents had ample time to reflect on their experiences. This allows respondents to discuss the value of the content to their ongoing work, whether they implement training content, and identify persisting gaps in training.

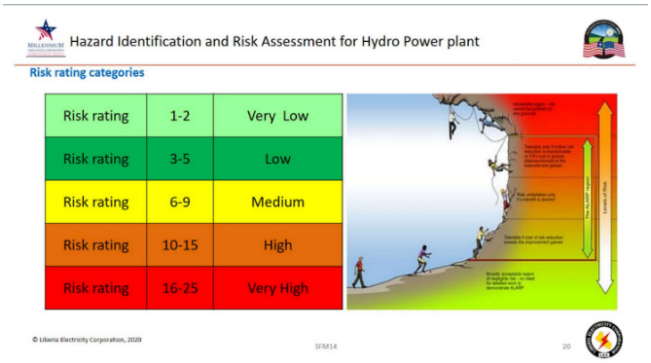
Training format and content

The virtual format reduced the training efficacy and respondents felt that switching to remote training was not appropriate for technical training. Remote training relied on more theoretical instruction, which did not fully meet the needs of LEC staff in generation and T&D who wanted in-person trainers to demonstrate on actual equipment and provide feedback as LEC staff worked.

Although respondents' opinions varied on the value of remote training, all respondents would have preferred an in-person format. Remote training hindered learning in three main ways:

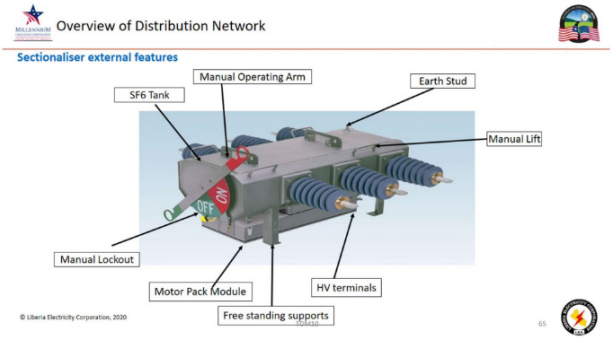
1. Poor internet connectivity led to frequent disruptions. Outages disrupted the flow of the training, broke trainees' concentration, and made it harder to stay engaged. In some cases, the Tata trainers were unable to cover all planned material because too much time was lost to connectivity issues.
2. Differences in accents and spoken English sometimes impeded comprehension. Participants reported challenges understanding the Tata trainers and felt the trainers struggled to understand them. This was exacerbated by the virtual format.
3. The virtual format was less engaging than in-person interaction. Some respondents praised the virtual interaction between participants and trainers, but many others were dissatisfied. Trainers had little ability to engage in one-on-one conversations with individual trainees, and some trainees did not feel comfortable asking questions. A sample of slides and a screen shot from the virtual training are shown in Figure III.2.

Figure III.2. Slides and screenshot from Tata's virtual training sessions

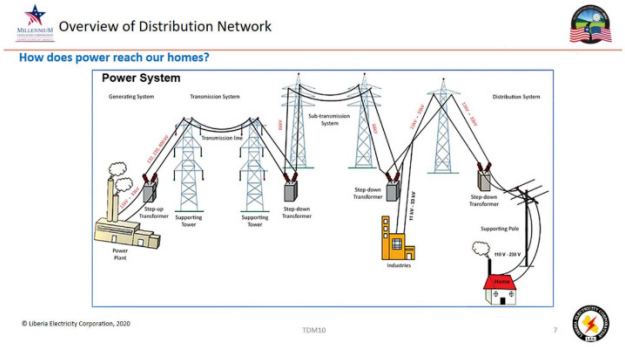


Slide from hydropower operation training

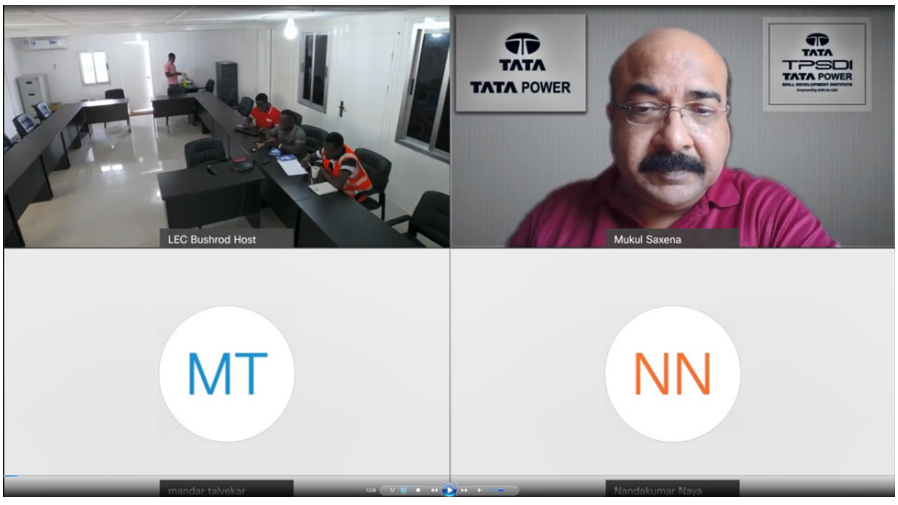
Slide from customer relationship management training



Slide from technical training for commercial staff



Slide from transformer maintenance training



Screen shot from remote training

> ***"Many don't understand like we're doing an online training and the Internet system was very poor where at times we couldn't go through. We couldn't go through a blackout, like one hour, the training stopped and then we waited because there was no power."*** – LEC trainee in the T&D Department

Notably, trainees were more likely to find the virtual format acceptable when the content focused on topics such as professionalism and customer interactions. Customer-facing respondents reported that they benefitted greatly from trainings on stress management and customer interactions.

T&D trainees felt the trainings topics were appropriate, but that Tata was unable to accommodate the full range of LEC's needs. Respondents acknowledged two key challenges in providing training to their department: (1) the huge variety of jobs and competencies within T&D and (2) vastly different baseline levels of knowledge and experience among staff. The Tata trainings were mostly effective at addressing the former, as many respondents felt the trainings covered key job functions such as operating transformers, grounding lines, and systematic troubleshooting. However, respondents complained that the material was too basic and did not provide new knowledge, suggesting that Tata was not fully able to accommodate the range of capacity among participating staff.

Participants reported that the lineworker trainings failed to deal with the specific types of equipment and systems currently in use. Given LEC's challenging infrastructure and assets, LEC staff require advanced training. However, respondents felt that the lineworker trainings lacked adequate information and skill development. Although some of the lineworker training was in-person at the OTC, participants complained that the transformer training was purely virtual and they felt strongly about the need to hold, touch, or see the device they were learning about. Respondents explained that transformer maintenance and repair is complicated in Liberia because of the range of transformers they have, the level of power theft causing failures, and the limited tools, parts, and equipment to repair them. In addition, two respondents recounted that the technical meter trainings they attended were essentially useless because the types of meters featured in the training are different than the vast array of meters that LEC use.

> ***"The training was basically about procedure. The training was not really about trouble shooting and solving the real-life problem that we are encountering on a daily basis."*** – LEC Trainee in the Generation Department

> ***"Yea, the training was not bad and to be realistic, I learn a lot of things during the training. At least we learn the proper way of grounding transformer even the range that should be away from 66kv line 22kv line, we learn all that and it was really helpful to us."*** – LEC Trainee in the T&D Department

Generation Department trainees appreciated the topics, but the theoretical presentation did not fulfil their needs. Trainees felt that their biggest need going into the training was better intuition and processes for troubleshooting the various mechanical issues that arise. Some respondents felt that Tata's trainers did not properly address this need because they focused too much on how equipment should work and not enough on what to do when equipment breaks down. These respondents felt that a more practical hands-on and in-person training could have been more useful.

MCHPP respondents also expressed concern about the relevance of technical training material. These participants offered praise for the expertise of the trainers and complimented job cards, other training material, and content on program logic control. However, they complained that some material was not tailored to MCHPP equipment or procedures. Others reported that the trainings were unstructured and hard to understand. On-the-job trainers from MCHPP often said that the material was largely a

refresher from previous, more comprehensive trainings they had attended. This seems consistent with reflections from Tata, which noted that the trainers from MCHPP were already quite knowledgeable. However, high-level stakeholders generally agreed that while LEC staff at MCHPP can adequately operate the plant, they are unable to anticipate or repair major or catastrophic failures.

> ***"When it came to the Mt. Coffee plant … they were not describing anything in Mt. Coffee. TATA power … their power plant design is far more different from Mt. Coffee power plant so why are you offering me training in power plant design and you are not describing the Mt. Coffee power plant that I should be handling."***
> – On-the-job trainer from MCHPP

Commercial and Finance Department trainees gave positive marks for the quality and relevance of training material. Commercial Department staff benefitted from technical trainings even though they work in non-technical roles. Several trainees expressed that, prior to the trainings, they had suffered from a lack of understanding about metering, electricity distribution, and other technical aspects of LEC's operations. Training made them more confident when fielding customer complaints about technical issues. There was broad consensus that the customer service training material was badly needed and positively impacted the department's performance and job satisfaction. A few participants reported they learned how to help indebted customers make payments, thus improving LEC's revenue collection. A Finance Department respondent also described how the loss reduction training had improved his ability to recognize signs of commercial losses in financial reports.

> **"[*The training] was very relevant to my department in regards to doing the financial reporting; so we reporting on revenue, reporting on losses, reporting on other key things across LEC…if we see the revenue coming down, we check the losses to know what going on."* –** LEC Trainee in the Finance Department

LEC employees from the Commercial Department report that the trainings helped them connect improvements in the customer experience to reductions in power theft. The trainings invited LEC commercial staff to take a broader perspective on their role at the company by exploring how customers are more likely to resort to power theft when they feel frustrated by their interactions with LEC customer service or if LEC does not respond to outages or replace damaged equipment. One respondent went so far as to associate learnings from the training with a decrease in power theft.

> ***"I think the training has given us more confidence that we can be able to help in enhancing response to our customer, there by trying to reduce the whole thing about power theft."*** – LEC Trainee in the Commercial Department

Trainees across departments praised the safety trainings; however, LEC's lack of safety equipment prevents staff from implementing safety procedures. Respondents reported that workplace safety training responded to a critical need across all departments and job functions. Some respondents felt that the safety training made them safer at work, but others said that LEC does not provide the equipment needed to properly implement safety procedures. Despite health and safety procedures developed by ESBI, including an electrical safety management plan, numerous T&D and Generation Department staff reported that they lack adequate safety and personal protective equipment including gloves, boots, and masks to comply with the best practices. Others reported lacking functioning fire extinguishers and that overall, LEC does not systematically enforce workplace safety protocols. While safety trainings were well-received, they likely intensified perceptions that LEC leadership is not fully committed to ensuring workplace safety. Multiple respondents expressed that they purchased their own boots and gloves after attending the Tata safety trainings, because they could not rely on LEC. One respondent noted that the

safety training significantly decreased his job satisfaction, because it only served to highlight how LEC's safety procedures endanger him daily. Tata noted lax safety protocols as a major threat to the continuity of LEC operations in its training needs assessment.

Training of LEC trainers to conduct on-the-job training

> ***"And after the training I get to realize that there are lots of dangers that are been involved in where I have been working the danger places taking precaution, now that I know and am not getting the requisite safety material it made me to be more afraid than ever before."*** – LEC Trainee

LEC ToT participants reported gaining improved technical skills rather than the training skills necessary to conduct ongoing on-the-job training with LEC staff. Interviewed ToT participants were asked to describe both the technical skills gained (such as meter installation and troubleshooting, SCADA, and safety practices) and the training skills taught during the Tata training. However, most respondents provided answers only on the technical skills learned. Although a few respondents described newly acquired training skills, they also reported that the instruction on pedagogical practices was insufficient. Several LEC trainers reported that Tata visited LEC and MCHPP post-training to assess their knowledge and training ability; however, this engagement seems to have been limited in both duration and reach (not all trainers received this in-person interaction). Generally, ToT participants felt they needed more individual, in-person feedback to improve their competency as on-the-job trainers. Despite these training limitations, most trainers reported they felt confident in their ability to conduct on-the-job training with their staff and noted that LEC staff are generally receptive and enthusiastic about receiving on-the-job training.

> ***"The only disappointment I have was because they told us that they would ... come and observe you performing that role that they have trained you for. And from there they were going to maybe grade you and see whether you have performed well or poorly. But I think they only did it for one person, maybe they did it for others. But for me I didn't see them doing it for me."*** – LEC on-the-job trainer

Despite feeling competent to train staff, implementation of on-the-job training has been inconsistent and appears to rely on the motivation and position of the individual trainer. About two-thirds of respondents said that they had trained staff in some way since the ToT, covering content such as transformer maintenance, meter installation, and technical loss reduction. Many respondents said that they had conducted informal one-on-one training as part of their daily work, but some were not sure whether that qualified as on-the-job training. About half of those who implemented on-the-job training had trained new staff, while the other half had trained experienced staff. Some respondents said they did on-the-job training immediately after the ToT but have not done any recently. Overall, most respondents said they had not implemented a formal, structured on-the-job training; only one respondent said that they had a formal training schedule.

LEC ToT staff reported uncertainty about the processes and approvals necessary to conduct on-the-job training. Some respondents said that management had not instructed or approved their use of on-the-job training yet. One respondent raised the issue of certification, saying that they had not been certified as an on-the-job trainer following Tata's training and therefore could not do any. Another reported that they are an engineer-in-training, so they cannot also be a trainer. These issues could reflect growing pains, as LEC's Training and Development Department works to standardize training procedures and establish multiple formal training programs, including internships and the Engineer-in-Training program.

Quotes demonstrating varied implementation of on-the-job training

"Right after the training, I was in high gear conducting training…but over some time, I have not been training my guys."

"To have an official training program where we go in there and have couple of days to train them … that has not been done yet."

"'Knowledge grows as it flows.' So, we are flowing the knowledge. Despite we are not calling them in groups, but when we meet them on the field, we flow the knowledge."

"I've not yet been selected to train any training anybody yet since the training."

"Well, the problem there, even though I participated in the training I have not been selected by LEC to say, oh yes, now you are trainer, you need to train these people …. So, I don't really consider myself yet to be a trainer."

"Like during the week, when I'm conducting my inspection on the network and I meet the guys working. When they are not doing the work according to what we have learnt over the years, I correct them and then take my exit. So, that is a form of training them as a trainer of trainer."

Other commonly cited barriers to conducting on-the-job training were inadequate administrative, material, and financial support from LEC. Only two respondents reported they felt LEC supported them conducting on-the-job training, while most respondents felt they lacked adequate support. Many respondents also highlighted challenges with sharing training materials because of a lack of internet, laptops, and printers. These issues also presented a barrier to conducting additional research, which some trainers felt was necessary to be an effective on-the-job trainer. Other barriers mentioned included lack of transportation, tools and equipment, and a heavy workload.

Training materials

"They have shared their personal experience because they say 'I used to do it this way, but now we have been taught to do it this way, and it's the safest way to do it.'"
– LEC on-the-job trainer

Respondents understood the purpose of the job cards produced by Tata and felt the related training sessions were useful, but most have never used the job cards. Respondents consistently defined job cards as a resource that helps them see the steps, objectives, time expectations, and safety requirements of different tasks within their department. Many said the job cards were the most interesting part of the training, but they were not using them. Responses suggest that some trainers are drawing on concepts from the job cards (such as more formally defining time expectation or safety requirements for a task) but are not using the cards produced by Tata. Some respondents specifically mentioned that they are not using job cards because LEC already has an alternative approach in place. For instance, trainers from MCHPP explained that HOI already has their own similar system for defining job responsibilities and procedures, so job cards are neither needed nor supported by management. One respondent suggested that the length of the job card was one reason why it wasn't being used[7].

Job cards

Job cards define the standard operating procedures associated with specific jobs. The job cards outline step-by-step procedures, capture best practices related to safety, quality, and timeliness, and define the assessment criteria for evaluating job performance (Tata 2021a).

[7] The examples provided to the evaluation team were 5-6 pages long.

C. Project sustainability

Evaluation question 3. How sustainable is the LEC Training Activity? Do LEC staff have the time, capacity, and budget to operate the training program? Are new LEC staff offered training and how does LEC maintain continuity of skills and capacity within the workforce?

The LEC Training Activity has serious risks to sustainability given LEC's financial situation and reliance on external partners for funding. Many staff do not have the time or resources to conduct ongoing on-the-job or classroom training despite LEC's need to maintain critical electricity infrastructure and assets. The Training Activity's inability to meet interim objectives suggest essential human resource capacity building and training is unlikely to be sustained without major institutional reform and significant donor support.

Key findings	Assessment of program logic
Continuity of skills and capacity	
(+) LEC staff recognize that training must be a continuous process of skill development, expansion, and reinforcement, rather than a one-time event.	(−) Equipment shortages and lack of funding for additional training pose risks to the assumption that increased capacity at LEC will be sustained post-MSC, particularly if there is inadequate donor coordination and support (Assumption 1).
(~) Nearly all participants agree that more trainings and/or refresher trainers are necessary to maintain the skills gained during the Tata training and to cover topics not addressed in the Tata training.	(−) Stakeholders are pessimistic that LEC has the capacity and resources to manage operations effectively and efficiently (Assumption 3).
(−) Insufficient administrative support and lack of equipment were commonly cited barriers to permanently adopting best practices from the trainings	(−) Given LEC's financial and operational constraints, the training program and related outcomes are unlikely to be sustainable without accompanying institutional reform and a large amount of donor support.
(+) LEC has expanded the ToT program across all departments and on-the-job trainers trained by Tata want to continue in their role.	
Ability to maintain infrastructure, sustain operations	
(−) Some stakeholders expressed concern in LEC's ability to maintain MCHPP, thermal generators, and other critical infrastructure.	
(−) A reliance on external funds and expertise is a barrier to the continuity of training and development at LEC.	

(+) = positive finding, (−) = negative finding, (~) = neutral finding

LEC staff recognize that training must be a continuous process of skill development, expansion, and reinforcement, rather than a one-time event. While some LEC staff are applying the training and sharing knowledge, most worry that insufficient support, material, and equipment are barriers to permanently applying the best practices learned during the training. Respondents felt they needed access to computers, office supplies, and other material resources to continue learning and skill development. Some wanted LEC to provide resources for self-study and a space with computers, internet, and literature to support independent, flexible, and continuous learning given the evolving technical demands of their jobs. Some staff independently watch how-to videos on YouTube and other online resources to build the skills needed to complete unfamiliar tasks.

Respondents noted that low computer literacy and a lack of computers and appropriate software caused administrative inefficiency and were barriers to improving LEC's commercial operations. A Finance Department respondent said they lacked the software needed to track customer bills and payments, while a Commercial Department respondent described how power theft stems directly from a lack of smart meters and insufficient software to manage the meter system. A respondent described the "lack of institutional willpower" to fight power theft and improve revenue, which compromises the sustainability of the commercial trainings. Respondents also noted that utility operations are constrained by complex procurement processes that reduced efficiency. Labor, vehicles, equipment, and supplies are not well-coordinated, resulting in hours of wasted time that could be used for training.

"You show me the tools online on the internet, you said yes this is used for this, and after the training I don't have what you told me about, which means, I will not be effective in my role." – LEC trainee from T&D Department

"We want to meter them the professional way but management is not supporting us to meter the people the professional way. Number one, they tell us that oh meters should be mounted on the house, right? Okay fine, we learn that the enclosure have to be drilled but no drill. We went as far as in providing in buying nails which we were not supposed to do. No tools, screw drivers, for the technician to even go in the field to do their work…it's a real barrier that is blocking our way in performance."
– LEC trainee from Commercial Department

Nearly all respondents agree that more trainings and/or refresher trainings would be beneficial to gain hands-on practice and to learn more in-depth about specific equipment or technologies. The most common theme was that hands-on training is needed. Respondents from T&D requested hands-on safety training to practice using safety equipment in the field. Generation staff also expressed desire for hands-on training on specific types of equipment, such as program logic control and water quality/waste management. Commercial staff requested additional training on metering to improve their ability to help customers; one respondent also linked metering training to reduced power theft.

Some stakeholders expressed concern about LEC's ability to operate independently and maintain its infrastructure. The goal of the LEC Training Activity was to provide LEC staff the skills and knowledge necessary to improve LEC operations, including LEC's ability to maintain its infrastructure and reduce system losses. Stakeholders felt that the significant size and broad scope of the Tata trainings made a tangible difference in bringing staff up-to-speed on key skills. Tata trainers felt that staff from MCHPP were knowledgeable, and they were optimistic that LEC could take over maintenance of MCHPP. Nevertheless, other stakeholders remain skeptical that LEC staff have the capacity necessary to maintain critical infrastructure, including the MCHPP and LEC's thermal generators. As the HOI contract ends in 2022, stakeholders express ongoing concern with the sustainability of MCHPP. In its Compact closeout report, MCA-Liberia also cites the critical need to retain trained staff at MCHPP to ensure the sustainability of the infrastructure.

> ***"You are a trainer, and you are going to train someone who earns more than you the trainer. That disparity affects the trainers."***
> – LEC on-the-job trainer

> ***"Yeah, trust me, I want to…continue to conduct training until our losses can reduced to 0%. As long as our losses have not reached 0%, I want to continue to conduct job training."*** – LEC on-the-job trainer

A reliance on external partners for funding and training is a major challenge for LEC's Training and Development Department. LEC's chronic financial crises mean that LEC is reliant on external donors for training funds, making it challenging to develop and implement a consistent training plan. Since the Tata trainings, LEC has had only one external partner—APUA. Some trainings have been delayed or canceled due to a lack of funds. When funding is not available, LEC relies on in-house training. While some LEC staff expressed a desire to have trainings led by Liberians, other stakeholders suggested that LEC must rely on non-Liberians to conduct trainings given weak capacity within Liberia.

> ***"I think the first thing is that there is no funding or direct budget for training. You don't know what is there for you to work with. You can do a beautiful training plan, if you don't have other partners to help, you can only do 10% or maybe 20%."***
> – LEC stakeholder

Despite these challenges, LEC has made notable progress in building out its Training and Development Department. LEC staff cited progress in multiple areas: accreditation by the Ministry of Education, creation of a Training and Development Policy, a complete overhaul of the internship program, and the introduction of standardized program documents for the Engineer-in-Training program. The department has also expanded the ToT program across all departments, citing the Tata work as a "booster" to engaging staff interest and creating a sustainable ToT model. Further, on-the-job trainers want to continue in their role, provided they receive the necessary support and additional guidance about when and how to implement on-the-job training.

IV. Conclusion

The LEC Training Activity, although reduced in scope from the initial design and additionally modified given the Covid-19 pandemic, was an important contribution to training efforts at LEC in 2020. While the Training Activity was as a relatively small, discrete investment, it was a key support to LEC's efforts to improve operations and maintenance of the growing network, use the new Integrated Management System for data management, reduce outages, decrease power theft, and improve customer service. The Training Activity succeeded in providing training to more than one third of LEC's staff on topics including generation operations and maintenance, transmission and distribution, customer service, revenue collection, Microsoft Office applications, safety, and loss reduction.

Implementation of the training activities offers crucial lessons for future training and capacity building at LEC and at utilities in other low-resource settings:

- Non-technical topics, such as improving customer service and computer applications, can be conducted remotely. However, as expected, virtual training is not effective for technical topics, such as repairing electrical parts and operating equipment.
- Consistent with the literature showing that training materials adapted from other countries often fail to properly account for cultural norms and internal political dynamics, our findings suggest that utility training must be highly tailored to the available equipment and existing operational processes. It must also account for on-the-ground constraints faced by trainees (such as lack of access to technology or equipment and institutional bureaucracy).
- An effective ToT model requires selecting motivated trainers who are well-positioned in their department to train others. Trainers need clear and consistent expectations and organizational support to ensure that quality on-the-job training is conducted and sustainable.
- Our findings support the broader literature, which suggests that technical trainings have limited impact on individual and organizational performance when structural and organizational inefficiencies prevent trainees from fully implementing their newly acquired skills. We found that training alone directly improved performance in some areas (for instance, customer service interactions and maintenance troubleshooting). However, LEC must provide equipment, resources, and organizational support for staff to implement training content sustainably.
- Finally, while small investments in training can yield positive outcomes, stakeholders must understand that large, ongoing, strategic investments in long-term capacity building are required to successfully improve utility operations in a sustainable way. LEC training staff noted that two ways to prioritize a long-term investment in training at LEC would be to (1) upgrade the Training and Development Department to a Division at LEC in order to have a seat at the LEC Executive Management meeting and (2) include Leadership and Performance Management Training for all staff.

LEC's human resource capacity needs are vast and continue to grow as the network expands, generation capacity grows, and customer connections increase. LEC's growing patchwork of electricity assets and infrastructure require that LEC staff receive sustained, intensive training and continuous capacity building to instill the skills needed to operate and maintain complex infrastructure. This study shows that one-time and piecemeal trainings, implemented and funded by different organizations, have been insufficient to yield the knowledge and expertise needed for staff to operate and maintain LEC's assets, equipment, and infrastructure.

Overall, LEC has made notable progress since 2018 including establishing the Training and Development Department, developing a Training Policy, creating in-house trainings, and partnering with organizations such as Tata Power, the West African Power Pool, APUA, and the Ministry of Education. However, the utility's financial crisis requires that the LEC Training and Development Department rely heavily on external partners for funding and training. Stakeholders understand the importance of training to LEC's performance and ability to overcome critical risks and threats—such as loss of assets, equipment, and life, and excessive financial risks due to technical and commercial losses. However, training and staff development still lacks adequate funding and prioritization, and trainings are often delayed, canceled, or modified. Moving forward, the GoL, LEC, and donors—in a strategic and coordinated manner—must invest in human capacity development along with infrastructure to improve utility operations and ensure the sustainability of infrastructure and assets.

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Appendix A

Documentation of the comments/feedback from country and MCC stakeholders

Table A.1. Stakeholder comments and evaluator responses

Reviewer Role/ Institution	Page Number	Comment	Evaluator Responses
Liberia Electricity Corporation Training & Development Department Staff	vii	The Construction of the Planned Training Center at Bushrod and procurement of the proposed list of training tools, equipment, and simulators could reduce this risk…	Thank you for this comment. We have integrated this perspective into the report in a few locations.
Liberia Electricity Corporation Training & Development Department Staff	viii	A VERY SIGNIFICANT FACTOR IS THAT TE TRAINING DEPARTMENT SOULD BE UPGRADED TO A Division in order for training voice to be independently discussed at LEC Executive Management meeting.	We have included this point in the text on page vii and 37
Liberia Electricity Corporation Training & Development Department Staff	4	Even with the establishment of the department, HOI provided limited cooperation with the department until 2020/2021	We have added this note to the text.
Liberia Electricity Corporation Training & Development Department Staff	4	Also, another booster was that LEC received an Accreditation from the Ministry of Education to run our Training Program ..	We have added this important detail to the text.
Liberia Electricity Corporation Training & Development Department Staff	7	The Management of LEC is in the process of adapting the Balanced Scorecard Performance Management Framework and for the first time will be establishing a Performance Framework Document. This year Performance Appraisal will be done by using KPIs established for every staff…	Thank you and noted. This section is the literature review, so we have not included the detail here.
Liberia Electricity Corporation Training & Development Department Staff	8	THIS WAS THE BIGGEST HIT TO THE TRAINING PROGRAM	We have some additional text to make this point (see pages vi and 9)
Liberia Electricity Corporation Training & Development Department Staff	9	The Management of LEC under ESBI approved to have the OTC site modernized through 3 phases approach . Phase 1 is already completed and phase 2 and 3 are pending due to funding availability.	We have added a footnote about this on page 24.
Liberia Electricity Corporation Training & Development Department Staff	14	This was another major challenge. Staff complain about clarity in the English spoken by some trainers from TATA…	We agree that this was a common complaint from respondents.
Liberia Electricity Corporation Training & Development Department Staff	18	TATA never communicated early the version of the Office Application that they were to use for the training.	We have noted this in the text.

Reviewer Role/ Institution	Page Number	Comment	Evaluator Responses
Liberia Electricity Corporation Training & Development Department Staff	19	The Donors should also consider the inclusion of Leadership and Performance Management Training. LEC will need consistent Leadership and Performance Management Training Support for all her staff.	We have added this note to the conclusion.
Liberia Electricity Corporation Training & Development Department Staff	30	Just to quickly point this out, recently the maintenance team in the absence of OI completed a major Maintenance work… This led to the visitation of the Actin CEO/Board Chair to pay a visit at Mount Coffee to appreciate the team…	Thank you for this information.
Liberia Electricity Corporation Training & Development Department Staff	31	With the vast Capacity needs, we cannot overemphasize the need to upgrade the Training & Development Department to a Divisional Status as most Utilities are doing now…	We have added a footnote with this point.
Liberia Electricity Corporation Training & Development Department Staff	33	I think specific name should also be included – Perry D. Brown, Jr.	We have added Perry's name to the citation.

Table A.2. MCC comments and evaluator responses

Reviewer Role (e.g. DCO, GSI, EA)/ Institution	Page Number (please reference the number at the bottom of the page)	Comment	Evaluator Responses
M&E Lead	Page v. "The $257 million Compact between the Government of Liberia (GoL) and the Millennium Challenge Corporation (MCC), which closed in January 2021, included energy investments to increase access to low cost and reliable power. "	For the second clause, recommend to quote the objective here. It is "to provide access to more reliable and affordable electricity"	This change has been made.
M&E Lead	Page 2 ">$2 billion in donor investment"	Is this in the sector energy sector as a whole?	We have revised and simplified this figure.
M&E Lead	Page 2	There are a lot of acronyms in the diagram that make it difficult to follow, even with the notes	We have revised and simplified this figure.
M&E Lead	Page 2	It is hard to follow this if you aren't steeped in the history	We have revised and simplified this figure.
M&E Lead	Page 2	I don't see ESBI in the notes	We have revised and simplified this figure.
M&E Lead	Page 2	Why is there an arrow from worsening macroeconomy yo PResident Weah?	We have revised and simplified this figure.
M&E Lead	Page 10	The footnote states that the numbers are not consistent with the ITT. Why aren't they? The ITT numbers are what we report so if they are incorrect we need to understand why. However, the ITT numbers should have come from Tata.	We were not able to determine why the numbers are inconsistent. The closeout ITT says that 36 people were trained as trainers and 319 people attended the general trainings. The ITT cites the final UTC report as the data source. However, the final UTC report says that 35 people were trained as trainers, 299 participated in the direct training, and 58 participated in the linesman training. Our own calculations from the training roster LEC shared with us produced a third set of numbers (these are what are in the table).
M&E Lead	Page 14	for the Exposure period, please note the time that elapsed between treatment and data collection consistent with figure II.3	This change has been made.
M&E Lead	Page 14	Was the sample randomly selected within the stratification?	Yes, and this detail has been added.

Reviewer Role (e.g. DCO, GSI, EA)/ Institution	Page Number (please reference the number at the bottom of the page)	Comment	Evaluator Responses
M&E Lead	Page 15	I think you can bring the content of the foot note into the main body. It is important to understand the context of the exposure period.	This change has been made.
M&E Lead	Page 17	Why is it difficult for LEC to keep the training center fully equipped?	Due to supply shortages. We heard in interviews that the materials are often taken for use in the field; the rapidly increasing number of connections has made this problem worse as more equipment is needed to maintain and repair connections. In addition, the generation, transmission, and distribution equipment come from different countries and manufacturers, which increases the complexity of needed equipment. We have added this detail to the text.
M&E Lead	Page 17	It would be useful to code the finding icons with colors.	This change has been made throughout the report.
M&E Lead	Page 17	For the table, we don't generally consider outputs to be findings.	We have replaced "key findings" with "implementation summary and key outputs"
M&E Lead, GSI lead	Page 22, "Some women and younger employees expressed that their groups were excluded from participating. "	Do we know why they may have been excluded? And do we have any quantitative indicators of exclusion, e.g. proportion of women participating relative to their representation at LEC?	Unfortunately, we did not have counts of all LEC employees, so we could not compare the training participants to the broader LEC staff. Respondents suggested that it can be challenging working as a woman in technical roles at LEC, though they didn't explicitly mention sexism. Younger employees said that often the older employees who have been at LEC longer and have professional connections are selected for trainings above younger, newer employees.

Reviewer Role (e.g. DCO, GSI, EA)/ Institution	Page Number (please reference the number at the bottom of the page)	Comment	Evaluator Responses
ESP	Page 25	There was additional Health and Safety work, including procedures developed by ESBI (include an Operational ESMP). That does not dispute the fact that LEC may not be implementing the procedural requirements or purchasing the necessary safety equipment or PPE.	We have included a note about this in the text.
M&E Lead	Page 27	You mention Job Cards several times in the paper but don't define it until here. Maybe a footnote or explanation earlier in the report could be helpful.	We have added a footnote in the report on the first mention of time job cards.
M&E Lead	Page 27, "One respondent suggested that the length of the job card was one reason why it wasn't being used."	How long is it?	The examples provided to Mathematica were 5-6 pages long. We have added a footnote with this information.
M&E Lead	Page 29	What is Program Logic Control?	Tata has defined this as "a customized computer used for control of machines and processes as desired."
Evaluation Lead/MCC	viii	Typo? *Given that funding is inconsistent, planful training is difficult and scheduled trainings are often delayed, canceled, or modified.*	Revised.
Evaluation Lead/MCC	Page 13	Please state the methodology in line with the PE options noted in the public Evaluation Management Guidance. This seems like an ex-post thematic analysis (not the greatest category, but we want to at least be clear that this wasn't looking at changes in data over time).	This has been added to the text.
EPG	Page vii , Second bullet, last sentence	The comment regarding transformer repair represents an inaccurate expectation of the training. Transformers should be sent out for repairs to a specialized provider as a repair facility at LEC would be more expensive to maintain quality repairs.	The Tata training included a session on transformer repair, and data from the interviews indicate that some LEC staff feel that they need to be able to repair transformers. We have revised the text to emphasize that the statement reflects LEC staff perceptions.

Reviewer Role (e.g. DCO, GSI, EA)/ Institution	Page Number (please reference the number at the bottom of the page)	Comment	Evaluator Responses
EPG	Page vii , Key Takeaways final sentence	The statement implies that the funding was reallocated to MCHPP intentionally. I do not think that that was the case. The reallocation was a means to apply compact resources after it became clear that the construction of a training center was not feasible given the activity design support from LEC.	We have revised the text here and in the main body of the report to reflect the comments in this document about the reallocation of funds. However, we would note that the Compact Completion Report implies that the reduction in scope was made to reallocate funds to the OMT (see p. 49). The ESBI and LEC leadership teams believed the training scope was reduced to cover OMT costs as well.
EPG	Page viii , Key Takeaways, last sentence in paragraph	The phrasing does not capture the fact that the GOL continues to fail to provide financial resources to LEC by failing to pay for electricity and refusing the enforce electricity theft law.	We have added some additional points about GoL's role in LEC's financial position. This is also a very salient point in our final evaluation report for Activities 1 and 2.
EPG	Page 3, Interim Management Team	The text does not refer to the corrupt acquisition of Chinese meters by the IMT contributing to the problems of training staff to maintain equipment.	This is not something that we were aware of at the time of writing. In other parts of the report, we do reference the various types of equipment as one of the training challenges.
EPG	Page 8, Section D, paragraph 2	See previous comment about the process of reallocating funds to MCHPP.	We have revised the text here to reflect the comments in this document about the reallocation of funds.
FIT	Overall	I think this is a very good report; while the report captures well the challenge of moving to virtual training because of Covid, one thing that the report does fully capture is how rushed the implementation of the training was in order to get things done by CED. My sense is that it was a minor miracle the training was in fact delivered by CED, while ALSO getting pretty good results.	Thank you for this comment. This was not a major theme in our KIIs, but it was mentioned in passing that stakeholders had been concerned that Tata wouldn't be able to complete everything within the compressed timeline. We've added a few sentences to the report (in the ES, the implementation section, and the first findings section) to emphasize this point a bit more.

Reviewer Role (e.g. DCO, GSI, EA)/ Institution	Page Number (please reference the number at the bottom of the page)	Comment	Evaluator Responses
HCD	page iv "The original scope and budget of the LEC Training Activity was reduced despite LEC's critical gaps in human resource capabilities. The original plan for the more robust Activity included the construction of an on-the-job, fully equipped training center, ample training of trainers (ToT) across departments, and an ongoing schedule of trainings. The scope was reduced to a one-time training of trainers, one-time training for a third of LEC staff, and construction of an outdoor training facility. However, LEC requires additional training investments to operate with efficiency and financial stability, manage complicated maintenance and repair, improve revenue collection, and decrease loss reduction and illegal connections."	This isn't nearly the full story and could be misleading. Importantly, in reviewing LEC's capacity and status at the time, MCC was concerned about LEC's capacity to effectively utilize and financially sustain a newly constructed training center. Importantly, the design deliverables did not provide a viable business plan for the proposed center. Moreover, we wanted to promote workplace-based/hands-on/operational/OTJ as opposed to classroom-based/theoretical training. Moreover, given the late start of the Activity overall, and the weak deliverables from the design contractor – the project faced significant completion risk.	We have revised the text here and in the main body of the report to reflect the comments in this document about the reallocation of funds. We have also included additional text to reflect LEC's perception that the de-funding of a full training center was a significant setback to their training activities.
HCD	Page vii "MCHPP staff reported that the training utilized equipment not used at MCHPP."	Can this be verified? Was there any triangulation of this? If true this seems a bit surprising. Perhaps is could be explained?	MCHPP staff and management both reported this and our team validated the finding during the April 2022 in-country visit. Additionally, LEC respondents explained that the loss reduction training did not include the more advanced meters that LEC uses, which was attributed in part to the rushed nature of the loss reduction training and the fact that the Tata team may not have had enough time to prepare.

Reviewer Role (e.g. DCO, GSI, EA)/ Institution	Page Number (please reference the number at the bottom of the page)	Comment	Evaluator Responses
HCD	page vii "Furthermore, MCC's reallocation of training funds to MCHPP, while necessary to sustain the hydropower plant, reduced the potential of the Training Activity to yield anticipated outcomes and sustainable results."	See comment above. We do not believe it accurate to assert that a physical center would have necessarily led to better or more sustainable results.	We have removed this sentence.
HCD	Page 1, "Meanwhile, human capacity development has not kept pace with the complexity of the piecemeal, discordant, and non-optimized donations."	This is very strident: "piecemeal, discordant, and non-optimized". Does the evaluator want to make such a sweeping statement? Perhaps it is justified, but suggest checking.	We feel this statement is appropriate given iterative and ongoing interviews with LEC and ESBI. We first noted this in trip reports after interviews in 2018. We documented it in the Evaluability Assessment and in the baseline report. It is still consistent with what we have learned across this evaluation but also our evaluation of Activities 1 & 2.
HCD	Page 1	Was it actually its own Activity? I thought it was a sub-activity?	It was an Activity.
HCD	Page 4 "The department completed a training assessment and gap analysis and began organizing ad hoc trainings, such as the West African Power Pool training and the Association of Power Utilities of Africa (APUA). "	Typo. APUA training?	Revised.
HCD	In July 2022, the ESBI contract as the MSC will expire, and the utility will again be managed and operated by local LEC staff.	Suggest the evaluator review this language. This could be misinterpreted since there seems to be an assumption that LEC is not capable. Perhaps consider just saying that the management contract will expire.	We have revised as suggested.
HCD	Page 7	MCC would appreciate copies of these studies to inform our future work?	We have shared a zip file of these studies along with the revised report.

Reviewer Role (e.g. DCO, GSI, EA)/ Institution	Page Number (please reference the number at the bottom of the page)	Comment	Evaluator Responses
HCD	Page 8 "This is a risk in Liberia, given that LEC has severe organizational and operational challenges, the legacy of civil war, loss of generational skills and knowledge, the EVD crisis, changes in management, political interference, macroeconomic challenges, and chronic underfunding."	This is very strong language, though perhaps not unwarranted. Consider reviewing to ensure accuracy and intent.	We maintain that it is important to cite each of the many challenges specific to Liberia's current situation.
HCD	Page 8 "However, while adequate staff training was a clear need, the Compact faced competing urgent priorities."	See comment above, the assertion that the construction component was cut because the money we needed elsewhere is not accurate.	We have revised the text here to reflect the comments in this document about the reallocation of funds.
HCD	Page 8 Table	This table is confusing because repeats UTC. Does this mean OTC? Check with numbers below.	The final UTC deliverable was submitted (and the final disbursement made) in 2021 We have revised the table for clarity.
HCD	Page 8 "which MCC thought were not adequately tailored to LEC. Consequently, Azorom's contract was not renewed."	I do not believe the contract had options, it was just a design contract.	We have removed this statement.
HCD	Page 9 ", Tata received a $972,170 "	Not aligned with the table above.	Please see new table note.
HCD	Page 11	Table: Tata didn't mobilize until January 2020. Bar above looks like they started Q2 2019. The UTC didn't go beyond the compact end date.	We have made these corrections to the figure.

Reviewer Role (e.g. DCO, GSI, EA)/ Institution	Page Number (please reference the number at the bottom of the page)	Comment	Evaluator Responses
HCD	Page 15 Table II.3	What's the distinction between ToT and the UTC part of UTC/loss reduction?	The UTC included a training of trainers as well as what Tata called "direct training" - this was the classroom-based training given to a large number of LEC staff. In this figure we are distinguishing between those two components of the UTC - the ToT and the "direct training". We have revised the figure slightly to hopefully make this clearer.
HCD	Page 18 "Further, the in-person ToT follow-up was inconsistent: most on-the-job trainers said there was no in-person observation of their training skills after completion of the classroom training."	It might be worth noting a number of circumstantial factors contributing to some of the limited performance. This includes the unique nature of the Liberia design (with rapid EIF), an overall low priority of this component, late engagement with MCC's HCD team, weak design deliverables, and delays caused by strategic decisions around scoping. All together this meant that Tata was mobilized with only had 12 months to implement. And then COVID hit right as they were planning to begin training. A lot more could have been done to course correct and make things more grounded/sustainable with more time.	Thank you for this background information. We have included some of these points at the beginning of the Findings, Project implementation section.
HCD	Page 22 "The virtual format reduced the training efficacy and respondents felt that switching to remote training was not appropriate for technical training.:	Miswritten in summary box above. Above it says it "was adequate."	We have made this correction.
HCD	Page 26 "LEC ToT participants reported gaining improved technical skills rather than training skills to conduct ongoing on-the-job training with LEC staff. "	This could be clearer or emphasized more. I fully agree that the pedagogy part (how to be a trainer) of training was weak/under emphasized compared to the technical skills content.	We have revised this paragraph for clarity, and also added a small point about this to the key findings table at the beginning of the section.

Reviewer Role (e.g. DCO, GSI, EA)/ Institution	Page Number (please reference the number at the bottom of the page)	Comment	Evaluator Responses
HCD	Page 28	Wrong story on why we pivoted. See above.	We are not able to find the relevant text on page 28; however, we made minor edits at the top of page 31 to address this comment.
HCD	Page 31 "However, virtual training is not effective for technical topics, such as repairing electrical parts and operating equipment."	Which we knew already. May be worth highlighting that this confirmed our expectations.	Added "as expected"
HCD	Page 31 "from developed countries "	Perhaps reconsider describing India as a “developed country.” The lesson of adapting to operational/technical realities is much more salient.	Revised to "other countries"
HCD	Page 31 "• Our findings support the broader literature, which suggests that technical trainings must be accompanied by efforts to address structural and organizational inefficiencies. We found that training alone directly improved performance in some areas (for instance, customer service interactions and maintenance troubleshooting). However, LEC must provide equipment, resources, and organizational support for staff to implement training content sustainably. "	Suggest reviewing this bullet. This makes it sound like you have to address everything all at once. This doesn't seem reasonable/justified. Are the lessons from the literature really that training MUST be accompanied by these otherer elements? The second and third sentences seem more justified/backed up.	We have rephrased this sentence to better reflect the key takeaway from the literature we reviewed.

Appendix B

Evaluation Gender Type

Background

MCC originally developed the following typology to document which of its independent evaluations produced "gender data" in accordance with its 2015 commitment to publish all such data in support of the Data 2X initiative.[5] These categories were later included in the agency's Women's Economic Empowerment Learning Agenda, which was adopted in 2019, to help identify and consolidate findings about the extent to which gender issues have been incorporated into the design, implementation, evaluation, and learning related to MCC's investments.

A Gender Type will be assigned by the MCC Evaluation Management Committee (EMC) for each MCC evaluation at two points in time:

1. Upon approval of Evaluation Design Reports (EDRs)
2. During review of final evaluation reports in case changes to the program or evaluation have implications for the original assignment

This assignment will be recorded in MCC's evaluation pipeline database for management and reporting purposes.

Definitions of MCC's Gender Types

- **Type 1:** Gender is/was part of the logic and evaluation design of the program being evaluated[6]
- **Type 2:** Gender is/was not part of the logic of the program being evaluated, but the evaluation design incorporates gender issues, e.g., in the evaluation questions or data collection methods
- **Type 3:** Gender is/was not part of the logic or evaluation design of the program being evaluated, but sex-disaggregated data will be/were collected
- **Type 4:** Gender is/was not part of the logic or evaluation design of the program being evaluated, and sex-disaggregated data will not be/were not collected
- **N/A:** This applies if interventions will not be evaluated or if an evaluation is canceled before an Evaluation Design Report has been approved

Assigned Gender Type

At the time of final evaluation report completion, the EMC determined the Liberia LEC Training Center Activity evaluation's Gender Type to be Type 4 based on the definitions above.

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